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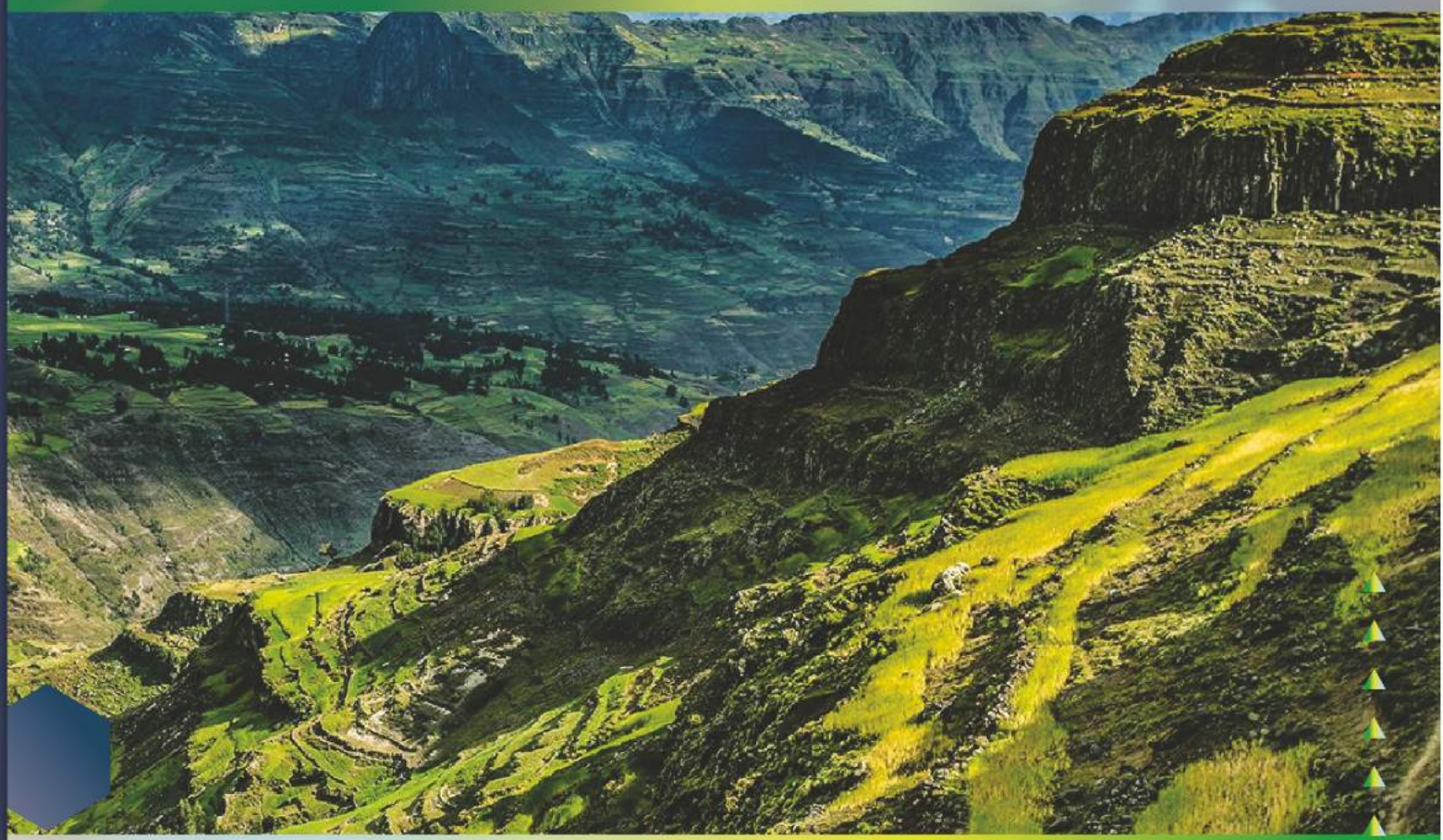
41st World Conference on Applied Science, Engineering & Technology

24th - 25th August 2022

WCASET-2022



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ISBN : 978-93-92105-14-2

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WCASET-2022

41st World Conference on

Applied Science, Engineering & Technology

"Technological Developments & Modern Trends in Applied Science and Advanced Engineering"

Virtual Conference

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Publisher : IFERP Explore

ISBN : 978-93-92105-14-2

Editorial

We cordially invite you to attend the **41st World Conference on Applied Science, Engineering and Technology (41st WCASET-2022)** which will be held on ***24th & 25th August, 2022*** - virtually conference. The main objective of **41st WCASET-2021** is to provide a platform for Researchers, Students, Academicians as well as Industrial Professionals from all over the world to present their research results and development activities in relevant fields of Science, Engineering and Technology. This conference will provide opportunities for the delegates to exchange new ideas and experience face to face, to establish business or research relationship and to find global partners for future collaboration.

These proceedings collect the up-to-date, comprehensive and worldwide state-of-art knowledge on cutting edge development of academia as well as industries. All accepted papers were subjected to strict peer-reviewing by a panel of expert referees. The papers have been selected for these proceedings because of their quality and the relevance to the conference. We hope these proceedings will not only provide the readers a broad overview of the latest research results but also will provide the readers a valuable summary and reference in these fields.

The conference is supported by many universities, research institutes and colleges. Many professors played an important role in the successful holding of the conference, so we would like to take this opportunity to express our sincere gratitude and highest respects to them. They have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work. We also would like to express our gratitude to the external reviewers, for providing extra help in their view process, and to the authors for contributing their research result to the conference.

Since June 2022, the Organizing Committees have received more than 110 manuscript papers, and the papers cover all the aspects in Electronics, Computer Science, Information Technology, Science Engineering and Technology. Finally, after review, about 41 papers were included to the proceedings of **41st WCASET-2021.**

We would like to extend our appreciation to all participants in the conference for their great contribution to the success of **41st WCASET-2021**. We would like to thank the keynote and individual speakers and all participating authors for their hard work and time. We also sincerely appreciate the work by the technical program committee and all reviewers, whose contributions made this conference possible. We would like to extend our thanks to all the referees for their constructive comments on all papers; especially, we would like to thank to organizing committee for their hard work.

Acknowledgement

Rudra Bhanu Satpathy
Founder & Chief Executive Officer
Institute for Engineering Research and Publication (IFERP)

IFERP is hosting the **41st World Conference on Applied Science, Engineering and Technology** this year in month of August. The main objective of **41st WCASET-2022** is to grant the amazing opportunity to learn about groundbreaking developments in modern industry, talk through difficult workplace scenarios with peers who experience the same pain points, and experience enormous growth and development as a professional. There will be no shortage of continuous networking opportunities and informational sessions. The sessions serve as an excellent opportunity to soak up information from widely respected experts. Connecting with fellow professionals and sharing the success stories of your firm is an excellent way to build relations and become known as a thought leader. I express my hearty gratitude to all my Colleagues, staffs, Professors, reviewers and members of organizing committee for their hearty and dedicated support to make this conference successful. I am also thankful to all our delegates for their pain staking effort to make this conference successful.

Rudra Bhanu Satpathy
Founder & Chief Executive Officer
Institute for Engineering Research and Publication (IFERP)

Welcome Message from Guest Speaker

Dr. Santosh Rane
Associate Professor
Former Dean Academics
Sardar Patel College of Engineering,
Mumbai, India.

I am extremely delighted to hear that Institute for Engineering Research and Publication (IFERP) is organizing 41st World Conference on Applied Science, Engineering & Technology (WCASET-22)"- VIRTUAL CONFERENCE scheduled on 24th-25th August 2022.

The conference will offer the perfect forum for debates and the exchange of fresh perspectives on this crucial area of research.

I am ecstatic about the theme **Technological Advancements and New Trends in Applied Science and Advance Engineering** since it is a very significant move in the right direction. I have no doubt that multidisciplinary Professionals, Practitioners and Research scholars form various countries will have gainful insights from the conference. Sincere compliments should be extended to Institute for Engineering Research and Publication (IFERP) for their remarkable work.

I also congratulate all conference delegates for getting associated with IFERP and presenting their research in this Global Conference WCASET-22.

I congratulate the IFERP for organizing this conference and give Best Wishes for grand success.

Dr Santosh Rane
Faculty and Former Dean Academics
Sardar Patel College of Engineering
Mumbai

WCASET-2022

41st World Conference on

Applied Science, Engineering & Technology

Virtual Conference | 24th – 25th August 2022

Keynote Speakers

Dr. Vitantonio Roma
Head of Geotechnical Engineering Department
TEAM Engineering Spa
Italy

Good morning to everybody,
It is a pleasure and a honor for me to be part as a Keynote Speaker to the **41st World Conference on Applied Science, Engineering & Technology (WCASET-2022) -Virtual Conference, 24th- 25th August 2022** organized by the **Institute for Engineering Research and Publication (IFERP).**
I think that it is fundamental to organize and to participate to events like this one, because these events foster the sharing of knowledge and they contribute to the technological and scientific progress.
If we meditate on the last 10 thousands years of human history, we observe the humanity has evolved thanks to exchange of knowledge. We moved from stone age to the current age of internet, in which information and knowledge are shared globally around the planet at the light speed.
Technological and scientific progress develops faster, thanks to the fact that knowledge is shared faster and to a greater number of intelligent human beings.
In my presentation I will explain the Role of the Geotechnical Engineering in the past, nowadays and in the next future.
Geotechnical Engineering is a relatively young science, less than 100 years from its formal birth, however, geotechnical applications have always existed and they date back to the time of the ancient human civilizations.
Nowadays the applications of the Geotechnical Engineering can be found in all the Civil Engineering works: bridges, tunnels, metro lines, highways, railways, roads, skyscrapers, electric and power plants, chemical and industrial plants, offshore structures, waste disposals, etc..
I think that also in the future the Geotechnical Engineering will play a fundamental role to make it possible and safer our surrounding world.

For all the above mentioned reasons you are warmly invited to take part to WCASET-2022.

My Warmest Regards to every body, 11 July 2022

Vitantonio Roma

Vitantonio Roma

Dr. Andrés J. Arenas Falótico
Senior Lecturer and EMBA Director Universidad Antonio de Nebrija Madrid
Spain

It is an honor for me to participate in the **41st World Conference on Applied Science, Engineering & Technology -Virtual Conference** (41st WCASET-2022), which is organized By **Institute For Engineering Research and Publication (IFERP).**

Undoubtedly, the constant evolution of technology has led to equally rapid changes in the world of work. Consequently, the concept of the office is also evolving, because it must be understood as a set of relationships and not as a physical space in which to carry out the work provision.

In the corporate culture that starts from the generation of profits, investment in technology is evident in almost all areas of production to the detriment of certain jobs and, not for this reason, positive signs of economic and business health are lost. Human employment does not have to disappear in favor of robotics, the only thing that must be valued is whether we can manage efficiently, recognizing that we are not essential in the production process; not work it disappears, in fact, jobs are lost in various specialties that are run by robots, creating different specialties; thus, employment evolves.

My special thanks to the organizers for their great efforts in making this scientific event remarkable, stimulating, and successful. My thanks also go to all the participants. Wishing you all the best.

I am sure you have your opinions about this interesting issue.

Professor Dr. Andrés J. Arenas F.
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Papers & Abstracts

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Phytochemical Screening, Antioxidant Activity, and Chromatographic Fractionation of Fenugreek (trigonella foenum graecum) Seeds Extract

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Abstract:-- **Plants contain bioactive compounds that have been used in traditional medicine for millennia, making them a wonderful source of treatment. Fenugreek (Trigonella foenum graecum) is a food crop grown in India, the Mediterranean, North Africa, Germany, France, Russia, and Yemen. Many nations utilize fenugreek leaves and seeds medicinally. The present study examines fenugreek seed extract's phytochemistry, antioxidant properties, and fractionation using a glass column on silica gel. Each fraction is analyzed using high-performance liquid chromatography (HPLC). Polyphenolic (33.58 mg GA/g), flavonoid (16.11 mg QE/g), flavonol (21.81 mg RE/g), and anthocyanin (1.87 mg cyanidin-3-glucoside/kg dry weight) concentrations were high. The extract exhibited ferric reduction and chelating metal properties, including 11.07 mg $FeSO_4$/g and 76.35 mg Fe^{2+}/g dry weight. Fenugreek seed had a high antioxidant capacity and inhibited α-amylase activity with high efficiency (84.21%). Column chromatography was run using silica gel and ethyl acetate-toluene-formic acid (100:36:36) as the solvent system, separating four fractions. Each collected fraction was tested using thin-layer chromatography (TLC). The crude extract and fractions were evaluated using HPLC, revealing that fenugreek seed extract and fractions are highly natural antioxidants.**

Index Terms: antioxidant activity, chromatographic fractionation, fenugreek, phenolics.

I. INTRODUCTION

Since ancient times, plant-based systems have played an essential part in primary health care in 80% of the world's impoverished and developing nations [1]. Compared to synthetic medications, herbal ones are generally considered less harmful and have fewer adverse effects [2]. Plants have long been utilized as traditional natural remedies to treat a wide range of illnesses, and they provide a safe alternative to modern pharmaceuticals [3].

Trigonella foenum-graecum L., Fabaceae, is native to the Near East and Mediterranean areas and is grown mainly in India, northern Africa, Germany, France, and Russia. Despite the lack of breeding or assessment in the southern hemisphere, at least two cultivars have been issued in Canada. Several accessions have been studied in the mid-western United States [4].

Asian, African, and Mediterranean people eat the seeds of this plant as part of their everyday diet. It is employed in various areas, including medicine, nutrition, drinks, perfumes, cosmetics, and more [5]. An excellent source of protein, the seeds also include inaccessible carbohydrates, mucilage, and saponins. Compared to other legumes, the seed is richer in minerals (Ca, P, Fe, Zn, and Mn) [3]. The seeds include flavonoids, carotenoids, and coumarins, among other compounds [6]. Bioactive phytochemicals such as flavonoids are linked to fenugreek's antioxidant and anti-inflammatory properties. The antioxidant and anti-inflammatory properties of flavonoids are the most well-recognized benefits of this class of compounds [7].

For medicinal purposes, the seeds may be employed in cooking or as a flavour enhancer for other treatments (Fig. 1) [8]. Fenugreek seeds are widely used in folk medicine to cure various ailments, including paralysis, diabetes, epilepsy, and fever [9]. Traditionally, fenugreek was suggested to breastfeeding mothers to boost milk production and, curiously, to Moroccan Saharawi women to enhance their physical beauty by increasing their appetite [10].

Fig. 1: Seeds of Trigonella foenum-graecum with leaves

There are sapogenin, galactomannans, antioxidants, and amino acids like 4-hydroxy isoleucine in fenugreek seeds. These ingredients possess sugar-lowering, cholesterol-lowering, fever-reducing, anti-inflammatory, cytotoxic, apoptosis-activating, antifertility properties [11], antifungal, antibacterial, and anticarcinogenic [10]. The phytochemical screening and antioxidant activity of fenugreek seed extract were examined in this work after the isolation of bioactive components. The first investigation employed TLC to find an acceptable mobile phase, followed by column chromatography to generate four fractions, and finally HPLC to analyze the fractions that had been separated.

II. EXPERIMENTAL SECTION

Chemicals

Analytical-grade chemicals and solvents were used in this study: Hexane and sodium dihydrogen phosphate were purchased from Carlo Erba, Sabadell (Spain). Quercetin and EtOAc were bought from Sigma-Aldrich (Germany). Gallic acid hydrochloride was obtained from (ISOLAB GmbH). Rutin trihydrate was bought from (Dr. EhrenstorferTM). Thin-layer chromatography (TLC) aluminum sheets 20 x 20 cm (60 F254), Silica gel for column chromatography (70–230 mesh ASTM), aluminum chloride, potassium ferricyanide, iodine, phenanthroline monohydrate, sodium acetate trihydrate, Ferrous sulfate heptahydrate, dipotassium hydrogen phosphate, sodium carbonate, Folin-ciocalteu's phenol reagent, sodium hydroxide, ferric chloride trihydrate, trichloroacetic acid, potassium hydroxide, and formic acid purchased them from Merck (Germany).

Plant material

In northern Iraq's Koy Sanjaq/Erbil area, they bought a fenugreek plant and cleaned it by hand. Used a dry grinder to ground dried plant materials into a fine powder. The was kept in a bottle at room temperature and in total darkness until required.

Preparation of plant extract

Maceration was a successful extraction method for plant constituents. It took three extractions of MeOH (75 ml) with 10 g of powder at room temperature and for 24 hours to get MeOH extract from the powdered material. At a temperature of 40 °C, the filtrate was concentrated after being filtered using Whatman filter paper No. 1. After the extract had been evaporated, hexane was employed to remove the fat. For further analysis, dry methanolic extract (1.16 g) will be kept in tubes at 4–6 °C in the freezer.

Total phenolic content (TPC)

A modification of the Folin–Ciocalteu technique was devised to measure the total phenolic content of the extract [12]. So, 0.1 mL (3 mg/mL MeOH) of the extract was added to 1.5 mL of distilled water and agitated vigorously for 5 minutes with 0.1 mL of Folin–Ciocalteu reagents, followed by 1.5 mL (10 %) sodium carbonate. When the combination had been in the dark for 60 minutes, measured it for absorbance at 765 nm (Thermo Scientific GENESYS 10S UV-VIS spectrophotometer, USA). It was determined using a regression equation built from the gallic acid standard calibration curve to get the total phenolic content (mg GA/g extract).

Total flavonoid content (TFC)

Flavonoid concentration was determined using the aluminium chloride colourimetric technique on a crude extract with restricted development [13]. Overall, 0.2 ml of extract (3 mg/mL) was combined with 1 mL of 5 % $AlCl_3$ solution, followed by 0.1 mL of 1.0 M CH_3COOK soln. Finally, 2.7 mL of MeOH stood for 60 minutes before testing. After that, the absorbance at 420 nm was reported. The total flavonoid content was determined using a calibration curve and expressed as mg QE/g of dry weight.

Total flavonol content (TF)

They used a slightly modified colourimetric approach based on aluminium chloride to determine the overall flavonol content [14]. This approach required the use of rutin to generate a calibration curve. In a test tube, 0.5 mL of extract (3 mg/mL) solution was added, followed by 0.5 mL of 2% aluminum chloride and 5% sodium acetate (6 mL). After 2.5 hours of incubation at room temperature and in the dark, stirred all the tubes continuously. Sample and standard absorbance were measured at 440 nm, and the findings were expressed in mg RE/g of dry weight using a calibration curve.

Total anthocyanin content (TAC)

Used a spectrophotometer and a pH differential method to determine anthocyanin contents [15]. The fenugreek seeds extract was diluted with KCl (0.025 M) and CH_3COONa (0.40 M) solutions separately, and the pH was changed with HCl to 1.0 and 4.5,

respectively, to determine anthocyanin concentration. The absorbance (A) was measured compared to pure water at 520 and 700 nm and reported. The content of anthocyanin was assessed using cyanidin-3-glucoside equivalents (mg cyanidin-3-glucoside/kg dry weight), which were derived using the following equations:

A = (A520 − A700) pH=1.0 − (A520 − A700) pH=4.5

The concentration of monomeric anthocyanin was determined using equation 1

[anthocyanins monomeric] (mg/L) = (A × M.wt × FD × 1000)/ (ε × l) (1)

Calculated the total anthocyanin concentration using equation 2:

[anthocyanins in total] (mg/L) = (A* × M.wt × FD × 1000)/ (ε × l) (2)

Where: A* = (A520 − A700) pH=1.0; M.wt = molecular weight (449.2 g/mol cyanidin-3-glucoside); FD = factor of diluting; ε = coefficient of molar extinction, (26900 L/ mol cm cyanidin-3-glucoside); l = path length (1 cm).

Ferric reducing antioxidant power (FRAP)

Potassium ferricyanide evaluated the reducing power to make a coloured complex containing antioxidant activities [16]. Mixed sample (3 mg/mL) and standard with 2.5 ml of 0.2 M phosphate buffer (pH: 6.6) and 2.5 mL of 1 % $K_3Fe(CN)_6$. The mixture was centrifuged for 10 minutes at 3000 rpm for 30 minutes at 50 °C, and 2.5 mL of 10% TCA was added. The supernatant was then pipetted into a second tube containing 2.5 mL of water and 0.5 mL of newly prepared 0.1% $FeCl_3$. The standard calibration curve was created using quercetin after measuring the absorbance at 700 nm. potency is reduced by using Quercetin equivalents (mg QE/g dry weight) to measure fenugreek seed extract.

Metal chelating ability (MCA)

The ability of fenugreek seed extract to chelate metals was evaluated using the 1,10-phenanthroline technique [17]. Fill the tubes with 0.1 mL of sample (3 mg/mL) and the standard solution. Then they added 1.5 mL of water to the mixture along with 1 mL of 0.2% $FeCl_3$, 1 mL of 0.2% phenanthroline, and 1.4 mL of water, respectively. Afterwards, they were placed in a dark place and incubated for around 20 minutes. The absorbance was measured at a wavelength of 510 nm. Calculate equivalent iron II sulfate concentrations in mg Fe^{2+}/g dry weight using the calibration curve and regression equation.

-amylase inhibition (AAI)

Used a modified starch iodine method to detect α-amylase inhibition [18]. In a nutshell, 0.25 mL α-amylase was incubated for 15 minutes at 37 °C with 0.25 mL (3 mg/mL) plant extract. After adding 0.25 mL of starch solution, the mixture was re-incubated for another 30 minutes. Add 0.1 mL of HCl (1.0 M) to halt the reaction. After the completed vortexing, added 1.0 mL of iodine reagent and 3.0 mL of distilled water. A spectrophotometer was used to measure the absorbance at 580 nm. Changed the absorbance of the backdrop by making individual blank, substituting plant extracts with 0.25 distilled water in the controls in the trials. Acarbose, a well-known diabetic drug, was used as a positive control. The percentage of inhibition was determined using the following formula:

% α-amylase inhibition = [(A c -A S) / A c] x 100

A c = Absorption of control; A s = Absorbance of standard

Select a plant fractionation solvent

Used TLC to confirm the separation of bioactive components from the methanolic extract. They tried a variety of solvents to find the one that worked best for them. Following the creation of the chromatogram, spots were identified using UV light (254 nm and 365 nm) and the iodine chamber. The necessary separation resolution was achieved using ethyl acetate- toluene-formic acid as the mobile phase. Using ethyl acetate-toluene-formic acid (100:36:36) as a column chromatography solvent proved to be a good choice because of its higher R_f value.

Column chromatographic fractionation of the extract

Column chromatography is one of the most efficient methods for isolating phytocomponents. This study discovered a new mobile solvent system for the first time. An activated silica gel (70-230 meshes)-packed glass column (450 mm by 40 mm) was used for chromatography and eluted with mobile phase by wet packing. Used a mobile phase solvent solution to prepare the slurry, then applied to the column for elution (Fig. 2). TLC plates were used to monitor the 58 fractions that were collected, and related fractions were mixed and concentrated under low pressure. Finally, we discovered four different fenugreek seeds extract fractions.

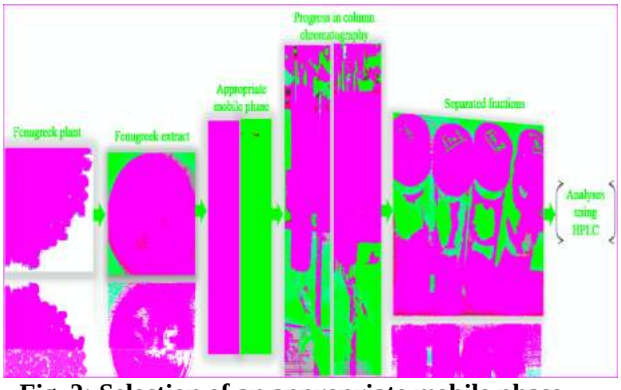

Fig. 2: Selection of an appropriate mobile phase and TLC confirmation, column chromatography was employed to produce four fractions

HPLC analysis of phenolic components

As part of the analysis of polyphenols, a Shimadzu HPLC was employed in conjunction with a Shimadzu DGU-20A5 vacuum degasser and a Shimadzu 20 ADXR solvent pump. A reversed-phase Clipeus C18 5 m column (250 mm x 4.6 mm) was used for the separations. For detection, a Shimadzu SPD-M20A photodiode array detector was applied. After dissolving 0.01g of polyphenols in deionized water and adding 10 mL of MeOH and water (1:1 v/v), we obtained 1000 mg/L stock solutions for analytically pure polyphenol standards. Using these stock solutions, produced diluted solutions of each polyphenol. Used the HPLC-DAD method to determine the phenolic compounds [19]. This experiment used a flow rate of 1.0 mL/min and an injection volume of 20 µL to determine the concentration using the gradient elution method with solvent A: 4.5 % acetic acid solution and solvent B: acetonitrile mobile phases. We injected the diluted extract and fractions straight into the HPLC apparatus and screened them using a photodiode array detector.

III. RESULTS AND DISCUSSION

Contents of total phenolic, flavonoid, flavonol, and anthocyanin

Table 1 displays the total phenolic, flavonoid, flavonol, and anthocyanin content of fenugreek, as well as the quantities of each. Folin–Ciocalteu analysis estimates the total phenolic content of an extract by transferring electrons from phenolic compounds to the Folin–Ciocalteu reagent in alkaline conditions. This approach is a straightforward strategy that is widely used [20]. The total phenolic content of the dry extract was 33.58 mg GA/g, indicating the highest total phenolic concentration.

Several essential polyphenols, such as flavonoids, aid in the body's defence against disease [21]. Flavonoid concentrations were significantly influenced by genetic diversity and biological, environmental, seasonal, and year-to-year changes [22]. The total flavonoid concentration in this extract was 16.11 mg of QE/g dry extract, which indicated that it had the most excellent total flavonoid content.

Table 1: Analyses of the phytochemical content of fenugreek seeds extract

Phytochemicals	Present quantity
TPC (mg GA/g)	33.58 ± 1.39
TFC (mg QE/g)	16.11 ± 0.71
TF (mg RE/g)	21.81 ± 0.59
TAC (mg cy-3-glu/kg)	1.87 ± 1.69

GE= Gallic acid equivalent, QE= Quercetin equivalent, RE= Rutin equivalent, Results are reported as mean ±SD of three determinations

To prevent coronary heart disease and other age-related illnesses like dementia, plant foods rich in flavonoids and polyphenols, such as flavonols, are necessary [23]. Among flavonol's many names are rutin, also called quercetin-3-rutinoside, rutoside and sophorin. It is a powerful plant-based antioxidant that is often used to treat many human ailments, including diabetes, cancer recurrence, oxidative stress, microbial contamination, and cardiovascular disease [24]. Most flavonols were found in fenugreek seeds extract, which yielded 21.81 mg of R/g dry extract of all flavonols.

According to a study of the preceding literature, Bhanger et al., found a TPC of 5.75 mg GA/g dry weight and a TFC of 0.607 mg QE/g dry weight [25]. Priya et al., determined that the extract of fenugreek seeds contained 0.876 mg GA and 0.489 mg QE per gram dry weight of TPC and TFC, respectively [26]. According to Al-Maamari et al., the extract of fenugreek seeds contained TPC at a concentration of 2.16 mg GA/g dry weight and TFC at a concentration of 0.328 mg QE/g dry weight [27].

Phytochemicals such as anthocyanins are naturally occurring pigments that colour fruits, vegetables, and plants. Apart from chlorophyll, they are the most prevalent group of plant pigments that may be seen [28]. Antiallergic, anti-inflammatory, antiviral, and antioxidant effects of anthocyanins have been shown in vitro and in vivo, indicating that they also work as reducing agents, hydrogen donors, and single oxygen quenchers [29]. To achieve this effect depends on it is crucial to consider how many OH groups are present, how much structural conjugation is present, and if electron-donating and electron-withdrawing substituents exist in the ring structure [30].

Because of its speed and simplicity, the pH differential approach is the most often used method for assessing anthocyanins. The TA content of fenugreek seeds extract was determined in mg cy-3-glu/kg equivalents, yielding 1.87 mg of cy-3-glu/kg dry extract (Table 1).

Ferric reducing antioxidant power (FRAP)

Measurement of antioxidant capacity is usually performed using the "ferric-reducing antioxidant power" test (FRAP). Testing the ability of phenolic antioxidants to give electrons or hydrogen is a common way to assess their antioxidant activity [31]. Fe $[(CN)_6]^{3+}$ reduction to Fe $[(CN)_6]^{2+}$ is employed in the current study to assess a compound's reducing agent power capability. The complex formation results in a rise in absorbance, demonstrating the enhanced reduction capacity. FRAP concentration in fenugreek seeds extract was evaluated by measuring the absorbance at 700 nm, which yielded 11.07 mg/g dry extract (Table 2). According to Al-Maamari et al., an earlier investigation determined the FRAP to be 0.259 mMoles/L dry weight [27].

Table 2. Fenugreek seeds extract ferric reduction power, chelating capability, and α -amylase inhibition

Antioxidants	Present quantity
FRAP (mg $FeSO_4$/g extract)	11.07 ± 0.81
MCA (mg Fe^{2+}/g extract)	76.35 ± 0.25
AAI %	84.21 ± 0.99

Results are reported as mean ±SD of three determinations

Capacity for chelating metal ions

Iron is a cofactor for various iron metallic enzymes necessary for proper cell function, such as oxygen transport and respiration [32]. 1,10-phenanthroline is expected to bind iron primarily as $[Fe(phenanthroline)]^{2+}$ when used as a chelating agent. Spectrophotometric analysis can aid in separating Fe^{2+} and Fe^{3+} since the Fe^{2+}-phenanthroline complex absorbs at 510 nm, and the reading is proportional to the Fe^{2+} level of the sample in the pH range of 2.5 to 8.0 [33]. Results demonstrated that fenugreek seed extract might chelate metals at a 76.35 mg/g dry extract (Table 2). Bhanger et al., previously reported a chelating activity of 1.02 mg/g dry weight [25].

α-amylase inhibition assay

Inhibitors of α-amylase have been found in many plants, making them potentially effective in the treatment of diabetes [34]. One of the essential enzymes in the human body is α-amylase, which breaks down starch into simpler sugars [35]. In inhibition studies, fenugreek seed extract inhibited α-amylase. Control samples with no plant extract were created and compared to test samples that included different amounts of the plant extract. Acarbose served as a positive control. The plant extract was evaluated using the quantitative starch-iodine method for their α-amylase inhibitory activities. Amylase inhibition impacts a plant extract, as shown in Table 2. An examination of the available literature indicated that Keskes et al., reported inhibition of α-amylase at a 52.1 µg/mL concentration [36].

HPLC analysis of extract and fractions

The use of column chromatography obtained a total of 58 fractions. Due to the similarity of TLC, they were separated into four fractions. As a result, determining the structure and biological characteristics of active plant components is very challenging. Consequently, high-resolution chromatographic technologies like HPLC detect and characterize several bioactive compounds discovered in the extract and fractions as a consequence [37]. Four fenugreek seed fractions (Fraction 1 to Fraction 4) and crude extract were tested. The crude methanolic extract had at least one major component, whereas three fractions contained the resveratrol substance (Table 3). The chromatograms indicated other peaks linked to additional phenolics, but they could not be identified due to inadequate standards.

Table 3. Phenolic compound concentrations (mg/kg dry matter) in fenugreek seed extract and fractions

Phenolic compounds		Fractions of fenugreek seeds extract			
	Extract	Fraction 1	Fraction 2	Fraction 3	Fraction 4
Gallic acid	n.d	n.d	n.d	n.d	n.d
Catechin	8.77	n.d	n.d	n.d	n.d
p-Coumaric acid	n.d	n.d	n.d	n.d	n.d
Epicatechin	n.d	n.d	n.d	n.d	n.d
Rutin	n.d	n.d	n.d	n.d	n.d
Resveratrol	n.d	0.135	0.065	0.092	n.d
Naringin	n.d	n.d	n.d	n.d	n.d

n.d, Not detected.

IV. CONCLUSION

This investigation aims to determine the extract's antioxidant capacity and fractionate it using column chromatography. The phytochemical analysis of the sample is crucial in establishing its antioxidant properties. The extract, for example, exhibited a high concentration of polyphenolics, flavonoids, flavonols, and anthocyanins, all of which have antioxidant properties. Similarly, the antioxidant capability of the natural extract was investigated using FRAP and MCA, which revealed that this plant has a significant capacity for free radical scavenging. The α-amylase inhibitory capacity revealed the most significant degree of inhibition. In addition, for the first time, an appropriate mobile phase was identified, and four fenugreek seed extract fractions were isolated using column chromatography. An HPLC examination revealed the presence of phenolic compounds such as catechin, and resveratrol. This study's results will be helpful for future researchers in isolating, identifying, and identifying the distinct molecule responsible for increased antioxidant activity.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

An Effective Way to Detect the Sum of the First N Term of an Arithmetic Progression

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Abstract:-- **The article looks at teaching students how to find the sum of the first n members of arithmetic progression. Using different approaches to solving a problem can stimulate and stimulate students' interest in solving a problem. Working on their own will have a positive impact on their development. Students need to be taught how to solve problems in two or more ways. There is a special technique that can be used to influence students' decisions quickly and efficiently. By using this approach, we can develop our students' memory, comprehensiveness, and logic. Here are some examples of finding the sum of the first n members of an arithmetic progression by a non-standard method. Special methods can be used by school students, young teachers, and math teachers.**

Index Terms : learning mathematics; solving problems in non-standard ways; arithmetic progression.

I. INTRODUCTION

One of the tasks of teaching algebra at the level of basic secondary education is to acquaint students with the sequence of numbers and methods of their representation, arithmetic and geometric progressions. Encouraging students to solve problems based on the formation of knowledge on the sequence of numbers, the functional dependencies between them, the applications of progressions and the development of their mathematical thinking is a very complex and multifaceted task. Therefore, the contradiction between the level of mathematical literacy of students and the quality of knowledge in accordance with modern requirements requires improving the methodology for the formation and development of applied aspects of mathematical knowledge. In this regard, the implementation of the task of teaching algebra courses in the main school and improving its methodology is relevant.

Theoretical justification of the development of research activities of students in the process of teaching the topic of arithmetic and geometric progressions in secondary schools.

The results of our research work allow school teachers to effectively organize the teaching of arithmetic and geometric progressions, their applications in the algebra course and easily solve problems by providing students with examples of the place of progression in everyday life and the application of progressions in various forms.

Our goal is to develop a methodology for teaching arithmetic and geometric progressions in the basic school algebra course, to teach students to make correct and quick decisions by solving problems in the most effective ways.

II. MAIN PART

Main tasks:

1) study of research work on the formation and development of students ' cognitive activity, the experience of advanced teachers-scientists in the process of teaching algebra in the main school and its types;
2) development of a methodology for organizing the study of arithmetic and geometric progressions in the algebra course;
3) development of a methodology for forming the ability to solve applied problems using formulas, properties of arithmetic and geometric progression.

Basic formula for calculating the sum of the first *n* member of the arithmetic progression:

$$S_n = \frac{a_1 + a_n}{2} * n$$

To apply this formula, we must necessarily know the first member, the last member, and the number of members. In some reports, you will need to calculate the sequence number of the last member. It requires additional calculation. Take as an example, calculate the sum of all two-digit numbers multiplied by 5. The largest two-digit number that is a multiple of 5 is 95. But its ordinal number is unknown, i.e. to use the basic formula that calculates the sum of the first *n* member, we need to find the ordinal number 95. And if we convert a formula that calculates the sum of the first *n* members of the arithmetic progression to problems of this type and produce a new formula, it will be easier to solve problems of this type. Formula of the nth member of the arithmetic progression: $a_n=a_1+(n-1)d$

Let's find n in this formula:

$$(n-1)d = a_n - a_1$$

$$n - 1 = \frac{a_n - a_1}{d}$$

$$n = \frac{a_n - a_1}{d} + 1 = \frac{a_n - a_1 + d}{d} = \frac{a_n - (a_1 - d)}{d}$$

If we have the expression a_1+d equal to a_2, then let's assume that the expression $a_1–d$ is a_0, that is, the Zero member of the arithmetic progression. To find a zero member, you need to subtract the difference of the arithmetic progression from the first member.

$$a_0 = a_1 - d$$

$$a_1 - d$$

if we put a_0 instead of the expression: $n = \frac{a_n - a_0}{d}$

After such transformations are completed, a new modified Formula appears that calculates the sum of the first *n* members of the arithmetic progression.

$$S_n = \frac{a_1 + a_n}{2} * n = \frac{a_1 + a_n}{2} * \frac{a_n - a_0}{d} = \frac{(a_1 + a_n)(a_n - a_0)}{2d}$$

Now, using this formula, let's look at a few examples.

Example №1: Calculate the sum of all two-digit numbers multiplied by 5.

Solution:

The first two-digit number that is a multiple of 5 is 10, i.e. a_1=10. the last digit is 95, i.e. a_n=95. the difference is 5, i.e. *d*=5. Now let's calculate a_0:

$$a_0 = a_1 - d = 10 - 5 = 5$$

Now let's use a new modified formula that calculates the sum of the first *n* members of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(10 + 95)(95 - 5)}{2 * 5} = \frac{105 * 90}{10} = 105 * 9 = 945$$

Example №2: Calculate the sum of all two-digit numbers multiplied by 7.

Solution:

The first two-digit number multiples 7 is 14, i.e. a_1=14. the last digit is 98, i.e. a_n = 98. the difference is 7, i.e. *d*=7. Now let's calculate a_0: $a_0=a_1-d$=14-7=7 Now let's use a new modified formula that calculates the sum of the first *n* members of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(14 + 98)(98 - 7)}{2 * 7} = \frac{112 * 91}{2 * 7} = 56 * 13 = 728$$

Example №3: 65+66+67+...+111+112 calculate the sum.

Solution:

The first member is 65, i.e. a_1=65. the last member is 112, i.e. a_n = 112. the difference is 1, i.e. *d*=1. now let's calculate a_0: $a_0=a_1-d$=65-1=64 Now let's use a new modified formula that calculates the sum of the first *n* members of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(65 + 112)(112 - 64)}{2 * 1} = \frac{177 * 48}{2 * 1} = 4248$$

Example №4: Calculate the sum of all natural numbers from 80 to 150, including 150. Solution: The first member is 80, i.e. a_1=80. the last member is 150, i.e. a_n = 150. the difference is 1, i.e. *d*=1. now let's calculate a_0: $a_0=a_1-d$=80-1=79 Now let's use a new modified formula that calculates the sum of the first *n* members of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(80 + 150)(150 - 79)}{2 * 1} = \frac{230 * 71}{2 * 1} = 8165$$

Example №5: Calculate the sum of all two-digit natural numbers.

Solution:

The first member is 10, i.e. a_1=10. the last member is 99, i.e. a_n=99. the difference is 1, i.e. *d*=1. now let's calculate: Now let's use a new modified formula that calculates the sum of the first *n* members of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(10 + 99)(99 - 9)}{2 * 1} = \frac{109 * 90}{2 * 1} = 4905$$

Example №6: Calculate the sum of three-digit even numbers.

Solution:

The very first member is equal to 100, i.e. a_1=100. The last member is 998, i.e. a_n=998. the difference is 2, i.e. *d*=2. Now let's calculate a_0: Now let's use a new modified formula that calculates the sum of the

first n members of the arithmetic progression to calculate the sum of these numbers:

$$S_n = \frac{(a_1 + a_n)(a_n - a_0)}{2d} = \frac{(100 + 998)(998 - 98)}{2 * 2} = \frac{1098 * 900}{2 * 2} = 247050$$

Thus, the proposed method can be called the most effective approach to teaching arithmetic progression. Students should always be taught how to create reports in several ways. Teaching tasks in two or more ways, if possible, contributes to the logical development of students.

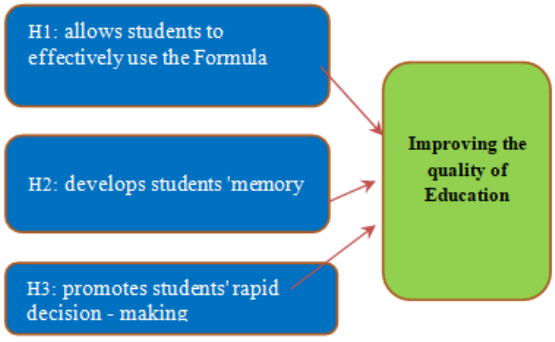
III. OBJECTIVES OF THE STUDY

The aim of the study is to offer the most effective way for students to find the sum of the first N terms of an arithmetic progression.

IV. HYPOTHESES

1) allows students to effectively use the Formula
2) develops students 'memory
3) promotes students' rapid decision - making

V. MODEL



VI. RESEARCH METHOD

The study used complementary system methods:
Theoretical: analysis of psychological, pedagogical and methodological literature, analysis, generalization, systematization of factual data; control method.
Experimental: the stage of analysis, identification, formation and control of pedagogical and psychological documents, methods of processing results (quantitative and qualitative analysis of the data obtained).

VII. CONCLUSION

Teaching schoolchildren an effective way to find the sum of the first n members of an arithmetic progression is considered. The use of various methods in the production of reports increases the interest and passion of students in the production of reports. Working with oneself has a positive impact on the development of activity. A special methodology is proposed, which will help students make quick and correct decisions. Using this approach, we can form students ' memory, comprehensive deep thinking, and logical thinking. The special methodology can be used by schoolchildren, young teachers and math teachers.

VIII. RECOMMENDATIONS

Based on the results obtained, it is better to take as a basis interdisciplinary continuity in high school mathematics.

Financing: this study was not funded. The study was conducted on a voluntary basis.

Conflict of interests: the authors have no conflicts between themselves. The order of authorship is agreed in advance.

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Abstract:-- **Today the renewable energy is playing a key role in the world. In that the solar energy one of the important source. The majority of the countries utilizing the solar energy. To consume the solar energy in to our daily life, the solar power converters are taking vital role; the present available converters are two types they are,**

1) Solar grid-tie/ grid-connected converters and
2) Solar battery backup converters

For grid-tied converters the grid supply is compulsory as a primary supply along with PV-array, and for battery backup converters battery supply compulsory as a primary supply along with PV array. It is observed that the above converters will not work without primary supplies even the PV source available. So it is not possible to utilize the solar energy without primary supplies with existing converters. To conquer this issue, the new innovative converter planed as a "Grid Independent and Battery-less Solar PV Power Converter" to utilize the solar energy directly via this new converter concept without any primary supply.

Key Words : Grid-tied, Battery less, Photovoltaic, Converter, Solar array, Energy.

I. INTRODUCTION

1.1 Solar Photovoltaic Power Converter

Grid-tied (also known as **grid-intertied** or **utility/grid-connected**) systems are intended to operate in parallel with an electric utility.

Such configuration is the most common. At night or during inclement weather, the electricity is supplied by the mains in grid-tied converters. During the daylight hours, the system generates some power, offsetting the consumption of electricity from the utility and cutting electric bills. The balance of the kWh required by user loads is automatically drawn from the input grid lines in grid tied converters.

The main disadvantages of such systems is that,

a. Normally they do not provide any back-up during grid failures / blackouts even if sun is shining; even the PV array is producing enough energy. Its meaning is that the grid supply mandatory for grid-tied converters along PV array, no grid means no output.
b. Secondly, it required Net-metering compulsory. If the PV panels are producing more electricity than usage, the system will feed the surplus of the energy back to the utility, i.e. it will export to grid. (It may even spin electric meter backwards, further reducing monthly bills. But in some states/countries we have to pay for energy back to the utility also if NO net-metering system).
c. So, there by these Grid-tied solar systems are not suitable for small capacity applications like domestic /residential applications, these are only suitable for large scale and commercial power plants only.

To overcome these above demerits, the latest topology is introducing for the future development of solar power utilization.

The latest concept is titled as ***"Grid Independent and Battery less Solar Photovoltaic Power Converter"*** It does not require any battery backup and primary/ reference grid supply etc. it can work even grid blackout at sun shine hours.

There will be no grid export issue and not required net-metering with this system and much suitable for low & medium capacity systems like domestic /residential applications etc.

II. DESIGN DESCRIPTION

The following block diagram shows the circuit blocks to generate the necessary signals:

Block Diagram:-

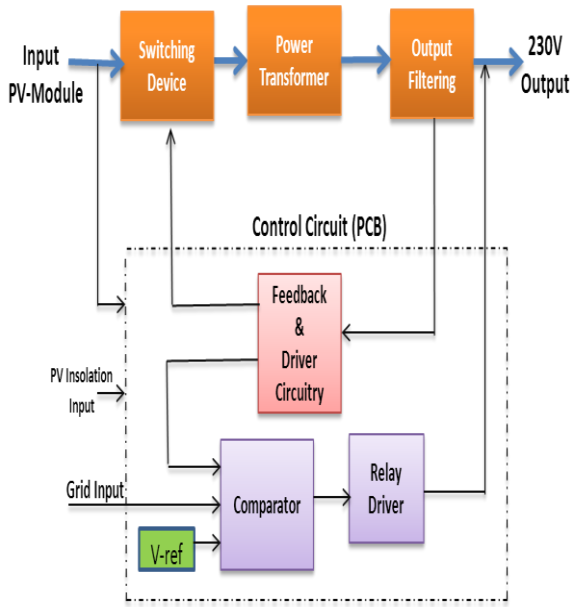

Fig.1 Block diagram of grid independent, battery less Solar Photovoltaic Power Converter.

In the above block diagram, the heart of the converter is feedback & MOSFET driver circuit. The DC is fed to the resonance circuit from the DC source of PV-modules. Then it builds up oscillations at the designed frequency at a low voltage. The frequency depends on the values of oscillator elements. The low AC output voltage from the oscillator is then fed to a step-up transformer for raising the output AC voltage up to the required level.

The solar direct photovoltaic power converter requires only with few components, like SG 1525A, LM 124, LM 158, SG7812 etc. The heart of this converter is PWM (Pulse Width- Modulation) control integrated circuit; the LM 124 (OP-AMP) IC used for various protections such as over-load, SPV- low, feedback circuits.

The main sections of control circuit of solar direct photovoltaic power converter are,

a) Power Supply & Feedback Section
b) PWM plus generator Section
c) Power MOSFET & driver Section
d) Over-load & PV- low Section
e) Intelligent Grid-interactive section

III. WORKING CONCEPT

The solar direct photovoltaic power converter will interact with Grid-supply (optional) and PV-supply at sunshine hours as per insolation-level, but at night time it will stick with Grid-supply only (If grid supply connected). The working concept of the system is shown in the below fig.2

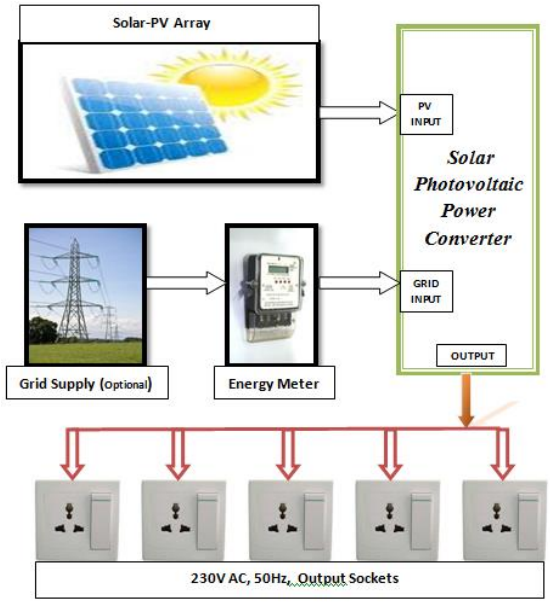

Fig.2 Working concept of the grid independent, battery less solar photovoltaic power converter.

IV. CONCLUTION

This new grid independent, battery less solar photovoltaic power converter designed with Quasi-sine wave output; it can adequately power most house hold appliances. It is more economical, 99% of appliances run happily with Quasi-sine wave. It does not require any battery backup and primary/ reference grid supply etc. it can work even grid blackout at sun shine hours. There will be no grid export issue with this system. It is purely suitable for residential applications & shopping-Malls etc.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Spectrum Decision Approach for Cognitive Radio Based IOT in 5G Communication System

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Abstract:-- **Spectrum Sensing (SS) plays an essential role in Cognitive Radio (CR) networks to diagnose the availability of frequency resources. In this we aim to provide an in-depth survey on the most recent advances in SS for CR. We start by explaining the Half-Duplex and Full-Duplex paradigms, while focusing on the operating modes in the Full-Duplex. A thorough discussion of Full-Duplex operation modes from collision and through put points of view is presented. Then, we discuss the use of learning techniques in enhancing the SS performance considering both local and cooperative sensing scenarios. In addition, recent SS applications for CR-based Internet of Things and Wireless Sensors Networks are presented. Furthermore, we survey the latest achievements in Spectrum Sensing as a Service, where the Internet of Things or the Wireless Sensor Networks may play an essential role in providing the CR network with the SS data. We also discuss the utilization of CR for the 5th Generation and Beyond and its possible role in frequency allocation. With the advancement of telecommunication technologies, additional features should be ensured by SS such as the ability to explore different available channels and free space for transmission. As such, we highlight important future research axes and challenging points in SS for CR based on the current and emerging techniques in wireless communications.**

Keywords : cognitive radio; channel sensing; Interference Sensing; spectrum sensing; full duplex, half duplex, Internet of things, wireless sensor networks, machine learning, 5G, B5G.

I. INTRODUCTION

Two decades ago, introduced a new concept in wireless telecommunication the Cognitive Radio (CR) is mainly based on Soft Defined Radio (SDR) where specific hardware can be replaced by more generic hardware that can be configured via software. In addition to being softly configurable, CR is aware and adaptable to the radio environment, which can be exploited in optimizing the use of available frequency bands while protecting the occupied ones from harmful interference

CR has been introduced as a potential candidate to perform complete Dynamic Spectrum Allocation by exploiting the free frequency bands that are "spectrum holes" or "white spaces" Being capable to identify these spectral opportunities, CR classifies the users into two categories: licensed, i.e., the Primary Users (PUs), and Secondary Users (SUs). While PUs can access the spectrum whenever they want, SUs are restricted by the activities of PUs. In other words, SUs should respect the PUs' Quality of Service and harmful interference coming from SUs to PUs transmission is prohibited. Therefore, three paradigms of CR can be distinguished according to the possibility of co-existence of SU and PU transmissions in the same channel, the permitted transmit power of SU and the cooperation between SU and PU, three main paradigms of CR can be distinguished: transmissions in the same channel, the permitted transmit power of SU and the cooperation between SU and PU, three main paradigms of CR can be distinguished

The usage of CR is extended to the domains IOT of WSN This was motivated by the huge number of new IOT/WSN devices that require additional frequency resources. Although using CR for WSN and IOT seems promising, more investigation is needed at several levels such as the design of the exchange protocols and access management. CR in IOT/WSN from SS perspective. SS for 5G-based application CR can be used to address interference issues from space, frequency and time domain.

CR for fifth Generation (5G) is expected to play an important role to answer the need of the increasing number of data hungry device Knowing that 5G will extend the spectrum band to the mililmeter wave

range, CR can be used to improve the spectrum utilization while providing better protection to co-existing users. Moreover, CR can be used to address interference issues from space, frequency and time domain. This is important knowing that 5G is expected to exploit spatial reuse of the spectrum as one of the main features of 5G systems. Yet, introducing CR in 5G imposes several challenges that need addressing.

CR has been introduced as a potential candidate to perform complete Dynamic Spectrum Allocation by exploiting the free frequency bands that are "spectrum holes" or "white spaces" Being capable to identify these spectral opportunities, CR classifies the users into two categories: licensed, i.e., the Primary Users (PUs), and Secondary Users (SUs). While PUs can access the spectrum whenever they want, SUs are restricted by the activities of PUs. In other words, SUs should respect the PUs' Quality of Service and harmful interference coming from SUs to PUs transmission is prohibited. Therefore, three paradigms of CR can be distinguished according to the possibility of co-existence of SU and PU transmissions in the same channel, the permitted transmit power of SU and the cooperation between SU and PU, three main paradigms of CR can be distinguished: transmissions in the same channel, the permitted transmit power of SU and the cooperation between SU and PU, three main paradigms of CR can be distinguished

1.UNDERLAY ACCESS: The SU may transmit simultaneously with the PU over the same channel. However, the transmitted power should not exceed a certain threshold in order to keep the interference on PU below a tolerable value

2. OVERLAY ACCESS: The SU may transmit simultaneously with the PU on the same channel up to its maximum power, but at the cost of playing a role of relay between two or more PU of Full-Duplex (IBFD) communication has recently been proposed in order to increase the spectrum efficiency the same frequency channel to transmit and receive simultaneously. IBFD is based on the Self-Interference Cancellation (SIC), where the Self-Interference (SI) is canceled in order to obtain the signal of interest. The application of SIC has been extended to CR providing it with the ability to sense and transmit at the same time leading to the so-called Full-Duplex Cognitive Radio (FDCR) this Based on the SIC capability and the flexibility of FDCR, several access schemes have been proposed and various challenges have been treated such as the SIC-based modes to be adopted, hybrid mode between HDCR and FDCR and the effects of the residual SI on the sensing process since SIC is imperfect, the SU sends its data while relaying the PUs. This kind of access requires high level of cooperation between PUs and SUs, which may expose the PUs privacy.

3. INTERWEAVE ACCESS : SU is allowed to transmit using its maximum power only when PU is absent. This paradigm is also known as the classical CR and it is the focus of the given its popularity.

C0gnitive Radio with IOT Based block diagram as shown in above figure

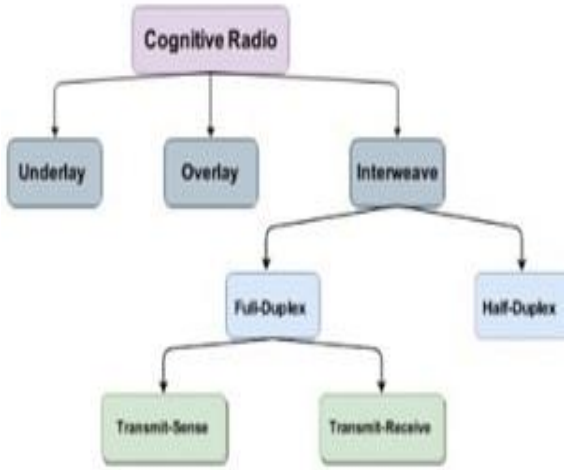


Figure 1. Cognitive Radio (CR) access Pasadigms

The main drawback of the underlay paradigm is the low transmitted power, which adversely impacts the throughput. The use of the overlay paradigm is limited to scenarios where PU and SU have a high level of cooperation. Interweave paradigm allows SUs to transmit with their maximum power, but at the cost of monitoring the activity of PU

In classical interweave systems, the SU activity period is divided into two time slots sensing and transmission. This leads to the so-called Half-Duplex Cognitive Radio (HDCR). HDCR applies the protocol by adopting an alternating sensing-transmission fashion. During the sensing slot, the SU only senses the channel to detect the presence or absence of the PU, and it cannot transmit. SU should remain silent if it detects a transmission from the PU. Otherwise, the SU resumes sending its data. Note that the silence of the SU during the sensing slot affects its transmission rate. Moreover, periodic sensing may lead to collisions between the SU and PU as the PU may become active again during the SU transmission after being silent during the SU sensing slot.

Based on the SIC capability and the flexibility of FDCR, several access schemes have been proposed and various challenges have been treated such as the SIC-based modes to be adopted, hybrid mode between HDCR and FDCR and the effects of the residual SI on the sensing process since SIC is imperfect

As a powerful tool, machine learning techniques are exploited in the domain of CR to improve the SS performance SS may be formulated as a binary classification problem related to the presence of PU. Unlike classical SS, the learning techniques may

overcome the to know statistical parameters of the channel or the PU signal. More- over, these techniques are proposed to predict the PU activity, which can enhance the spectral efficiency of the secondary network and protect the primary transmission from the secondary interference.

CR for fifth Generation (5G) is expected to play an important role to answer the need of the increasing number of data hungry device Knowing that 5G will extend the spectrum band to the millimeter-wave range, CR can be used to improve the spectrum utilization while providing better protection to co-existing users. Moreover, This is important knowing that 5G is expected to exploit spatial reuse of the spectrum as one of the main features of 5G system.

CR is proposed to be used in various wireless communication technologies, since it proves itself as one of the efficient techniques to ensure fair and flexible frequency allocation CR benefits from the emergence and development of learning techniques applied to wireless communication Accordingly, SS should be ceaselessly improved to keep up with the recent technological advancements. In this context, several challenges are raised such as the need for huge frequency resources, sensing of the spatial availability, intelligent sensing of the spectrum and energy-efficient protocol design

In the literature several survey the usage of SS for CR in the presented many aspects of spectrum sensing from a cognitive radio perspective However this recent applications and paradigms. surveys FDCR technique by focusing on the concurrent transmit–sense mode while other techniques, such as transmit–receive, were not covered. details the challenges of applying CR in IOT networks by focusing on the issues related to SS. surveys the techniques of SS with a focus on wideband and compressive sensing. in the survey the recent techniques of SS by highlighting the mathematical models deriving the SS metrics (detection and false alarm probabilities). However, recent paradigms, such as Full-Duplex, and recent applications, such as the Internet of Things, are not addressed. The work limited to technical issues related to the application of CR in IOT Finally the use of CR for 5G communication without further explanation of recent development in SS.

This aims at providing comprehensive surveying and analysis of the recent research advancements and emerging applications in the field of SS for CR. For numerical evaluation of SS explain the fundamental concepts of SS and summarize the state of the art in the context of SS for CR. Moreover, we discuss the use of machine learning to enhance SS and the applications of we propose possible perspectives to develop this promising domain. The main contributions as follows

- A state of the art on the classical SS techniques is provided the operating modes of CR derived from involving the FD tool in CR are detailed and investigated
- The role of Machine and Deep Learning in enhancing the SS is surveyed, where we analyzed the contributions of these techniques from local sensing and cooperative sensing levels
- Using SS in IOT/WSN and the latest achievements in both Spectrum Sensing as a Service and Dynamic Spectrum Sharing for IOT/WSN networks are surveyed.
- The possible application of CR, especially SS, in the 5G and the upcoming technologies is discussed
- New trends and challenges related to the future wireless communication technologies are also discussed and investigated.

Half-Duplex Cognitive Radio.

$y(n) = x(n) + w(n),$

where $y(n)$ is the received signal, η is the channel indicator, i.e., $\eta = 0$ if PU is absent and $\eta = 1$ otherwise. $x(n)$ is the PU signal and $w(n)$ is the additive noise at the receiver of SU. For active PU ($\eta = 1$), SU receives a noisy version of the PU signal. Therefore, it should be aware of the PU channel status by overcoming the noise effects. By contrast, when PU is absent, SU receives only the noise $w(n)$. Here, SU should be able to detect the presence or the absence of PU to better exploit the channel availability. In Equation, the received signal $y(n)$ does not depend on the SU signal, since we consider that SU remains silent during the SS period

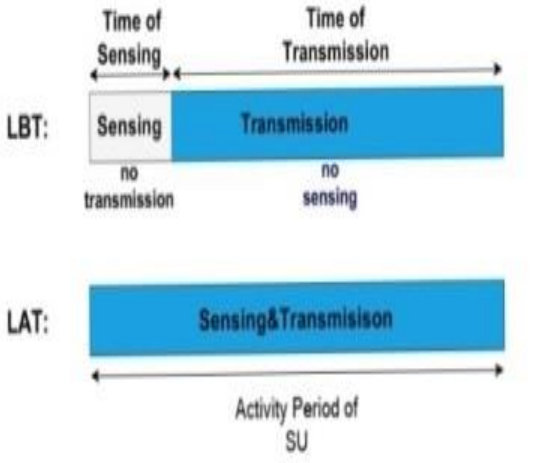
The silence period of SU in HDCR is inevitable due to two main challenges. First, some detectors like Energy Detector (ED) cannot distinguish between PU and SU signal Thus SU must be silent during the sensing period so that the sensing process can reliably diagnose the channel status. Second, most of the detectors suffer bad performance at low Signal-to-Noise-and-Interference Ratio (SNIR). Due to the short distance between the transmit and the receive antennas of SU, any transmission of SU during the sensing period leads to huge SI compared to the PU signal. This SI would lead to an unreliable decision of the sensing process.

II. FULL-DUPLEX COGNITIVE RADIO

Applying SIC in CR aims at eliminating the effect of the transmitted secondary signal (i.e., Self-Interference) on the reliability of the SS decision. SU seeks to receive purely the PU signal (with noise) when the latter is active, or only the noise if PU is absent. Thus, the transmitted signal of the SU should be canceled at the SU receiving antenna, if the SU starts to simultaneously transmit and sense. by applying LAT protocol, FDCR can continuously

monitor PU without the need to interrupt the transmission to make the SS, as in the case of HDCR where LBT is applied.

Another strategy for the LAT protocol is adopted in without using SIC. The sensing operation is performed by the receiving SU instead of the transmitting one. After decoding the signal received from its peer (another SU), the secondary receiver subtracts the signal of its peer from the overall received signal. After that, spectrum sensing is carried out based on the remaining signal in order to decide about the presence/absence of the PU.ie Primary Use The features of the communication signals can be exploited by the SU to distinguish them from the noise. Processes, such as the modulation, oversampling, sine-wave carrier, adding a cyclic prefix (e.g., for the OFDM signal), etc. do not exist in the noise. Several detectors were proposed in the literature by exploiting these characteristic such as the Detector which distinguishes the PU signal from the noise based on the cyclic features caused by the modulation, the sinewave carrier etc. Other detectors such as Auto-Correlation Detector (ACD) and Eigenvalue-based Detector (EVD) exploit the correlation presented in the PU signal due to the over sampling and cyclic prefix. The main advantage of such detectors is their independence of the noise variance, which also overcome the NU problem.



'igure 2. The two main functioning modes of SU activity. Listen-befc luring the sensing period and no sensing is performed during th LAT): sensing and transmission are made concurrently.

III. LEARNING TECHNIQUES FOR SPECTRUM SENSING

Machine Learning (ML) and Deep Learning (DL) are among the most powerful tools in solving complex classification problems. More specifically, they have been employed in wireless communication to efficiently manage the spectrum and the power resources, and to ensure high quality of services for the mobile users in the CR domain, one of the objectives of using ML and DL is to enhance the SS performance. Learning techniques usually use two phases: learning and prediction. For SS applications, the data provided in the learning phase is related to the PU features and the SU sensing parameters (such as the Test Statistics, SNR, geo-location, etc.), whereas the prediction phase could be related to the sensing outcome, the power efficiency, the functioning model to be adopted and other issues.

The main objective of using IOT system is to connect numerous heterogeneous devices, and system together to provide some smart services with minimal device resource requirement power hardware complexity and cost expenses to achieve the connectivity between devices should always maintained in all circumstance. This motivate us to focus on SS and spectrum sharing process in CR-based IOT.

The proper SS approach for the CR based IOT device. More ever determine the spectrum band allocation precisely to satisfy the PU protection constrains when exploiting the vacant spectrum band to achieve those two goals the following factors have to be considered.

1. IOT application
2. Enabling technology

Learning techniques in local and cooperative spectrum sensing.

IV. WIRELESS SENSOR NETWORK AND COGNITIVE RADIO

The use of WSN/IOT is substantially expanding, and it is expected to cover almost all of the life sectors: monitoring purpose, traffic, e-health applications, smart homes, agriculture, etc. CR and WSN/IOT can significantly benefit from each other. On the one hand, the wide development of WSN/IOT can be exploited by the CR in monitoring the PU channel. For example, Spectrum Sensing as a Service (SSS) emerges as a new model On the other hand, the huge number of WSN/IOT devices give rise to high demand on spectral resources. Here, CR technology can be considered as a solution to its dynamicity in enabling spectrum sharing

V. DYNAMIC SPECTRUM SHARING FOR WSN COMMUNICATION

The increasing popularity of using WSN/IOT devices requires better utilization of the limited frequency resources. Dynamic Spectrum Sharing using CR has been proposed to overcome the limitation of the available frequency resources in the context of WSN.

In Dynamic Spectrum Sharing for WSN communication, CR considers the WSN nodes as SUs. By monitoring the PU channel, the WSN nodes bear extra energetic burdens, since more energy

consumption is needed to accomplish the SS task. In fact, energy consumption is of high importance for the IOT/WSN networks, since the nodes are operating under protocols to extend their lifetime to several years. For instance, in Low Power Wide Area Network (LPWAN) IOT networks, the lifetime of a sensor may exceed 5 years due to the transmission specifications, especially the small duty cycle of less than 1% as in LAR networks

Adapting the CR mechanism to the WSN/IOT networks is challenging due to several issues such as providing the nodes with the available frequency bands, deploying the SS capability, selecting the nodes responsible of spectrum sensing, etc. Several studies tackle the implementation of CR in an IOT network and the standardization of the CR features required to perform the CR mechanism such as implementing hardware and protocols. This includes switching from one frequency band to another depending on the sensing process. Indeed, multiband access becomes necessary due to a large number of WSN/IOT devices, and having several available frequency channels makes the channel switching simpler and more efficient

The energy-throughput optimization of the CR-IOT is investigated in where cooperative SS is adopted. Cooperative sensing necessitates the participation of several SUs/nodes in the SS. Despite the sensing improvement, cooperative sensing may impose additional energy consumption challenges for the participating SUs related to the continuous SS and reporting operations. The adoption of local sensing or cooperative sensing is discussed in under different sensing conditions and applied to CR-based NB-IOT technology with slotted-ALOHA protocol. The study of concludes that it is more convenient to use local SS when SNR is relatively high and limits the use of cooperative SS to the situations of low SNR.

Given that the CR functionality is implemented, new challenges emerge such as in- creasing the throughput and the spectrum efficiency and reducing the energy consumption of the wireless nodes. Dynamic licensed-unlicensed access is proposed in where the CR-based nodes may access both licensed and unlicensed bands in a dynamic mechanism. Such a mechanism may lower the demand on the unlicensed bands (where the WSN/IOT nodes operate usually) by sharing available licensed bands.

To compensate the additional energy consumed by the CR functionalities, such as SS and spectrum sharing, Energy Harvesting has been proposed in order to enhance the energy efficiency of the CR-based IOT system

CR seems a promising mechanism to address the high demand of the WSN/IOT networks on the frequency resources.

VI. COGNITIVE RADIO APPLICATION FOR 5G AND BEYOND 5G

The 5th generation (5G) of mobile technologies is expected to provide users with communication, very low latency and high reliability. 5G networks are designed to operate on two types of channels: the licensed channels and the unlicensed channels.

VII. BEAMFORMING-BASED COMMUNICATION

Massive MIMO and Ultra-Dense Network deployment are key enablers of 5G aiming at maximizing the spectrum reuse in this context, the base stations adopt tight beamforming techniques looking to maximize the transmit power in the direction of the receiver. Moreover. Cell-free networks have recently been proposed to serve a high number of users in a cellular network. A key enabler of this technology is the beam forming tech.

Here, CR may exploit a new dimension for its opportunistic transmission in addition to the time-frequency dimension: the spatial dimension. An example of new spatial dimension of CR is SU becomes provided with the ability to transmit the data concurrently with PU but under the constraint that the SU transmits the data in a different beam than that of PU.

When the transmission beam of the PU is well identified, SU may exploit the remaining space in order to transmit the data on a non-overlapping beams base SUs, in this case, should be equipped with a multi-antenna system in order to adjust their beam far from the primary receiver to avoid interference. In this context, joint sensing and localization of PU becomes of high importance since the localization of PU transmitter may facilitate the mission of SUs in identifying the beam and thus to diagnose the spatial temporal availability of the spectrum Recently, some work has been introduced to enable spatial SS by identifying the PU's location and adjusting the SU's beam using the received power at SUs surrounding the PU In this regard, estimation techniques have to be more developed in order to estimate the PU beam blindly or in the case where little information about PU transmission is available Nevertheless, identification of the PU transmission remains a complicated task for the SUs, especially where no cooperation is available between secondary and primary networks. In addition, interference caused by the secondary transmission should be carefully controlled since it is inevitable even though the transmission is beamforming-based. The interference level depends on the number of transmit antennas at the SUs, the distance between SU and PU and the angle of arrival of the secondary signal at the primary receiver. Accordingly, the transmit power and the beam of SU transmission should be adjusted.

The use of WSN/IOT is substantially expanding, and it is expected to cover almost all of the life sectors: monitoring purpose, traffic, e-health applications, smart homes, agriculture, etc. CR and WSN/IOT can significantly benefit from each other. On the one hand, the wide deployment of WSN/IOT can be exploited by the CR in monitoring the PU channel. For example, Spectrum Sensing as a Service (SSS) emerges as a new model On the other hand, the huge number of WSN/IOT devices give rise to high demand on spectral resources. Here, CR technology can be considered as a solution to its dynamicity in enabling spectrum sharing.

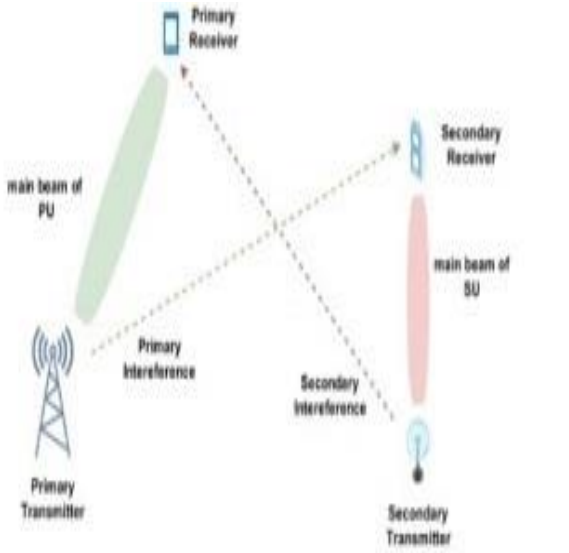


Figure 5. Spatial Dimension of CR application: SU is able to exploit the spatial dimension by transmitting in a non-overlapping direction with the PU transmission. Here, SU should be able to estimate/know the PU beam in order to avoid the interference.

VIII. CONCLUSIONS

In this survey, we presented the fundamental principles and motivations of applying spectrum sensing in cognitive radio networks. The concepts of half-duplex and full-duplex cognitive radio are presented. The main criteria exploited by SU to make the PU signal detection are presented and. different modes of operation for the case of full- duplex are described. Moreover, the use of learning techniques are at both local and cooperative levels. Then, the potential of applying spectrum sensing in WSN/IOT network is investigated, in addition to the essential role of IOT/WSN in the Spectrum Sensing as a Service. We also discuss the use of cognitive radio in 5G and B5G from spectrum allocation and frequency efficiency perspectives. Based on exhaustive surveying of the state of the art, we present several challenges and staggering points that need to be further investigated.

IX. FUTURE CHALLENGES

The main philosophy of CR is to dynamically share the spectrum among different wireless communication technologies. Accordingly, SS for CR is highly impacted by the advancement and growth of these technologies. Wireless communication is undoubted evolving in many ways including infrastructure deployment (e.g., massive deployment of small cells), system operation and management (e.g., self-organized networks), new concepts (e.g., cell-free systems), new technologies (e.g., intelligent reflecting surfaces) and many other techniques. Thus, SS should keep up with the evolution progress. In the following, we present several future challenges related to applying and developing SS for the new trends of CR.

Channel Coding for Interference Sensing is mainly applied in the TR mode of the FDCR. Being able to use only one available channel to establish bidirectional communication between two SUs,

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Virtual Cloth Warping using Deep Learning

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Abstract:-- **Virtual Try-On is a technology that can realistically clothe an individual virtually, it transfers a clothing image onto a target person's image. This is attracting attention from the industrial and research centers and can make the in-store experience achievable. The 2D image-based and 3D model-based methods developed recently have their own benefits and limitations. This paper describes the development of a 2D image-based Virtual Try-On Clothing system. Our solution comprises major modules: Human representation which is pose estimation using OpenCV and human parsing using Self Supervised Joint Body Parsing and Pose Estimation Network (SS-JPPNet) and the Try-On module which utilizes Cloth Warping Module (CWM) and Cloth Fusion Module (CFM) to generate the final try-on output. The technologies that are used for CWM is Convolutional Neural Network and for CFM is Generative Adversarial Network. Our application as of now supports only upper body clothing (tops, t-shirts, etc.). A graphic user interface is created where one can virtually try on clothes by uploading their picture and selecting the clothing item to try on, bringing the shopping experience to one's doorstep.**

Keywords : virtual try-on, convolutional neural network, generative adversarial network, cloth-warping.

I. INTRODUCTION

As predicted by retail consultants and industry experts, the pandemic has changed the way people shop. Stores are reopening but are reoriented to avoid interaction by closing fitting rooms, sample counters, and testers. Choosing the appropriate designs, sizes, and fits may make or break a purchase. This brings the issue of trying on garments, as dressing rooms have the main role in real-life shopping trips. Customers will think twice about the products they purchase, and vast inventories of stock on the shop floor will make way for new, tech-driven experiences with Virtual Try-On technology at the forefront. Using our proposed model solution retailers and fashion brands can blend the physical and virtual systems to create a customer experience that is safe, easy, convenient, and efficient for customers, whether online or in-store.

Motivation

Global lockdowns meant shoppers were unable to buy products in-store. Even when those retail locations opened up again, people were more hesitant to try on clothing items, worried it increased their risk of exposure to the virus. Virtual fitting rooms empower customers to make more informed purchasing decisions, it can alleviate many of the challenges faced by the fashion industry today: struggles with the fit, sky-high returns, and the resulting impact on our environment that could help brands to achieve their conversion goals.

Research Objectives

The Primary objective of this study is to understand the working of Virtual Cloth Warping Systems and develop one.

- To develop an approach with Gender Independent, Cloth Warping in mind.
- To improvise on the Warping / Fusion issues of the precedent research works.
- To try Generative Adversarial Networks to be utilized to its fullest.

Proposed System

Virtual Cloth Warping can be implemented using various technologies like Convolutional Neural Network(CNN), Generative Adversarial Network(GAN), and Cloth Interactive Transformer(CIT). Our proposed system is based on two stages, the first stage is a Convolutional Neural Network called a Clothes Warping Module and the second stage is a Generative Adversarial Network called Clothes Fusion Module.

II. RELATED WORK

1. *Cloth Interactive Transformer for Virtual Try-On*

A virtual try-on proposed consists of a novel two-stage Cloth Interactive Transformer (CIT) for image-based virtual try-on tasks. Their work is the first to utilize a Transformer for this task. In the first stage, a transformer-based matching block can model global long-range relations when warping a cloth via learnable thin-plate spline transformation and as a result, the warped cloth can be more natural [2]. The reasoning block can strengthen the important regions within the input data, on the other hand, the mutual interactive relations established via the reasoning block further improve the rendering process to make the final Tryon results more realistic.

2. VITON: An Image-based Virtual Try-on network

The Network Proposes To Help In Visualizing The person in target clothing using 2D resources. It initially generates an image with the person having the same pose and in the target clothing. and it is trained to improvise on the blurry portions formed during the generation process [4], [14]. The Encoder-Decoder generator and Refinement network both work on Convolutional neural networks.

3. VTNFP: An 2D-based Try-on Approach

In this paper, a three-module approach is proposed wherein the target clothing is warped and a segmentation map is predicted based on the previous results, and a synthesis module is used to fuse the target cloth & input human image. [20]

4. Towards Photo-Realistic Virtual Try-On by Adaptively Generating↔ Preserving Image Content (ACGPN)

The last approach [4] produces a semantic layout of a rough image that needs to be modified after try-on and then decides if the information of the image needs to be produced or preserved giving rise to fine results with details included. The first module uses semantic segmentation to collectively predict the needed semantic layout after try-on. Second, the warping of clothes is done according to the produced layout. In the third module, all information is gathered to do the clothes fusion and produce the output.

It consists of U-Net generators and all the discriminators are from pix2pixHD. Second-order spatial transformation is used in this approach to prevent Logo distortion and retain the characters making the model more fine-tuned. The first module specifies and preserves the unchanged portions of the image directly. It is made for fitting the clothes into the shape of clothing items with perceptible natural distortion according to the pose estimation. For the second module, a coarse body shape is created and used as a reference to produce the final output.

Some problems which occurred in [2] are overcome in this approach which are high distortion and misaligned warped clothes, and networks responsible for blending cannot retain the remaining clothes due to improper human representation. This approach has two stages which are the Geometric Matching Module and Try On Module. In the first stage, the target clothing is warped around the target human and in the second stage, the wrapped clothing is blended with the target person's image. The first stage is very important to get the target body silhouette from the target person's image.

5. Toward characteristic preserving image-based virtual try-on network

This approach [20] uses 2D image synthesis methods and 3D model deformation methods to target person pose. This approach can be applied to various clothing categories. The Skinned Multi-Person Linear (SMPL) model is used for the reconstruction of clothes with various poses. It is a fusion method in which 3D warped clothes are blended with 2D human poses to generate accurate outputs while preserving the original pixel quality of the image.

III. METHODOLOGY

1. Preprocessing

A. Human Parsing

Human parsing refers to the partitioning of the person or people captured in an image into multiple semantically consistent regions, e.g., body parts and clothing items. To implement Human Parsing we compared SCHP (self-correction for human parsing) and SS-JPPNet (Self Supervised Joint Body Parsing). The results obtained in SS-JPPNet were found to be better and more reliable than in SCHP. The recommended model to use for the generation of parsed human images is Body Parsing using SS-JPPNet (Self Supervised Joint Body Parsing and Pose Estimation Network) which is a deep learning method for human parsing built on Tensorflow. The model used is known as Self Supervised since the model is capable of generating "Structure-Sensitive" losses on its own without any additional information, these losses are used to improve the accuracy of parsing. DeepLab Model, which is a widely used Machine Learning library has been used here with ResNet-101 and Attention as the primary network. In the ResNet model, the input sent to a layer is also sent as input to its subsequent layer, thus they help in solving the problem of vanishing gradient. The model is trained on the LIP dataset and tested on our custom dataset. Consider an image I, we define joint configurations $C_I^P = \{c_i^p \mid i \in [1, N]\}$, c_i^p is the heatmap of the i-th joint. C_I^{GT} I = $\{c_i^{gt} \mid i \in [1, N]\}$, obtained from the parsing ground truth respectively. N is a variable that defines the number of joints in the

input images of human bodies. If there are joints missing in the image, the heatmaps are replaced with maps filled with zeros. The joint structure loss is the Euclidean (L2) loss, which is calculated as

$$L_{\text{Joint}} = \frac{1}{2N}\sum_{i=1}^{N}\|c_i^p - c_i^{gt}\|_2^2 \quad (1)$$

Here, c_i^p is the heatmap of the i-th joint and c_i^{gt} refers to the heatmap of ground truth.

The final structure-sensitive loss, denoted as $L_{\text{Structure}}$, is the combination of the joint structure loss and the parsing segmentation loss, L_{Parsing} is the pixel-wise softmax loss calculated based on the parsing annotations.

$$L_{\text{Structure}} = L_{\text{Joint}} \cdot L_{\text{Parsing}} \quad (2)$$

The proposed SS-JPPNet significantly improves the performance of the labels such as arms, legs, and shoes, which demonstrates its ability to refine the ambiguity of left and right. The overall accuracy of SS-JPPNet is 84.53%. The mean IoU score is 44.59.

Figure 1: Human Parsing Results

Fig.1 shows the input image selected from the dataset and its parsed image. The images in the dataset are of women wearing different sizes, colors, and patterns of clothes in various poses. The image on the left-hand side is the person image and on the right side is the parsed image.

B. Pose Estimation

It is a technique used to track various movements of human beings as well as objects. It is usually performed by finding the location of critical points for a given image. Based on these critical points various poses can be compared to draw conclusions.

For the execution of the pose estimation model, MediaPipe is used. The MediaPipe Body landmark model gives high-fidelity body pose tracking. When an image is passed through the pose estimator model, pose landmarks are obtained, and an array of key points is marked on the image using various draw utiles. Pose estimation deals with labeling each image pixel-wise semantically along with joint-wise structure prediction. MediaPipe uses the BlazePose model in which 33 key points can be marked on the input image [21] but some modifications have been made to get 18 specific key points that are required in the output.

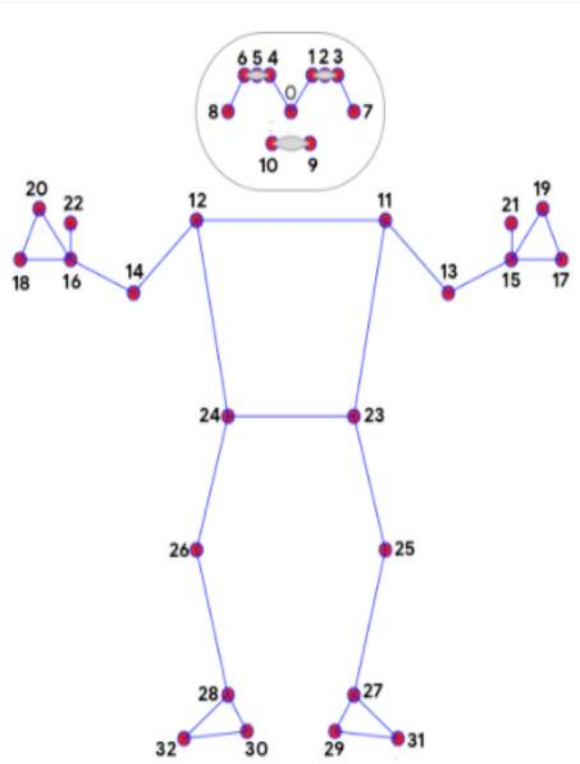

Figure 2: BlazePose topology

Fig.2 shows the BlazePose topology which is a pose tracking solution with 33 key points and is used by MediaPipe for pose detection purposes.

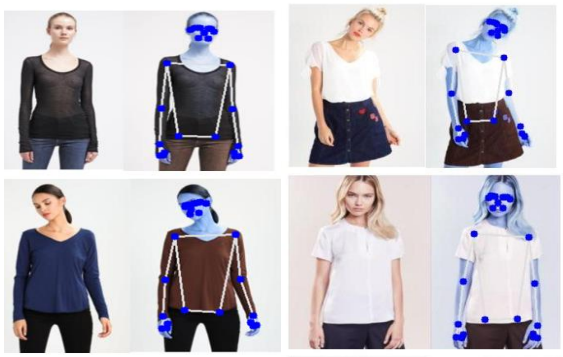

Figure 3: Pose Estimation Results

Fig.3 shows the image from the dataset. The image on the left side is the input image and on the right side is the final output after performing the pose estimation. The images are converted to RGB for ease of processing. The blue dots that are seen on the image are the required key points.

Fig 4: Flowchart

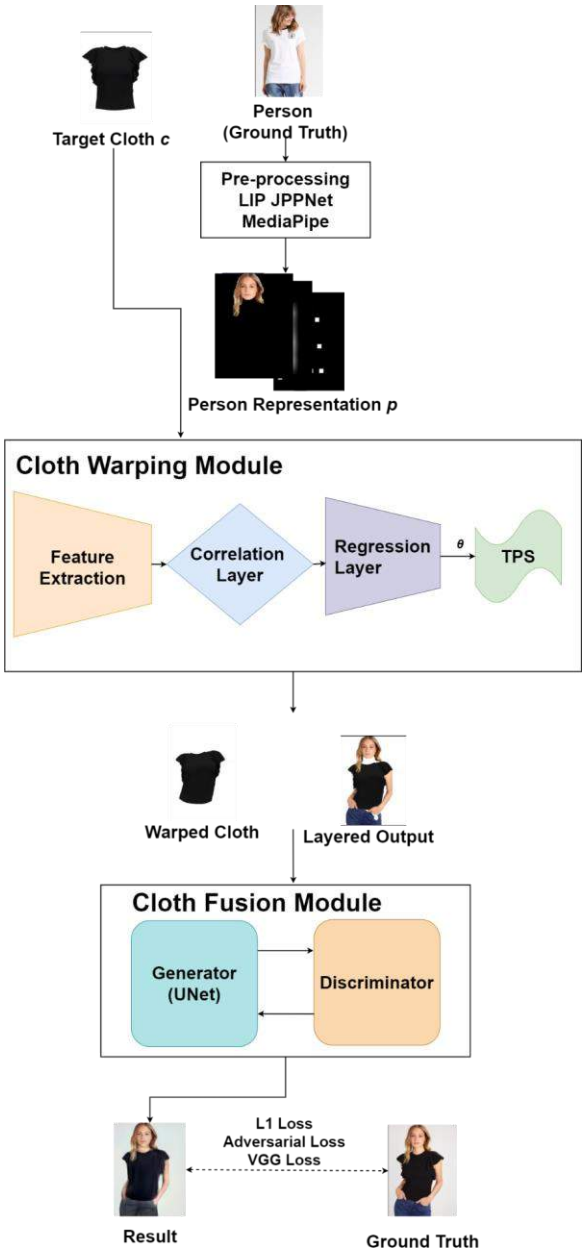

Fig.4 shows the flow chart of the proposed model.

2. Cloth Warping Module

The Fusion of Cloth onto the person's image is research in itself, since it requires an understanding of human bodies and categories of shapes and how they can be utilized to ensure a piece of cloth, a two-dimensional image can be fused well. Since the traditional use case would involve two-dimensional images, the model developed here utilizes the two-dimensional properties and tends to build the logic over it.

Cloth Images can not be fused simply by overlapping the image over the person's image. There is a need for segmenting the picture of the person on the basis of regions (skin, hands, head, etc.) and additionally estimating the pose, in order to form a clear understanding as to how the dress needs to fit over the person. This part of segmentation and pose estimation is done with the help of preprocessing the images.

Further, the model is divided into two major steps - a model trained to warp the two-dimensional cloth image based on the features of the person (arm size, body shape, pose, etc), and another model which is trained to develop the nearest possible result that would look similar to the person actually "trying on" a cloth.

The Cloth Warping stage needs the information of the person image, i.e. its feature details, and thus, a network is trained to extract features from the person and cloth images. Following the features, a layer is used to combine the tensors onto a single feature. This Feature is used as an input, based on which, the level of warping/warping parameters would be determined. This conversion of feature tensor to a parameter rating for warping is performed with the help of a regression neural network.

The Cloth Warping Module takes Person representation p, target cloth c as input and it comprises 3 stages: (1) Feature Extraction Networks for p & c, (2) Correlation layer to combine the results onto one tensor to pass it as input to regressor network, (3) Regression network to predict the transformation parameters θ. The parameters are passed onto the Thin Plate Spline Transformation Module, which warps the cloth accordingly.

The above-mentioned pipeline is learnable end-to-end and the sample triplets (p, c, c_t) have been trained, under the pixel-wise L1 loss between the warped result $\hat{c}$ and ground truth c_t, where c_t is the clothes worn on the target person in I_t.

The parameter θ is calculated using the following formula. The Human Representation H_t and the Mask M_{Ci} is used here, instead of the colored mask C_i , to compute

$$\theta = f_\theta(f_H(H_t), f_C(M_{Ci})) \quad (3)$$

The Approach for Cloth Warping Module of the Virtual Cloth Warping using Deep Learning (VCWDL-CWM) is improvised on certain aspects: the loss function of CWM includes the *L1* distance between the warped (C_{Warped}) and real images (C_t) of cloth on the body. Hence getting the warped cloth & mask of warped cloth as output. Our experiments with existing methods showed that the current warped cloth is distorted and thus we chose to keep Regularization for the estimation of TPS parameters. The pixel-wise L1 loss is formulated as follows.

$$L_{VCWDL\text{-}CWM} = \lambda_1 \cdot L_1(C_{warped}, I_{Ct}) + \lambda_{reg} L_{reg} \quad (4)$$

Cloth Warping stage is crucial since, during the training the model learns how to warp a two dimensional cloth image based on the person and cloth features. This Warped cloth, i.e. Output of the first stage plays a huge role in further processing of

the model, without the need for using the previously used features.
Being a retrainable model, it allows a lot of flexibility based on the market fit, datasets available or the target audience. The Output, i.e. the warped cloth image is not directly multiplied over the person, instead, it is taken as a reference and developed over it, based on the body shape of person and the fit of cloth onto the individual.

3. Cloth Fusion Module

There have been several approaches to fuse the cloth over the person. Primarily, a Network using UNet Architecture with additional loss functions to generate the output with comparison over ground truth to improvise it further. Failure of these approaches has been its ability to learn from the losses calculated. To solve this, a generative adversarial network trained to improvise on the "level" of fusion of cloth onto the human is proposed.
For the Cloth Fusion Module, in-shop clothing image *c*, person representation *p* & CFM output image I_o are taken as inputs & model is put to judge whether the output is real/fake. This module contains Unet Generator, VGGLoss, NLayerDiscriminator and L1 loss.
The Unet generator has a u-shaped architecture that propagates context information to higher resolution layers. Supplementing a usual contracting network by successive layers is the main idea and pooling operations are replaced by non-sampling operators, due to which these layers increase the resolution of the output. The Generator network is trained to produce the "try-on" result using the cat function provided by pytorch.
The Outputs are further segmented into the combination of *cloth* and composition mask (*comp_mask*) and the rendered person (*rendered)*. The Try On Person image is generated by:

try_on_person = cloth(comp_mask) + rendered*(1-comp_mask)* *(5)*

For the purpose of solving the adversarial networks, the real and fake variables are created. We compute the L1 loss, L1 mask loss and VGG loss for the results obtained from the generator.
Following which, the forward propagation of the discriminator network is processed and the loss is computed for the discriminator performance. The losses for generator and discriminator are calculated and these losses are rectified with the help of backpropagation of the generator and discriminator networks.
The Generator loss(*gen_loss)* is the summation of L1, VGG and Mask loss,

gen_loss = l_l1 + l_vgg + l_mask + l_adv/batch_size *(6)*

Where, L1 loss (*l_l1*) , VGG loss (*l_vgg*) and the loss related to mask (*l_mask*) along with adversarial loss (*l_adv/batch_size*) is appended so as to get a good clarity on how the generator is performing.
The discriminator network is a deep convolutional network containing convolution blocks which are followed by dense fully connected layers, followed by a batch normalization layer. The two dense layers at the end of the network work as a classification block. The last layer is used for prediction to predict the probability of an image belonging to the real dataset or to the fake dataset.

4. Graphical User Interface

The Model, which comprises of Preprocessing Network (SS-JPPNet[17] and Mediapipe [18]), Cloth Warping Model, and Cloth Fusion Module, is integrated into a pipeline-like structure with a Graphic User Interface (GUI) such that user could access and interact with the model and get results which could visually give them an idea on how the cloth looks on a particular human.
The Graphical User Interface is created with the help of Tkinter library in python. Tkinter is an open source, standard Graphical User Interface library for Python language. User Interface could be built with the help of an inbuilt Tk function.

IV. RESULTS AND DISCUSSIONS

CP-VTON clothing-human pair dataset has been used for all experiments. Dataset split contains 13221 image pairs in the training and 1000 image pairs in testing and 2032 pairs in validation. The Dataset has been procured with the help of different previous approaches and also customized for the suitable use case of our paper and target audience. The Dataset contains images of target cloth and person wearing the same target cloth in the training set, so as to help the model learn how well the warping needs to be done compared to the original image.
For the Cloth Fusion Module, UNet Architecture is used, and a custom N Layer Discriminator with 6 layers. In the Unet generator, parameters used are input channels as 25, output channels as 4 with batch normalization. In NLayerDiscriminator, input channels used are 28, and the norm layer is InstanceNorm2d. The cloth Warping Module was trained for 100 epochs and Cloth Fusion Module for 50 epochs with batch size 16, with the Adam optimizer with $\beta1 = 0.5$ and $\beta2 = 0.999$. The learning rate was fixed at 0.0001. The Proposed Model was trained using NVIDIA 1050Ti & 1060 Max Q Mobile GPUs.
In the previous approaches of VITON and CP-VTON-PLUS, there were occlusions like blurry arms and misaligned images due to reconstruction loss. To address that, the proposed model uses CNN in the first stage and GAN in the second stage. Adversarial loss is considered and the model has trained adversarially against the discriminator. For evaluation

of the model, the metrics chosen are SSIM, and Inception Score as performance metrics to compare other approaches like VITON, CP-VTON, and ACGPN over the same clothing try-on cases. The Proposed Model outperforms VITON, CP-VTON, and ACGPN in all measures.

Table I: Performance comparison

	IS	**SSIM**
VITON	2.514 ± 0.13	0.77
CPVTON	2.78 ± 0.05	0.745
ACGPN	2.798 ± 0.12	0.81
Ours	**3.0 ± 0.04**	**0.79**

Table I shows a performance comparison between our model and existing models

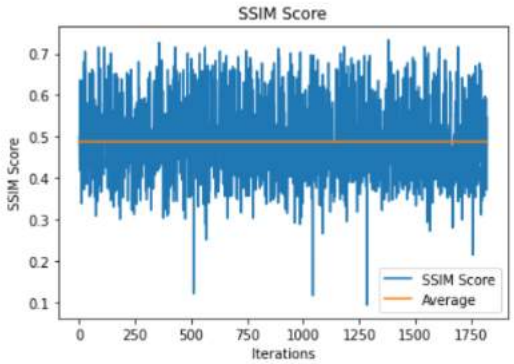

Figure 5: SSIM Score vs Iterations

Fig. 5 shows the SSIM score for each iteration along with the average SSIM score.
The Qualitative Results are as follows.

Graphical User Interface Output

Figure 6: Final Page of the GUI without output

Fig.6 shows a Tkinter window letting the user choose the human image and the target clothing.

Figure 7: Final Page of the GUI including result

Fig.7 shows the Tkinter window where the human image, target clothing item, and the final output are displayed.

First Stage Output

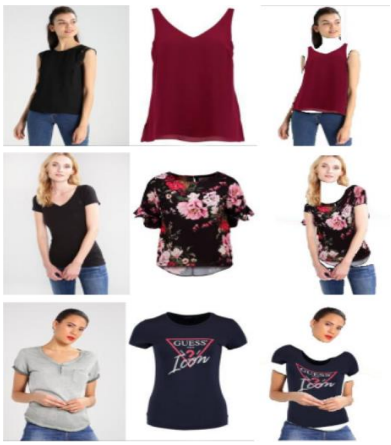

Figure 8: First Stage Output
Input Target Cloth Output

Fig.8 shows the images in following order (L to R): person image, cloth image and cloth overlapped over person image. This is the output of the first stage of the model.

Second Stage Output

Figure 9: Second Stage Output
Input Target Cloth Output

Fig.9 shows the second stage output of the model. The images are in the following order (Left to Right): person image, warped cloth image, and output generated by the second stage of the model.

Occlusion Cases

Figure 10: Occlusion Cases
Input Target Cloth Output

Fig.10 shows the cases where our model failed to produce appropriate results. In the first figure, hands are not correctly identified in the output picture. In the second figure, the details of the target cloth are missing in the output and a blurry image is produced.

V. STATEMENT OF CONTRIBUTION

The approach proposed, Virtual Cloth Warping using Deep Learning (VCWDL) has several improvements over the previous approaches. Compared to CPVTON [14], our approach tends to work on a larger spectrum of image datasets and produces better warping and quantitative progress as shown in Table 1. Also, the use of Generative Adversarial Networks (GANs) for this idea is a novel concept and other approaches using GANs [23], use a rather complicated structure that tends to perform inferior as seen in Table 1.

The Idea of using a Convolutional Neural Networks (CNNs)-like model along with a GAN is new. Our team trials noted that, with better access to hardware, this approach can perform qualitatively and quantitatively. Since our Entire Approach ran for a mere 50 epochs, we could see the path it leads to, but as we train it for more epochs and test it with fresh data, one can attain standard results which can be brought to public usage and business prospects.

VI. CONCLUSION

The proposed VCWDL model consists of two pre-processing stages: pose estimation and human representation and two processing models which are the Clothes Warping Module (CWM) and Clothes Fusion Module(CFM). CWM is based on CNN and CFM is based on GAN. For pose estimation, MediaPipe is used and for human parsing, JPP Net is used. In the processing stage, the CWM gives the warped cloth along with the coarse result, and these go as input to CFM which gives the end result. The training and testing of both stages are done. The accuracy matrix used is Inception Score and SSIM. The SSIM achieved is 0.78 which is higher than CP-VITON and CP-VITON+.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Implementation of Soft Computing Techniques on Combined Operation of Solar System with Unified Power Quality Conditioner for Power Quality Improvement

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***Abstract*:-- Harmonic contamination, non-linear loads, voltage sag-swell, and other issues can all have an impact on the quality of electricity. The fluctuation of load side voltage has made it extremely difficult to maintain power quality in recent years. For controlling the variation of load side voltage problem optimization based control method is best solution. In this work, additional solar power is provided with a maximum power point tracking method controlled by a particle swarm optimization technique tuned fuzzy based PI control technique, which is used in the UPQC, in order to balance and increase the load side power. Total harmonic distortion has decreased from an average of 2.77 percent for voltage to 1.16 percent, and from an average of 4.48 percent to 2.02 percent for current. Results of the simulation run using MATLAB software.**

Keywords : Fuzzy Logic Controller, Emerging Techniques, Conventional Controller, Power Quality.

I. INTRODUCTION

Due to their great advantages in preserving the quality of electricity at fluctuating loads or voltage variations, Over the last twenty years, Unified Power Quality Conditioners (UPQC) have garnered a lot of attention. By combining back-to-back shunt and series converters on the dc side, the Unified Power Quality Conditioner (UPQC), a traditional power device, may correct load current and supply voltage errors. In order to correct for a variety of power quality problems, such as voltage harmonics, voltage unbalance, voltage flickers, voltage sags, voltage swells, current harmonics, current unbalance, reactive current, etc., UPQC can be utilized. One of the best ways to mitigate serious power quality issues is by active power filtering. UPQC has been created employing no series injection transformer for medium voltage applications [1-2]. Clearly explained in the UPQC system is the solar energy fed unified power quality conditioner, which can also send active electricity to the grid [3]. Determining the most effective strategy for active power filters to improve power quality. As a result, the voltage added by a series active filter needs to match the voltage difference between the supply and the ideal load. As a result, the series active filter serves as a source of controlled voltage. The shunt active filter eliminates all current-related problems such as current harmonics, reactive current and current unbalance.

While any voltage-related problems and voltage unbalance are controlled by the series active filter [4]. Shunt active filters are used to maintain a constant level of dc link voltage. In that work, they designed control approaches like PI and fuzzy for a 3 phase 4 wire UPQC systems to cope with the most critical power quality themes, such as voltage and current harmonics, sag & unbalanced voltage state, and unbalance situation in loads with elevated reactive power demand [5-8]. Harmonic sag-swell, nonlinear load, and other factors can also have an impact on the quality of power. Recent changes in load side voltage make it extremely difficult to maintain power quality [9-10]. Controlling the load side voltage variations problem, optimization based control method is the best solution. For monitoring stability of electronic system neural network controller is employed and control algorithm developed [11-12]. Development of soft computing approaches for UPQC system and proposed fuzzy logic based controller for compensation signal to CSI based system [13-15]. Power quality improvements such as total harmonic distortion, voltage sag and swell, load side voltage improvement, and real and reactive power improvement using different controllers are explored during the design and control of unified power quality conditioners [16-18]. In this study, solar-based additional power using Maximum Power Point Tracking method controlled by Particle Swarm Optimization (PSO) technique is presented to correct and enhance the load side power in the distribution network. Moreover, modern techniques like PI controllers, Fuzzy logic controllers, and neural networks are used to optimize the UPQC's shunt active and series active filters. Total Harmonic Distortion (THD) present values of the controller decreased from average values of 2.77 percent for voltage to 1.04 percent and from average values of 4.48 percent to 1.55 percent for current, respectively.

II. METHODOLOGY OF UPQC SYSTEM AND MODELING

A power electronic device called a UPQC system has the ability to enhance power quality right where it is installed. It adjusts, respectively, the current at the load side and the voltage at the source side. The series and shunt active power filters that make up the UPQC system are connected by a bidirectional DC link capacitor. While the series active power filter is utilized to regulate the load voltage and serves as a voltage control source, the shunt active power filter uses a sinusoidal approach to manage supply current. The series APF and the shunt APF are used here to manage the load voltage and source current, respectively. In UPQC, the mathematical method is used to compute power flow. The symbols Vs, Vt, and Vl respectively, stand for the source voltage, the terminal voltage, and the load voltage. Is and Il respectively, stand for the source current and the load current. Current is injected through a shunt active power filter, while voltage is injected through a series active filter. Equation (1) then provides the apparent power that is absorbed by the series APF and the shunt APF (2).

$$S(c) = P(c) + jQ(c) \quad (1)$$

$$S(f) = V(ch)I(f) \quad (2)$$

Where,

$$P(c) = V(c)I(s)\cos\phi(s)$$

$$Q(c) = V(c)I(s)\sin\phi(s)$$

Where, P(c) and Q(c) are the real and the reactive powers that series APF absorbs.

Figure 1 shows the circuit diagram of the proposed soft computing controller based UPQC connected system. The system consists of shunt active power filter, series active filter, solar system and non-linear load connected AC source.

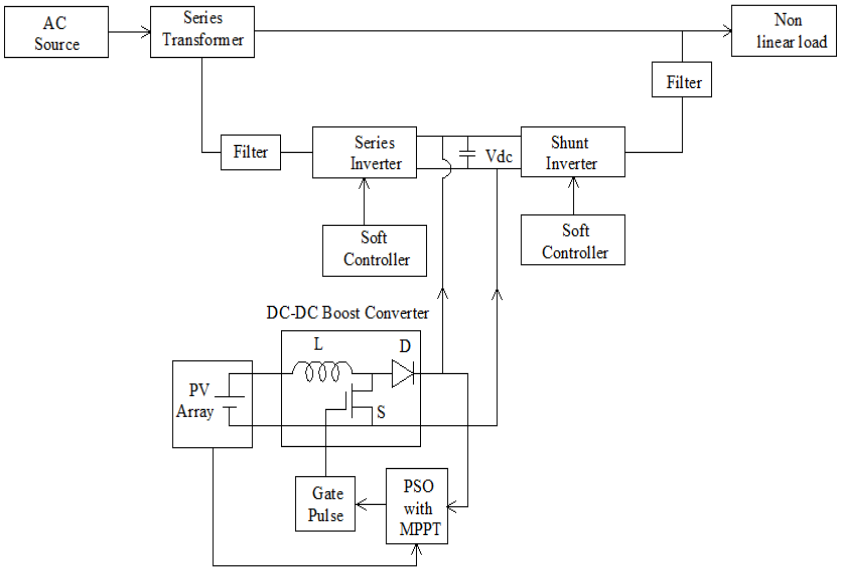

Figure.1. Configuration of UPQC with Solar system

The DC link capacitor is combined with the solar system in order to increase the level of the power. The series injection transformer is served with the AC supply source. The filtered output of the transformer is given to the series and shunt inverter. In between these inverters the DC link capacitor is connected. Different controllers are used to control the level of the voltage in this capacitor. Nonlinear load is connected in the system to maintaining the control voltage. DC capacitor link is connected in order to control voltage.

III. PROPORTIONAL INTEGRAL CONTROLLER

Because of its straightforward performance and construction, it is the most popular controller used in industries. Since its introduction, the PI controller has undoubtedly been the best performing industrial controller; it has the most impressive track record in terms of the number of productive industrial applications. It is most frequently employed due to its sturdy construction, simplicity of usage, and successful outcomes for linear systems. PI controllers can be tweaked in a number of ways, such as manually, automatically, using Ziegler-Nichols, analytical approaches, optimization, or pole placement. The Ziegler-Nichols tuning rules are obtained in the following way in this work first set Ti=0 and Td=0. Kp is adjusted from 0 to a critical value Ku at which it exhibits sustained oscillations using simply the proportional control. As a result, the simulation method is used to determine the critical gain Ku and the associated period Pu. The tuning parameters for the PI controller tuning are shown in Figure 2, with the proportional gain being 1.6 and the integral gain being 36. The tuning value is used to determine the best controllable voltage.

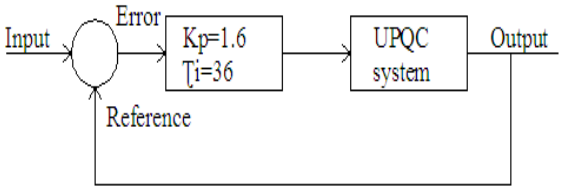

Figure.2. Schematic block diagram for PI controller

IV. UPQC SYSTEM VOLTAGE CONTROL USING FUZZY LOGIC SYSTEM

Figure3 shows, Fuzzy control algorithms are developed for the UPQC system and explained in the following section. Traditional fuzzy controllers never take into account the integral element and always take error and error difference as two inputs. Integral action is added to the traditional fuzzy control system in order to remove steady state mistakes and enhance dynamic control outcomes. The fuzzy PI controller combines the benefits of fuzzy control with the simplicity and robustness of traditional PI controllers. The decision on the execution of action is determined by assigning strategies to the rules using the fuzzy logic controller's two inputs, E (Error) and CE (Change in Error), and a single output based on the generated rule base. The output is defuzzified when the rules are merged. 49 control rules were developed for this UPQC system using Error (E) and Changing Error (CE) as input variables, with each variable having seven membership functions labeled NB (negative big), NM (negative medium), NS (negative small), ZE (zero), PS (positive small), PM (positive medium), and PB (positive big). The 49 sets are finally defuzzified to produce a single value.

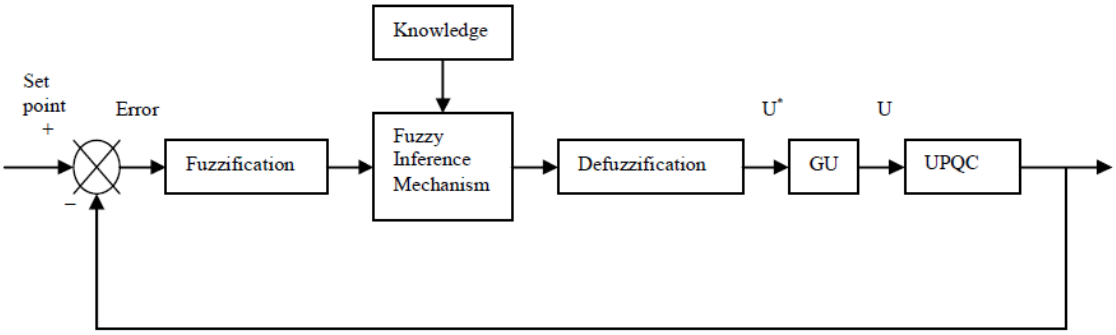

Figure.3. Fuzzy control structures

A program was written in Matlab software with Fuzzy logic toolbox to control the voltage level
The procedures followed are,

1. Sort the data into training data and validation data before storing the measured simulation data for each phase's voltage and current power factor in the workspace.
2. FIS settings Initialized, training data grid partitioning, data matrix generation, and membership function generation for the FIS parameters.
3. Till you reach the target and epoch; perform training using the least squares and gradient descent algorithms.

4. Reduce training in order to maximize the error e (t) difference between the predicted and measured output.
5. Model validation is carried out, and the output response is plotted.

V. UPQC VOLTAGE CONTROL USING NEURAL NETWORK MODEL

A three-layered feed forward neural network trained model employing the Levenberg-Marquett (LM) back propagation method is created for managing the UPQC system voltage. Figure 4 demonstrates that with this coding, seven neurons were utilized in the input layer and 27 neurons were used in the hidden layer. One neuron in the output layer was employed to maintain a constant level of voltage control for the UPQC system. The approach adjusts the neural weights and bias values using the gradient decent method to reduce the square sum of the difference between the desired output and output value when compared by the net value.

Sum of Square Error = $\frac{1}{2n}\sum(t_d - y_d)^2$ (3)

The procedures for BP algorithm are as follows,

1. Training data load to the input layer.
2. The original and desired output is compared.
3. In each neuron error is calculated.
4. The output for each neuron is calculated.
5. The weights are calculated to minimize the error.

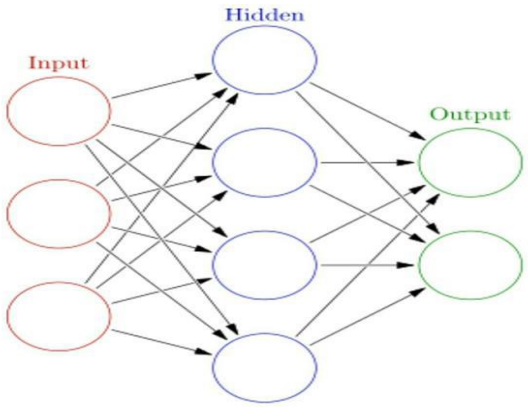

Figure.4. Neural Network layers

The three operational processes in a neural network algorithm are, successively, prediction, correction, and control move determination. The neuron was trained using the UPQC method. Voltage and current are the proposed work's input and output variables, and they were recorded over a range of time periods. For this simulation, a sample period of 10 seconds was used. The 2500 sample is used for validation and training. The neural network model of the non-linear process was created by training the input and output data. The LM back propagation algorithm was utilized for training and validation purposes.

VI. SOLAR SYSTEM MAXIMUM POWER POINT TRACKING ALGORITHM BASED ON PSO

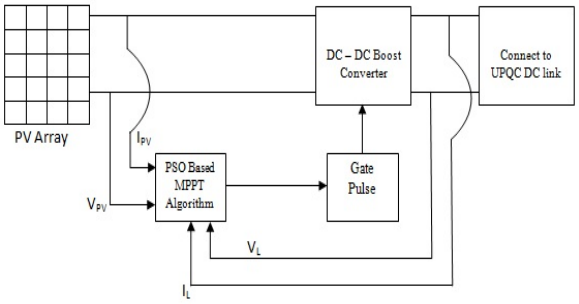

Figure.5. Solar system connect to dc link capacitor terminals of UPQC

The schematic diagram 5 shows the PSO technique is used in the solar system. In this work system output is Vpv and Ipv and similarly boosts converter output V_L and I_L. These two things are compared and output error signal was obtained, which is given to MPPT algorithm using PSO techniques. The MPPT based developed algorithm is used to improve the power stability. The output voltage and current is feedback to PSO for MPPT algorithm. Depending upon the Duty cycle the PSO technique calculating the value and given to pulse generation of switch.

Particle Swarm Optimization is the best method to optimize the multi variable function. The output of DC-DC boost converter is connected to the DC link input terminals. The optimized method is used to optimize the multi variable function in to single one. In this method variables are randomly assigned and initialized and number of variable are determined the dimension of space.

Algorithm for PSO Implementation:

Step 1: Limit assigned for velocity and position.
Step 2: Set the position and velocity initial values.
Step 3: Find out each particle's fitness value.
Step 4: Identifying of best fitness.
Step 5: Current position of G-best position
Step 6: Continue with Steps 3 and 4 until the ideal answer is found.
Step 7: The optimized best value is provided by G-best at the end of the most recent iteration.
Step 8: The duty-cycle calculation is complete.

VII. RESULTS AND DISCUSSION

In the proposed work, a modified UPQC system is used to maintain the quality of the power in the distribution side along with a hybrid model of the Maximum Power Point Tracking algorithm based on PSO and solar system to enhance the level of power at the load side.

To regulate the switching strategy of the shunt and series inverters of the UPQC system, various controllers including PI controller, Fuzzy controller, and Neural Network controller were developed.

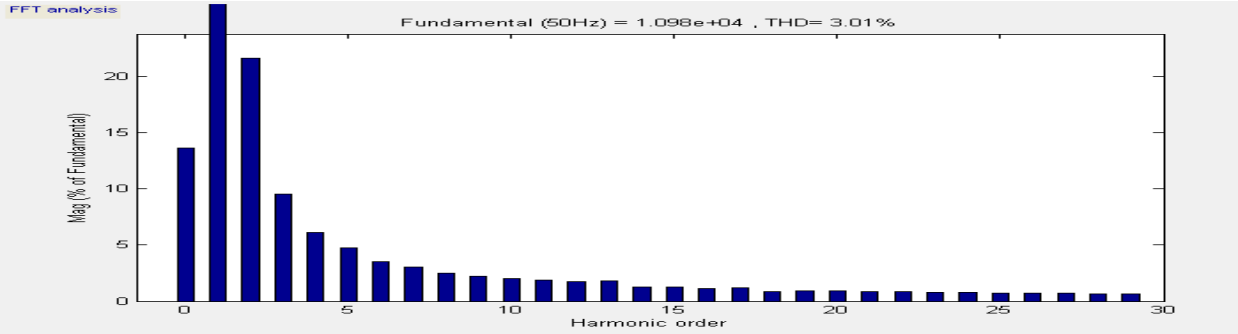

Figure.6. Phase a voltage harmonics (THD %)

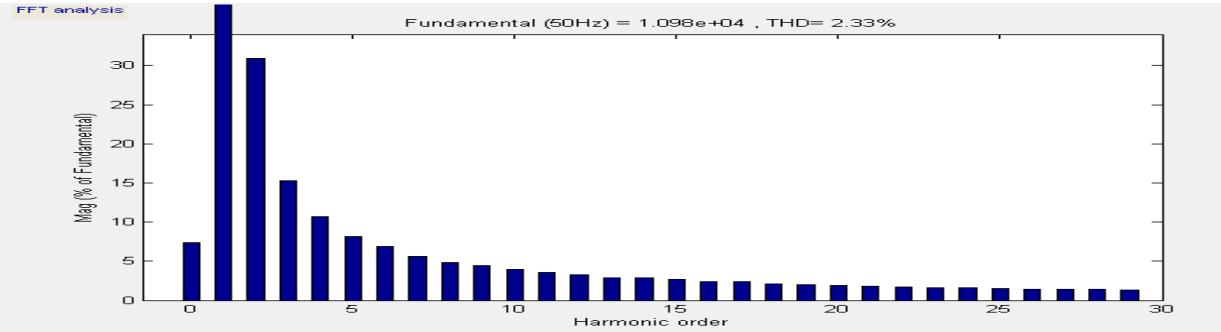

Figure.7. Phase b voltage harmonics (THD %)

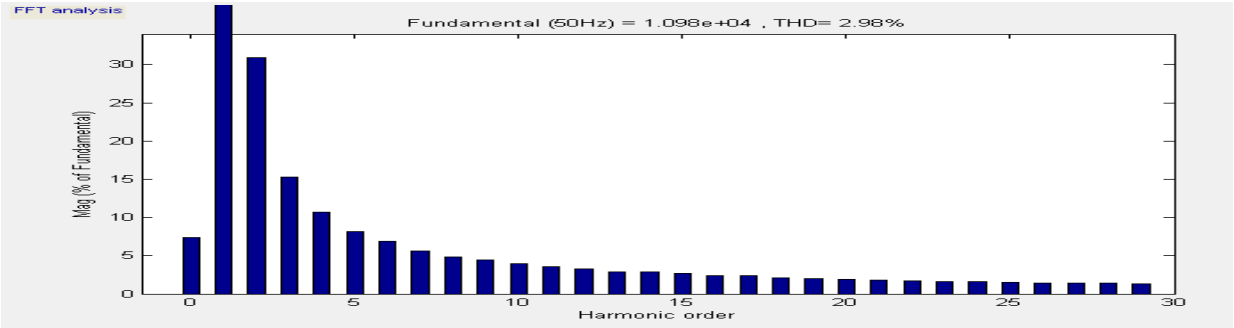

Figure.8. Phase c voltage harmonics (THD %)

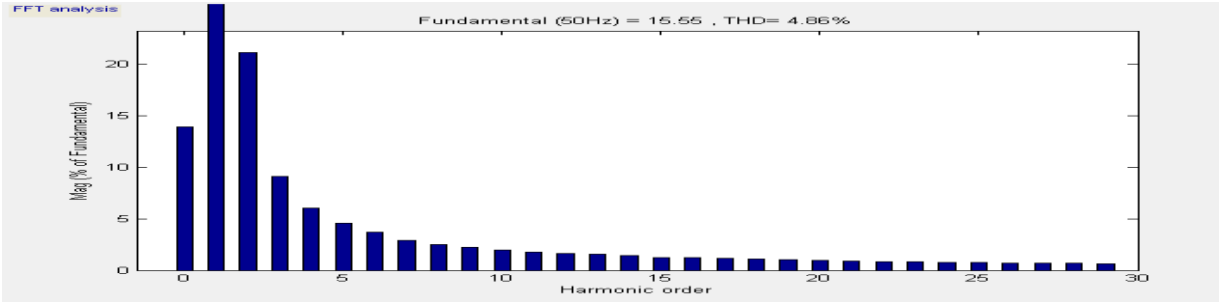

Figure.9. Phase a current harmonics (THD %)

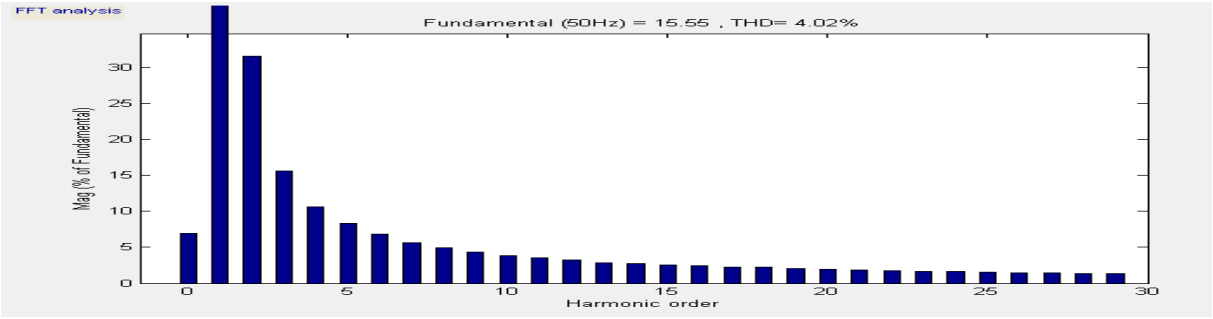

Figure.10. Phase b current harmonics (THD %)

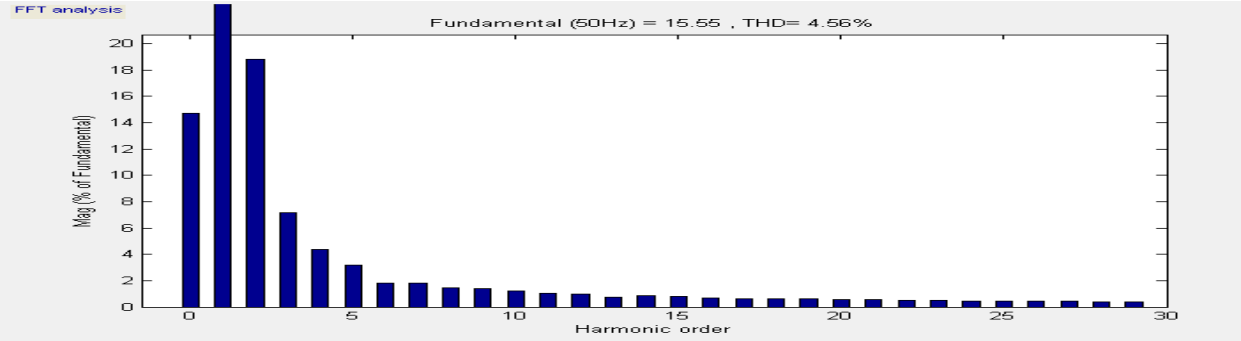

Figure.11. Phase c current harmonics (THD %)

The controller performance were tested with input voltage Vrms11kv, PI controller was able to provide Total Harmonic Distortion (THD) for the various phases of voltage is 3.01%, 2.33% and 2.98% from figure6 to 8 and similarly current is 4.86%, 4.02% and 4.56% from figure9 to 11. From this value, average value of Total Harmonic Distortion (THD) for voltage is 2.77% and current is 4.48%.

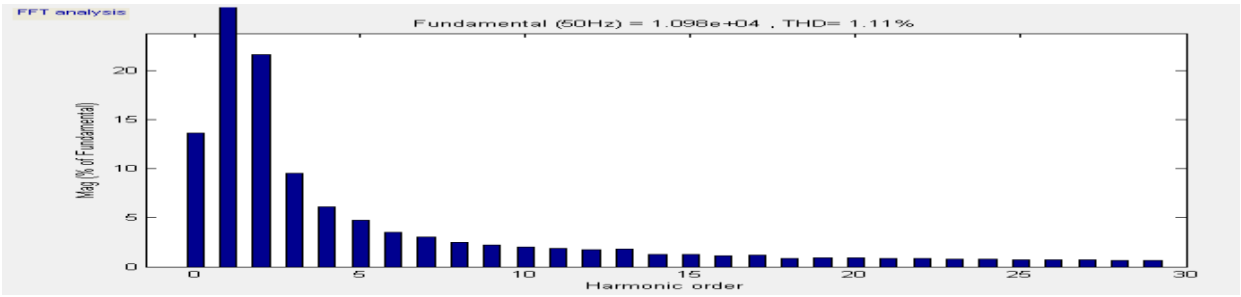

Figure.12. Phase a voltage harmonics (THD %)

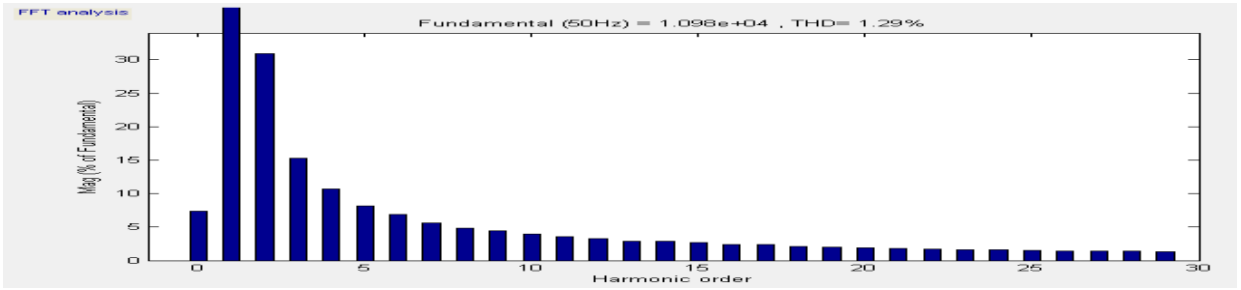

Figure.13. Phase b voltage harmonics (THD %)

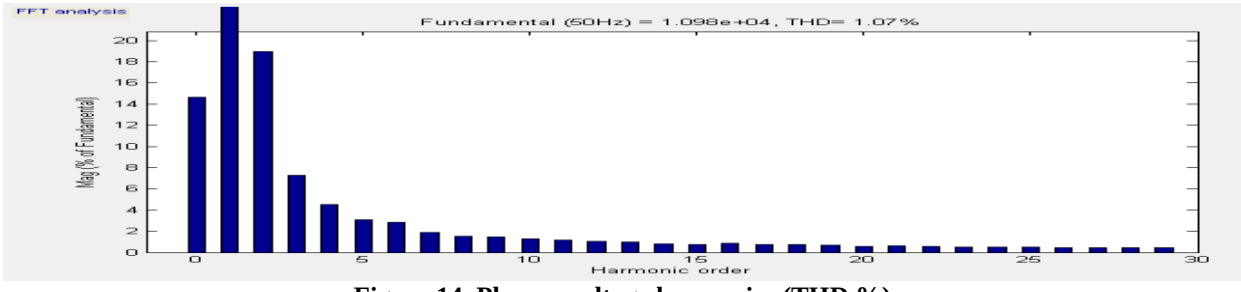

Figure.14. Phase c voltage harmonics (THD %)

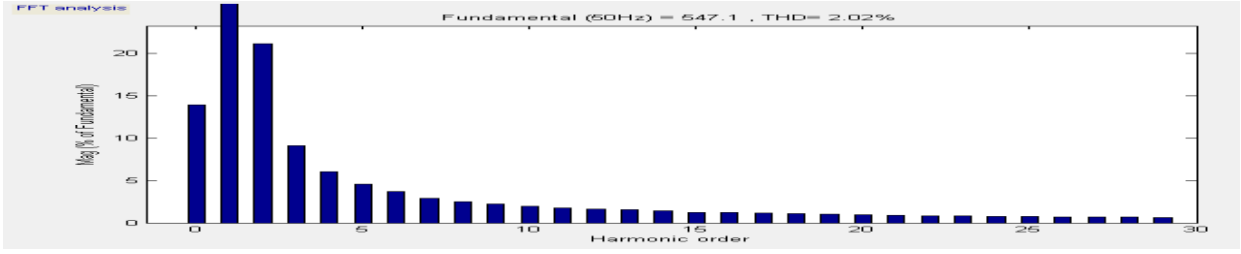

Figure.15. Phase a current harmonics (THD %)

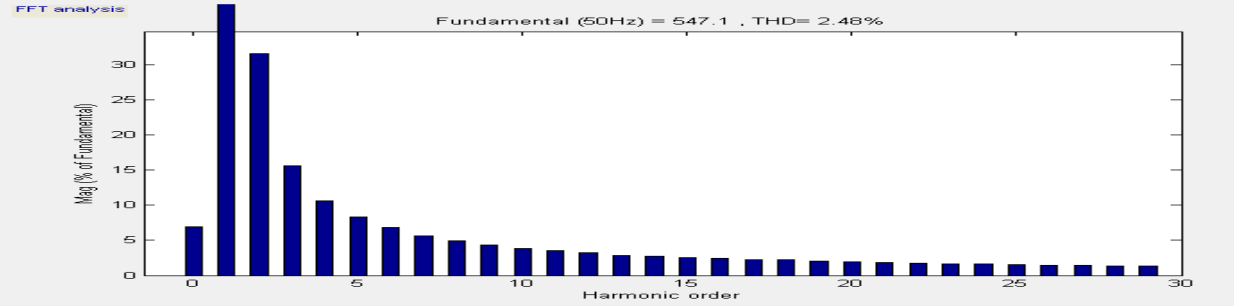

Figure.16. Phase b current harmonics (THD %)

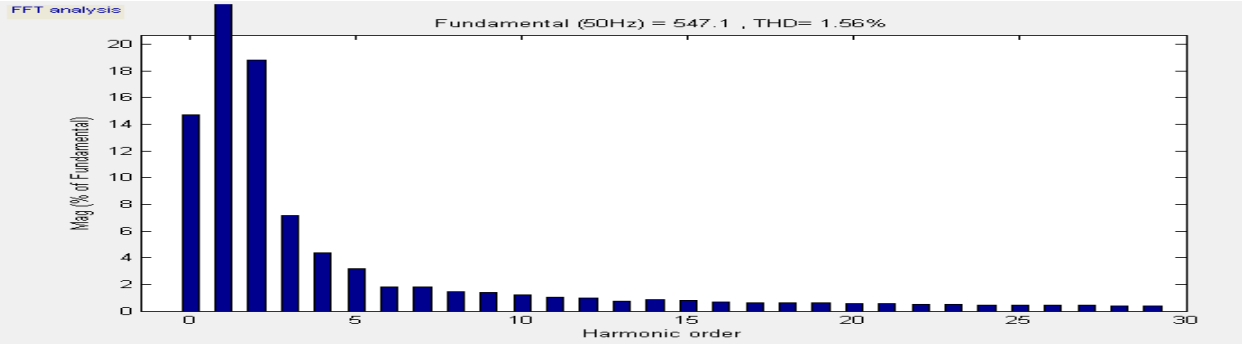

Figure.17. Phase c current harmonics (THD %)

Fuzzy controller was able to provide Total Harmonic Distortion (THD) for the various phases of voltage is 1.11%, 1.29% and 1.07% from figure12 to 14 and similarly current is 2.02%, 2.48% and 1.56% from figure15 to 17. From this value, average value of Total Harmonic Distortion (THD) for voltage is 1.15% and current is 2.02%.

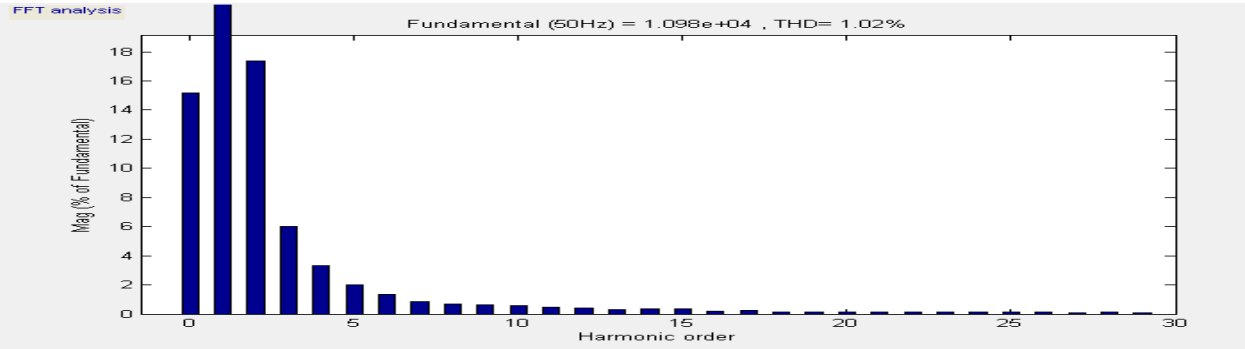

Figure.18. Phase a voltage harmonics (THD %)

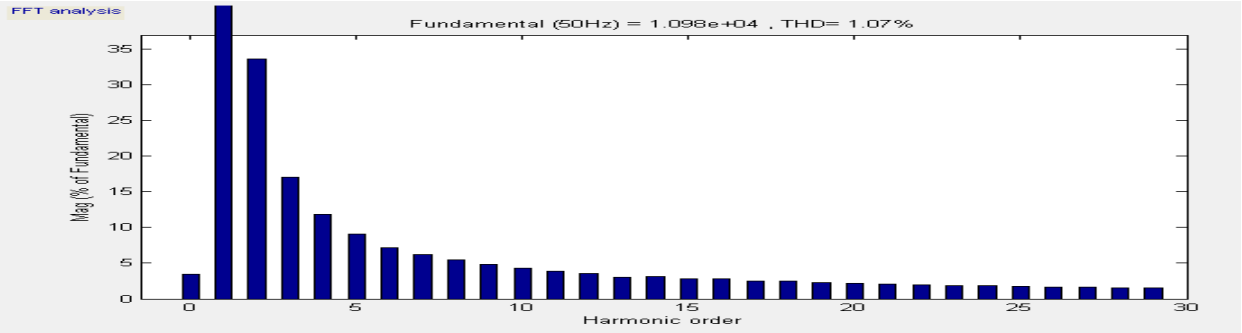

Figure.19. Phase b voltage harmonics (THD %)

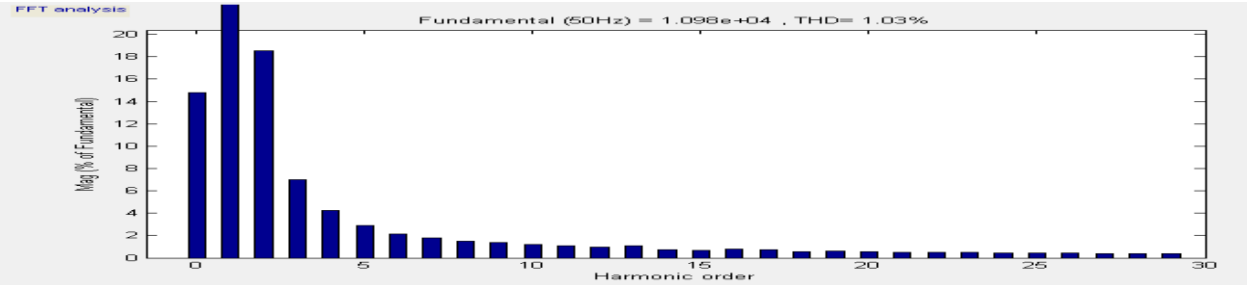

Figure.20. Phase c voltage harmonics (THD %)

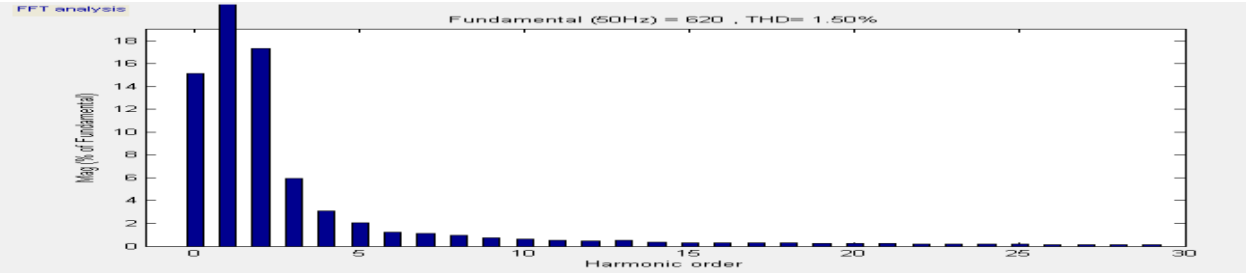

Figure.21. Phase a current harmonics (THD %)

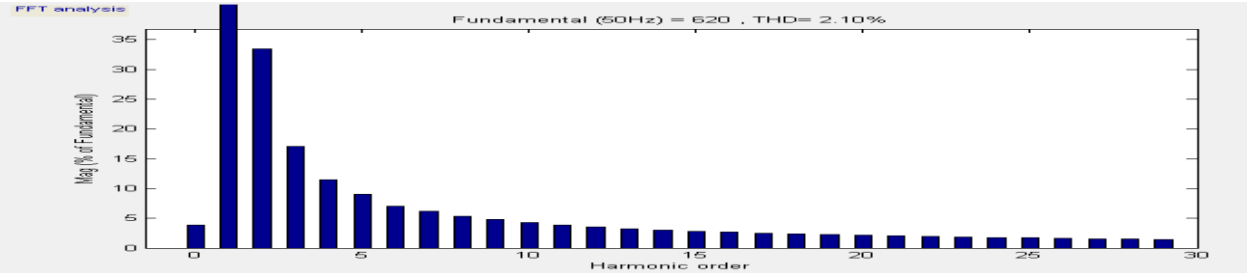

Figure.22. Phase b current harmonics (THD %)

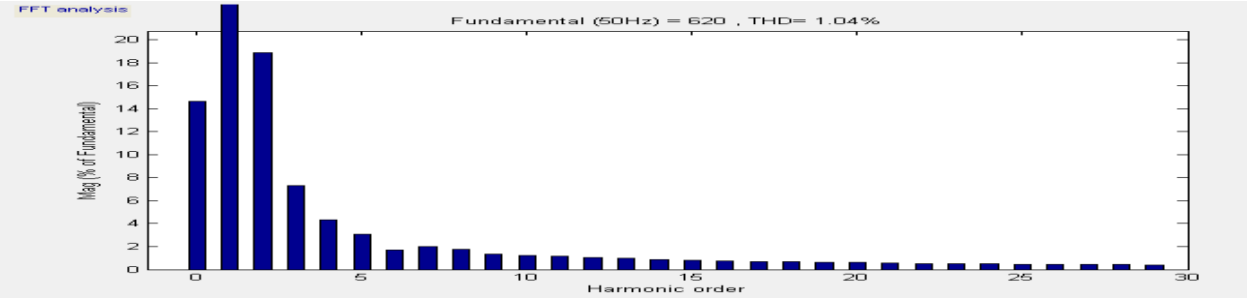

Figure.23. Phase c current harmonics (THD %)

Neural Network controller was also able to provide Total Harmonic Distortion (THD) for the various phases of voltage is 1.02%, 1.07% and 1.03% from figure18 to 20 and similarly current is 1.50%, 2.10% and 1.04% from figure21 to 23. From this value, average value of Total Harmonic Distortion (THD) for voltage is 1.04% and current is 1.55%.

Comparison of Harmonic Analysis for various controllers is shown in the table 1. From the table1 it is inferred that Neural Network is superior to Fuzzy logic controller and conventional controller hence Neural Network based pi tuned controller is best suited for this work.

Table.1. Comparison of Harmonic Analysis for various controllers

S.NO	Controller	THD for Voltage Harmonics (%)			THD for Current Harmonics (%)		
		A	B	C	A	B	C
1	PI Controller	3.01	2.33	2.98	4.86	4.02	4.56
2	Fuzzy Controller	1.11	1.29	1.07	2.02	2.48	1.56
3	Neural Network Controller	1.02	1.07	1.03	1.50	2.10	1.04

VIII. CONCLUSION

The goal of the neural network-based PI tuned controller is to increase power quality and maintain a constant voltage level in the UPQC system. We can see that from the table.1. The optimal controller for this system is a neural network tuned PI controller. The results show that, in comparison to the traditional controller seen in the table, the THD for the output voltage and current of the proposed system is fairly low. Therefore, the load receives the maximum amount of electricity. For nonlinear systems, the neural controller can offer more skill than the traditional controller.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Blockchain Technology Adoption in Canadian Organizations: An Empirical Analysis for a Future Outlook

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Abstract:-- **Blockchain technology adoption (BCT) in Canadian Organizations calls for testers for it to come into realization. Although the literature on blockchain technology adoption requires more research cases, it is more timely and relevant that the analysis be done as early as today. Various empirical supports for Technology Acceptance Model are available depending on situation specifics. TAM remains a popular and useful conceptual framework for analysis of factors contributing to technology acceptance or rejection. This study aims to find the driving forces that effectively illustrate the blockchain technology adoption in Canadian Organizations and to be able to face the challenges associated with the process of adoption. This study examined BCT application using contacts from Canadian Companies Capabilities directory (CCC) and applied SEM regression using AMOS software with 2435 respondents using TAM framework. Path analysis results were good: chi2 (4918.592), chi2 / DF (5.513), RMSEA (0.049), CFI (0.753), and TLI (0.804). Perceived ease of use, Perceived Usefulness, attitude towards use, and intention to use predicted BCT utilization. All components explain more than 50% of variation, hence presenting a reasonable fit between the data examined and the research model. These findings will help in understanding of organizations' adoption of BCT for researchers, regulators and developers and providing supported evidence on factors contributing to the adoption of BCT in Canadian Organizations.**

Index Terms : Blockchain, Technology Acceptance Model (TAM), Technology Adoption, Driving Forces, Challenges, Canadian Organizations, Canada.

I. INTRODUCTION

Blockchain is a fascinating new technology with several uses. Blockchain technology, similarly acknowledged as Distributed Ledger Technology (DLT), works devolution and cryptographic hashing to make digital asset histories unalterable and accessible. Blockchain technology is increasingly being used, and its applications span from data security to shared pieces of information, and from secrecy to openness [1]. BCT provided a new way of securing data and transaction records for use by multiple parties without relying on a trusted central authority; this proposition inspired businesses and governments in a variety of sectors to develop ICT solutions based on BCT, including financial, sport, healthcare, retail, oil and gas, pharmacy, tourism, and education. The Technology Adoption Model (TAM) was utilized in this study to describe the broad factors of computer acceptance that lead to understanding user behavior in the example of Blockchain Technology (BCT) adoption in Canadian Organizations. This paper provides current examples demonstrating that BCT is a fundamental driver of digital transformation in organizations and a source of new economic value generation.

Following 2008, blockchain gained a lot of scientific and media attention, as well as people's enthusiasm for its possible uses and role in decentralizing society as well as the consequent independence from central authority [2]. According to [3,4] people's interest has been stirred by the positive or disruptive effects that broad adoption of this technology will bring to our society. Because Bitcoin is the most extensively used and important blockchain technology with the largest user base, the majority of research is focused on the Bitcoin ecosystem. There are also ongoing studies that raise concerns about Bitcoin's long-term viability, taking into consideration the environment, social issues, and economic aspects of the blockchain-based infrastructure. Alsaed, et al. [5] examined the role of blockchain in controlling and mitigating the COVID-19 situation. Similarly, [6] stated that the health industry is one among the most

sectors affected by the COVID-19 dilemma, and blockchain technology offers attributes that enable it to transform numerous industries. Furthermore, the European Parliamentary Research Service (EPRS) considers blockchain to be a vital tool in the battle against COVID-19.

II. LITERATURE REVIEW

A. Technology Adoption Models

Today, blockchain technology is a prominent issue and has helped numerous businesses. According to [7], a literature analysis was undertaken to describe the adoption frameworks used to research blockchain adoption and identify the commercial segments where these prototypes have been utilized. By dividing articles into five key categories—supply chain, industries, finance, cryptocurrencies, and miscellaneous studies—a research of 56 publications on blockchain adoption models was conducted (excluded from the former fields). The TAM, TOE, and new conceptual frameworks were the most commonly discussed models in the research. Other popular models were those based on the technology acceptance model (TAM). There has been a lot of discussion about how blockchain technology is being employed in various supply chains and businesses recently.

The technology adoption models are the available theories and frameworks that can possibly make the business organizations accept or employ advanced technology. They explain how individuals make use of the recent technology for purposes which include businesses, health, education, communication and others. The adoption of technology builds confidence among users who utilize the appropriate models. Scholars presented Several technology adoption models to determine the reasons for technology adoption. This technology motivates the business organizations to freely employ technology due to its importance through the course of time [8].

Various supports are readily available regarding Technology Acceptance Model depending on the specifics and the natural barriers present during the adoption [9]. Also, Rogers stated that the diffusion of innovation includes five stages of modern revolutionary technology categorized as first movers, early utilizers, early mainstream, late mainstream, and followers. Different organizations benefit with Digital Object Identifier (DOI). Article [10] described eight factors such as authorization, production timeliness, compatibility, reliability, ease of training, relationship with users, locateability, and quality. In addition to utilization, [11] stated that the theory of Task-Technology Fit (TTF) measure, is found to be an important predictor of user reports of improved job performance and effectiveness that was attributable to their use of the system under investigation.

According to [12], the Theory of Reasoned Action (TRA) suggests that an person's action is the result of his or her aim, and this intent, in turn, is what the community to which he or she belongs sees. Similarly, [13] emphasizes TRA in the Theory of Planned Behavior, in which every action is motivated by a social purpose, which is influenced by attitudes, subjective standards, and acknowledged behavioral control. However, [14] claimed that valid evaluation procedures are insufficient, and that whatever is accessible in connection to the system being used must be validated before it can be acceptable to computer users.

Blockchain (BC) was originally presented to the public by [15] in the year 2008, and it is presently getting the attention of a great number of companies owing to the significance it has in altering the operations of enterprises. According to the primary attributes of blockchain technology, such as smart contracts, , transparency, traceability, and cyber protection, this technology is not only used for its primary application as a cryptocurrency, but it is also applicable in a variety of other areas, such as healthcare, government elections, supply chain management, identity management, logistics, and so on. Blockchain technology's primary application is as a cryptocurrency, but it is also applicable in a variety of other areas [16]. Because of the widespread use of blockchain technology over the course of the last decade, a wide variety of frameworks and platforms have been available. These infrastructures addressed concerns such as the Internet of Things (IoT), bitcoin, and smart contracts in order to develop blockchain.

The blockchain framework was given and summarized as follows by [17-19]. As an open-source technical structure, Ethereum enables the creation of un-centralized internet services as well as decentralized programs based on smart agreements. The Ethereum virtual machine (EVM), un-centralized programs, framework performance parameters, and smart agreements are the four key components of this platform. Another structure supported by IBM and the Linux systems is the Hyper-ledger. This architecture might be used to build blockchain technology in a variety of businesses. Furthermore, Bitcoin, the most prominent and well known cryptocurrency system, was founded in 2009. The Corda platform is yet another structure that was created for two primary programs: legal agreements and data distribution between communally trusted enterprises. This also allows for the development of several apps based on interoperability on a single network.

EOS is another another blockchain technology that has the potential to be used in both the public and private sectors. This platform is able to cater to the particular requirements of the firm, such as speed that leads the market, safe app processing, and role-based permissions for security. The next framework is

going to be the Internet of Things applications (IOTA) system, which was introduced in 2016 as a small transaction settlement for Internet of Things applications. Activities on this platform may be executed via the use of a one-of-a-kind peer-to-peer mechanism that is referred to as tangled [20]. This particular platform does not have the typical blockchain architecture, in contrast to other platforms. Another kind of architecture that may be used for currency conversion and payment networks is known as Ripple (XRP), which was formerly known as OpenCoin Ripple. The XRP Ledger, which is a distributed ledger database, serves as the foundation for the network known as RippleNet. This framework intends to bring together payment providers, digital asset exchanges, and banks in order to accelerate and lower the overall cost of global financial transactions.

In addition to the systems already stated, the Waves structure is a distributed and open platform that enables designers to create apps that use new currency. Application developers may be able to build all blockchain-based applications utilizing a software system that offers a variety of utilities and tools if this blockchain platform has the claimed unique attribute that allows them to do so. In addition, the design of the Quorum blockchain was employed in order to address the primary challenges that are linked with the utilization of decentralized registries and smaller contractual applications within the financial industry. J.P. Morgan created this platform with the goal of increasing the number of transactions conducted by institutions. Through the use of the Quorum architecture, restricting access to the transaction history while maintaining system transparency is possible. The ultimate platform, also known as the emerging business movement (NEM or XEM), was built with the goal of achieving high speed as well as scalability. This private platform incorporates a proof-of-concept (POI) method, which is a ground-breaking consensus technique that can add a block to the blockchain and is used to evaluate network users.

In the past, discussions have been held on various blockchain-related concepts, applications, and general frameworks. The important finding of this study is to examine the adoption of blockchain technology in various businesses. This allows the researchers to create a comprehensive list of the modeling techniques that may be adopted for BC acceptance. This contribution is based on the usage of BC technology in various domains. In addition, the findings of this study provide adoption models that vary according to the fields of investigation, which may imply that not enough industries have been investigated. In the following parts, we will discuss the many acceptance models that are important, as well as the significance of researching blockchain adoption. After that, publications that examined blockchain adoption in a variety of settings will be evaluated (in the methodology section), and this will lead to the identification of research topics such as "the models applied in blockchain adoption" and "the industries of study." In conclusion, a discussion of the results will be held in order to explain the value of blockchain technology in a variety of organizations.

Another theoretical framework is Technology Acceptance Model. Articles [14,21] first proposed this approach, which is based on the TRA framework, to overcome the ambiguity of psychometric and theoretical standards in TRA by eliminating subjective norms. As one of the most often referenced frameworks, the TAM covers ease of use and perceived utility as the major considerations. According to TAM, not only does it include BI, but it also considers two important concepts (perceived ease of use and perceived utility) that have an influence on users' attitudes toward the system, which are analyzed as favorable and unfavorable against it.

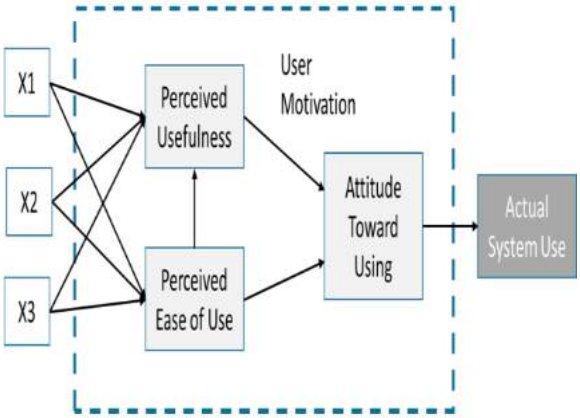

Figure 1: Technology Acceptance Model [21].

Perceived usefulness in figure 1 is directly influenced by ease of use in this paradigm, whereas attitudes and business outcomes are influenced by the perceived usefulness indirectly. External factors such as system characteristics, user training, user participation, etc. are also taken into account by this approach.

B. Blockchain Adoption in Canada

Blockchain (BC) is a decentralized digital database that is publically reachable to be utilized and shared at the same time. Article [16] stated many firms are concentrating on blockchain, which was originally invented by [15] in 2008, because of its importance in changing operational procedures. Furthermore, [22] asserted that blockchain technology is useful in a broad range of sectors, including government votes, healthcare, transportation, identity management, and supply chain, according to important qualities such as traceability, transparency, smart contracts, and security.

Blockchain (BC) was first presented in 2008 by [15], and it is now a priority area for many firms because of its significance in transforming operational procedures. Traceability, transparency, smart contracts, and security are just a few of the many uses for blockchain technology that go beyond its primary role as a cryptocurrency.

According to [23] Walmart Canada utilized bockchain in order to resolve incompatible enterprise systems resulting from the use of multiple information systems between Walmart Canada and its carriers. Vast data discrepancies in the invoice required expensive auditing processor and delayed payments without mentioning the time-consuming manual later to complete the data, so the leaders resorted to suggesting the use of automating process.

Another study conducted by [24] incorporated diffusion of innovation theory with TAM while studying block chain technology. They propose new lessons on the features driving acceptance to remediate lack of application of advanced statistical methods studying integration of blockchain technology for e-learning or electronic in higher education.

Many scholars such as [24] stated that former studies advocated technology acceptance model (TAM) as the main method in order to illuminate adoption of information system (IS) and there is uncertainty whether this approach could be employed in assessing any case of information system acceptance. Furthermore, [24] reported that various experimental studies suggested that TAM could be incorporated with more theories such as Constructivism, Technology Readiness Index, Information and System Success in order to take care of swift alterations in dealing with data.

In reviewing the literature of blockchain technologies by [24] reveals that the majority of research focus on showing the benefits and drawbacks of deploying disruptive technology. The deployment of distributed ledger technology applications has received minimal attention. One of the primary studies has looked into the adoption of blockchain in the education industry. The goal of this study is to gain a thorough knowledge of the many decision-making variables that impact user intentions to utilize blockchain in education. The purpose of the presented model is to evaluate the applicability of TAM constructs in the context of diffusion of innovation theory.

In the field of education, a study conducted by [25] intends to close the gap by examining and assessing the experience of blockchain-based solutions adoption in academia from 2017 to 2020. It is perhaps the first research on DLT usage in science conducted within the context of blockchain adoption studies, and one that uses qualitative technique to analyze the experience from the actors'/players' perspective. Furthermore, [26] argued/claimed that blockchain has a good probability of bringing new options and outlets to science management. Yet, simply promising a better digital future is inadequate. DLT research programs must succeed in reaching out to individual scientists as well as the hundreds of fragmented academic "tribes" to reach the top. The study also shed light on National Research Council of Canada's pilot project as a successful example in the public division where Ethereum blockchain to proactively broadcast award and donation information in actual time.

As per [27], blockchain is a digital technology that is still in the process of growing and has very little impact on the economy and labor market of Canada. Building Canadian Consent investigates not just the present condition of the blockchain ecosystem in Canada but also its possible future applications. Before going on to discuss the labor market and opportunities for studying and working in blockchain, the Data and Telecommunications Technology Council (ICTC) provides an overview of the technology, the industries in which it is utilized, its applications, and regional differences.

The blockchain is a new technology that is still in its early phases, and the impact that it will have on the economy and job market in Canada is only starting to take shape. Building Canadian Consensus investigates the blockchain ecosystem in Canada at the present time, documenting both its existing condition and its possible future applications. Before moving to the labor market and prospects for working and studying in blockchain, the Data and Telecommunications Technology Council presents an overview of distributed ledger technology, the sectors it is present in, its uses, and variances throughout Canada. This is done via in-depth talks with industry experts and a broad variety of data collecting..

III. THE RESEARCH MODEL

The TAM model comprises five variables: (1) Perceived Usefulness (PU), (2) Perceived Ease of Use (PEOU), (3) Attitude Towards Use (ATU), (4) Intention to Use (IU), and (5) Actual Usage of Block Chain Technology (AUBCT)—this is the model outcome variable and theoretical contribution to the existing TAM model addressing the characteristics of firms that adopted BCT. AUBCT forecasts BCT business success based on PU, PEOU, ATU, and IU. The user's attitude and purpose mediate the new technology's usefulness.

In Canada, this research assesses six hypotheses (see Figure 2) (H1) PEOU and PU are positively correlated; (H2) PU and ATU are positively correlated; (H3) PEOU and ATU are positively correlated; (H4) PU and IU are positively correlated; (H5) ATU is positively correlated with ITU; and (H6) ITU and AUBCT are positively correlated.

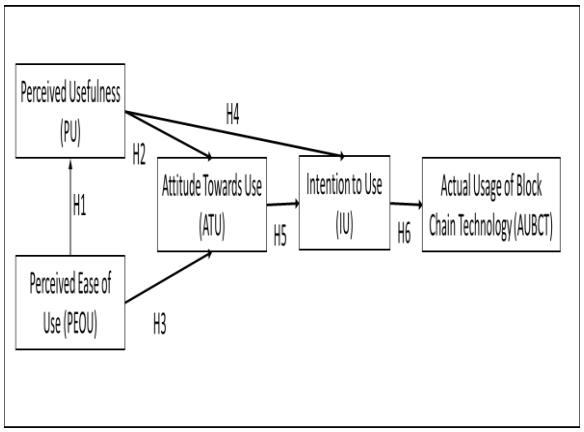

Figure 2. The research proposed model of BCT adoption based on TAM theoretical model (Created by the authors).

IV. METHODOLOGY

This study focuses on Canadian BCT companies; hence a questionnaire was constructed. Using a 7-point Likert scale, we rated the firms' progress (1-Extremely badly, 2-Poor, 3-Somewhat poor, 4-Uncertain, 5-Somewhat high, 6-High, and 7-Extremely high). About ten thousand firms were targeted from CCC directory. Only 2435 survey responses (24%) were legitimate. Regression and correlation to explain data. Cronbach's Alpha validated the findings.

Businesses and governments are pressured to use technology. For competitive advantage, researchers-built models and theories to study consumer tech adoption. This study used TAM to describe computer acceptance and user behavior in BCT adoption in Canada. BCT provided a revolutionary way for protecting data and transaction records without a trusted central authority. Businesses and governments in many areas, including finance, sport, healthcare, retail, oil and gas, pharma, tourism, and education, developed BCT-based ICT solutions. Blockchain implementation challenges include data security, cost/budget restrictions, regulatory issues, and uncertainty. BCT fosters digital transformation and delivers corporate value, according to many cases.

V. RESULTS AND DISCUSSION

Cronbach's Alpha was used to examine the variables' internal co-linearity and consistency. All values over 0.90 The study concludes that the scale describes the TAM model, and its five components are consistent. PU, PEOU, ATU, IU, and AUBCT had overall Cronbach's Alpha values of 0.90, 0.862, 0.959, 0,967, and 0.875.

Not all pathways were significant but all were positively related, according to SEM analysis. Positive and acceptable association was discovered between PU-ATU, PEOU-ATU, ATU-IU, and IU-AUBCT. Two hypotheses were rejected as they were insignificant namely PEOU-PU and PU-IU. All the constructs help achieve the model's result even with the rejected hypotheses as they were serving as mediators with partial effect on the linked constructs and the other accepted hypotheses contributed in validating the model's constructs. Table 1 depicts the association among the study model's components and shows a positive correlation between PU and ATU (r=0.40), PEOU and ATU (r=0.33), ATU and IU (r=0.40), and IU and AUBCT (r=0.96).

Each variable is meaningful to the other since the P value is large. In this model, ATU and IU are significantly related and very important, as the value shows that 40% (0.40) of the ATU benefits the IU. IU has an 96% positive impact on AUBCT (0.96). This means that the model's components work together fairly. The GOF analysis produced chi2 (4918.592), DF (910), p=0.05, normal chi2 (5.513), model CFI (0.753), TLI (0.804), NFI (0.725), and RMSEA (0.049). According to the results, the model matched most of the assumptions.

Table I: Results Of Hypotheses Analysis

Constructs	SE(r)	P-Value	State
PEOU->PU	0.29	<0.003	Reject
PU->ATU	0.40	<0.001	Accept
PEOU->ATU	0.33	<0.001	Accept
PU->IU	0.11	<0.101	Reject
ATU->IU	0.40	<0.001	Accept
IU->AUBCT	0.96	<0.001	Accept

VI. CONCLUSIONS, RECOMMENDATIONS AND FUTURE RESEARCH

This research measured perceived usefulness, perceived ease of use, attitude toward use, and intention to use to determine the adoption of blockchain technology in Canada. The study asks: Why has Canada adopted BCT? This study aims to add to the literature on TAM and BTC adoption in Canada by adjusting for respondent behavior variations. This research examines the link between perceived and real BCT ease of use. The findings demonstrate that TAM model components aided with BCT adoption, indicating that developing the model further will increase the number of technology-adopting enterprises (i.e., BCT adoption).

The study also shows a favorable association between model constructs in Canadian businesses in general while rejecting two hypotheses linking perceived ease of use with usefulness and attitude toward use with intention to use. SEM used to assess model construct relationships. Four out of six tested hypotheses were affirmative and accepted. With limited company resources, decision makers are urged to establish and

expand their firm's internal awareness while implementing BCT to maintain a high degree of users' perceived utility and simplicity of use of the technology. More financial expenditure on other functions (e.g., building favorable attitudes and intentions towards BCT adoption among users) might produce higher benefits for organizations.

As Canadian Business Organizations were used in this study to assess the BCT adoption using the TAM model, future direction may include multigroup analysis for these firms. Future research should use additional models, nations, and technology. Each company having just one key responder may lead to common method bias, which should be addressed in future research.

ACKNOWLEDGMENT

The authors of this study would like to express their gratitude to Yanbu Industrial College for all of their support (Royal Commission for Jubail and Yanbu).

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Methodology for Hardware testing of an Application Specific Integrated Circuit (ASIC)

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***Abstract*:-- The paper demonstrates an efficient process flow for the Hardware Testing of an ASIC (Application Specific Integrated Circuit). The procedure is implied on Comparator, ADC (Analog-to-Digital) and Present Cipher Crypto ASIC. This involves the testing functionality of an Analog, Digital and Mixed Signal design ASIC. The results obtained during functional testing are verified through simulations on Cadence, in case of comparator and ADC ASIC, and vivado in case of Crypto ASIC. The method gives high accuracy and requires less power even at high frequency**

Index Terms : ASIC (Application Specific Integrated circuit), Filters, MSO (Mixed Signal Oscilloscope), FPGA (Field Programmable Gate Array).

I. INTRODUCTION

ASIC (Application Specific Integrated Circuit) is an electronic IC (Integrated circuit) designed for a specific purpose that is reliable, requires less power, and provides greater performance, than an FPGA. Owing to its advantages ASIC are widely used in many sectors namely medical, transport, communication, defense and many more. The designing of an ASIC requires time and specialization, as it cannot be reprogrammed once manufactured. Therefore, before mass production the functionality of an ASIC should be tested. The challenge for testing of an ASIC is that not much indetail method or procedures are available to do Testing of an ASIC at hardware level. The paper proposes a methodology to test an ASIC of all domains which can be used for real time applications. Moreover, the results are validated through software simulations.

The manufacturing and design companies have issues application notes on testing of Analog, Mixed Signal Designs such as ADC, which has various usage in electronics [1]. However, digital design comparator ASIC Testing is hardly available. The cryptography chips is widely used in many domains, its functional testing of ASIC on software simulations [2] is accesible but not much could be found on Crypto ASIC hardware testing . The main contribution of the paper is as follows:

- The process flow is demonstrated for hardware testing of an ASIC of all designs that might vary same as per the ASIC domain and its operation.
- A detailed selection guide for peripheries of an ASIC such as Buffers, external filters for impedance matching to increase signal strength.
- The Grounding technique is demonstrated on basis of ASIC ring and core power supplies to reduce the coupling of noise i.e. generated in ASIC.
- The different methods to capture the output and give input signals are also demonstrated while testing the ASIC.

II. ASIC TESTING METHODOLOGY

The ASIC Testing contains two stages: Before and After PCB designing, demonstrated in Figure 1.

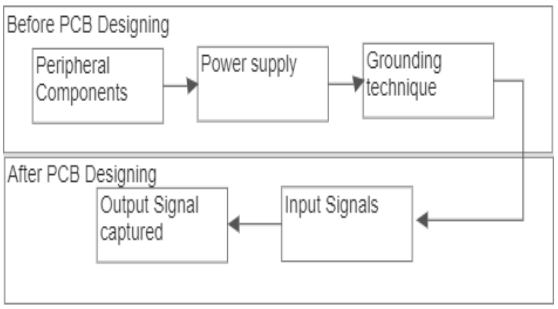

Fig. 1: ASIC Testing Methodology stages

A. Before PCB Designing

1) Peripheral Components: The components are required to interface the pins of an ASIC with the external world using peripheries to remove distortion while communicating. Some of them are buffers, resistance and capacitance to avoid cross coupling and noise distortions, whose choice is explained in detail as follows:

a. Buffer: The buffer is an electronic circuit to segregate the input and output signal side and make sure the signal is not altered at the receiver side. It consumes very less current and does not distort the input circuit functionality. Moreover, it is used where signal requires high current gain while upholding the same voltage level of the signal. In digital circuits TTL buffers are not preferred as they have high input capacitance which leads to increase in dynamic switching currents, whereas CMOS buffer are used that operates around switching threshold voltages gives output as "0 or 1" as required in digital circuits [q]. While choosing the buffers for the circuit one should make sure the saturation and delay time is less, lower power dissipation, high noise immunity and high output drive capability. The Figure 2. Shows the output with and without buffer [3]. The yellow output is of without buffer and pink one is of with buffer in which output is setlled in less
time.

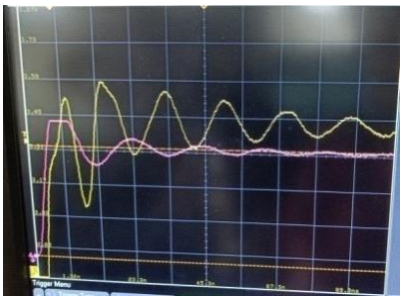

Fig. 2 Transient Response Output with and without Buffer

b. Impedance Matching: The impedance matching is used to prevent signal reflections at the receiver side, provide maximum power transfer and make driver/receiver impedance resistive. The impedance matching circuit constitutes of filters of different types such as Pi, T, parallel LC and series/shunt. These filter behavior is usually High pass; low pass and band pass filters [4]. The rule of thumb while choosing resistor and capacitor values is that for high frequency circuits the capacitor and resistor value with lower values like 0.1 μF or 0.001 μF and 50Ω or 100 Ω respectively, vice versa for lower frequency signals.

c. Level Shifter: In electronic devices, the internal components are usually made of CMOS, as they are small in size and economic to use, which work at lower voltages. However, the external controllers or USB operate at 3.3 or 5V.Therefore, to communicate between ASIC and controllers a level shifter is required to convert data in to required voltages without altering the data.

d. Linear Dropout (LDO) Voltage Regulator: The power supplies available are usually of 5V, 9V or 12 V. But at commercial level lower voltage components are used in the circuit, as they are economic and libraries are easily available at software level of such components. Therefore, the designer uses LDO to drop the voltage and utilize the required level of voltage for the device.

2) Power supply

In an ASIC, there are number of power supply pins (VCC as VDD and Ground as VSS). This is to obtain efficient, signal integrity and power architecture. Moreover, some ASIC architecture requires multiple voltage values such as in microcontrollers. In some ASIC there are different analog and digital power supply pins. As some internal circuits need analog power supply like comparator, resistive ladder etcetera and digital power supply is requisite in encoders, gates etcetera. The multiple ground pins helps to provide more current path for the heat dissipation [5].

3) Grounding technique

The grounding plays an important role to test the circuit to prevent the unwanted noise, decoupling, corrupting performance especially in mixed signal devices and high speed circuits. In mixed signal designs, analog circuit and power supply is more susceptible to noise. Therefore, different power supplies for analog and digital power supplies should be used so as to hinder digital noise to distort the analog circuit functionality. Moreover, a 0.1μF capacitor ought to be used between VDD and VSS in high frequency circuits to remove unwanted noise and glitches from the power supply. The testing of an ASIC involves many electronic devices used; each device should be connected common ground in star configuration [5].

Once all the peripheral components, power supply and grounding technique is cleared, PCB is Designed.

B. After PCB Designing

1) Input Signals: The The ASIC input signal includes the data, analog signal, clock, select signals and many more. The clock signal, digital data signal like any plain text could be given through controller or an FPGA. The analog and clock signal could be given from function generator as well. The select signal is just a controlled digital signal achieved through a switch interfaced with a controller, or an FPGA that has on-chip switch.

2*) Output Signal captured*: The output of an ASIC can be seen on an Oscilloscope weather be it analog or digital. The data displayed on oscilloscope can be

saved in the pen drive for future reference. The digital signal number of bits depends on the oscilloscope buffer size. Large number of bits can be stored using Analog Discovery kit or Xilinx IP core and chipscope software of FPGA [6].

Therefore, taking consideration of above mentioned parameters one could remove distorion and control environmental constraints. Furthure for experimental testing setup of an ASIC is explained in section III.

III. EXPERIMENTAL RESULTS AND COMPARISON

The Functional testing system of Digital and Mixed signal design ASIC is explained in this section. The 48LQFN package ASIC comprises comparator and ADC circuit named as EDU0043. The 16LQFN package ASIC is prototype of Present Lightweight Cryptography algorithm named as EDU0084. Both the ASIC are designed at 180nm CMOS technology operating at 1.8 V power supply. The Keysight MSOX4024A is used to capture the output, Rigol Power supply is used to supply power, and function generator is used to give input signal. The Basys 3 is used to give select signals and plaintext. As proof-of-principle the output results of ADC and comparator are cross-verified on Cadence software tools. The Present Lightweight cryptography is performed on Xilinx Vivado as proof of concept.

Initially, the EDU0043 QFN package is converted in DIP package using QFN to DIP convertor, to make soldering convenient. The experimental setup of comparator comprises of a filter a 100 Ω resistor and 0.1 µF capacitor for impedance matching and a digital buffer 74AUP2G34 as is shown in Figure 3. In comparator the input of reference signal is given through voltage divider, analog and clock signal is given through function generator. The output is seen on MSO as shown in Figure 4 and authenticated from the comparator output in Cadence

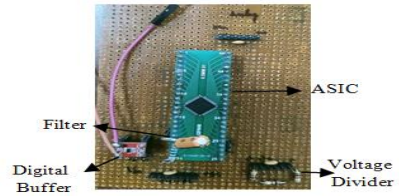

Fig. 3 Comparator ASIC Testing PCB

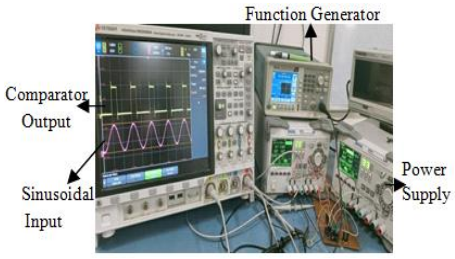

Fig. 4 Comparator ASIC Output

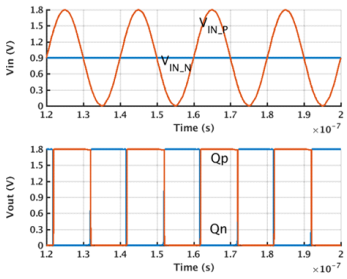

Fig.5 Comparator Software Output

In Analog-to-Digital Convertor (ADC) testing, impedance matching with 100 Ω resistor and 0.1 µF capacitor is done at analog input which is given from function generator of 5 MHz sinusoidal signal. The analog and digital power supply is given separately. At the output digital buffers are used to get the output which is seen at MSO and analog discovery. For the verification, a DAC is given the ADC output after a level shifter as the DAC used works at 3.3V and ADC at 1.8V, so as to check if one gets the same output as input.

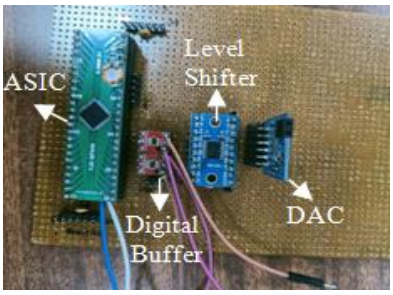

Fig. 6 ADC ASIC Testing PCB

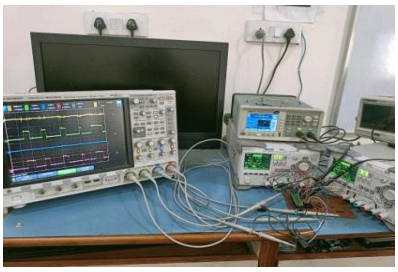

Fig.7 ADC ASIC Output

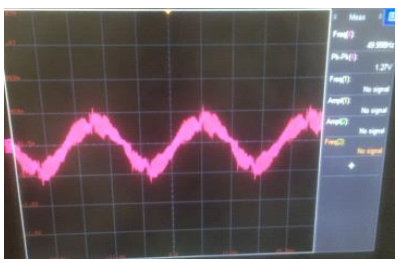

Fig.8. ADC Output retrieves from DAC

The Present Crypto ASIC EDU0084 is a 16 pin QFN package which is soldered on DIP package convertor. The Basys 3 FPGA through level shifter gives plaintext (Data + Key), 10MHz Clock and Select

signals such as Reset, Key Data Load and Reset. The select signals are controlled through switches on the basys 3.The Led act as a flag for Output is ready. Finally, the Data output is see at MSO through digital Buffer. If MSO buffer size is less than one can use Analog Discovery kit to capture the entire 64 bits output. The output data is validated performing simulation on Vivado tool with same plaintext as given while crypto chip testing.

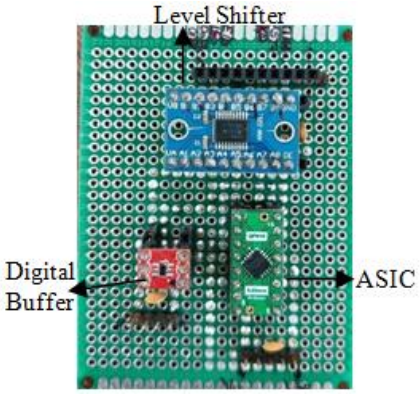

Fig. 9 Crypto ASIC Testing PCB

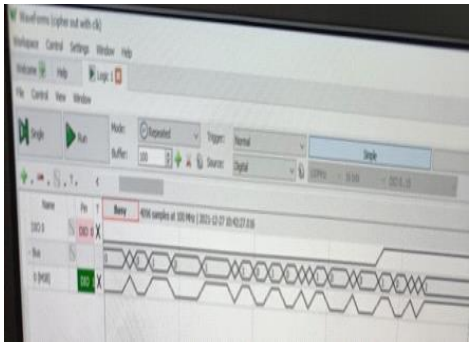

Fig.10 Crypto ASIC Output

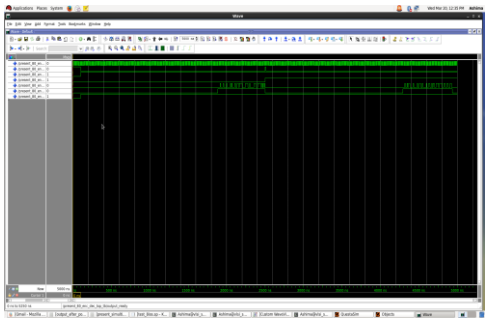

Fig.11 Crypto Software Output

IV. CONCLUSION AND FUTURE SCOPE

The unique Test Plan for functional testing of an Application Specific Integrated Circuit (ASIC) is explained in the paper. The Test Plan is described using analog, digital and mixed signal design ASIC so as to cover all domains. The testing methodology is divided in two parts before and after PCB designing. The results obtained while ASIC testing are validated by the simulation from software tools. The methodology needs minimal components and with (high) 99% output efficient rate.

The ASICs tested in System Design (Prototype) are beneficial for real time applications. The ADC tested is all digital 6-bit Flash ADC and can be used in Car brakes for clash avoidance. Moreover, the Present crypto ASIC could be used to encrypt the multilingual languages, utilized by layman to protect their data.

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A Review on the Impact of Deep Learning in the Identification of Atrial Septal Defect and a Comparative study on the Algorithms Employed in the Imaging Modalities

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***Abstract*:-- Among the congenital heart diseases, atrial septal defect constitutes the third most common type. In many cases, the patient remains asymptomatic throughout the childhood even having large shunts. Methodologies that can be employed for identifying the defects are : echocardiogram , chest X-ray, electrocardiogram, cardiac catheterization, MRI, CT scan, phonocardiogram . Deep learning can be effectively utilised for the automated estimation of the defect from the test result. The goal of this review paper is to provide an insight into ASD, the methods for identifying it and the application of deep learning models for distinguishing the defect. The paper reviews various algorithms used for identification of defects also points out the limitations of each algorithm.**

Index Terms : Atrial Septal defect; Image Processing; Deep learning; Diagonostic tools; Classifiers; CNN; U-Net architecture; LSTM; Image Segmentation ; MRCNN.

I. INTRODUCTION

Congenital heart disease (CHD) is the most frequently occurring congenital disorder and is responsible for about 28% of congenital birth defects [1]. A group of serious heart defects that are present from birth is critical congenital heart disease. There is a large variation of care available for children in medium income countries, including India, than it from high income countries. Due to this large number of affected ones and limited resources, a huge proportion of children with CHD go undiagnosed and untreated in India. For the management of children with CHD over the last three decades, a significant amount of progress has been made in India, but it still remains grossly inadequate. In order to improve the overall outlook for children with CHD, healthy communication with pediatricians and other front line health staff are necessary . Fruitful discussions with health policy makers is vital so that more resources are allocated for children with CHD – at primary, secondary and tertiary levels [2].

Deficiency of the atrial septum, which permits shunting of blood between the two atria is Atrial Septal Defect (ASD) . It is one of the most common congenital heart defects [3] occurring in up to 10% of all congenital cardiac disfigurement [2] and, in conjunction with bicuspid aortic valve, is the most frequently identified congenital heart defect in adulthood. Most children with ASD are identified by incidental detection of a cardiac murmur by the pediatrician [4].

Artificial Intelligence(AI) [5] is a broad term that covers any computer program (algorithms and models) that mimics human logic and intelligence. Deep learning (also known as deep structured learning) is part of a broader family of machine learning methods based on artificial neural networks. In deep learning [5], a computer model learns to perform classification tasks directly from images, text, or sound. Using a large set of labeled data and neural network architectures that incorporate many layers, the models are trained. Developing an efficient deep learning model for the identification of ASD could be extremely helpful helpful for the benefit of patients and sonographers. Here a computer model is made to perform identification task directly from images.

Motivated by this consideration, the contribution of this paper is to investigate the deep learning approaches applied for identifying ASD. The goal is to provide an insight into ASD, the methods for identifying it and the application of deep learning models for distinguishing the defect.

II. Atrial Septal Defect

The human heart is a muscular organ which is responsible for efficiently receiving and pumping blood. Since the body's tissues rely on the blood to carry nourishment (oxygen, glucose) and remove waste products (carbon dioxide), proper blood flow is vital to health. The cardiovascular system (heart, blood vessels) contains two separate circulatory systems - venous (right) and arterial (left) [6], under normal conditions.

The internal anatomy of heart uncovers four chambers. The upper two chambers (atria) are collecting chambers and the two lower chambers (ventricles) are stronger and they pump blood. The right atrium collect blood from body which is deoxygenated and right ventricle pump it to the lungs. The left atrium gather blood from the lungs which is oxygenated and the left ventricle pump it throughout the body [6]. A set of four valves manages the one way flow of blood through the heart.

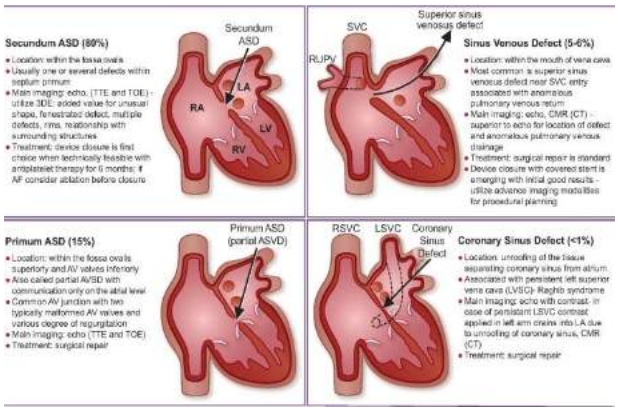

Figure 1 : The different morphological types of ASD [7]

In fetus, lungs do not achieve the function of oxygenating the blood as in adults. Placenta is the provider of oxygen to fetus. Unlike adult heart, in fetus, the oxygenated blood mixes with deoxygenated blood and collects in the right atrium. Since lungs require very little of this blood, the fetus has three unique features that establish the shunting of blood from right side of the heart to left side [6].

The first aspect in fetal heart is foramen ovale, which is a valve covered by two flaps that prevents the regurgitation of blood, in the inter atrial septum and it is a passage of blood to flow from the right atrium to left. The second aspect is the ligament of inferior vena cava, which is a large vein that carries the deoxygenated blood and functions in fetal circulation and the third feature is the way for oxygenated blood [6].

A wedge of tissue, which is the first partition, known as the septum primum, extends inferiorly, between 3 and 4 weeks of fetal development and is produced by the depressed roof of the atrium . The crescent-shaped septum reaches the floor and hence separating the right and left atria and thus it forms a foramen along its free edge, ostium primum ("first mouth/opening"), during the fifth week. Towards the end of the sixth week, the growing edge of the septum primum reduces the ostium primum to nothing. The septum primum grows the perforations simultaneously, that integrates to form a new foramen the ostium secundum("secondopening"). Thus, a new channel for right-to-left blood flow opens before the old one shuts. Unitedly this, the septum secundum ("second partition") which is a second crescent-shaped wedge of tissue, develops from the roof of the atrium. It is positioned alongside the septum primum on the side of the right atrium. The secundum is thick and muscular as it grows posteroinferiorly, unlike the septum primum. It absolutely extends to the floor of the right atrium and leaves a hole in the inferior portion, the foramen ovale. There will be the shunting of blood during the rest of fetal development, from the right to the left atrium to pump out of the heart through the aortic artery. This shunt closes at birth because of the crusty dilation of the pulmonary vasculature united with the loss of flow through the umbilical vein [6].

The left-to-right atrial flow is permitted by an atrial septal defect, after the septum primum and septum secundum are pressed together at birth, if the septum secundum is too short to cover the ostium secundum completely. Atrial septal defects (ASD) make up the third most common type of congenital heart disease . Even with large shunts[4], most patients remain asymptomatic throughout their childhood. The different morphological types of ASD [7] based largely on their location are as shown in Figure. 1.

III. Methods for identification of ASD

Medical image segmentation intents to make anatomical or pathological structures changes in more clear in images; it often plays a vital in computer aided diagnosis. The development and growing popularity of medical imaging equipments, which include X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and ultrasound have become four crucial image assisted means to help clinicians diagnose diseases, to estimate prognosis, and to plan operations in medical institutions.To aid the clinicians make accurate diagnosis, it is important to segment some crucial objects in medical images and extract features from the segmented areas [5].

3.1 Cardiac Murmur : Most children with ASD are recognised by incidental detection of a cardiac murmur by the pediatrician. Hardly an infant with ASD may present with failure to thrive, feeding difficulties, breathlessness or recurrent lower respiratory infections [4]. A regular first heart sound and a wide and fixed second sound establishes the classical auscultatory findings in large ASD. The normal split of the second sound is generally well audible, in healthy young children and may be exaggerated and persistent in the recumbent position, which on occasion leads to the notion of an ASD.

3.2 Chest X-Ray : X-ray radiography is the most frequently available techniques that can be utilized for the detection and diagnosis of many diseases. A large quantity of radiographic images and reports are accessible in hospital archives around the world. Enlargement of the right heart chambers is an implication of hemodynamically significant shunt in ASD [4].

3.3Electrocardiography (ECG): Electrocardiogram (ECG) is the transthoracic perception of the electrical activity of the heart over a period of time [8]. An ideal ECG signal is as depicted in the Figure. 2. The complexes P, QRS and T are present in the trace ot the signal and they costitute one heartbeat. The duration of the heartbeat is notated by the interval R-R. Absence of sinus arrhythmia is a consistent aspect of ASD. While unaccomplished right bundle branch block is a commonly pointed out in ASD, the span of the QRS tends to be greater with increasing right ventricular volume encumber.

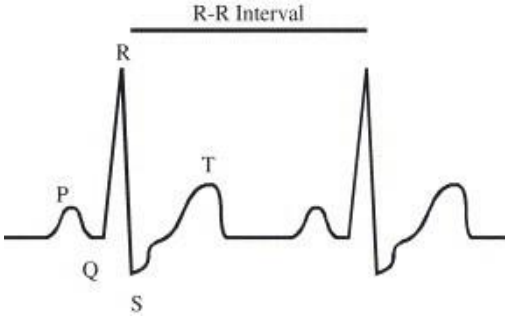

Figure 2 The normal ECG signal [8]

Right atrial enlargement in the patient is often pointed out by subtle peaking of 'P' waves with rarely any increase in its amplitude. Right axis deviation of the QRS generally notates the presence of significant pulmonary hypertension and occasionally pulmonary vascular disease [9]. The significance of electrocardiographic findings in the diagnosis of atrial septal defect is demonstrated by Nermin Bayar et al. [10]. Ostium secundum ASD, Sinus venosus ASD, Ostium primum ASD and Eisenmenger ASD are as shown by the traces A, B, C and D respectively in Figure. 3.

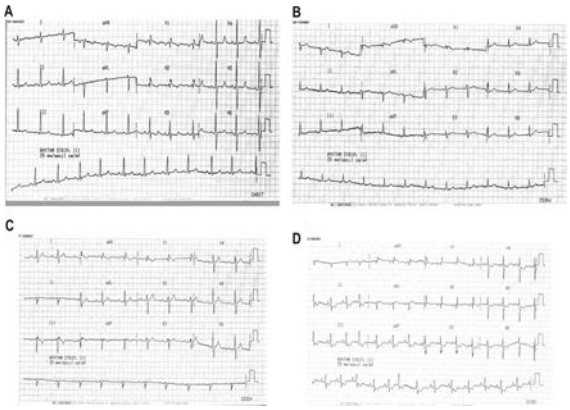

Figure 3 The electrocardiographic findings for recognising the atrial septal defect [11]

3.4 Echocardiography : An echocardiogram (echo) is a graphic blueprint of the heart's movement. uring an echo test, ultrasound, which are high-frequency sound waves, from a hand-held wand positioned on chest frunshies the images of the heart's valves and chambers, which aids the sonographer to evaluate the pumping action of the heart. Echo is often combined with Doppler ultrasound and

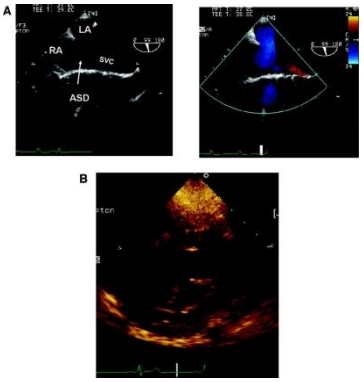

Figure 4 Recognising ASD from echo [13]

color Doppler to grade blood flow across the heart's valves [1]. Transthoracic echocardiography is the primary modality used for the scrutiny and depiction of ASD. Multiple views should be used to delineate the size, shape and position of the ASD and its association with adjacent cardiac structures [10]. Among the imaging modalities, Tranesophageal echocardiography (TEE) and intracardiac echocardiography are well advocated [12].

Itzhak Kronzon et al. [13] compared the value of transthoracic (TTE) and transesophageal (TOE) echocardiography in the estimation of various types of ASD in adults. TTE is the first-line imaging modality providing an authentic diagnosis, shunt quantification, and computation of haemodynamic consequences, including pulmonary hypertension, for the majority of adult patients with ASD [7]. TOE is required for precise estimation of ASD before or during transcatheter or surgical closure, providing

meticulous quantification of defect size and morphology. It is as shown in Figure 4.

3.5 Cardiac Catheterization : Cardiac catherization is a conduct in which a thin, flexible tube (catheter) is guided through a blood vessel to the heart to analyze or treat certain heart conditions. While an invasive catheterization is not demanded for the diagnosis of ASD, cardiac catheterization still remains the gold standard for the estimation of shunt[14].

3.6 Magnetic resonance imaging (MRI): Magnetic resonance imaging (MRI) is a medical imaging approach that utilises a magnetic field and computer-generated radio waves to create detailed images of the organs and tissues [15]. Efficient estimation of the shunt and its impact on the structure and function of heart can be analysed using MRI.

3.7.Computerized tomography (CT): CT scan associates a series of X-ray images taken from different angles around the body and does the processing using computer to generate cross-sectional images (slices) of the bones, blood vessels and soft tissues inside your body. CT scan images provide more comprehensive information than plain X-rays [15]. CT scan also can furnish the shunt estimation of ASD.

IV. Deep learning for the recognition of ASD

Jiaming Wang et al. expose the intelligent diagnosis of pediatric murmurs due to congenital heart disease (CHD) [16]. Phonocardiogram (PCG) signals were recorded and a segmentation method based on the discrete wavelet transform [17] combined with Hadamard product was implemented to detect the first and the second heart sounds from the signal. The accuracy was 93% , with sensitivity, and specificity of diagnosis for heart murmurs being 93.5%, and 91.7%, respectively. Eventually, a method of intelligent diagnosis of pediatric CHD murmurs is developed successfully and can be employed for online screening of CHD in children. For a nonprofessional volunteer who records PCG signal by placing an electronic stethoscope in any other position, the method may be inappropriate.The denoising method used was not able to rule out strong noises coming from children crying and moving during the recording and the output data in the prediction were volatile because the mild, moderate, and severe murmurs were not notified. The results are as shown in Figure 5.

In deep learning, convolutional neural networks (CNN) strongly achieve hierarchical feature representation of images. As CNNs employed for feature learning are insensitive to image noise, blur, contrast, etc., they fetch excellent segmentation results. For medical image segmentation tasks, supervised learning is the most caught on method [5]. Ronneberger et al.[18] proposed the U-Net, that is the first high impact encoder-decoder structure and has been extensively used for medical image segmentation.

In the last 20 years, the mortality due to CHD has halved in high income countries (HICs) whereas low and middle income countries (LMICs) have seen a rise in disability and death . Scaling up surgical care in these countries can cut down congenital heart disease related deaths by 58% [19]. However, prompt identification of patients is crucial to make sure of the improved outputs. Machine learning models such as neural networks have the ability to recognize congenital heart disease flawlessly without the need for trained personnel. The diverseness of the diagnostic methods used to train these models and the diversification of the CHD recognition included between the studies is a major constraint. [20].

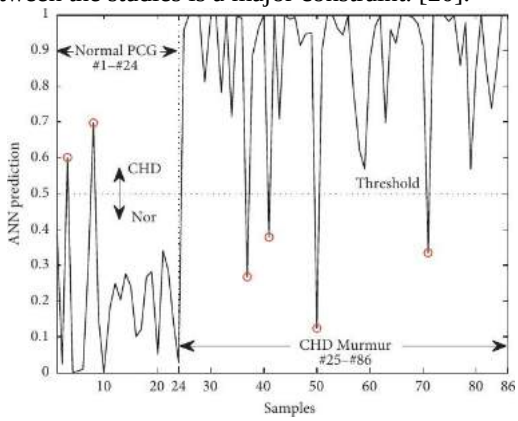

Figure 5 The result of PCG classifiction. [16]

Yar Muhammad et al. [21] developed an intelligent predictive system based on contemporary machine learning algorithms for the prediction and diagnosis of heart disease. The correct prediction of heart disease can prevent life threats while an incorrect one can prove to be fatal at the same time. The paper focusses on the experimental results of various contemporary classification algorithms. The performance of all used classification models that includes K-Nearest Neighbors (KNN), Decision Tree (DT), Extra- Tree Classifier (ETC), Random Forest (RF),Support Vector Machine (SVM), Logistic Regression (LR), Naïve Bayes (NB), Artificial Neural Network (ANN), Adaboost (AB), and Gradient Boosting (GB) along with full feature space is evaluated first . The four feature selection algorithms (FSA), which includes, Fast Correlation-Based Filter (FCBF), Minimal Redundancy Maximal Relevance (mRMR), Least Absolute Shrinkage and Selection Operator (LASSO), and Relief are applied to select the crucial and high variant features from

feature space. For measuring the performances of the classification models, various performance evaluation metrics are implemented . An Intelligent Hybrid Framework was developed for the prediction of heart disease as depicted in the block diagram Figure. 6.

Different machine learning algorithms and deep learning and were applied to compare the results and analysis of the UCI Machine Learning Heart Disease dataset by Rohit Bharti et al. [22]. An accuracy of 94.2% accuracy was obtained by using deep learning approach. It is as shown in Table 1 [22].
Magnetic resonance imaging (MRI) of the heart allows both planar and volumetric assessment of the cardiac anatomy, and it can be effectively employed for the identification of atrial septal defect. Yu Lu et. al. [23] devised a variant of the U-Net architecture Fig. 7, which is widely used in deep learning, to segment the right atrium in images acquired using MRI from ASD patients. The proposed method provides higher accuracy segmentation .The main problem with existing encoder–decoder networks is that the skip connection and the encoder–decoder path cannot jointly preserve details and semantic information. Along with high-resolution semantic information, residual and dense connections, a extracted by a deep monitoring mechanism can also be explored.

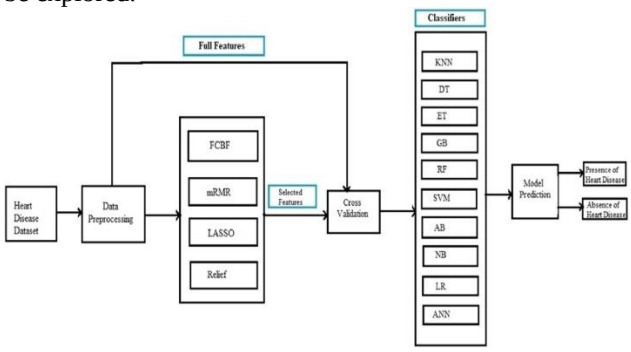

Figure 6 An Intelligent Hybrid Framework for the prediction of heart disease. [21]

Types of classifiers	Percentage of accuracy	Specificit y	Sensitivity
Logistic regression	83.3	82.3	86.3
K neighbours	84.8	77.7	85.0
SVM	83.2	78.7	78.2
Random forest	80.3	78.7	78.2
Decision tree	82.3	78.9	78.5
DL	94.2	83.1	82.3

Table 1 Comparison of performance parameters of classifiers [22]

The heart murmur which is allied with atrial septal defects is often faint and can thus only be detected by chance. Although ECG examination can prompt diagnoses, recognition of specific findings remains a major challenge. Hiroki Mori et. al. [24] demonstrated improved diagnostic accuracy realized by incorporating a proposed deep learning model, comprising a convolutional neural network (CNN) and long short-term memory (LSTM), along with ECGs [25] for identifying ASD. They used a deep learning model comprising a CNN and LTSMs [26]. The deep learning model results provided the accuracy of 0.81 having sensitivity of 0.76, specificity of 0.96 with the positive predictive value of 0.88, and F1 score of 0.81. In developing the model two primary limitations were encountered. The first being,the volume of images used for deep learning (DL) was relatively small and so the study may contain bias; the priming effect and Hawthorne effect should be taken into consideration in the physicians' tests [19] [27].This may have yielded higher false positive and true positive ratios than if ASD had not been stated as the disease being potentially identified. The diagnostic quality of the proposed deep learning ECG method could continue to be refined for applications in clinical pre-examination ECG screening, if these limitations are addressed in further work.

Echocardiography utilises ultrasound technology to capture high temporal and spatial resolution images of the heart and its surrounding structures, and is the most frequently used imaging modality in cardiovascular medicine. By using CNN on a large new dataset
,Amirata Ghorbani et al. provided deep learning interpretation of echocardiograms [28]. Deep learning applied to echocardiography can point out local cardiac structures, estimate cardiac function, and anticipates systemic phenotypes which modifies cardiovascular risk but not readily identifiable to human interpretation. The proposed deep learning model, EchoNet, accurately recognised the presence of pacemaker leads, enlarged left atrium, left ventricular hypertrophy, left ventricular end systolic and diastolic volumes and ejection fraction along with the prediction of systemic phenotypes of age,

sex, weight, and height. Interpretation analysis endroses that EchoNet shows convinient attention to key cardiac structures when performing human-explainable tasks and features hypothesis-generating regions of interest when figuring out systemic phenotypes that is difficult for human interpretation.

Authentic screening for septal defects is vital for supporting radiologists' interpretative work. Siti Nurmaini et. at. proposed the accurate detection of septal defects with fetal ultrasonography images using deep learning [29].

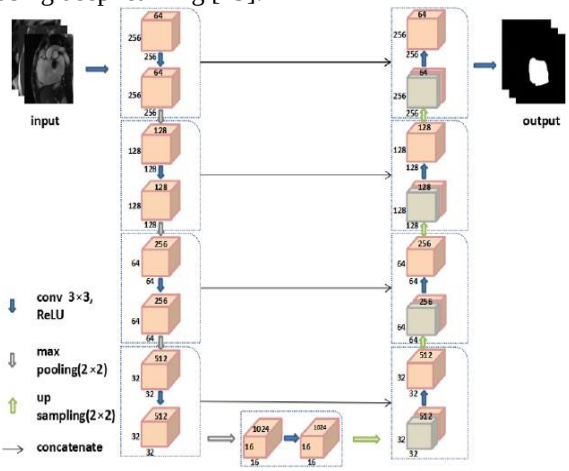

Figure 7 Architecture of proposed U-Net variant for atrium segmentation [23]

The fetal heart may encompass multiple objects, such as the atria, ventricles,aorta and valves. Besides, blurry boundaries (shadows) or a lack of consistency in the acquisition ultrasonography can lead to wide variations. This study used Mask-RCNN (MRCNN) [30] to handle fetal ultrasonography images and employ it to detect and segment defects in heart walls with multiple objects. The proposed MRCNN model gains better performance in multiclass detection of the heart chamber, with 97.59% for the right atrium,for the left atrium it is 99.67% and for the left ventricle 86.17%, 98.83% for the right ventricle, and 99.97% for the aorta. The proposed model provide reliable detection of septal defects, including defects in the atria, ventricles, or both. All results have been validated by experts to ensure the appropriate achievement of hole detection. A familiar problem having the septal defect dataset is the ground truth consists of a very limited and strict dataset.

Transthoracic echocardiography [31] represents the mainstay in the routine imaging estimation of patients with congenital heart disease. Gerhard Paul Diller et al. aimed to investigate the utility of deep learning algorithms in de-noising transthoracic echocardiographic images and removing acoustic shadowing artefacts specifically in patients with congenital heart disease (CHD) [32]. Also, the performance of DL algorithms that is trained on CHD samples was compared to models trained entirely on structurally normal hearts. Deep neural network based autoencoders [33] were built for denoising and removal of acoustic shadowing artefacts based on routine echocardiographic apical 4-chamber views and performance was assessed by visual assessment and cross entropy is evaluated. The study establishes the potential of autoencoders for denoising and artefact elimination in patients with congenital heart disease and structurally normal hearts. The models trained entirely on samples from structurally normal hearts perform reasonably in CHD and the data illustrates the value of dedicated image augmentation systems trained specifically on CHD samples.

The statistics of relevant research articles published in the recognition of atrial septal defect by employing deep learning in the imaging modalities is depicted in Figure 8. Major articles were published in the peroid 2019 - 2021. The advent of efficient deep learning algorithms steered the research in ASD detection.

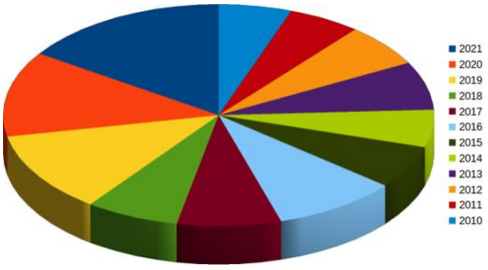

Figure 8 Statistics of research articles

V. CONCLUSION

Deep learning has demonstrated tremendous potential in recognising ASD. These techniques have proved their efficiency as powerful tools in dealing with defect detection in the areas of preprocessing, feature extraction, feature selection, classification , and also in clustering. DL can be incorporated in all the modalities used for the recognition of the ASD. The performance of different diagnostic methods were discussed in terms of the defect detection accuracy and algorithm parameters. Echocardiograhy has been identified as very effective for the recognition of ASD. MRCNN model furnishes better performance in detecting the cardiac chambers. The deep learning model Echonet provides better interpretation of enlarged chambers. As a summary, we can conclude that an efficient deep learning model for the identification of ASD could be extremely advantageous for the benefit of patients and the sonographers.

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Critical Evaluation of Strategic Management in the Indian Fast-Food Chain Business

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Abstract:-- **Strategic management entails planning, monitoring, analysing, and evaluating business needs to meet pertinent goals. The study's objective was to critically assess strategic management practices used by the Indian Fast-food chain businesses. This study used the secondary data analysis/archival study method, in which diverse databases like websites and peer-reviewed articles were used. Some findings are that the influence of fast-food chain businesses' strategic management decisions in India is influenced by FDI policies, minimum wage laws, and a large young population under 35. Digital marketing enhances marketing and sales. QSR faces legal restrictions. Specific operational and functional strategies by Indian QSR are 4Ps, Total quality management, Franchise market expansion model, and market adaptability and sensitivity to meet customer satisfaction.**

Index Terms : QSR, India, Fast-food chain Business, Strategic Management

I. INTRODUCTION

Strategic management is a critical component in the contemporary organisation entailing planning, monitoring, analysis, and evaluation of the organisation's needs to meet its goals [5]. The hospitality industry has faced innumerable dynamics compelling the players to delve deeper into the strategic management of the businesses. The fast-food restaurant chain or quick-service restaurants are integral constituents of the organised Indian food industry [10]. The chain restaurants comprise 25% of the Indian Market share, while the rest of the standalone restaurants have 75% market share. Recently, multiple international fast food restaurant chains have entered the Indian market as part of the diversification and industry expansionary strategies [3]. The focus of the new market entrants is the affordability of high-quality meals and speed of service delivery. The Indian fast food market is fast growing due to the high economic growth rate, population growth, disposable income, and discount offers associated with plastic money [6]. Similarly, technological grip and a higher female working population have equally contributed to the growth and development of the Indian fast food restaurant chain.

The dominant quick-service restaurants (QSR) in the Indian market include McDonald's, KFC, Dominos, and Subway; they are also the market leaders in India [6]. QSR has become popular in India because they offer convenient and cost-effective models, despite widespread criticism that they offer unhealthy food. The common characteristic across all the chain QSR is adherence to Indian-oriented menus [9]. The common offerings include wraps, cold drinks, pizza, burgers, milkshakes, French fries, and sandwiches. Other strategic managerial orientations by the QSR are competitive pricing and service delivery speed, making them the most preferred eateries. This study aims to critically evaluate the strategic management of the Indian fast-food chain Business. The study also aims at establishing how strategic management approaches adopted by fast-food businesses contribute to their effective performance in Indian Market.

II. MATERIALS AND DISCUSSION

The study adopted Secondary Data Analysis/Archival Study approach to achieve the ultimate aims. Secondary data analysis or archival study was preferred due to its cost-effectiveness in collecting data, and also, it is time savvy as the data is already collected and documented in various secondary databases. Besides, only open-source secondary data were utilised; hence there was no need for data acquisition ethical procedures involved. In addition, commensurate to the aim of this study, comprising a critical evaluation of the diverse strategic management approaches used in India by fast-food chain business, secondary data analysis/archival

study allowed the researcher sufficient time to concentrate on critical appraisal of the data than collecting in the field [15]. However, the study methodology encompasses the issue of reliability of the data since its accuracy is dependent on the third party; but only reliable sources were used to boost internal and external validity of the pertinent findings.

Specific sources used to inform the study comprised secondary sources such as the websites of the respective fast-food chain businesses in India, government publications on diverse issues, and peer-reviewed scholarly articles. Similarly, newspapers and books published online on specific strategic management concepts of the Indian fast-food chain businesses were consulted. Similarly, dissertations related to the study were used to inform the study. On the other hand, the secondary data analysis entailed the researcher leveraging the data content to evaluate new perspectives per the study aims.

III. RESULT AND DISCUSSION

3.1 Industry Overview

The Indian fast-food sector can be described as a nation facing unity in diversity; there are fast foods of Indian origin and international businesses. Some Indian-origin fast-food chain businesses are Nirula's, Bikanervala, Haldiram's, Sagar Ratna, Shiv Sagar, and Sharvana Bhawan [19]. On the other hand, the international fast-food chain businesses in Indian hospitality include McDonald's, Domino's Pizza, Pizza Hut, KFC, Taco Bell, Burger King, Subway, and Nando's [4]. Starbucks, Costa Coffee, and Dunkin's are other international fast food chain businesses popular in India. On the other hand, there are special fast-food chain businesses in India capitalizing on one-dish. Some of the one-dish fast-food chain businesses in India include, Wow! Momos, Goli Vada Pav, Karachi Bakery, Roll 'Em up, KaatiZone, Faasos, Barbeque Nation, and Vadilal Ice Cream. The findings herein imply that each fast-food chain business must establish distinctive corporate strategies to sustain its market share due to the pertinent competition. Following figure 1.0 summarizes the brand equity of the QSR firms in India.

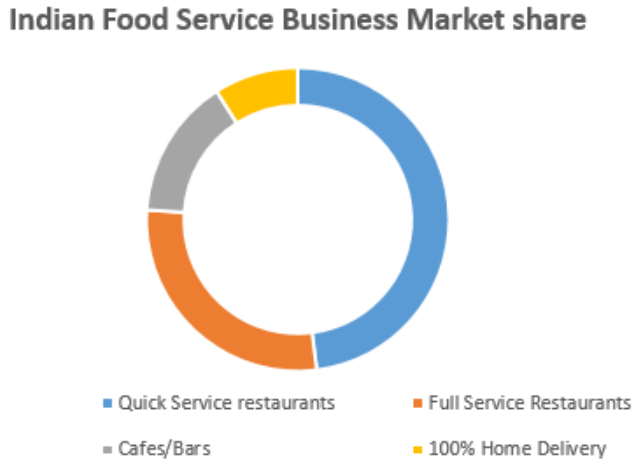

Figure 1.0: Food Service Market in India 2021 [16]
From the above figure, it is evident, quick service restaurants (QSR) hold the greatest market share of the food service industry. Full service restaurants takes second position, followed by the cafes/bars. Only a small portion of the food service businesses make home deliveries in India

3.2 Strategic Management Approaches Analysis

a.PASTEL analysis

PESTEL analysis is a critical tool in defining the macro-environment of a business, the decision upon which a corporate strategic plan is founded. The following is the PESTEL analysis for India's Fast-food Chain business sector;

Political

From August 2017, the government of India allowed foreign direct investment targeting food products. As a result, the international fast-food businesses have exploited the policy provision to invest in India and open up new markets in India. Similarly, India's economic reform policy of 1991 on public sector contraction targeting industrial licensing abolition and capital goods importation paved the way for foreign investors in the fast-food business [1]. The fast-food business leverages the political stability in India. Foreign and Indian-origin fast food businesses thrive without political interferences. As a result, more job opportunities are created with the firm depending on the local labor as opposed to labor importation.

The government issuing the minimum wage that assures the firms' competitive labor costs around Asia prompts profitability. The minimum wage in India is $2.80 U.S, translating to about INR176 per day, commensurate to the minimum wage Act 1948 and the code on wages Act 2019 [8]. Fast-food chain businesses leverage cheap local labor to optimise profitability.

Economic

From 2004-2005, the GDP of India expanded 2.47 times; the 2019 GDP was $2.871 Trillion, and it is expected to rise steadily through 2025 [20]. The GDP per capita has been on a positive trajectory since 2000. Fast-food chain businesses leverage the increased disposable income on the target market to increase revenue.

The post-Covid-19 crisis has left the Indian economy struggling, increasing inflation as the cost of basic commodities rises like fuel and vegetables. The retail inflation as of June 2022 was 7.01%, which thus hurts the profitability of fast food firms [14]. The Fast food market has thus been weakened through the post-Covid-19 recovery session.

Social

The demographic comprising of under 35years contribute to the fast growth of the fast-food market. There is thus a ready market. An increasingly high number of people prefer to eat out, thus becoming a target market for the GSR.

QSR has, through history, maintained social and religious sensitivity. For example, Beef and Pork are not the main menus in the Indian QSR, with some like McDonald's having never introduced such menus.

Over 25% working population are women in India, contributing to the culture of fast-food eateries for both workforce and families [18]. Often, working women contribute to fast food eating culture as they frequently spend their disposable income on fast food bought on their way from work. However, increased health consciousness may affect the consumption of some fast food, especially junk food offered in the QSR.

Technological

Digital marketing has provided easy-to-access fast food ordering platforms [18]. As a result, fast food businesses leverage e-commerce channels for marketing and sales. Similarly, digital payment methods like credit cards contribute to the fast processing of QSR orders. McDonald's introduced self-order kiosks leading to the fast growth of sales outlets across India. Besides, improved kitchen equipment has impacted the speed of QSR service delivery and automation of some services, as well as standardisation.

Environmental

QSR has increased adherence to corporate social responsibilities. For example, McDonald's took the initiative to show support during the covid-19 crisis [13]. Besides, most QSRs have adopted reduce, re-use, and recycle business concepts to reduce the carbon footprint [21]. Corporate reputation has been impacted positively as a result.

Legal

Legal restrictions hinder QSR business, like restrictions on working hours for women, business licensing, and restrictions on business working hours. Similarly, corporate tax is quite high, with an average of 3% [2]. However, recent lower goods and services tax where some goods are 0% tax rated have contributed to QSR profitability avenues [7]. QSR has more legal compliance issues due to the pertinent legal framework for businesses in India; the ease of new entrants is undermined.

Key QSR Functional Strategies

The QSR marketing mix comprising the 4Ps is a fundamental strategy for market sustenance [17]. Some QSRs update their menu regularly to meet consumer needs. Frequent market research and testing of their products help maintain relevancy and quality. The fast-food market is very dynamic, and firms exercise flexibility.

QSR utilises the right media to reach out to the right customers. Social media marketing and e-commerce platforms are the common strategic marketing channels [22]. On the other hand, product customisation through pricing strategies helps meet the demand of the target market. The QSR in the Indian market targets the middle class; hence products are priced at affordable rates. In addition, QSR businesses are strategically situated for the convenience of access; to populated market sections.

QSR uses total quality management practices in the Indian market. Product quality is maximised amid internal constraints like price limits and product costs [11]. Most QSR used the production line method to sustain consistency in quality. Operations management is the core strategic decision aimed at meeting customer satisfaction.

The QSR in India operates on Franchise, especially international businesses like McDonald's [12]. The franchise managers make strategic managerial decisions under local and corporate control, such that all branches maintain some commonalities. For example, McDonald's has a select maintenance service provider for standardising services and equipment across the branches nationwide. Further, the adaptability and flexibility of QSR operations is a fundamental strategic management approach deployed in India. Firms seek to change their operation management decisions to suit the local market conditions.

IV. CONCLUSION

Present strategic management practices adopted by the diverse fast-food chain businesses in India are fueled by the dynamics and competition in the hospitality sector. Indian QSR comprises international firms and firms of Indian origin with numerous commonalities in the strategic management

endeavours such that there is unity in diversity. PESTEL analysis informed the forces driving the strategic corporate strategies driving QSR firms in India; increased FDI owing to favourable political policies and favourable minimum wage policies. The large young population creates a ready market for fast food, and the working women population exacerbates the fast-food consumption in the families. Digital marketing enables customer access, and firms have become more sensitive to CSR. However, legal hurdles to business licensing have increased business compliance costs. The QSR in India uses 4Ps, including affordable pricing, high quality, and total quality management (TQM). The franchise model is embraced in the management of International QSR in India. QSR adaptability and flexibility are embraced to meet customer satisfaction.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Engineering Graduate Employability – A Tool Based Approach

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Abstract:-- **Global IT industry has large dependency on recruiting engineering graduates to fulfil their staffing needs, with growing IT industry, requirement of fresh engineering graduate talent is increasing day by day. While industry has increased demand but still the employability of engineering graduates is a major concern globally. IT Industry skill expectations from engineering graduates has not changed significantly but industry is finding it difficult to get right talent. Industry must spend substantial time and energy while onboarding engineering graduates before they are deployed on the projects. To overcome the challenge industry and academic needs to come together and work on the structured approach to help academic institutes and students to understand Industry expectations while recruiting. The roles and job expectations offered by IT industry differs by the services they offer. Students at early stage of their engineering education should decide on his or her career preferences and start working towards it. Students needs to assess where they stand as against what industry needs and bridge the gaps before getting ready for the recruitment process. Academic institutes play key role in mentoring students throughout the process to make sure students are employable. The overall process will result in better employability and reduced time and efforts for the recruitment process. A tool developed as part of the study "Engineering Graduate Employability http://www.ege.org.in/" will help to structure the process and help in improved employability.**

Index Terms : Employability, Engineering Graduates, IT Industry, Academic Institutions, Employability Tool

BACKGROUND

'Employability" is referred as individual's capability to gain and sustain employment **(Hillage and Pollard, 1998)**. In the academics, employability is considered as ability of a student to gain the employment through campus recruitment process. From the student's perspective, employability is to have required skills, mindset, and attitude that industry needs to gain the job one is aspiring for. From Academic institute perspective it is more of a ratio of number of students passed as against number of students placed in the industry. But largely employability is more related to the labour environment or industry situation at that point of time as hiring requirement changes due to market conditions. The study carried out by **Harvey, L in 2001** identifies that some external coaching and guidance can bridge this gap in graduates to be employable in the industry. Employability and Industry connect is directly connected and success of having such connect will result in better employment. Employability is a serious concern in India as well, former Indian President, Dr. APJ Abdul Kalam also stated that India should be focusing more on employability rather than employment. **Agarwal, Gao, DesRoche & Jha, (2010)** carried out detailed review of technical and professional education system in India encompassing Engineering colleges, Management Education colleges and many more institutes which are governed by different bodies like AICTE, Medical Council, Bar Council and allied regulatory boards. As per the study diploma or degree level technical academic institutes were unable to meet industry needs or technical or engineering workforce requirements of the country resulting in more public and private technical academic institutes during 1950's and 1960's. This also resulted in development of Regional Engineering Colleges in India. **Pandey, Ghosh, Lahiri, Sengupta, Mete, Bedr & Chintala, (2020)** identified that most of the development in technology sector resulting in substantial increase of public and private engineering colleges in India. The study done by **Kaushal, (2016)** revealed that Technical and Engineering education systems in India more focuses on developing technical skills while the focus on other personal soft skills are considered as low priority.

Over the period, the information technology (IT) and Information Technology enabled Services (ITeS) industry has positioned India with strong presence globally and influenced education system to cope up with the rising demand. India had cost advantage over the competitors making it Unique Selling Point (USP) favouring India in the competitive worldwide sourcing market. Globalization has resulted in higher competitiveness in education and training. As global economy became more unpredictable, it is imperative to have presence across industry sectors and your manpower is skilled and equipped with required knowledge to cope up with the situation. A FICCI – World Bank MHRD review conducted in September – October 2009 revealed that 64% of the Indian Industries are not satisfied with engineering graduates' quality and capability. 75% of engineering graduates cannot be employed. About 25% technology Graduates and 15% Other qualified Graduates can be employed in IT / ITeS industry – NASSCOM expressed by **Mckinsey Report 2005**. Hence World Bank finding recommended that inclusion of Soft Skills and appropriate level of Industry-Academic relationship should be mandated to overcome employability challenge. **Nagabhushan & Sohoni, (2020)** study revealed major gap between academia and what Indian industry needs. As per the Annual Employability Survey 2019 conducted by Aspiring minds, it was identified that 80% of the engineers passed out from various Private and Public engineering colleges are not fit for employment. **Arora, Kwwatra, & Agarwal, (2020)** concluded that there are not sufficient internship opportunities or Industry based projects in India for Engineering students. About 40% of the engineering students undergoes internship and 36% undertake industry projects. Indian academic syllabus is more theory-based and lack teaching the application of engineering concepts applied in industry application. The study conducted by **Puranik, (2015)** identified that the engineering college students passed out in India lacks required skills to be absorbed in Indian IT or ITeS Industry. The survey conducted by The Hindustan Times revealed that about 97% of the engineering graduates lack in communication skills and were struggling to speak English fluently.

How Industry, Academics and Students responding to situation in India:

A study was carried out to review employability of Pune based engineering colleges with respect to IT industry in specific. A detailed survey followed by select interviews were carried out. Accepting employability as an issue, industry, academic institutions as well as students are adapting to various initiatives and steps to overcome the employability challenge coping up with the business dynamics.

Initiatives from Academic Institutions:

Within the functional boundaries of AIECTE & UGC, academic institutes are trying their best to cope up with the situation and improve the employability. Increased employability helps academic institutes to get their branding more popular resulting in more competitive admissions in upcoming year. Some of the key initiatives which academic institutes in India driving are:

- As part of Atal Innovation Mission of government of India to create and promote culture of innovation and entrepreneurship across India, academic institutes have established separate cell to drive innovation. These cell focuses on driving various industry-based projects with the help of students which can potentially generate IP (Intellectual Property) or patents and can help students to think of start-up.
- Academic Institutes are working on developing / improving industrial connect for possible option of jointly working on industry research-oriented projects or involve industry experts in coaching or mentoring students
- Academic Institutes are trying to identify industry subject matter experts who can conduct knowledge sessions for students which can also provide potential opportunity for students to have industry / subject matter expert connect to leverage for
- Various training / coaching programs are conducted by academic institutes which can help students to improve on industry required skills
- Academic institutes are trying to provide industrial certification opportunities to students which can help them to get potential job opportunities

Some of the academic institutes have identified dedicated position for industry connect where the role is expected to develop and drive new projects, engagements, and potential opportunities to work with industry.

Initiatives from Industry:

IT Industry has large dependency on recruiting engineering college freshers to meet their staffing needs, some of the large IT services companies do mass recruitment while product companies do selective recruitment. The required skills shortage is impacting India growth directly or indirectly (Blom & Saeki, 2011). To get better talent recruited and to achieve numbers required Industry initiates key activities like:

- Upfront work with industry internal stakeholders to understand growth plan and define recruitment plan much in advance
- Approach academic institutes at earliest to get early recruitment slot so that larger pool of students available to select from

- Provides selection criteria, job roles to offer upfront to academic institutes so that right level of information is provided to students before the actual recruitment process
- Deliver Pre-Placement talk to students and provide company vision, details of the job role, working culture and career path
- Conducting knowledge sessions with students on technology trends and specific skills
- Driving research projects jointly with academic institutes and sponsoring such project to get "out-of-box" thinking and give opportunities to students to get hands on experience

Industries have dedicated team to manage campus recruitment throughout the year and their focus is more to have constant connect with academic institutes and work closely to explore opportunities on various connect initiatives.

Initiatives from Students:

Most of the students strive hard with a dream to get a job post their engineering graduation. With all available resources available around them, they try their best to utilize those and get employment. IT Industry perceives that student do not possess skills that industry considers mandatory to be employable (Jaschik, 2015). Industry has experienced that student who have been offered internship lack in communication skills, work ethics and respect towards subordinates (Hargis, 2011).

Some of the key initiatives that students take to get an employment are:

- Considering market trends look at the technology required and do the training courses, where possible go for certification
- Participate in various initiatives or events organized by their academic institute and try to leverage opportunities from that
- Get enrolled into various career-oriented courses offered by their academic institutes
- Explore opportunities for internship which can provide hands on industry exposure which can benefit during recruitment process
- Approach their social or family contacts and get their guidance / mentorship

Students closely work with college "placement" cell during the recruitment process to explore possible opportunities of interest to them and where they qualify the criteria.

Gaps that is overall impacting Employability

Some of the possible reasons about the gap in Industry and academics are mindset difference, course curriculum changes take long time to effect while industry changes are constant due to changing business scenarios, while industry drives for short term goal of recruitment for the year, academic focuses on long term perspective (Kapil P., 2014). Three core coordinates in the employability process that is Academic Institutes, Industry and Students are taking various initiatives to improve employability, but still overall result of the process is not encouraging, employability factor has not significantly improved.

Narendra Agarwal carried out a study on engineering graduates' employability and identified that lack of interpersonal and technical skills has serious implications on recruiting engineering graduates for an Indian IT / ITeS industry. To mitigate the issue, most of the Indian IT companies have a dedicated Learning & Development department who conducts onboarding training programs to get them deployable for the projects (Agarwal N, 2014).

Some of the factors which could have direct or indirect impact on the employability are:

- Most of the IT industry have a qualifying criterion to have > 60% marks throughout but engineering colleges do not have such criteria to admit students, hence in most of the occasions such students are not even qualified to appear for recruitment process
- Industry qualifying criteria and expectations are not well understood by students
- Students do not have clarity on where they stand with respect to soft skills, standardized assessment is required which can map it to industry expectations
- Students are not clear on what skills industry is expecting and rather focuses more on current technology knowledge which is not the key consideration during recruitment process
- There are very limited internships offered to students by industry which results in limited exposure to students about industry requirements
- Academic institutes are driving various initiatives but there is no measure on how it is helping students to improve employability
- Academic syllabus is static and there is limited or no scope for academic institutes to align it what industry requires
- Soft skills related training programs are organized just before actual recruitment process and hence usefulness of such programs is not much seen during the interviews
- There is a gap in what students are expecting from IT Industry job and what is on offer from IT industry

Looking at the identified gaps, there is some level of coordinated efforts required across Industry, Academic Institutes and Students which can help during campus recruitment process and may result in

productive outcome with increased employability. A "Tool" which can connect students with industry requirements via academic institutes is designed to meet up the requirements.

Engineering Graduate Employability Tool:

Though employability of student is a generic term, but it is identified that a student who is not suitable for one organization may be employable at other organization. Hence employability of a student should be looked at whether student is employable at an organization for the role.

A tool is developed which will take industry requirements and students skills as an input parameter and identify which are the students who are meets industry requirements and will also identify skills which students lack and provide list of courses that student can take up to improve the chances of getting employed.

Key factors about employability revealed by study are:

- IT Industry considers 10 common soft skills on which it evaluates students' capability while recruiting engineering graduates
- Preference of engineering branch varies by IT companies
- Overall guidance on educational scores is similar
- There are no gender specific requirements, though some of the roles do have consideration
- Students recruited during campus recruitment process undergoes onboarding training which varies from 4 weeks to 12 weeks but focuses more on soft skills and organizational process trainings

High level system function is as follows:

- Industry specific requirements are captured at Educational Performance, Soft skills expectations, technical skills expectations, any functional domain knowledge expectations, and any other skills expected. Job related details like – role description, location and expected date of joining are also captured
- Tool captures students' details on their academic performance, technical or functional domain skills and soft skill levels (as evaluated from various commonly available tools like wheebox, 123test etc.)
- System provides flexibility to map IT industry required skills as against skills evaluated by tool
- User can define various training courses against industry required skills which will be used to provided individual development plan for a student when student is below the expected skill level
- The tool will generate two types of lists – one will be students who qualify for a role with the industry and other list will be students who do not qualify for the industry what are the specific training courses that one needs to undertake which can make them qualified for future recruitment processes
- Tool processes employability for the company and for the role while students' data can be common across companies

The developed tool is a web based and hosted at http://www.ege.org.in/ with access controls defined with appropriate data privacy considerations.

Tool Validation

The tool is piloted at one of the engineering colleges in Pune where campus recruitment drive for 2 IT companies for 2 different roles. The results of the tool validation is specified in below table:

	IT Company-1	**IT Company-2**
Total # of students of qualifying branch	71	147
Total # of students of qualifying branch and academic score	29	71
Technical Skills matching	6	19
Domain Skill matching	6	19
Soft Skills matching	4	11
Recruitment Process qualified by engineering graduate employability tool	4	11
# of students selected from the tool recommended candidates	3	9
Overall success ratio	**75%**	**81%**

CONCLUSION

A tool or a platform which will be common across Students, Academic Institutes and Industries is required which can help to improve employability. Industry skills requirement is not changing year over year and hence academic institutes should focus on developing students' skills right from early stage of engineering so that student can get required time to get them fully skilled before they appear for the recruitment process. Academic institutes should give realistic picture to students if their education qualification score is below industry requirements and provide them alternate options to consider.

Internship will certainly help to improve employability and industry needs to provide opportunities for students, if government can mandate it will help to govern.

Scope for Future Studies

Tool is developed based on requirements captured for IT industry which can be validated for other industry segments. There could be potentially gap in the skill levels expected by IT industry and accessed by the tool may vary and may required to be standardized.

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Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Date fruit classification and sorting system using Artificial Intelligence: Application of Transfer Learning

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Abstract:-- **The date palm, which occupies 50% of the nation's total agricultural land and 80% of all fruit crops, is Oman's most significant agricultural crop. Technology advancement has benefitted date palm pruning and pollination for increased yield and harvesting. Like that, introducing technology for date fruit post-harvest processing to Oman could have a significant economic impact. Widely used manual date fruit classification based on quality is tedious, inconsistent, and time-consuming. Another issue with manual processing is the non-uniformity of sorting since human sensors' quality and calibration vary from person to person. This paper proposes a transfer-learning-based automatic date fruit classification system. The model included an electromechanical system for the steady movement of the date fruits. A microcontroller interfaced with a sensor identifies the presence of date fruits on the conveyer belt and initiates control signals for the fruit image capturing. The captured images are categorized using the transfer learning-based models incorporated with the MIT App and the teachable machine. A microcontroller-based system receives commands from the transfer learning-based system and activates piston movement. Piston movement is employed to collect categorized dates in smart bins. The proposed model could achieve appreciable classification accuracy.**

Index Terms : Artificial Intelligence, Date fruit classification, Teachable machine, Transfer learning

I. INTRODUCTION

The date palm is Oman's most important agricultural crop, accounting for 80% of all fruit crops and 50% of the country's total agricultural land. Date palm growing accounts for about half of Oman's total farming area [1]. Despite its nutritional and economic importance, it substantially impacts Oman's social and religious life[2]. Even though Oman ranks ninth in the world for date production, only 2.0 percent of the total produced dates are exported[3,4]. Humans and animals eat the remaining dates in the area. Pruning and pollinating date palms for greater productivity and harvesting have benefited from technological innovation. Similarly, bringing technology for post-harvest processing of date fruits to Oman might make a massive difference in the economy. After being used as fresh fruit and by-products such as date sugar, syrup, medical and industrial alcohol, vinegar, and so on, most produced dates are discarded. According to studies [2], roughly 67,000 tons of surplus dates in 2007 might be processed for storage and export. This work aims to build and implement a system that classifies and sorts of dates according to their features.

The size, texture, shape, and color of a date are usually used to determine its quality. Bruises, changes in skin tone, and wrinkles on the surface of defective dates have been reported [5]. Separated or tampered skin, dry skin, sugar spots, mold formation, and other issues might occur with damaged dates. Insect pests may also cause dates to deteriorate. Categorizing the dates as healthy or defective aids in creating an efficient storage system and, as a result, a more effective marketing approach. Considering the mutually overlapping effects of dates of varying maturities, grouping them is not recommended. Categorizing dates depending on their quality is tiresome, uneven, and time-consuming. The non-uniformity in sorting is another concern of manual processing, as human sensor quality and calibration differ from person to person. As a result, today's world necessitates the development of a quick and precise system for categorizing date fruit.

The proposed system entails the structural design of an electro-mechanical system for categorizing the flow of fruits. A sensor-based system detects the presence of fruits on the conveyor system. An intelligent approach for automatically capturing the image of the fruit is provided. A transfer learning-

based system sorts the dates according to their quality and sends a control signal to a microcontroller-based system to activate a piston system. To collect classified dates in smart bins, piston movement is used.

The remaining sections of this essay are organized as follows. Section 2 provides a thorough assessment of related studies in this area. The proposed date fruit sorting system's process flow and requirements are illustrated in section 3. The proposed model results and discussion are thoroughly presented in section 4. Section 5 presents a conclusion to the work.

II. LITERATURE REVIEW

Many studies have been conducted to determine the benefits and importance of date fruits. [6] examine the sorts and availability of dates in the Sultanate of Oman. Many algorithms have been developed to categorize dates based on their characteristics. May et al. [7] demonstrated a fuzzy logic and RGB color model-based automated oil palm fruit classification system. Using fuzzy logic, they identified the fruit as ripe, overripe, or underripe based on the color intensity value. Adnan et al.[8] conducted a comparative analysis of date fruit classification algorithms based on texture, size, and color. They concluded that the support vector machine model outperforms neural network and decision tree methods regarding prediction accuracy. Khalid et al.[9] used MLP and RBF networks to demonstrate a date fruit sorting system. Fruit characteristics such as form and color were used as classification criteria. Ghulam Muhammed and colleagues [10] suggested a date classification system based on the fruit's shape, color, and texture. They broke down the visual color into constituent pieces to classify it by color. For the texture component, local texture descriptors are extracted. The classifier is based on SVM. A CNN-based fruit classification system was described by Bindu et al. [11]. They tested the classifier's performance with oranges and bananas.

Liu et al. [12] presented their research on fruit identification systems in 2017. They discovered that the support vector machine (SVM) and its derivatives are an excellent method for fruit grading study. They also claim that deep learning (DL) models, particularly CNNs, are more efficient in computer vision. The computer vision-based fruit categorization approach is generally described by Naik et al. [13]. According to their findings, DL-based algorithms, notably CNNs, are becoming more popular. It's worth considering Zhu et al. work's [14], which offers an overview of DLbased algorithms and discusses key ideas, restrictions, implementation, and training methods. Their work is critical because it helps agricultural experts comprehend primary DL techniques better. The authors discover that crop productivity, plant disease reduction, and agriculture or agroindustry automation are all closely linked to recent agricultural innovation efforts. Bansal's review examines the use of computer vision and image processing techniques in the agri-food business [15]. The essential quality qualities of agricultural products are color, size, texture, shape, and flaws. Regarding food quality evaluation, they look at KNN, SVM, ANN, and CNN as classification algorithms. They claim that DL-based fruit classification and recognition algorithms, such as convolutional neural networks, are particularly good at reducing classification error. In Reference [16], Hameed et al. compare different computer vision methodologies for identifying fruits and vegetables, such as SVM, KNN, decision trees, ANN, CNN, and other feature extraction methods. They also point out that, while several classification methods for quality assessment and autonomous harvesting have been developed, these tactics are confined to a few classes and small datasets. Furthermore, they define three types of fruit and vegetable classification applications in their article: quality assessment, autonomous harvesting, and store inventory.

III. PROPOSED METHODOLOGY

A. Data set

Over 300 different kinds of Omani dates exist [17]. The Khunaizi, Khalas, and Fardh dates are the most well-liked types in terms of flavor and sweetness. Dates are a common food item on the Omani table, especially during the Holy Month of Ramadan. Al Nagal and Ash Patash varieties are among the first to enter the market during the harvest season in Oman. Khalas and Fardh dates are the next two most popular types among consumers. We employed the three categories Khalas, Fardh, and Nagal in this data collection. The data set's specifications are shown in Table 1.

Table 1 Image Data set

Sl.no.	Date type	Date fruit color	Shape and size of dates	Date fruit image
1	Fardh	Black/dark brown	Pristinely shaped and small seed	
2	Nagal	Brown	Medium-size dates are oval-shaped	
3	Khalas	Golden brown	Oval shape	

1) Khalas

The fruit is oval, the base is truncated and oblique, the funnel is large and conspicuous, the top and edge are hollow and twisted, and the fruit is medium in

size (30-40 mm x 19-23 mm)[1]. The color of the fruit is yellow, the taste is sweet, and the dates are reddish amber with light waxy dust. In the middle of the growing season, it ripens. It is marketed at premium costs compared to other types and is regarded as one of the top cultivars. It can be kept in storage. The class stands out for its drought endurance. The palm's typical yield ranges from 40 to 60 kilograms.

2) Nagal

In the Sultanate, Nagal variety palm trees are one of the most spread, with nearly 657,498 trees reported by the Ministry of Agriculture and Fisheries in 2017 distributed over all wilayats in the Sultanate. Nagal dates are small, slightly chewy, and sweet [18].

3) Fardh

For the year 2017, the Ministry of Agriculture and Fisheries reported that approximately 486,912 palm trees of the Fardh variety were planted throughout the Sultanate. Fardh varieties are considered mid-ripe varieties because flowering begins in late February and moistness begins in early July. The color of the Fardh fruit is blonde during the Besser period, yellow, red during the wet period, and dark brown during the Tamer period. It is an elongated oval. The average fruit weight is 9.2g, length is 3.4cm, and width is 2.2cm. Table 1 provides the details of the dataset used.

B. Transfer learning

Transfer Learning (TL) is the foundation of both the MIT app and teachable machines. Transfer learning in machine learning is the process of combining components from an existing system with new data [19]. If the two models carry out comparable tasks, generalized information can transfer between them. TL lowers the development expenses and the volume of labeled data required to train the new models. Transfer learning in machine learning occurs when existing models are applied to a new challenge or issue. TL is a model training strategy or technique rather than a specific machine learning method. Since it takes time and resources to develop new machine learning models, transfer learning is more effective. Furthermore, accurate tagging of large datasets takes a lot of effort. Organizations frequently come upon unlabeled data. This is particularly true when a machine learning algorithm must be trained on a vast dataset. Transfer learning allows you to train a model on a labeled dataset and then use it for a related task on an unlabeled dataset.

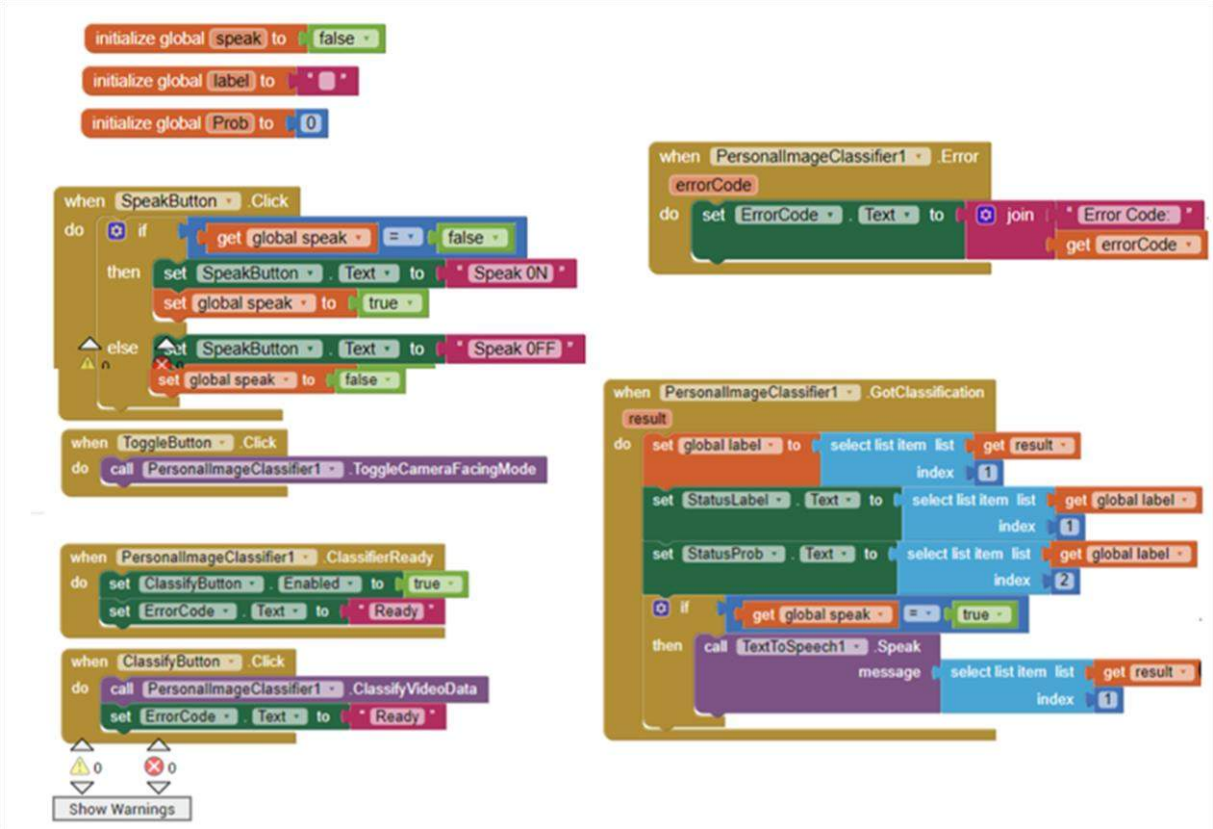
1) MIT App Inventor

App Inventor enables us to create Android apps using a web browser and the associated phone or emulator. App Inventor's servers store our work, making it more straightforward for us to manage our apps. Additionally, voice recognition and image classification are both possible with this application. The block-based coding system known as App Inventor consists of an App Inventor Designer where we choose the components for our app and a blocks editor where we write code blocks that instruct the parts how to act. The Personal Image Classifier (PIC) is used for training and testing. Fig. 1 shows the scratch program to classify date fruits captured. Fig. 2 shows the selected PIC model details.

2) Teachable Machine

Initially launched in 2017, Teachable Machine is a web tool allowing us to create machine learning models quickly and easily[20]. It was revamped in 2019 with improved features, such as saving the model to Google Drive and exporting it to other applications. In deep learning, transfer learning is a widespread technique. In a fully trained model, most of the neural network architecture is retained while a small portion is replaced based on the data. Not only does this method require less computing power, but it also requires a smaller dataset for training. Using deep learning algorithms and neural networks, Google's Teachable Machine uses some of the best models.

Data gathering, training, and exporting are the three steps in the teachable machine classification process.



It offers assistance for pose projects, audio projects, and image projects. Both the embedded and common image models are supported by the image project. The image is a 224 by 224-pixel color image in the standard image model. It is exportable to TFlite, TensorFlow, and TF.js. Greyscale images with a 96x96px resolution can be exported from the embedded image model to TFLite and TF.js. The webcam can be used to capture real-time training and testing photographs, or we can upload images from our smartphone, Google Drive, or both. Our smartphone, Google Drive, or the camera can all be used to post-training and test photographs.

C. Process flow diagram

Fig. 3 shows the flowchart for the proposed date fruit sorting system. The initial step in the sorting procedure is to gather images of dates. Omani dates named Khalas, Nagal, and Fardh are used during the training and testing phase. As the size of the training data increases, an artificial intelligence-based classification system's classification accuracy rises. We took 1500 photos of each class to classify them accurately. With the teachable machine based on transfer learning, dates are organized, and the MITapp inventor is used to confirm the system's efficacy.

The webcam captures the image. Capture duration and delay time are fixed based on the conveyer belt speed. The model is trained with standard settings; epochs-50, batch size – 16, and a learning rate of 0.001. The model is trained with 250 images from each category. The accuracy of the classification model is evaluated using the preview option, and the generated code is exported as a tensor flow document.

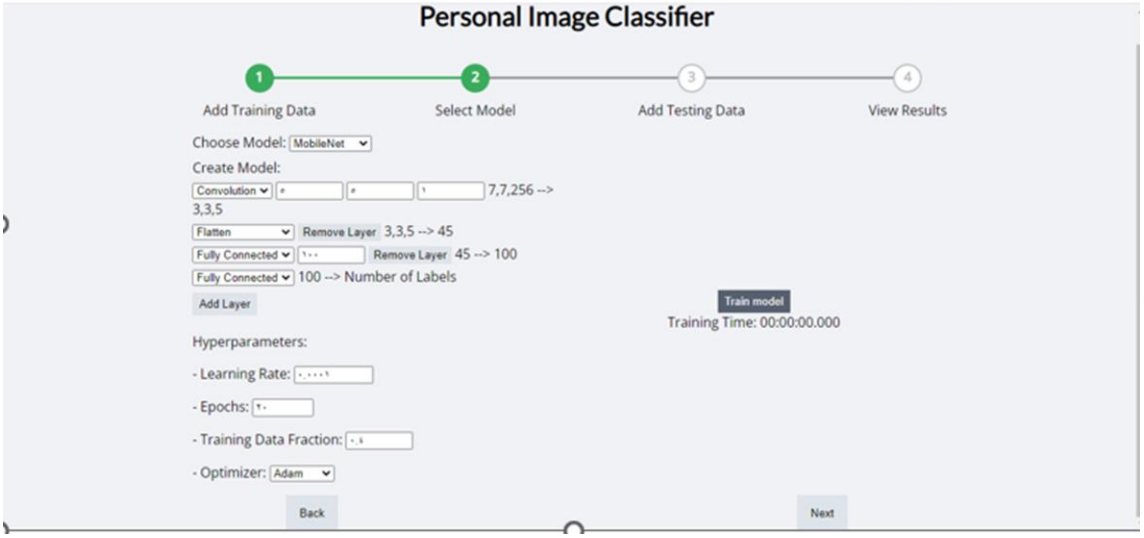


Fig. 2 The PIC model details.

The TensorFlow file is opened in a python IDE, and the commands needed for enabling the camera from the python environment are added to the code.

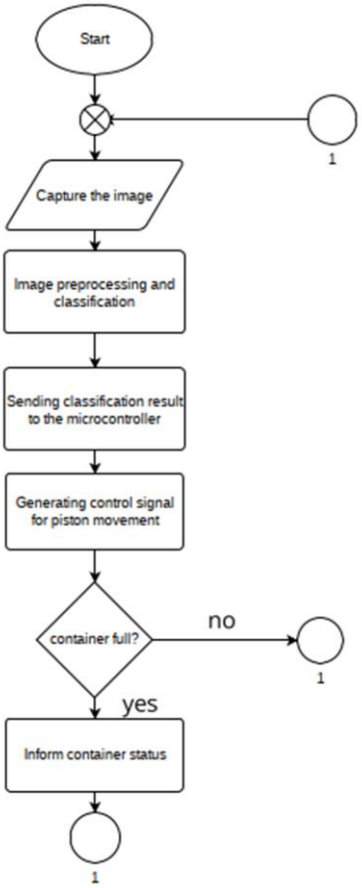


Fig. 3 Proposed process flow diagram

Fig.4 shows the testing interface result of Khalas and Nagal. It identifies Khalas with a probability of 0.59 and Nagal with 0.99.

After testing, we exported the custom models for use in the MIT App Inventor PIC Extension. This enables App Inventor apps to feed data into a pre-trained PIC model and take actions based on the model's classification outputs.

Fig.5 shows the testing result of Khalas, Fardh and Nagal. It identifies Khalas with a probability of 0.95, Fardh with an accuracy of 0.82 and Nagal with 0.82.

E. Date fruit classification using Teachable Machine

A standard image model is used in this date fruit classification system. Webcam is used to capture the image of the date fruit placed on the conveyor belt during the training and testing phase. The conveyer belt setup for the date fruit classification system is shown in Fig.6.

Fardh, khalas and nagal dates were used for the training, testing, and validation process in the teachable machine-based classification model. A webcam is used to take live images. Live pictures are captured using a webcam. The date fruits are loaded onto a conveyer belt controlled by a microcontroller. Along the conveyer belt, three pistons are positioned evenly apart. The information is passed to the microcontroller IDE when the program recognizes the date fruit type. The microcontroller generates a control signal for the movement of a particular piston based on the classification result. Fig.7 shows the fardh classification

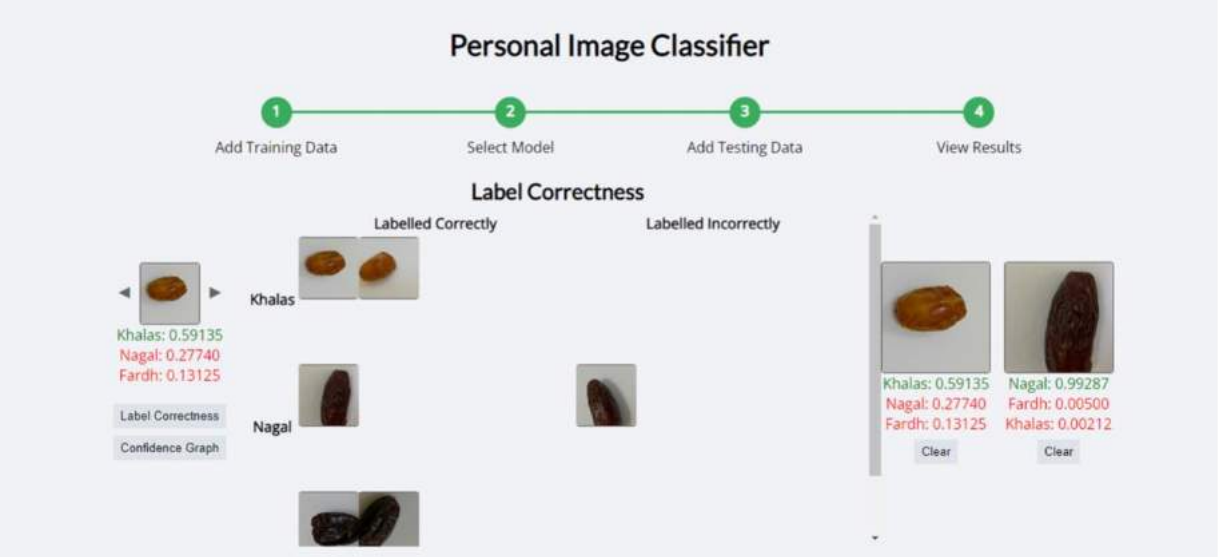


Fig. 4 The PIC testing interface

Fig. 5 The PIC testing result

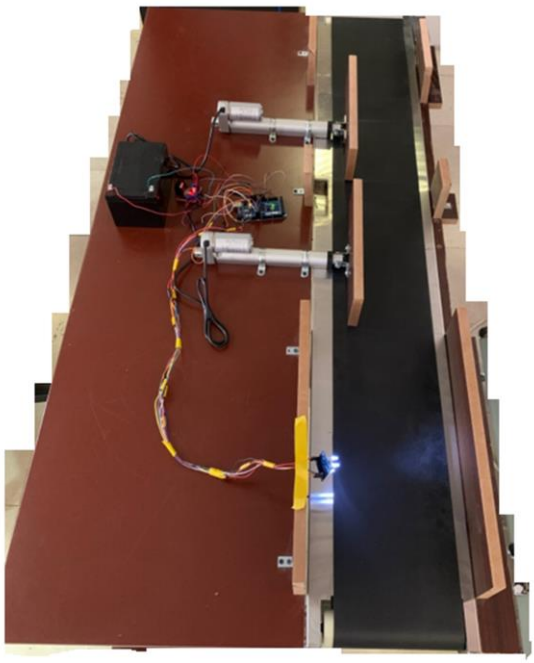


Fig. 6 Conveyer belt setup for the date fruit movement

Fig. 7 Classification result-Fardh

result. When the classifier identifies the fardh category, piston one is activated, and the fruit is collected in the container box1.

Fig.8 Classification result-Khalas

Fig. 8 shows the khalas classification result. The second piston is activated, and the fruit is collected in box2. The classification accuracy obtained is appreciable in a moderate speed of the conveyer belt.

V. Conclusion

A transfer-learning based automatic date fruit classification system was suggested in the paper. For the regular movement of the date fruits, the model had an electromechanical mechanism. Date fruits are detected on the conveyer belt by a sensor interfaced with a microcontroller, which then sends control signals to start the fruit image capture. The teachable machine and the transfer learning-based models integrated with the MIT App are used to classify the collected photos. The transfer learning-based system sends instructions to a microcontroller-based device, which then activates piston movement. Categorized dates are collected via piston movement and placed in intelligent bins. The suggested model could produce a discernible level of categorization accuracy.

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Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

A Novel approach of True Random Number Generation using Vedic Multiplier

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Abstract:-- **In field of cryptography, True Random Number Generators (TRNG) are widely used which generates a number in disordered pattern. The generation by these TRNG devices become biased in bit generation due to process variations and fluctuations in operating conditions. Although there are techniques available from analog to digital that can be used to remove the bias. And hence the proposed study aimed to develop a calibration technique for TRNG to reduce the biased bit generation and compared it with XOR function and Von-Neumann corrector for evaluation using Vedic multiplier. Also, the performance of the proposed design was then evaluated with metrics such as power consumption, and time taken. The results from the study indicates that the calibration technique is effective for XOR function about 12%. And the entropy extracted were 56% lesser energy per bit than the Von Neumann Corrector. The analysis thereby demonstrates that circuit calibration provides an efficient tradeoff between entropy and energy/bit for removing bias in lightweight TRNG.**

Index Terms : TRNG, Vedic Multiplier, number generation, Cryptography

I. INTRODUCTION

In the modern revolution of computers and telecommunication, the transfer of data from one place to another place becomes crucial [1]. And these transfer of data often accompanies with the cryptography process to ensure the transfer completes securely. Almost all modern way of transferring data are now subjected to security issues and requires cryptography[2]. The rapid development makes the necessity of securing every transactions and transfers happens through any form of medium. There are handful of research studies are developed in field of cryptography to secure the connections and makes the transfers safe [3, 4].

1.1. Random Number Generation (RNG) and True Random Number Generation (TRNG)

In modern day cryptography, the random numbers and randomization techniques are critical. RNG is one of the key components in the encryption process and makes it difficult for the attackers to break in. the strength of the encryption process is directly proportional to the randomness of the binary numbers generated in it. And it takes a lot of potential to build efficient random number generator. These are used for the secured keys, padding values and provide counter measures for the side-channel attack [5]. And in the application of secure transmission, random number generators (RNGs) are a critical components. RNGs are deterministic based number generator and takes mathematical function approach. And True random number generator (TRNG) are non-determinstic and often engages with physical devices to generate the numbers [6]. And for secure transmission through device based communications, the developers and engineers prefers the TRNGs as it has wide range and uses physical components to generate number. RNGs are light and they don't require the physical devices and do have ease of implementation[7]. It depends on the application, where the random number generations are needed.

1.2. Vedic Multiplier

Vedic multiplier is based on the mathematics from the ancient Indian Veda literature[8]. And it refers to the 16 sutras and it could solve any problem based on algebra, geometry and trigonometry. It derived from the part of Sthapatya- Veda, which is supplement of Atharva Veda. The multiplier is based on UrdhvaTiryakbhyam which means Vertical and Crosswise. It is used to generate n number of bits and it is independent of the clock frequency of the processor. The advantage of using the multiplier is that it reduces the necessity of higher clock frequency based computation of the microprocessors [9]. Comparing to the other multipliers, the power consumption and the gate delay can be reduced while using the Vedic Multiplier[10]. Hence the proposed study aimed to use the Vedic multiplier in TRNG to

reduce the randomness bias in the number generation and improve the TRNG further in terms of power consumption and gate delay [11].

1.3. Recent Studies

TRNG [12] are applied for cryptographic applications, and it becomes standard in many European countries. The implementation of AIS-20/31 for the three FPGA families, such as Xilinx Spartan 6, Altera cyclone V and micro semi smart fusion 2. The study used parameters like bit rate, energy consumption and area for evaluation. Similarly the present study also adopts the evaluation method to analyze the feasibility of the proposed generator[13]. Here, the authors also adopted the generators for the individual families that can be obtained from the web sources. For many cryptographic protocols, [14] at different terminals random inputs are required. And the study used a memristor to resolve the random inputs. The designs are simulated in SPICE and evaluated for multiple window functions. And the proposed design was able to generate random output for different window functions. The bias randomness problem is often addressed by the researchers [15] and the techniques to overcome this problem suffers from power consumption issues[16] and this becomes critical issue in new generation of IoT devices [17, 18].

II. OBJECTIVES

Based on the earlier research studies, the following objectives are adopted for the proposed study,

- To generate true-random number generator using Vedic multiplier, ring oscillator and compare calibration generation method using VHDL spice simulation.
- The common design parameters like area, entropy, power/energy consumption with the TRNG by using proposed and the technique available in literature.

III. METHODS

The proposed study was aimed to calibrate the TRNG and reduce the biased bit generation. To achieve this, the study adopted Vedic multiple and its implementation in FPGA.

3.1. Selection of TRNG CORE

Initially, the selection of TRNG CORE for the required application. The main criteria considered for the TRNG selection is that it should suitable to recent FPGA family and should comply with AIS-20/31 standard. And the following requirements are considered for the TRNG cores selection,

- The design of the TRNG CORE should be simple and the randomness source should be clearly defined.
- The random process should be stable and should have feasible stochastic model.
- For both on-line and off-line testing, the raw binary signal must be available.

Single-event ring oscillator based TRNG CORE are preferred for the study based on the above requirements. The design is simple and the source for randomness is defined appropriately. Also, it has stable random process and feasible stochastic model.

3.2. TRNG using calibration

For the proposed study, the calibration technique has two stages. And here the device is comprised of programmable inverter and has pull-up and pull-down transistors which can be tuned to manage the drive capacity of the device due to vibration.

Stage I - In stage I, TRNG is performed without any correction. So the circuit will be basic TRNG circuit without any post-processing or calibration. For comparison purpose, it is simulated for with different transistors lengths in two inverters.

Stage II – In stage II, TRNG with XOR function is used as entropy extractor. And for the implementation, two TRNG circuits are connected in parallel and their outputs are connected to XOR gate. In this way the improved randomness can be achieved as the any variations in anyone of TRNG, then it would be optimized by XOR gate.

3.3. TRNG using Vedic Multiplier

TRNG is implemented with the Vedic Multiplier for the proposed study. The circuit shown in the fig 1 shows the implementation of the Vedic multiplier where the two oscillators RO1 and RO2 are connected to the flip flops to reduce the noise and the RO2 is connected to the frequency divider before generating the output.

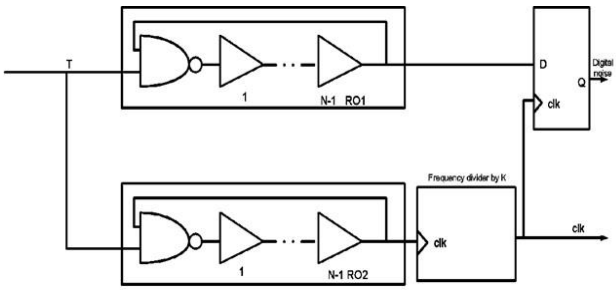

Fig. 1. TRNG using Vedic Multiplier

In similar to the Vedic Multiplier, the calibration circuit is also made and displayed in the fig 2. This calibration circuit is based on the simple TRNG device application.

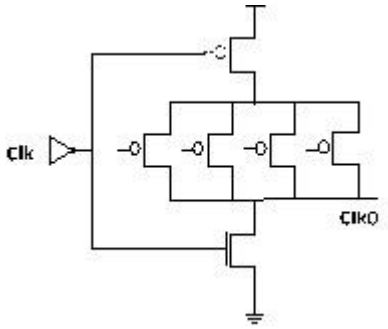

Fig. 2. Calibration Circuit

3.4. *TRNG using Von Neumann corrector*

The Von Neumann corrector is a commonly used corrector tom improve the entropy of TRNGs[19]. Here in the fig 3 the TRNG with Von Neumann corrector is shown. It is used to correct the bias randomness of the TRNG. The corrector do not generate random bits at a constant rate[20]. The distinctive generation of the output bits depends on the shift register.

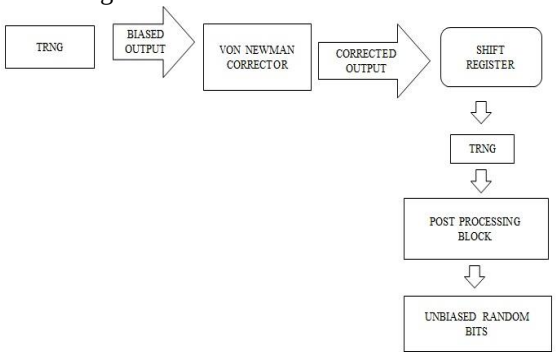

Fig. 3. TRNG with Von Neumann Corrector

Also, the table 1, gives the projection of the output from the Von Neumann corrector based on the input bit pairs.

Table 1. Von Neumann Function

Input		Output
0	0	No output
0	1	1
1	0	0
1	1	No output

IV. Results and Evaluation of TRNG

After the successful simulation of the design, the observed results are noted and discussed here. Some parameters are used for the evaluation of TRNG. The following performance metrics are used for evaluating the model,

- ***AREA****:* the term area referred here, to the number of Look up table (LUT) and the registers in the design.
- ***Power consumption in mW*****:** TRNG power consumption for the proposed method.
- ***Bit rate in Mbits/s:*** Bit rate is the rate of data transfer that happened during the process based on the TRNG generator.
- ***Energy efficiency in bits/µWs*****:** The parameter indicates the bits obtained per unit of energy.
- ***Entropy rate per output bit*****:** The parameter indicates the rate of entropy per output bit.
- ***Product of entropy & bit rate:*** It gives the relationship between the entropy and the bit rate of the proposed method.
- ***Feasibility and repeatability:*** It shows the ease of implementation of the design and its ability to reproduce the results.

For Entropy Calculation 247 samples have been taken and the probability of number of '1' and '0' has been considered. Let the probability of occurrence of '0' and '1' is taken as 'P_1' and 'P_2' respectively. Then for 247 samples

From the simulation, the Number of 0 and 1 are observed as 754 and 2210, from the total sample of *2964.*

$$P1 = \frac{total\ number\ of\ zeros}{total\ samples} \quad (1)$$

$$P2 = \frac{total\ number\ of\ ones}{total\ samples} \quad (2)$$

Therefore P1 is 0.254 and P2 is 0.7456

And entropy is given by,

$$Entropy = p1 \times log\left(\frac{1}{p1}\right) + p2 \times log\left(\frac{1}{p2}\right) \quad (3)$$

And the result for the generated P1 and P2 entropy is 0.818165, and in terms of percentage it is 81.816%

By applying the vedic multiplier,

For the same samples, the returned number of 0 and 1 are observed as 341 and 595. By the above entropy equation, the percentage of entropy obtained is 94.621.

4.1. Comparison with other multipliers:

From the table 2, it can be observed that KCM have the lowest Look up table (LUT). A LUT is an array of table that matches the input values and the output values corresponding to their mathematical function. And path delay for the Vedic multiplier is the lowest, which means the signal between the transmitter and the receiver has the lowest delay. And hence it is evident that Vedic Multiplier has the quicker transmission.

Table 2. Comparison with other Multipliers

	Array Multiplier	KCM	Vedic Multiplier
Number of LUTs	141	75	132
Path delay	17.192	21.864	16.915

Table 3. Energy consumption comparison of TRNG models

Bias removal technique For TRNG	without correction	XOR function	Von Neumann corrector	calibration
Average energy/bit (pJ)	0.001	0.006	0.282	0.124

From the table 3, it can observed that TRNG without correction has the lowest consumption as there is no process involved at the initial stage and after the XOR functions as well. The energy consumption of Von Neumann corrector and the calibration technique showed that the TRNG with calibration from the proposed method has the lower consumption rate (0.124) than the TRNG with von Neumann corrector (0.282).

The performance comparison of the calibration technique with varying number of calibration bits shown in the graph displayed in fig 4. The graph was plotted between the entropy and the device mismatch percentage. And from the graph it can be observed that the entropy gets down as the mismatch increases, but for the entropy reduction seen improved with increased calibration bits.

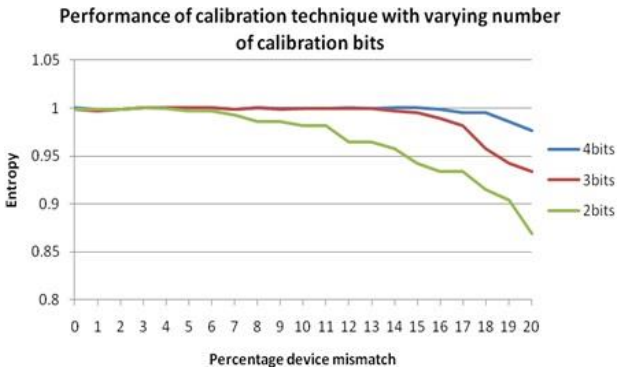

Fig. 4. Performance of calibration technique with varying number of calibration bits

The variation of entropy with device mismatch for the TRNG using Von Neumann corrector is compared with the TRNG. Similar to the previous graph, displayed in fig 4, fig 5 also plotted between the entropy and the device mismatch percentage. And from the graph it can be observed that the entropy becomes stable for the Von Neumann corrector and it reduces gradually for the TRNG model.

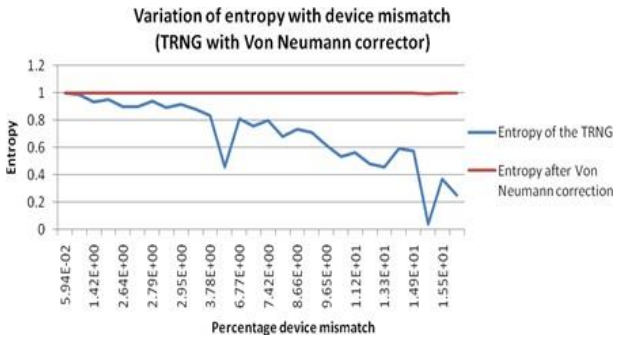

Fig. 5. Relationship between the entropy and device mismatch based on Von Neumann corrector

The variation of entropy with device mismatch for the TRNG using Von Neumann corrector is compared with the TRNG. Similar to the previous graph, displayed in fig 4, fig 5 also plotted between the entropy and the device mismatch percentage. And from the graph it can be observed that the entropy becomes stable for the Von Neumann corrector and it reduces gradually for the TRNG model.

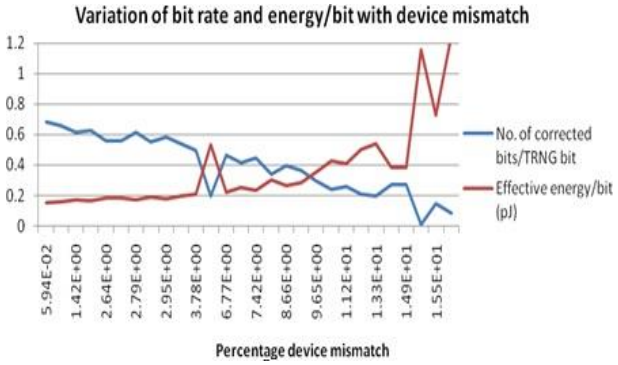

Fig. 6. Relationship between the bit rate and energy per bit based on device mismatch

Fig 6 shows the variation of bit rate and energy per bit. The number of corrected bits for the percentage of device mismatch is decreases with the lowered bit rate, it implies that at the lower bit rate the necessity of correcting the bits makes the energy consumption more as well at the same range.

V. CONCLUSION

The proposed study was aimed to reduce the bias randomness in the generated output of TRNG. In order to achieve this, the study used the Vedic multiplier and calibration techniques. While aiming to reduce the bias randomness, the proposed model was simple in design and the implementation was quicker. The results showed that the performance of the proposed method had performed better than the Von-Neumann corrector. Also comparing with the other multipliers, it revealed it has the quicker transmission of data. Also, the selection of TRNG becomes critical and it should be based on the application of the TRNG. Also, even after the

selection of the TRNG CORE, the design can be further improved as in the proposed study, it can be observed that TRNG without Vedic has 84.8% and with Vedic multiple it improved to 94.62.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Brain Tumor Segmentation & Classification using Optimized k-means (SFLA) and Ensemble Learning

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***Abstract:*-- Brain tumor is a common disease that can occur at any age in humans. Early-stage brain tumor segmentation and classification from low-contrast MRI images is always difficult. In this paper, a new hybrid optimized k-means algorithm based on the shuffled frog leap algorithm (SFLA) followed by thresholding and morphological with ensemble learning is developed. The proposed work is divided into two segments. After pre-processing of low-contrast MRI images the brain tumor area is calculated from the segmented MRI image then the most efficient features are also extracted using discrete wavelet transformation (DWT) techniques. In the second segment, these extracted features are fed as input parameters into a trained brain tumor classifier using an ensemble learning approach. The ensemble-leaning approach model is trained by a feature dataset collected from an online source. The KNN, decision tree, gradient boosting, random forest, and ANN classifiers are used to classify the type of tumor (benign or malignant) from the low contrast brain tumor MRI image. The proposed framework is more efficient and has an accuracy (average of all models accuracy) of 98.07 percent, sensitivity of 98.21 percent, and specificity of 97.25 percent in predicting the type of brain tumor.**

Index Terms : Brain tumor, Optimized k-means, Feature extraction, Ensemble-leaning (SVM, KNN, Random-forest, Decision tree, Gradient boosting, ANN).

I. INTRODUCTION

Brain tumor, a dangerous life-threatening problem is mainly connected to our stress levels and exposure to unwanted fluids. A brain tumor occurs when abnormal cells form within the brain varies in size. it can be as small as an ant and as big as a worm. We usually come through two types of tumors: - cancerous and non-cancerous (primary)[1]. If we talk about the behavioural changes, we can seek during the brain tumor is: - inappropriate social behaviour, temper tantrums, laughing at things that merit no laughter clearly in short, our brain stops responding to us the way we want it to. It can cause depression and anxiety, it can also lead to unemployment, unstable relationships, and lack of control. Mutations and deletions of tumor suppressor genes such as p53 are thought to be the cause of some brain tumors. There is a myth that says that cell phone radiation causes brain tumors, it's not true and also proved by the biological section of science. A brain tumor can be treated in many ways: Surgery (objective of removing as many tumor cells as possible but there is a risk of brain tumor coming back), Radiotherapy (the most commonly used, the tumor is irradiated with a beta, x-rays or gamma rays) and Chemotherapy (it just prevents some drugs from reaching the cancerous cells). The survival rate in primary tumors depends on the type of tumor, age, functional status of a patient, and how the patient's family is treating him/her. Ladgham et al [2] developed an efficient and optimal brain tumor detection system using a modified shuffled frog leap algorithm (MSFLA), which recognizes the exact size and location with an improved convergence rate. Yang et al [3] suggested a hybrid model for the type of gene selection using SFLA and a genetic algorithm (GA). The accuracy rate of the proposed model for gene classification is about 92.45%. Aswathy et al [4] developed a fully automatic brain tumor segmentation and classification model using a genetic algorithm with a support vector machine (SVM) classifier. The accuracy scores of the proposed model are quite good. There are a lot of available techniques for medical image analysis but this field is always challenging. In this proposed work an optimized k-means (SFLA) with an ensemble–learning approach has been developed.

II. PROPOSED MODEL FOR BRAIN TUMOR SEGMENTATION AND CLASSIFICATION

In this research, a hybrid brain tumor segmentation and classification model is developed from low-contrast brain tumor MRI images. The suggested model has six stages to segment as well as classify the tumor. These six stages are low contrast MRI brain tumor image acquisition and preprocessing segmentation with an optimized k-means algorithm, morphological & thresholding operation, brain tumor extraction and feature extraction, and classify the tumor using different types of classifier [5]. A 70:30 ratio concept is used to train and test the proposed model respectively. The flow chart of the proposed brain tumor segmentation and classifier is shown in figure 1.

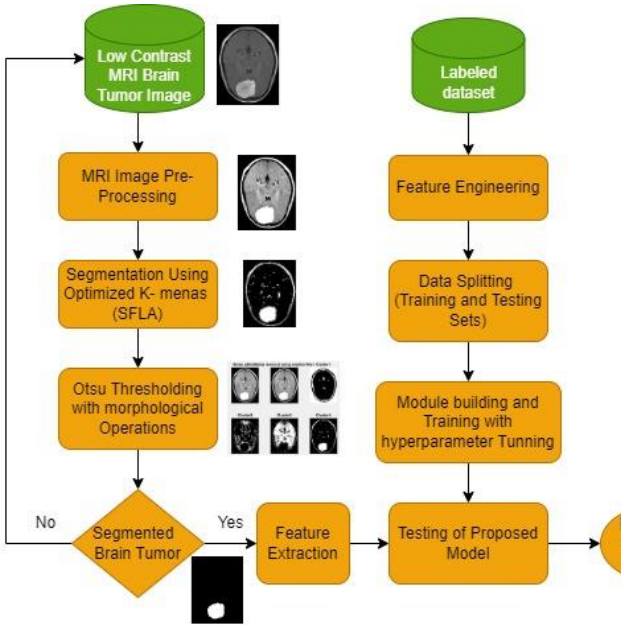


Figure 1: Proposed model for brain tumor segmentation and classification

The operation of the proposed model is divided into two groups. In the first phase after preprocessing and segmentation of brain tumor, the most important features like, mean, variance, correlation, entropy, etc. are extracted. In the second phase, a brain tumor classifier is developed using an ensemble-learning concept.

2.1 Dataset collection and Pre-processing

The 500 low contrast brain tumor MRI images belonging to two classes; benign (250) and malignant (250) are collected from the online resource "UCI machine learning repository". 30 T1-weighted brain tumor (benign and malignant) are collected from a hospital for model evaluation. The collected low-contrast images are first preprocessed using an open cv library and noise-removing filters, therefore the model is less complex and efficiently classifies the brain tumor with optimal computational time. A sample of collected low contrast brain tumor MRI images and preprocessed brain tumor MRI images are shown in figure 2 and figure 3.

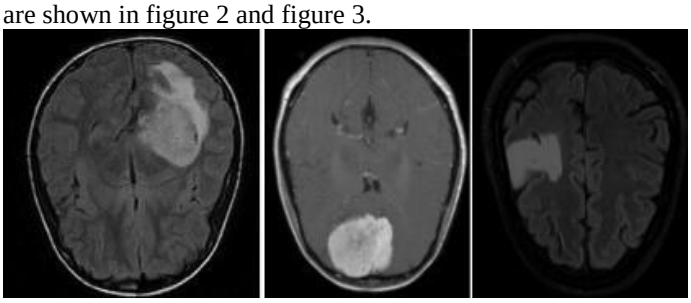


Figure 2: Sample of a collected low contrast brain tumor MRI image dataset

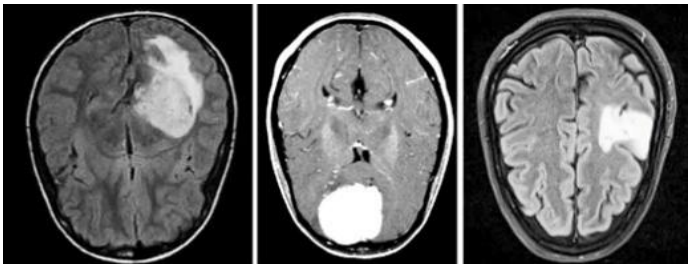


Figure 3: Sample of a preprocessed low contrast brain tumor MRI image

2.2 Optimized K- Means algorithm

The proposed optimized k-means approach with threshold and morphological operation for brain tumor segmentation is a combination of k-means and shuffled frog leap algorithm (SFLA). The k-means clustering approach is a hard clustering and requires maximum time for the convergence of image pixels into a particular cluster [6].

2.2.1 K-Means Clustering

The basic steps of the k-means clustering approach are listed below.

Step 1: Low contrast MRI image acquisition and define the no. of clusters using the elbow method.

Step 2: Randomly select the center of each cluster (using average method).

Step 3: Calculate the euclidian distance between each pixel with the center value of each cluster.

Step 4: The selected pixel moves to a cluster with minimum euclidian distance.

Step 5: Calculate the new center of the cluster in which the selected pixel is moved.

Step 6: Repeat step 3, 4, and 5 till all image pixels belong to a particular cluster.

2.2.2 Shuffled Frog Leap algorithm (SFLA)

The frog leap algorithm (FLA) is an efficient and optimized technique that improves the convergence rate so that computational time is reduced [7]. The FLA gives more optimized results for complex

problems with a large amount of population. The total population is based on two parameters; memeplexes and the number of frogs in each memeplex. This approach is based on local and global searches. The basic steps of shuffled FLA are given below.

Step 1: Initialize the parameters; p (population), m (memeplexes), n (no. of frogs), and no. of shuffling iteration.

Step 2: Evaluate the total population for initialized m and n.

Step 3: Evaluate the fitness of each result.

Step 4: Analyse and sort the frogs as per the performance.

Step 5: Divide the sorted frogs into memeplex.

Step 6: Shuffle the memeplex and repeat the above step still all pixels belong to this

The proposed optimized k-means algorithm for brain tumor segmentation is more efficient in terms of pixels convergence rate and detects the region of interest (ROI) from low contrast brain tumor MRI images in minimal computational time.

2.3 Thresholding and morphological Operations

Thresholding is a binarization process in which any image is converted into binary or black and white according to a threshold value. The pixels below are predefined threshold level belong to 'o' or black and above or equal to belongs to '1' or white pixels [8]. But how to select the threshold value is a big task, so optimal thresholding (otsu) is a better choice. The otsu thresholding is based on the variation of grayscale value in an image histogram [9]. To achieve the optimal threshold value for binarization or separation in between the foreground and background of an image, the maximum of difference in grayscale values of the two clusters (V_b) or of minimum difference within the grayscale values of clusters (V_w) are considered and shown in equations no. 1 & 2.

$$V_w = w_{1^*} v_1 + w_{2^*} v_2$$

$$V_w = \frac{w_1 * \sum_{p_i \in c_1} (p_i - \mu_1)^2}{N * w_1} + \frac{w_2 * \sum_{p_i \in c_2} (p_i - \mu_2)^2}{N * w_2}$$

$$V_w = \frac{\sum_{p_i \in c_1} (p_i)^2}{N} - w_1 * {\mu_1}^2 + \frac{\sum_{p_i \in c_2} (p_i)^2}{N} - w_2 * {\mu_2}^2 \quad (1)$$

$$V_b = w_{1^*} (\mu_1 - \mu_t)^2 + w_{2^*} (\mu_2 - \mu_t)^2$$

$$V_b = w_{1^*}\, w_2 (\mu_1 - \mu_2)^2 \quad (2)$$

Where,

w_1 & w_1=probability of two class c_1 & c_2 at t

v_1 & v_2 = total variance of an element in class c_1 & c_2

N = total number of image pixel

μ_1 & μ_2 = total mean of an element in class c_1 & c_2

μ_t = total mean at threshold t

The morphological operators are used to add the pixels or remove the pixels from the image boundary. There are four types of morphological operations; dilation, erosion, opening, and closing. The dilation-operated image becomes more visible because it adds the pixels at the boundary so that small holes are considered but in erosion, boundary pixels have removed so that most important information is lost. In this work, first opening (erosion then dilation), then erosion morphological operations are used.

2.4 Segmented brain tumor area

The basic steps for determination of the brain tumor area from the segmented MRI image are [10];

Step 1: Segmented image is a combination of black and white pixels.

$$Segmented\ image = \sum_{i=0}^{255} \sum_{j=0}^{255} I(0) + I(1) \quad (3)$$

Step 2: The grayscale value of pixels related to a tumor is high as compared to normal, therefore calculate the total number of white pixels.

$$Total\ number\ of\ white\ pixels\ (W) = \sum_{i=0}^{255} \sum_{j=0}^{255} I(1) \quad (4)$$

Step 3: Brain tumor area (mm^2) = $[(\sqrt{W})^2 * Area\ of\ one\ pixel$

2.5 Feature Extraction

To classify the type of tumor, the most efficient features related to benign and malignant tumors are extracted using discrete wavelet transformation [11]. Some important features are listed below.

2.5.1 Mean

To analyze the image's background and foreground, the mean is calculated. It is the average of all pixels' intensity. If $G_1, G_2, \ldots . G_n$ are the grayscale values of n number of pixels then the mean (μ) is calculated using equation no. 3.

$$Mean = \frac{\sum_{i=1}^{n} G_i}{n} \quad (5)$$

2.5.2 Contrast

The variation in gray level co-occurrence is measured using contrast. The contrast is low for similar grayscale values of image pixels, which measure the accuracy of cluster formation of similar image pixels.

2.5.3 Entropy

The entropy is a texture feature of an image and it measures the randomness of pixel intensity.

2.5.4 Correlation

To evaluate the linear dependence of image pixels on their neighboring pixels, the correlation feature is used.

2.5.5 Variance

A measure of within distance between the mean and pixel intensity of the cluster is called the variance of an image. For good clustering, approach variance is low.

2.6 Brain tumor classifier

When the tumor area and features are extracted from the low contrast brain tumor MRI image using the first phase of the proposed model, then these features as a reference are used by the classifier to classify the type of brain tumor (benign or malignant). Before testing the brain tumor classifier, the model is trained using a training dataset with some data augmentation operator and shuffling. There are many classifiers but some are explained below.

2.6.1 K-nearest neighbors (KNN) classifier

The K-nearest neighbors (KNN) classifier gives better results for regression as well as classification problems. it is a slow learning algorithm that requires too much time. The result of the KNN classifier is based on the majority of the nearest neighbors[12],[13]. After selecting the random number of k clusters (max. value = no. of features), the belongingness of the new pixel to clusters depends on the euclidian distance or manhattans distance as given below in equations 6 and 7. This process for pixel convergence to the k number of clusters is repeated till no pixels are left without a cluster name.

$$Euclidian\ distance = \sqrt{(x_2 - x_1)^2} + (y_2 - y_1)^2 \quad (6)$$

$$Manhattan\ distance = |(x_2 - x_1) + (y_2 - y_1)| \quad (7)$$

Where;

x_2 , x_1= horizontal coordinates of a points

y , y_1= vertical coordinates of a points

2.6.2 Random forest classifier

The random forest (supervised algorithm) approach is based on decision trees[14]. It is part of ensemble learning, in which one algorithm is applied multiple times or multiple algorithms is applied a single time. The final prediction of random forest is based on the voting or average of all-time predicted results. The basic steps of the random forest approach are given below.

Step 1: Select the random samples from the dataset

Step 2: construct the decision tree and predict the results for all samples.

Step 3: for every sample result, voting will be performed.

Step 4: Final prediction based on the average of all votes or most of the time predicted the same result.

2.6.3 Artificial Neural network (ANN) classifier

The ANN (neural networks or neural nets) is an interconnected node or artificial neuron's structure with some predefined weights. The backpropagation algorithm is used to train the model [15]. These weights are updated till the model predicts the results with good accuracy. The structure of a single neuron in the ANN classifier is shown below in figure 4

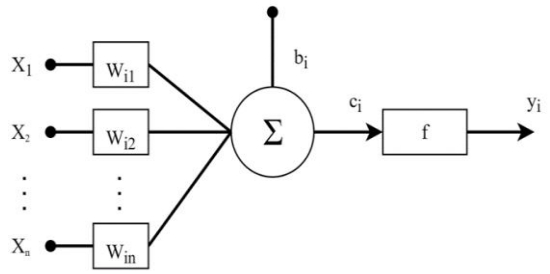


Figure 4: ANN classifier structure

$$y_i = f * c_i$$

$$y_i = f * \left[\left((X_1 * W_{i1}) + \cdots + (X_n * W_{in})\right) + b_i\right] \quad (8)$$

Where;

$X_1, X_2, \ldots\ldots, X_n$ = no. of input neurons (features)

$W_{i1}, W_{i2}, \ldots\ldots, W_{in}$ = weight assigned to each neuron

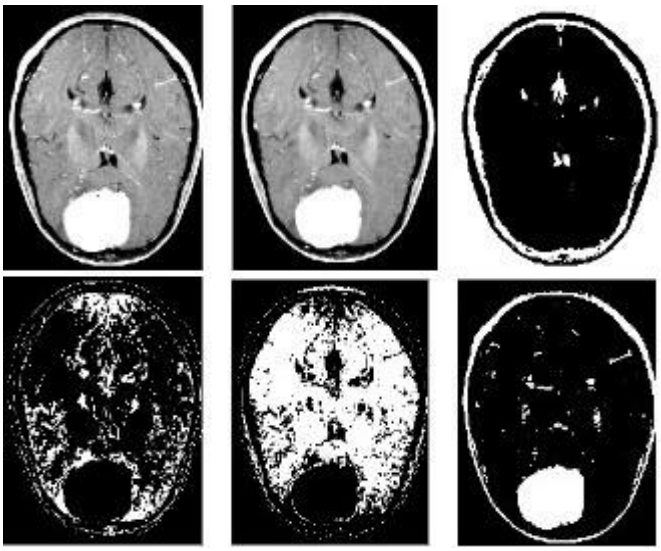
b_i = biased (constant that control the output)

c_i = intermediate output $\{(input * weight) + bias\}$

y_i = output of the neural network

III. Experimental Results

The suggested brain tumor classifier for low contrast MRI images is implemented in jupyter notebook with python 3.9. The proposed model is tested using a system that has 4 GB RAM, and an 8th generation i7-2.5 GHz processor. The low contrast brain tumor MRI image segmentation using an optimized k-means algorithm is shown in figure 5



Figures 5: Brain tumor segmentation by optimized k-means algorithm

Figure 5, shows the segmented brain tumor using an optimized k-means algorithm with otsu thresholding and morphological operations. After contrast improvement and noise removal, the input brain tumor MRI image is segmented and the area of the brain tumor in the input MRI image is calculated using the tumor area calculation approach [16].

Figure 6, shows the segmented brain tumor area in terms of no. of white pixels from the input MRI image using an optimized k-means algorithm. The segmented brain tumor area of an input image is 2384 white pixels.

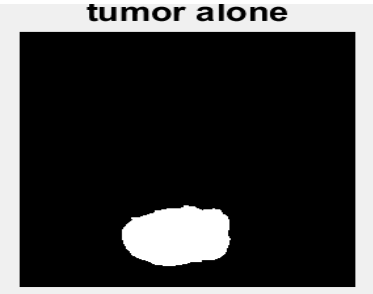


Figure 6: Segmented brain tumor (area=2384) by optimized k-means algorithm

After brain tumor area segmentation, the discrete wavelet transformation (DWT) approach is used to extract some most important features like; mean correlation, variance, standard deviation, contrast, entropy, kurtosis, etc. Table 1, shows the extracted most efficient features for input image number 3, from the database.

Table 1: Extracted features (image no. 3) using DWT

Feature Name	*Value*
Mean	*5.9582*
Variance	*959.7120*
Standard Deviation	*30.9792*
Entropy	*0.0015*
Skewness	*5.6780*
Kurtosis	*33.4289*
Contrast	*151.2297*
Energy	*0.0320*
ASM	*0.0010*
Homogeneity	*0.2439*
Dissimilarity	*7.7010*
Correlation	*0.9642*

These extracted features are fed to the brain tumor classifier to classify the type of brain tumor.

3.1 Confusion Matrix

The confusion matrix is used to evaluate the classifier scores. Multiple models like; k-nearest neighbors, decision trees, random forest, logistic regression, and artificial neural networks are used as a part of an ensemble-learning approach. The suggested hybrid model for low contrast brain tumor MRI images is first trained using a feature dataset after selecting the most important features like; variance, kurtosis, contrast, skewness, and standard deviation collected from online sources are tested. To calculate the classifier score parameters, following mathematical equations are used as given below [17].

$$Precission = \frac{True\ Positive}{(True\ Positive + False\ Positive)} \quad (9)$$

$$Sensitivity = \frac{True\ Positive}{(True\ Positive + False\ Positive)} \quad (10)$$

$$Specificity = \frac{True\ Negative}{(True\ Negative + False\ Positive)} \quad (11)$$

$$Accuracy = \frac{True\ Positive + True\ Negative}{(Positive + Negative)} \quad (12)$$

The accuracy score & corresponding bar graph of the proposed model with different types of models used in the ensemble-learning approach is shown below in table 2 and figure 7. The model complexity and computational time are also reduced when a fine tuned dataset in terms of the most important feature dataset which is responsible only for the classification of brain tumors [18],[19].

Table 2: Accuracy of the proposed model with different classifiers

Hybrid Algorithm	*Training Accuracy*	*Testing Accuracy*
Optimized K-Means+ KNN	*98%*	*97.5%*
Optimized K-Means + Logistic Regression	*97.1%*	*98.4%*
Optimized K-Means + Decision Tree	*98.8%*	*98.1%*
Optimized K-Means + Random Forest	*100%*	*98.8%*
Optimized K-Means + Gradient Boosting	*99.9%*	*98.9%*
Optimized K-Means + SVM	*98%*	*97%*
Optimized K-Means + ANN	*98.3%*	*97.8%*

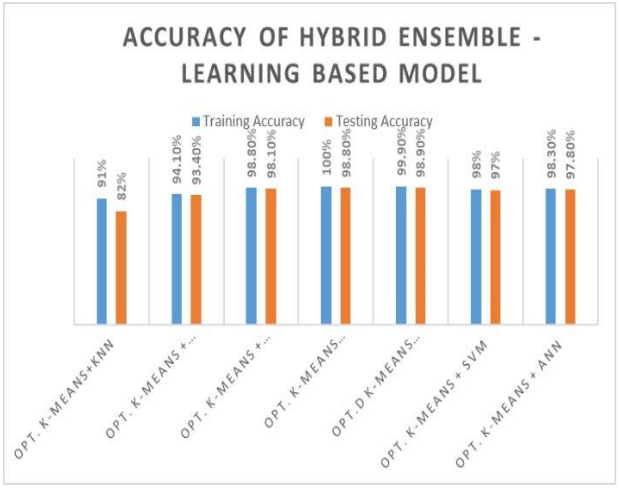


Figure 7: Bar graph of proposed model accuracy with different classifiers.

3.2 The proposed model segmentation and classification after feature extraction-using DWT

The suggested hybrid low contrast brain tumor segmentation and classification have two phases. In the first phase, the low contrast brain tumor MRI image is acquired from the brain tumor MRI database then after performing preprocessing steps the tumor is segmented using an optimized k-means algorithm followed by thresholding and morphological operations after that the important features are extracted using discrete wavelet transformation (DWT). In the second phase, different types of classifiers like; KNN, decision tree, random forest, logistic regression, gradient boosting, and artificial neural networks are implemented in google cloab and trained features dataset of benign (‘0’) or malignant (‘1’) brain tumor MRI images of about 3763. The whole feature dataset is divided into training and testing sets in a ratio of 70:30 percent [20]. Figure 8 (a), (b), and (c) shows the acquired input low contrast brain tumor MRI image, preprocessed and segmented brain tumor using optimized k-means respectively.

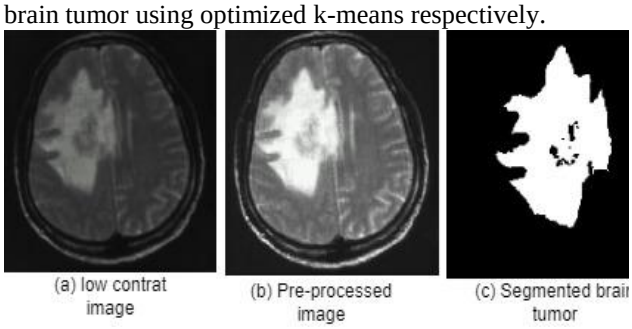


Figure 8: (a) Low contrast, (b) preprocessed, and (c) segmented brain tumor images by optimized k-means

Figure 9, shows the model predicted results according to extracted features using DWT

```
brain_tumor()

Enter the value Mean:9.8046
Enter the value of Variance:1147.0
Enter thevalue of Standard Deviation:34.
Enter the value of Entropy :0.0035
Enter the value of Skewness:3.9785
Enter the value of Kurtosis:16.325
Enter the value of Contrast:67.358
Enter the value of Energy:0.02457
Enter the value of ASM:0.00245
Enter the value of Homogeneity:0.4586
Enterthe value of  Dissimilarity:4.78524
Enter the value of Correlation:0.99254
The expected type of Brain_Tumor 1
```

Figure 9: Model predicted results with labels

When extracted features from a segmented brain tumor are fed to the classifier the predicted output label of low contrast brain tumor MRI image is ‘1’ which means the type of brain tumor is malignant and for a benign tumor, this value is ‘0’.

Figure 10, shows the training of an artificial neural network as a part of a hybrid model with an optimized k- means algorithm.

```
Epoch 1/10
301/301 [==============================] - 1s 2ms/step - loss: 0.4780 - accuracy: 0.9219
Epoch 2/10
301/301 [==============================] - 1s 2ms/step - loss: 0.1313 - accuracy: 0.9807
Epoch 3/10
301/301 [==============================] - 1s 2ms/step - loss: 0.0705 - accuracy: 0.9821
Epoch 4/10
301/301 [==============================] - 1s 2ms/step - loss: 0.0598 - accuracy: 0.9834
Epoch 5/10
301/301 [==============================] - 1s 2ms/step - loss: 0.0561 - accuracy: 0.9827
Epoch 6/10
301/301 [==============================] - 1s 2ms/step - loss: 0.0537 - accuracy: 0.9844
Epoch 7/10
301/301 [==============================] - 1s 2ms/step - loss: 0.0523 - accuracy: 0.9837
Epoch 8/10
301/301 [==============================] - 1s 2ms/step - loss: 0.0510 - accuracy: 0.9834
```

Figure 10: Training of ANN classifier

Figure 11, shows the weightage of the most important features according to different type classifiers, used to classify the type of tumor. According to figure 11, it is clear that the weightage of most features used to classify the type of brain tumor from low-contrast MRI images is varying in nature. The classification accuracy of logistic regression is good for a lower value of the learning parameter. The accuracy of gradient boosting and decision tree classifiers mainly depends on the entropy features but in the case of random forest, it highly depends upon entropy, Active shape model (ASM), energy, and homogeneity type of features.

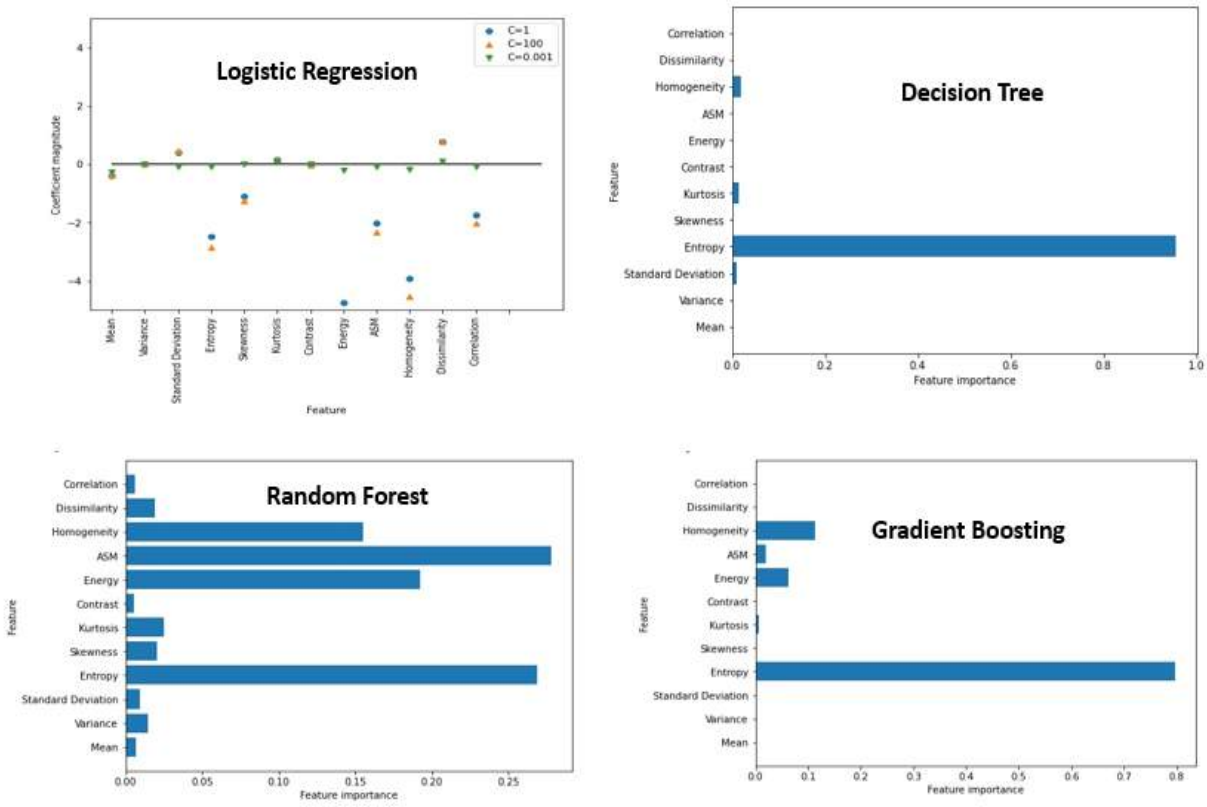


Figure 11: The weightage of the important features for different classifiers

IV. CONCLUSION AND FUTURE WORK

In this presented work, an optimized k-means algorithm followed by a thresholding and morphological approach is developed for low contrast brain tumor segmentation from MRI images. Some important features are extracted from a segmented brain tumor and these features are fed to a brain tumor classifier, which is based on an ensemble learning approach i.e. multiple models are used to classify the type of brain tumor at a time. The used models are logistic regression, k nearest neighbor (KNN), decision tree, random forest, gradient boosting, support vector machine (SVM), and artificial neural network (ANN). The proposed model is trained by the 70% part of the feature dataset related to the benign and malignant types of tumors. The comparative study according to training and testing accuracies of hybrid optimized k-means and ensemble learning approach-based classifier is shown in table 2. According to table 2, the performance of gradient boosting is quite good as compared to classifiers. The accuracy score of random forest is also good but its training accuracy is 100% i.e. the sign of overfitting. The accuracy scores of the proposed model is quite good but still, it requires some improvements. In the future, that will be achieved by using deep learning and transfer learning approaches.

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Experimental analysis on the performance of the thermo acoustic refrigeration system using air as working medium

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Abstract:-- **Thermo acoustic refrigeration has been a newer technology for the last few years and has gathered appreciation from the scientific community which involves the generation of low temperatures with the help of acoustic sound waves. Thermo acoustic refrigeration system is a device which uses acoustic sound energy as an input to transfer heat through a solid medium called as stack in a resonator tube. The temperature difference generated across the stack is important to the performance of thermo acoustic refrigerators. The stack is the most essential part of the thermo acoustic system. The present experimental investigation involves the use of the stack which is in the shape of the honeycomb structure and is made from Mylar material. The experimental data and the analysis of the system was carried out using a combination of set independent and dependent variables. The working medium used in the system was air which was operated at different pressures and also at different resonant frequencies in order to extract the optimal performance parameters involved in the design. The results are represented which confirm that the optimal performance in the design of the thermo acoustic refrigeration system depends on the stack and parameters associated with it. The analysis presented provides guidelines for increasing the effectiveness of thermo acoustic refrigerators, which still lack effectiveness because of their relatively low accomplishment. Further by variations in other parameters like the resonant frequency, resonator tube medium, the coefficient of performance of the system can be increased.**

Index Terms : Thermoacoustic Refrigeration, Stack, Coefficient of Performance

I. INTRODUCTION

Thermoacoustic refrigeration refers to processes in which sound acoustic energy is transformed into heat energy, thereby creating a temperature difference which is required for refrigeration purpose. This functionality of conversion of sound energy into generating a temperature difference has attracted a lot of attention by the scientific community in the recent past. [1, 2]. The thermo acoustic refrigeration systems use power of sound to generate a temperature difference between a low temperature space and a high temperature space. Thermoacoustic systems are gaining attention not only due to their environmental friendly effect, but also from fabricating and maintaining outlook. In departure from conventional devices they do not possess any moving components or parts, and do not use any harmful refrigerants or chemicals [3–5].

Moreover, the present applications of the thermoacoustic refrigeration systems are constrained due to less performance as compared to vapor compression refrigeration systems, ie the thermoacoustic refrigeration systems achieve 10% to 20% of Carnot efficiency as compared to 30% to 45% for vapor compression refrigeration systems [6].

In a refrigerator working on thermoacoustic principle the sound energy is provided by an acoustic driver ie a loudspeaker. An illustration of a standing wave thermoacoustic refrigeration system driven by a loudspeaker is shown in the (Figure 1a). The system consists of a loudspeaker, a resonator tube, a stack, incorporated with heat exchangers and a working medium which is generally air or any other inert gas. The gas parcels inside the resonator tube are expanded and compressed adiabatically by a standing acoustic wave supported by the loudspeaker at the resonant fundamental frequency for the specific resonator tube.

For the gas parcels fluctuating inside the stack, at about some thermal penetration depth in the stack, the thermal interface with the stack changes the original temperature fluctuations caused by the acoustic sound wave, both in the phase and the

magnitude. The displacement of the gas fluid parcel towards the pressure antinode is supplemented with an increase in temperature and pressure of the wave and a transfer of heat from the fluid to the plate (Figure 1b). The ensuing expansion of the gas fluid parcel results in temperature and pressure decrease and then in a transfer of heat back to the gas fluid from the plate [7, 8]. As there are many gas fluid parcels fluctuating in the stack at the location of the thermal penetration depth from the plate, heat is transferred by one gas fluid parcel and is deposited on the plate and, the same amount of heat is further transferred by the adjacent parcel, due to which a temperature difference ΔT is developed along the stack [9-10]. (Figure 1c). In order to use the effect of temperature difference generated for the heat pumping process, heat exchangers are attached at hot end as well as the cold end of the stack. The cold heat exchanger absorbs heat from the low temperature space to be cooled, while the hot heat exchanger rejects heat to the surrounding [11, 12].

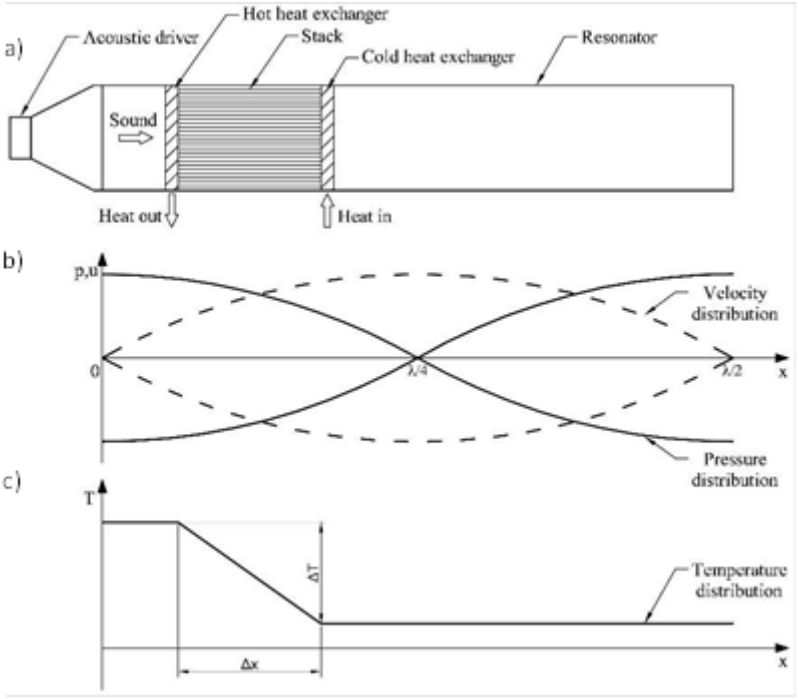

Figure 1 Working Principle of the standing-wave thermoacoustic refrigerator with pressure, velocity and temperature distribution

The working of the thermoacoustic refrigeration framework utilizing a loudspeaker driven acoustic standing wave is responsive to numerous parameters, like material parameters (density, specific heat of working fluid, thermal conductivity, and stack material) working parameters (resonant frequency, mean temperature and pressure, cooling load) and geometrical design parameters (stack position, stack length, stack porosity) [13]. As of late endeavors have been made to improve and optimize the performance of thermoacoustic systems, which have been widely concentrated theoretically and experimentally. Most of the analysis has been done on the geometrical design parameters predominantly the stack [14]. Tijani et al [14] researched the ideal stack position for the geometry of parallel plate stack. As per their outcomes, the ideal gap between the plate ought to be somewhere in the range of 2 and 4 thermal penetration depths. Different designs of the stack, similar to a spiral, honeycomb, and it were likewise tentatively experimented also. In [15] the impact of stack material, calculation, length, and position on temperature distinction produced across the end of the stacks were contemplated. The most extreme temperature difference was accomplished for a 4 cm corning Celor stack located at 4 cm from the loudspeaker. Numerous sorts of examination were done exclusively on stack area also. The ideal stack position was estimated as far as temperature gradient [12, 13] and also the COP [14]. Most frequently the best area falls between $\lambda/8$ and $\lambda/20$, where λ represents the sound wavelength [9]. Picollo and Wetzel et al. [15, 16] researched the effect of the resonator tube on the functioning of the stack, it was presented that the ideal effective resonant frequency contrasts from the plan in light of condition f_0 = a / ($2L_0$) and that the suitable combination of the resonant frequency and the resonance tube length leads to an increase in the difference of temperature at the two ends of the stack by around 56 %. Likewise Wetzel et al. [16] showed that the length of the resonator tube has a critical impact on the resonant frequency, which in their estimations

diminished with the increment of the length of the resonator tube.

The review presented in this paper explores the impact of the various working frequencies on the resonator tube length on the functioning of the thermoacoustic refrigeration system. A model thermoacoustic refrigeration system driven by an acoustic loudspeaker coupled to the amplifier and the signal generator, with air as a working fluid was gathered for trial and error inside referenced boundaries. The hot and cold heat exchangers were eliminated from the exploratory contraption. The thermoacoustic impact was estimated exclusively for the temperature difference produced across the stack.

II. EXPERIMENTAL SETUP AND DETAILS

Figure 2 describes the scheme of the exploratory thermoacoustic system. The device was simply used to obtain the temperature difference generated between the two ends of the stack, hence the thermoacoustic refrigeration system did not incorporate a cold and hot heat exchanger. A commercial amplifier driven loudspeaker with 50 W consistent power was utilized as an input acoustic device to generate the standing acoustic wave of the desired frequency. The acoustic loudspeaker was connected to one end of the stack which was connected to the resonance tube and the buffer volume. The two ends of the stack acted as the location of the hot temperature and the cold temperature spaces. A porous stack of material Mylar with circular pores was used as the material and the geometry of the stack. The temperature difference which was generated across the two ends of the stack is due to the exchanges between the working fluid and stack material which was measured by the type-T digital thermocouple. The temperature readings for each end of the stack was displayed with an accuracy of 1 K. Taking into justification all important considerations which influence on the performance, the overall precision and accuracy of the experimental data is of the order of 10%.

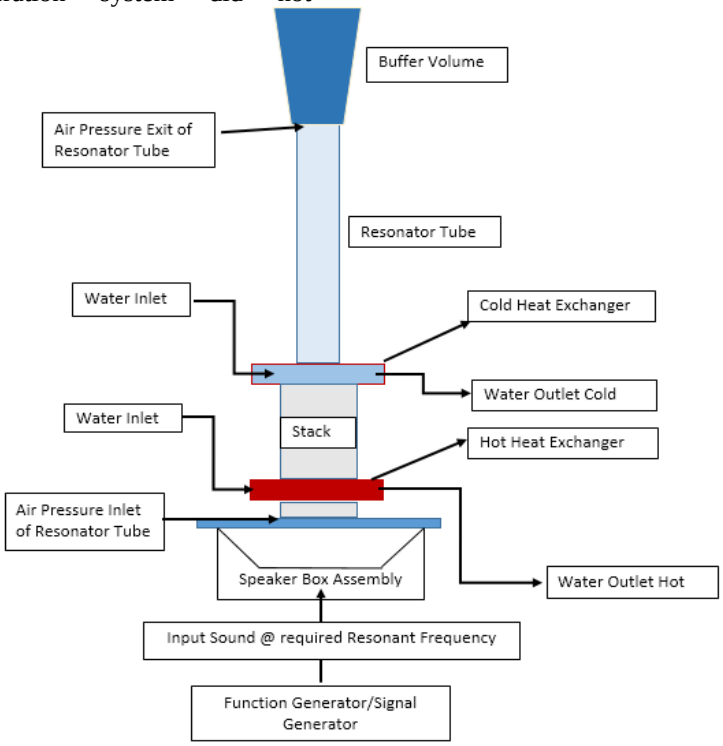

Figure 2 Schematic illustration of experimental setup.

The experiments were directed to assess the working of the thermoacoustic refrigeration system under different working frequencies and at different pressures. The resonant frequency corresponding to the length of the resonator tube and the along with the speed of the sound in air as working medium can be given by the equation:

$$f0 = \frac{C}{4 * Lt} \qquad (1)$$

Where f_0 represents the resonant frequency, C is the velocity of sound in air, Lt is the length of the resonator tube. The resonant frequency was estimated for 3 different modes required for the generation of the standing acoustic wave ie ($\lambda/4$), ($3\lambda/4$), and ($5\lambda/4$) respectively. Considering the length of the resonator tube (Lt) to be constant, the resonant frequency were calculated for 3 different modes i.e. f_0 = 294 Hz for ($\lambda/4$), f_0 = 885 Hz for ($3\lambda/4$), and f_0 =1474 Hz for ($5\lambda/4$). For each set of experimental measurements the data was obtained until the difference of

temperature between the ends of the stack turn out to be stable. After running the experiments for the desired resonant frequency range, the experiment was conducted for a fixed duration of time, in order to incorporate the comparative analysis with dependence on time.

III. RESULTS AND DISCUSSIONS

The various factors which have been considered for the comparative analysis of the experimental output have been depicted in the figures below.

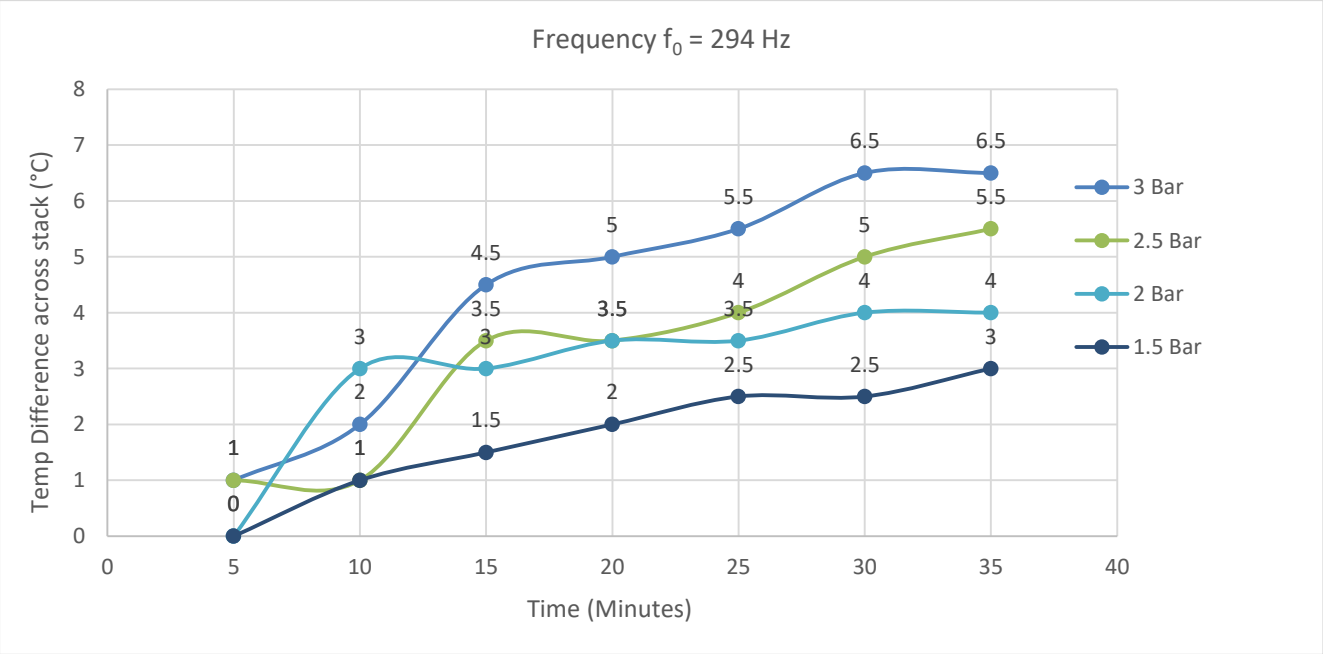

Figure 3 Variation of Temperature Difference with Time at f_0 = 294 Hz

Figure 3 represents the variation of the temperature difference generated across the stack at the resonant frequency of 294 Hz, the variation depicts that as the pressure of air in the system is increased from 1.5 bar to 3 bar the temperature difference across the stack also increases proportionally.

Similarly, the experimental output for the variation of the temperature difference generated across the stack at the resonant frequency of f_0 = 885 Hz for (3λ/4), and f_0 =1474 Hz for (5λ/4) have been shown in Figure 4 and Figure 5 respectively. A similar trend of performance was obtained for higher resonant frequencies.

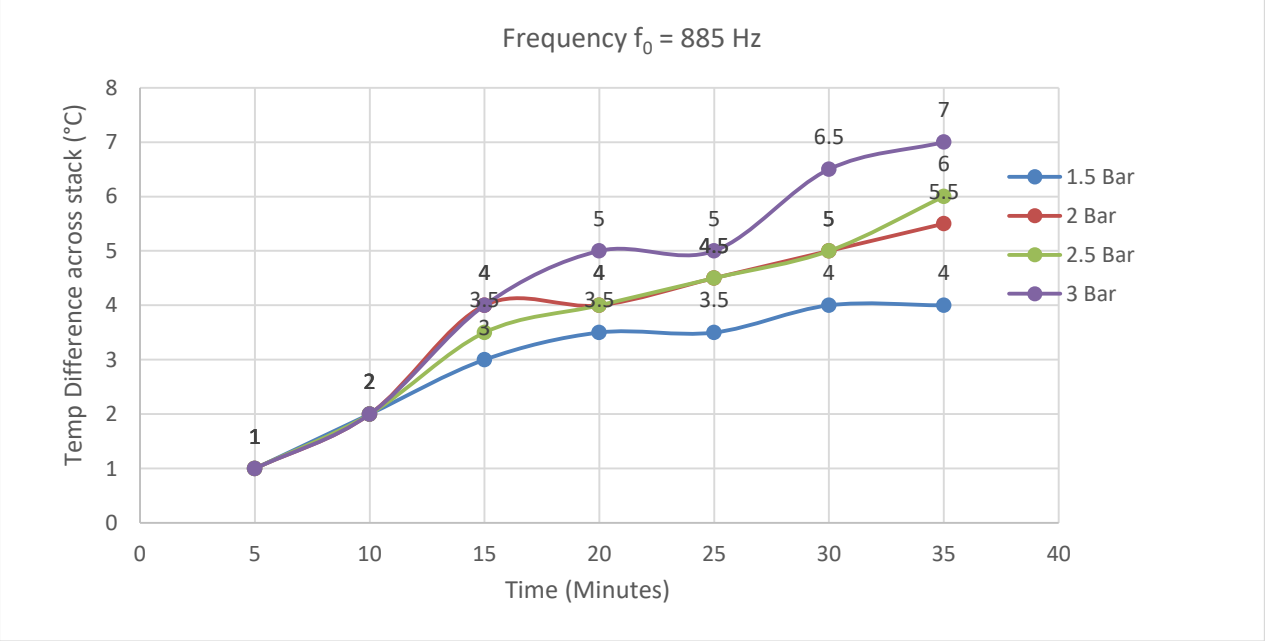

Figure 4 Variation of Temperature Difference with Time at f_0 = 885 Hz

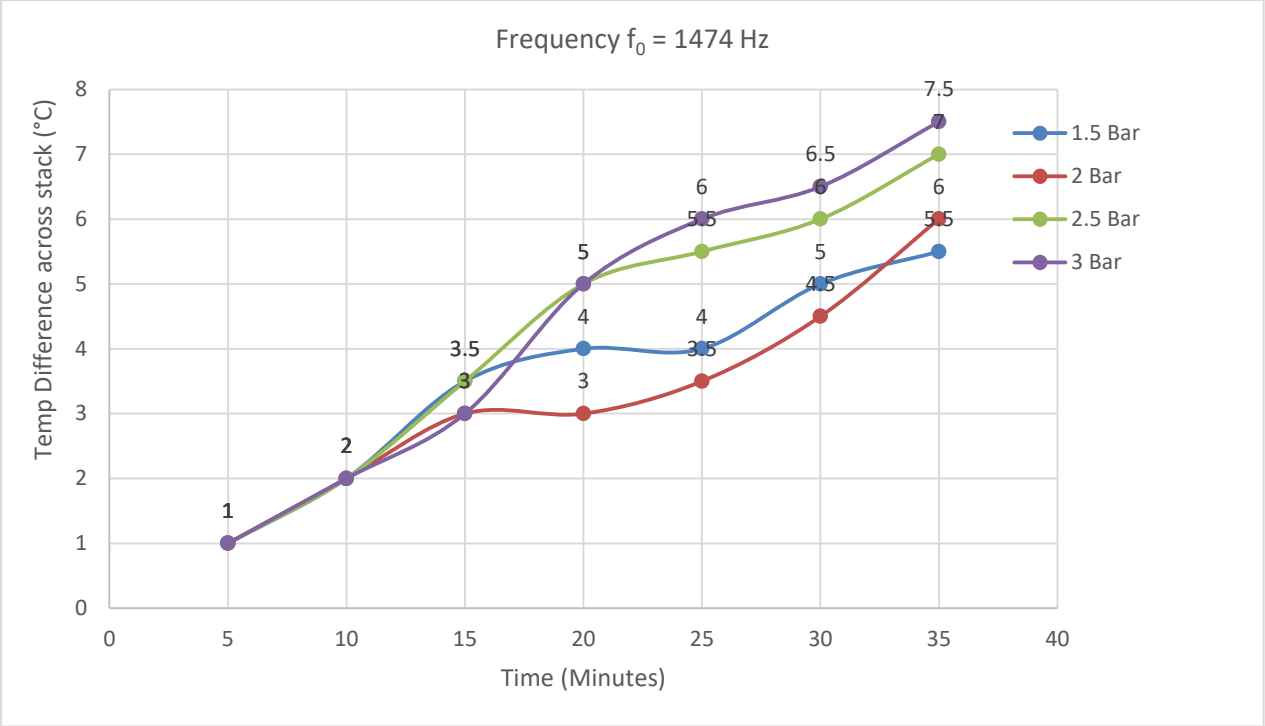

Figure 5 Variation of Temperature Difference with Time at *f0* = 1474 Hz

As the acoustic sound power is supplied to the system a temperature difference begins to set up between the hot end and cold end of the stack. In all the above graphs and experimental readings, it was observed that as the system pressure goes on increasing the temperature difference between the ends of the stack also increases. As per the experimental output, it is clear that the temperature difference generated across the stack is dominantly proportional to the pressure of the fluid inside the system. Moreover, the highest temperature difference across the stack of 7.5°C was obtained at a pressure of 3 Bar for a resonant frequency of f_0 = 1474 Hz, and the highest temperature difference across the stack of 7.0°C was obtained at a pressure of 3 Bar for a resonant frequency of f_0 = 885 Hz, and the highest temperature difference across the stack of 6.5°C was obtained at a pressure of 3 Bar for a resonant frequency of f_0 = 294 Hz.

IV. CONCLUSION

In this experimental analysis, the impact of the working medium i.e. air with constant resonator tube length on the presentation of the standing wave thermoacoustic refrigeration system with various resonant frequencies and pressures was envisaged. Three different resonating frequencies corresponding to i.e. f0 = 294 Hz for (λ/4), f0 = 885 Hz for (3λ/4), and f0 =1474 Hz for (5λ/4) were taken into consideration for increasing pressures inside the resonator tube from 1.5 Bar to 3 Bar were analyzed as far as the temperature difference between the ends of the stack is concerned.

The experimental performance suggests that the resonating frequency and the pressure of the working medium in this case air, altogether affect the activity of the thermoacoustic refrigeration system. The outcomes show additionally that the most elevated temperature differences obtained across the stack are accomplished for higher resonating frequencies. Furthermore, various studies can be carried out by varying the resonator tube, length, the working medium, and the stack size shape and geometry.

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Components (Eyes,Nose,Mouth) based Face recognition using deep learning

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Abstract:-- **Facial recognition forms the most crucial component of many biometric systems, but in most cases the use of facial encodings is very common. Various kinds of approaches can be used for facial landmark detection like OpenCV's built-in HAAR Cascade classifier, pre-trained HOG with Linear SVM object detector, face localization using deep learning algorithms. Shape prediction consists of an important component called Facial landmark detection. By passing an input image to a certain model and usually accompanied with a region of interest, a shape predictor which then localizes key points of interest. This forms the first part of our proposed method. This part consists of creating these landmarks to isolate parts of the faces. For this we used a pre-trained model called Haar Cascade Classifier. The next part then consists of recognition using these isolated features. These images are then labelled according to whom they belong to. For facial recognition part we use a Siamese network to determine if images belong to the same person or not, as Siamese networks have proved quite useful in similar situations in the past. The Siamese network defined in this paper is custom in nature. The Siamese network in the proposed model varies from the traditional one in a few things. One of which is that the model uses duplet dataset instead of triplet dataset which reduced the overall time for data generation. The applications of our model can be seen in many different fields. For example in forensics in case of accidents where sometimes the deceased may have only some parts of the face untouched or in criminal investigation where criminals have part of their face covered.**

Index Terms : Face recognition, Face verification through nose and mouth, Facial landmark detection, Iris recognition

I. INTRODUCTION

Face recognition as a task covers many different fields and disciplines and is an important research problem. Face Recognition's practical applications are numerous but not limited to Surveillance system, Bank Card Identification, Access Control, security monitoring, searching using mugshots. It also constitutes to form an integral part of human behavior that is important for effective communication and interaction among individuals.

One of the fast evolving areas in computer vision is biometric systems; which includes identification, authentication, security, surveillance system and so on. For face recognition eyes, nose and mouth among other things constitute to the face recognition task. For facial expressions eyes and mouth play very big part in determining these expressions. Eyes can play a major role in determining an identity of an individual using just his face. The reason being that the inter-ocular distance, which by nature is constant among people and is totally unaffected by mustache or beard. Another valuable face feature is the nose, it can too help in uniquely identifying a person, because the nose tip has symmetry point between right and left half of the face region in most cases and it can indicate head pose and is not affected by facial expressions. The mouth on the other hand may not be as distinguishing as other features but it still points us to an untapped application. As a result of these facial features[1] influence facial recognition in a major way. By extracting these features we can do facial recognition in a spread out fashion. This type of facial recognition may not yield as good as accuracy in traditional facial recognition systems. But if partial image is available or background is not plain we can do facial recognition using such components[3],[4]. The Haar Cascade Classifier can be used to do face parts recognition[2]. After extracting eyes, nose mouth we use Siamese network for facial recognition.

II. LITERATURE SURVEY

For Face recognition which is computer aided and is based on partial facial images, the literature concerning this topic is too few and far between and also not that consistent. Many different methods are

introduced in this paper[6][7]. One of the earliest work that was able to be identified by our research was that of Savvides et al. [8]. It was a case study, the authors tested facial recognition for various facial regions to establish quantifiers with discriminative ability. Based on grey scale images the method of kernel correlation filters was utilized to reduce image dimensionality and for feature extraction. For this particular case study[9], the images of the faces are projected onto face space that is the feature space in another term that best encodes among many different faces their variation. They do not by definition correspond to eyes, nose and mouth which are isolated facial features. The ability to adapt to recognize new faces is provided by the framework in an unsupervised way. The paper[10] studies facial expression recognition with the components by the way of face parsing. It is commonly known that different facial parts contain different quantity of information for facial emotions and expressions, and to recognize facial expressions using different facial components which are active and inactive in disclosure of expression is proposed. Deep belief networks which are tuned by logistic regression are used to train the face parsing detectors. The various parts of face are detected hierarchically that is the face is detected first then the nose is detected, eyes and mouth in that order. A stacked with deep architecture pre-trained encoder is applied to the task of expression recognition using face with the concentrated features of detected components. The face space is defined by the way the authors call the eigen–faces, which in essence are the eigen vectors calculated for a set of features.

III. METHODOLOGY

For a good enough machine learning model the formulation plays a key part in the design. For if the target is not placed correctly, how will one aim it correctly.

For the machine learning model implementation, Jupyter Notebook has been used.

The kaggle dataset is used in facial landmark detection. It contains high dimensional photos of celebrities.

The 3 different recognition is done in this paper. They are in respective order eye, nose, mouth.

There are a variety of facial landmark detectors, but all methods essentially try to localize and label the following facial regions:

Facial landmark detection from images- The pre-trained facial landmark detector inside the dlib library is used to estimate the location of 68 (x, y)-coordinates that map to facial structures on the face. The different ranges in 68 points defines eyes, nose, mouth, jaw etc.

This method starts by using:

1. Mouth
2. Right eyebrow
3. Left eyebrow
4. Right eye
5. Left eye
6. Nose
7. Jaw

The dlib library in python contains an inbuilt pre-trained facial landmark detector, which is used to detect and estimate the positions of 68 points which are denoted in (x, y) co-ordinate form that is mapped to the facial structure of the human face. The facial features are then defined by various sets of ranges of points. The points are arranged in such a way that these sets are in most cases not disjoint but continuous in nature. Refer the figure.

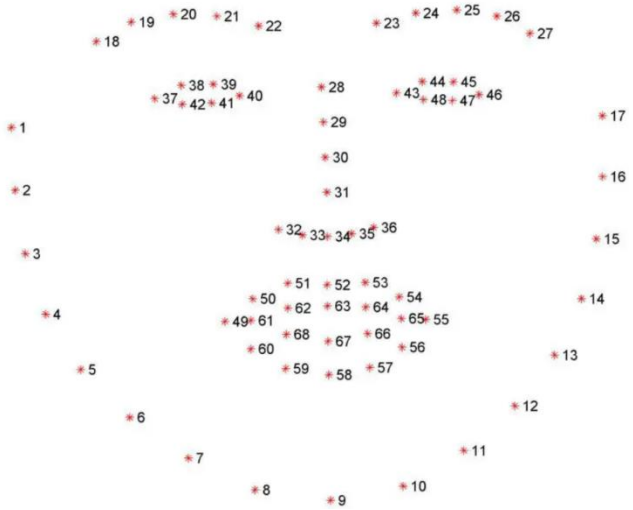

Fig 1. 68 point facial landmarks in sequence

We can extract facial features which can be accessed through this 68 points

- The mouth can be accessed through points [48, 68].
- The right eyebrow through points [17, 22].
- The left eyebrow through points [22, 27].
- The right eye using [36, 42].
- The left eye with [42, 48].
- The nose using [27, 35].
- And the jaw via [0, 17].

The model in paper used to point out these features(eye, mouth, nose, etc.) is Haar cascade model. It is specially used for object detection.

This method starts by using:

1. A training set of labeled facial landmarks on an image. These images are manually labeled, specifying specific (x, y)-coordinates of regions surrounding each facial structure.
2. Priors, of more specifically, the probability on distance between pairs of input pixels.
3. Given this training data, an ensemble of regression trees are trained to estimate the facial landmark positions directly from the pixel intensities themselves

4. The end result is a facial landmark detector that can be used to detect facial landmarks in real-time with high quality predictions.

Preprocessing for the eyes:

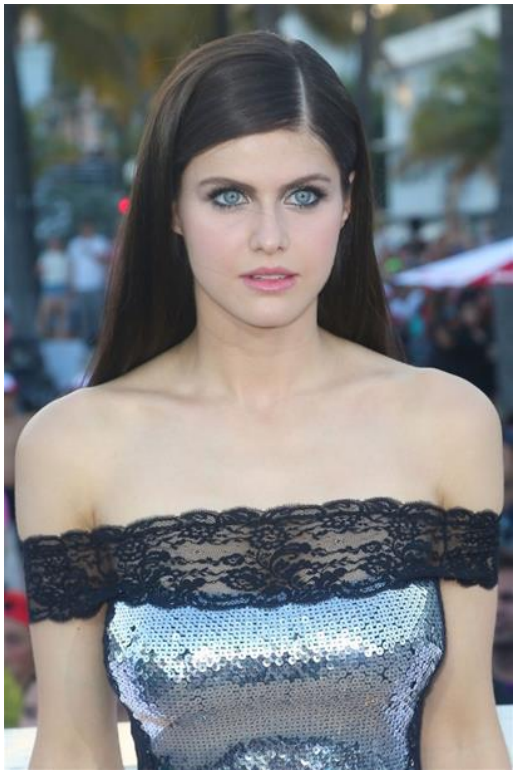

Fig 2. Image of a person

A. Cropping out the eye:

The eye is not directly cropped. Offset is provided to the y-direction distance from upper eyebrow to uppermost point of eye is taken up and down].For x direction,distance from nose to rightmost point of eye is taken and offset is added to leftmost point.

Fig 3. Cropped Image of an eye

B. Re-shaping of all cropped image to square image of equal size

Fig 4. Further Cropped Image

As all images cropped are of different sizes, all image contain eye at centre position, all images are cropped to the size of [80,80] equal size to give input in neural network

Preprocessing for the nose:

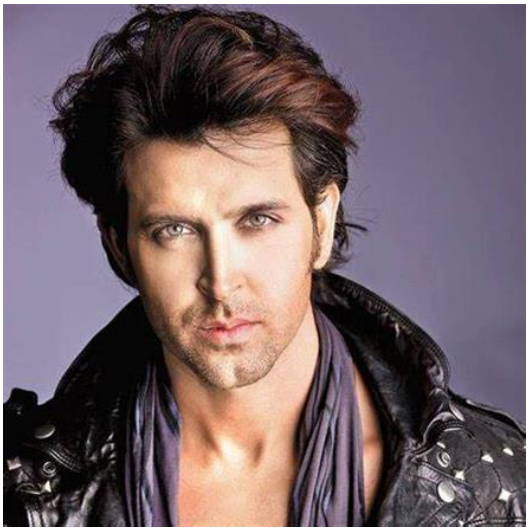

Fig 5. Image of a person

Cropping out nose from the image:

Fig 6. Cropped Image of the nose

Preprocessing for the mouth:

Fig 7. Image of a person

Cropping out mouth from the image:

Fig 8. Cropped Image of the mouth

Siamese Network:

Iris recognition, Face verification through nose, Face verification through mouth is done using Siamese network.

For Iris recognition-29 folder(celebrities) with atleast 10 photos are preprocessed to crop out left eye from image of person.

Face verification through nose- 30 folder(celebrities) with atleast 10 photos are preprocessed to crop out nose from image of person

Face verification through mouth- 30 folder(celebrities) with atleast 10 photos are preprocessed to crop out mouth from image of person

Siamese Network architecture:

A Siamese network is a class of neural networks that contains one or more identical networks. We feed a pair of inputs to these networks. Each network computes the features of one input. And, then the similarity of features is computed using their difference or the dot product. For same class input pairs, target output is 1 and for different classes input pairs, the output is 0

The siamese network is trained over different classes training set,it consist of two instances of same CNN model and L1 norm layer where the two enconding coming out of each instance is taken and relationship is find out between two encodings. Then it is tested over validation set

Model is defined below

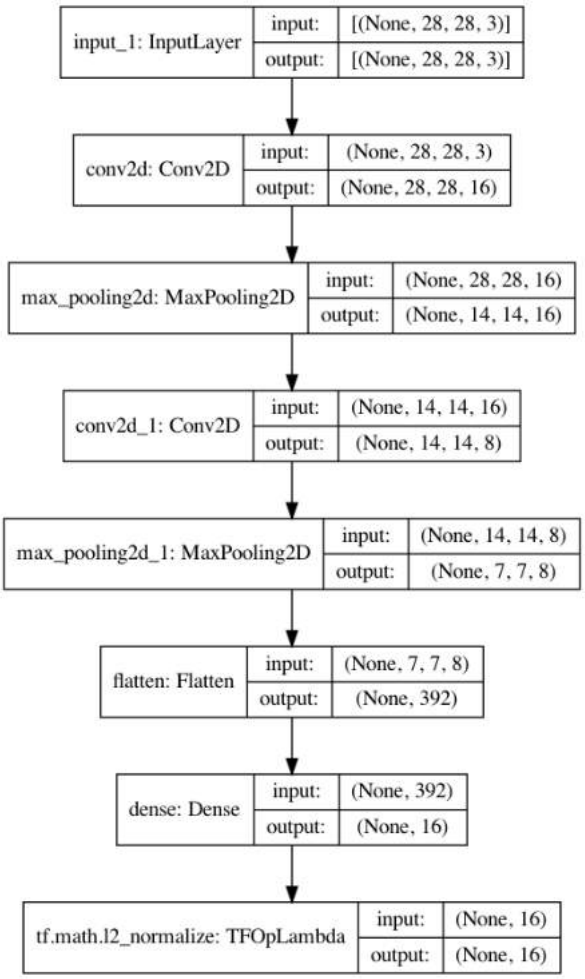

Figure 9. Model of the network

If two instance of model is taken,if input image is provided to each model then encoding taken for both image then it is passed through L1 norm then ouput is given if both image of same person or not

Model summary for eye

```
Model: "model_7"
__________________________________________________________________________________________________
Layer (type)                 Output Shape              Param #   Connected to
==================================================================================================
input_15 (InputLayer)        [(None, 80, 80, 3)]       0         []

input_16 (InputLayer)        [(None, 80, 80, 3)]       0         []

sequential_7 (Sequential)    (None, 4096)              5406016   ['input_15[0][0]',
                                                                  'input_16[0][0]']

lambda_7 (Lambda)            (None, 4096)              0         ['sequential_7[0][0]',
                                                                  'sequential_7[1][0]']

dense_15 (Dense)             (None, 1)                 4097      ['lambda_7[0][0]']

==================================================================================================
Total params: 5,410,113
Trainable params: 5,410,113
Non-trainable params: 0
```

Fig 10. Snapshot of eye model summary in python

Similar model summary for nose and mouth with different input size

The L1 norm is used to check similarity between two encodings

Output is 1 when eyes extracted from two images are of same person otherwise 0

Similar in case of mouth and nose

The accuracy for the left eye is 82%

Fig 11. Snapshot of classification report for eye model

The accuracy for the nose is 89%

Fig 12. Snapshot of classification report for nose model

The accuracy for mouth is 65% as mouth is open,close,tilted,make up etc added

Fig 13. Snapshot of classification report for mouth model

IV. CONCLUSION

The face landmark detection model(Haar cascade) works and points out features like eyes,nose, mouth,jaw etc works precisely.By correctly given offset and cropping out features like eyes,nose ,mouth in rectangular or square shape gives correct input image for doing further processing.The siamese network used for facial recognition works effectively on iris recognition,face verification through nose, face verification through mouth.The accuracy given on minimal data gives good results.The L1 norm used for detecting similarity between encoding gives good result after training it.The work to guess person through parts of faces proves effective.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Stress Prediction in Working Employees using Artificial Intelligence of Things

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***Abstract:*-- Stress issues are a common issue among today's working IT professionals. As people's lifestyles and workplace cultures change, employees are more prone to encounter stress. In this project, we will use IoT and machine learning approach like supervised learning to examine stress in working employees. After proper data cleaning and preprocessing, we used a variety of Machine Learning approaches like KNN, Decision Tree and Naïve Bayes algorithm to train our model. The accuracy of the above-mentioned models was determined and compared. Among the models used, KNN Algorithm had the best accuracy. Significant factors that affect stress were found using KNN, Decision Tree, and Naive Bayes algorithms. With these findings, organizations can set their sights on reducing stress and providing a much more comfortable working environment for their employees.**

Index Terms : Employees, Machine Learning, KNN, Decision Tree, Naïve Bayes, Stress.

I. INTRODUCTION

Working people frequently experience stress-related mental health illnesses such as depression, pressure, stress, interpersonal sensitivity, fear, anxiousness, etc. As people's lifestyles and workplace cultures change, stress among employees is more likely to occur. Although many corporate sectors and industries offer mental health-related programs and seek to improve the workplace culture, the problem is still out of control. In order to comprehend and recommend therapies with a deviated mental behavior, the evaluation of mental health is absolutely essential.

In India's private sector, over 42% of working professionals experience depression or general anxiety disorder as a result of job-related stress brought on by long hours and stressful deadlines, according to research by the industry association Assocham [4]. Prioritizing the maintenance of a stress-free workplace will raise productivity and improve employee wellbeing. Working professionals can benefit from counselling, career advice, stress management classes, and health awareness initiatives as ways to manage stress and maintain their mental health. Early detection of employees who will require such assistance will increase the likelihood of such actions being successful. By applying machine learning techniques, we can develop a model to forecast the risk of stress in working individuals by considering some of his or her professional and personal aspects as parameters and are collected through meticulously obtained questionnaires, by this we can simplify this process. This method will assist HR managers in better understanding their employees and in taking preventative action to minimize the possibility that a worker would perform below expectations. We are using machine learning techniques in this system to assess employee stress patterns and identify the factors that have the biggest impact on stress levels. IoT Sensors are used to extract some parameters required for stress prediction.

Sensors such as PIR Sensor, Hear-Beat sensor, and Temperature Sensor. After thorough data cleaning and pre-processing, our model is trained using a variety of machine-learning approaches.

Furthermore, the paper is organized as described below.

Section 1 contains the Introduction and it covers the brief overview of employee stress and Machine Learning Techniques used.

Section 2 contains the literature survey related to the proposed work. It illustrates the existing system and it also illustrates enhancement of the existing system. Overall abstract of each paper is explained in a brief.

Section 3 describes the proposed system.

Section 4 describes the various Machine Learning techniques used for building the model.

Section 5 covers methodology.
Section 6 covers results and the performance analysis of the different models used for stress prediction.
Section 7 Covers conclusion and future enhancements.

II. RELATED WORK

In [1], G. Azar et al. aimed to predict the psychological disorder. They have used various machine learning approaches and intelligent genetic algorithm to build a semi-automated system. They have compared the person's mental health with the DSM-IV-TR. The further aim is to make the system fully automated. Through this experiment, they have proved that genetic algorithms can be applied for many real-time applications.
In [2], The goal of Fang Li was to forecast student stress. In light of this, the author integrated resources for mental health education into the cloud using data mining and a cloud platform, allowing them to share each other's high-quality resources. The author also covered three elements that affects the mental health of college students i.e., students, society and education. The author proposed several ways to support the management of college students' psychological health through the examination of the management system for the psychological health of students.
In [3], A.R. Subhani et al. used various machine learning frameworks to analyze and predict the levels of stress. The analysis of stress included the use of EEG signals. They proposed to implement Logistic Regression, Support Vector Machine, and Naive Bayes, as well as EEG feature extraction. The experiment's findings have provided the best accuracy for stress prediction. In the experiment, accuracy for level 2 stress was 94.6 percent, and accuracy for multi-level stress was 83.4 percent.
In [4], Aditya Vivek Thota et al. aimed at predicting stress of IT employees. Working professionals in the tech industry who participated in the OSMI mental health survey provided the data. The best accuracy was achieved by boosting (75%), while the lowest accuracy was attained by bagging (69.43%). Among the other models Logistic Regression acquired 73%, KNN attained an accuracy of 73%, Decision Tree attained 70%, Random Forest attained 73%. The cross-validated AUC value for the random forest classifier was higher, indicating a more stable model.
In [5], Sandhya P et al. used various machine learning approaches to predict stress in IT Employees. The dataset was taken in the form of a questionnaire where employees were asked to fill in the details. The best accuracy was achieved by boosting (81.7%), while the lowest accuracy was attained by bagging (77.7%). Among the other models Logistic Regression acquired 79.9%, KNN attained an accuracy of 80.4%, Decision Tree attained 80.6%, and Random Forest attained 81.2%.
In [6], the goal of Monisha S. et al. is to forecast student stress. In order to assess reliable data and organize the components most likely to cause stress based on probabilistic characteristics, the authors employed the Naive Bayes technique. Authors have examined stress patterns using a variety of machine learning techniques.
In [7], Vidit Laijawala et al. aim at mental health using data mining techniques. Authors have collected data from online-available datasets. To forecast the mental health of individuals, various machine learning techniques are applied. In that, decision tree attained the highest accuracy of 82.2%, while random forests attained an accuracy of 79.3% and Naïve Bayes of 78.7%. The data has been analyzed using WEKA tool.

III. Proposed system

The algorithm determines factors that significantly affect stress levels. Employees' stress levels were determined based on their pulse, temperature, family history, and the availability of health insurance at work. The system's major goal is to identify risk variables that have an impact on employee mental health.

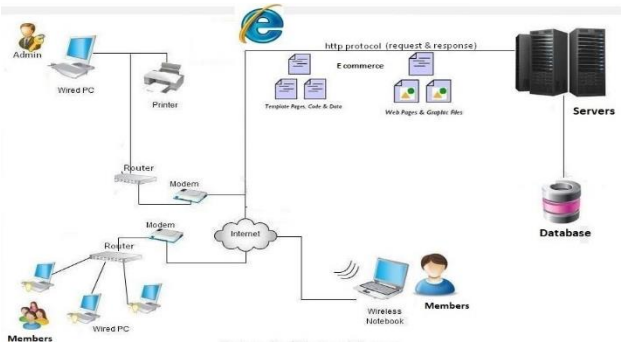

Fig1. Proposed System

Gender, Family History, Colleague History, Illness, Working Hours, and other parameters are used by the system. Using IoT sensors, the system also harvests real-time information such as pulse, temperature, and staff mobility.
Some of the reference ranges considered for prediction are heart rate <=100 is Normal and >100 and without any symptoms is considered as abnormal which is related to stress.[8]

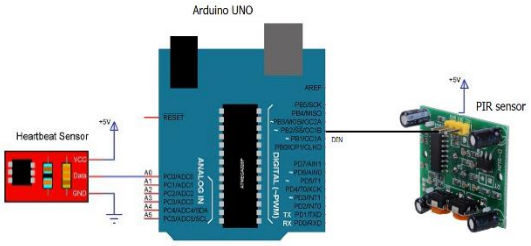

Fig2. Circuit Diagram

Sensors used: PIR Sensor, Heartbeat Sensor and LM-35 sensor.

IV. MACHINE LEARNING TECHNIQUES USED

Artificial intelligence, known as machine learning, enables computers and computing systems to autonomously learn from the past and advance over time without explicit human programming. The construction of computer programs with the capability to access data and learn on their own is the cornerstone of machine learning. When properly given to an intelligent system and educated effectively, this is very helpful in the healthcare industry, where there is a great amount of data. The final prediction model will be superior, free of human errors, and minimize the diagnostic process time.

a. **KNN Classifier:** The K-Nearest Neighbor (KNN) classifier is one of the supervised learning techniques that can be applied to labelled data. In this instance, it was used to ascertain whether the employee was under stress. KNN classifies the dependent variable based on how much an example from the known data that is comparable to the dependent variable resembles the independent variables [4].

b. Decision Tree - A decision tree can be used to model several options, if-else statements, or decisions in a way that resembles a tree. Decision trees are used in this instance to determine the 15 attributes that contribute most frequently [4].

c. **Naïve Bayes-** One of the simplest and most effective classification techniques for developing machine learning models that can predict outcomes is the Nave Bayes Classifier. In this case, Naïve Bayes is used to compare the values and classify the attribute values to one of the predefined set of classes [6].

V. METHODOLOGY

For the benefit of IT firms, the system can be implemented as a real-time application. We utilize Visual Studio and SQL Server for application development since they are more real-time and application-friendly.

2. **Data Collection:** We gather data on stress at this stage of the employee stress prediction procedure. Data has been gathered from a variety of sources and includes variables like gender, age, financial_problems, family, working_ hours, learning_method, health_problems, partiality_fix,colleague_issue,pressure,regular_ interaction, etc.
3. **Data Preparation**: Only pertinent data was extracted after analysis of the stress data. Data that is needed for processing is extracted and segmented in accordance with the specifications. The essential data extraction is carried out since the entire data is not required for processing and processing would take too long if we entered all the data.
4. **Data Splitting:** At this point, the data will be split into a training dataset and a testing dataset in a ratio of 90:10.
5. **Model Education:** The machine learning algorithm is trained by providing datasets to it at this phase. Regular training can increase the machine learning model's prediction rate greatly. Various machine learning algorithms are used to train the model. In this model we have used.
6. **Stress Prediction:** After the model is trained, the system predicts the stress of the working employee based on the parameters and value driven by IoT sensors.

VI. RESULTS AND PERFORMANCE ANALYSIS

To forecast the stress of a working employee, all of the above-mentioned models were trained. The results are tabulated in the table below.

The classification performance of all trained models is shown in Figure 3, with KNN having the highest accuracy (87.2%) and Naive Bayes having the lowest accuracy (56.8%).

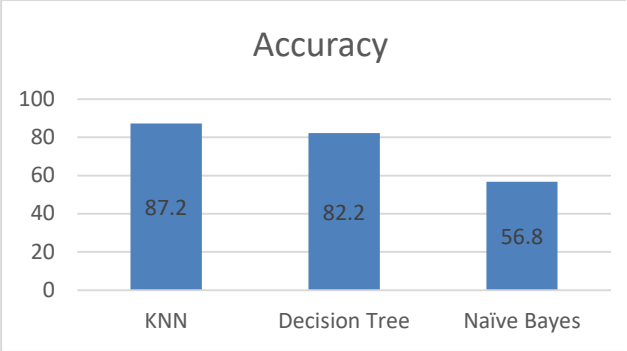

Fig3. Performance analysis of each method

Figure 4 shows the time taken for execution of each model being the KNN has the least execution time.

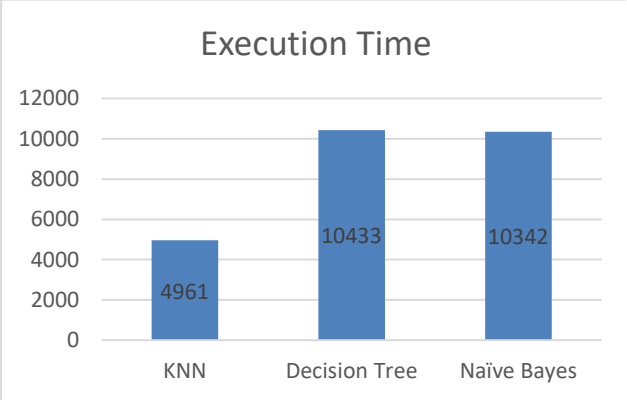

Fig4. Execution Time

Table 1 contains the evaluation and tabulation of the performance of several trained models. KNN outperformed the other models in terms of accuracy and execution time after the model was trained using a variety of machine learning approaches.

Table1. Performance of different models trained

Algorithm	Accuracy	Execution Time
KNN	87.2	4961
Decision Tree	82.2	10433
Naïve Bayes	56.8	10342

VII. CONCLUSION AND FUTURE WORK

Family medical history, idle time during workdays, in terms of relationships with coworkers, more important than other considerations is whether a firm offers its employees mental health benefits. Using real-time parameters adds a step in predicting stress in working employees. Because of the strict deadlines and extended working hours, those who work for IT organizations are somewhat more likely to experience stress [4]. Using some IoT sensors, capturing some parameters like pulse and temperature will play a major role in predicting stress.

From the above Algorithms used KNN Algorithm acquired good results of 87.2% whereas the Decision tree algorithm acquired a result of 82.2% and Naïve Bayes acquired the least accuracy of 56.8%.

The goal of this article was achieved by using machine learning techniques to predict stress and mental health conditions. These techniques produce notable findings and can be further investigated.

In the future, one can use a Convoluted Neural network and various deep learning techniques to analyze the accuracy of the models. One can consider a dataset released by some healthcare providers or the questionnaires released from various institutes

One can use different machine learning techniques to build a model where the model is capable of giving a solution if the employee is undergoing some stress attacks.

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Document Organizer Apps (DOApps): An Innovative Processing System of the Accrediitation Documents

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Abstract:-- **This descriptive research determined the effectiveness of the Accreditation App for organizing documents for the different AACCUP Areas in preparation for the Level III Phase II accreditation with the aim of developing convenience, accuracy and systematic processing of documents. Ten (10) area coordinators were requested to evaluate effectiveness of the application software in terms of its accuracy, systematic impact and convenience. Results revealed that all area coordinators evaluated the apps as highly convenient and systematic, however, in terms of accuracy it was evaluated to be slightly accurate for only few documents were tested. As evaluated by the area coordinators, the effectiveness of the apps was described as Area 1 highly effective, Area 2 slightly effective, Area 3 effective, Area 4 slightly effective, Area 5 effective, Area 6 slightly effective, Area 7 slightly effective, Area 8 effective, Area 9 effective and Area 10 slightly effective. Based on the evaluation made by the area coordinators, it can be recommended that the apps may be subjected for more refinement. It can also be regarded that the school must provide high capacity devices in order to store maximum data.**

Index Terms : application program, effectiveness, area, AACCUP

INTRODUCTION

The world of today faces a lot of challenges in the field of competition for quality instruction and learning. The trendsetter in education particularly in schools or in university, is the quality of educational services provided to the clientele and this can all be measures to the performance, employability, quality of the teacher and the physical appearance in school.

All of these can be measured in terms of accreditation. Most of the universities and colleges particularly in the Philippines, subjected their academic programs for accreditation to verify and determine the quality of services rendered by an academic institution. Accreditation is a voluntary process of self-regulation and peer review adopted by the educational community. Institutions of higher education have voluntarily entered into associations to evaluate each other in accord with an institution's stated goals. Non-accredited institutions must be able to demonstrate that they possess certain "characteristics of quality" before they are allowed to become members of the association of accredited institutions (Kumar, P., Shukla, B. & Passey, D., 2020).

As cited by Rivera (2012), AACCUP strategically has put in place a system that externally assess the quality of provisions of degree offerings among chartered colleges and universities. This external assessment of quality will drive these institutions to improve continuously and further enhance the quality not only of the provisions of the degree offerings but critically to improve the overall quality of highereducation programs they offer.

Considering that in the part of state universities in the rural areas, like where Northern Iloilo State University is situated, the bulk of works in accreditation is undeniable. Oftentimes, the task force members during the accreditation program are the academic faculty. Some of them had more than one preparations or higher and being a part of the accreditation task force team is an additional burden for them. Searching and organizing documents were one of the top ranking issues being encountered which caused the delay of the preparation of the documents.

The institution particularly the researcher who is also a task force member of the accreditation had looked into the possibility of creating a system to strategize the organization o of the documents. The purpose of which is to make the process easy, convenient and systematic for such an instance that some of the documents can be also evidences of the other area of evaluation.

So, through the advent of technology not only in the teaching but also in some operational processes, the organizing apps had been created and initiative in order to help out segregating the documents in every area of evaluation.

Thus, this research study was conducted to determine how effective and operational is the process.

Hence, this study.

METHODOLOGY

This descriptive survey research aimed to determine the effectiveness and functionality of the document organizing apps (DOApps) in the organizing of the documents, as evaluated per area in terms of accuracy, convenience and systematic operations. This sought answers to the following questions:

1. What is the effectiveness of the DOApps to children in terms of accuracy, convenience and systematic operations as a whole and when grouped into different areas such as Area 1 – VMGO, Area 2 – Faculty, Area 3 – Curriculum and Instruction, Area 4 – Support to Students, Area 5 – Research, Area 6 – Extension and Community Development, Area 7 – Library, Area 8- Physical Plant, Area 9 – Laboratory and Area 10- Administration.

2. What can be recommended into the system to make it more efficient and functional in on the part of the task force or area coordinators?

RESULTS

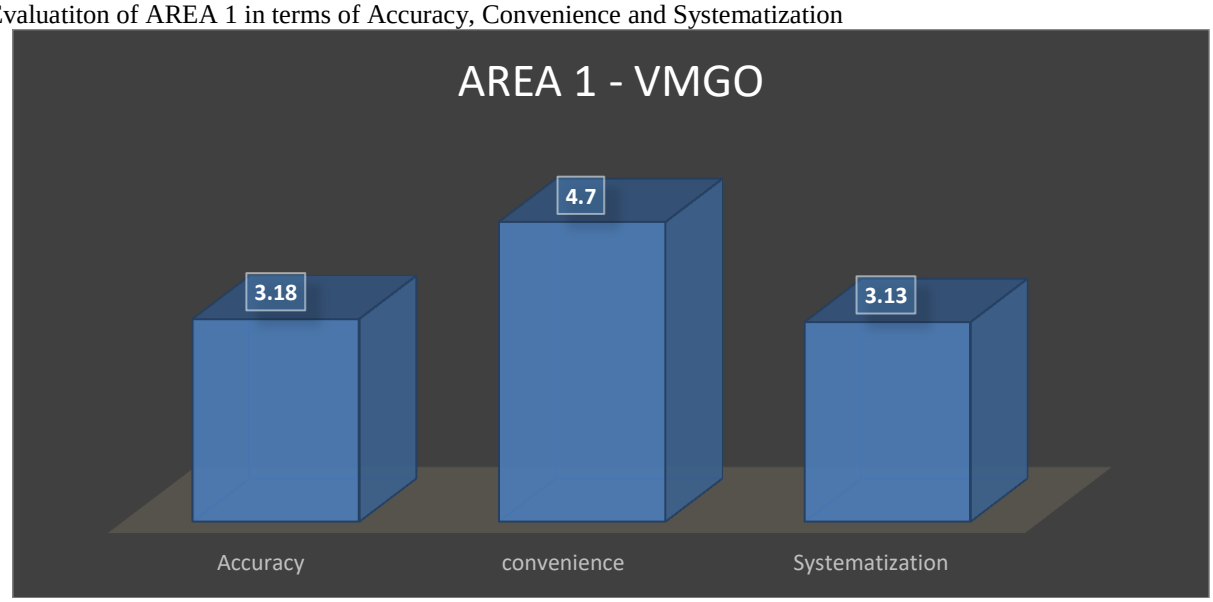
Evaluatiton of AREA 1 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 1 (Vision, Mission, Goals and Objectives) were evaluated as moderately accurate, very highly convenient, and in terms of systematization it was described as moderate.

Graph 1 presents the results.

Graph 1

Evaluatiton of AREA 1 in terms of Accuracy, Convenience and Systematization



Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

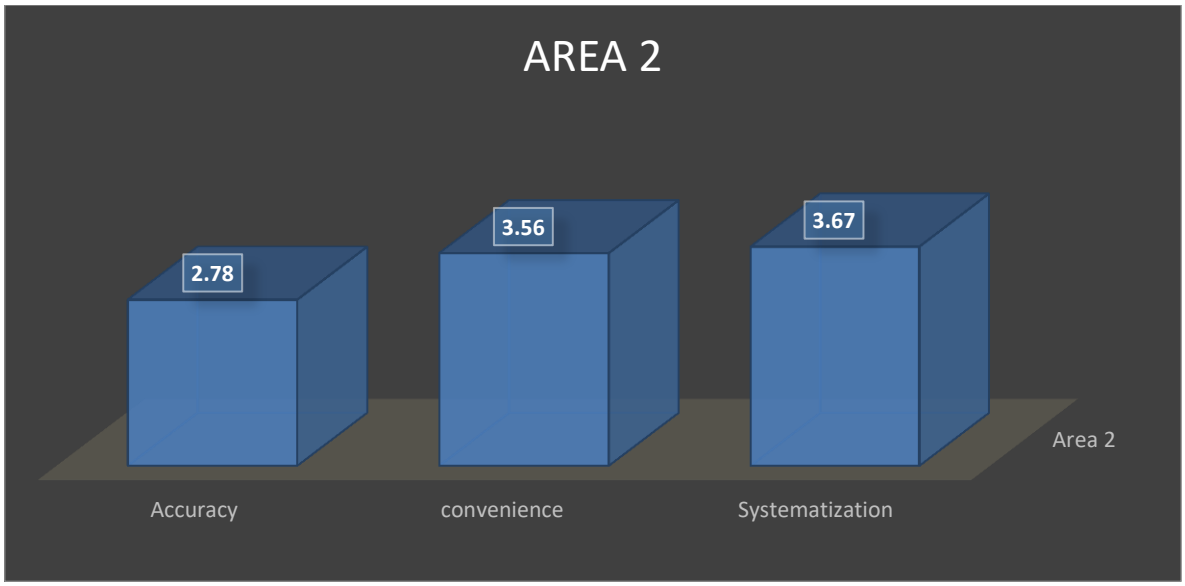
Evaluatiton of AREA 2 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 2 (Faculty) were evaluated as moderately accurate, highly convenient, and in terms of systematization it was described as high.

Graph 2 presents the results.

Graph 2

Evaluatiton of AREA 2 in terms of Accuracy, Convenience and Systematization



Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

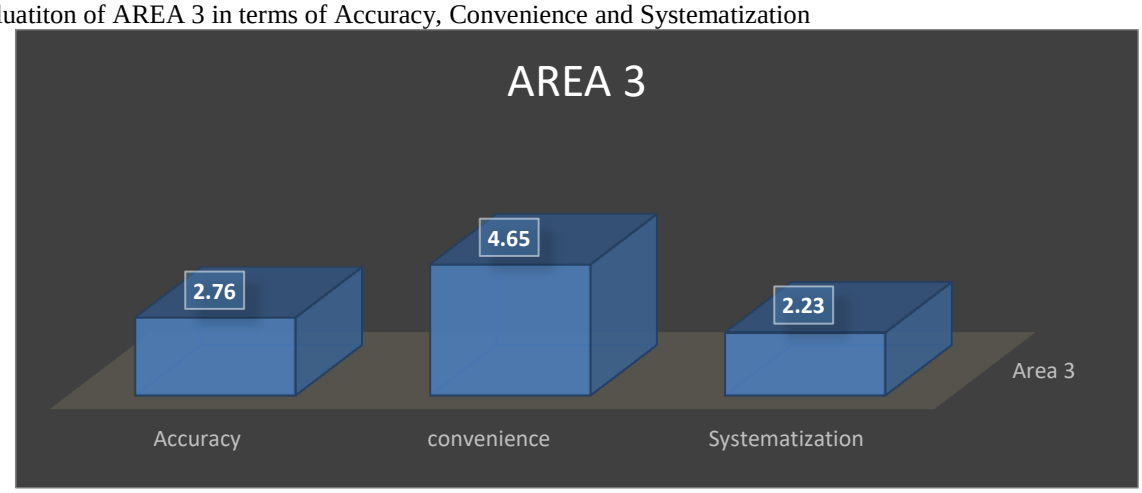
Evaluatiton of AREA 3 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 3 (Curriculum and Instruction) were evaluated as moderately accurate, very highly convenient, and in terms of systematization it was described as low.

Graph 3 presents the results.

Graph 3

Evaluatiton of AREA 3 in terms of Accuracy, Convenience and Systematization



Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

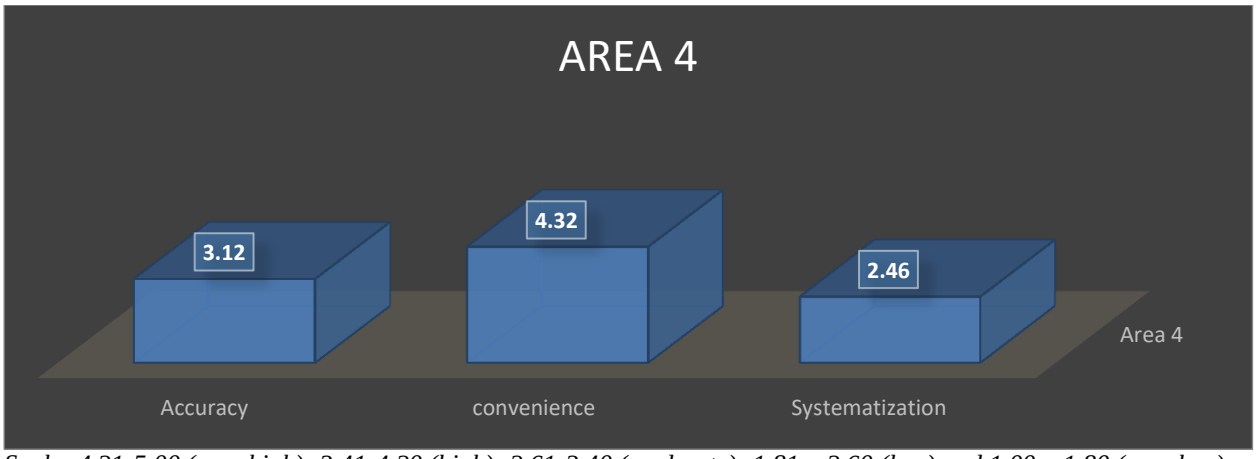
Evaluatiton of AREA 4 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 4 (Support to Students) were evaluated as moderately accurate, highly convenient, and in terms of systematization it was described as low.

Graph 4 presents the results.

Graph 4

Evaluatiton of AREA 3 in terms of Accuracy, Convenience and Systematization



Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

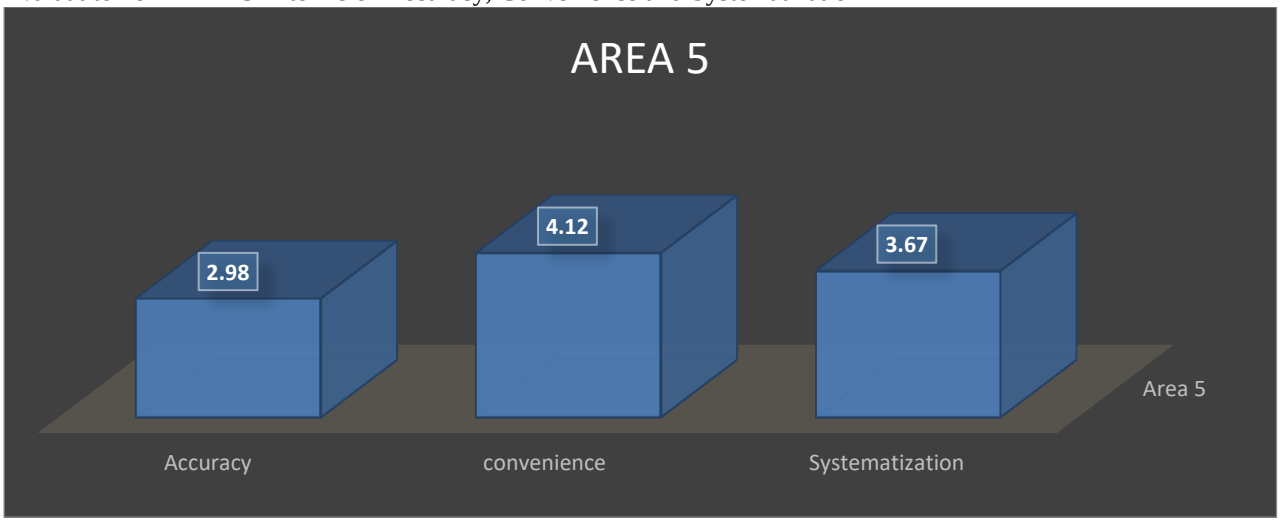
Evaluatiton of AREA 5 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 5 (Research) were evaluated as moderately accurate, highly convenient, and in terms of systematization it was described as moderate.

Graph 5 presents the results.

Graph 5

Evaluatiton of AREA 3 in terms of Accuracy, Convenience and Systematization



Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

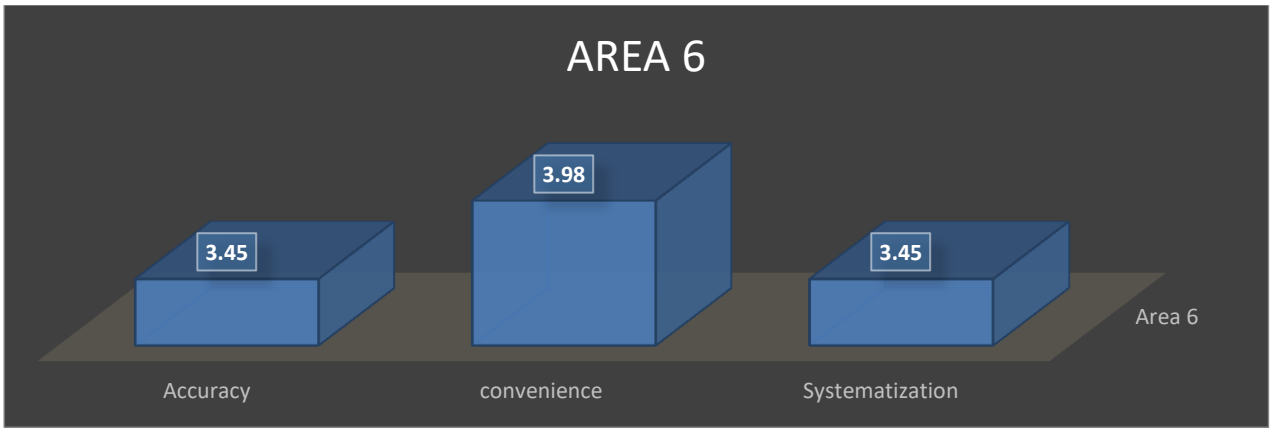
Evaluatiton of AREA 6 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 6 (Extension and Community Services) were evaluated as highly accurate, highly convenient, and in terms of systematization it was described as high.

Graph 6 presents the results.

Graph 6

Evaluatiton of AREA 6 in terms of Accuracy, Convenience and Systematization



Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

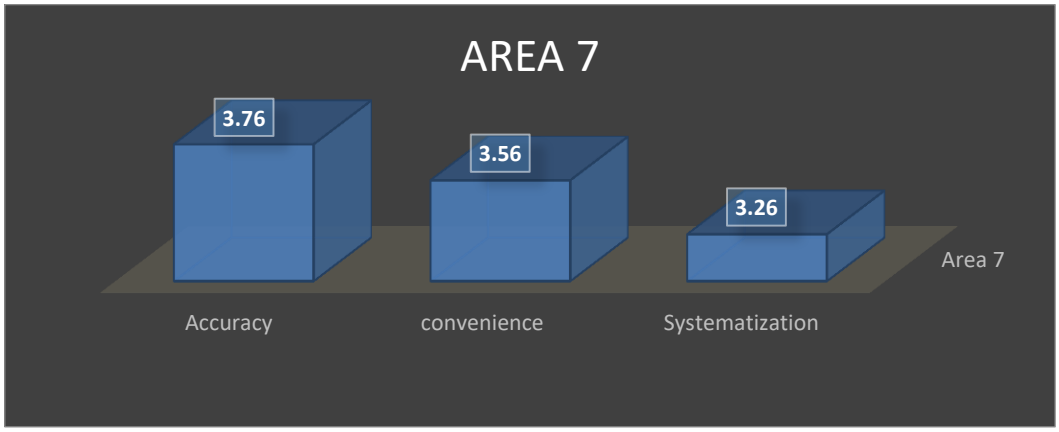
Evaluatiton of AREA 7 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 7 (Library) were evaluated as highly accurate, highly convenient, and in terms of systematization it was described as moderate.

Graph 7 presents the results.

Graph 7

Evaluatiton of AREA 7 in terms of Accuracy, Convenience and Systematization



Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

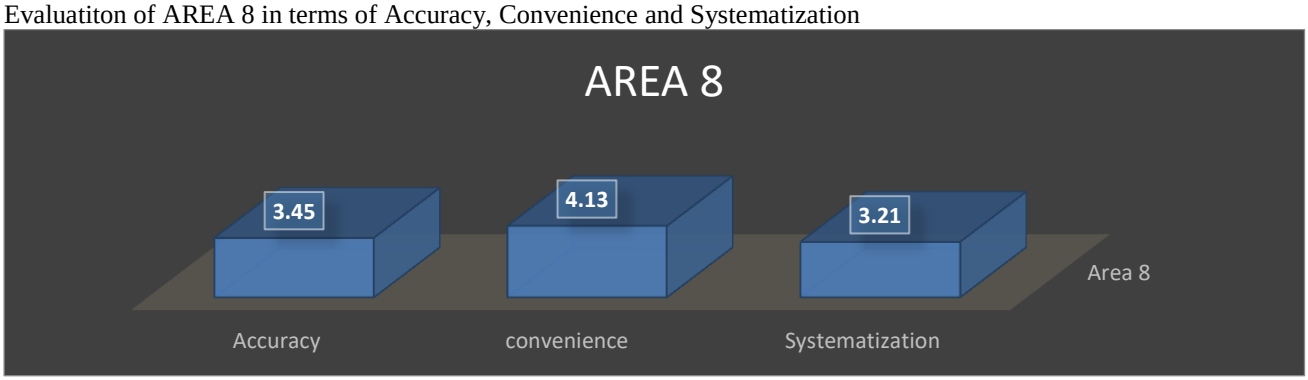
Evaluatiton of AREA 8 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 8 (Physical Plant and Facilities) were evaluated as highly accurate, highly convenient, and in terms of systematization it was described as moderate.

Graph 8 presents the results.

Graph 8

Evaluatiton of AREA 8 in terms of Accuracy, Convenience and Systematization



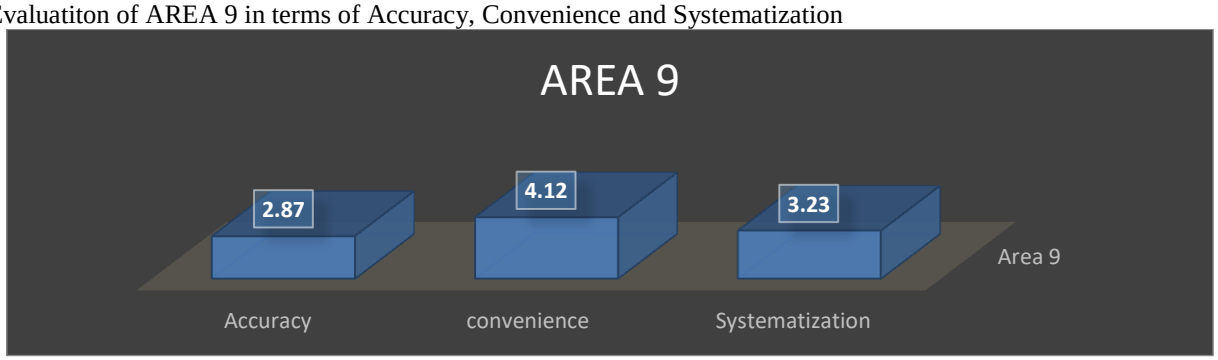
Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

Evaluatiton of AREA 9 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 9 (Laboratory) were evaluated as moderately accurate, highly convenient, and in terms of systematization it was described as moderate.

Graph 9 presents the results.

Graph 9
Evaluatiton of AREA 9 in terms of Accuracy, Convenience and Systematization



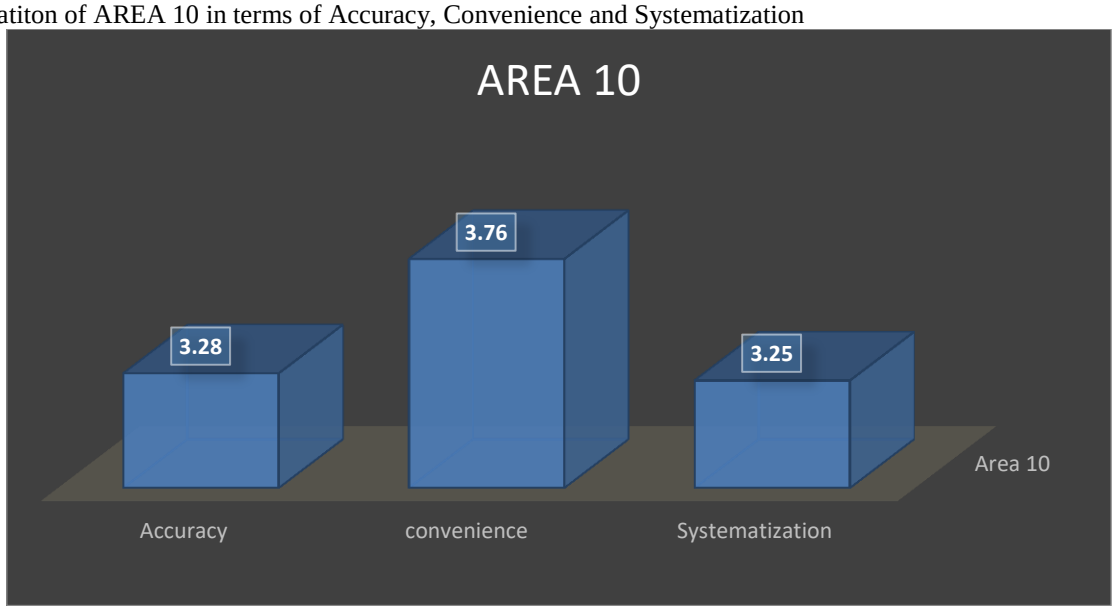
Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

Evaluatiton of AREA 10 in terms of Accuracy, Convenience and Systematization

The graph shows that Area 10 (Administration) were evaluated as moderately accurate, highly convenient, and in terms of systematization it was described as moderate.

Graph 10 presents the results.

Graph 10
Evaluatiton of AREA 10 in terms of Accuracy, Convenience and Systematization



Scale: 4.21-5.00 (very high); 3.41-4.20 (high); 2.61-3.40 (moderate); 1.81 – 2.60 (low) and 1.00 – 1.80 (very low)

DISCUSSION

Considering that as mandated by the Commission on Higher Education (CHED), the state universities and colleges (SUCs) have four mandated functions such as instruction, research, extension and resource generation. The areas mentioned above supports the mandated functions of the tertiary institutions and thus, its functions or operation supported all the activities, programs and operations.

CONCLUSION AND RECOMMENDATIONS

In its own perspective, determining or evaluating the quality of instructional services to the institutions is part and parcel of the educational processes. By ensuring the sustainability of the quality services provided, there must be a system of adaptation in order that the attainment of the planned vision and mission to serve the clientele is regarded. Thus, this documentation accreditation apps or shortly called “DOApps” can be the surest solution to reach out this purpose.

Just what Gregory (2012) concluded in his study that, as evident from the requirements of the various accreditation levels, higher education institution accreditation in the Philippines is centered on four key result areas, namely: quality of teaching and research,support for students, relations with the community, and management of resources. Thus, by far accreditation infact is a process that could bring out the best in all areas of the academic institution.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Improved MAC Control Using Fuzzy Logic for Enhancing Battery Life Time in Wireless Sensor Networks (WSNs)

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***Abstract:*-- Now a days, the Wireless Sensor Networks (WSNs) is the tremendous ongoing research area due to applications in the various fields. In wireless medium the major drawback is the high rate of packet drop, due to this data aggregation performed on the sensed data can be lost, however energy aware on the network path parameters is also essential to select an appropriate path for sending the data. In addition, to increase the battery life of a network, an efficient strategy is needed. Therefore, in this paper interestingly we propose Energy Aware-Radio Activation Policy (EA-RAP) MAC with collaboration of cross-layered fuzzy rule scheduling to guarantee QOS requirements, that all packets are transmitted with low Bit Error Rate (BER), minimize waiting time and improved network life time. As a result, our protocols are referred to as EA-RAP MAC and EA-MAC respectively applied for health care scenario. To this end, numerous simulations have been conducted for evaluating the performance of the proposed protocols in the perspective of network lifetime. In addition, sufficient comparisons have been conducted with the existing state-of-the-art protocols. In overall, the EA-RAP MAC protocol keeps the network functioning the longest.**

Index Terms : Bit Error Rate, Battery Lifetime, Network lifetime, Wireless Sensor Networks (WSNs)

I. INTRODUCTION

Wireless sensor networks have gained importance in a wide spectrum of science, engineering, new consumer applications, they do not specifically tackle the challenges associated with healthcare systems [8] like human body monitoring WBSN system shown in Fig.1. Advancements in sensing, processing, and battery powered devices, known as sensor nodes, have drawn extensive research attention in healthcare, body monitoring [9] can be achieved using sensor nodes attaching them to the body's surface thereby can be implanted into the tissues for more accurate clinical diagnosis. A wireless sensor node is typically battery operated and is thus energy constrained is considered to solve the problems in healthcare industry. To maximize [10] the lifetime of the sensor node after its deployment, all aspects, including circuits, architecture, algorithms and protocols, must be made energy efficient. Most WSN applications [11] require operation over extended periods of time beginning with their deployment. Hence, network lifetime [1] is critical and is a primary consideration in the design, development, and deployment of an energy constrained WSN for clinical practice. A MAC protocol is the fundament of the communication among sensor nodes, which ensures that there isn't any two nodes interfering with each other's transmission so that successful operation of the network. Although there are various MAC [12] [13] layer protocols proposed for sensor networks, there is no protocol accepted as a standard. One reason for this is that the MAC protocol choice will, in general, be application dependent, which

means that there will not be one standard MAC for sensor networks. Enhancing battery life in WSN [6] is a challenging task due to resource limitations in the sensor nodes. Several research works have focused on extending life time along with reducing the energy consumption in WSN. Moreover, recent research studies have proved the efficiency of adopting cross-layer design in improving the network performance [7] and meeting the lifetime requirements of WSN applications. Compared to traditional layered design, the cross layer design ensures information exchange and communication between different layers, in order to optimize the network performance. In this paper the proposed cross layer design focus on either improving one or more parameters such as PHY signal quality, packet waiting time, residual battery life time and SNR. In this paper, an improved MAC control based on cross-layer design for enhancing lifetime in WSN, using fuzzy logic is proposed. Unlike existing approaches, the proposed design aims at meeting both the QoS [14] and energy management by application of fuzzy rules, while maintaining the quality of service and higher reliability by having FLS in each sensor. Fuzzy logic has been used in many WSN [15] related research works such as clustering, routing and power optimization. In the proposed cross-layer design a fuzzy rule based scheduler is used, to prolong the lifetime, improve SNR[16][17], and waiting time, a fuzzy logic controller is employed to adjust the data rate dynamically[18], making the application more responsive to the dynamic changes in network conditions and maintaining an acceptable level of network quality[19].

II. RELATED WORKS

We have covered several research issues and challenges related to the field of WSNs, which shows that energy efficiency, reliability, and network stability period are the most vital issues in WSNs. Although much study has been done, it is still required to propose more stringent efficient and reliable approaches to extend the lifetime of WSNs while keeping in mind their resource constraints. In this section, we review the most notable WSNs activities in the domain of network lifetime, low bit error rate and reliability.

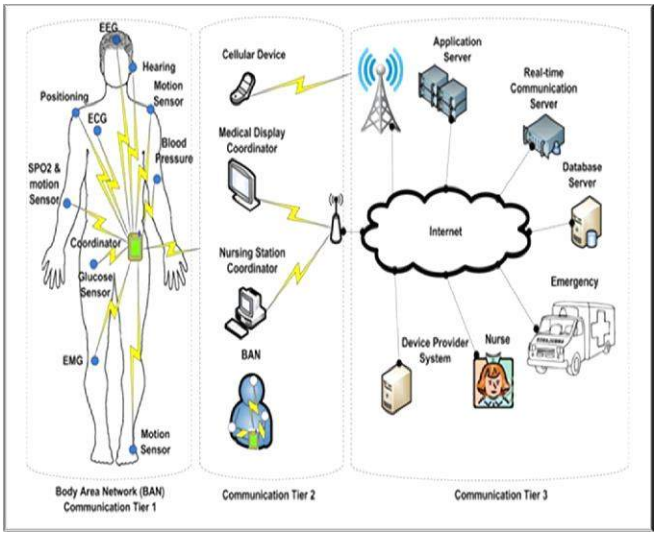

Fig : 1 - WBSN Communication System

Y.Qu.G.Zheng et al.[3], an opportunistic routing scheme was developed to improve the network lifetime by using the movement of body components. The proposed approach's major goal is to reduce end-to-end delay. The proposed strategy outperforms the other single-hop and multihop strategies in terms of performance. The average energy usage per bit is kept as low as possible.

G.Mehmood et al.[5],[6] discussed about an energy-efficient and cooperative fault-tolerant communication approach for wireless body area networks and in this paper identification of faults and communication approach towards network lifetime is discussed

To handle the drawbacks of "M-ATTEMPT", Ahmad et al.{14] developed the notion of "RE-ATTEMPT," a thermally unaware routing strategy "Reliability-Enhanced Adaptive Threshold-Based Thermal Unaware Energy-Efficient Multihop Protocol (REATTEMPT)." RE-ATTEMPT employs a multihop communication paradigm in which the shortest route between sensors and sink nodes is selected. In this approach, sensor nodes exchange HELLO messages to discover all accessible routes. When a current path is unavailable, it chooses a less-than-ideal alternative to ensure reliable transmission. Because of limited number of forwarder nodes, this strategy can avoid relaying of unnecessary traffic. On the other hand, direct communication with the sink is not the best solution

Quwaider et al.[21} developed on-body store and flood routing (OBSFR) is proposed on-body packet routing technique for wireless body area networks that provides improved routing time and hop count. The proposed protocol employs an opportunistic forwarding strategy depending on node distance from the on-body sink node. Furthermore, the end-to-end packet delay, number of packets per transmission, and packet delivery ratio are checked and compared to existing routing protocols.

S.Nepal et al.[17] discussed that fault tolerance is also an important issue, which means that how to maintain network operations without faults and failures, and recover failed nodes. In a resource constrained WSNs, fault-tolerance is highly important because the deployed sensors are battery operated and have a limited battery lifetime.
Given the importance of network lifetime and battery lifetime and to keep the network activity as long as possible the need to arose to propose and develop an improved EA-RAP MAC protocol which extends the battery life enhancements.

III. PROBLEM FORMULATION

The MAC layer is responsible for coordinating channel accesses, by avoiding collisions and scheduling data transmissions, to maximize throughput efficiency at an acceptable packet delay and minimal energy consumption. The 802.15.4 MAC [2] is intended to serve a set of applications with very low power consumption and cost requirements, though with relaxed demands for data rate and Quality of Service (QoS). In the literature, it is already possible to find some publications in relation to wireless BSNs in healthcare systems [19], such as [3], [4], where the authors performed an evaluation analysis of 802.15.4 [2] under medical settings. It was pointed out that the scalability of 802.15.4 is not a given feature, since the current 802.15.4 MAC design does not support a high sensor density area and its use is extremely restricted under interference scenarios. Simulation results in [5] confirm that the 802.15.4 MAC is energy efficient in controlled environments, (i.e. without interference), but it fails in supporting QoS in co-existing scenarios, which is a serious issue for medical applications. Human monitoring BSNs must support high degrees [20][21] of reliability under specific message latency requirements, without endangering sensor power consumption to avoid frequent battery replacements. The fact that the 802.15.4 MAC does not fully satisfy BSN requirements highlights the need for the design of new scalable MAC solutions [22]. These guarantee low-power consumption to all different sorts of body sensors while ensuring rigorous QoS under co-existent scenarios in healthcare systems.

EA-RAP System Model

In the proposed EA-RAP MAC Protocol shown in Fig.2 utilizes the two common logical distributed queues CRQ and DTQ, for serving access requests (via the "access mini slots") and data packets (via the "data slot") respectively. However, instead of keeping a first-come- first-served discipline in DTQ, a cross-layer fuzzy-rule based scheduler is introduced in the EA-RAP system model as depicted. The use of the scheduler permits a body sensor, though not occupying the first position in DTQ, to transmit its data in the next frame collision-free "data slot" in order to achieve a far more reliable system performance. Practically speaking, this is obtained by integrating a fuzzy- logic system in each body sensor in the BSN. As explained, a fuzzy-logic approach allows each particular body sensor to individually deal with multiple cross-layer inputs of diverse nature (i.e. x_1, x_2, to x_k) and react accordingly to demand.

IV. PROPOSED MAC PROTOCOL

For patient monitoring, improvement of battery life time of body sensors is mandatory keeping reliable, message delivery and diminished packet delay. Fuzzy logic can be incorporated in each body sensor to deal with multiple cross layer input variables. Wireless body area networks must be resilient against regarding changes in network topology.
A novel MAC protocol model with energy sensitive radio activation policy to meet medical requirements under Body Sensor Networks (BSNs) is proposed. Cross layer fuzzy scheduling is used in the proposed model to improve quality of service. Energy Aware Radio Activation Policy (EARAP) based MAC is developed over traditional MAC Control.

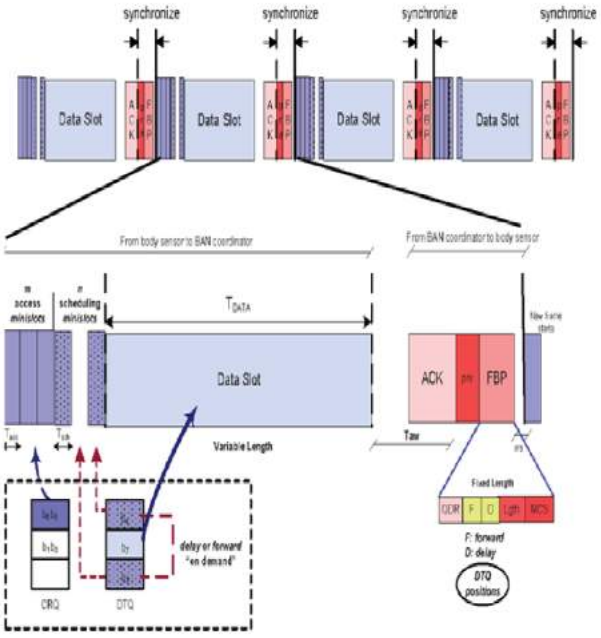

Fig: 2 – EA-RAP MAC Model

Instead of keeping a first-come first served discipline in DTQ module, cross layer fuzzy rule based scheduler is incorporated in the DQBAN logic system. The scheduler permits a body sensor (if not occupy first position in DTQ) to transmit data in the next collision free data slot to achieve greater reliability. Fuzzy Logic (FL) permits each body sensor to deal with multiple cross layer inputs of

diverse nature [X_1 , X_2,……X_k] and react according to demand or refuse.

PROPOSED CROSS-LAYER FUZZY LOGIC SCHEDULER

The main objective is to optimize MAC layer performance in terms of QOS and energy management by application of fuzzy rules. Instead of keeping a first come-first served discipline in DTQ, a cross layer fuzzy rule based scheduler is used. This scheduler shown in Fig.3 allows sensor not occupying the first position, to transmit the data in the next collision free "data slot" for achieving higher reliability by having FLS in each sensor. Fuzzy logic allows each sensor to individually deal with multiple cross-layer inputs of diverse nature such as X_1 , X_2,……X_k and react according to demand or refuse the next frame data slot.

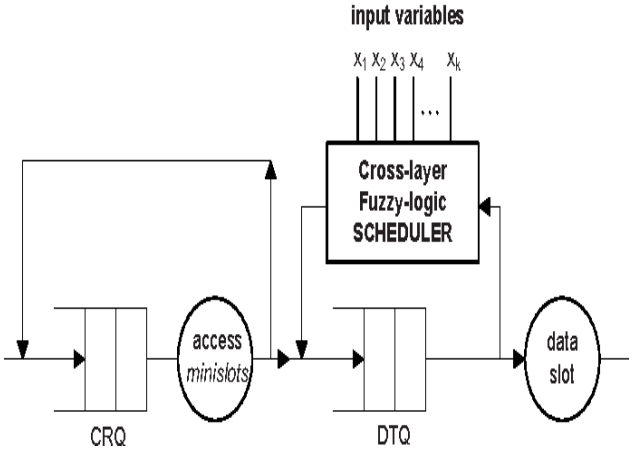

Fig: 3 - Cross-Layer Fuzzy-Logic Scheduler

Cross layer constraints cover PHY signal quality, packet waiting time, residual battery lifetime, choice of next frame, collision free data slot through scheduling of mini slots. FLS provides a non-linear mapping of input data vector into scalar output. FLS has fuzzifier, fuzzy rules, inference engine and defuzzifier. The defuzzifiers are not required as sensors use unique linguistic variable of decision. The inputs to the proposed scheduler are SNR, Waiting Time (WT), Battery Life (BL) and Choice factor, the signal to noise ratio is derived from bit error rate, WT_{MAX} and BL_{MIN} are the other important inputs.

FUZZY LOGIC CONTROLLER

Fuzzy Logic Control (FLC) system is fuzzy theory based systems. This set theory is advanced version of classical set theory called crisp theory. In crisp set theory, an element may belong or may not belong to a set. But fuzzy set provides a flexible sense of membership of elements to a set. Many degrees of membership, between 0 and 1, are allowed. The membership function is linked with a fuzzy set in such a way that the function provides element by element mapping of the universe of discourse or the reference set to the interval [0, 1]. On the other hand in crisp logic, the truth values acquired by propositions or predicates are two-valued, namely TRUE or False which may be treated numerically equivalent to (0,1). However, fuzzy logic follows multi valued system in which truth values are: absolutely true, partly true, absolutely false very true, and so on and are numerically equivalent to any value in the range 0 to 1. Fuzzy logic allows inclusion of expert knowledge and intelligence in control system. A fuzzy logic system contains sets which are used to categories input data (fuzzification), decision rules that are applied to each set, and a way of generating an output from the rule results (defuzzification). Inference unit is the core of the fuzzy controller. It generates fuzzy control actions by applying the rules in the knowledge base to the current process state. Thus the degree to which each measured value is a member of a given labeled group is determined.

Fuzzy logic controller consists of following blocks:

1. Fuzzifier: Converts the crisp input to a linguistic variable
   using the membership functions stored in the fuzzy knowledge base.
2. Knowledge data base: The rule base and the data base are
   jointly referred to as the knowledge base.
   a. Rule base: containing a number of fuzzy IF-THEN rules;
   b. Data base: it defines the membership functions of the
   fuzzy sets used in the fuzzy rules.
3. Fuzzy inference system: Fuzzy inference (reasoning) is the
   actual process of mapping from a given input to an output
   using fuzzy logic.
4. Defuzzifier: Converts the fuzzy output of the inference
   engine to crisp using membership functions analogous to
   the ones used by the fuzzifier.

FUZZY INFERENCE METHODS

The most important two types of fuzzy inference method are Mamdani and Sugeno fuzzy inference methods. Mamdani fuzzy inference is the most commonly seen inference method. This method was introduced by Mamdani and Assilian (1975). Another well-known inference method is the so-called Sugeno or Takagi-Sugeno-Kang method of fuzzy inference process. This method was introduced by Sugeno (1985), and called as TS method. The main difference between the two methods lies in the consequent of fuzzy rules.

Mamdani Fuzzy Models: To compute the output of this Fuzzy Inference System(FIS) given the inputs, six steps has to be followed.

1. Determining a set of fuzzy rules
2. Fuzzifying the inputs using the input membership functions

3. Combining the fuzzified inputs according to the fuzzy rules to establish a rule strength (Fuzzy Operations)
4. Finding the consequence of the rule by combining the rule
strength and the output membership function (Implication)
5. Combining the consequences to get an output distribution
(aggregation)
6. Defuzzifying the output distribution (this step is only if a
crisp output(class) is needed).

FUZZY INFERENCE SYSTEM(FIS)

The fuzzy controller module shown in Fig.4 represents the core of the proposed approach, which is fuzzy inference system(FIS).The proposed FIS is designed based on the Mamdani model, which consists of three units: fuzzifier, inference engine, and defuzzifier. The FIS has two inputs and one output. The inputs represent the Signal to Noise Ratio (SNR) and Waiting Time in the network. The output of the FIS determines the battery life suitable that should be used by the application. The system performance was evaluated under different scenarios with varied network conditions. The inputs and the output are the fuzzy variables of the FIS, which are represented by their corresponding fuzzy sets, fuzzy logic rule base for proposed MAC is shown in Table-1. For low cost of implementation and power requirements triangular and trapezoidal memberships are selected to model the fuzzy sets of the FIS variables. These linear shapes were selected because they provide the adequate representation of the expert knowledge and at the same time simplify the computation time significantly; this was used in order to make the proposed FIS generic and suitable for any network scenario.

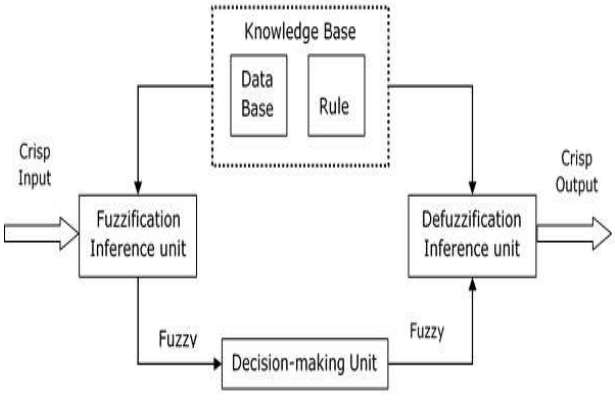

Fig: 4 - Fuzzy Inference System

The fuzzifier module in the FIS converts the crisp values of the inputs to the corresponding fuzzy sets. In this stage, membership functions are applied to the inputs to specify the degree of membership for the input crisp values. The next step is to take fuzzified inputs and apply them to the system fuzzy rule base. Each fuzzy rule base is represented as IF-THEN statement. If there are more than one input in the antecedent part of the IF statement, the fuzzy sets of the corresponding inputs are combined together using the 'AND, OR' operators, and the output of the fired rules is aggregated to a single fuzzy set. The last step in the FIS is the defuzzification by which the aggregated output set is converted into a single numerical value representing the output of the system. In order to design Fuzzy Inference System (FIS) the following steps are used:

1. Input parameter taken are (i) SNR (ii) Waiting Time
2. Member ship functions are assigned to the variables. Rule
based design depending on two input parameters are
depicted in the Table-I. The rule base in a fuzzy system
takes the form of IF-AND-OR, THEN with the operations
AND,OR etc…

TABLE-I: FUZZY LOGIC RULE BASE FOR PROPOSED MAC PROTOCOL

S.No	Signal to Noise Ratio(SNR)	Fuzzy Connection	Waiting Time	Battery Life
1	Very Low	AND	Low	Low
2	Medium	AND	Medium	Medium
3	Low	AND	Low	Low
4	Medium	AND	Medium	Low
5	High	AND	Medium	High
6	Very High	AND	High	High
7	Very High	AND	High	Very High
8	Very Low	OR	Low	Low
9	Low	OR	Medium	Medium
10	Low	OR	High	Medium
11	High	OR	High	Medium
12	High	OR	High	High
13	High	OR	High	High
14	Very High	OR	High	High
15	Very High	OR	High	Very High

V. EXPERIMENTAL RESULTS & ANALYSIS

In this section, we present the experimental results of our proposed MAC against various studies using MATLAB simulation using FL approach is shown in Fig.5. The metrics used to evaluate performance of the protocol are SNR, Waiting Time and Battery Life

with membership functions are shown in Fig.6, Fig.7 and Fig.8. The overall evaluation of the proposed MAC is carried out by employing fuzzy logic scheduler with radio activation policy based on energy-aware requirements is shown in FLS rule editor for battery (OR & AND) shown in Fig.9 and Fig.10.In our investigations shown in Fig.11, Fig.12, Fig.13 it was identified that if a body sensor rums out of battery, its replacement is done automatically without effecting the network under operation. In the experimental investigations parameters like waiting time, Bit Error Rate, battery life time with varied SNR values of 21.6, 39.2 and 45.2 is 24.1, 25.9 and 27.6 days is observed, which gives better performance for proposed EA-RAP MAC protocol. The surface view of battery FIS characteristics are shown in Fig.14, Fig.15, Fig.16 and Fig.17. In Fig.18 simulation result for proposed EA-RAP MAC is shown in terms of Bit Error Rate (BER) versus Number of sensor nodes, In particular at node 2, 7 and 8 the BER for improved EA-RAP MAC was 0.474,0.455 and 0.421, BER for existing EA-MAC was 0.482,0.465 and 0.464 respectively. For increased SNR of 45.2,EA-RAP MAC gives increased battery life of 662.40Hours whereas for existing EA-MAC battery life of 506.25Hours.In this way, the proposed improved MAC outperforms the existing strategy providing network functioning the longest.

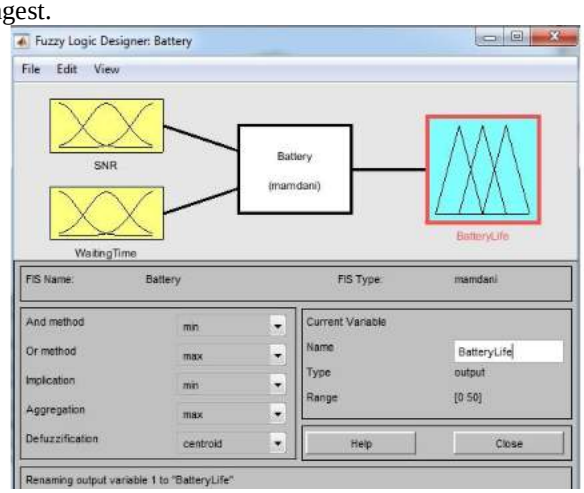

Fig:5- MAMDANI Model for Fuzzy Decision

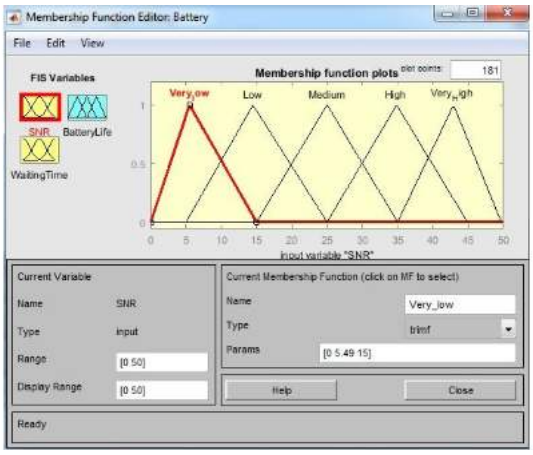

Fig: 6 - Membership function of SNR

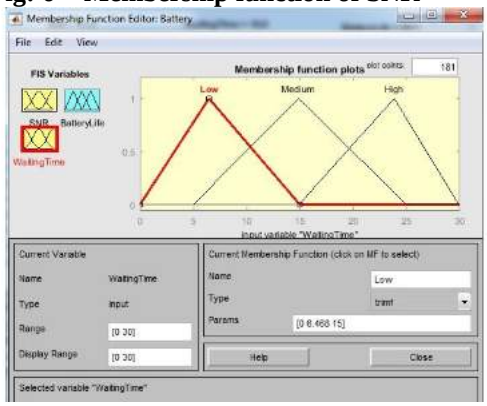

Fig: 7- Membership function of Waiting Time

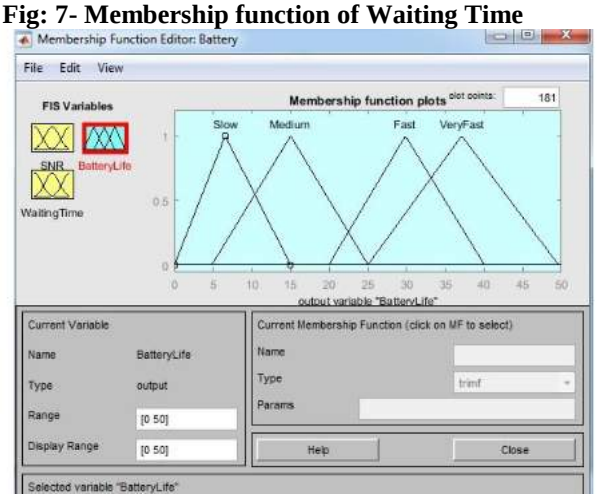

Fig: 8 - Membership function of Battery Life

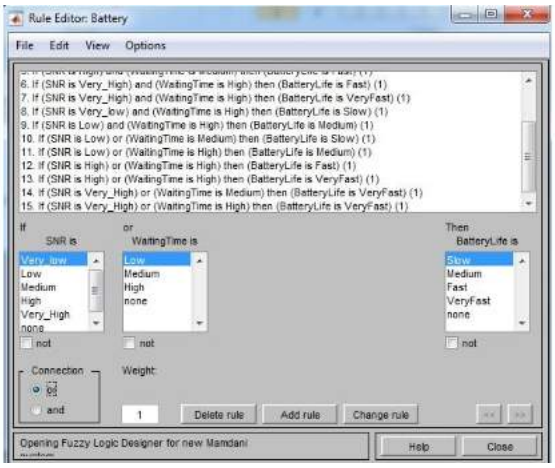

Fig: 9 - FLS Rule editor for Battery (OR connection)

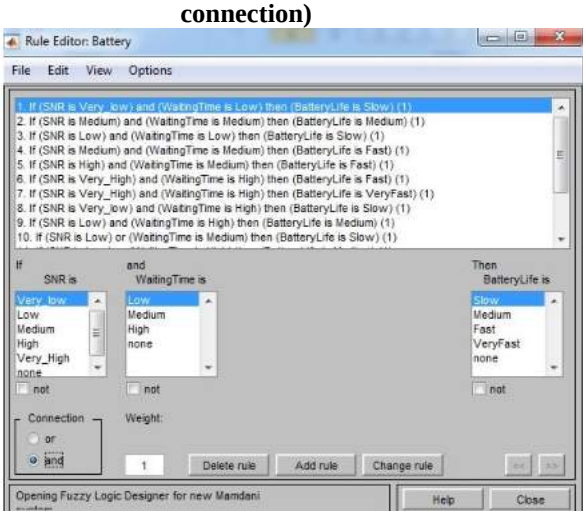

Fig: 10 - FLS Rule editor for Battery (AND connection)

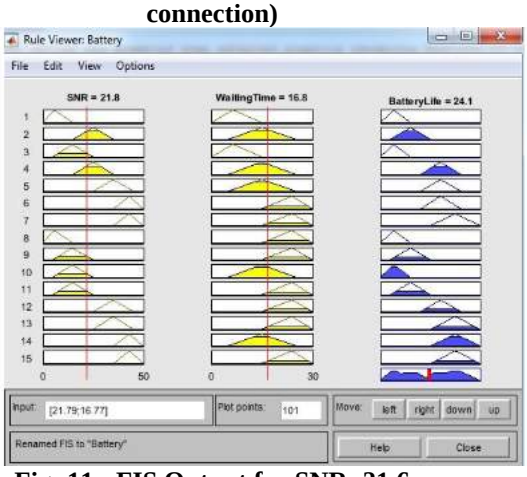

Fig: 11 - FIS Output for SNR=21.6

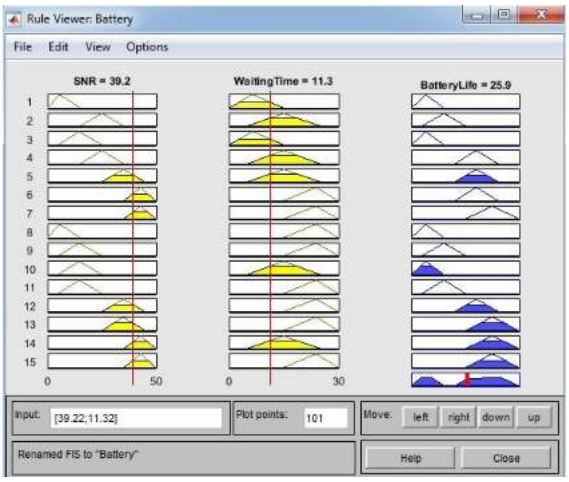

Fig: 12 - FIS output for SNR=39.2

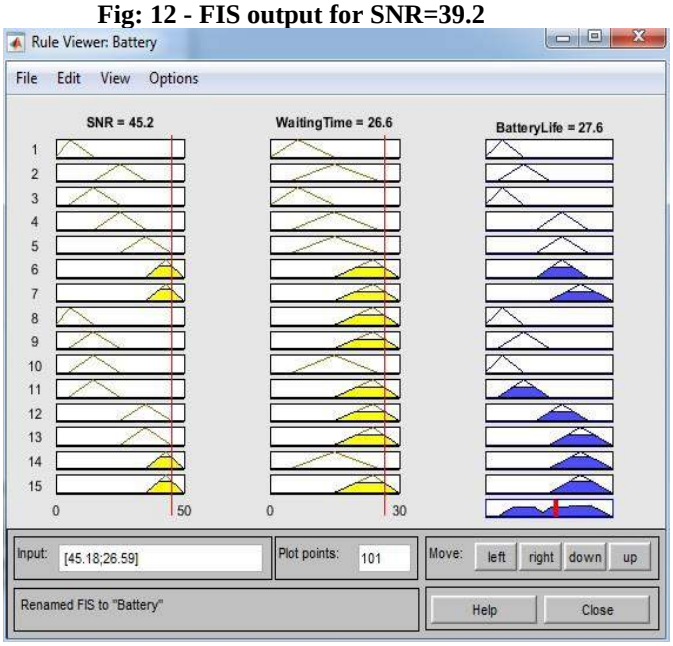

Fig: 13 - FIS output for SNR=45.2

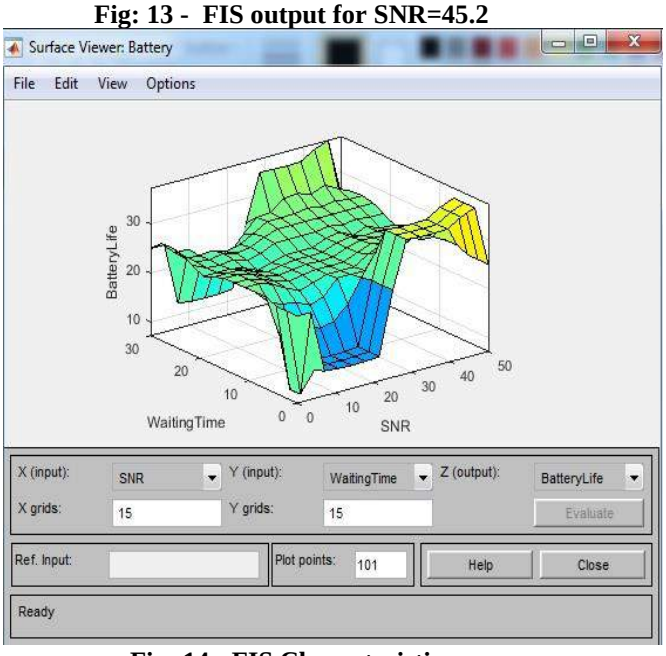

Fig: 14 - FIS Characteristics

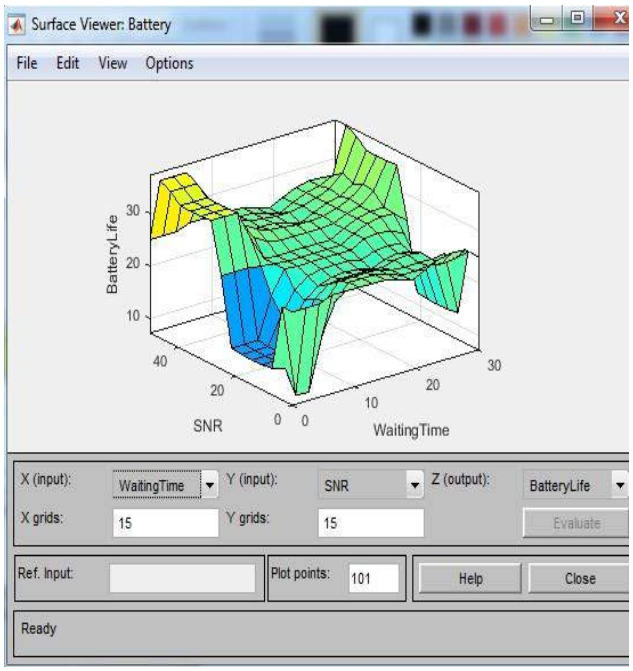

Fig: 15 - FIS Characteristics

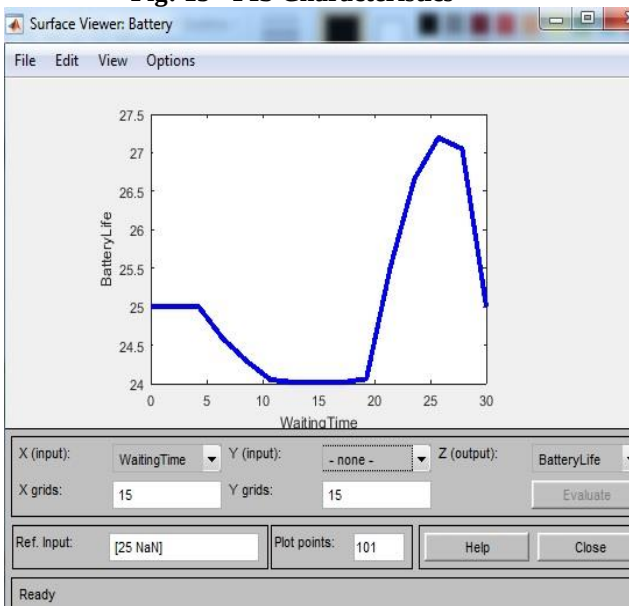

Fig: 16 - FIS Characteristics

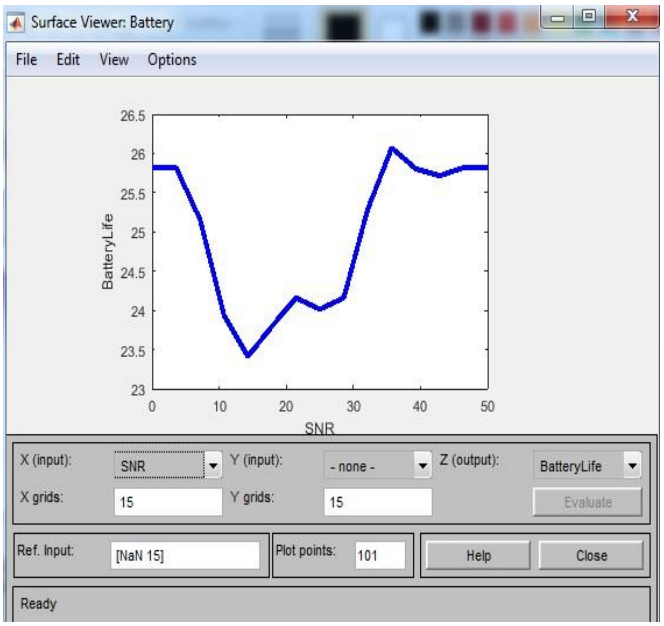

Fig: 17 - FIS Characteristics

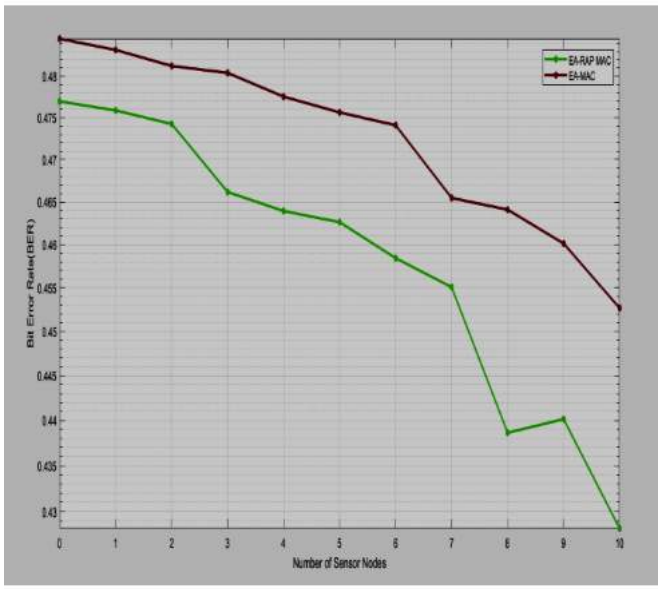

Fig: 18 - BER Vs Number of Sensor Nodes

VI. CONCLUSION

This paper addressed important research issues for Wireless Sensor Networks in healthcare scenario which are waiting time, SNR and battery lifetime. These issues are very important for successful deployment of WSNs because the frequent change of a battery life will impede the success of body sensor nodes. In this paper main focus is on waiting time, low Bit Error Rate, battery life time with varied SNR values of 21.6, 39.2 and 45.2 is 24.1, 25.9 and 27.6 days which gives better results for proposed EA-RAP MAC protocol. The simulation results show that the proposed EA-RAP scheme outperforms as compared with EA-MAC. Further work will be carried out in

future to analyze the battery life time of sensor network for different noise and interference conditions in health care scenario.

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Circularly Polarized 2 × 2 MIMO Antenna for 5G Applications

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***Abstract*:-- A flexible single band frequency circularly polarized multiple input multiple output (MIMO) antenna is designed with a low loss material RT Duroid 5880 as the dielectric substrate. The radiating patch having a thickness of 0.035 *mm* is made up of copper. To achieve circular polarization a single coaxial feed technique is used. On radiating patch a cross slot is provided which is helpful in increasing bandwidth and reduce patch size. The simulation is carried out on HFSS. The simulation results exhibits impedance bandwidth around 250 MHz with central frequency 3.5 GHz. The gain achieved of the planned MIMO antenna is more than 6 dB. An envelope correlation coefficient (ECC) of 0.1. Channel capacity loss (CCL) of 0.3bit/s/Hz The mean effective gain (MEG) is about 0.4 dB.. The isolation is below than -20 dB. Total active reflection coefficient (TARC) of -9. It has good radiation directivity. The proposed MIMO antenna having dimensions 128 × 128 × 1.6 mm^3. This antenna can be useful for 5G applications.**

Index Terms : Circular polarization; coupling, MIMO, isolation, 5G technology

I. INTRODUCTION

5G communications systems are likely to provide certain Gbps data rates to multiple users with minimum latencies. In MIMO technology multiple antennas are used at transmitter and receiver side. Such multiple antennas improved channel capacity and signal to noise ratio. Multiple data streams are delivered utilizing the same frequency and time resources called as spatial multiplexing. It also support growing data traffic with great constancy. To combat the multipath propagations inside the buildings and a poor coverage area, 5G networks need a variety of smart antenna types [1]. With the help of intelligent beam forming antennas operating at higher frequencies and with a wider signal bandwidth [2]. In Wireless Communication losses such as rain, fog interference can be reduce by using circularly polarized antenna because of multipath reflection effects [3]. [4] Presents a USB dongle antenna which is work on 3.5 /5.5 GHz (MIMO) antenna with dual-band. In [5-7] The MIMO antenna system for WBAN wearable applications has been investigated. The pentagonal patch of CP 4×4 MIMO antenna with a unique form were described [8]. In [9], authors reported Pattern Diversity MIMO Antenna System with for cellular applications. Future 5G indoor systems explained with the help of antenna for multilayer base station which operating at 3.5 GHz was investigated [9].

This paper presents four-element MIMO antenna which resonate at 3.5 GHz single band. A circular patch of radius 15.7 mm is designed. A cross slot is provided on circular patch in ordered to increase bandwidth. A designed 2 × 2 CP MIMO antenna attain total gain around 6.2 dB and impedance bandwidth of 250 MHz. Proposed design has size of 128×128×1.6 mm^3. The CP radiation is achieved with coaxial feed method. An antenna with CP has a better gain and a coaxial feed for impedance matching

II. MATHEMATICAL FORMULATION

To design a patch antenna there is only one degree of controllability that is radius of each patch. The effective radius a_e is taken into account since the fringing makes the patch electrically larger. Equations 1 to 4 can be used to calculate a_e

$$a_e = a + \Delta a \quad (1)$$

$$a_e = a\left\{1 + \frac{2h}{\pi a \varepsilon_r}\left[In\left(\frac{\pi a}{2h}\right) + 1.7726\right]\right\} \quad (2)$$

Therefor the frequency of resonance for the dominating mode TM^z_{110} can be express (Including fringing)

$$fre_{110} = \frac{1.8412\vartheta_0}{2\pi a_e \sqrt{\varepsilon_r}} \quad (3)$$

Here $\vartheta_0$is light velocity in free space.

Specify known parameter dielectric constant ε_r , height of substrate h cm, the resonant frequency f_r in Hz

Actual patch radius can be calculated

$$a = \frac{F}{1+\frac{2h}{\pi F \varepsilon_r}\sqrt{\left[In\left(\frac{\pi F}{2h}\right)+1.7726\right]}} \quad (4)$$

Where $\frac{8791\times10^6}{f_r\sqrt{\varepsilon_r}} = F$

III. ANTENNA GEOMETRY AND DESIGN

a. Design of single Patch Antenna

The fatness of the substrate is 1.6 mm, and the loss tangent is equal to0.0004. The radius of the upper copper patch is 15.7 mm, and a cross gap perpendicular to it is 10 mm long and 2.2 mm broad. The feed position is 5.6 away from the feed point, which is fed by 50- coaxial lines.

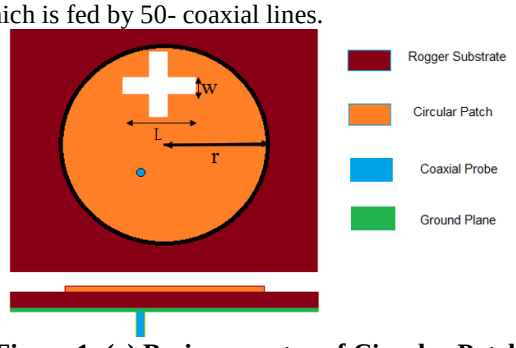


Figure 1: (a) Basic geometry of Circular Patch With r = 15.7 mm, L= 10 mm, W= 2.2 mm

b. Design of The 2 × 2 MIMO Antenna

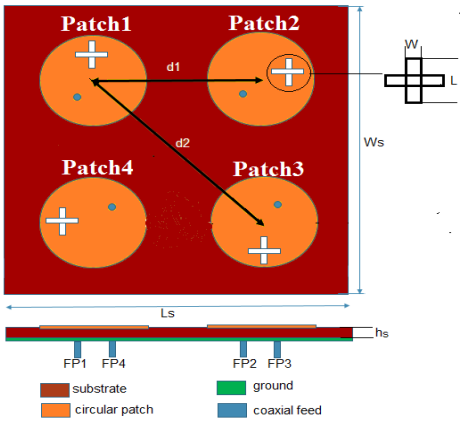


Figure 2. The 2 × 2 MIMO antenna

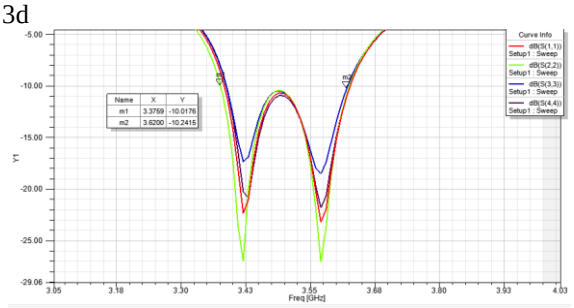
4 CP elements make up the proposed antenna (Figure 2). The dimension of the substrate is 128 × 128 mm^2.

IV. SIMULATION

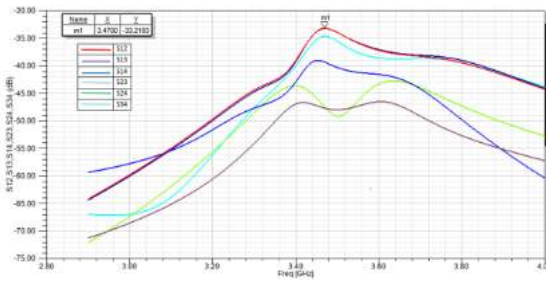
The antenna is simulated using HFSS over the resonant frequency 3.5 GHz.

Simulated impedance bandwidth is 250 MHz. at central frequency 3.5 GHz as shown in figure 3a.

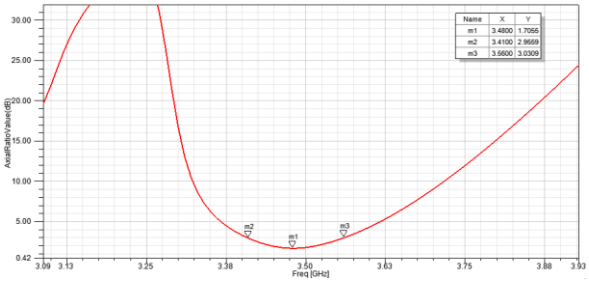
The elements along diagonal (spread out by 0.8717 λ_0) with same CP and adjacent elements (spread out by 0.25 λ_0) with unlike CP. Elements (patch 2 and patch 4) have RHCP, elements (patch 1 and patch 3) have LHCP. The simulated isolation is greater than 30 dB .presented in graph 3b. The achieved AR value is 1.0766 dB, and the AR bandwidth is 150 MHz as shown in figure3c. The impedance bandwidth is greater than the AR bandwidth in patch antenna. The total gain is observed to 6.38 dB displayed in figure 3d



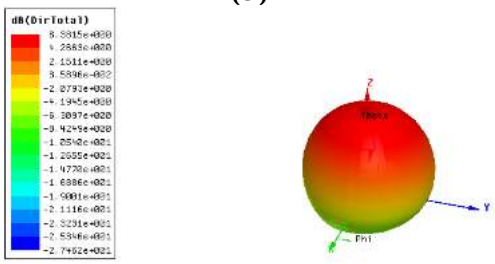
(a)



(b)



(c)



(d)

Figure3 Simulated (a) Retun loss (b) Isolation (c) Axial ratio (d) Total Gain

5. MIMO ANTENNA VERIFICATION AND DEBATES

(a) Forward-facing view (b) Back view

Figure4. Photograph of the invented antenna

The simulated and measured S11 parameter of patch 1 is displayed in figure 5. It is observed that impedance bandwidth is about 250 MHz. Figure 6 illustrates the simulation and measured mutual coupling (S_{12}, S13, and S14) among the antenna elements.

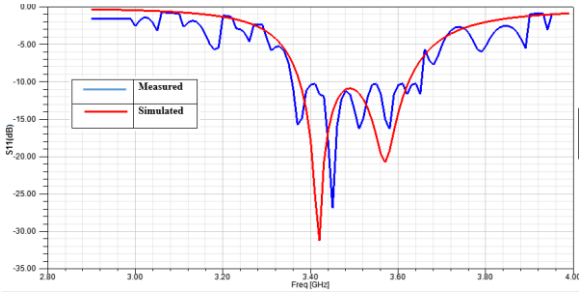


Figure5. Simulated and measured S11 of patch1

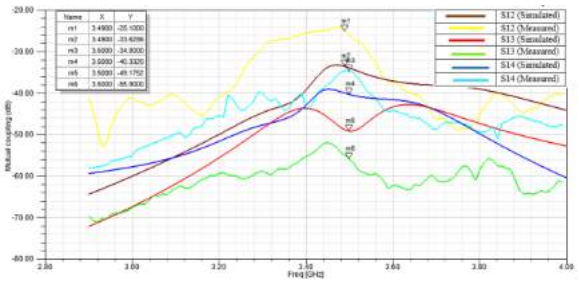


Figure6. Simulated and measured Mutual Coupling (S_{12}, S_{13}, S_{14})

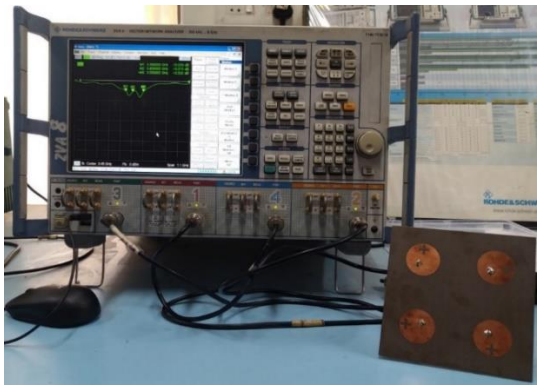


Figure 7. Experimental set up (VNA (ZVA8 0 - 8 GHz)

Figure7 depicts the experimental configuration. Calibrated 4 – port VNA (ZVA8, 0 - 8 GHz) is used for the measurement of antenna parameters. Patch1's measured return loss at 3.5 GHz with a 250 MHz impedance bandwidth shown in figure 5 and isolation between the patches below - 26.28 dB is shown in Figure 6.

V. CONCLUSION

The designed CP MIMO antenna with four ports is suggested for applications in 5G domain in this paper. The four radiating components of the suggested design for 3.5 GHz as the resonant frequency. The MIMO antenna is 128 x 128 x 1.6 mm^3 in total. Antenna output indicates DG > 9.5714 dB. Therefore, based on the results so far, we can conclude that the developed MIMO antenna has enough features to meet 5G-application requirements.

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Modality and Effectiveness of Delivering Instruction through Mobile Teaching as an Alternative Teaching-Learning Tool in the New Normal: Basis for Enhancing Responsiveness of Faculty in the SUCs

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Abstract:-- **This descriptive research determined the modality and effectiveness of delivering instruction as an alternative tool in the new normal. The results served as basis for determining the responsiveness of the Faculty in the State and Universities and Colleges in Northern Iloilo. Results revealed that most of the faculty were using a combination of modular and online learning modality. The faculty sent modules and followed up through online discussion, and also sent and retrieve modules through online, utlized several devices such as cellphone, laptops and tablets. Likewise, faculty conducted lessons through online twice a week, and the time allocated for the discussion depended on the allocated schedule provided by the program chairs. Moreover, the flexible learning was evaluated by the faculty as moderately effective and absorption rate of the learners were also described as less than 50%. Learners performance according to the faculty was described as satisfactory, through this they preferred to have a mobile school to visit different houses of the learners for monitoring and follow up. The faculty were also willing to be assigned as mobile teachers however, the limitations identified were more on the sustainability of the project in terms of financial aspect, facilities and manpower. Faculty were willing to serve on the best of their capacity and time however, if in terms of financial support if noted to be up to the limit, faculty would decide to eventually not to participate. Finally, the learning modality preferred in terms of mobile learning had a great impact to the learners and the community as well.**

Index Terms : learning modality, effectiveness, mobile teaching.

I. INTRODUCTION

The COVID-19 pandemic had alarmed the whole country in which the most affected agency are the schools both from elementary, secondary, tertiary and even up to graduate education. The impact had brought several adjustments and adaptive measures in order to ensure quality and education is still prioritized. Despite the hang ups and the threats, education in all parts of the world continue to source out measures on how to capture the interest of the learners without being fearful of what is happening around them.

Teachers in all levels had their own initiatives in order to cater the needs of the learners and by reaching out for the support of the parents.

According to Verde and Valero (2021), from March to September 2020, due to the declaration of a State of Alarm by the National Government, the educational centers could not be opened, and they had to optimally adapt to this fact.

In such, each educational center had to base its teaching on the online mode and to adapt teachers and students to this new reality: videoconferencing software was used to avoid social disconnection, students were disoriented, ignorance of new tools had to be overcome to teach classes, and the evaluation systems need to be redesigned. The pandemic revealed the shortcomings of educational institutions, mainly about the infrastructures and the training of teachers in the Information and Communication Technology (ICT) tools. However, it also meant improvements. The teachers were trained in new

online methodologies and showed interest in learning new teaching tools in the face of the new reality and challenges that arose.

To answer the undelighted questions and queries of the parents, on how education can be conducted, several ways were planned and done. Thus, the institutions come up of learning modalities in the new normal, to respond to the educational needs of the learners. Academic freeze was proposed but that was contradicted for the reason that learners had to earn the expected knowledge and assimilated the target competencies for them to become professionals and responsible citizens of the country.

Blended learning or flexible learning was properly introduced and gradually adapted. With this, learners adjusted on their own ways. That is why, this research study basically looked into how the teachers and learners went through with the process and what challenges and feedbacks arise during the implementation.

In as much that the primary purpose is to deliver the knowledge, values and skills to the learners, the tertiary institutions ensure the utilization of different modalities, and through this research investigation it can be outrightly determined its effectiveness in terms of its impact and benefits to the learners and the teachers. Thus, this study.

II. METHODOLOGY

This investigation was carried out with the purpose of describing the modality and effectiveness of delivering instruction through mobile teaching as an alternative teaching-learning tool in the new normal as basis for enhancing responsiveness of faculty in the SUCs. There were 105 faculty members utilized in the study who were further grouped into sex and department. A researcher-made questionnaire was utilized to gather the data. The selection of the faculty were done by purposive sampling through visiting the campus during the schedule of delivery of modules. The first 15 faculty members who were present during the time of the administration of the study was considered in the selection of the respondents.

Table 1 presents the profile of the respondents.

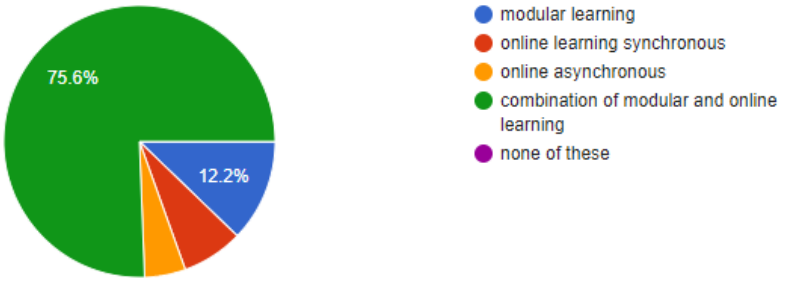
Table 1
Profile of the Respondents

Category	f	%
Sex		
- Male	32	30.47
- Female	73	69.53
Department		
- General Education	78	74.28
- Professional Education/Core Faculty	27	25.72

The study was conducted within the seven campuses of Northern Iloilo Polytechnic State College namely, Ajuy Campus, Barotac Viejo Campus, Batad Campus, Concepcion Campus, Estancia Campus (Main), Lemery Campus and Victorino Salcedo Sara Campus.

III. RESULTS

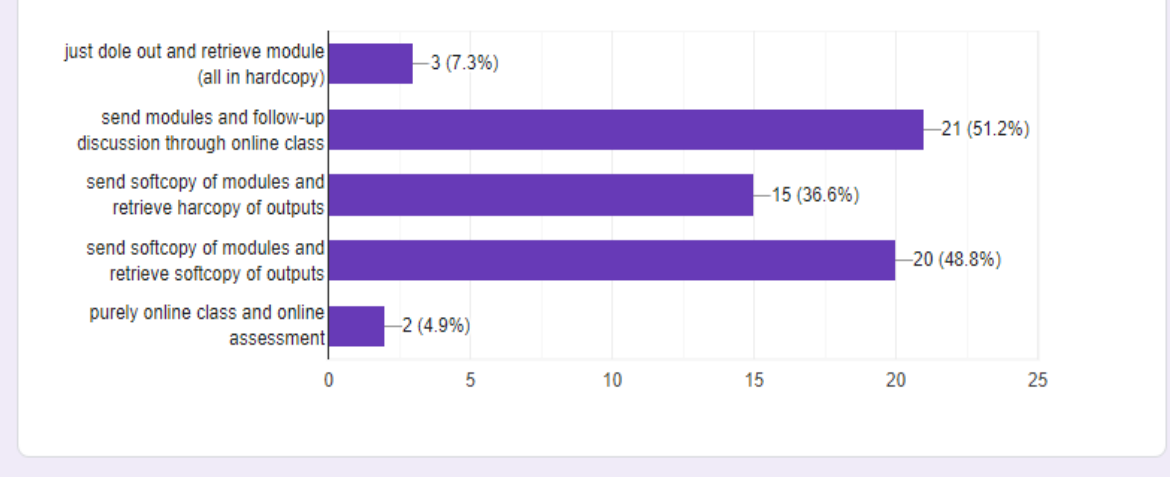
1. What modality do you use in delivering instruction during this pandemic?



The results revealed that 75.6% utilized both modular and online learning or the so-called blended learning modality, 12.5% utilized modular learning; 7.3% used online synchronous learning and 4.9% used online asynchronous learning.

According to Abel (2020), blended learning in the Philippines is still considered new and young. However, this growing demand for blended learning possesses problems and challenges that are noteworthy to investigate, specifically in emerging higher education institutions, which hinder effective and efficient delivery of teaching and learning.

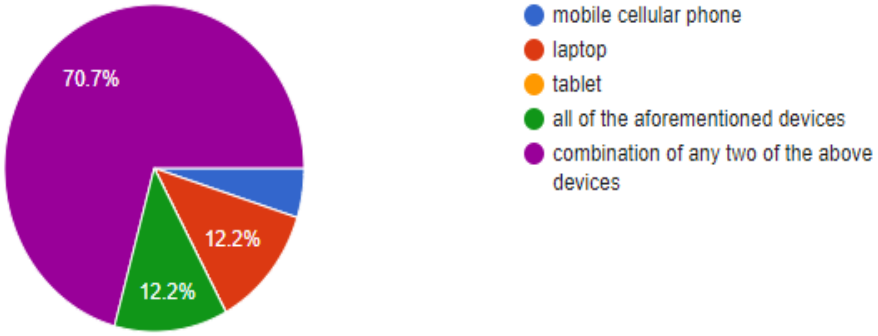
2. What teaching strategy do you usually use in your chosen modality? (Please check all that apply)



As stipulated on the above graph presented how the teachers were able to implement the chosen modality during the conduct of the blended learning. 51.2% of the respondents sent modules and followed up discussion through online class, 48.8% of them sent modules in softcopy and retrieved softcopy of the outputs, 36.6% of them sent softcopy of the modules and retrieved hardcopy of outputs; 7.3% just doled out and retrieved modules all in harcopy and 4.9% purely online class and online assessment.

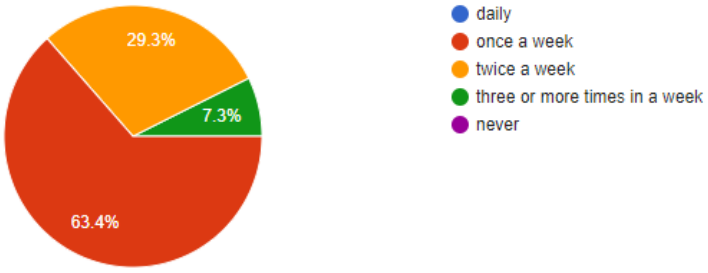
As supported by the study of Aldosemani et al. (2018), it can be construed that ICT is not confined to its functions of delivering high quality data, but it also offers a platform for using variety of instructional tools. This can be further applied and made significant for distance learning, such as in the case of blended-based approach (Rivera, 2017).

3. What teaching device/s are you using?



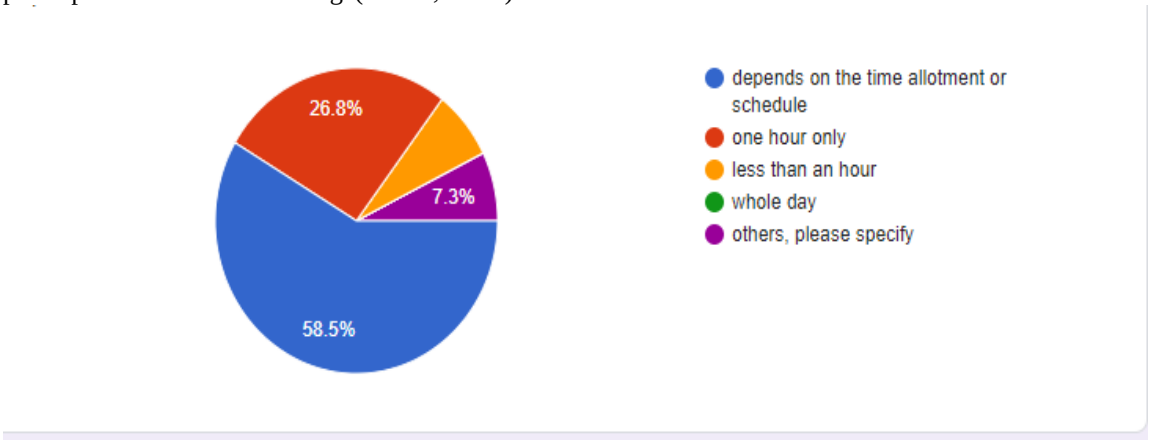
As per investigation made, 70.7% were utilizing more than two devices or a combination of different technological devices like tablet, cellular phone, etc. 12.2% signified that they used laptop and tablets, and only 4.9% used mobile cellular phones. Contradictory to the results in the survey made by Libero, et al (2020), the cell phone, now the most widely used medium in Asia, has major educational implications. Most users, however, do not realize the cell phone's potential for education, nor even for the communication functions for which it was originally designed. Most educators still see the computer and the cell phone as unrelated devices, and the tiny cell phone more as a personal accessory, especially for young people. However, in the case of the institution most of the faculty had been using both the combination several devices.

4. How frequent do you deliver/discuss your lesson to your students?



As shown in the above results, 63.4% deliver or conduct discussion once a week, 29.3% did it twice a week, 7.3% three or more times in a week. It can be noted that the success of e-learning and blended learning can largely depend on students as well as teachers gaining confidence and capability to participate in blended learning (Hadad, 2007). This implies that teachers and learners had to have regular meet up and communication even it is still on flexible be it online or modular in nature to achieve the expected learning to be assimilated by the learners.

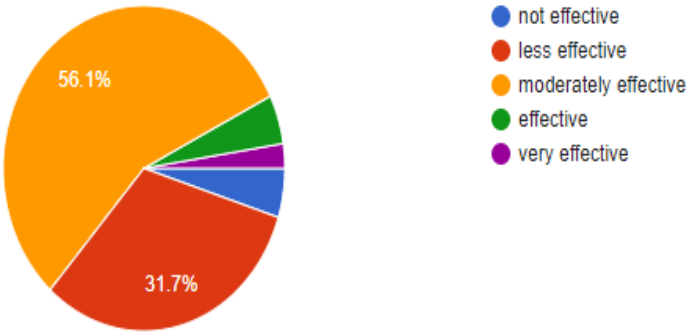
5. How long would you usually spend in discussing the lesson?



During the conduct of the discussion during the online class or even limited face to face, the faculty spent considerable time such that 58.5% depended on the time allotment or schedule, 26.8% conducted one hour only, 7.3% conducted less than an hour or through daily transactions like messenger or calls.

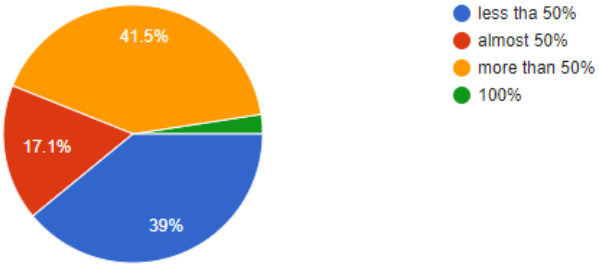
Studies comparing blended learning with traditional face-to-face have indicated that learners perform equally well in blended learning and their performance is unaffected by the delivery method (Kwak, Menezes, & Sherwood, 2013). In another study, learning experience and performance are known to improve when traditional course delivery is integrated with online learning (Stacey & Gerbic, 2007).

6. How do you find delivering instruction this pandemic?



Being confined on the challenges brought about by the pandemic, the respondents evaluated that 56.10% that the delivery of the instruction as moderately effective, 31.7% described it as less effective, 4.9% effective and not effective and 2.4% only described it as very effective.

According to CHED (2020), in the delivery of instruction, flexible learning is learning interventions and delivery of programs with the consideration of the learner's unique needs, that may or may not involve the use of technology. In the Philippines, DL is being offered in two forms: online distance learning (ODL) and modular distance learning (MDL). But most parents and students would prefer ODL, considering and hoping that the interaction between students and the teacher can ensure learning**.**



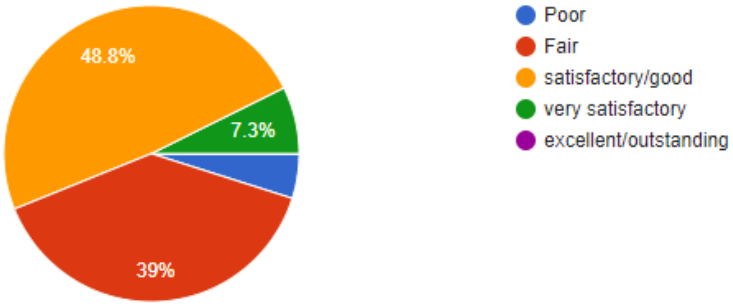
In the absorbance of learning during the learning modality preferred by the learners, the faculty also noticed how the students were able to grasp the lessons, thus, the evaluation on the absorption rate was 41% more than 50%, 39% was less than 50% absorptive rate, 17.7% almost 50% and 2.4% only rated that absorption rate was 100%.

Further supported by Gautam (2020) that the disadvantages of online learning: technology issues, sense of isolation, teacher training, and managing screen time. When she mentioned technology issues, she meant more than just computer or gadget complexity; she also meant poor internet connection. With the pandemic and DL imposed on all students, the quality of internet connections was tested. Sadly, not all students have access to a strong internet connection. Intermittent connectivity may also lead to poor quality of online learning. This may be detrimental to the teaching and learning process.

7. How would you rate the absorption rate of the learners?

In the context of online learning, user satisfaction is described as the degree to which online learning students realize satisfaction in their sole decision to depend on such services and how effectively they fulfill their requirements [Roca JC, Chiu CM, Martínez FJ, 2006].

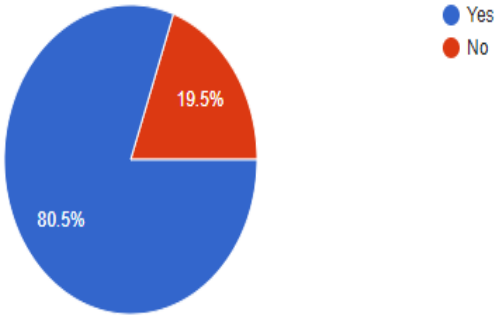
8. How would you evaluate the performance of the learners?



One of the learning impacts of COVID -19 was that the performance of the learners became different as compared to their performance during the traditional face to face classes, that is 48.8% was described as satisfactory, 39% fair performance, 7.3 % had a very satisfactory performance and only 4.9% was poor.

With this, Bijeesh (2021) also mentioned the disadvantages of DL by mentioning the tendency for high distraction. Because students are not in the classroom and are in the comfort of their homes, distractions can't be avoided and may be torn between classes and the desire to listen to music, sleep, or do something else. This can result in poor performance of the students. This challenges teachers to make their lessons engaging, to motivate their students to focus on the lesson.

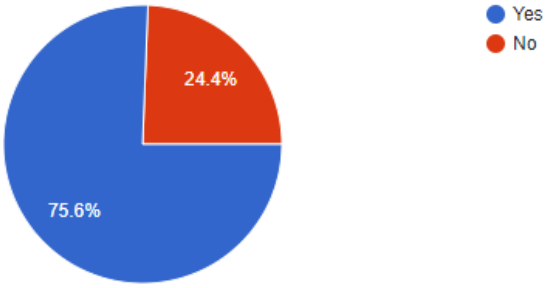
9. If ever given a chance to deliver instruction through mobile school/vehicle, would you recommend this to reach out learners?



Through the discovery and implementation of the learning modality, most of the respondents answered yes to utilize mobile school or vehicle whihc was 80.5% while 19.5% disagreed and did not recommend the use of technology in learning.c According to Crompton et al. (2016), research on it evolved rapidly with the advent of smart handheld devices. Mobile learning or m-learning is an emerging trend of digital learning even before the outbreak of the pandemic.

The research conducted by Jin and Sabio (2018) showed that most learners in chosen public high schools explored meaningful opportunities to utilize mobile devices for a range of learning tasks beyond the classroom environment

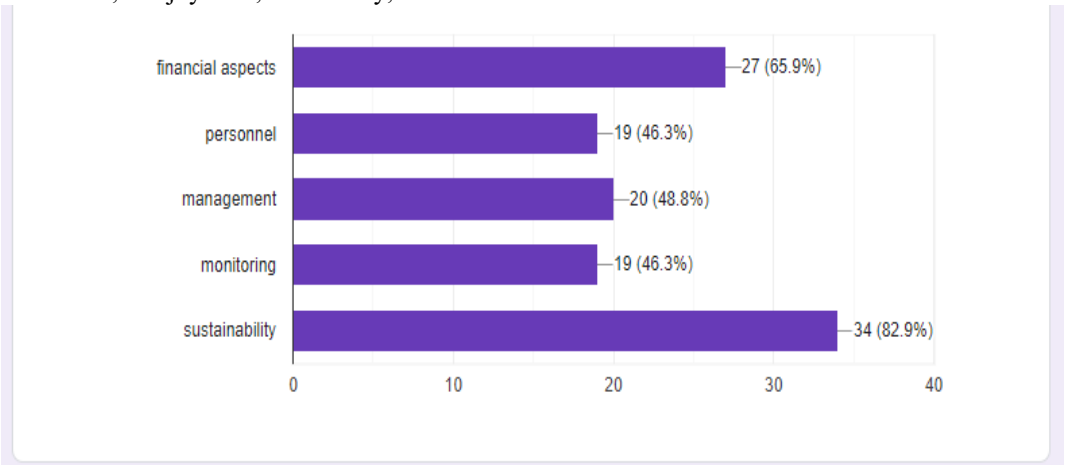
10. Are you willing to be one of the mobile teachers?



In the development of the mobile vehicle as proposed learning modality, 75.6% agreed and only 24.4% do not want to have a mobile school.

In higher education, m- learning plays a central role in creating modern instructional methodologies for students (Bombaes, 2018). He posited that perceived ease of usage, perceived usefulness, enjoyment, creativity, and teachers' influence are the main determinants of the student's attitude towards m-learning. He further added that most of thenational university students utilize m-technology actively.

11. What do you think are some limitations of developing a mobile school or vehicle? Check all that apply.

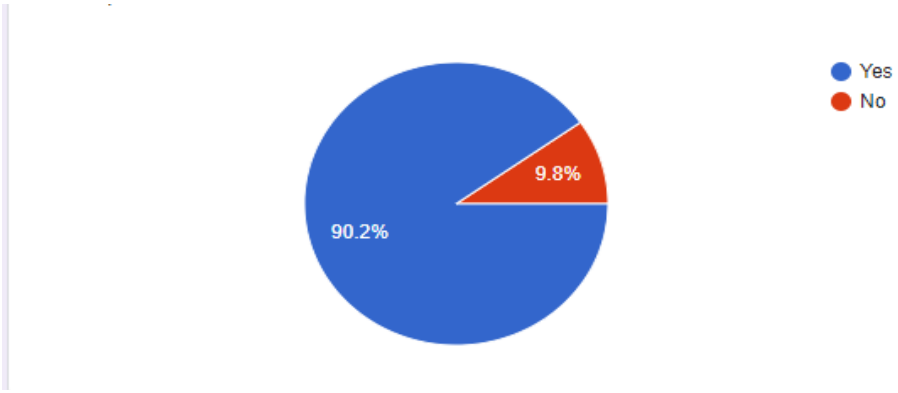


In the new normal, the acceptancec of the newest learning modality is dp hard for the clientele. With this, several factors may hamper its acceptance and so much with its implementation. However, the researchers identified that among the challenges and limitations, 82.9% considered thay sustainability was the greatest challenge, then financial aspects as 65.9%, management (46.8%), monitoring and personnel aspects comprised the 46.3%.

Some of these limitations and constraints apply to specific situations and devices. For example, it has been pointed out that mobile devices of different sizes might encourage learning in different ways (Huang et al., 2012; Quinn, 2012).

Examples of functions through which mobile devices can improve learning include sharing of data and information, accessing relevant information, reading relevant documents, giving a presentation, discussing and brainstorming, and working in an appropriate place through mobile applications (Domingo & Garganté, 2016).

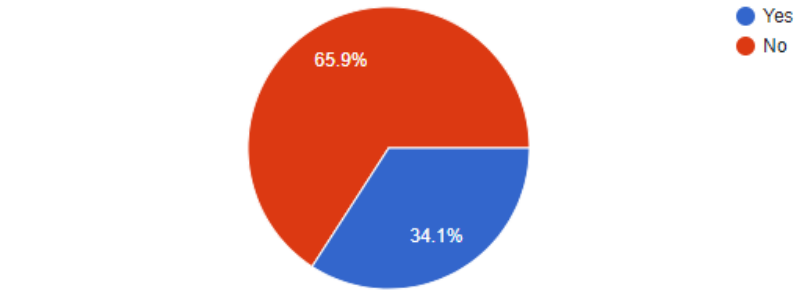
12. Do you think, this would give positive impact to the community?



The respondents agreed that with perseverance, 90.2% said yes and 9.8 % said no.

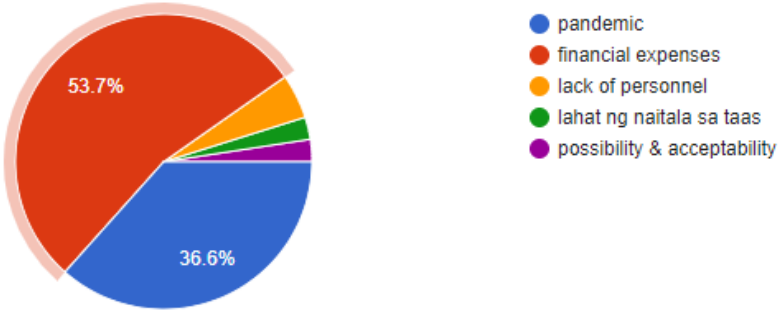
Despite the great development of smart phone programs and applications, and the wide-spread of these devices among students, their use for the educational purposes remains weak.

13. Are you in favor of spending your money just to materialize this purpose?



With this, most the respondents answered 85.9% and 34/1% disagreed to spend money for such purpose.v Many countries, the Philippines included, have shifted from classrooms to online education through online learning platforms. Even governments have promoted mobile learning as an efficient way through which students continue learning. This push has allowed online learning platforms to flourish

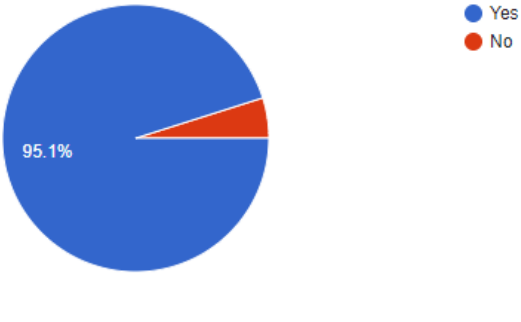
14. What do you think might hinder the implementation of this project?



In the conduct of the traditional face to face learning,as compared to this mobile learning, limitations in its implementation were described such that 53.7% financial aspects, 36.6% due to pandemic, 4.9% lack of personnel, 2.4% for possibility and acceptability which was the same lack of experience.

Although mobile learning is known as a learning channel among people who have technology readiness, the use of this channel requires appropriate infrastructure and the educators to have basic instructional skills (UNESCO, 2011). Many countries, such as China, Singapore, Taiwan, or Malaysia, have been preparing their infrastructure and supporting the use of mobile devices in various domains of the education sector (UNESCO, 2012

15. Do you think that this project be accepted by the community?



The rapid development of mobile technology and higher education student and faculty ownership of mobile devices with Internet access have expanded communication methods, opportunities for collaboration, access to traditional learning, and access to information resources. Innovations in cell phones and other devices allow students to have mobile access to academic email, library staff, podcasts, videos, Internet information resources, course documents, and peer collaboration on projects (Wentzel, P., van Lammeren, R., Molendijk, M., de Bruin, S., & Wagtendonk, A. (2005).

IV. DISCUSSION

The results served as basis for determining the responsiveness of the Faculty in the State and Universities and Colleges in Northern Iloilo. Results revealed that most of the faculty were using a combination of modular and online learning modality. The faculty sent modules and followed up through online discussion, and also sent and retrieve modules through online, utlized several devices such as cellphone, laptops and tablets. Likewise, faculty conducted lessons through online twice a week, and the time allocated for the discussion depended on the allocated schedule provided by the program chairs. Moreover, the flexible learning was evaluated by the faculty as moderately effective and absorption rate of the learners were also described as less than 50%. Learners performance according to the faculty was described as satisfactory, through this they preferred to have a mobile school to visit different houses of the learners for monitoring and follow up. The faculty were also willing to be assigned as mobile teachers however, the limitations identified were more on the sustainability of the project in terms of financial aspect, facilities and manpower. Faculty were willing to serve on the best of their capacity and time however, if in terms of financial support if noted to be up to the limit, faculty would decide to eventually not to participate. Finally, the learning modality preferred in terms of mobile learning had a great impact to the learners and the community as well.

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Adsorption of Methylene Blue and Congo Red onto Granulated Sugar Based Activated Carbon: Equilibrium and Kinetics Study

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Abstract:-- **Activated carbon (AC) that acts potentially as adsorbent was prepared from granulated sugar. AC from granulated sugar was prepared through dehydration process then activated chemically with NaOH for further Congo Red (CR) and Methylene Blue (MB) adsorption. The synthesized AC was characterized through FTIR, BET, SEM and TGA methods. It was found out that the prepared AC contained various functional groups. The functional groups presented were carboxylic acid, free alcohol, NH_2 and SO_3 groups. From SEM characterization method, the prepared AC showed rough surface that would enhance adsorption process. BET on the prepared AC revealed that the activated carbon exhibited type IV isotherm, which consists dominantly of mesopores and micropores as minority. TGA characterization method revealed that the prepared AC was significantly unstable around 100 °C and around 200 °C. The optimum operating conditions for CR and MB adsoprtions were found to be in acidic and basic environments respectively. Moreover, the adsorption equilibriums of both chemicals were best described by Langmuir model with pseudo second order as the kinetics model with the highest correlation coefficients (R^2 > 0.99) for both adsorption processes. Considering the equilibrium and kinetics of synthesized AC, it has potential for waste water treatment application.**

Index Terms : Activated Carbon, Granulated Sugar, Langmuir Equilibrium, Pseudo Second Order

I. INTRODUCTION

Industrial waste is one of the serious problems in the era of industrialization. The industrial revolution, industrial and mining operations have been solved by many problems including industrial waste which may be toxic, flammable, corrosive or reactive. If not managed properly, this waste can have dangerous health and environmental consequences. It is produced at every stage in the process of production, use and disposal of manufactured products.

Liquid waste treatment processes will vary from each waste, however, for aqueous wastes or wastes which are based on water there are some general principles that do apply and which relate to the treatment process. Wastes with high carbon loads (high BOD or COD) will often be treated with a biological process either aerobic or anaerobic depending on the waste. Non-aqueous wastes are treated, recovered for re-use or destroyed depending on the type of the waste. In fact, management of industrial liquid wastes is a very open-ended topic due to the huge variety in types of liquid wastes [1].

The waste from the area varied between solid, liquid and gas according to different kinds of industries. Disposal of these wastes is a big problem affecting the area and its surroundings for longtime. Dumping of these wastes was done randomly in neighboring areas which damaged the natural resources; there are many signs of environmental degradation like soil contamination and health problems which indicate a dangerous situation.

The underlying reason for the waste is not only from the production process but also from survival. Therefore, waste treatment must be carried out as well as possible from upstream to downstream because if this is not done then the threat to pollution will be fatal [2], [3]. The basic problem of handling and managing waste is the lack of knowledge of business actors from small industrial business groups. This later became a justification for the low awareness of small industrial business actors on the management of handling and processing waste.

Activated carbon is a carbonaceous material which is predominantly amorphous in nature and in which a high degree of porosity is developed by the process of manufacturing and treatment. Every activated carbon has a memory which largely depends on the source and the preparation conditions[4]. Activated carbon can be manufactured from virtually all carbonaceous materials. However agricultural wastes offer the most available and cheapest of all the known raw materials. Activated carbon

is inexpensive and hence very widely used adsorbent[5], [6]. This waste can be a renewable source of activated carbon. Several uses are attributable to activated carbon, ranging from removal of undesirable odor, color, taste and other organic and inorganic impurities from domestic and industrial wastewater. The extraordinarily large internal surface and pore volume are developed during the preparation stages. The preparation involves two main steps which are carbonization and activation of the carbonized product. The carbon is usually charred at temperature below 600ºC during the carbonization[7].

It is an amorphous carbon with a surface area ranging from 300-3500 m^2/g and has been treated with steam and heat to have a very strong affinity for adsorbing (adsorption) various materials with a high ability of activated carbon. This is related to the internal pore structure which causes activated carbon to act as an adsorbent. Activated carbon can be used in various fields such as the pharmaceutical and food industries for filtering, deodorization, and taste. Petroleum chemical industry, water purifier, shrimp farming, sugar industry, gas purification, catalyst and fertilizer process[8].

Activated carbon (AC) has been widely used in wastewater treatment for a long time. However, the applications of the AC are limited by the difficulties associated with their regeneration process after usage. Fortunately, the samples in this study could not only be regenerated many times, but also maintained its adsorption efficiency. Herein, highly porous carbon has been prepared from white sugar using acid dehydration method. The prepared carbon was activated in a nitrogen environment which resulted in the formation of the activated sugar-based carbon[9].

The applications of activated carbon in treating dying material in treating waste water has been widely used. Particulaly, Congo Red and Methylene Blue are alternatives in modelling the pollutant in waste water[10][11]. On the other harnd, granulated sugar has been regarded as an available and sustainable source of carbon. It has a short-chain and soluble carbohydrates which can be extracted from most plants, especially sugarcane. Generally, white sugar is obtained from raw sugar through a purifying process to remove the molasses[12].

This research aims to determine the model that fits adsorption process of dying materials in waste water onto granulated sugar based activated carbon to enhance the kowledge and sustainability process of waste water treatment especially in industrial waste water.

II. LITERATURE REVIEW

1. Carbon and Activation

Activated/porous carbon is usually obtained by carbonization of natural or synthetic precursors, followed by activation. During carbonization, the carbonaceous material is thermally degraded in an inert atmosphere, where complete or partial volatilization of the feedstock occurs. Carbon precursors lose their weight due to the removal of functional groups and hetero-atoms. As a result, the carbon content increases. Activation aims to increase the volume and enlarge the diameter of the pores formed during carbonization and create some new porosity.

Activated carbon is the oldest industrially produced adsorbent. Usually activated carbon is used in the production of drinking water and wastewater treatment. Apart from that, activated carbon has significant importance and is used in many applications, such as air treatment and adsorption of organic matter. Activated carbon has also proven to be very effective for the removal of various pesticides, dissolved organic compounds from water and wastewater, and the elimination of heavy metals.

The adsorbent properties of activated carbon are basically attributed to its large surface area, well-developed porous structure, and favorable pore size distribution making the internal surface accessible and increasing the adsorption rate.

The control of the pore size distribution in activated carbon depends on the type of feedstock and the activation method. The manufacture of activated carbon by physical or chemical activation is significant from an industrial point of view.

The preparation of activated carbon itself can be done with two treatments, physical and chemical. Physical treatment involves the carbonization of the raw material alone without oxygen and in the presence of an inert gas followed by activation using an oxidizing agent such as steam, air, carbon dioxide, or a combination. Meanwhile, chemical treatment involves the carbonation of raw materials with activation of dehydration and oxidation of materials such as H_3PO_4, $ZnCl_2$, KOH, and NaOH[13]. The phosphoric acid-activated activated carbon showed that wave numbers were formed in the range of 900-1200 cm-1, this was due to the absorption by the OH, CH, C-OH, and CH2 groups on the glycosyl units in the activated carbon.

2. Saccharides based Activated Carbon

Preparation of activated carbon from molasses has been carried out by impregnation of the precursor with sulfuric acid, followed by carbonization under various conditions (temperature and gas coverage) to optimize the preparation parameters[14]. the samples obtained under these conditions were highly microporous, with a high surface area (≥1200 m2/g) and the maximum adsorption capacities of methylene blue and iodine were 435 and 1430 mg/g, respectively. Effective three-dimensional interconnected silica structure as a template for porous carbon materials could also be used[9].

Mesoporous carbon is synthesized using the carbon precursor sucrose. mesoporous carbon with a surface area

of 850 m2/g, a pore volume of 1.5 cm3/g, and well-connected pores were obtained with a pore size of 3 nm. [15] coated the monolith using polysaccharides (sucrose and dextrose) as carbon precursors, then the activated carbon of the monolith was activated using ZnCl2. [16] used sucrose as a carbon source in the manufacture of mesoporous carbon. MCM-48 silica with various pore sizes was used as a template. [17] in their research study present a simple two-step synthesis pathway to produce a cost-effective high porosity carbon material through the dehydration of white sugar.

Activated carbon is adopted as a material for supercapacitor electrodes for high-power applications. The results obtained are highly porous nanostructured materials for energy storage device applications.[9] reported that high porous carbon was prepared from white sugar using the dehydration method. Then, the carbon is activated in a nitrogen environment resulting in the formation of sugar-based activated carbon. The findings obtained revealed that the pore carbon parameters were considered adequate for adsorption. Furthermore, the resulting carbon is used for adsorption of rhodamine B solution (Rhd B), the maximum adsorption efficiency is about 98.28% and the adsorption capacity is 123.46 mg/g. The results achieved reveal that activated carbon can remove Rhd B in an aqueous solution in a very short time (12 minutes), with an adsorption efficiency of almost 98%.

3. Adsorption

Adsorption is an event of absorption or enrichment of material from a component of a gas/liquid mixture in the interphase region where the material to be separated is attracted by the surface of the solid. The absorbent material is in the form of a solid, the absorbent is only on the surface of the adsorbent. In the adsorption event, the component will be in the interfacial region, but not enter the phase. The component that is absorbed is called the adsorbate (adsorbate), while the area where the absorption occurs is called the adsorbent (substrate).

The adsorption method can be done in two ways, namely static (batch) and dynamic (column). Static method (batch) in which the sorbent is added to a solution containing the desired component. Then stirred for a certain time. Then it is separated by filtering and dynamically (column), where the sorbent is passed through a solution containing certain components, then the components that have been absorbed are released again by flowing the solvent (effluent) according to the smaller volume[18]. While the dynamic method (column) is to pass a solution containing a certain component into a column filled with a certain component, then the component that has been absorbed is released again by flowing the solvent (effluent) according to the smaller volume[19].

One of the adsorption types is physical adsorption. This type of adsorption is reversible, takes place quickly with little heat absorption, the interaction is considered to only produce van der walls forces and occurs in all adsorption processes, and takes place at low temperatures. A dynamic equilibrium reaction can occur if the reaction that occurs is an alternating reaction. The reaction is written with two opposite arrows. The reaction takes place in two directions, namely from left to right and from right to left, the product of the reaction can be returned as the original substance. Reactions never stop because the components of a substance never run out.

The other type is chemical adsorption. It occurs in the form of a chemical reaction, requiring activation energy. The high heat of absorption is due to reactions that form chemical reactions. The absorption time is longer than physical adsorption and is difficult to regenerate. In the event of a one-way reaction, the reactants cannot react again to form the reactants. The reaction proceeds in one direction from left to right. The product of the reaction cannot be returned to the original substance. The reaction only stops when one or all of the reactants are used up. The differences between chemical and physical adsorptions are listed in Table I.

Table I. Physical and Chemical Adsorption Comparison

No	Physical Adsorption	Chemical Adsorption
1	Molecules bounded through Van der Walls force	Molecules bounded through chemical bond
2	Possesss reaction enthalpy -4 to -40 Kj/mol	Possesss reaction enthalpy -40 to – 800 Kj/mol
3	Formes multilayer sheet	Formes monolayer sheet
4	Adsorption happens at adsorbate boiling point	Adsorption happens at high temperature
5	Number of adsorption is function of adsorbate	Number of adsorption is function of adsorbent characteristics and adsorbate
6	Does not involve certain activation energy	Involves certain activation energy
7	Has general properties	Has specific properties

2. Adsorption Mechanism

The adsorption process can be described as a process in which molecules leave the solution and stick to the surface of the adsorbent due to chemistry and physics[20].

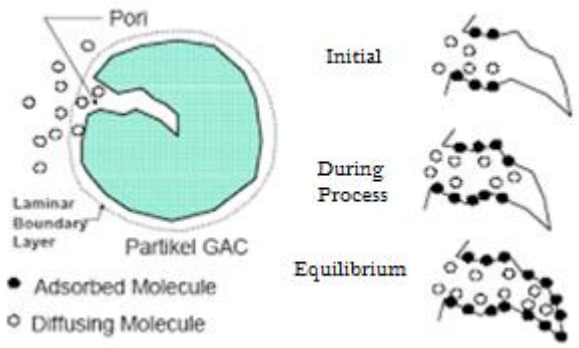


Fig 1. Adsorption Mechanism

The adsorption process depends on the nature of the adsorbing solid, the nature of the atoms/molecules being absorbed, concentration, temperature, and others. The adsorption process is divided into 4 stages, namely[20]:

1. Transfer of adsorbed solute molecules to a film layer surrounding the adsorbent.
2. Diffusion of the adsorbed solute through the film layer (film diffusion process).
3. Diffusion of the adsorbed solute through the capillaries/pores in the adsorbent (pore diffusion process).
4. Adsorption of the adsorbed solute on the pore wall or adsorbent surface (actual adsorption process).

The operation of the adsorption process can be carried out in 2 ways, namely[20]:

1. The adsorption process is carried out in a vessel with a stirring system, where an adsorbent which is usually in the form of a powder is added, mixed, and stirred with water in a building so that there is a repulsion between the adsorbent particles and the fluid.
2. The adsorption process is carried out in a vessel with a filtration system, where the vessel containing the adsorbent media flows with water using a gravity flow model. This type of absorbent media is often used in the form of lumps or granules and the adsorption process usually occurs as long as the water is in the absorbent medium.

3. Factors Affecting Adsorption

There are several factors that affect the adsorption process, namely[21]:

a. Agitation (Stirring)

The rate of adsorption is controlled by both film diffusion and pore diffusion, depending on the degree of agitation in the system.

b. Characteristics of Adsorbent (Activated Carbon)

Particle size and surface area are important characteristics of activated carbon according to its function as an adsorbent. The particle size of the carbon affects the adsorption rate; The adsorption rate increases with a decrease in particle size. Therefore, adsorption using PAC (Powdered Activated Carbon) carbon is faster than using GAC (Granular Activated Carbon) carbon. The total adsorption capacity of carbon depends on its surface area. The particle size of carbon does not affect its surface area. Therefore, GAC or PAC with the same weight has the same adsorption capacity.

c. Solubility of Adsorbate

Soluble compounds have a strong attraction to the solvent so that it is more difficult to adsorb than insoluble compounds.

d. Adsorbate Molecular Size

The adsorption rate on aliphatic, aldehyde, or alcohol usually increases followed by an increase in molecular size. This can be explained by the fact that the attraction between the carbon and the molecule will increase as the size of the molecule approaches the pore size of the carbon. The highest adsorption rate occurs when the carbon pores are large enough for the molecules to pass.

e. pH

Organic acids are more easily adsorbed at low pH, while organic bases are effective at high pH.

f. Temperature

The adsorption rate increases followed by an increase in temperature and a decrease with a decrease in temperature.

4. Adsorption Isotherm

The amount of adsorbate that can be absorbed by the adsorbent is a function of the characteristics and concentration of the adsorbate and temperature. Important properties of adsorbate include solubility, molecular structure, molecular weight, polarity, and hydrocarbon saturation[22]. Generally, the amount of adsorbed material is determined as a function of concentration at a constant temperature, and the resulting function is called the adsorption isotherm. For adsorption in liquid media, the isotherm is obtained by carrying out a batch equilibrium study. For batch adsorption, the solute concentration adsorbed on the adsorbent (solid phase) at equilibrium can be calculated from the material balance equation[23]:

$$q_e = \frac{(C_0 - C_e)V}{m} \quad (1)$$

where qe is the concentration of the solid phase at equilibrium (mg/g), C0 is the initial concentration of the liquid phase (mg/L), Ce is the concentration of the liquid phase at equilibrium (mg/L), V is the volume of liquid (L) and m is the mass of the adsorbent (g).

Some typical isotherms are shown in Figure 2. The linear isotherm indicates that the amount adsorbed is proportional to the concentration in the liquid. The upward convex isotherm is preferred, because relatively high solid loadings can be obtained at low concentrations in the fluid and an example of this type of isotherm is the Langmuir isotherm. For very favorable isotherms the empirical Freundlich equation qe is often more suitable, especially for adsorption from liquids[24]. The limiting case of a particularly advantageous isotherm is irreversible adsorption, in which the amount adsorbed is independent of concentration to very low values. Most adsorption systems show a decrease in the amount adsorbed with

increasing temperature. However, desorption is advantageous at high temperatures[24].

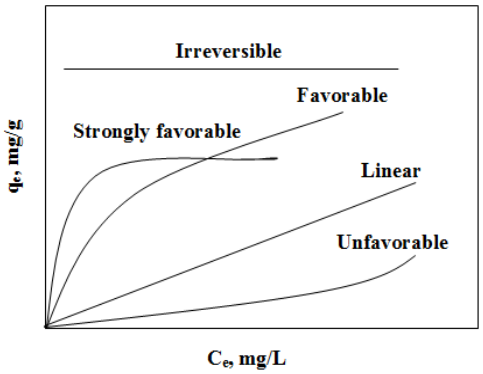


Fig 2. Adsorption Isotherm Patterns

6.1. Langmuir Isotherm

The Langmuir isotherm is a theoretical adsorption model originally developed to represent the relationship between the amount of gas adsorbed on a solid surface and the pressure of that gas[25]. It is proposed based on the following assumptions:

1. The adsorbent has a uniform surface,
2. There is only one layer of adsorbed material, that is, the adsorption site is identical,
3. The system is under constant temperature and there is no lateral interaction, and
4. The rate of attachment is proportional to the driving force times the bare surface area. The Langmuir isotherm is given as[26]:

$$q_e = \frac{K_L C_e}{1 + a_L C_e} \tag{2}$$

where KL represents the solute adsorption (L/mg), and aL corresponds to the adsorption energy (L/mg). The single layer capacity of the Langmuir isotherm (qm) is given as[27]:

$$q_m = \frac{K_L}{a_L} \tag{3}$$

The linear form of (2) is:

$$\frac{C_e}{q_e} = \frac{1}{K_L} + C_e \frac{a_L}{K_L} \tag{4}$$

The effect of isotherm shape is discussed with the aim of predicting whether the adsorption system is 'favorable' or 'unfavorable'[28], [29] proposed a dimensionless separation factor, RL, as an important feature of the Langmuir isotherm which is defined as:

$$R_L = \frac{1}{1 + a_L C_0} \tag{5}$$

The importance of $R_L$values has relations between isotherm type as shown in Table II.

Table II. Isotherm Types

R_L Values	Isotherm Tyes
0 < RL < 1	Favorable
RL > 1	Unfavorable
RL = 1	Linear
RL = 0	Irreversible

6.2. Freundlich Isotherm

The Freundlich isotherm is the earliest known relationship to describe absorption equilibrium[30]. The Freundlich isotherm describes an equilibrium on a heterogeneous surface where the adsorption energy is not the same for all adsorption sites, thus enabling multi-layer adsorption. Freundlich's equation is given as:

$$q_e = K_f C_e^{1/n} \tag{6}$$

where K_f is the Freundlich constant and n is the Freundlich exponent. The higher the adsorption capacity, aF, the higher the adsorption capacity. The more heterogeneous the surface, the closer 1/n is to zero.

The linear form of (6) can be obtained by taking the logarithm of both sides:

$$\log q_e = \log K_F + \frac{1}{n} \log C_e \tag{7}$$

5. Adsorption Kinetics

The adsorption absorption mechanism can be broadly divided into reaction-based models and diffusion-based models. The main approaches to determining the rate equation for an adsorption system will be briefly discussed.

7.1. Pseudo First Order

Lagergren's pseudo-first-order rate equation is the simplest rate equation for sorption in liquid/solid systems based on solid capacity[31]:

$$\frac{dq_t}{dt} = k_1 (q_e - q_t) \tag{8}$$

where k is the equilibrium rate constant of the apparent first-order adsorption (1/min), qe the number of cadmium or zinc ions adsorbed at equilibrium (mg/g), and qt the number of cadmium or zinc ions adsorbed on the surface qt activated carbon at any time t (mg/g). Integrating (8) at t=0 with q_t=0 until q_t;

$$\log(q_e - q_t) = \log(q_e) - \frac{k_1}{2.303} t \tag{9}$$

If pseudo-first-order kinetics can be applied to the system, then a plot of log (qe-qt) versus (7) will give a linear

relationship, with k_1/2.303 and log qe) as slope and intercept respectively.

7.2. Pseudo Second Order

The pseudo-second-order kinetic rate equation can be written as[23]:

$$\frac{dq_t}{dt} = k_2(q_e - q_t)^2 \quad (10)$$

where k2 is the equilibrium rate constant of the apparent second-order absorption (g/mg min), the number of cadmium or zinc ions adsorbed at equilibrium (mg/g) and qt is the number of cadmium or zinc ions adsorbed on the activated carbon surface at any time *t* (mg/g). Rearranging (10) becomes:

$$\frac{dq_t}{(q_e - q_t)^2} = k_2 dt \quad (11)$$

The linearized of (11), the equation becomes:

$$\frac{t}{q_t} = \frac{1}{k_2 q_e^2} + \frac{1}{q_e} t \quad (12)$$

If pseudo-second-order kinetics holds for the system, then the t/qt vs t plot of (12) will give a linear relationship, for 1/qe and as slope and intercept, respectively. The values of qe and k_2 are determined from the slope and intercept. The pseudo-second-order kinetic model has been successfully applied to several bio-sorption systems as reported by[32].

7.3. Intra-particle Diffusion

Solid-liquid adsorption processes, the mass transfer mechanism is usually characterized by external mass transfer, intraparticle diffusion, or both. The three steps that explain the adsorption mechanism are as follows:

i. Mass transfer of the solute from most of the solution to the surface of the adsorbent particles (film diffusion
ii. Adsorbate absorption at the surface site (solid diffusion).
iii. Intraparticle diffusion of solutes either through pore diffusion or solid diffusion (pore diffusion).

The most widely used intra-particle diffusion equation is given by[33]:

$$q_t = k_{id} t^{0.5} \quad (13)$$

where k_{id} is the intra-particle diffusion rate constant (mg/g min0.5). The kid value is calculated from the slope of the straight line plot qt versus $t^{0.5}$. (13) has been used by a number of researchers[32], [34]–[36].

6. Adsorbates

8.1. Congo Red

Congo red is one of the reactive dyes from azo compounds which is often used in the textile industry. These dyes are soluble in water and difficult to degrade. The presence of Congo red dye in the aquatic environment can damage various species of living things due to the nature of Congo red dye which has fairly high toxicity. Congo red that accumulates in the body can cause impaired liver, kidney, and nerve function[37].

According to [38], azo dyes generally have an auxochrome hydroxyamine group and a substituted amino group. Azo dyes are dyes that have an azo group (-N=N-). The general structure of azo dyes is R-N=N-R. Based on the number of bound azo groups, the structure of the dye can be grouped into four parts, namely:

1. Moazo dengan satu gugus azo, (R-N=N-R)
2. Diazo dengan dua gugus azo, (R-N=N-R'-N=N-R")
3. Triazo dengan tiga gugus azo, (R-N=N-R'-N=N-R"-N=N-R'")
4. Poliazo dengan empat atau lebih gugus azo.

Congo red compound is a water-soluble salt and is known as benzidine diazo-bis-1-naphthylamine-4-sulfonate acid. Congo red is red in color and sensitive to acids. Congo red is used as an indicator on the pH route: 3.0-6.2 with a blue-purple-red color. This compound will turn blue with the addition of an acid and turn red with the addition of a base. Congo red was the first synthetic direct dye which was commercially successful due to its ability to develop cotton (cellulose) by simple dyeing. Congo red is also known as direct dye 28 which is a derivative of a diazo compound synthesized in 1884 by Boettiger. Congo red build formula is presented in the following figure.

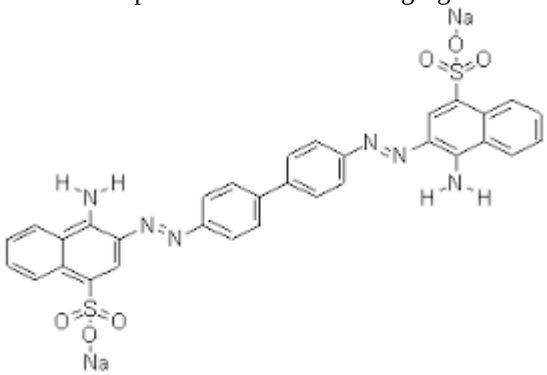


Fig 3. Confo Red Structure

Congo red compound has a molecular weight of 696.68 g/mol with the IUPAC name sodium diphenyldiazo-bis-α-naphthylamine sulfonate. The molecular formula of the compound congo red is C32H22N6Na2O6S2 with a water solubility of 1g/30 mL. Congo red degradation mechanism based on UV-Vis and GC-MS analysis is described in the following figure.

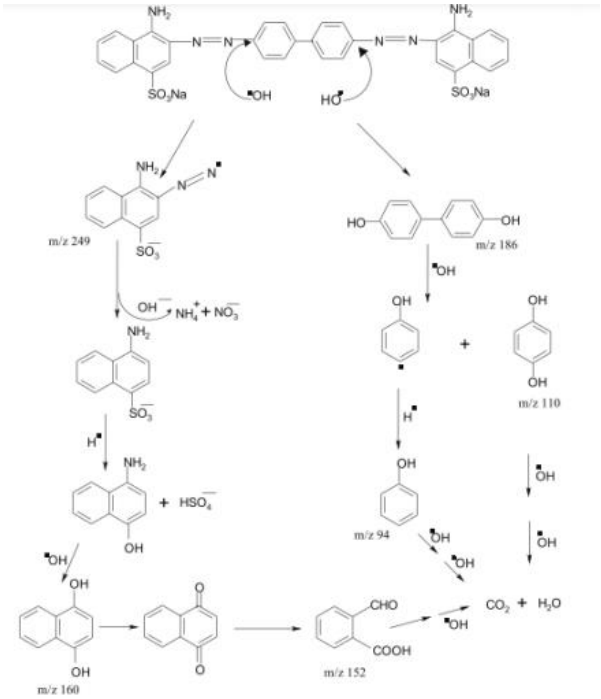


Fig 4. Congo Red Degradation Mechanism

[39]conducted a study related to the degradation process of congo red using the results of GC-MS analysis. In the 50th minute, the m/z spectra showed intensities of 249, 253, 274 and 186 which indicated that the congo molecule was cleaved. Intensity 249 indicated the intermediate of 4-amino, 3-azo napthalene sulphoric acid and intensity 186 indicated the formation of the intermediate 4,4, dihydroxy biphenyl. The test for 2 hours showed m/z intensity at 110 and 160 which indicated the formation of quinol intermediates (1,4 dihydroxy benzene) and 1,4 napthalene diol. Tests carried out at 3.5 hours showed the intensity of m/z at 94 and 152 which indicated the formation of phenol and 2-formylbenzoic acid intermediates. The last test was carried out at 5 hours and showed an intensity of m/z which was 44 which indicated the formation of CO2 and became the final process of congo red degradation.

8.2. Methylene Blue

Methylene blue (Methylene blue) which has the chemical formula C16H18ClN3S, is a toxic aromatic hydrocarbon compound and is a cationic dye with very strong adsorption power. In general, methylene blue is used as a dye for silk, wool, textiles, paper, office equipment and cosmetics. This compound is in the form of dark green crystals. When dissolved, methylene blue in water or alcohol will produce a blue solution. Methylene blue has a molecular weight of 319.86 g/mol, with a melting point of 105°C and a solubility of 4.36 x 104 mg/L (Endang Palupi, 2006:6). The structure of methylene blue is shown in Fig 5.

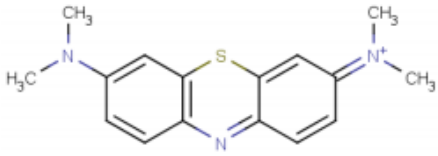


Fig 5. Methylene Blue Structure

The dye molecule is a combination of unsaturated organic substances with a chromophore as a color carrier. Unsaturated organic substances found in the formation of dyestuffs are aromatic compounds, including aromatic hydrocarbons and their derivatives, phenols and their derivatives, and nitrogen-containing hydrocarbon compounds[40]. The chromophore group is the group that gives the molecule its color. In Table III it can be seen some names of chromophore groups and their chemical structures that give binding power to the colored fibers. The chromophores of reactive dyes are usually azo and anthraquinone systems with relatively small molecular weights. The absorption of fiber is not great. So that the dye that does not react with the fiber is easily removed. The linking groups can affect the absorption and resistance of the dye to acids or bases. Reactive groups are parts of the dye that are easily separated. With the release of this reactive group, the dye becomes easy to react with the fabric fiber. In general, in order for the reaction to run well, it is necessary to add alkali or acid to reach a certain pH[40]

Table III. Chromophore structures

Functional Groups	Chemical Structure
Nitroso	NO or (-N-OH)
Nitro	NO2 or (NN-OOH)
Azo group	-N=N-
Ethylene group	-C=C-
Carbonyl Group	-CO-
Carbon-Nitrogen Group	-C=NH; CH=N-
Carbon Sulfur Group	-C=S ; -C-S-S-C-

Recent Stuides on Congo Red and Methylene Blue Adsorptions

Removal of Congo Red from wastewater has become an area of interest for many researchers and dye-related industries due to more stringent regulations introduced by the government as well as environmental concerns. A summary of the different adsorbents used to adsorb Congo Red is given as follows:

[41]used a chitin suspension after enzymatic and sonoenzymolysis taken as adsorbent to evaluate the adsorption properties of Congo red (CR) dye. Compared with the untreated chitin suspension, the adsorption performance of CR was significantly improved after enzymolysis and even more so after sonoenzymolysis. According to the kinetic model and different adsorption isotherms, the Langmuir isotherm and pseudo-second-order model are more reliable to describe the adsorption

process of CR to different samples of chitin and show a monolayer and favorable physisorption process. Structural characterization before and after adsorption verified the physical adsorption between chitin and CR, and a larger specific area and higher porosity of the chitin suspension was obtained after sonoenzymolysis with more available active sites. Combined with the results of thermodynamic studies, the adsorption of CR by different samples of chitin was a monolayer, endothermic and favorable physisorption process.

[42]produced mesoporous activated carbon from Sargassum fusiforme through physical activation with carbon dioxide. Studying the effect of the parameters on the specific surface area, total pore volume, and rate of combustion of activated carbon, and the parameters of the effect of methylene blue adsorption values were identified using analysis of variance. The adsorption behavior of Congo red was studied. The effect of parameters on the adsorbent dose, temperature, PH, and initial congo red concentration was investigated. The adsorption properties of activated carbon were investigated by kinetics. The equilibrium removal rate and maximum adsorption capacity reached up to 94.72%, 234 mg34g·1, respectively when the initial congo red concentration was 200 mg· L−1 under the adsorbent dose (0.8 g L−1), temperature (30°C), pH7.

[43]prepared activated carbon from Ashitaba waste and walnut shells to study the adsorption mechanism of Congo red and methylene blue dyes in an aqueous solution. These adsorbents were characterized by XRD, FTIR and SEM techniques and the dye adsorption isotherm at three temperatures was quantified. Statistical physics models were applied to interpret the adsorption mechanism of the tested dyes and adsorbents. The modeling results show that this dye is practically separated in solution so that there is no aggregation process. The adsorption orientation of the dye molecules on the adsorbent changes depending on the temperature and the nature of the system. The adsorption capacity of Ashitaba waste-activated carbon to remove congo red is significant enough to indicate a strong interaction between this dye and the adsorbent being tested. The calculated adsorption energy varies from 7.25 to 20.43 kJ/mol and indicates that the adsorption of the two adsorbates occurs through physical interactions at different temperatures where the removal process is endothermic.

[44]chemically modified eggshell membranes and used them to adsorb congo red from synthetic aqueous effluents. FTIR spectra confirmed the presence of hydroxyl, carbonyl, and methylene groups on the eggshell membrane. Scanning Electron Micrographs (SEM) were also performed to characterize the modified eggshell membranes. Congo red concentration was measured using a UV spectrophotometer. The effect of various parameters such as initial pH, ESM dose, contact time and initial Congo red concentration were investigated. The highest adsorption percentage (98%) was obtained at pH 4.5 at a solid-to-liquid ratio of 1g-100ml congo red solution with a concentration of 100mg/l. The pseudo-second-order kinetic model is the most suitable model for this study. The reaction rate constant is 58.04×10−3gmg−1 min−1. The adsorption mechanism should occur through film diffusion or through intraparticle diffusion. Langmuir isotherm gives better suitability for adsorption than Freundlich isotherm. The maximum single-layer adsorption capacity was determined to be 117.65mg/g. Thermodynamic parameters (ΔG, H and S) were also studied in this study. The enthalpy change and the entropy change were found to be 29.217kJ/mol and 0.124kJ/mol K, respectively. The value of G was found to be more negative with increasing temperature.

[45]studied the adsorption properties of walnut shells on methylene blue and congo red. The adsorption of methylene blue (MB, cationic dye) was studied in batch mode and column mode. The amount of adsorption on MB is 80.4 mg/g at 318 K and the process is endothermic. The adsorption kinetics and the equilibrium process were predicted by the pseudo-second-order kinetic model and the Langmuir model, respectively. The shape of the breakthrough curve is affected by the dye concentration and flow rate.

[46]studied the performance of acacia wood-based activated carbon for the removal of methylene blue (MB) dye in an aqueous solution. This adsorbent is prepared through a physicochemical activation process consisting of treatment of potassium hydroxide (KOH), followed by gasification of carbon dioxide (CO2) under microwave heating. MB adsorption to acacia wood followed Langmuir and pseudo-second-order for isotherm and kinetic studies, respectively, with Langmuir monolayer adsorption capacity of 338.29 mg/g. Mechanism studies revealed that the adsorption process was controlled by the film diffusion mechanism and indicated that it was thermodynamically exothermic.

[47]synthesized three different types of activated carbon from tea waste by chemical activation method using three activating agents - H3PO4 (H-AC), KOH (K-AC), and ZnCl2 (Z-AC) to analyze the effect of activating agent on the physicochemical properties and absorption of the material. Fourier transform infrared spectrometer (FT-IR), field emission scanning electron microscope (FESEM), X-ray diffractometer (XRD), thermogravimetric analyzer (TGA), N2 gas adsorption-desorption analyzer, and zero charge point (pHPZC) were used for characterization. synthesized material. The adsorption capacity of H-AC was found to be higher than that of K-AC and Z-AC, and the removal efficiency of methylene blue (MB) HAC was around 98% for an adsorbent dose of 0.15 g/L. The larger MB removal capacity of H-AC may be due to its higher surface area and micropore volume than K-AC and Z-AC. The experimental data of batch equilibrium studies for H-AC and Z-AC matched well with the Freundlich isotherm

model while the absorption of MB to KAC followed the Langmuir isotherm. The adsorption kinetics data for all adsorbents followed a pseudo-second-order model. The intraparticle diffusion model shows the effect of outer surface adsorption and intraparticle diffusion on the adsorption mechanism.

[48]produced activated carbon from sugar beet pulp. In this study, activated carbon based on sugar beet pulp was prepared using phosphoric acid as an activating agent for methylene blue adsorption. The condition of the preparation process significantly affected the adsorption of methylene blue. The nature of the sugar beet pulp-based activated carbon is characterized by the nitrogen adsorption isotherm. Adsorption increased with increasing contact time, temperature and pH of adsorption, and initial concentration of methylene blue. A batch kinetics study showed that an equilibrium time of 100 min was required for adsorption, and the adsorption of methylene blue was 244.76 mg/g at equilibrium. The kinetic model, Weber's pore diffusion model and Boyd's equation were applied to the experimental data to study the adsorption mechanism and the controlled step. The results showed that the adsorption kinetics followed the pseudo-order kinetics model, intraparticle diffusion was not a rate-limiting mechanism and the adsorption process was controlled by film diffusion.

[49] made the natural layered magnesium silicate mineral (serpentine) as an adsorbent for three common water pollutants (methylene blue dye, Congo red dye, and Cr(VI) metal ion. Kinetic studies found that the equilibrium time for the adsorption of Congo dye, blue dye methylene, and Cr(VI) ions was obtained after 180 minutes, 240 minutes, and 480 minutes, respectively. The absorption process of all examined pollutants was chemical adsorption and represented by pseudo-second-order kinetic models, not by intra-particle diffusion and kinetic models. Elovich The adsorption equilibrium modeling of methylene blue and Cr(VI) is described as monolayer adsorption and fits the Langmuir model rather than the Freundlich or Temkin isotherm model. The adsorption of Congo red dye occurs in a multilayer form and fits the Freundlich isotherm better than the other studied models. The pollutant is mostly controlled by pH value. Alkaline media promises to remove methylene b iru, while acidic conditions were favored for the adsorption of Congo red dye and Cr(VI) metal ion. Thermodynamic parameters showed that the adsorption of methylene blue dye was an endothermic reaction, while the adsorption of Congo red dye and Cr(VI) metal ion was an exothermic reaction. Modifying the serpentine surface through acid and thermal activation increases the removal of the intended pollutant to high levels. Acid leached serpentine using 15% HCl acid and thermally activated serpentine at 200 °C were the best-modified products to remove Congo red dye, methylene blue dye, and Cr(VI) metal ion maximally. Fixed bed column studies gave the best results at a bed thickness of 3 cm, a flow rate of 5 mL/min, and an initial concentration of 25 mg/L.

III. METHODS

1. Equipments and Materials

1.1. Equipments

1	Erlenmeyer 250 mL	12	Shaker
2	Erlenmeyer 1000 mL	13	Centrifuge
3	Volumetric Flask 1000 mL	14	Ayakan 100 mesh
4	Volumetric Flask 100 mL	15	Neraca Digital
5	Volumetric Flask 50 mL	16	Spektrofotometer UV/Vis
6	Volumetric Flask 10 mL	17	Bola Penghisap
7	Beaker 100 mL	18	Spatula
8	Pipet Volume 10 mL	19	Cawan Porselin
9	Beaker glass 100 mL	20	Alumunium Foil
10	pH meter	21	Desikator
11	Termometer	22	Kertas Penyaring

1.2. Materials

1 Granulated Sugar
2 Congo Red/Kongo merah ($C_{32}H_{22}N_6Na_2O_6S_2$)
3 Aquadest
4 HCl 0.5 N
5 NaOH 0.5 N
6 H_3PO_4 4 N
7 Methylene Blue ($C_{16}H_{18}C_lN_3S$)

7. Research Variables

2.1 Fixed Variables

1	Adsorbent Mass	:	0.5 gram
2	Adsorbent Particle Size	:	100 mesh
3	Volume	:	100 mL
4	Activator Volume (H3PO4)	:	500 mL
5	Carbonation Temperature	:	500 ºC

2.2. Independent Variables

Adsorbate concentrations: 20, 40, 60, 80 and 100 ppm.

2.3. Dependent Variables

i. Langmuir, Freundlich, and Redlich Peterson isotherms
ii. Correlation Model Langmuir, Freundlich, and Redlich Peterson
iii. Adsorption capacity and percent absorption

3. Procedures

3.1 Carbon Synthesis

i. Spread some paper towels on the tray.
ii. Put the sugar into a 300 mL beaker.
iii. Insert the stirring rod into the center of the sugar.
iv. Place the beaker on a paper towel on the tray.
v. Add 70 mL of sulfuric acid to the sugar and stir briefly.
vi. Stand about 1 - 2 meters (because the reaction is exothermic) and wait for the reaction to start.

3.2 Carbon Activation

i. Soak the carbon in a solution of H_3PO_4 with a concentration of 4 M while being shaken using a shaker for 5 hours.

ii. Strain the marinade

iii. The residue is washed until neutral

iv. Dry in the oven at 110 ℃ for 8 hours

iv. Put it in a desiccator.

3.3 Adsorbate Preparation

The standard solution was made with a concentration of 100 ppm which is the mother liquor. Preparation of standard solutions, Congo red and methylene blue were weighed as much as 0.1 g each added to a 1000 mL volumetric flask and added with distilled water to the mark and then homogenized.

3.4. pH based Adsorption Analysis

i. Add 100 mL of Congo red and methylene blue with a concentration of 60 mg/L into a 250 mL Erlenmeyer.

ii. Then the samples were adjusted to varying pH, namely 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 using a solution of 0.5 N HCl and 0.5 N NaOH.

iii. Then the sample was shaken for 1.5 hours with a mass of 2 grams of adsorbent.

iv. Then the sample was pipetted as much as 14 ml and then centrifuged.

v. The filtrate was tested using a UV/Vis spectrophotometer at wavelengths of 660 nm (Methylene Blue) and 497 nm (Congo Red).

3.5. Adsorption Equilibrium Analysis

i. Enter 100 mL of congo red or methylene blue with varying concentrations of 20, 40, 60, 80, and 100 ppm into a 250 mL Erlenmeyer flask.

ii. Then the solution is made with the maximum absorption pH

iii. Then the sample is shaken until the absorption reaches equilibrium using an adsorbent mass of 1 gram with a carbonation temperature of 500 ºC.

iv. Then 10 ml of the sample was pipetted and then centrifuged and the filtrate was tested using a UV/Vis spectrophotometer.

3.6. Adsorption Qualitative and Quantitative Analysis

i. Congo red or methylene blue solution with a volume of 200 mL was put into a 250 mL Erlenmeyer with a concentration of 20, 30 and 50 mg/L.

ii. Congo red or methylene blue was stirred using a shaker at 150 rpm, at ambient temperature (30˚C).

iii. The supernatant solution was pipetted for ± 5 mL and then sifted.

iv. The filtrate that was free of adsorbent was analyzed using UV/VIS with a wavelength of 491.40 nm (CR) and 660 nm (MB).

Congo red and methylene blue solutions that have been adsorbed are then analyzed for their absorption values using (13).

$$q_e = \frac{V}{m}(C_0 - C_e) \tag{13}$$

where

Co = Initial concentration (mg/L)

Ce = Final concentration (mg/L)

V = Volume of solution

m = mass of the sample

Congo red and methylene blue solutions were analyzed for percent absorption using (14).

$$Adsorption(\%) = \frac{(C_0 - C_e)}{C_0} \times 100\% \tag{14}$$

IV. RESULTS AND DISCUSSION

1. Initial pH Effects

One of the main parameters that control the absorption of methylene blue on the adsorbent is the pH value. Variations in pH can change the characteristics and availability of methylene blue ions in solution as well as the chemical status of the functional groups responsible for adsorption[50]. Changes in pH affect the adsorptive process through the dissociation of functional groups at the active site on the surface of the adsorbent. The adsorption of various anionic and cationic species on the adsorbent can be explained based on the competitive adsorption of H+ and OH- ions with the adsorbate. It is a common observation that the surface adsorbs anions better at lower pH due to the presence of H+ ions, while the surface is active for cation adsorption at higher pH due to the deposition of OH- ions [51].

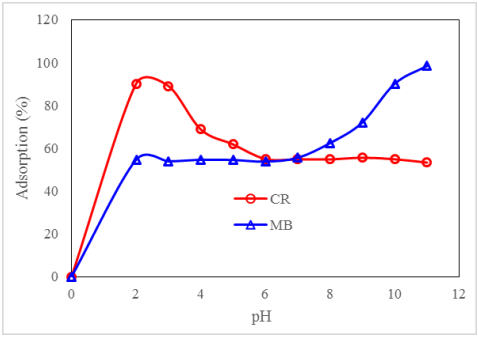


Fig 6. Initial pH effects on Methylene Blue (Blue) and Congo Red (Red) Adsorptions

Efforts to determine the optimum pH conditions for the absorption of methylene blue (MB) on granular sugar-based activated carbon, the effect of pH was observed in the pH range of 2.0 - 11.0. The research was conducted on adsorbate' concentration (60 mg/l), contact time (1.5 hours) and adsorbent dose of 1 g/l at a constant temperature of 30±1°C. The results obtained are presented in figure 6 which shows that the adsorption of methylene blue from pH 2.0 to 7.0 is constant in the range of 55.56%,

then the absorption increases with increasing pH value. The maximum adsorption of Methylene Blue was 98.45% at the optimum pH of 11.0. While the maximum absorption that occurs for CR is at pH 2.0 with an absorption capacity of 90.14%, then the absorption decreases gradually to pH 6.0 and then remains constant at pH 11.0.

8. Adsorption Equilibrium

The equilibrium relationship between adsorbate and adsorbent is explained by the adsorption isotherm, therefore it is very important to understand the adsorption behavior between adsorbate and adsorbent at equilibrium to optimize the design of the adsorption system unit. Efforts to optimize the adsorption system design on CR and MB adsorption are important to establish the most precise correlation for the equilibrium curve. Two of the most famous isotherm equations namely Freundlich and Langmuir isotherms have been applied to describe the characteristics of the deeper adsorption equilibrium from the experimental data obtained. The Freundlich (1906) isotherm was derived with the assumption that the surface is heterogeneous with a non-uniform distribution of adsorption heat over the surface, whereas Langmuir's (1918) theory, the basic assumption is that adsorption occurs at certain homogeneous active sites in the adsorbent.

Langmuir and Freundlich models for the adsorption of CR and MB onto granular sugar-based activated carbon are plotted in figures 7 and 8. The Langmuir model is based on the assumption that the adsorbent is structurally homogeneous where all the adsorption sites are identical and energy equivalent, so that the absorption occurs at the adsorbent surface is a monolayer.

Figure 7 shows the Langmuir isotherm that absorbs CR and MB on mesoporous activated carbon which is described using (4). The straight line in Figure 7 is obtained by plotting (C_e/q_e) vs. C_e, which is then used to obtain the slope and intercept values in order to obtain the constants K_L and a_L, as well as other necessary constants such as the correlation coefficient (R^2).

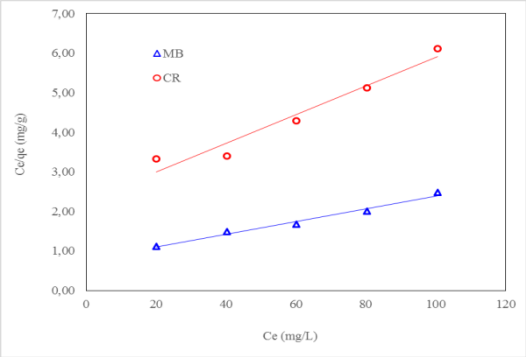


Fig 7. Methylene Blue and Congo Red Adsorption using Langmuir Model

The efforts to ensure the absorption event that occurs at the adsorption equilibrium, the Freundlich isotherm model is also applied in this study. The Freundlich equation is an empirical equation used to describe a heterogeneous system characterized by a heterogeneity factor of 1/n. Therefore, an attempt to identify the surface heterogeneity of the adsorbent using the Freundlich isotherm model was used and also provided details of the interaction between the adsorbate and activated carbon. The graph depicted in Figure 4.3 is obtained using (7).

Figure 8 shows the q_e vs. log plot C_e which produces a straight line, thus allowing the determination of the magnitude of the values for 1/n and KF of the slope and intercept, respectively. The K_F and 1/n values obtained respectively indicate the capacity and intensity of adsorption of CR and MB to granular sugar-based activated carbon. The higher the 1/n value, the higher the affinity and heterogeneity of the adsorbent sites. Table 4 shows that the value of 1/n is less than 1, which indicates good adsorption properties of CR and MB (favorable) on granular sugar-based activated carbon.

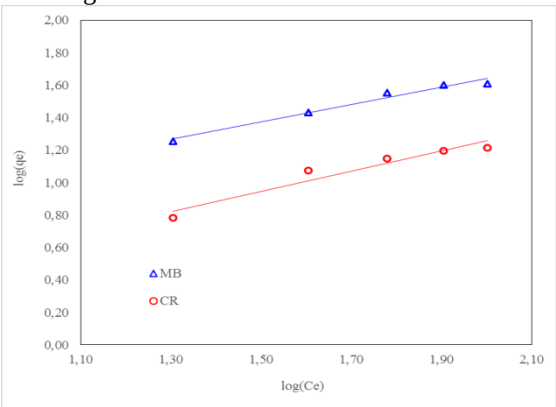


Fig 8. Methylene Blue and Congo Red Adsorption using Freundlich Model

The constants of the Langmuir and Freundlich isotherms for the adsorption of CR and MB are presented in Table 4. Determination of isotherm parameters for CR and MB by linear regression seems to provide an acceptable fit for the experimental data, especially for the MB dye. Overall, the Langmuir isotherm model has the highest correlation coefficient (R^2) for both CR and MB adsorbates.

The adsorption capacity (q_m) or the K_L/a_L ratio gave the monolayer saturation capacity of the CR and MB systems on granular sugar-based activated carbon of 27.548 mg/g and 62.112 mg/g respectively. This indicates that the activated carbon used in this study has a higher adsorption capacity on MB than CR.

The isotherm constants for the studied Langmuir and Freundlich models and the correlation coefficient (R^2) with the experimental data are tabulated in Table IV. The correlation coefficient (R^2) for the Langmuir isotherm is the highest compared to the value obtained for Freundlich. Therefore, the Langmuir isotherm is the most suitable isotherm for the adsorption of CR and MB onto white sugar-based activated carbon. The high value of K_L on MB adsorbate indicates a higher affinity than CR.

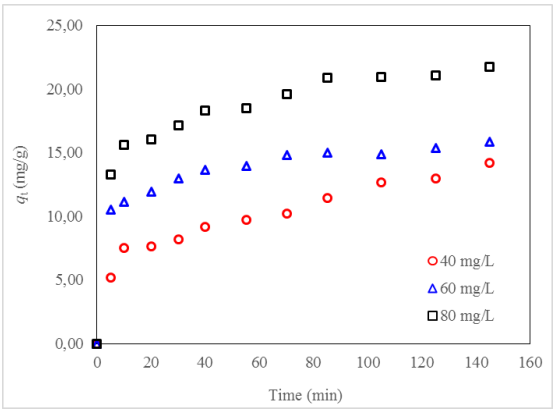
Table IV. Isotherm Parameters in Different Models

Models	CR	MB
Langmuir		
q_m (mg g^{-1})	27.55	62.11
K_L (L mg^{-1})	0.44	1.28
a_L (L mg^{-1})	0.02	0.02
R^2	0.9501	0.9820
Freundlich		
K_F (mg g^{-1})	1.04	3.72
$1/n_F$ (L mg^{-1})	0.62	0.54
R^2	0.9353	0.9722

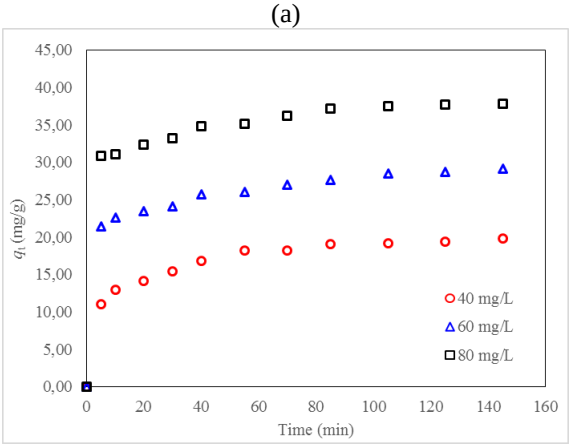
9. Adsorption Kinetics

The relationship between contact time and uptake of CR and MB by granular sugar-based activated carbon was studied through batch kinetics experiments and the results are shown in Figures 9 and 10 Figure 9(a) shows that equilibrium CR was reached after 85 min for initial CR concentrations of 40, 60 and 80 mg/L, respectively. Figure 9(b) shows that for MB, the equilibrium time required for the initial concentration of MB of 40 mg/L is 85 minutes, while the initial concentrations of 60 mg/L and 80 mg/L both occur at 105 minutes. For all investigated cases, the CR and MB adsorption profiles were single, smooth, and continuous curves leading to saturation, indicating possible coverage of the CR and MB dye monolayers on the adsorbent surface.

As shown in Figure 9 the amount of CR and MB adsorbed at equilibrium, q_t, increased with increasing initial concentration. This is because the available space is crowded with dye molecules approaching high concentrations, thereby delaying the equilibrium time [52]. The adsorption process can be divided into three regimes. The first regime is fast as a result of the fast absorption of CR and MB particles onto the adsorbent surface. The second regime is slower probably because adsorption takes place in the pores (intraparticle diffusion) and in the third regime the adsorption process decreases, indicating that equilibrium is reached. This observation is in line with that reported by [53] which absorbs CR using Chrysanthemum Indicum microparticles as adsorbents. As the initial concentrations of CR and MB increased, a longer time was required to reach equilibrium and the adsorption capacity was also found to increase.



(a)



(b)

Fig 9. Disappearance Period for Congo Red (a) and Methylene Blue (b)

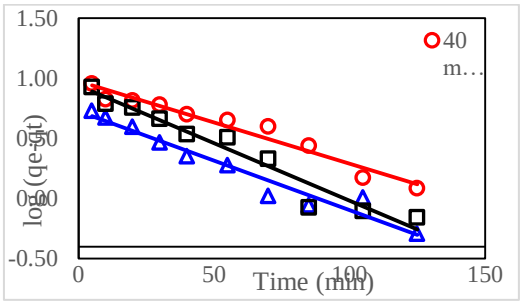
To design a fast and effective model, a study was conducted on the adsorption rate. Appropriate models are needed to understand the adsorption mechanisms, such as chemical reactions, mass transfer, etc. The experiment in this adsorption kinetics study was carried out with three different initial concentrations, namely 40, 60 and 80 mg/L, with an adsorbent weight of 0.3 grams. Three kinetic models that are often used by researchers, namely pseudo-first-order kinetic models, pseudo-second-order, and intraparticle diffusion are applied to evaluate the adsorption kinetics mechanism. The validity of the three models can be checked from the linear plots shown in Figures 10 - 12.

10. Pseudo First Order Model

Lagergren's pseudo-first-order kinetics model is the simplest rate equation proposed for a liquid/adsorbent adsorption system based on the capacity of the adsorbent. The linear form of the pseudo-first-order kinetic model is given in (9). A log plot (q_e - q_t) versus t is presented in Figure 10 to test the applicability of the experimental data to a quasi-first-order kinetic model. To plot Figure 10, the qe in log (q_e - q_t) was obtained from the equilibrium experiment. The pseudo-first-order rate constants, k_1 and q_e ($q_{e,calc}$) were obtained from the slope and intercept, and the results are tabulated in Table V. For the application of the quasi-first-order kinetic model, the correlation

coefficient R^2 must be high enough and $_{qe,exp}$ must be quite close to $q_{e,calc}$.

In all cases, it was found that this model can only be applied in the early stages of the adsorption process and is not suitable for the entire contact time range. This is because the absorption of CR and MB is not the only ion exchange mechanism but other absorption mechanisms also occur. In most cases from the literature, the quasi-first-order equations do not fit well over the contact time range [54]. This pattern was also observed by [55] for the adsorption of chlorophenol from water by bituminous shale and also by [31] for the removal of pollutants in various sorbents. The value of the correlation coefficient R^2 is quite high. However, as shown in Table 5, the values of $q_{e,exp}$ and qe,calc are very different. Therefore, it can be concluded that the pseudo-first-order kinetics model is not able to properly describe the adsorption kinetics of CR and MB on granular sugar-based activated carbon.



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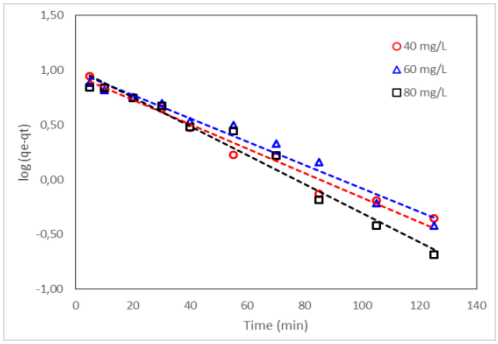


(b)

Fig 10. Disappearance Period for Congo Red (a) and Methylene Blue (b) using Pseudo First Order Model

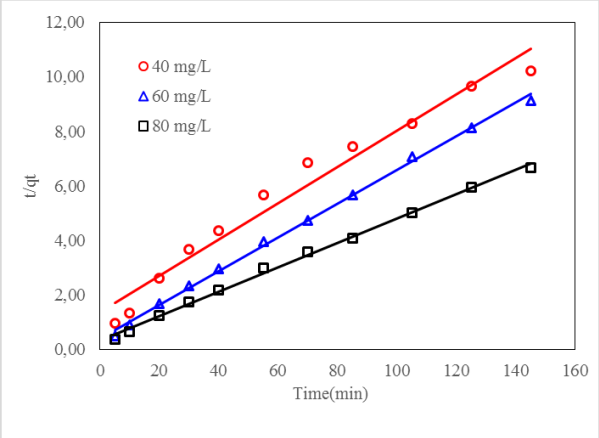
Table V . Congo Red and Methylene Blue Adsorption Parameters using Pseudo First Order Model

Initial Concentrations	Congo Red (CR)				Methylene Blue (MB)			
	k_1	$q_{e\ exp}$	$q_{e\ calc}$	R^2	k_1	$q_{e\ exp}$	$q_{e\ calc}$	R^2
(mg/L)	min^{-1}	mg/g	mg/g		min^{-1}	mg/g	mg/g	
40	0.0157	14.17	9.44	0.9586	0.0256	19.85	8.90	0.9764
60	0.0189	15.86	5.32	0.9524	0.0246	29.11	9.65	0.975
80	0.0219	21.73	8.63	0.952	0.0304	37.86	10.30	0.9745

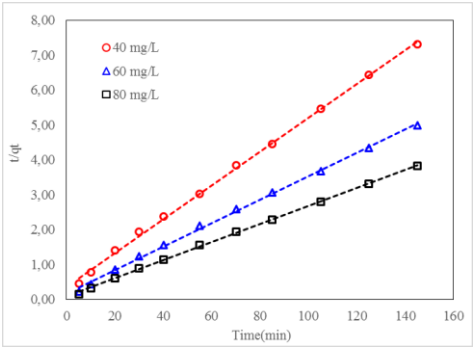
11. Pseudo Second Order Model

As shown in (12), the pseudo second-order rate constants k_2 and $q_{e(qe,calc)}$ can be obtained from the slope of the t/qt versus t plot as shown in Figure 11, and the parameters of the pseudo second order as listed in Table VI. For the application of the pseudo second-order kinetic model, the correlation coefficient R^2 must be sufficiently high and $q_{e\ exp}$ must be sufficiently close to $q_{e,calc}$.

The adsorption kinetics of CR and MB were found to comply with pseudo second-order kinetics, with high correlation coefficient values, R^2 ($R^2 > 0.99$) and fairly close values of $q_{e\ exp}$ and $q_{e,calc}$. This shows that the experimental data can be explained using this model. The rate of adsorption of CR and MB appears to be controlled by chemisorption. he same phenomenon was reported by [56] regarding the adsorption of sulfur dioxide onto activated carbon prepared from oil palm shells and by [57] on the adsorption of phenol on activated carbon made from palm shells. From Table 6, it was found that the rate constant, k_2, increased from 0.0063 g $mg^{-1}min^{-1}$ to 0.0072 g $mg^{-1}min^{-1}$ for MB, while for CR the increase in the reaction rate was irregular (ie 0.0033 for the initial concentration of 40 mg/L; 0.0100 for 60 mg/L while for 80 mg/L it fell again to 0.0061).



(a)



(b)

Fig 11. Disappearance Period for Congo Red (a) and Methylene Blue (b) using Pseudo Second Order Model

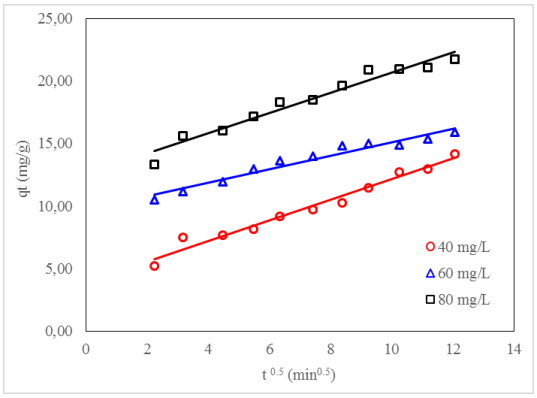
Table VI. Congo Red and Methylene Blue Adsorption Parameters using Pseudo Second Order Model

Initial Concentrations	Congo Red (CR)				Methylene Blue (MB)			
	k_1	$q_{e\ exp}$	$q_{e\ calc}$	R^2	k_1	$q_{e\ exp}$	$q_{e\ calc}$	R^2
(mg/L)	min^{-1}	mg/g	mg/g		min^{-1}	mg/g	mg/g	
40	0.0033	14.18	14.9925	0.9698	0.0063	19.85	20.66	0.9986
60	0.0100	15.87	16.12903	0.9979	0.0064	29.11	29.76	0.9984
80	0.0061	21.73	22.37136	0.9971	0.0072	37.86	38.61	0.9993

12. Intraparticle Diffusion Model

Intraparticle diffusion is characterized by the dependence between the adsorption capacity at each reaction time, qt, and the square root of the time, with the slope of the relationship being the parameter of the intraparticle diffusion rate. A Weber-Morris plot of q_t versus $t^{0.5}$ is presented in Figure 12 for the adsorption of CR and MB onto granular sugar-based activated carbon. For the adsorption process in order for intraparticle diffusion to be controlled, the qt versus $t^{0.5}$ plot must pass through the origin and R^2 must be sufficiently close to one. The intraparticle diffusion parameter, kid, for this region was determined from the slope of the plot in figure 12.

The straight line in Figure 12 does not pass through the origin, indicating that pore diffusion is not controlling. Overall, the correlation coefficient (R^2) using the equation of the intraparticle diffusion model is lower than the correlation coefficient of the quasi-second-order model. In conclusion, the most suitable model to describe the experimental kinetics is a pseudo-second-order kinetics model with a correlation coefficient, $R^2 > 0.99$. The rate limiting process is chemisorption.



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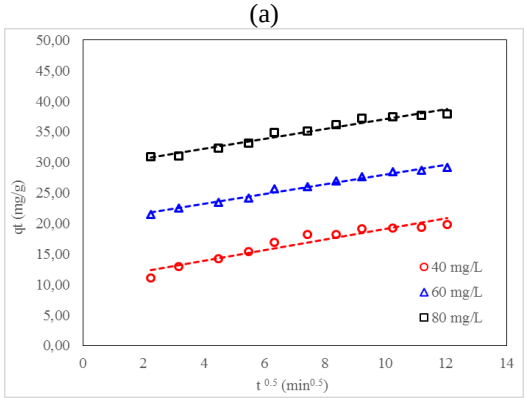

(b)

Fig 12. Weber and Morris Intraparticle Model of CR (a) and MB (b) Disappearance

Table VII. Congo Red and Methylene Blue Adsorption Parameters using Weber and Morris Intraparticle Diffusion Model

Initial Concentrations	Congo Red (CR)				Methylene Blue (MB)			
	k_1	$q_{e\ exp}$	$q_{e\ calc}$	R^2	k_1	$q_{e\ exp}$	$q_{e\ calc}$	R^2
(mg/L)	min^{-1}	mg/g	mg/g		min^{-1}	mg/g	mg/g	
40	0.8270	3.8685	0.9723	0.8769	10.372	0.9225	0.8270	3.8685
60	0.5362	9.7325	0.9523	0.8034	19.989	0.9829	0.5362	9.7325
80	0.8111	12.555	0.9546	0.7997	29.06	0.9622	0.8111	12.555

V. CONCLUSION

The adsorption equilibrium data for CR and MB were studied and the adsorption data were found to be most suitable using the Langmuir model. The adsorption capacity of MB on granular sugar-based activated carbon was higher than that of CR.

The experimental analysis of the contact time showed that the pseudo-second-order kinetic model well described the dynamic behavior for the adsorption of both CR and MB under different initial concentrations. Therefore, the chemisorption mechanism is a rate limiting step in adsorption absorption.

This study provides an initial understanding of the phenomenon of CR and MB adsorption on granular sugar-based activated carbon. Some suggestions for further work are the performance of granular sugar based activated carbon needs to be studied/assessed using samples from industrial wastewater. Moreover, adsorption studies should be carried out in packed columns for more practical use in dyestuff industrial wastewater treatment facilities

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

A Case Study on Defending against Cyber Crimes

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Abstract:-- **Cyber terrorism is the premeditated, politically motivated assault on information, computer systems, computer programmes, and data that results in violence against property, the government, and the general populace. In the age of globalisation, the use of steganography as a form of internet terrorist communication – Red Fort case, E-mail threats in Taj Mahal case, and Supreme Court E-mail Threat case. The use of the internet by terrorists to organise and execute the September 11 World Trade Centre attack reflects the current state of affairs and provides the answer to the question, "Is the internet the new boon or bane of science?"**

In India, cyber laws prohibit any crime committed with the aid of technology, where a computer is a tool for cybercrime. Cybercrime rules prevent citizens from sharing sensitive information with strangers online. Since the establishment of cyber laws in India, the IT Act 2000 was enacted in 2000 and updated in 2008 to cover all sorts of cyber offences in India. Without a doubt, India's Cyber security or Cyber laws give protection against cybercrime. However, prevention is always preferable to treatment.

Cyber law and cyber crimes have also become more complicated in today's technologically advanced society. Internet and technology were developed for research purposes and to make human life easier, but as the number of people using the internet in India expanded, the necessity for Cyber Laws became apparent. Due to the anonymous nature of the internet, it is simple to commit cybercrimes. Consequently, numerous individuals could abuse this component so extensively. Therefore, India has a need for cyber law.

Index Terms : Cybercrime, Cyber Law, Steganography, National Cyber Investigative Joint Task Force

I. INTRODUCTION

Cybercrime, often known as computer-oriented crime, involves a computer and a network. The computer may have been used to commit a crime, or it may be the intended victim. Cybercrimes are defined as: "Offenses committed against individuals or groups of individuals with a criminal intent to intentionally harm the victim's reputation or cause physical or mental harm, or loss, to the victim directly or indirectly, using modern tele communication networks such as the Internet (networks including chat rooms, emails, notice boards, and groups) and mobile phones (Bluetooth/SMS/MMS)" [1]

In 2014, a research (supported by McAfee) projected the annual damage to the world economy to be $445 billion.

[2] In the United States, over $1.5 billion was lost to online credit and debit card theft in 2012. [3] In 2018, the Centre for Strategic and International Studies (CSIS) and McAfee conducted a study concluding that close to $600 billion, or roughly one percent of the global GDP, is lost annually to cybercrime.

Each year in India, almost $120 million worth of mobile phones are lost or stolen. Nearly 69% of information thefts are committed by current and former firm workers, whereas only 31% are committed by hackers, according to The Hindu on October 27, 2007. Therefore, if we are technologically competent and use internet banking or online shopping, we need be very cautious about revealing personal information.

• To provide a concise overview of cybercrime and its consequences on the general populace

• The report provides guidelines for defending against cybercrime.

II. TYPES OF CYBERCRIMES

Fig.1.Types of Cybercrime

Computer-assisted criminal activity

There are numerous instances of computer-assisted crime in which the computer is used to commit the crime. Several are explored in detail below:

2.1.1 Data Piracy: This refers to the replication of digital data and the simple distribution of print, images, sound, and multimedia combinations, as well as the use of copyrighted material for personal gain.

1.1.2.1 Pornography/Child pornography: The unethical and unlawful dissemination of sexually explicit material concerning children in particular.

1.1.2.2 Illegal Interception of Material The increased speed and capacity of data flow over the Internet has increased its susceptibility. Now, it is easier for unauthorised individuals to obtain critical information. It comes in numerous forms, including:

1.1.2.2.1 Internet time thefts: Phishing, spoofing, and spam (unsolicited mail), in which a perpetrator sends bogus e-mails that appear legitimate, inducing the victim to provide personal information. [4]

2.1.3.2 Online Credit Card Fraud, E-Bank Theft: The unauthorised acquisition of a credit card number for online transactions or bank account information in which money are diverted to an account accessible to the criminal.

2.2 Computer-Based Cyber Criminality

There are further instances of Computer Oriented Cyber Crime in which the computer is the target:

The act of obtaining information from a computer storage device or hard drive, as well as stealing a username and password and modifying data, is known as hacking.

This involves the reproduction of documents, certificates, identity theft, and counterfeit cash.

2.2.3 Altering Websites: In this attack, the hacker deletes some pages of a website, uploads new pages with the same name, and manipulates the website's messages.

Corporate espionage has become a serious worry for organisations, since approximately 80% of CEOs use detectives and surveillance companies to spy on their ex-workers, employees' lifestyles, and their constant whereabouts, in addition to pre- and post-employment verification.

In addition, as per section 354D, the female ex-employees are permitted to file a FIR, and if the stalking offence is proven, the perpetrator will be punished with imprisonment of either description for a term which may extend to three years, as well as a fine; and be punished on a second or subsequent conviction, with imprisonment of either description for a term which may extend to five years, as well as a fine.[5]

It involves E-murder or homicide or suicide or Spyware. [6]

III. REASONS FOR CYBERCRIME

3.1 Ease of Access: The difficulty in preventing unauthorised access to a computer system is that it is possible to violate the technology by stealing access codes, recorders, PINs, retina imagers, etc., which can be used to fool biometric systems and bypass firewalls to circumvent a number of security systems.

Cybercrimes can be committed solely for the purpose of posing a danger or harming a person's reputation. This is the most perilous of all possible causes. The participants believe in fighting for their cause and desire to attain their objective. They are referred to as cyberterrorists.

3.3 Negligence There is a possibility of not paying attention to system protection. This neglect offers criminals the ability to do computer damage.

3.4 Revenge or Motivation: The desire to control a complex system while inflicting harm on the victim. This includes young people or those who are motivated by a desire for quick cash and who manipulate data such as e-commerce, e-banking, or fraudulent activities.

3.5 Weak Law Enforcement Agencies:

Due to the absence of cyber laws in many nations, numerous cybercriminals escape punishment.

3.6 Cybercrimes Committed for Publicity or Recognition: Typically perpetrated by juveniles who wish to be acknowledged without offending anyone's feelings.

IV. Online CRIME INVESTIGATIONS

According to research, no law can be properly implemented to eradicate cyber crimes. In 2012, cyber crimes increased by 61%, totaling 2,886, with Maharashtra registering the highest number of incidents. During 2008, 2009, 2010, 2011, and 2012, a total of 176, 276, 356, 422 and 601 cases were registered under cyber crime-related provisions of the Indian Penal Code (IPC). The previous year

exemplified how rapidly the threat landscape continues to grow, as the danger to organisations continues to intensify and now spreads across varied mobile platforms. The Web sense Security Lab reaffirmed that conventional security methods are ineffective against cyber threats. The providers of security must move toward more viable defences. Case studies are presented to expound on the threats and defence strategies against cyber attacks.

Case 1: Examination of Phishing

One Doctor from Gujarat had filed a criminal complaint alleging that certain individuals ("Perpetrators") had committed fraudulent acts using emails that appeared to originate from ICICI Bank's email address. These actions were committed with the goal to deceive the Customers. The investigation was conducted with the aid of the customer's e-mail, bank account IP details, and domain IP information, and the crime scene was inspected for evidence.

Case 2: Online Credit Fraud and Counterfeiting

In one of the most notable cases of 2003, Amit Tiwari, a 21-year-old engineering student, used many names, bank accounts, and clients to cheat CC Avenue, a Mumbai-based credit card processing company, out of over Rs. 900,000.

Case 3: Financial Crimes

Due to organised criminality, Wipro Spectra mind lost the telemarketing contract with Capital one. In order to increase Capital one's sales, the telemarketing representatives offered bogus discounts and free items to Americans. Surprisingly, the internal audit also discovered that these telemarketers' superiors were complicit in the scheme. [7]

Case 4: Corporate Espionage

In 2013, three individuals stole the customer information of a reputable private insurance firm and utilised it for unfavourable publicity of the company, its policies, and its schemes. These individuals were competitive business owners that engaged in corporate espionage. The theft of client data was a violation of the Information and Technology Act and section 379 of the Indian Penal Code. (Origin: DNA)

India recorded 2,08,456 cases in 2018, 3,94,499 in 2019, 11,58,208 in 2020, 14,02,801 in 2021, and 2,12,485 in the first two months of 2022.

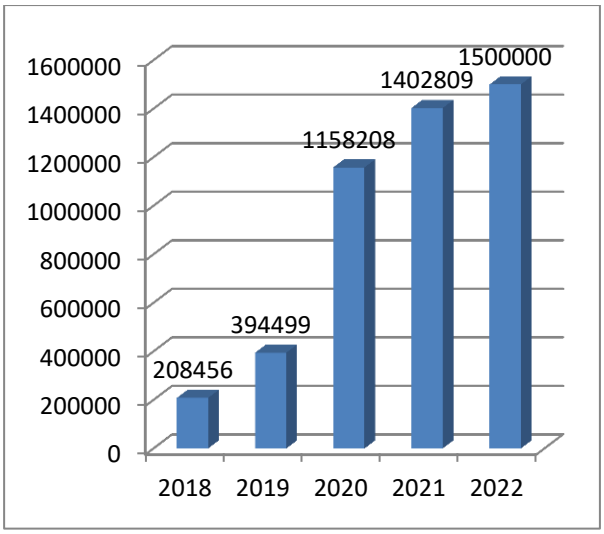

Fig.2.Incidents of cybercrime in India

The US Federal Bureau of Investigation (FBI) recently released a report related to the victims of cybercrimes in the world. India ranks **fourth on the list**.

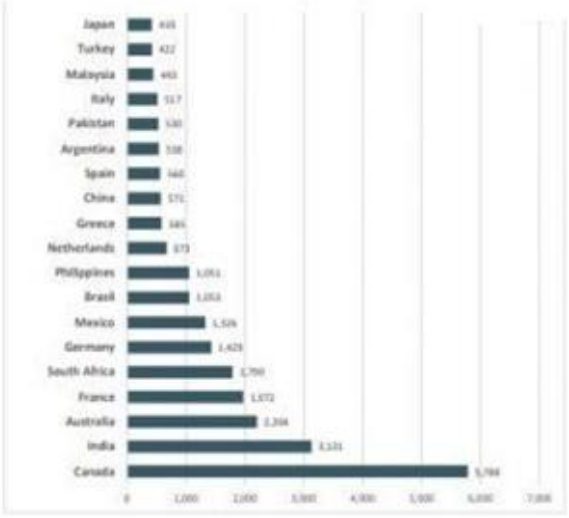

Fig..3. India's rank world wide

V. DEFENDING AGAINST CYBER CRIMES

As demonstrated by the preceding three incidents, established cyber security measures to protect agency networks are essential. Cybercriminals identify security flaws that professional criminals or cyberterrorists may exploit in the future.

Protecting and monitoring wireless access points, network access points, and network-connected devices by protecting interfaces between agency-controlled and non-agency-controlled or public networks. Controlling user access to information resources by standardising authentication mechanisms in place for both users and hardware and by standardising authentication techniques for both users and equipment.

5.2 To avoid insider assaults on agency networks, access rights to files should be restricted and allowed only when necessary for the performance of job responsibilities.
5.3 Networks that serve distinct agencies or departments should be divided, and access to those segmented networks should be provided via VLANs, routers, firewalls, etc., as necessary.
5.4 Access badges should be configured to permit access only to designated areas. In Cyber Crimes and Information Security: Threats and Solutions 839, such as after the Wipro Spectra mind case, staff are subjected to a comprehensive security check, the use of mobile phones is forbidden, and technology is employed to monitor data records.
5.5 Users' system activity should be monitored.
All hosts that are possible DoS (Denial of Service) targets should be secured to prevent unauthorised access to information.
5.7 Trojan scan programmes should be used to install authentic apps.
5.8 To Prevent Against Exploitation:
• Scan periodically for spyware, adware, and bots (software robots).
• Executed using anti-spyware applications that detect these malicious applications.
• Automatic denial of all incoming communications through the perimeter defence.
• Provision of annual security awareness training to workers that, in part, warns against downloading software packages from the Internet without prior consent from the proper agency
5.9 Viral Defense: To reduce virus fake Virus detection programmes and procedures must be deployed agency-wide. All agencies are responsible for maintaining up-to-date software on their network to prevent the introduction or spread of computer viruses by utilising antivirus software, performing frequent backups of data files, utilising write-protected programme media, such as diskettes or CDROMs, and validating the source of software prior to installing it on all CDs or other media brought from home or any other outside source.
Cybercrime endangers the public's safety and our national and economic security. The cyber strategy of the FBI aims to impose risk and repercussions on cyber enemies. Our objective is to alter the behaviour of criminals and nation-states that feel they can compromise U.S. networks, steal financial and intellectual property, and endanger vital infrastructure without incurring any risk to themselves. In order to accomplish this, we employ a unique combination of authorities, capabilities, and relationships to impose repercussions on our cyber adversaries. The FBI leads government investigations into cyberattacks and intrusions. We collect and disseminate intelligence, interact with victims, and attempt to identify individuals who participate in malicious cyber actions, wherever they may be.

How to fight?
Immediately make a report with the Internet Crime Complaint Centre (IC3) if we have been the victim of an online or internet-enabled crime. The goal of crime reports is for investigation and intelligence gathering. Additionally, timely reporting can aid in the recovery of misplaced monies. Visit ic3.gov for more information, including current crime trends and prevention tips.
Get in touch with our Local FBI Field Office
If our organisation is the victim of a network intrusion, data breach, or ransomware assault, please contact your local FBI field office or visit tips.fbi.gov to file a complaint.
Defending against the Evolving Cyber Threat
Our adversaries want to exploit vulnerabilities in our intelligence and data security networks. The FBI is dedicated to working with government partners, international partners, and the corporate sector to close these gaps.
These alliances enable us to defend networks, attribute hostile conduct, punish bad behaviour, and combat our enemies abroad. The FBI promotes this team-based strategy by establishing unique hubs where government, industry, and academia develop long-term, trustworthy ties to combat cyber threats.
Within the government, the National Cyber Investigative Joint Task Force is the focal point (NCIJTF). This task group consists of over thirty co-located agencies from the Intelligence Community and law enforcement and is led by the FBI. The NCIJTF is structured around mission centres focused on significant cyber threat domains and is led by senior executives from partner organisations. Using these mission centres, operations and intelligence are combined for optimum effect against U.S. adversaries.
In a digitally interconnected world, safety, security, and confidence can only be achieved via collaboration.
How We Operate
Whether by creating innovative investigation techniques, employing cutting-edge analytic tools, or forging new community relationships, the FBI continues to adapt to address the difficulties posed by the ever-changing cyber threat.
Each of the FBI's 56 field offices has specially trained cyber teams that collaborate with interagency task force partners.
The rapid-deployment Cyber Action Team can respond to serious incidents across the nation within hours.
With cyber assistant legal attachés stationed in embassies around the world, the FBI collaborates closely with our overseas partners to pursue justice for victims of malicious cyber activity.
The Internet Criminal Complaint Center (IC3) gathers Internet-related crime reports from the general population. Using such allegations, the IC3's

Recovery Asset Team has assisted victims of cybercrime in freezing hundreds of thousands of dollars.
CyWatch is the FBI's round-the-clock operations centre and watch floor, providing support to track incidents and interact with field offices across the country.
Guard our Systems and Information
Maintain up-to-date systems and software, and install a robust, reputable anti-virus programme.
Generate a secure, unique password for each online account we maintain, and change it frequently. Using the same passphrase for many accounts increases our vulnerability if one account is compromised.
Do not open any attachments unless the file, document, or invoice is expected and the sender's email address has been validated. Protect our Connections
Use caution when connecting to a public Wi-Fi network, and avoid conducting any sensitive transactions, including purchases, while connected to a public network.
Avoid free charging stations in airports, hotels, and retail malls. Malicious actors have worked out how to use public USB ports to infect devices with malware and monitoring software. Instead of bringing our own charger and USB cable, we should use an electrical outlet.
Protect our Money and Private Data
Examine the email address in any correspondence and the URLs of any websites that you visit. Scammers frequently imitate a reputable website or email address by utilising a minor spelling difference. Or, an email may appear to originate from a respectable business, but the real sender's email address is suspect.
Do not click the link in an unsolicited text message or email that requests our account information be updated, checked, or verified. If we are concerned about the state of our account, we should visit the company's website to log into our account or call the number indicated on the website to determine if something requires our immediate attention.
Carefully examine all requests for electronic payments or transfers of funds.
Be especially wary of any communication that demands urgent action.
Credit cards offer an added layer of security against fraud when used to make online purchases.
Do not send money to anyone we meet online or allow someone we don't know well to transfer money in or out of our bank account.
If we are a Victim, we file an IC3 Report.
Immediately make a report with the Internet Crime Complaint Centre (IC3) if we have been the victim of an online or internet-enabled crime. The goal of crime reports is for investigation and intelligence gathering. Additionally, timely reporting can aid in the recovery of misplaced monies.
Visit ic3.gov for more information, including current crime trends and prevention tips.
Learn about further prevalent cons and crimes. And learn more about the Cyber Division's activities.
If We Identify a Scam Message, Please Notify the FTC. Received a questionable message? Inform the Federal Trade Commission so that they can assist in protecting others.

CONCLUSION

This study concludes that as the prevalence of cybercrime rises, more detection mechanisms and user education on online safety must be implemented, coupled with comprehensive instruction on the advantages and downsides of the Internet before accessing it. There is no doubt that the Internet provides several chances for crooks. Information is the most effective kind of defence. In order to secure computer systems from cyber attacks, it is necessary to devise methods for preserving and tracking electronic evidence. In addition, new cyber laws and policies must be devised to combat the many types of cybercrime. Even businesses must take the necessary precautions to examine and protect their interest

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41st World Conference on
Applied Science, Engineering & Technology
24th - 25th August 2022 Virtual Conference

Simulation the solar ventilation with PCM in building envelop with TRNSYS and DESIGNBUILDER

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Abstract:-- **When it comes to building simulation, many applications and programs come to us from all over the building envelope, solar gains, solar ventilation ,HVAC systems and equipment, and economic performance evaluation. These programs also take into account for the most part climatic input data. It allows the evaluation of different terms of energy performance and thermal comfort and is thus an important decision-making tool. The resulting increase in the precision requirements of the calculations makes it essential to appreciate the uncertainties associated with these forecasts in order to improve the construction and evaluation process. This article presents a comparison between the evaluations of uncertainties based on the results of simulations in the design phase. If the diversity of these programs is a boon in that it allows many different simulations to be compared, it also poses a problem in terms of comparison of results and even choice of program.**

Index Terms : TRNSYS AND DESIGNBUILDER, PCM, Performance energetic , Dynamic simulation, MSV.

I. INTRODUCTION

Numerical simulation is used in many fields of research and development such as mechanics, astrophysics, physics, nuclear energy, aeronautics, meteorology, astrophysics... is a tool to simulate real phenomena. It is possible to simulate complex physical phenomena such as the prediction of climate change, or to test the performance of a building. Simulation is used to study the functioning and properties of the modeled system and to predict its evolution. Energy performance is a requirement that is becoming more and more important, both for new buildings and for improvements to the building envelope. Therefore, to improve energy performance, it is essential to be able to reliably estimate the projected consumption of a building in operation. For many years, there have been tools on the market that allow thermal simulations to be carried out, ranging from simple spreadsheets to very sophisticated tools. The majority of these tools were initially developed to calculate the thermal needs of heating and cooling of a building, based on the characteristics of the envelope. In the case where this calculation is carried out on short time steps (generally one hour) and in a "dynamic" way, we commonly speak about DTS (Dynamic Thermal Simulation). The DTS, in its most common meaning, has two main limitations: The calculation is generally limited to the envelope (thermal needs) and does not integrate the thermal losses, nor the performance of the different - Ventilation-heating-Cooling (HVAC) systems at the level of emissions, regulation and generation. The calculation only includes the heating and cooling needs. The consumption of ventilation auxiliaries, heating, as well as consumption such as domestic hot water (DHW), lighting or equipment are generally not taken into account or are only taken into account in a "flat rate" manner. In order to overcome these limitations, some tools have gradually evolved to take into account the HVAC, DHW and lighting systems: this is called DES (Dynamic Energy Simulation). In this paper, we have exploited the numerical platform Trnsys and Designbuilder to identify the measurement uncertainties but also the uncertainties of the modeling assumptions. A presentation of the most used tools is proposed as well as the corresponding simulation assumptions which are not always in adequacy with the constructions of today. The thermal behavior of building and their uncertainty ranges are presented. A period has been analyzed to identify the uncertainty range of several parameters. Finally, a comparison between the two simulation programs (TRNSYS and

DESIGNBUILDER) to evaluate the uncertainties associated with the predictions of heating, cooling, solar ventilation and air temperature. Many simulation tools are available to the building industry: Trnsys [11] , EnergyPlus[2], Comfie+ Pléiades. All these tools have shown their performance and have been the subject of extensive validation. The PASSYS and BESTEST projects are the most emblematic projects that have been interested in the validation of simulation tools applied to the thermal engineering of buildings

The European project PASSYS was proposed in 1986 by the European Commission with the aim of increasing the reliability of passive solar systems and it was interested in validating the simulation codes [1]. One of the axes of this program was the realization of test cells in several countries, as a means of standardized evaluation of "passive solar gain components". The PASSYS cells are composed of five faces considered adiabatic, the facade (oriented South) being adjustable and allowed to carry out an experimental validation of the codes. The work of the BESTEST project [9], which stands for "building energy simulation test" consisted in setting up a procedure which allows to compare the results of the simulation tools with test cases by comparing different construction modes such as buildings with high inertia compared to buildings with low inertia allowing to test and compare the numerical tools between them. In spite of the different validation projects, important differences between the simulation results can be observed between the tools. A study was carried out by A. Brun et al (2009) [1] on the comparison of different simulation tools (PHPP, Comfie+Pléiade, CoDyBa, Trnsys, EnergyPlus and SimSpark) applied to the case of the I-DM house located at the INES . Two configurations were tested, in the first case the convective exchange coefficients are constant and equal, imposed by Pléiade and in a second time average annual values were used for the convective exchange coefficients in the case of three tools, EnergyPlus[2], Trnsys [11] and CoDyBa. T. Duforestel (2008) et al [6] give a broad overview of modeling assumptions that are no longer in line with the increasing performance of buildings. The following examples will be developed in this section: the use of hourly time step. The positioning of the weather station, the simulation of the natural ventilation, the estimation of the thermal comfort in a naturally ventilated building, the estimation of the internal loads and the behavior of the occupants, the life span of the materials Flory-Celini C. (2008) [3], used experimental designs in her thesis to provide bioclimatic solutions for existing buildings. The simulations were performed with the TRNSYS tool for two building configurations: a collective building from 1900 and a single-family house from 1966. Chlela F. (2008) [4], developed a methodology using experimental design to optimize the design of low energy buildings. M.A. Piette et al (2001) [10] carried out a commissioning operation on a building in San Fransisco (USA), the technical management of the building (GTB) makes it possible to by controlling all the technical and electronic equipment in a commercial building, building management systems (BMS) enable energy savings to be made, while optimizing the comfort of the occupants. The work of the BESTEST project [7],[8] which stands for "building energy simulation test", consisted in setting up a procedure that allows to compare the simulation tools with test cases by comparing different construction modes such as high inertia buildings versus low inertia buildings allowing to buildings with low inertia allowing to test and to compare between them the numerical tools.

II.METHODOLOGY.

Presentation of the modeling software : The creation of the geometry of the studied models was carried out through the exploitation of the software "Sketch-Up[5] " by using the plugin in Trnsys.

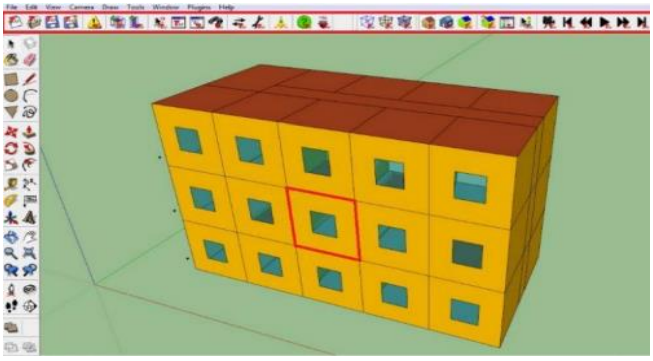


Fig.1. The creation of the geometry of the models studied (Source: Author, 2017).

Building thermics is a discipline that studies the energy needs of buildings(example in energy plus Fig1). It mainly deals with the notions of thermal insulation , ventilation and offer the best thermal environment to the occupants. It also deals with problems of energy supply for heating, air conditioning, ventilation and production of hot water and the production of domestic hot water.

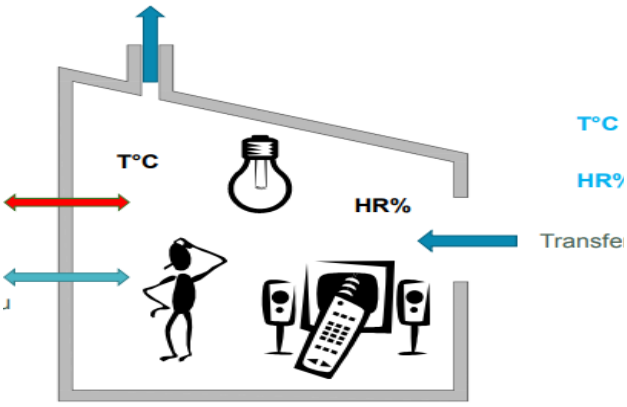


Fig.2.The external environment.

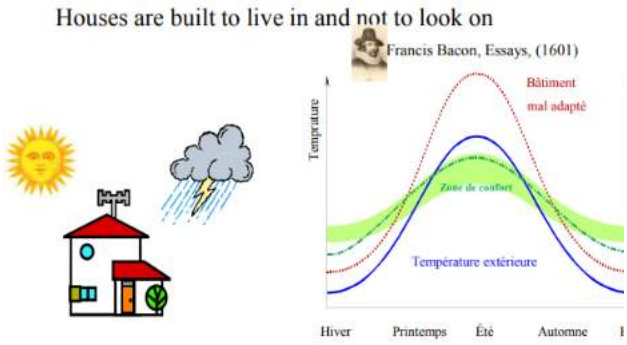


Fig.3.Exemple the thermical building.

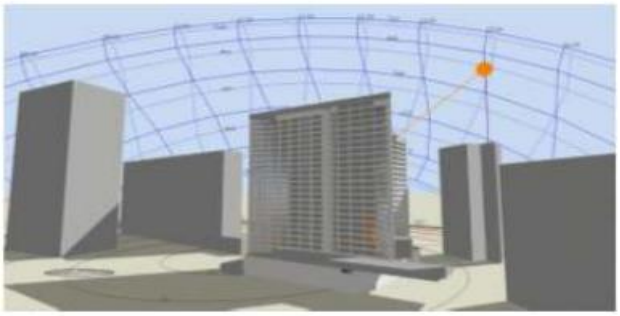


Fig.4.Desingbuilder source.

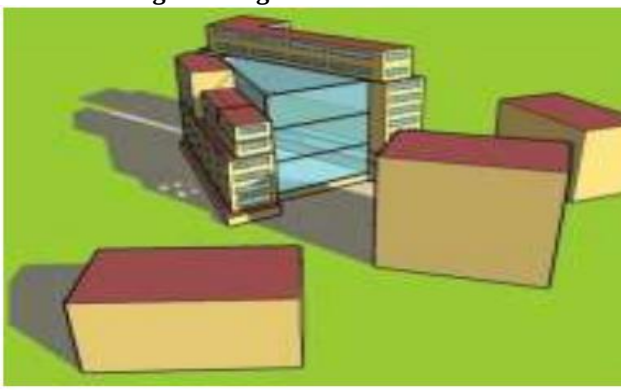


Fig.5.TRNSYS Source.

Fig.6. List of publishers software .

A low energy building does not behave like traditional buildings. A modeling of its behavior is efficiency to optimize its building envelope with regard to heating needs and summer comfort, the treatment of thermal bridges, the management of solar and internal contributions, the waterproofing of the building... Moreover, a highly insulated building is more prone to summer overheating due to the "Thermos" effect. It is therefore essential to minimize solar and internal gains, to maximize inertia and to implement an efficient cooling strategy. It is therefore necessary to quantify in advance the impact of the architectural design on heating needs and summer comfort. This is the dynamic thermal simulation (DTS).The dynamic thermal simulation is more and more often requested in the programs of construction projects and is sometimes considered as an end in itself. The DTS allows to identify and quantify the impact of various energy leaks (thermal bridges, infiltration, ventilation ...) in order to validate the concepts and technical solutions. However, it is a tool for design that can provide multiple indications to designers and owners. Like any tool, the dynamic thermal simulation has limits and fields of application that it is important to know in order to use it in optimal conditions.

A) Dynamic thermal simulation applications:

The most common application consists in the analysis of the thermal comfort in summer in the absence of air conditioning. For this it is common that the programs indicate a certain number of hours of exceeding a threshold temperature, often 28°. Other methods can be used. Most of the tools on the market allow this type of analysis to be carried out, taking into account the operating temperature, which depends on the internal comfort air temperature in the zone and the average temperature of the building envelope. other application of the dynamic thermal simulation is the quantification of heating needs for heating or even cooling in the presence of an active cooling system, in order to study the consequences of different technical solutions on the envelope. Finally, among the common applications, we find less

frequently the estimation of realistic consumption forecasts which requires to implement calculation engines taking into account in a refined way the technical systems, the ventilation systems, or the heating and cooling emission systems, even distribution and production. A first limitation of dynamic thermal simulation tools is the validation of input data. Another limit of the dynamic thermal simulation calculations lies in the basic assumptions of this type of calculation which is the zone model.

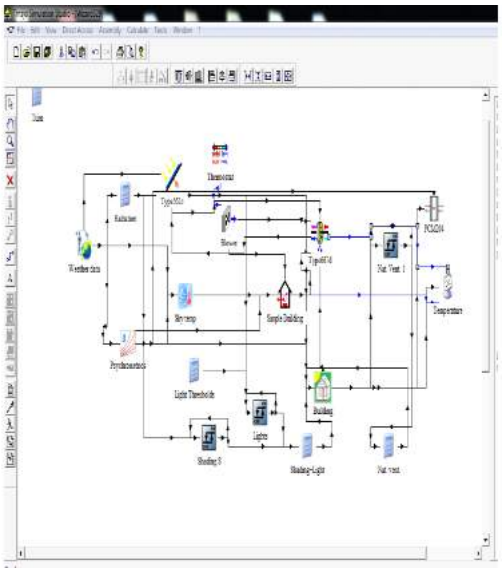


Fig.7. TRNSYS interface.

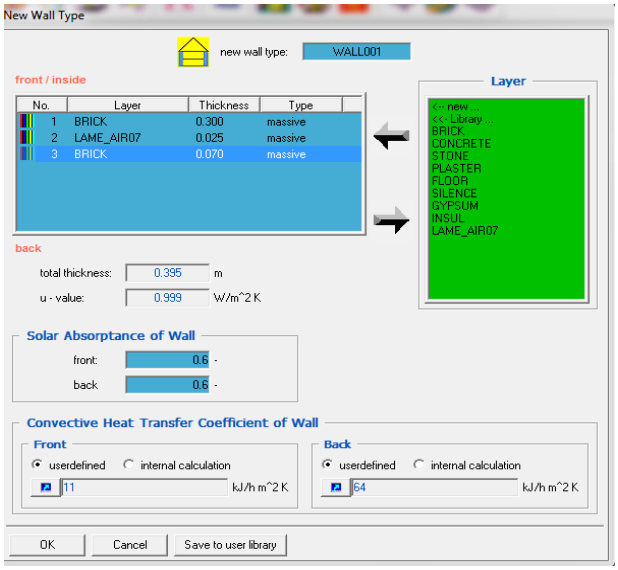


Fig.8. Parameters of the reference wall in building envelope.

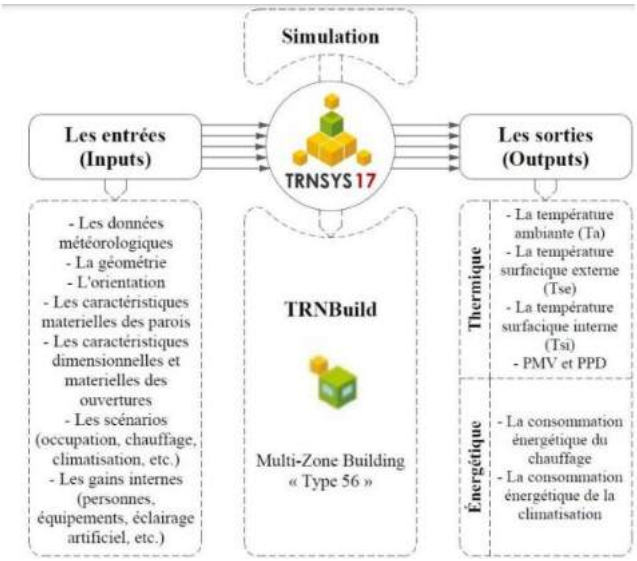


Fig .9.The inputs and outputs of the simulated model .

Concerning the inputs, it is necessary to define the geometry of the studied model (shape and dimensions) as well as its orientation. The meteorological data of the city in question have been introduced in "Tm2" format. Subsequently, the details of the building are introduced through the use of "TRNBuild".At the "TRNBuild" level, it is possible to define the material characteristics of the walls (wall, ceiling, floor) and openings, the scenarios exploited (occupancy, use of blinds, opening of windows, infiltration, operation of heating or air conditioning, etc.) as well as the internal gains (number of people and their activities, equipment, artificial lighting, etc.). About the outputs, the software "TRNSYS" gives the possibility to simulate several parameters of different natures. In our case, two aspects have been studied, the first one is of thermal nature (the ambient air temperature, the internal temperature, the external temperature, the PMV and the PPD) and the second one is of energetic nature (the energetic consumption of the heating and the cooling in order to ensure comfortable thermal ambiences).

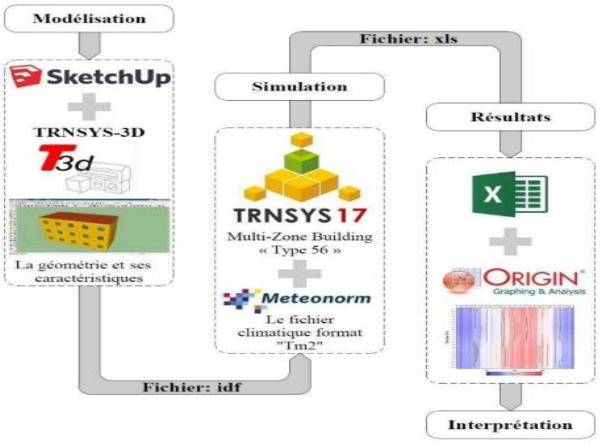


Fig.10.Summary diagram of the digital study .

Strengths: Modularity: tool based on components ("types") that can be freely connected to each other to create its own system. Flexibility: possibility to define equations to define the control logic of the equipment.
Extensibility: possibility to add calculation modules and user interfaces. Very suitable tool for system simulation, especially

for complex systems (e.g. thermo-fridge-pumps, active slabs, predictive control). Areas for improvement (ongoing or future).Not very user-friendly interface, including the interface for the building definition (TrnBuild). 3D module available in Google Sketch Up but not very powerful. No modeling of lighting in the building model. Expert" tool: long learning time. Other functionalities Functionality Method. Regulatory calculation - Hot sizing - Cold sizing - Comfort indicators PMV, PPD.

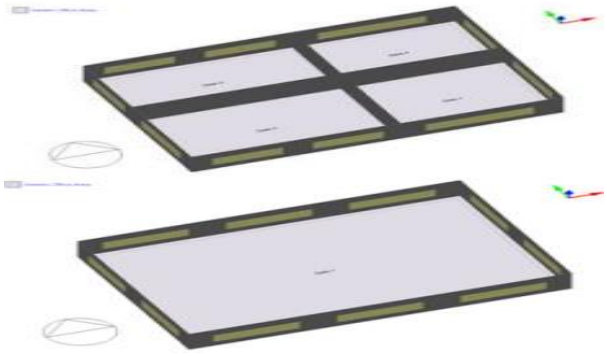
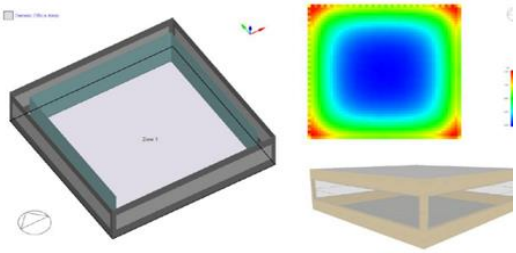


Fig.11. Zone Block By Drawing Partitions.

Energy Plus Applications : Alows modeling of air conditioning,ventilation,heating...It allows to perform simulations with a time step lower than one hour, to model complex energy systems, to analyze thermal comfort, to handle multi-zone, to manage natural ventilation and it can be coupled with other tools like WINDOW5 or Dymola. EnergyPlus is only a calculation engine without a user-friendly graphical interface.
This project is meant for demonstration purposes only and should not be considered to be representative of actual building performance.It is provided for the purposes of illustrating the functionality of the TRNSYS/CONTAM coupling implemented in version 3.1 of CONTAM.



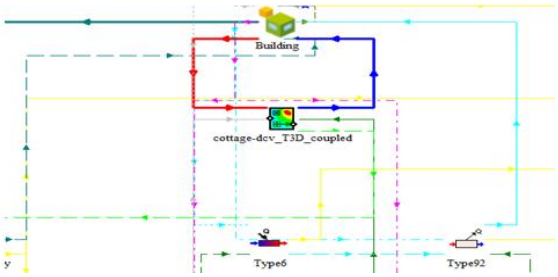


Fig.12.Outline partitions.

The knowledge of how EnergyPlus works was first provided by the Rational Use of Energy course. The presentation of the DesignBuilder software but especially the explanation of the functioning of the calculation program (which is none other than EnergyPlus), allowed an easier approach of the program and its components. You can find in particular the two documents : - Input Output Reference, cataloguing all the information processed by EnergyPlus: inputs and outputs. First, the files used by EnergyPlus are exposed and explained. Also, each object and its characteristics are described. Units, default values, mandatory and optional information are also given. Finally, examples of IDF files are provided. - Interface Developer, dedicated as its name indicates to interface developers, this guide was extremely useful. It explains the behind-the-scenes of EnergyPlus, the writing conventions and the prerequisites to launch a simulation. Finally, an inexhaustible EnergyPlus, the writing conventions and the prerequisites to launch a simulation. Finally, an inexhaustible source of knowledge is none other than the Internet, a lot of information . DesignBuilder is a thermal modeling software with which you can work on building modeling. It includes a range of environmental performance parameters such as: annual energy consumption, maximum summer temperatures and HVAC component sizing, air conditioning and cooling equipment, optimization and simulation of the layout of heating, cooling,

mechanical and natural ventilation systems cooling, solar and natural mechanical ventilation systems of a room using CFD. Economic analyses based on construction costs, service costs and life cycle costs.

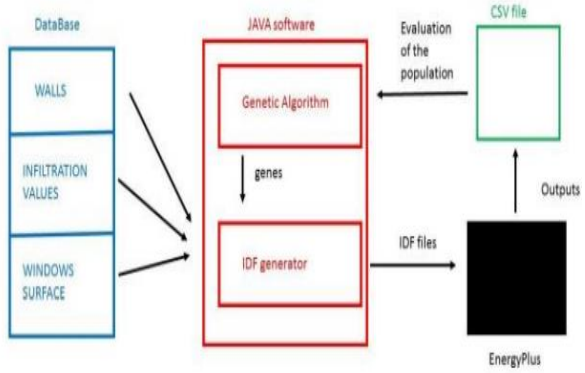


Fig. 13. global software logics.

TRNSYS AND DESINGBUILDER :

These tools can take various forms: databases, spreadsheets, tools to analyze the energy performance of buildings as a whole. In this section, the aim is not to present the different simulation codes, as the reader can refer to the presentation of each tool, but to differentiate the objectives and levels of precision of each of these tools, the relevance of which depends on the use and the needs of the user. The use of a tool whose energy system could be modeled from the pre-project stage which consists in obtaining a trend of the energy performance.

Fig. 14: Plan of the house.

The building generated directly from the TRNSYS and DesignBuilder software used for the Dynamic Thermal Simulation the building envelope in CASABLANCA MOROCCO Its 100 m2 in surface and occupied by 4 people.

Mathematical description :

Cc :capacity rate
Ch :capacity rate on hot side, mh Cph .
Cmax: maximum capacity
Cmin :minimum capacity .
ε : heat exchanger .
mc **:** mass flow rate on cold side.
mh :fluid mass flow rate on hot side.
QT: total heat rate across heat exchanger.

Cc=mcCpc **Ch=mhCph**

$$\varepsilon = \frac{1-\mathrm{EXP}\left(-\frac{UA}{Cmin}\left(1-\frac{Cmin}{Cmax}\right)\right)}{1-\frac{Cmin}{Cmax}\,\mathrm{EXP}\left(-\frac{UA}{Cmin}\left(1-\frac{Cmin}{Cmax}\right)\right)}$$

Zone Outputs:

NTYPE#	Label	Description	Unit
NTYPE 1	TAIR	air temperature of zone	[°C]
NTYPE 2	QSENS	sensible energy demand, heating(-), cooling(+)	[kJ/hr]
NTYPE 3	QCSURF	total convection to air from all surfaces within zone incl. internal shading	[kJ/hr]
NTYPE 4	QINF	sensible infiltration energy gain of zone	[kJ/hr]
NTYPE 5	QVENT	sensible ventilation energy gain of zone	[kJ/hr]
NTYPE 6	QCOUP	sensible coupling gains of zone	[kJ/hr]
NTYPE 7	QGCONV	internal convective gains of zone	[kJ/hr]
NTYPE 8	DQAIR	sensible change in internal energy of air in zone since the beginning of the simulation	[kJ/hr]
NTYPE 9	RELHUM	relative humidity of zone air	[%]
NTYPE 10	QLATD	latent energy demand of zone, humidification(-), dehumidification (+)	[kJ/hr]

Fig.15.Zone output.

AIR SPEED : It is generally agreed that air velocities below 0.25m/s over the whole body do not affect thermal comfort in normal situations. comfort in normal situations. Therefore the comfort related to a distribution of temperature and heat flow.

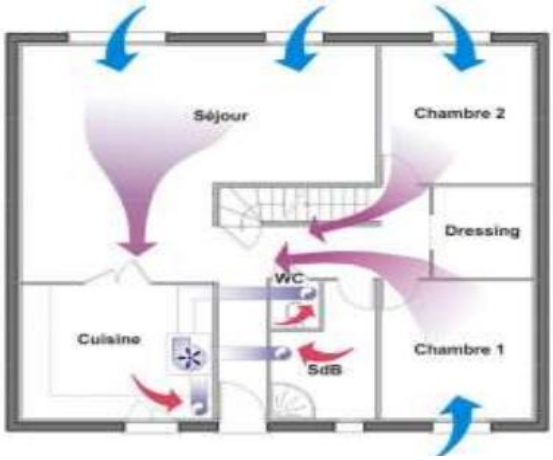


Fig .16. Airtightness with ventilation.

Ventilation = Organized and voluntary organized and voluntary air renewal for comfort and sanitary quality.

Infiltrations = Uncontrolled air renewal, not organized, badly known and involuntary which creates discomfort and overconsumption.

Reactivty indice of the simulation TRNSYS and ENERGYPLUS are calculated in the case of methods based on the study of the variance consisting in determining which part of the variance of the response is due to the variation of each parameter. These techniques include the methods FAST and So bol methods. The reactivity indices are:

- The first index Ri which quantifies the reactivity of the output **Y** with respect to the input parameter **Xi**
- The second index Rij which quantifies the of the reactivity output **Y**with respect to the cross interaction X ,

and Xj without taking into account the effect of the variables alone. The reactivity of the output y with respect to the cross interaction of the parameters without taking into account the effect of the variables alone.

- The total index corresponds to the reactivity of the parameter alone and the reactivity to the interactions of this

parameter with all the parameters. It corresponds to

$$RT\ i = Ri + Rij + Rik + \ldots + Rijk +$$

U: building envelope loss coefficient (kJ/hrm2 -°C) Cap building envelope capacitance (Kj/°C) .

Cpair: specific heat of building envelope (kJ/kg-°C)

ρ air: density of building envelope (air) (kg/m3) .

Area building surface area (m2)

ω mult: humidity ratio multiplier (-).

T initial: initial temperature (°C)

ω initial :initial humidity ratio (-) .

Tvent : Temperature of ventilation (° C)

ω vent: humidity ratio of ventilation (-) .

Mvent: ventilation air mass flow rate (kg/hr) Tamb: ambient temperature (° C).

Ωamb: ambient humidity ratio (-) Qlights :rate of energy convective from lights (kJ/hr) .

Qequip: rate of energyconvective from equipment (kJ/hr)

Qpeop :rate of sensible energy convective from people

Ωgain: rate of humidity (kg/hr) Tzone ωzone: zone humidity ratio (-).

mvent :mass flow rate of ventilation (kg/hr) minfil :mass flow rate of infiltration (kg/hr) .

Qinfls :sensible energy from infiltration (kJ/hr) Qvents: sensible energy from ventilation .

$$\frac{dT}{dt} = \frac{UA}{cap}(Tam - T) + \frac{mven*cpair}{cap}(Tven - T) + \frac{minf*cpair}{cap}(Tinf - T) + \sum Q\ gains.$$

The moisture balance:

$$\frac{d\omega}{dt} = \frac{minf}{\rho V}(\omega inf - \omega) + \frac{mven}{\rho V}(\omega ven - \omega) + \frac{\sum Q\ gains}{\rho V}.$$

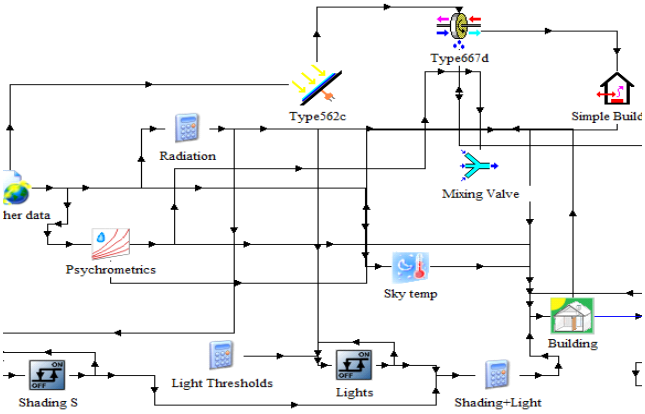


Figure .17. Simulation model inTRNSYS.

III.RESULTS AND DISCUSSION:

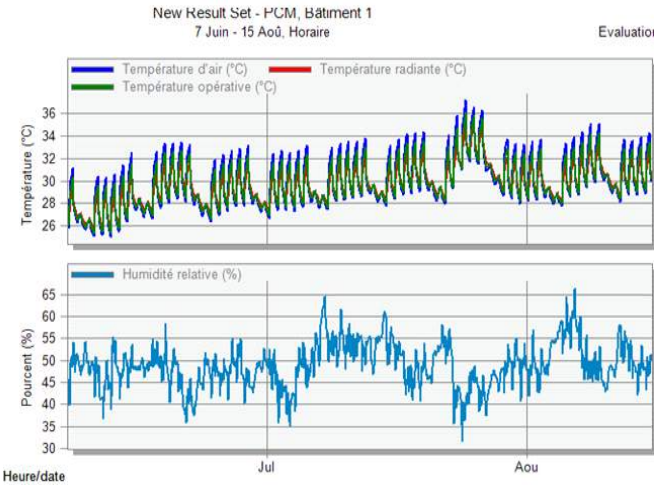


Figure .18. Evolution the humidity and temperature in DESINGBUILDER without(MSV+PCM)in summer.

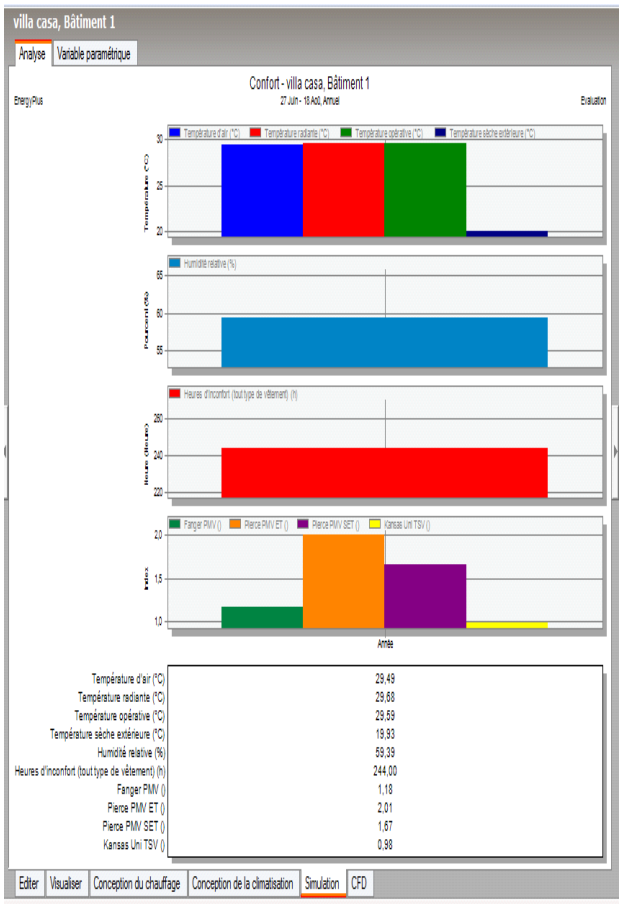


Figure.19.Evolution the annual humidity, comfort and temperature without solar ventilation.

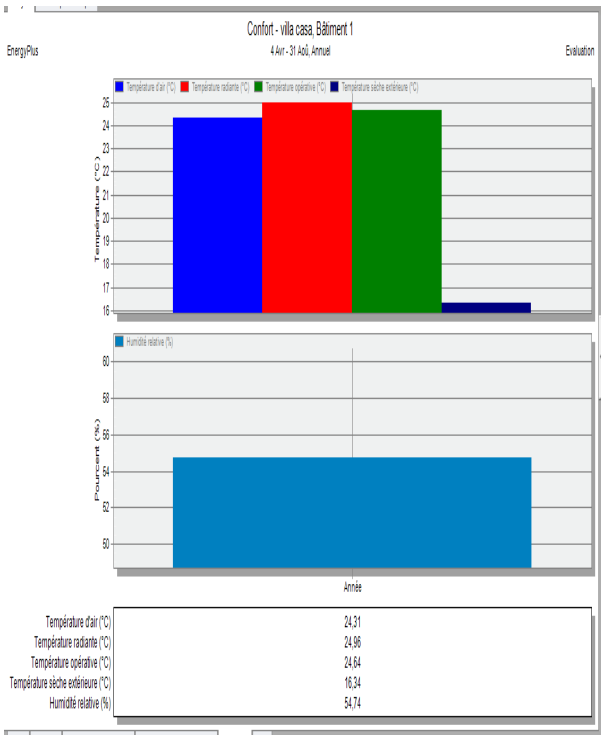


Figure. 20.Annual Evolution about the humidity and temperature with solar ventilation.

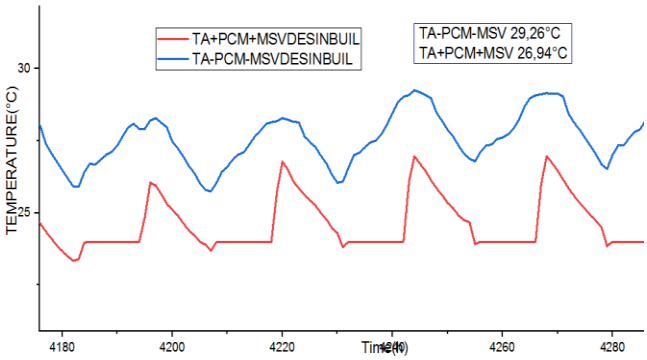


Fig. 21. Evolution of the internal air temperature without solar ventilation and with solar ventilation in summer with DesignBuilder .

Fig18.19.20.21. Show the evolution of the relative humidity, the comfort effect and the internal air temperature without(PCM+MSV) and with(PCM+MSV)and in DesignBuilder softward in zone climate CASABLANCA. The internal air temperature without (PCM+MSV)is 29.26°Cand with(PCM+MSV)is26.4°C fluctuation of 3°C.

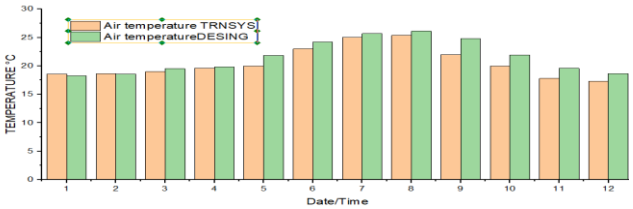


Fig. 22. Evolution the annual internal air temperature with solar ventilation in TRNSYS and DesignBuilder.

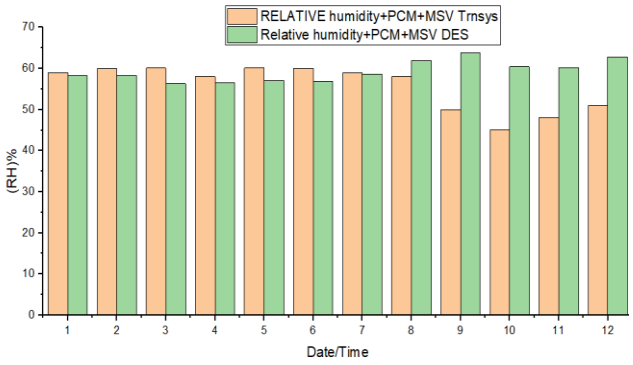


Fig. 23. Evolution the annual of the relative humidity with(PCM+MSV) in TRNSYS and DesignBuilder

Figure 22 and Figure 23 show the evolution of the indoor relative humidity and humidity ratio ,temperature of the two simulations TRNSYS and DESIGNBUILDER of the standards is made, according to a comfort interval (19°C to 25°C) with(PCM+MSV. The platform corrects the setpoint

temperature and the incoming airflow of the ventilation according to the ventilation according to the detected standards.The fluctuation of the internal air temperature is 2°C and 16 % the deference about relative humidity. WE Overview that the TRNSYS application has expert software for dynamic temperature and energy simulation.

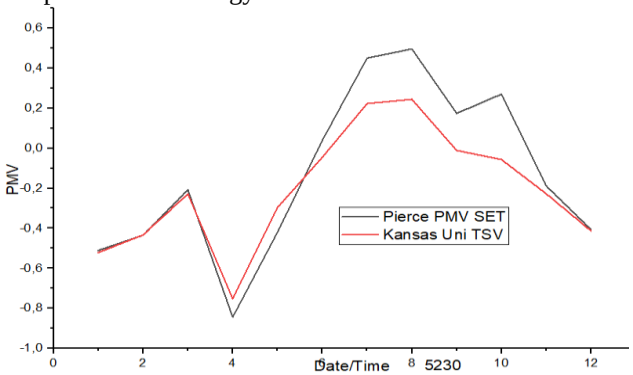


Fig.24. The "PMVSET and KANSAS TSV" index simulated during one year with solar ventilation.

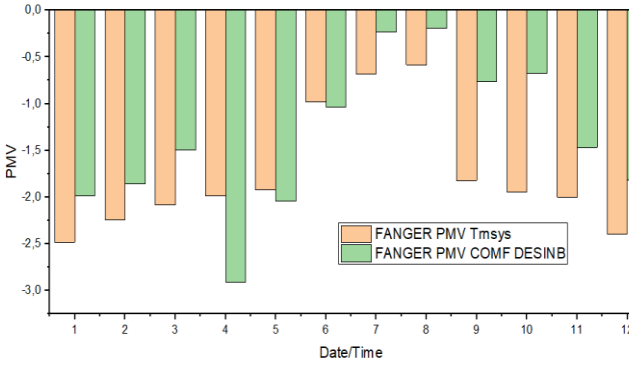


Fig.25. The "PMV FANGER" index simulated during one year with solar ventilation in TRNSYS and DesignBuilder.

Fig.24.25.Present the "PMV FANGER" index simulated during one year with (PCM+MSV)in TRNSYS and DesignBuilder in our study the value of fanger PMV with (PCM+MSV) I in TRANSYS varies between 0 zone the comfort and -2.3 , -2,5 in the summer period and the value of Fanger PMV with (PCM+MSV)in DESINGBUILDER varies between 0 (zone the comfort) and - 3. The adverse result express very small temperatures and the positive resultindicate very high temperatures. The thermal comfort zone is between (-1) and (+1). An index of the PMV equal to (0) expresses an optimal feeling of thermal comfort.

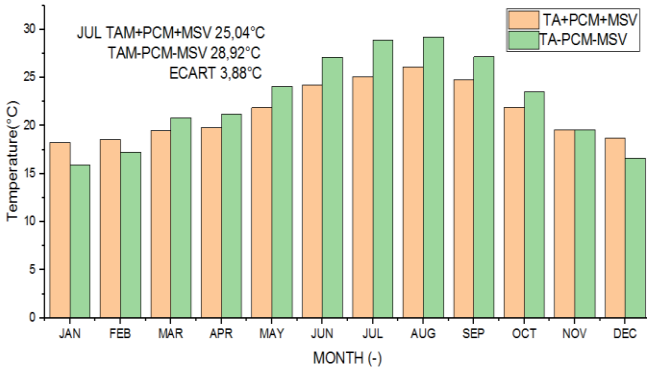


Fig.26.Monthly evolution of the air temperature with and without solar ventilation.

Figure 26 represent the evolution of the annual indoor temperature simulated by the numerical model DesignBuilder without solar ventilation and with solar ventilation in (CASABLANCA NOUASSEUR), and the distribution of difference is 3.8 °C .

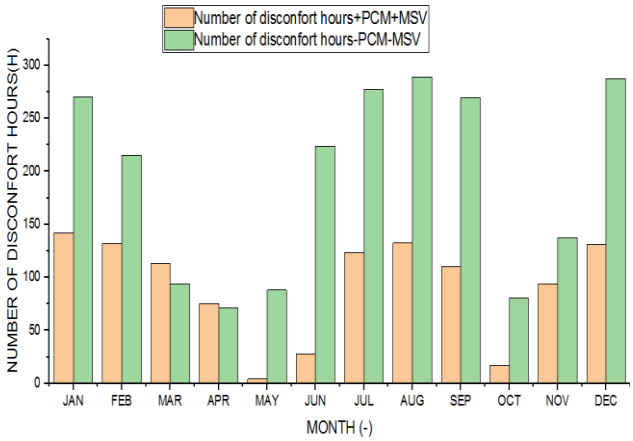


Fig.27. Thermal discomfort indexes with and without solar ventilation.

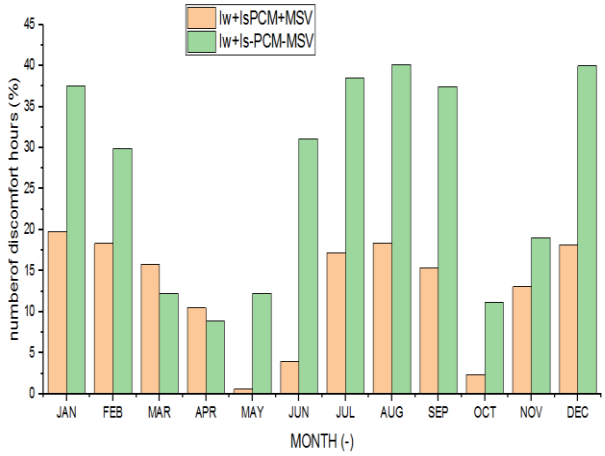


Fig.28 . Number of discomfort hours with and without solar ventilation.

Fig.27.28. Present Number of discomfort hours without phase change materials and solar ventilation and with phase change materials and solar ventilation in Morocco zone . The result showed that the phase change materials and solar ventilation in building envelope can created the fresh air and comfort zone , maintain the heating in the summer period, decrease the overflow rate and relative humidity and minimize the number of discomfort hours .

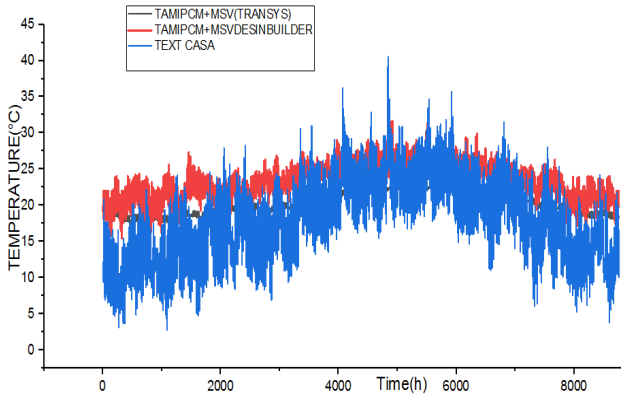


Fig.29. Growth of the annual internal and external ambient air temperature .

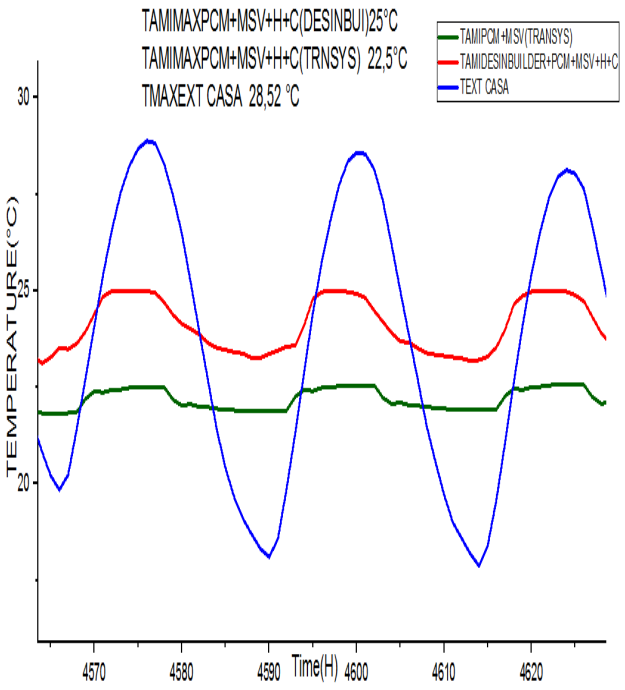


Fig.30. Growth of the external and internal ambient air temperature in summer.

The figure 29 represent the annual evolution of the inner and extern temperature, figure 30 represent the growth of the inner and extern temperature modeled by the Energy plus and TRNSYS , We noticed that the TRNSYS software is one of the most used in the research field and is very complete and on the internal and external energy and temperature that integrate on Energy plus and also expert software for 100% flexible dynamic temperature and energy simulation . The result shows a fluctuation of 2.8°C, so the results confirming the great sensitivity of the calculation codes to the variation of physical parameters . The comparison about relative humidity between the 2 simulation tools for the building envelope with solar ventilation and phase change materials was performed. It was observed that the simulation with TRNSYS has the same trend as DESINGBUILDER .

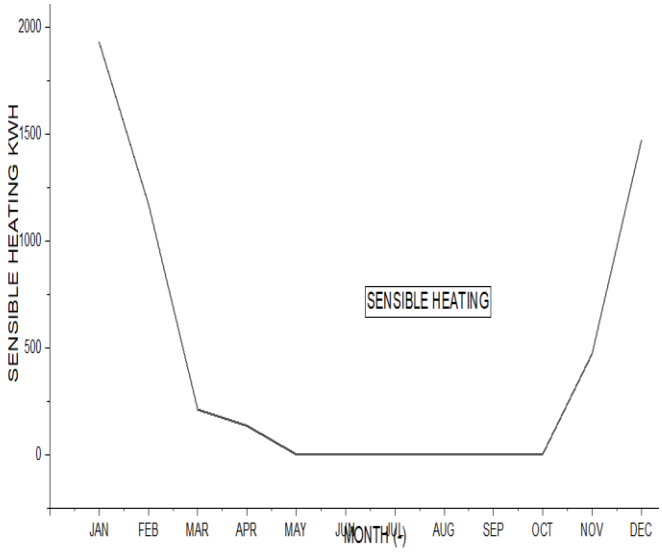


Fig.31. Annual evolution the sensible heating production with solar ventilation in TRNSYS and Energy plus.

Fig. 31.32. Present the annual evolution about the sensible heating production with solar ventilation in TRNSYS and Energyplus applications. The results of the simulation showed that the solar ventilation and phase change material play a role in an grwth in the thermal energy storage. January the biggest sensible heating production month of the year is 1900 kwh .

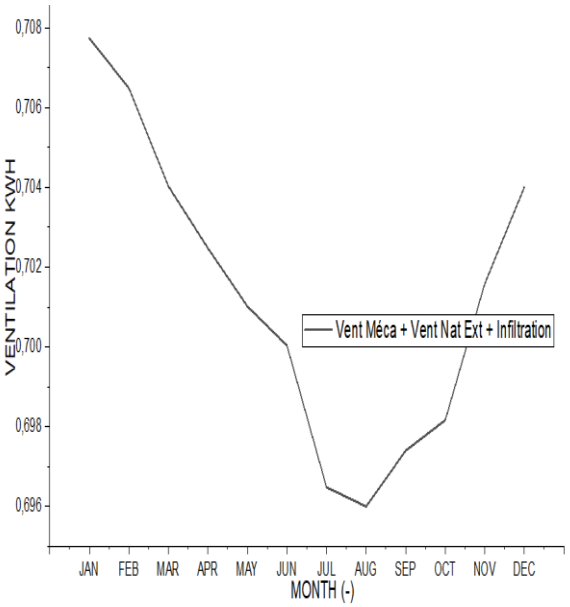


Fig. 32. Annual evolution the mechanical solar ventilation.

IV.CONCLUSION

The construction of low energy buildings reducing the consumption of buildings and the annual demands of air conditioning and heating and control the ambient temperature and heat flow and create a more comfortable area. To assist in the rationalization of energy use in the building sector, dynamic thermal simulation is being used and the requirements for accurate calculations have increased and it is becoming essential to appreciate the uncertainties associated with these predictions in order to improve the building process. Modelization tools are the most reasonable way, in terms of time and cost, to analyze and improve the energy performance of buildings, whether in the building or rehabilitation phase. This implies that the tools have first been subjected to rigorous validation tests, simulated under climate in Morocco . Numerical simulation programs are considered as powerful tools for decision support that give researchers a global reading and a good understanding of the phenomenon or the studied element. In the building sector, simulation software is used to study the various physical phenomena (air temperature, ventilation) and energy related to buildings and their components including the facade and its elements. They also allow optimizing the design of a building by proposing a realistic the thermal functioning of the construction with detailed energy calculations. They give the possibility to appreciate the thermal phenomena which take place in the building and to apprehend them globally on the complete cycle of a year. The numerical simulation represents the technique of research the most exploited by the researchers in the quasi-totality of the studies considering their assets on several plans as well as the precision and the reliability of the obtained results.

ACKNOWLEDGEMENT

The technical inputs of Mr MOUHIB TAOUFIQ of Physical Engineering Department are acknowledged and HassanI First University of Settat, (ENSA) Ecole Nationale des Sciences Appliquées, LISA Laboratory and CNRST organism.

CONFLICT OF INTEREST:

The authors declare that there are no conflicts of interest.

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An Overview on Applications and Developments in Education on Agent Based Ontological Cooperative Learning

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[1][2] Department of Computer Science and Engineering, Aarupadai veedu institute of technology, Vinayaka missions University, Chennai, Tamilnadu

Abstract:-- **In this paper, we have defined various types of concepts which are applied in the real time classroom environments such as Ontology, Cooperative Learning through an I-MINDS infrastructure which could enable the students to participate actively in virtual mode rather than passive listening to the lectures in a traditional way of teaching and learning environment. In teaching and learning process, I-MINDS plays a major role where it monitors' the students activities and help the teacher manage and adopt to the class where as in learning environment, it has its applications which helps to measure the knowledge and understanding capability of the students which helps them to interact with other agents to support Cooperative Learning Environment.Mainly,we discuss about the agents involved in the development of learning process of education ,we also discuss about the methodologies and architecture involved in the development of the learning process through ontological Cooperative Environment.**

Index Terms : Cooperative Learning, Education, Multi-Agent System, Ontology.

I. INTRODUCTION

Here we apply the concept Multi-agent System in the form of agents which supports the Cooperative Learning activities through Ontological process. In education, Ontology plays an important role in management of knowledge and representation. It helps to formulate the representation of the learning domain through the comparison of knowledge and relations between the concepts and all the properties which exists. In this paper, we discuss about the concepts which basically explains the research done on the various domains applied in education and its recent developments in education.

In this system, it is applicable in both the ways such as teaching and learning environment. It is basically helps the teacher to teach better and guides the students to learn. Most of the technology user supports to improve the learning process .It has also been proved that it helps to stimulate more interactive learning through Cooperative Learning process.

According to Leen-kiat, Hong Jiang [], they strongly describe the learning capabilities of the students and supports them to develop their knowledge and understanding capabilities .In learning process, it is widely believed that these technologies are

- It is inherited good knowledge and remain competitive in an institution.
- It helps to deliver a cost free effective education.
- Offers more opportunities over Student-Student and Student-Teacher Interaction to gain control over the knowledge.
- It also offers the wider and broader resources to learn about opportunities to learn about faculty and students and their view points.

In our education system, we incorporate this technology named I-MINDS in the real time classroom environment with Cooperative learning methods which helps to support the students to learn and gain knowledge in a real-time environment. Here we also apply the Ontological concepts and its application in education. It is mainly used to guide students to understand the organization of their own learning and organization of their own learning and self-access their own progress. It is created by the set of people with expertise in content, teaching, psychology and measurement.

The main purpose of our project is

- To improve the teaching and learning process (e.g. : STEM technology)

- To be cost effective such as virtual learning environment, easy access to the knowledge gained in teaching and learning process
- Is to develop new innovating techniques in Computer Science and Engineering such as Multi-Agent Systems and implement various educational tools for the development in the learning architecture.
- It is also applicable to investigate the various technologies which is incorporated through Cooperative Learning by using I-MINDS as an active and flexible learning environment.

We describe about the agents involved and the related work which is involved in educational applications. In Section [3], we describe the design and methodology of various domains such as Ontology, Cooperative Learning and Multi-Agent Systems such as I-MINDS through education. In Section [4],we discuss about various view points and practical application of various technologies and developments in its educational architecture.

II. BASIC CONTEXT

The ultimate goal of a human learning environment is to improve the learners knowledge and build software applications which is for the one environments rather than many environments which is designed in such a way that could help user to learn and accomplish the task rather than designing the task for the user.Multi-Agent System has various systems address tasks [9] sorting e-mail and filtering news group messages [7].By applying various designed tools, it could be used as a relieving tool to the user's task.

As said and distinguished by Malone, these agent make an important difference between toys and tools with gaming technology. Toys are considered as a module with no external goal whereas tools are considered as a easy to use which could find the users external goal. These kind of external tasks are provided to the user to build the human learning process. It basically teaches the user about the process of learning and teaches the user to reach the goal easily which could easy the process the task.

Generally, this kind of learning process is basically of two types such as training and education. Training is based on the learning of job related skills, etc..In education, It is basically for the academics process such as primary, secondary, college and university. As defined, agents are defined as a flexible, proactive, reactive or social.

We also describe about the applications of ontology and Cooperative learning in education. Ontology has various applications in education which helps in the representation of learning process which are related to the concepts and relations. In paper [1],it explains about the representation of learning concepts where as Cooperative learning it helps a method which helps the student to work in groups.

All the methods implemented are developed in to the development phase where it enhances the learning process.

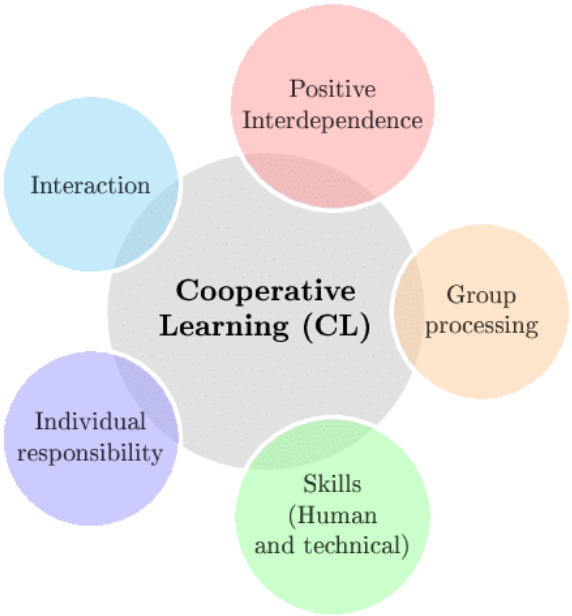
III. ARCHITECTURAL VIEW

A) Cooperative Learning

This is the architectural view of Cooperative learning where it mainly exposes the design of a platform for the learning of control systems based upon collaborative efforts of the students in this area. The context of this platform arises according to some general educative and technical elements. The first element is to help to the technical processes that the students follow in the design of digital control.

The modes involved in Cooperative learning are

- Interaction with the students to undergo the gained knowledge.
- Positive inter dependence of the module
- Helps to process the group discussions
- Involves in technical and fundamentals of teaching and learning process.
- It also helps the person to analyze the responsibility of an individual.

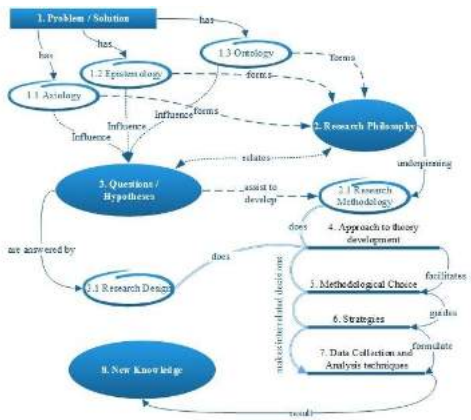


a)Cooperative view of learning

b) Ontological view in education

Ontology represents a multi-dimensional map of a domain of learning. At the top level, it specifies the core concepts and principles, and the cognitive demands which embed them, that are essential to competency in a domain, whether that domain defines a unit, a course, or high school expectations. Drilling down from these core concepts are the

supplementary knowledge and skills which students are expected to develop as they progress toward competency. An ontology thus represents a multi-dimensional depiction of how learning is defined and through what knowledge and skills it develops and also provides an organizational scheme for integrating expectations, mapping progress, and coordinating learning resources and supports By relating (or binding) instructional objects, help routines, worked examples, brief explanations, language requirements, lessons units in courses, professional development, and so on, an ontology can be sampled along different vectors or even levels for detailed development. Our goal is to produce ontology's that provide clarity, a path toward fewer standards, and analytic evidence of more challenging, complex requirements. Although typically imagined as a top-down process, we believe ontology development can proceed at different points of entry, for example, by aligning assessment tasks, or courses and curricula relative to the ontology, or move among levels. In our most recent developments, which are based on earlier work at CRESST, we are developing an assessment task ontology that could be used to identify gaps or mismatches in assessments and the goals they claim to assess. The assessment task ontology would systematically link data or evidence for various purposes to support validity interpretations and other technical quality requirements.



b) Ontological view of education

Macal and North categorized of all these MAS in two types such as,

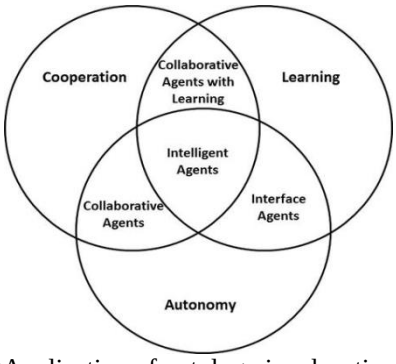
a) Minimalist model: Based on the assumptions, it is designed to capture the silent feature of the system. These are explanatory electronic laboratories, involving resources of the computer modeling model.

b) Decision Support System: I is designed to answer the wide range of real-world policy questions, makes decisions to support stack holders.

Actually MAS has been applied in the various field of knowledge .Practical cases of uses include [6], the modeling of the organizational behavior, team work, supply chain etc..

IV. APPLICATIONS AND DEVELOPMENT IN EDUCATION:

c) Multi-Agent System in Education



a)Application of ontology in education :

- these INCLUDE, AMONG others, information research, personal assistants, E-mail management etc.
- it helps in the management of data
- it helps to capture the knowledge within a certain domain (organization/information SYSTEMS)
- as a model generally as a data model, helps to capture certain knowledge.
- *These models are captured than be queried by users, to answer complex questions and display relationships across a domain*

b) Applications of MultiAgent System in Education:

- The main application of Multi-Agent System are Ambient Intelligence, Grid computing, Electronic business, the Semantic Web, Bioinformatics and computational Biology,Monitering and Control, Resource Management,Education,Space,military and manufacturing applications ,and so on.

Whereas graesser [5], believe that an agent ,must be a continuous process of execution and represented dramatically which divide the autonomous agents into three main groups such as

1. Biological agents
2. Robotic agents
3. Computational agents

The agent based application can be classified through orthogonal dimensions which could be classified according to the various factors such as

- Types of agent
- Technology used to implement the agent
- By the application domain itself.

After the establishment of topology, Nwana [4], defined seven categories' of agents according to their architecture and function :

1. Collaborative agents
2. Interface agents
3. Mobile agents
4. Information agents
5. Reactive agents

Fig 3: Categories of agents

CONCLUSION

We have presented an innovative multivalent system to support cooperative learning among students both in the real classrooms. A teacher agent monitors the student activities and helps the teacher manage and better adapt to the class. A student agent, on the other hand, interacts with the teacher agent and other student agents to support cooperative learning activities behind-the-scene for a student. here we also apply various other technologies' such as ontology,Multi-Agent System which will help to enhance the learning skills and develop the teaching methodology also. will will try to enhance the teaching and learning methods.

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Smart Plant Monitoring System for Plant Fitness Using IoT

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***Abstract:*-- Technology has made amazing strides in all regions of lifestyles which includes enterprise and agriculture. Agricultural improvement is vital to our survival. Researchers are looking to comprise current era into agriculture to broaden new techniques to enhance agricultural lifestyles. People in large towns have a difficult time retaining their veggies in exact condition. These studies article indicates smart IoT-primarily based totally lawn tracking primarily based totally at the microcontroller, which allows customers perceive modern humidity and mild traits in their plant life. With the assist of Bolt-IoT cloud person you may be capable of get statistics approximately plant fitness on their phones. Users might be capable of higher control their gardens approximately plant fitness and increase with the assist of this era. The cause of this examine is to introduce and enhance the improvement of IoT in clever towns in our society**

Index Terms : IoT, NodeMCU, Smart Garden, Bolt-IoT cloud

I. INTRODUCTION

Everything in the world can now be automatically controlled and influenced. Our nation's agriculture depends heavily on crop monitoring because crops were grown under carefully managed climatic conditions for maximum yields. Automation is the process of taking over control of industrial equipment and operations from humans. The Internet of Things (IoT) is a method for using computers, mobile phones, or digital gadgets to monitor and control basic aspects of daily living. In this document, the technology of the plant monitoring system provides feedback to the user via smartphone or laptop. These types of systems can monitor plants using IoT and cloud computing. This automatically helps in the sustainable growth of the plants with good health and best yield. The system uses various modules such as Bolt-IoT cloud, microcontroller, LDR (Light Detecting Resistor) and soil moisture sensor. Automated systems reduce the need for human resources and hence reduce errors. This finally helps to easy the process of taking care of plants manually and helps the user to get the day by day update of the plants health status.

II. BACKGROUND

Humidity levels exceeding 80-85% since they can increase the likelihood of disease and impede plant growth. Therefore, it is important to routine check the humidity of corps for their benefit. With the aid of MATLAB analysis, an innovative approach of physical parameter monitoring, data display, data integration to the cloud, alarm production, and value prediction is put into practice. Building an integrated system that will address all these issues. For instance, the essential elements such as temperature, humidity, water and nutrients are important for plant growth. Global Warming makes smart farming extremely vital. Real-time environmental and water management monitoring is a crucial factor to take into account in smart plant monitoring. With the use of a wireless sensor network the gardener will be able to govern faraway areas easily and thus they could take care of their plants heath in a better way. There are hurdles like the perfect fusion of sensor, information interface, irrigation control, connectivity, and software design yet design systems that have the edge. This offers a framework for remote sensor monitoring using GSM and GPRS advancements, which could be an early indictor of the productivity of e-farming. The major goal of this e-gardening creation is to enjoy gardening process by people and more people enroll for gardening.

III. PROPOSED SYSTEM

The proposed system consist of NodeMCU ESP8286 with WIFI Modul, they serves as the basis for the prototype. The ESP8286 WIFI MODULE is the brain of the system and is connected to the soil moisture sensor and LDR (Light Detecting Resistor) to detect

the time to time status of the plant and inform the user immediately if there occurs any problem for the plant development or any resource is lacking for the plant.

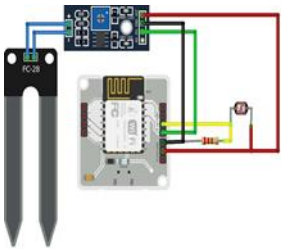

Figure 1 Interfacing Diagram NodeMCU with WiFi Model and Soil Moisture

Steps to design the system

1. Join the LDR's two ends, one end to pin A0 and the other end to the 3.3V power supply.
2. Connect a 10k ohm resistor between the volt's A0 and GND pins. Next, connect the Vcc, GND, and Do (digital output) pins of the amplifier circuit to 3.3V of the volt unit using the female header, and attach the soil sensor probe to the circuit using female header wires.
3. Insert the soil sensor probe into the plant, then turn the bolt on.
4. Create an Integromat account first on the website integromat.com.
5. To create a new scenario after creating your account, by clicking on the Create New Scenario icon.
6. In the services, select Twilio messaging and Bolt IoT.
7. Now try to create the necessary logic flow using the services.

IV. BLOCK DIAGRAM OF THE SYSTEM

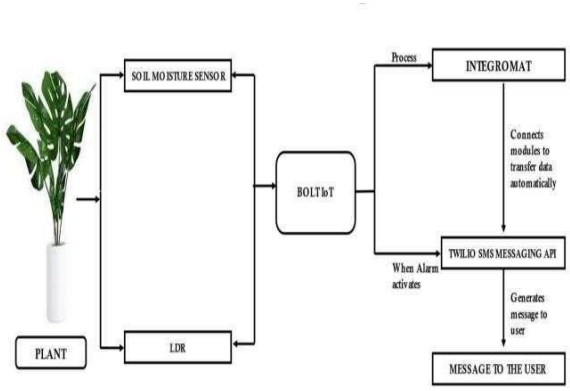

Figure 2 Block Diagram of the system

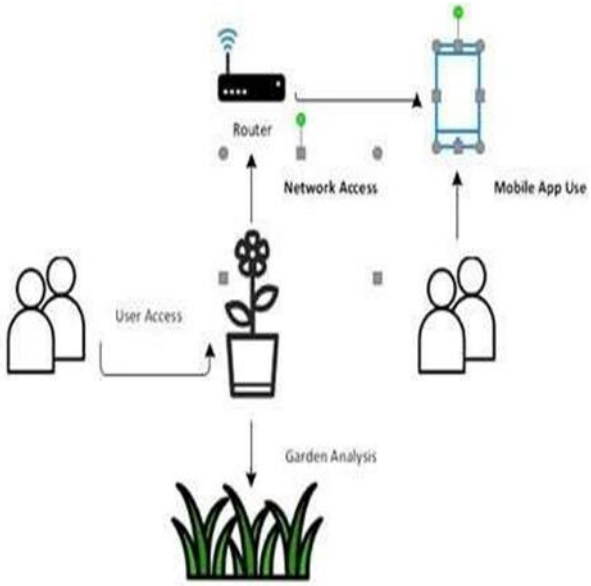

Figure 3 Representation Flow

ANALYSIS OF THE BLOCK DIAGRAM

Bolt IoT Platform: Provides the ability to control the device and securely and reliably collect data from IoT devices.

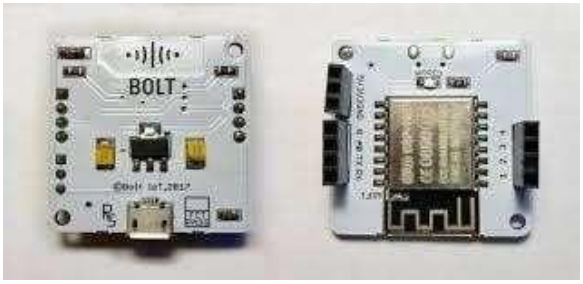

Figure 4 Bolt IoT

Integromat: The role of Integromat is to create an environment that automatically sends and transforms data by simply connecting the app to a compact module. It recognizes the RFID tags are affixed to the products using EM-Fields. Every tag has a unique serial number.

Figure 5 Twilio

Twilio: Twilio is the latest communication API that developers use to build communications. The Twilio

Communications API enables voice, messaging, and video conversations within web and mobile apps. This makes it easy for developers to communicate between different apps.

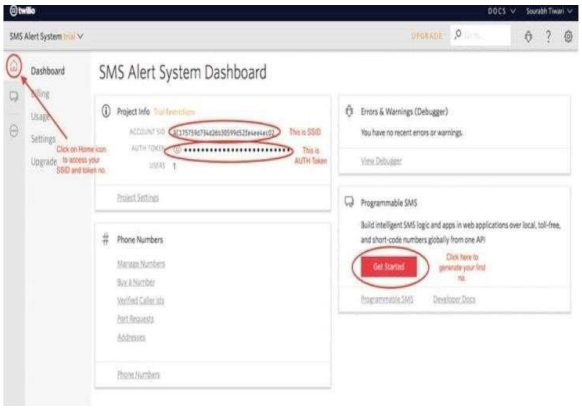

Figure 6 Dashboard Twilio

Soil Moisture Sensor: This sensor measures the soil's water content. Between the sensor's two electrodes, the electrical resistance is measured. When a programmable threshold is exceeded, a comparator triggers a digital output. According on the soil moisture level, the sensor's output voltage varies. The output voltage drops when the soil is wet. Dry: An rise in output voltage

Figure 7 Soil Moisture Sensor

LDR: A light sensing resistor, also known as a photoresistor, is an electronic device used to measure the amount of light a plant receives.

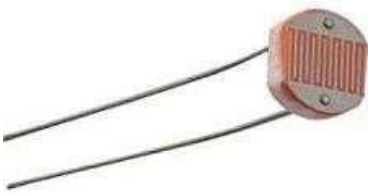

Figure 8 LDR

Jumper wires: Used to complete a circuit by joining two sites. Frequently used to make it simple to update a circuit as needed while using breadboards and other prototyping tools.

Figure 9 Jumper Wire

Header pins: Female pin header is a type of electrical connector which is widely used in instrumentation of PCB.

Figure 11 Header pins

Node MCU: The ESP8266 NodeMCU (Node Microcontroller Unit) development environment is used, a System on a Chip (SoC) with a very cheap cost, which connects objects via the Wi- Fi protocol to transfer data. You can transfer it.

Each GPIO Pin has a unique I/O Index number, which is utilised for GPIO Pin addressing. A full and independent WiFi networking solution is provided by the ESP8266EX. It can be used to float WiFi networking tasks from another application processor or host the application. The ESP8266EX launches the application straight from an external flash when it serves as the host. To enhance the system's performance in certain applications, it features inbuilt caching.

Figure 12 NodeMCU ESP8266EX

The soil sensor measures how wet the soil is, while the LDR gauges how much light is reaching the plant. The Bolt unit reads both data and transfers them to the Integromat logic when it receives a read request. For soil sensors, the sensor output will be LOW if the water content is below the threshold (specified by the user), and HIGH if it is higher. Pin 0 of the bolt is used to read this digital data. Analog data is read from bolt pin A0 for LDR.

You may monitor your crops' exposure to sunshine and water levels using the straightforward techniques above, and you'll get alerts when you need to take action.

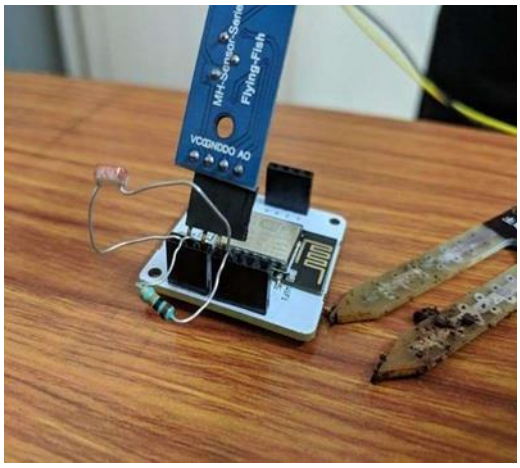

Figure 10 System

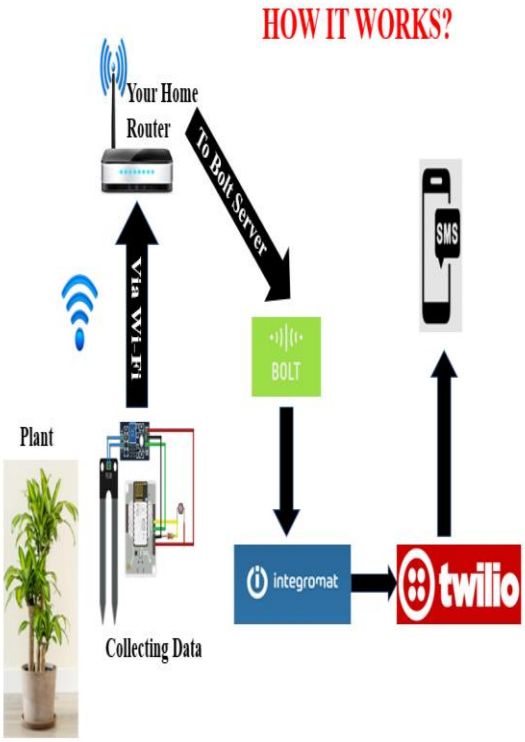

Figure 13 How it Works

Steps Flow Chart

1. First of all, place the soil moisture sensor in the soil of the plant and the LDR in the direction where the plant is getting sunlight.
2. After the setup is done start the simulation in the Integromat software.
3. The sensor sends the information of the plants Light Intensity and soil moisture to the BoltIoT cloud server with the help of our router system.
4. The cloud server if the BoltIoT takes the information time by time and gives the information to the Integromat Software.
5. Here in the Integromat Software the information goes through the logic created and then according to the satisfied logic the Programmed Message goes to the Twilio server.
6. Then the Twilio server configures the Users Mobile number and sends the information to the user successfully.
7. Thus, the user gets the information about the health of their plant to their mobile according to the alarm time set by them in the Integromat Software.

The Steps to configure the software setup is as follows:

1. First make an account on Integromat using the intergromat.com website.
2. After setting up the account, create a new scenario using the 'Create a new scenario' button located on the top right corner in dashboard.
3. In the services choose BoltIoT and Twilio.
4. Now using the services build the required logic flow
5. Enter the required credentials of the Twilio in the Twilio services respectively.
6. Enter the required credentials of the BoltIot in the BoltIot services respectively.
7. Now after the required logic using the Integromat is ready Enter the required logic for the sending the information to the user mobile using the Twilio services.
8. After the setup is ready run it to check for the errors.

V. RESULTS

The purpose of this paper was to design a circuit using the idea of the Internet of Things, which consists of sensors, monitors, processing, upload data on cloud and analyzes the information provided by the sensors, and informs the user about changes in the state of the power plant. Automating watering of plant can save a lot of time and also organize an individual's lifestyle. This device monitoring system is an inexpensive system whose basic use is for home purposes. Besides, it's quite an interesting concept because the plant itself can call for water and protection whenever it needs it. So, with this IOT based automated system we can monitor the farm and also the irrigation process. A system that takes into account the farm environment and acts according to our needs. This plant monitoring system successfully sends the plant health report to the user. This allows users to easily maintain plant growth.

Figure 15 Software Display

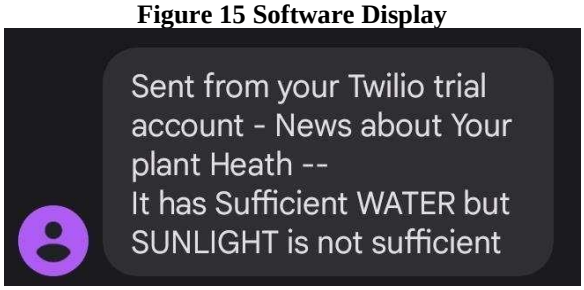

Figure 16 Software Display

VI. CONCLUSION

The proposed method for intelligent plant monitoring systems is based on Node MCU microcontrollers, mobile computer and Internet of Things. It provides real-time statistics about the natural elements in the garden and allows local users and growers to take care of their crops. Soil moisture and associated moisture are considered natural factors. The results are displayed on the integrated TFT screen via the proposed device. The results are provided via a mobile application. This strategy can address the horticultural issues that arise in urban areas since there aren't enough farmers there. This system can be used anywhere because of its low initial cost and simple installation. The system can be expanded to the next level thanks to the advancement of sensor technology, enabling customers to make the most of their investment.. The system can be modified to deliver fertilizer exactly to the garden if sensors for soil nutrients can be fitted. This system saves manpower and makes efficient use of available water resources, ultimately resulting in good systems. The system's feedback will help the gardening procedure be implemented more effectively. A system has been developed to monitor temperature, humidity, and soil moisture levels, and this project offers the chance to examine current systems, their benefits, and their drawbacks.

Agriculture is one of the activities with the largest water consumption, The farm owner can monitor the process with the help of their Android mobile. In future to expand the performance we plan to expand the performance of the system by adding a link to a vital archive of all history records. In addition, add standard care features and familiar plant safety precautions. This is displayed as the value of a specific parameter value. This allows consumers and farmers to manage their crops or plants more carefully.

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Forced Convection Heat Transfer in Corrugated Backward Facing Step with Nanofluid

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Abstract:-- **Forced convection of nanofluid in a backward facing step combined with a corrugated wall was carried out in this work, the downstream wall was heated with uniform heat flux while other walls were adiabatic. Three configurations of corrugations (triangular, trapezoidal and square) were tested and compared with smooth wall. Three types of nanoparticles (Al_2O_3, SiO_2 and TiO_2) were compared with distilled water in order to improve the heat transfer. ANSYS FLUENT code was examined to resolve the equations using the finite volume method. The results are validated by further research. Streamlines, isotherms, velocity profiles, temperature, Nusselt number, friction factor and PEC factor for a Reynolds number (5000< Re <20 000) are presented. The findings indicate that the triangular corrugations provide more significant improvement of heat transfer than the smooth wall, trapezoidal and square. Additionally, SiO2 is the best in terms of heat transfer improvement followed by TiO_2 and Al_2O_3.**

Keywords: Backward facing step, Corrugated wall, Forced convection, Nanofluid.

I. INTRODUCTION

Heat exchange, in industry, is an important factor when considering the performance of industrial installations. Efficient heat exchange is often synonymous with increased performance, and therefore energy savings cost reduction, and a significant reduction in the site's environmental impact.

The intensification of these heat exchanges by convection has aroused great interest among researchers to find techniques to improve these exchanges, among these techniques intensifying the turbulence by the use of BFS. In literature, Armaly et al [1] were the first who made an experimental and numerical study to visualize recirculation zones in laminar, in transition, and turbulent flow in BFS followed by the numerical work of J.T. Lin et al [2], in which forced convection heat transfer is considered in inclined BFS, A. Sh. Kherbeet et al [3] examined the effect of height step on heat transfer (S = 350 µm, S = 450 µm et S = 550 µm). [4], [5], and [6] introduced ribs and vortex generators in different forms, positions, and orientation angles to improve brewing motion in the fluid flow. On the other hand, [7], [8] played on the properties of fluids by adding nanoparticles and studying the effect of their volume fraction on heat transfer, results show that increasing volume fraction provides better values of Nusselt Number but causes more pressure drop. [9] and [10] had an idea of using a double and triple BFS as a geometry problem, they traced streamlines of velocity and temperature to reveal recirculation zones in this case and their impact on fluid flow and heat transfer. In our work, we proposed different forms of corrugations on the downstream wall with different types of nanoparticles insert in water.

II. MATHEMATICAL FORMULATION AND NUMERICAL SOLUTION

2.1 Problem description

In our study the geometry used is a backward facing step filled with nanofluid, the downstream wall is corrugated with different forms given in **Figure. 1** and exposed to uniform heat flux.

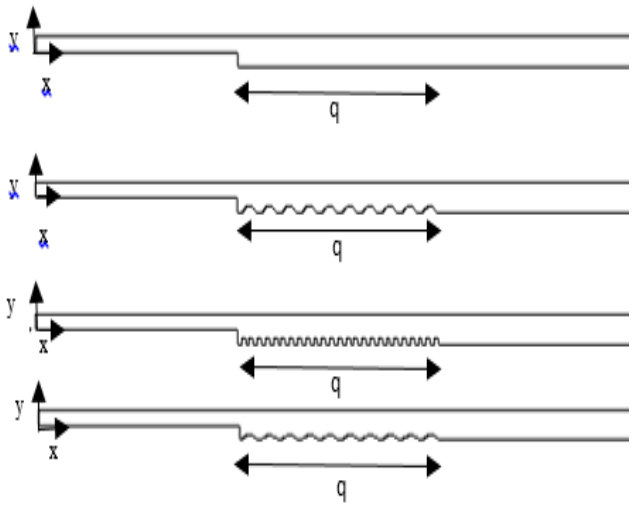


Fig.1 geometry of the problem.

2.2 Equations

The average equations that govern incompressible and Newtonian turbulent two-dimensional flow are

$$\frac{\partial \bar{u}_i}{\partial x_i} = 0 \qquad (1)$$

$$\frac{\partial(\bar{u}_i\bar{u}_j)}{\partial x_j} = -\frac{1}{\rho}\frac{\partial \bar{p}}{\partial x_i} + \frac{\partial}{\partial x_j}\left(\nu\left(\frac{\partial \bar{u}_i}{\partial x_j} + \frac{\partial \bar{u}_j}{\partial x_i}\right) - \overline{\acute{u}_i\acute{u}_j}\right) \qquad (2)$$

$$\frac{\partial(\rho C_p u_j \bar{T})}{\partial x_j} = \frac{\partial}{\partial x_j}\left(K\frac{\partial T}{\partial x_j} - \rho C_p \overline{\acute{u}_j \acute{t}}\right) \qquad (3)$$

$$\bar{u}_j\frac{\partial k}{\partial x_j} = \nu_t\left(\frac{\partial \bar{U}_i}{\partial x_j} + \frac{\partial \bar{U}_j}{\partial x_i}\right)\frac{\partial \bar{U}_i}{\partial x_j} + \frac{\partial}{\partial x_j}\left[\left(\frac{\nu}{\sigma_k} + \frac{\nu_t}{\sigma_{k,t}}\right)\frac{\partial k}{\partial x_j}\right] - \varepsilon \qquad (4)$$

$$\bar{u}_j\frac{\partial \varepsilon}{\partial x_j} = \frac{\partial}{\partial x_j}\left[\left(\frac{\nu}{\sigma_\varepsilon} + \frac{\nu_t}{\sigma_{\varepsilon,t}}\right)\frac{\partial \varepsilon}{\partial x_j}\right] + C_{\varepsilon 1}\frac{\varepsilon}{k}\nu_t\left(\frac{\partial \bar{U}_i}{\partial x_j} + \frac{\partial \bar{U}_j}{\partial x_i}\right)\frac{\partial \bar{U}_i}{\partial x_j} - C_{\varepsilon 2}\frac{\varepsilon}{} \qquad (5)$$

And for turbulence modeling, the K-epsilon RNG model was used.

2.3 Hybrid nanofluid properties

We used the following expressions to calculate nanofluid properties:

$$\rho_{nf} = (1-\phi)\rho_f + \phi\rho_{np}$$

$$(\rho C_p)_{nf} = (1-\phi)(\rho C_p)_f + \phi(\rho C_p)_{np}$$

$$\mu_{nf} = \mu_f \times \frac{1}{(1 - 34.87(d_p/d_f)^{-0.3} \times \phi^{1.03})}$$

$$k_{nf} = k_f\frac{(k_p + 2k_f) - 2\varphi(k_f - k_p)}{(k_p + 2k_f) + \varphi(k_f - k_p)}$$

2.4 Boundary conditions

Inlet

U=u $_{in,}$ K_{in} and ε_{in} are calculated by the code

Outlet

$\frac{\partial u}{\partial x} = 0, \frac{\partial v}{\partial x} = 0, \frac{\partial T}{\partial x} = 0, \frac{\partial p}{\partial x} = 0, \frac{\partial k}{\partial x} = 0, \frac{\partial \varepsilon}{\partial x} = 0$

near the wall

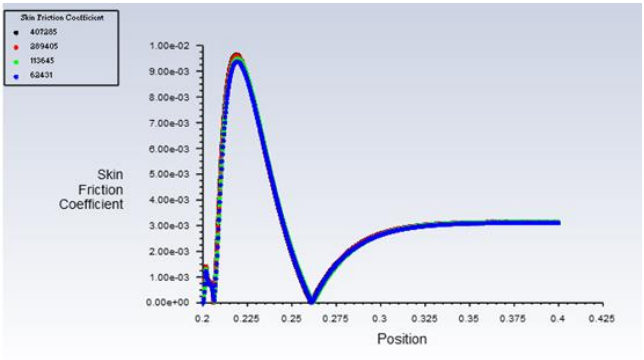
The condition of non-slip and impermeability are verified

v=u=0

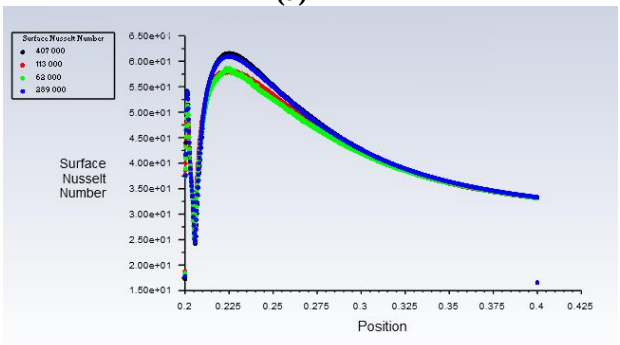
III. NUMERICAL METHOD

3.1. mesh independence

before proceeding to the calculations of our study, we tested four different meshes 62431, 113645, 289405, and 407285 To achieve the independence of the mesh on the solution. The variation of the local Nusselt number and Skin Friction Factor for Re = 5000 (**Fig.1)** shows that a mesh size of 289405 provides accurate results with a minimum computational time.



(a)



(b)

Fig.2. (a & b). Skin Friction Factor and local Nusselt number for different meshes.

3.2 Validation of the calculation code

Validation of the numerical simulation is necessary in order to verify the accuracy of the numerical results. A comparison of our results with the experimental results found by A. R. Talib et al [11] is carried out

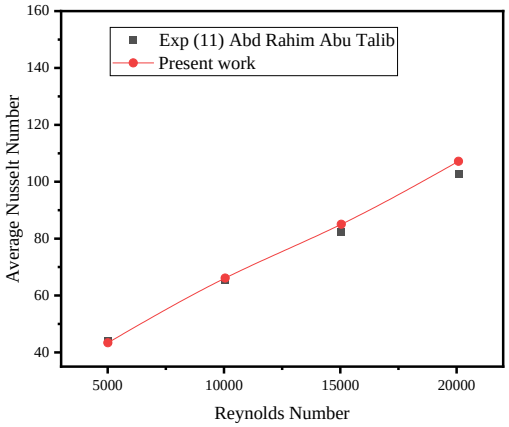
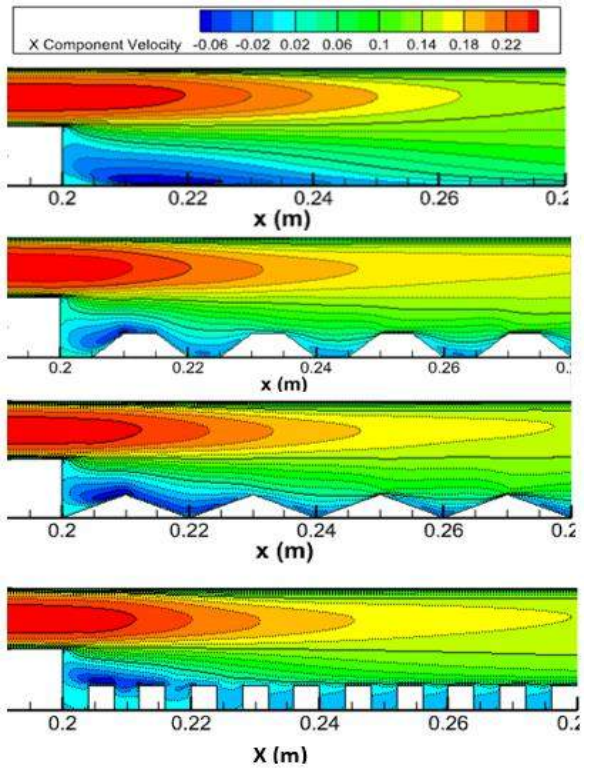


Fig.3. Comparison of Average Nusselt Number with the experimental results.

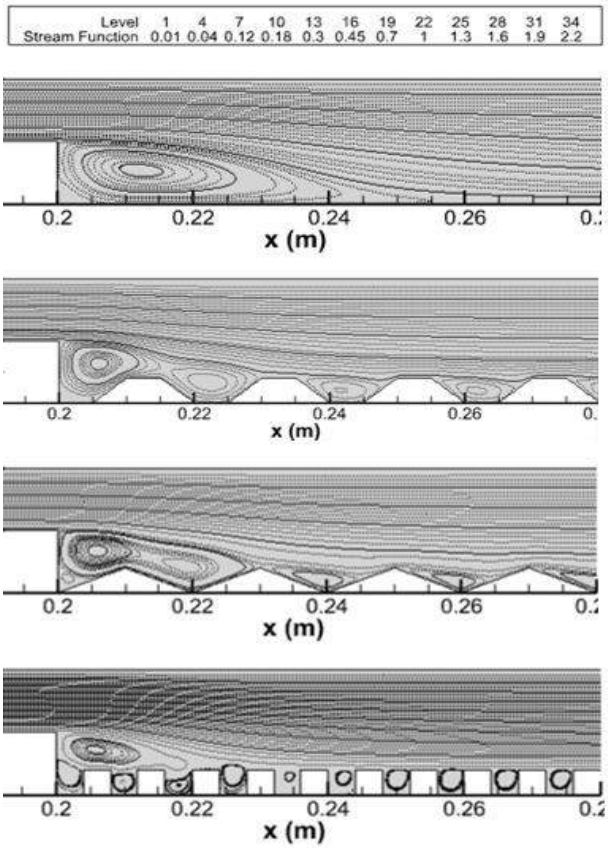
IV. DISCUSSION

4.1 Effect of corrugation's geometry

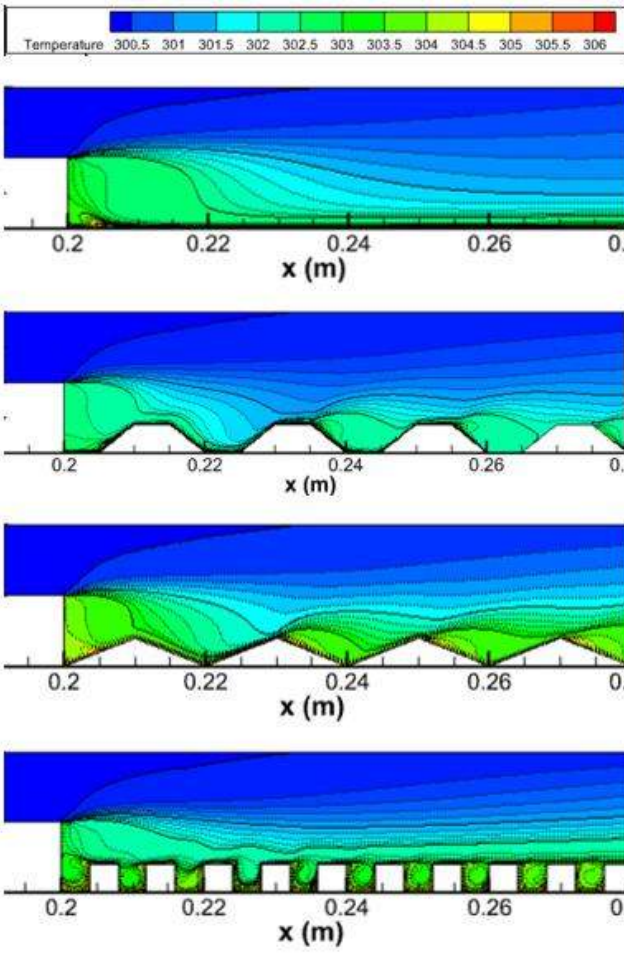
Fig.4 illustrates velocity, temperature, and stream function contours for distilled water flow in smooth and corrugated BFS (triangular, trapezoidal, and square) with convection heat transfer between the fluid and the downstream wall for Re = 5000, The result indicated that the corrugated wall plays a significant effect on the velocity streamline gradient, we notice the formation of a recirculation zone near the step and it distributes on all corrugations that improved brewing motion in the fluid flow, Therefore the heat transfer enhanced.



(a)



(b)



(c)

Fig.4. (a) Velocity, (b) stream function, and (c) temperature contours for Re= 5000, distilled water fluid flow in BFS with different corrugation's geometry.

Nusselt number, skin friction factor, and PEC values for Reynolds Number varied between 5000 and 20000 are presented in **fig.5, 6**, and **7** respectively for smooth and corrugated BFS (triangular, trapezoidal, and square). It is clear that BFS triangular corrugation provides the highest values of Nu number and friction factor but the performance evaluation criteria show that it is the most efficient shape followed by trapezoidal than square.
(PEC compares the gain in energy when using a corrugated wall by the loss in pressure drop, the corrugated wall is useful when PEC>1).

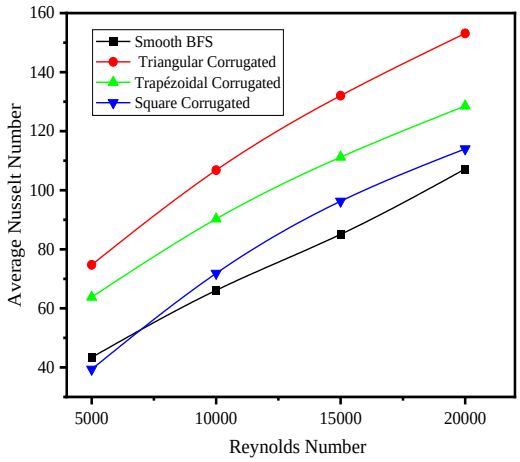


Fig.6. Average Nusselt Number for different corrugation's geometry and different Re Number.

Fig.7 illustrates the variation of Friction Factor values with Re Number for smooth and corrugated BFS, we observe that friction factor decrease when Re increase.

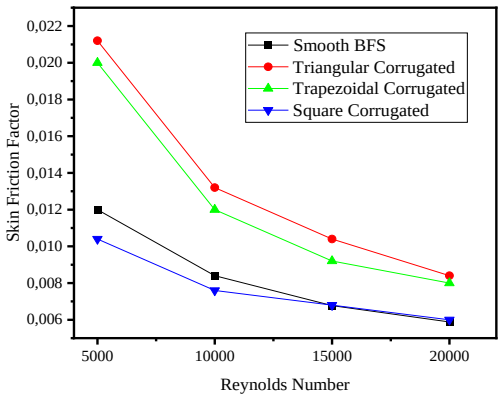


Fig.7. Skin Friction factor for corrugation shapes and different Re Number.

Fig.8 present PEC values for the three corrugation's geometry studied with different Re number, graph shows that PEC decrease with the increment of Re, also we notice that all curves are above the line PEC = 1.

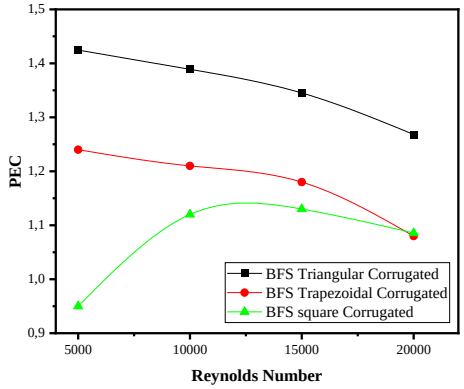


Fig.8. PEC for different corrugation shapes and different Re Number.

4.2 Effect of nanoparticle's type

Fig. 8 and **9** present Nusselt Number and Skin Friction Coefficient respectively for three types of nanoparticles in distilled water flow over BFS triangular corrugated for 5000 <Re<20000, we can see that Nu number and Skin friction factor increase with Re number increment. The highest Nu values are observed with SiO_2 followed by Al_2O_3 and TiO_2 in distilled water however, the friction factor is insensitive to the nanoparticle's type.

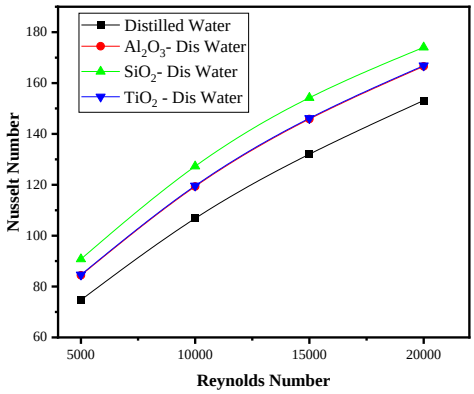


Fig.9. Nusselt Number for different nanoparticletypes and different Re Number.

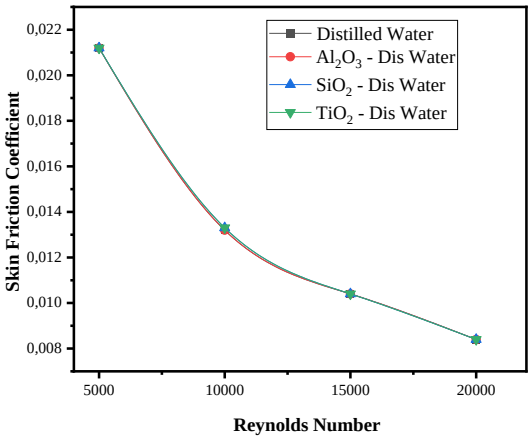


Fig.10. skin friction Factor for different nanoparticle types and different Re Number.

V. Conclusion

Forced confection in a backward facing step is treated for Reynolds number varied between 5000 to 20000. The effect of corrugation's geometry (triangular, trapezoidal, and square) and nanoparticle's type have been carried out. The results indicated that triangular corrugated backward facing step filled with SiO_2-Distilled Water nanofluid provided the best results.

NOMENCLATURE

BFS	Backward facing step
C_p	Specific heat [J/kg. K]
$C_{\varepsilon 1}, C_{\varepsilon 2}$	RNG K- ε model constants
dp	nanoparticle diameter [m]
df	fluid particle diameter [m]
K	Thermal conductivity [W/m. K]
k	Turbulent kinetic energy [m^2/s^2]
Nu	Nusselt number
P	Pressure [pa]
PEC	Performance evaluation criteria
q	Heat flux [W/m^2]
Re	Reynolds number
T	Temperature [K]
u, v	Velocity components [m/s]
$\acute{u}, \acute{v}$	Turbulent velocity component [m/s]
x, y	Cartesian coordinates [m]

Greek Symbols

α	Diffusivity [m^2/s]
β	Coefficient of thermal expansion [K^{-1}]
μ	Dynamic viscosity [kg. m/s]
ε	Turbulent kinetic energy dissipation
ρ	Density [kg/m^3]
σ	Prandtl number

ϕ volume fraction

Subscripts

nf Nanofluid
f Fluid
np Nanoparticle
t Turbulent

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Investigation of the Optical Flow and the Formation of a Positioning Algorithm Based on it

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Abstract: The report is devoted to the mathematical and algorithmic foundations of optical odometry. This direction is actively developing towards minimizing computational costs and maximizing positioning accuracy. The optical flow is considered as a combination of two fields and on the basis of this, a number of problems satisfying the main directions of development are solved, in particular, the problem of determining the minimum number of key reference points is solved and the problem of creating an algorithm for determining the fields of rotation and displacement specified by the guiding vectors is solved based on the minimum number of key reference points. Using the linear nature of the scalar product, the main regularities are derived based on metric data obtained from a pair of images (with a time difference) and the values of the total field from the same images. Based on the found ratios from the aggregate of the minimum number of reference points, the field of rotations is located at the beginning, and then the field of displacements. Based on the found patterns and relationships, an algorithm for determining the fields of rotation and displacement is formed and implemented in the form of a c++ program.

Man's Transformation from Ego-Centrism to Eco-Centrism

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Abstract: Eco-centrism recognizes intrinsic value in all life-forms. It takes a much wider view of the world that enlarges the boundaries of the community. But people believe in anthropocentrism feels as if they are the most important entities in the universe. Eco-centrism is nature centric value system as humans have the responsibility to protect and preserve the environment. The universal disturbance of the biosphere by humans is a "threats" to the environmental construction where both positive and negative aspects can be seen. So, Ecological revolution is necessary that strongly focuses on other species and the need to protect the integrity of nature is reflected which results in the rise of a new ecological movement that is 'Deep Ecology'. Deep Ecology is a move from Anthropocentrism to Eco-centrism. It arises as a new perception and spiritual dimensions to envisage the unavoidable changes that humanity currently face with. This holistic approach of facing environmental problems brings together thinking, feeling, spirituality and action. Towards the phenomenon of life 'Deep Ecology' is associated with greater 'Self – Realization' which is said to be the heart of deep ecology. Self with capital 'S' is the universal self should be achieved through diminishing of the ego or small's' and realizing the maxim "Everything is interrelated, interconnected and interdependence". This "Relational Model" claimed by Aldo Leopold strongly affect the anthropocentric attitude where humans are regarded to be the center of the universe. Thus, Arne Naess's Self Realization involves in man's transmutation from egocentrism to eco-centrism and enhancing joy and meaning of life.

Keywords: Eco-centrism, Anthropocentrism, Ecological Revolution, Deep- Ecology, Self-Realization, Relational Model.

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Improving the Technical Characteristics of Continuously Variable Transmission by Creating a Wavy Micro Profile on the Surface of Pulleys

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Abstract: Currently, there are great demands on improving fuel efficiency and environmental friendliness of vehicles. Continuously variable transmissions with a metal belt (CVT) are a technology that can balance these conflicting requirements. One of the ways that can be used to improve the transmission efficiency of belt variators is to improve the coefficient of friction between the belt elements and pulleys. In this study, an attempt is made to improve the friction coefficient of the element-pulley by forming a micro profile of the pulley with the specified parameters.
To the scientific novelty of this study, the following can be distinguished:
- the relationship between the parameters of undulation and processing modes during finishing turning has been established;
- the relationship between the operational properties of the surface of the part and its undulation has been established.
- theoretical and experimental studies have been carried out to confirm the reliability of the established parameters, and to evaluate their effectiveness.
Thus, the authors propose an approach to the technological processing of pulleys of a V-belt transmission, which forms the undulation of the microgeometry of the surface, which allows to improve the performance of a continuously variable transmission.

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Globalization and management of the pandemic Covid -19

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Abstract: Throughout the centuries of history, mankind has faced crucial challenges to overcome. Human resource management and consequently economic has had its ups and downs. Their mismanagement has often led to serious problems in human life.I would add: is humanity prepared to live in a global world without borders? It is difficult to give an accurate answer to these dilemmas.Throughout the centuries of history, people have always been in contact with each other. They have given and they have received.The fact is that the more contacts there are between people, the more challenges they face. Globalization, in itself, is a comprehensive relationship.The Covid-19 pandemic that planet Earth is still experiencing is a syndrome of globalization and living in a global system. It had been more than 100 years since a pandemic of this magnitude had occurred because the world was closed and when a severe epidemic occurred, it was localized to specific regions and did not spread to the rest of the world. Already, when borders have fallen symbolically, international business has flourished, but so have acute issues like the covid-19 pandemic.

Keywords: pandemic, global, crisis, economy, politics, man.

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Vertebral Pose Estimation between Preoperative CT image and Intraoperative X-ray image using 3D-2D registration

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Abstract: Vertebrae pose estimation is the foremost step performed in spine surgery. The pose estimation between preoperative and intraoperative images guides surgeons in identifying and mapping corresponding anatomical regions. The most popular technique utilized in the pose estimation problem is 3D-2D registration. These 3D-2D registration systems play a major role in image-guided surgeries and navigation systems. A 3D-2D navigation system can be based on either feature correspondence or intensity correspondence between two images. Intensity-based registration is computationally intensive and faces low capture range issues. On the other hand, feature-based registration techniques are subjected to limited visuals and accuracy of segmentation. Hence, to address these challenges, a hybrid registration module is proposed. The hybrid registration framework is designed with the objective of vertebral pose estimation between preoperative CT and intraoperative X-ray images. The developed framework can act as an assistant tool in the intraoperative environment for vertebral pose estimation. The developed framework can be easily scalable to address problems faced in cardiovascular and neurosurgery.

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ISBN: 978-93-92105-14-2