ENHANCEMENT OF HIGH-FIELD PHYSICS MEASUREMENTS USING DIODE-PUMPED SOLID- STATE OSCILLATOR

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ABSTRACT: In this paper Enhancement of High-Field Physics Measurements using Diode-Pumped Solid- State Oscillator(DPSSO) is implemented. Passively mode locked thin disk lasers can drive and even enhance high field physics measurements at >10-MHz repetition rate. Electron spectroscopy images in xenon confirm high signal-to-noise ratio and peak intensities. This report on the first generation of high-contrast, 164-fs duration pulses from the laser system polaris reaching focused peak intensities in excess of 2×1020W. This is the highest peak intensity reported so far which has been achieved with a fully diode-pumped solid-state laser (DPSSL). Several passive contrast enhancement techniques have been specially developed and implemented achieving a relative pre-pulse intensity better at t=-30 ps before the main pulse. Furthermore a closed-loop adaptive-optics system has been installed. Together with angular chip compensation this method has led to a significant reduction of the focal spot size and an increase of the peak intensity.

KEY WORDS: Electron spectroscopy, Diode, solid state oscillator.

I. INTRODUCTION

Laser sources generating femtosecond pulses at high average output power and microjoule pulse energy are essential for numerous applications, including micromachining, multi-photon ionization studies and high harmonic generation. In the past, Ti:Sapphire based laser systems were used for most of these applications. A major advancement was the demonstration of high power passively mode-locked femtosecond thin disk lasers. These oscillator sources operate at multi-megahertz repetition rates and achieve pulse energy levels previously only accessible with amplifier systems.

Recently, we have demonstrated a substantial increase in pulse energy, achieving 63 W average powersin 5µJ pulses [1], which is substantially higher than state-of-the-art passively mode-locked second lasers based on different concepts. Simple temporal pulse compression in a photonic crystal fiber can be used to increase the peak power to levels beyond 10 MW [2, 3].

Here, we will demonstrate for the first time the use of a passively mode-locked thin disk laser for experiments in high field science. We present the first photoelectron imaging spectroscopy experiments performed with a nonamplified laser source. Ionization experiments in xenon at a repetition rate of 14 MHz confirm intensities of 6.1013 W/cm^2. Due to the high repetition rate, a huge number of events can be measured in a short time, resulting in a shorter measurement time and a high signal-to-noise ratio.

At the Institute of Optics and Quantum Electronics in Jena (IOQ), Germany and at the Helmholtz Institute Jena, the DPSSL system POLARIS aiming at the generation of high peak-power laser pulses applicable in high-intensity experiments, has been under continued development over the last years [4]. At its current stage, the system generates pulses at a central wavelength of 1030 nm having a duration of τ_L = 164 fs full width at half maximum (FWHM) with a repetition rate of 1/40 Hz. For the successful application of such laser pulses in high-intensity experiments the peak intensity and the temporal intensity contrast (TIC) have proven to be important pulse parameters.

With certain changes in the architecture of POLARIS we have significantly improved both parameters. In a recent experiment, POLARIS pulses delivering up to 2.3 J on target were used to accelerate protons from 2 μm thin Tafoils to peak energies of 18 MeV via target-normal-sheath acceleration [5]. In this presentation, we describe the laser system and the changes which have helped improving the contrast and the focusability of the pulses establishing POLARIS as the first fully diode-pumped laser system routinely available for high-intensity experiments.

The principle of laser action was first experimentally demonstrated in 1960 by T. Maiman (Maiman, 1960). This first system was a solid-state laser in which a ruby crystal and a flashlamp served as gain medium and pump source, respectively. Soon after this first laser experiment, it was realized that solid-state lasers are highly attractive sources for various scientific and industrial applications such as laser marking, material processing, holography, spectroscopy, remote sensing, lidar, optical nonlinear frequency conversion, THz frequency generation.

Since the early 1980's with the development of reliable high power laser diode and the replacement of traditional flashlamp pumping by laser-diode pumping, the diodepumped solid-state lasers (DPSSL's), have received much attention and shown the significant improvements of laser performance such as optical efficiency, output power, frequency stability, operational lifetime, linewidth, and spatial beam quality. Nd:YAG and Nd:YVO4 crystals have been extensively used as a gain medium in commercial laser products with high efficiency and good beam quality. The active ion of Nd^{3+} has three main transitions of $4F3/2 \rightarrow 4I9/2$, $4F3/2 \rightarrow 4I11/2$,

and $4F3/2 \rightarrow 4I13/2$ with the respective emission lines of 0.94, 1.06 and 1.3 μm.

The emission wavelengths of DPSSL's associated with nonlinear crystals cover a wide spectral region from ultraviolet to the mid-infrared range and very often terahertz range by using frequency mixing process in simultaneous multi-wavelength solid-state lasers. DPSSL's are conventionally categorized as being either end-pumped or side pumped lasers. End-pumping configuration is very popular because of higher efficiency, excellent transverse beam quality, compactness, and output stability which make it more useful for pumping tunable dye and Ti: Sapphire laser, optical parametric oscillator/amplifier, and Raman gain medium.

The better beam quality is due to the high degree of spatial overlap between pump and laser modes while the high efficiency is dependent on good spatial mode-matching between the volume of pump and laser modes or non-dissipating of pump energy over pumping regions that are not used by laser mode. In addition, end pumping allows the possibility of pumping a thin gain medium such as disk, slab, and microchip lasers that are not be accessed from the side-pumping [6].

II. LASER SYSTEM

Pulses with 900 fs duration from a passively mode-locked thin disk laser similar to the one described were launched into a pulse compression system based on a microstructured large mode area (LMA) fiber and a single prism pair for dispersive recompression. This method is very efficientmore than half of the average power incident on the fiber is transferred into the output pulses, which are a factor of 20-30 shorter and have a more than ten times higher peak power.
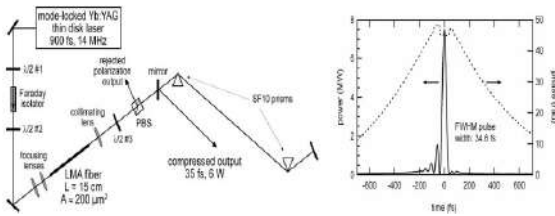
Fig. 1. TEMPORAL PULSE PROFILE MEASURED USING FROG (RIGHT)

For the ionization experiments, we generated 35fs pulses with up to 0.5 µJ energy from initial pulses with 0.7 µJ energy. A FWHM duration of 35 fs was measured using a SHG-FROG setup. The maximum pulse energy was limited by damage of the 200µm^2 mode area fiber. Using fibers with larger mode areas would allow launching of higher pulse energies, resulting in substantially higher peak power levels.

After the last amplifier the pulses are recompressed to a minimal pulse duration of τ_L=164 fs, which is measured over the full beam profile. Taking into account the compressor transmission of 63% pulses delivering an energy of 4 J onto the target are routinely available for experiments. Pulses of the multi 10J level will be available after the commissioning of the final amplification stage A5 in 2013.

The side-pumping geometry allows scaling to high-power operation by increasing the number of pump sources placed around the gain medium before occurring thermal fracture [7]. In this arrangement the pump power is uniformly distributed and absorbed over a large volume of the crystal which leads to reduce the thermal effects such as thermal lensing and thermal induced stress. However, the power scaling of end-pumped lasers is limited due to the physically couple of many diode-lasers into a small pumped volume and the thermal distortion inside the laser crystal. To improve power scaling of an end-pumped laser, a fiber-coupled laser-diode array with circular beam profile and

high-output power and a crystal with better thermal properties can be employed as a pump source and gain medium, respectively.

Laser performance is characterized by threshold and slope efficiency. The influence of pump and laser mode sizes on the laser threshold and slope efficiency has been well investigated. It is known a smaller value of the pump radius leads to a lower threshold and a higher slope efficiency. However, in the case of fibercoupled end-pumped lasers, due to pump beam quality, finite transverse dimension, diffraction, absorption and finite length of the gain medium, the pump size can be decreased only to a certain value. It is worthwhile to mention, that for both longitudinal and transverse pumping, the pump radius varies within the crystal mainly because of absorption and diffraction.

It is possible to consider a constant pump radius within the crystal when the crystal length is much smaller than the Rayleigh range of the pump beam and also than the focal length of thermal lens. However, in the case of longitudinal pumping, the pump intensity is still a function of distance from the input end even this circumstance is also satisfied. Meanwhile, the lower brightness of the laser-diodes than the laser beam makes the Rayleigh distance of the pump beam considerably be shorter than the crystal length.

The effect of pump beam quality on the laser threshold and slope efficiency of fiber-coupled end-pumped lasers has been previously investigated. The model is developed based on the space-dependent rate-equations [8] and the approximations of paraxial propagation on pump beam and gain medium length much larger than absorption length. Further development was made by removing the approximation on

gain medium length, while for a complete description, rigorous analysis is required.

III. ELECTRON SPECTROSCOPY EXPERIMENTS

The momentum distribution of the electrons from the ionization of xenon is determined with a mobile version of a photoelectron imaging spectrometer. The linearly polarized beam from the fiber compression system is launched into the vacuum chamber, where it is focused with a parabolic mirror (f = 30mm). A variable leak is used to regulate the xenon pressure inside the vacuum chamber. In the focal region ionization of xenon occurs, which represents a point source of photoelectrons.

A static electric field projects these electrons onto a multichannel plate (MCP) with a phosphor screen attached. The fluorescence of the phosphor screen caused by the impact of the electrons gives us the possibility to measure the angular and energy distribution of the photoelectrons with a computer based CCD video camera. The experimental results are obtained by adding together the electron signal from more than 109 laser pulses, which only takes few minutesto the 14 MHz repetition rate.
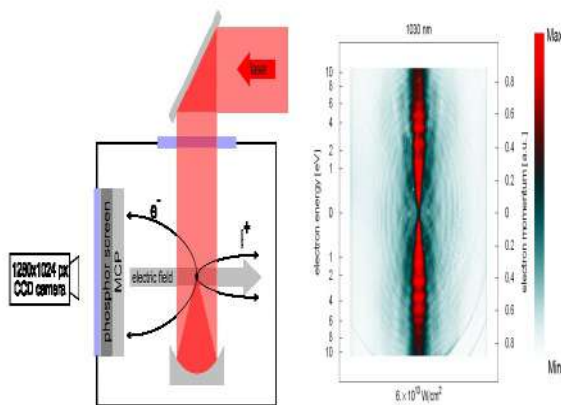

Fig. 2. PHOTOELECTRON SPECTRUM MEASURED AT MAXIMUM INTENSITY (RIGHT)

We have measured the intensity dependence of the electron momentum signal. The appearance of the non-resonant ionization processes in the electron momentum distribution allows us to estimate the maximum peak intensity of $6 \cdot 10^{13}$ W/cm^2. A typical Abel-transformed picture is shown in Fig. 2. The polarization of the laser beam is parallel to the MCP detector surface and perpendicular to the static electric field. The distance of a photoelectron impact to the center of the phosphor screen depends linearly on the photoelectron momentum perpendicular to the direction of the static electric field. The bright above-threshold ionization (ATI) structure visible in the measured spectrum underlines the achieved maximum laser intensity in the focus.

IV.CONCLUSION

We demonstrate the first electron spectroscopy measurements with a non-amplified laser system, confirming the suitability of temporally compressed pulses from a passively modelocked thin disk laser for applications in high field science. Peak intensities of up to $6 \cdot 10^{13}$ W/cm^2 were generated at 14 MHz repetition rate resulting in momentum images with high signal-to-noise ratio. Further scaling of our system towards the multi-microjoule regime appears feasible using state-of-the-art large mode area fibers. The resulting peak intensities well above 10^{14} W/cm^2 will allow for further experiments in high field science, such as single-pass high harmonic generation at megahertz repetition rates.

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DISTRIBUTED FOG-AUGMENTED MACHINE LEARNING ARCHITECTURE FOR ATTACK DETECTION IN FOG-IOT

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ABSTRACT: The growing interest in the Internet of Things (IoT) applications is associated with an augmented volume of security threats. The increasing number of various devices connected to IoT and their different protocols has led to growing volume of zero-day attacks. Recently, ML has been used in cyber-attacks detection because of its capability of extracting and learning deep features of known attacks and detecting unknown attacks without the need for manual feature engineering. Therefore Machine learning (ML) has demonstrated its superiority in big data fields and cyber-security. One of the weakest parts in IoT infrastructure is in the cloud layer that can cause the system failure, but it can reduce the possibility by controlling and maximizing the ability in the fog layer.This paper presents Distributed Fog-Augmented Machine Learning architecture for attack detection in Fog-IoT. Specifically, we develop a system that comprises multiple Machine learning (ML) based classifiers built by us using three classification methods -- Naïve Bayes (NB), Support Vector Machine (SVM), and Random Forest (RF). The results confirm that Naïve Bayes classifier is achieves the highest Accuracy, Recall and Precision with lowest Computation time as compared with other classifiers.

KEYWORDS: IoT infrastructure, Support Vector Machine (SVM), Naïve Bayes (NB), Machine learning (ML), attacks detection, Distributed Fog.

I. INTRODUCTION

The Internet of Things (IoT) paradigm offers prodigious opportunities to the industries [1]. Cloud Computing is a critical component of the Internet of Things (IoT) architecture. Data collected from the sensors and devices is transferred to the Cloud servers. It is then aggregated, normalized, and processed depending on the applications and acted upon. Once the sensors detect an anomaly, the system must take corrective action immediately, otherwise the defect will propagate. The time from detection to correction must be in seconds.

A variety of cutting-edge technologies such as cloud computing, software defined networking, big data analysis, intelligent sensors, etc. have been developed to utilize the complete power of IoT [2]. However, most of these technologies for IoT are in the developing stage and subjected to increased technical implications in implementing these technologies for IoT. Hence these new technologies of IoT have new challenges in ensuring security and privacy. In the case of a self-driving car, the response time must be in milliseconds.

For these applications, the round trip time from sensors, then to the gateway, then to the Cloud Server and, back to the sensors takes too long. A different architecture is needed where the data collection and processing is done closer to the data producing devices or the sensors. Fog computing extends the Cloud Computing paradigm by providing computation, storage, and networking services between the end devices and the traditional Cloud server [3]. Fog Computing nodes are typically located at the edge of network located away from the main Cloud Data Centers.

Fog computing is the latest concept Cisco has implemented to expand cloud computing to the edge of the network to support IoT devices system requirements. For analytics purposes, fog computing can build low latency network connections between endpoints and IoT devices. Furthermore, fog computing allows more effective software

applications to nearly run on the network edge to reduce the issues of resource limitations in IoT and the overhead in cloudbased. Therefore, before sending further analysis to the cloud layer, the fog layer contains multiple fog nodes (e.g, smart e-health gateways) that are located nearer to the edge of the network, so each fog node can provide the security techniques for IoT devices to be locally analyzed and can detect more efficient malicious behaviors [4]. For instance, fog computingbased in has recently been met with great success in real-time remote monitoring applications. In order to prove the efficiency, a machine learningbased technique to detect the attacks in the fog layer is proposed.

Researchers have used machine learning (ML) algorithms such as decision tree (DT), random forest (RF), support vector machine (SVM), Bayesian network, and K-means to detect network attacks [5]. We develop a system that comprises multiple machine learning (ML) based filters. These filters are built by us using three ML classifiers -- Naïve Bayes (NB), Support Vector Machine (SVM), and Naïve Bayes Multinomial (NBM) – and five pre-processing and feature selection methods (called filters, PF1 – PF5). The rest of the paper is organized as follows. Section II reviews the related work. Section III describes the methodology and design. Section IV provides the results analysis. Section V concludes and gives future directions.

II. LITERATURE SURVEY

Ismail Butun et. al. [6] introduced Anomaly detection and privacy preservation in Cloud-Centric Internet of Things. This paper, for the first time, presents the challenges and opportunities in anomaly detection for IoT and cloud. It first introduces the prominent features and application fields of IoT and Cloud, then discusses security and privacy

risks to personal information and finally focuses on solutions from anomaly detection perspective.Kuan Zhang et. al. [7] presents Sybil Attacks and Their Defenses in the Internet of Things. Specifically, we first define three types Sybil attacks: SA-1, SA-2, and SA-3 according to the Sybil attacker's capabilities. We then present some Sybil defense schemes, including social graph-based Sybil detection (SGSD), behavior classification-based Sybil detection (BCSD), and mobile Sybil detection with the comprehensive comparisons.

Caiming Liu, Jin Yang et. al. [8] Research on Immunity-based Intrusion Detection Technology for the Internet of Things. Antigen, self and non-self in the IoT are simulated. Immature detector, mature detector and memory detector are defined to detect attacks in the IoT. To adapt the complicated and changeful environment of the IoT, detectors evolve dynamically to detect mutated, even new IoT attacks. Attacks detected by detectors in the IoT are combined with the attack information library to alarm the manager of the IoT.

Rongrong Fu et. al [9], An Intrusion Detection Scheme Based on Anomaly Mining in Internet of Things. This paper shows an intrusion detection scheme based on the anomaly mining. The paper has two parts - (i) in the first part an anomaly mining algorithm is developed to detect anomaly data of perception layer, (ii) in the second part a distributed intrusion detection scheme is designed based on the detected anomalies. Finally our evaluation and analysis shows that our approach is accurate and extensible.

Research work [10] by Rajasegarar et al. discuss about anomaly detection in wireless sensor networks. They examine statistical approach, rule based approach, Support Vector Machine based approach, clustering

based and density based approach as important methods.

III. FOG-AUGMENTED ML ARCHITECTURE FOR ATTACK DETECTION

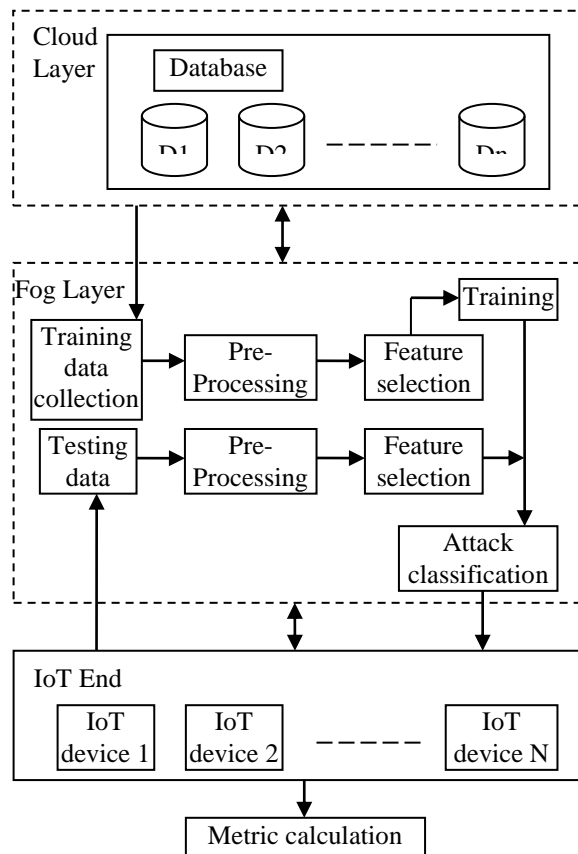Fig. 1 depicts the architecture of Distributed Fog-Augmented Machine Learning for attack detection in Fog-IoT.

Fig. 1: SYSTEM ARCHITECTURE

The process of the described attack detection system is having five main blocks as: Dataset, Pre-processing, Feature selection, Attack classification and Metric calculation. KDD Cup'99 dataset is selected for the experimentation process of described method of Distributed Fog-Augmented Machine Learning for attack detection in Fog-IoT.Probe, R2L, DOS, U2R and Normal are the different attacks in KDD'99 Cup dataset. The datasets that contain benign and spam data are used for training

and testing purposes. Pre-processing is needed to clean and prepare the data for the next stage. Classification includes the training phase and then the actual classification of the data into attacks. The training dataset was divided into 66% and 34% for testing. Pre-processing of data is an important step in machine learning. It involves steps such as stop word removal and stemming, cleaning, transformation, reduction, and tokenization. Moreover, the efficiency and effectiveness of the content based classification methods and machine learning models depend on proper selection of a feature set. In order to investigate and find a good hybrid configuration, we have used five different combinations of various pre-processing and feature selection methods as PF1 to PF5.

The PF1 filter tokenize the string using the java.util.StringTokenizer. PF2 uses the lowercase pre-processing. All tokens will be in lowercase characters. The PF3 filter uses the same preprocessing methods of PF2 in addition to the Info Gain Attribute feature extractor. This feature extractor evaluates the value of an attribute by measuring the information gain depending on the class (benign/spam). PF4 uses lower case tokens, and the number of words to be kept is set to 500. It uses the Info Gain Attribute feature extractor without any stemming or stop words removal. The PF5 filter is similar to PF4 with the addition of a new attribute that uses the message length values to be examined by the classifiers.

Classifiers are methods that map input data to a specific class. The classifiers that have been used for attack detection could be classified into evolutionary or machine learning classifiers. NB (Naïve Bayes), SVM (Support Vector Machine)and Random forest (RF) are the three Machine Learning classifiers used in this attack

detection method. NB is one of the most well-known classifiers in the field of message classification. The classifier can give the finest results when dimensions of the input are high. It is common to use NB with text documents because it uses Bayesian theorem that assumes the attributes of the dataset are independent and computes the probability of them by calculating the frequency of values, and the relationship between them. SVM is a supervised learning algorithm and can be used for regression or classification. It classifies by building an N-dimensional hyperplane that separates the data into two classes. Random forest (RF) is a mixture of multiple-choice trees to obtain the pattern and the variables. During the training phase, it will construct multiple decision trees, and the decision of the majority of the trees is chosen by the random as the final decisions. The classifiers are trained using the dataset and are evaluated for these datasets along with the five pre-processing and feature extraction filters that we have developed, PF1 – PF5.The numerical evaluation criteria used in this work include FP, TP, FN, TN, accuracy, and precision, which are widely-used.

IV. RESULTS ANALYSIS

KDDCUP'99 dataset was widely used for evaluating machine learning models. The specific attack types are regrouped into different attack categories, namely probing (Probe), Remote to Local (R2L), Denial of Service (DoS), and User to Root (U2R). The training dataset was divided into 66% and 34% for testing. A hybrid configuration could be used where the training is done on the server and actual classification is done on the IoT device. This flexibility of multiple platforms allows the proposed system to be executed, partly or fully, in the cloud, fog or edge devices, allowing optimization of resources, privacy, security, and QoS. We have collected results for a range of metrics including Accuracy, Precision and Recall.

The numerical evaluation criteria used in this work include True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN) parameters. TP means the number of positive (attack) detected correctly as attacks. TN is the number of negative (normal) detected correctly as normal. FP shows the number of positive (attack) detected incorrectly as normal. FN represents the number of negative (normal) detected incorrectly as attacks.

Accuracy determines the percentage of the total number of records that are correctly classified as normal or attack records. It can be calculated by equation 1 as:

$$Accuracy = \frac{TP + TN}{TP + TN + FN + FP} \ldots (1)$$

Recall is also known as the true positive rate (TPR) or the Detection rate and identifies the percentage of correctly classified attack records, and it can be defined as the following equation 2 as:

$$Recall = \frac{TP}{TP + FN} \ldots (2)$$

Precision or Positive predictive value is the number of accurate positive scores divided by the number of positive scores predicted by the classification algorithm represented in below equation (3) as:

$$Precision = \frac{TP}{TP + FP} \ldots (3)$$

Table 1: PERFORMANCE OF DIFFERENT CLASSIFIERS

Parameters	NB	SVM	RF
Accuracy	97.2	89.4	85.6
Recall	96.4	88.8	82.7
Precision	97.3	87.6	80.1

From Table 1, it is clear that the performance of the Naïve Bayes (NB) is high (97.2%) than the remaining two classifications. The graphical representation of Accuracy, Recall and Precision is represented in below Fig. 2.
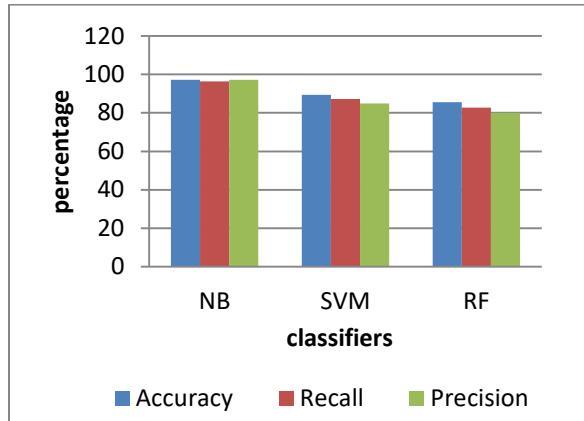

Fig. 2: COMPARATIVE ANALYSIS FOR DIFFERENT CLASSIFIERS

Table 2 represents the computing time results for three classifiers as NB (Naïve Bayes), SVM (Support Vector Machine) and Random Forest. Based on the proposed simulation, Naïve Bayes has the fastest computing time with 1.45 seconds among other algorithms.

Table 2: COMPARISON TABLE FOR COMPUTING TIME

Methods	Computing time (sec)
NB	1.45
SVM	2.48
RF	3.57

From results it is clear that, Naïve bayes classifier is effectively detects the attacks using Fog augmented Machine Learning method for Fog-IoT.

V. CONCLUSION

In this paper, architecture of Distributed Fog-Augmented Machine Learning for attack detection in Fog-IoT is described. KDD CUP'99 dataset is used for this method for attack detection process. This dataset consists of five types, normal, DOS, U2R, R2L, and Probe. We have developed and studied the performance of dataset with different preprocessing and Feature selection combinations in order to find the best process configurations a system should use in various layers of a distributed system; cloud, fog, and edge layers. Accuracy, Precision, Recall and computing time are the parameters which are used in this process for attack detection. From results it is clear that Naïve Bayes (NB) classifier is good at performance in terms of Accuracy as 97.2% with less Computing time as 1.45 sec than remaining two classifiers.

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OPTIMIZATION OF HYBRID VECTOR ARTIFICIAL PHYSICS WITH MULTI-DIMENSIONAL SEARCH METHOD

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ABSTRACT: Artificial physics optimization algorithm (APO) is a new swarm intelligence algorithm to solve global optimization problem based on Physicomimetics framework. An n order diagonal matrix of shrinkage coefficient is introduced to ensure that each individual is within the decision space. Multidimensional search method is merged into the vector model of APO to improve the local exploitation capability of vector APO. The simulation results confirm that the performance of the hybrid vector APO with multi-dimensional search method is effective.

KEY WORDS: Artificial physics optimization; APO; global optimization problem; multi-dimensional search methods.

I. INTRODUCTION

Nature-inspired heuristics have proven very effective in solving complex global optimization problems, such as evolutionary methods (EAs), swarm intelligence algorithms, bio-inspired methods and physics-inspired methods. One of the earliest and most popular EAs is the Genetic Algorithm (GA) [1]. GA utilize techniques inspired by evolutionary biology, such as inheritance, selection, crossover, and mutation to simulate "survival of the fittest." Swarm Intelligence, by contrast, is inspired by the collective behaviors of social insect colonies or animal societies, examples being ant and bee colonies, flocks of birds, or schools of fish.

Particle Swarm Optimization (PSO), which is based on the swarming behavior of birds seeking food, is the earliest example of a Swarm Intelligence algorithm. Other bio-inspired methodologies are even more elemental. The Artificial Immune System (AIS) heuristic, for example, is inspired by mammalian immunology at the cellular level. An important subset of AIS is the Clonal Selection Algorithm (CSA) that mimics clonal selection in the natural immune response to the presence of "non-self" cells.

Examples of physicsinspired algorithms include Simulated Annealing (SA), Central Force Optimization (CFO, and the Electromagnetism-like algorithm (EM). SA performs optimization by analogizing the statistical mechanics of systems in thermal equilibrium. CFO analogizes gravitational kinematics using Newton's universal law of gravitation and equations of motion [2].

CFO searches for extrema by "flying" through the decision space a group of "probes" whose trajectories are deterministically governed by the gravitational analogy. EM is inspired Coulomb's Force Law for electrostatic charges. In CFO, each probe has a "mass" and position; and in EM each particle possesses "charge" and position [3]. The underlying force laws are very similar, the force of gravity being proportional to the product of masses and inversely proportional to the square of the separation distance, while the electrostatic force is proportional to the product of the charges with the same distance dependence.

But EM is inherently stochastic, while CFO is deterministic. As a consequence, EM exhibits better diversity (ability to fully explore the decision space) because it traverses points throughout the decision space. CFO, by contrast, is fast and reproducible leading to better local searching. Both CFO and EM are based on

physics-inspired force laws, and they serve as examples of the efficacy of searching a decision space by analogizing a law of Nature.

As a new swarm intelligence algorithm, Artificial physics optimization (APO) shows an evident predominance in search global optima of global optimization problem. APO algorithm was motivated by the success of Physics "Artificial Physics" (AP) as a metaphor for controlling multi-robot system. In the algorithm, each particle (solutions to the optimization problem) is treated as physical individual that has mass, position and velocity. An attractive-repulsive rule can be used to lead the population to search the better fitness region of the problem.

APO has been improved in algorithm itself, which include three force laws, four different mass functions, using the best history information of each individual, and a vector model (VAPO algorithm) [4]. A hybrid vector APO with one-dimensional search method (HVAPO-ODS) improves the local search capability of VM-APO algorithm. APO has been elementarily applied to solve multi-objective optimization problem, swarm robots search and constrained optimization problems, which all show that APO is effective.

Similarly, motivated by natural physical forces, William M. Spear, Diana F. Spear and Rodney Heil, etc. presented Physicomimetics (or Artificial Physics, AP) framework. The virtual physical forces drive a multi robot system to a desired configuration or state. The desired configuration is one that minimizes overall system potential energy. The system acts as a molecular dynamics ($F = ma$) simulation. In basic AP framework, robots can be treated as physical particles existing in two or three dimensions [5]. Each particle has a mass m, position and velocity. The continuous behavior of each particle is approximated by many discrete-time perturbations. At each time step, the perturbation of each particle depends on the current velocity, i.e., X Vt $\Delta=\Delta$.

And the change ΔV in velocity is controlled by the force on the particle, i.e., $\Delta=\Delta$ V Ftm, where F is the force on the particle. The parameters Fmax and Vmax restrict the maximum force exerted on a particle and the velocity of the particle, respectively. AP framework has been applied to the distributed control of swarms of robots, such as robots formation, obstacle avoidance tasks and coverage tasks. But it has not been applied to global optimization.

II. GENERAL MODEL OF APO

AP was applied to robots formations whose mission is to form a hexagonal lattice, thus creating an effective antenna. The hexagon can be created via overlapping circles of radius R . To map this into a force law, each robot repels other robots that are closer than R , while attracting robots that are further than R in distance. A force law is defined as:

$$F = G\frac{m_i m_j}{r^p} \tag{1}$$

Where G is the "gravitational constant", F < Fmax is the magnitude of the force between two particles i and j , and r is the distance between the two particles. The variable p is a user-defined power, which ranges from -5.0 to 5.0. In the real Universe, of course, p = 2.

But in AP-space, the user is free to assign an entirely different force variation (for example, p = −1). The above idea of robots formations with AP method can be used to solve global optimization problems. There are many similar points between AP method and population-based optimization algorithm. In various population-based

optimization algorithms, each sample solution in decision space is considered as a particle that has a fitness, position and /or velocity (for example, in PSO and EAs).

The decision space is multi-dimensional space, in which particles can be global located. And particles enjoy the information of the whole swarm. Various intelligent search strategies lead these particles to move towards the regions of the decision space with better fitness. Similarly, AP method treats each entity as physical individual that has a mass, position and velocity. The motion space is two or three dimensional space, in which individuals only can be local located. Individuals only enjoy the information of neighbors. An appropriate attraction-repulsion rule can cause APO's population to search regions of the decision space with better fitnesses. So AP method can be easily mapped to population-based optimization algorithm. The mapping of AP method to optimization algorithm is shown as Figure 1.
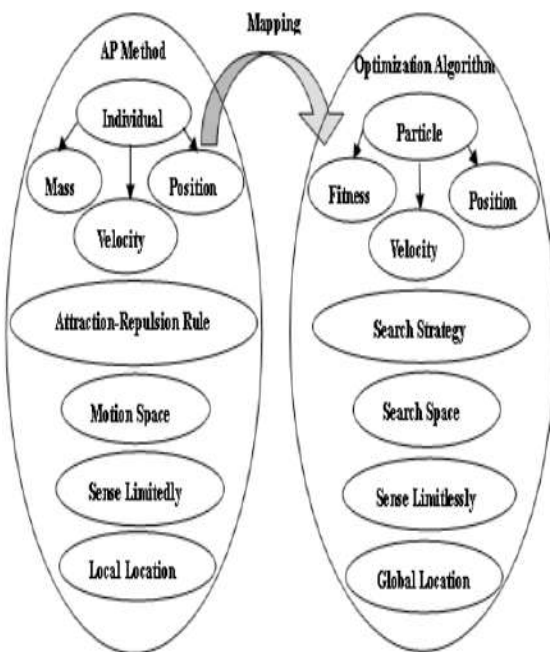

Fig. 1: THE MAPPING OF AP METHOD TO OPTIMIZATION ALGORITHM

Obviously, the characteristic attributes possessed by individual in AP method and particle in optimization algorithm are similar. In our approach, we construct the relationship between individual's mass with its fitness that we are trying to optimize. The better the objective function value, the bigger the mass, then the higher the magnitude of attraction. The individuals move towards the better fitness region, which can be mapped to individuals moving towards others with bigger masses.

As mentioned before, the virtual forces drive each individual motion. The bigger mass determines the higher magnitude of attraction. In addition, the individual with the better fitness attracts others with the worse fitness, whereas the individual with the worse fitness repels others with the better fitness. Especially, the individual with the best fitness attracts all the others, whereas it is never repelled or attracted by others. The attractive-repulsive rule can be treated as the search strategy in optimization algorithm which will used to lead the population to search the better fitness region of the problem.

In initial state, individuals are randomly released in the feasible region. Velocities of all individuals are initialized to be random numbers restricted in decision space and their masses are all changed by their fitness. After calculating the mass of each individual, we use it to obtain a velocity vector for each particle to move in next iterations. The change of velocity is controlled by the total force on the individual.

The total force is calculated by adding vectorially the forces from each of the other individuals calculated separately. Newton's second law supplies reference to the motion of individuals. Until the forces decreased to

zero, the lowest PE of the system is obtained and the desired configuration is emerged. The above method is called Artificial Physics Optimization (APO) algorithm.

III. THE HYBRID VECTOR MODEL OF APO

In the Initialization, N individuals are sampled randomly from a d-dimensional problem space. Their velocities are also randomly. Then the fitness value for each individual is calculated using the function pointer f(x), and the individual that has the best function value is elected and stored in Xbest.

Step1: Initializing a population of K individuals in the above decision space with random positions and velocities. Setting parameters including K, G, w, d, LOOP, etc.. Calculating ( ) f X of each individual and selecting the best and worst individual.

Step2: Computing the forces vector exerted on each individual.

Step2.1: Calculate the mass of each individual at time t according to (2).

Step2.2: Calculating the force vector exerted on each individual via all other individual

Step3: Updating the velocity and position vectors of each individual

Step4: Computing f(X) of each individual. Updating the global best position Xbest and its fitness

Step5: If the stop criteria are not satisfied (that is the iteration t is smaller than LOOP), go to Step 2. And goto end.

IV.CONCLUSION

This paper proposes a hybrid vector APO with multidimensional search method (HVAPO-MDS) to improve the Local search

capability of VAPO algorithm. The multidimensional optimization supplies a more chance than HVAPO-ODS and VAPO algorithms.

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DYNAMIC CAPABILITIES FOR STRATEGY OF HUMAN RESOURCE MANAGEMENT FOR MANAGEMENT SYSTEM

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ABSTRACT: In this paper the strategic research on automated network for human resource management using knowledge management. The main intent of HRM is to manage the people in the organizations. The proposed system gives effective and efficient outputs by ensuring the human talent based on the goals of organization. Here the main intent of KM is to compensate, trained and recruited by using human resources. RMA is used in the proposed system to improve the performance assessments in effective way. The HRM based KM provides the contribution between the people to share the knowledge. Hence the proposed system ensures the knowledge focus and reinforces the management goals in effective way.

KEY WORDS: Human Resource Management (HRM), Knowledge Management (KM), RMA (Resource Management Agencies), Data Acquisition, Adaptation and Perfection.

I.INTRODUCTION

Knowledge Management (KM) is a rising field of specialization in various callings including Information Science (IS). The various callings are adding to and affecting the improvements in KM in their own particular manners [1]. In any case, it is contended here that it isn't adding to the progression of KM as much as it ought to for various evident reasons. It targets contributing towards accomplishing an agreement among IS experts on conceptualization, objectives and extent of KM in HR [2].

The proposals of the paper center around how the calling could proactively be engaged with propelling knowledge the board is an expanding field of research and work on speaking to the two scholastics and experts.Professionals work in a situation of fast ecological change and data over-burden, which builds the requirement for information so as to understand enormous amounts of unique.

Data and information. Reliable with the progressions that happen practically speaking, researcher's center their exploration endeavors toward distinguishing and improving KM rehearses and gaining by the IC inside an association. Customarily, the board scientists have made information that for the most part shows up in peer-evaluated productions. As of late, questions have been raised about the commonsense pertinence of research delivered by KM business scholastics.

There is a wide agreement among researchers and experts the same that boosting the possibilities of HR is vital to hierarchical adequacy and execution in the 21st century worldwide commercial center of extraordinary social Darwinism.

It has to be sure been recommended that the manner by which an association oversees individuals can impact its presentation. In any case, the connection between successful Human Resource Management (HRM) work and hierarchical execution has stayed a vexed issue among researchers, chiefs and even among HR specialists. Without a doubt, there is a progressing banter on what the HR work truly adds to associations. The most principal issue remains how to see how HRM away on execution [3].

Subsequently, creating an un equal reaction to the inquiry 'what does HRM truly add to authoritative execution has stayed slippery. This article fundamentally assesses the contemporary HR work, with a perspective on featuring its commitments to

authoritative adequacy and execution. It contends that there are experimental confirmations to recommend that there are clear linkages between compelling HR work and authoritative adequacy and improved execution;however the best challenge remains how to evaluate these commitments. The paper likewise takes note of that a ton should even now be possible to expand these linkages and commitments; and infers that for this to occur (i.e. augmenting HR's commitments), HR should fundamentally reevaluate its capacities and position itself to assume an increasingly vital job in reinforcing hierarchical abilities and skills and be proactive in its methodology [4-5].

II. LITERATURE SURVEY

So as to adapt to the new challenge originating from the informationbased advancement, endeavors should set up and actualize powerful information the executive's technique from the accompanying a few perspectives:

A. Constructing the Proper Knowledge Management Strategy:

Basically, the development of big business information the board methodology is to oversee inward and outside information from the perspective on the general circumstance and the best worth. For big business information the board, the most significant is to control information stream both inside and outside the venture, and afterward information can be moved.

Simultaneously, undertakings likewise need to oversee challenges and issues in the way of information moving, which can accomplish the information sharing easily, and make the information settle down at the association. After this procedure, ventures can accomplish the information advancement and additional worth. This needs to characterize the information

moving procedure in three zones: people (individual information), inside the undertaking (venture information) and outside the endeavor (providers, clients and other information), as is appeared in figure 1.Information moving in these three districts can make an incentive for the endeavor; each move technique can expand their exceptional information and improve the aggressiveness of undertakings.

B. Building a Learning-oriented Corporate Culture:

So as to do viable information advancement, endeavors must form a learning-focused corporate culture to improve the hierarchical limit of learning. Learning direction as a lot of association's qualities impacts the undertaking capacity of getting, spreading, utilizing and making.
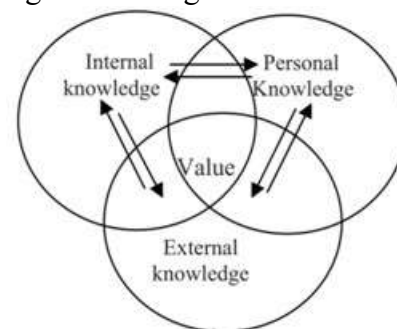
Fig. 1: ENTERPRISE KNOWLEDGE TRANSFER DIAGRAM KNOWLEDGE.

Ventures advance the assortment of information through learning-focused culture and make the information stock keep on expanding, which will give a decent information stage to development. Furthermore, learning direction can likewise advance learning and sharing the understood information, changing the certain information into unequivocal just as moving inside the association.

Simultaneously, undertakings ought to set up a connection in the information obtaining, retention, creation and the association's objectives; this will deliver a guideline instrument in the current

information and new information framework which is the most important to the development capacity.

Likewise, the undertaking must have the essential advancement speculation, which is useful for the exchange and portion of information in the endeavor interior. The making of new information is additionally irreplaceable, which is fundamental to the making of new information. These incorporate R&D input, preparing instruction venture, making the learning association, etc.

C. STRENGTHENING HUMAN RESOURCES DEVELOPMENT AND MANAGEMENT:

Under the states of information based economy, HR is progressively turning into the most significant assets in the venture. A great deal of understood information in the endeavor is appended to the individuals, and in this way the degree of information the executives and development capacity level are firmly identified with the individual information load of the representatives, the eagerness to share information, learning frames of mind and capacity.

Along these lines, ventures should manufacture a successful HR improvement and the executives framework to get, keep up and propel staff through staff enrollment, preparing, motivating forces and different methods or techniques, which can create, spread and use information continually to accomplish the objective of big business information development.

Ventures ought to pick the staff with fitting limit and suitable demeanor so as to encourage the incorporation of information and capacity of the undertaking group. Endeavors may do successful worker preparing to advance association's human

capital stock and the portions of information, which is useful to understand the fast aggregation of information.What's more, so as to make a more prominent commitment to the advancement limit of ventures utilizing the current supply of information, undertakings ought to build up a framework to encourage information sharing inside the association, and make up for the information sharing conduct to advance the information coordination and development.

III. RESEARCH METHODOLOGY

This theoretical structure acquires a portion of its highlights from HRRBs. A portion of those highlights incorporate controlled access to the fundamental structure and certain territories, observing, adhering to explicit directions, regarding the guidelines, and so forth. The fundamental thought behind this system is to wipe out the idea of disagreeableness and treat squander transfer offices as cutting edge terminals, apparatuses, or gadgets that can (1) get all data identified with the arranged things at the same time, and (2) store data and offer to be utilized in manageable arranging/improvement or to be utilized for irregular checking/assessment.This applied system is introduced in figure 2. The underneath structure speaks to a framework that exceptionally depends on innovation. The results of such framework are like the destinations as of now being sought after by the Malaysian government through the authorized partition at source program without innovation contribution.
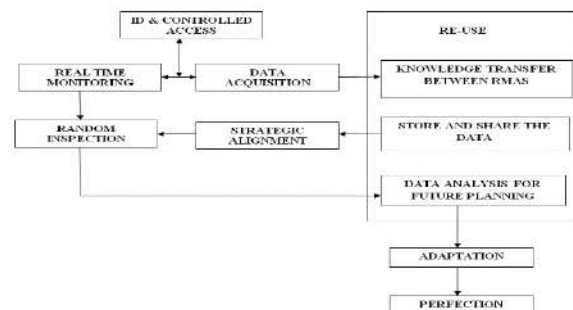

Fig. 2: RESEARCH METHODOLOGY

The primary thought is to make the feeling of modernized checking/controlling however in a reasonably marked manner. Access cards with explicit IDs relegated to each HRRBs lodging unit are required for transfer. Utilizing ID cards, the front entryway consequently slides down and empowers the clients to leave their things in the transfer chamber. The rest will be finished by the machine.The whole detachment at source is streamlined into three classes of Recyclables (R), Organic (O), Incineration (I). Natural waste and dampness content, with the proportion of over half in produced MSW in Malaysia are the significant obstructions to reusing if not considering the cleanliness issues and ecological harms caused.

Recyclables can be arranged without bundling, expecting no biodegradable material notwithstanding/joined. Arranged things can be at first broke down so as to record two significant qualities for example weight (utilizing transport scales) and creation. This decides how much recyclable, natural, and cremation squander is being produced by each building or even by each lodging unit (each HRRBs lodging unit has its own virtual record). A non-stationary part with the capacity of moving between R, O, and I chambers takes test photographs to be put away in client account. This empowers checking ill-advised bundling and spillage.

Furthermore, a X-Ray chamber can be utilized for arbitrary assessment to screen the substance within each pack to decide whether partition at source is being performed by that particular lodging unit. Nonetheless, for this situation security and moral issues must be considered so as to abstain from imperiling the general wellbeing or their protectionThis model attempts to be as much as near the present

transfer framework/technique yet in another and modernized style.

Notwithstanding, notice this is only a theoretical perception or understanding of the gathered information, not portrayal of a develop item. It tends to be structured in any frame and be implanted from multiple points of view. Symbols, signs, measurements, hues, parts, the general plan, thoughts, and so on are representative.Since this paper isn't an item manual or a patent portrayal, experiencing little subtleties is out of the region of study. The gadget/machine can be inserted in an encased room or at the two sides of a divider with access from inside (clients) and access from outside (cleaners/gatherers/upkeep). Boundless potential outcomes of how to put, install, and utilize this gadget can be inspected later on.

IV. RESULTS

The below figure (3) shows the reliability and validity analysis of HRM.

Fig. 3: RELIABILITY AND VALIDITY ANALYSIS OF HRM

Table. 1: STRATEGY OF HUMAN RESOURCE MANAGEMENT

S.No.	Parameter	Coefficient load	Grade mean value
1	Price	0.919	4.075
2	Resource capacity	0.908	3.925
3	Comprehensive quality	0.931	2.396

V. CONCLUSION

This paper shows the research on HRM using KM. This strategy mainly used for the category of houses to get best options for the change the current situations. The proposed system will transfer the data between resource management agencies. In the same way it will develop the rapid urbanization in the cities. The human resource management is used worldwide by using online data bases. Hence the proposed system gives accurate approximation compared to others.

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MATHEMATICAL STRATEGY OF PRINCIPAL COMPONENT ANALYSIS BASED ON EIGEN VALUES AND VECTORS

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ABSTRACT: Principal Components Analysis (PCA) is a practical and standard statistical tool in modern data analysis that has found application in different areas. It has been called one of the most precious results from applied linear algebra. PCA is a straightforward, non-parametric method for extracting pertinent information from confusing data sets. It presents a roadmap for how to reduce a complex data set to a lower dimension to disclose the hidden, simplified structures that often underlie it. This paper mainly addresses the Methodological Analysis of Principal Component Analysis (PCA) Method. PCA is a statistical approach used for reducing the number of variables which is most widely used in face recognition. In PCA, the training set is represented as a linear combination of weighted eigenvectors called Eigen faces. These eigenvectors are obtained from covariance matrix of a training set. The weights are found out after selecting a set of most relevant Eigen faces.

KEY WORDS: Principal component, Covariance matrix, Eigen value, Eigenvector and PCA (Principle Component Analysis).

I.   INTRODUCTION

Principal component analysis is also called "Hotteling transform" or "Karhunen-leove (KL) Method". Principle Component Analysis (PCA) is one of the most frequently used multivariate data analysis. Principal Component Analysis can be considered as a projection method which projects observations from a p-dimensional space with p variables to a k-dimensional space (where $k < p$) so as to conserve the maximum amount of information (information is measured here through the total variance of the scatter plots) from the initial dimensions.

If the information associated with the first 2 or 3 axes represents a sufficient percentage of the total variability of the scatter plot, the observations will be able to be represented on a 2- 3- dimensional chart, thus making interpretation much easier [1].

Principal component analysis (PCA) involves a mathematical procedure that transforms a number of (possibly) correlated variables into a (smaller) number of uncorrelated variables called principal components. The first principal component accounts for as much of the variability in the data as possible and each succeeding component accounts for as much of the remaining variability as possible [2].

To discover or to reduce the dimensionality of the data set, to identify new meaningful underlying variables the mathematical technique used in PCA is called Eigen analysis: this solve for the Eigen values and eigenvectors of a square symmetric matrix with sums of squares and cross products. The eigenvector associated with the largest Eigen value has the same direction as the first principal component. The eigenvector associated with the second largest Eigen value determines the direction of the second principal component. The sum of the Eigen values equals the trace of the square matrix and the maximum number of eigenvectors equals the number of rows (or columns) of this matrix.

The first component extracted in a principal component analysis accounts for a maximal amount of total variance in the observed variables. Under typical conditions, this means that the first component will be

correlated with at least some of the observed variables. It may be correlated with many. The second component extracted will have two important characteristics. First, this component will account for a maximal amount of variance in the data set that was not accounted for by the first component. Again under typical conditions, this means that the second component will be correlated with some of the observed variables that did not display strong correlations with component 1. The second characteristic of the second component is that it will be uncorrelated with the first component.

Literally, if you were to compute the correlation between components 1 and 2, that correlation would be zero. The remaining components that are extracted in the analysis display the same two characteristics: each component accounts for a maximal amount of variance in the observed variables that was not accounted for by the preceding components, and is uncorrelated with all of the preceding components.

A principal component analysis proceeds in this fashion, with each new component accounting for progressively smaller and smaller amounts of variance (this is why only the first few components are usually retained and interpreted). When the analysis is complete, the resulting components will display varying degrees of correlation with the observed variables, but are completely uncorrelated with one another.

II. RELATED WORK

Principal component analysis is sometimes confused with factor analysis and this is understandable, because there are many important similarities between the two procedures. Both are variable reduction methods that can be used to identify groups of observed variables that tend to hang together empirically. Both procedures can be performed with the SAS System's FACTOR procedure and they sometimes even provide very similar results.

Nonetheless, there are some important conceptual differences between principal component analysis and factor analysis that should be understood at the outset. Perhaps the most important deals with the assumption of an underlying causal structure: factor analysis assumes that the co-variation in the observed variables is due to the presence of one or more latent variables (factors) that exert causal influence on these observed variables.

An example of such a causal structure is presented in Figure (1). The ovals in Figure (1) represent the latent (unmeasured) factors of "satisfaction with Supervision" and "satisfaction with pay". These factors are latent in the sense that they are assumed to actually exist in the employee's belief systems, but cannot be measured directly.

However, they do exert an influence on the employee's responses to the seven items that constitute the job satisfaction questionnaire described earlier (these seven items are represented as the squares labeled V1-V7 in the figure). It can be seen that the "supervision" factor exerts influence on items V1-V4 (the supervision questions), while the "pay" factor exerts influence on items V5-V7 (the pay items).

Researchers use factor analysis when they believe that certain latent factors exist that exerts causal influence on the observed variables they are studying. Exploratory factor analysis helps the researcher to identify the number and nature of these latent factors. In contrast, principal component analysis makes no assumption about an underlying causal model.
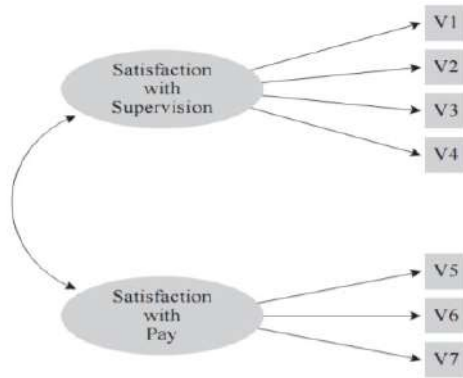
Fig. 1: EXAMPLE OF THE FACTOR ANALYSIS

Principal component analysis is simply a variable reduction procedure that (typically) results in a relatively small number of components that account for most of the variance in a set of observed variables. In summary, both factor analysis and principal component analysis have important roles to play in mathematics research, but their conceptual foundations are quite distinct.

III. PROPOSED METHOD

Step 1: Get some data Let us consider a simple arbitrary three dimensional data set. The reason why chosen this is so that for providing plots of the data to show what the PCA analysis is doing at each step. The data that was used is found in Figure (1), along with a plot of that data.

Step 2: Subtract the mean For PCA analysis, should have to subtract the mean from each of the data dimensions. The mean subtracted is the average across each dimension. So, all the x values have (the mean of the values x of all the data points) subtracted, and all the y values have subtracted from them and all the z values have subtracted from them. This produces a dataset whose mean is zero.

Step 3: Calculate the covariance matrix since the data set is 3 three dimensional, so the covariance matrix will be 3 × 3. Now, the covariance matrix of new adjusted data set is obtained.

Step 4: Calculate the eigenvectors and Eigen values of the covariance matrix since the covariance matrix is square, the eigenvectors and Eigen values can be calculate for this matrix. These are rather important, as they tell us useful information about our data. It is important to notice that these eigenvectors are both unit eigenvectors i.e. their lengths are both 1. This is very important for PCA, but luckily, most mathematics packages, gives unit eigenvectors.

Step 5: Choosing components and forming a feature vector, here is where the notion of data compression and reduced dimensionality comes into it. Looking at the eigenvectors and Eigen values from the previous section, will be notice that the Eigen values are different values. In fact, it turns out that the eigenvector with the highest Eigen value is the principle component of the data set.

In this example, the eigenvector with the largest Eigen value was the one that pointed down the last of the data. It is the most significant relationship between the data dimensions. In general, once eigenvectors are found from the covariance matrix, the next step is to order them by Eigen value, highest to lowest. This gives the components in order of significance Feature.

Vector = (eigenvector 1, eigenvector 2 … … … … ... eigenvector n)

Now, this will ignore the components of lesser significance. This will lose some information, but if the Eigen values are small, you don't lose much. If this will out some components, the final data set will have fewer dimensions than the original.

Step 6: Deriving the new data set, in order to find out new final data set, the components (eigenvectors) have been chosen that to keep in this data and formed a feature vector, simply take the transpose of the vector and multiply it on the left of the original data set, transposed.
Final Data Set = Row Feature Vector × Row Adjusted Data Set

= Feature Vector T × Adjusted Data Set T

Where, Row Feature Vector is the matrix with the eigenvectors in the columns transposed so that the eigenvectors are now in the rows, with the most significant eigenvector at the top, and Row Adjusted Data Set is the mean-adjusted data transposed, i.e. the data items are in each column, with each row holding a separate dimension.

It will give us the original data solely in terms of the vectors that are chosen. This original data set had three dimensional, so our data was in terms of them. If these axes are perpendicular, then the expression is the most efficient. This was why it was important that eigenvectors are always perpendicular to each other. This will have changed our data from being in terms of the axes x, y and z, and now they are in terms of our 3 eigenvectors. In the case of when the new data set has reduced dimensionality, i.e. we have left some of the eigenvectors out; the new data is only in terms of the vectors that we decided to keep.

To show this on our data, this had done the final transformation with each of the possible feature vectors. It will transpose of the result in each case to bring the data back to the nice table-like format. This also plotted the final points to show how they relate to the components. To show this on our data, hence the final transformation with

each of the possible features vectors. Therefore the transpose of the result in each case to bring the data back to the nice table-like format. This also plotted the final points to show how they relate to the components. In the case of keeping both eigenvectors for the transformation to get the data.

This data is basically the original data, rotated so that the eigenvectors are the axes. This is understandable since no information have lost in this decomposition.

Transformed Data Set = Row Final Data Set
= Final Data Set T

Step 7: Getting the old data back, this step is most important to recover the original data set. If we took all the eigenvectors in our transformation will we get exactly the original data back. If we have reduced the number of eigenvectors in the final transformation, then the retrieved data has lost some information. Now, recall the equation of the final data set that is used in

Final Data Set = Row Feature Vector × Row Adjusted Data Set

= Feature Vector T × Adjusted Data Set

Now, Row Adjusted Data Set
= Final Data Set × Row Feature Vector – 1

IV. CONCLUSION
The problem of dimension reduction is introduced as a way to overcome the curse of the dimensionality when dealing with vector data in high-dimensional spaces and as a modelling tool for such data. It is defined as the search for a low-dimensional manifold that embeds the high-dimensional data. A methodological analysis of dimension reduction problems is performed in this paper.

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OVERVIEW ON FUNCTIONAL DIFFERENCES BETWEEN LEAD-ACID BATTERY AND LI-ION BATTERY

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Abstract: Lithium – ion battery plays a vital role in the life of modern society as the technology use in miniature electronic devices like mobile communications, laptops and tablets etc. The lithium ion battery technology broken functional barriers over the earlier batteries like Carbon-Zinc batteries, silver oxide batteries, Zinc – Air batteries, lead acid batteries etc. Currently research work is in progress to increase efficiency of Li-ion batteries by adding the polymers and Nano fibres. Presently the need of our to use these batteries in terms huge global potential towards energy sustainability and substantial reduction in Carbon emissions. In this paper a detailed review is presented on various functional parameters between lead-acid battery and Li-ion battery and also the future perspectives of it.

1 INTRODUCTION:

In periodic table the first group elements called as Alkali metals . All alkali metals have their outermost electron in an s-orbital: this shared electron configuration results in their having very similar characteristic properties. These alkali metals consist of the chemical elements Lithium (Li), Sodium (Na), Potassium (K), Rubidium (Rb), Caesium (Cs), and Francium (Fr). Together with hydrogen they constitute group 1, which lies in the s-block of the periodic table. Indeed, the alkali metals provide the best example of group trends in properties in the periodic table, with elements exhibiting well-characterised homogeneous behaviour. This family of elements is also known as the lithium family after its leading element [1].

All the alkali metals react with water, with the heavier alkali metals reacting more vigorously than the lighter ones. The alkali metals are all shiny, soft, highly reactive metals at standard temperature and pressure and readily lose their outermost electron to form cataions with charge +1. They can all be cut easily with a knife due to their softness, exposing a shiny surface that tarnishes rapidly in air due to oxidation by atmospheric moisture and oxygen (and in the case of lithium, nitrogen) [2]. Because of their high reactivity, they must be stored under oil to prevent reaction with air, and are found naturally only in salts and never as the free elements.

Caesium, the fifth alkali metal, is the most reactive of all the metals.Lithium is a chemical element with the symbol **Li** and atomic number 3. It is a soft, silvery-white alkali metal. Under standard conditions, it is the least dense solid element and the least dense metal [3].

2 HISTORY AND CONCEPT ABOUT BATTERY:

A battery is a device that is able to store electrical energy in the form of chemical energy, and convert that energy into electricity. Batteries provided the source of electricity before the development of electric generators and electrical grids around the end of the 19th century. In 1836, first we use the Daniell cell which consists of a copper pot filled with a copper sulphate solution and Zinc as a cathode and an anode to produce the practical source electricity in a battery. This is the first working standard for definition of the volt [4]. In 1837, A version of the Deniell cell was invented by Guy"s hospital.

In 1860, Callaud invented a variant of the Daniell cell called the Gravity Cell. In 1859, Gaston Plante invented the Lead – Acid Battery, i this battery Lead as a anode and lead dioxide cathode immersed in sulphuric acid. In early 1930's, a gel electrolyte produced by adding silica to a charged cell was used in the LT battery of portable vacuum-tube radios.The first consumer grade Nickel-Metal hydride batteries for smaller applications appeared in 1989 as a variation of the 1970s nickel-hydrogen battery. After these we used so many types' batteries like Carbon-Zinc batteries, silver oxide batteries, Zinc – Air batteries, lead acid batteries etc [5]. But now days, use of very low and high efficiency batteries like Lithium.

Table 1: Various functional parameters difference between lead acid and Li-ion battery

Parameters	Lead-Acid	Lithium-Ion
Working	Lead-acid and lithium-ionbatteriessharethesameworking principle based onelectrochemistry. They store(charge) and release (discharge)electrons (electricity)through electrochemicalreactions.	While discharging, Lithium ions(Li+) are exchanged betweenthe negative electrode (anode)and the positive electrode(cathode).
Electrical Capacity	30–40Wh/kg	110–250Wh/kg
Energydensity	80-90Wh/l	250–670Wh/l
Specificpower	180W/kg	250–340W/kg
Discharge	Lead-acidbatteries,over-dischargingcreateparasitereactions (sulfation) at theelectrodes, slowly damaging thesystem.	In lithium batteries only startwhen the depth of dischargereaches60%,thereforema nufacturers recommend 80%DOD to improve their total lifeduration.
Durability	Only work well for 350 cycles oroneyear.	10,000cyclesor10years
QuickCharge/discharge	Lead-acid batteries don'tsupport quick charge. Theircharging time range from 6 to15hours.	Lithiumbatteriesarefitforquickchar geanddischarge.Youcan charge them to 80% of theirfull capacity in 1 to 2 hours(dependingonthepower output)
BestforSolarEnergy	Lead-acid batteries can bedamaged by these occurrencesbeforetheyfollowthethr ee-stepprocessforproper charging.	Only a few hours to charge fully.Consequently, they are perfectlyfitforsolarenergystorage.

Risk &Safety	Risk:Spillingofacidicelectrolyte,Rel easeofhighlytoxicH2Sgas– Safety: Electrolyte as a Gel orabsorbed on a glass mat (AGM)andValveRegulation	Risk:Fire/explosion Safety: Airtight packaging,Battery Management SystemandSolidelectrolyte
Cost	Expensive	Over its lifetime the lithiumbattery is two times cheaperthanthelead-acid.
Recycle	New lead-acid batteries usuallycontain more than 80% recycledmaterial.	Lithiumbatteriescouldberecycledu pto96%.
DIY (Do it Yourself)	Lead Acid batteries are sealedandcannotbeupgradedor modified	Lithium-ionbatteriesaremodularandyoucan buildyour ownbatterypackathome.

3 CHANGE FROM A LEAD-ACID TO LITHIUM BATTERIES:

3.1How Do They Work?

Lead-acid and lithium-ion batteries share the same working principle based on electrochemistry. They store (charge) and release (discharge) electrons (electricity) through electrochemical reactions.

Both of them feature the following parts:

- Two electrodes: Anode (-), Cathode (+)
- Electrolyte
- Membrane separator

They differ in the material used for each component [22]

	Lead-Acid	Lithium-Ion
Anode	Pb	Carbon
Cathode	PbO_2	Lithium Oxide ($LiFePO_4$, $LiCoO_2$, $LiMn_2O_4$, etc...)
Electrolyte	H_2SO_4 (liquid, gel)	Lithium salt (liquid, solid, gel)

While discharging, Lithium ions (Li+) are exchanged between the negative electrode (anode) and the positive electrode (cathode). To balance the reaction, electrons are released from the negative electrode to the positive electrode.While charging, the opposite reaction occurs, and electrons are flowing from the positive electrode to the negative. For lead-acid, similar reactions occur, but in this instance, it is the acid electrolyte (H_2SO_4) thatparticipates in the reaction with $2H^+$ (aqueous protons).

3.2Which One Has The Best Capacity?

From a microscopic point of view, the capacity of a battery is related to the global charge of the transferred ions (Li^+ or H^+), multiplied by the

working voltage of the electrochemical reaction.Here we have the main difference between Lead-Acid and Lithium-Ion – weight. Lithium is the lightest metal on earth, one kg of lithium contains 29 times more atoms than lead. In addition, the working voltage of Lithium-Ion is 3.2V vs 2V for lead-acid. Consequently, you can store much more energy in 1kg of lithium battery than in lead-acid.The chart below summarizes the energy storage capacity of both technologies. The theoretical density does not take into account the mass of the electrolytes and other components (battery casing, safety equipment…).

Lead-Acid	Lithium-Ion	
Storage capacity theory	167 Wh/kg	11'600 Wh/kg
Storage capacity practice	30 – 40 Wh/kg	110 – 250 Wh/kg

Two other interesting figures are the battery capacity, also called energy density in Wh/l and the specific power of the battery in W/kg [22]

	Lead-Acid	Lithium-Ion
Energy density	80-90 Wh/l	250 – 670 Wh/l
Specific power	180 W/kg	250 – 340 W/kg

In the end, Lithium-Ion batteries are lighter (up to 6 times for the same capacity) than lead-acid, more compact, and up to two times more powerful.

3.3 Can it Fully Discharge?

If you've already purchased a lead-acid battery, you might have noticed that the manufacturer advises not to discharge the battery below 50% of its full capacity to improve its life duration. In lead-acid batteries, over-discharging creates parasite reactions (sulfation) at the electrodes, slowly damaging the system.Researchers and engineers worked hard on this matter and introduced the GEL and AGM batteries. Both of them offer a better depth of discharge (DOD) than the traditional flooded lead-acid battery but are still affected if fully discharged.Conversely, degradations in lithium batteries only start when the depth of discharge reaches 60%, therefore manufacturers recommend 80% DOD to improve their total life duration. Recent improvement enables 100% DOD without extra damage to the battery.

3.4 Self-Discharge Rate

Both technologies, when stored, will slowly lose their initial capacity. The discharge rate is affected by the initial charging state of the battery. It is recommended to fully charge your battery before storing it. For Lead-acid, the self-discharge rate is 3-20% a month, and for Lithium-Ion 0.35-2.5% per month

3.5 Charge/Discharge Efficiency

The charge efficiency reflects the actual quantity of energy effectively stored in the battery. For example, when charging a 1 kWh battery you might use more than 1 kWh, due to internal loss.For lead-acid technologies, you'll get around 90% efficiency and for lithium batteries, 95% to 99%.

3.6 Which Is More Durable?

Durability is one of the most important factors to consider when buying a product.The same applies to batteries, and unfortunately, this is clearly not the strength of Lead-Acid batteries. Over the years some improvements were made: lead-acid batteries became maintenance-free and AGM and GEL technologies were introduced that slightly improve their performance.With only 2 years of good service (when discharged at 50% of its maximum capacity) the life duration is extremely low, especially for a century-old technology. If deeply discharged at each cycle (80% or more), your lead-acid battery will only work well for 350 cycles or one year.On the other side, lithium batteries have increased their life duration over the last 5 years, and manufacturers are now offering warranties as high as 10,000 cycles or 10 years (70% of initial capacity).

3.7 Do They Support Quick Charge/Discharge?

Due to technical limitations, lead-acid batteries don't support quick charge. Their charging time range from 6 to 15 hours and follow a three-step process as outlined below:

- Bulk charge: charging voltage increases steadily to its maximum value and charging current is kept at its maximum value. The battery will reach up to 80% of its full capacity in approximately 6 to 8 hours.
- Absorption charge: Charging voltage is kept at its maximum value, while the current slowly decreases until the battery is charged at 90-95%.
- Float charge: Charging voltage and current decreases to zero, while the battery reaches full charge.

On the other hand, lithium batteries are fit for quick charge. You can charge them to 80% of their full capacity in 1 to 2 hours (depending on the power output of your charger). The remaining 20% will take another 2 to 3 hours. Therefore, you can fully charge a lithium-ion battery in 3 to 5 hours.Both types of batteries support quick discharge and can provide intense pulses of current (hundreds of amps) if required.

3.8 Which One Is The Best For Solar Energy?

Solar energy, like all renewable, is intermittent. Therefore, its power output varies depending on the time of the day, and the weather. Passing clouds generate drastic power output modifications that strongly affect the battery charging current. As previously mentioned, lead-acid batteries can be damaged by these occurrences before they follow the three-step process for proper charging.In addition, their charging time could reach 15 hours, and in most countries, days are shorter than 15 hours, meaning full charge can never be achieved.On the other hand, intermittent charging does not affect lithium-ion batteries and it can take only a few hours to charge fully. Consequently, they are perfectly fit for solar energy storage.

3.9 Lead-Acid Vs Lithium-Ion: Are They Safe?

Lead-acid and lithium-ion both contain hazardous material that could possibly harm the users and the environment.

To make their products safe, manufacturers have developed different strategies summarized in the chart below[22]

	Risk	Safety equipment
Lead-acid	Spilling of acidic electrolyte	Electrolyte as a Gel or absorbed on a glass mat (AGM)
	Release of highly toxic H_2S gas	Valve Regulation
Lithium-Ion	Fire/explosion	Airtight packaging
		Battery Management System (BMS)
		Solid electrolyte

Most of the lead-acid batteries available on the market are now Valve Regulated (VRLA) and maintenance-free, therefore safe to use.Pure lithium is highly flammable when in contact with air. Battery Management Systems (BMS) were developed for safety purposes to monitor each battery cell and make sure that there is no overcharge/discharge.In the end, both types of batteries are safe to use, but they still need to be handle with caution.

3.10 Which One Is Cheaper?

The Levelized Cost of Storage (LCOS) is the best way to compare the cost of different battery technologies. LCOS is expressed in USD/kWh and takes into account all the expenses related to energy storage over the lifespan of a battery.As batteries are maintenance-free, the only cost would be the price of the battery itself.Let's have a look at the example below[22]

	Lithium-ion 12V, 100Ah	Lead-acid 12V, 100Ah
Upfront cost	739.99 USD	174.99 USD
Depth of discharge	80%	50%
Total number of cycles	(10 years) – 3600 cycles	(2 years) – 700 cycles
Total kWh over lifetime	3'456 kWh	420 kWh
LCOS	0.214 USD/kWh	0.417 USD/kWh

At first, the lithium-ion battery (LiFePO$_4$) costs 4 times more than the lead-acid battery. However, it lasts much longer and in the end, has the lowest LCOS. Therefore, over its lifetime the lithium battery is two times cheaper than the lead-acid.

3.11 Can it Recycle?

As previously mentioned, both batteries contain hazardous, highly toxic material and should be disposed of properly.Lead-acid batteries are the most recycled product in the world. The recycling rate reaches almost 100% in the US as nearly all parts (sulfuric acid electrolyte, ABS casing, lead plates) can be recycled. New lead-acid batteries usually contain more than 80% recycled material.On the other hand, lithium-ion is a new technology and as such, recycling this material still proves to be challenging. However, recent studies show that lithium batteries could be recycled up to 96%. In 2018, 97,000 tons of lithium batteries were recycled and battery recycling is now seen as a source of material as demand rises.

3.12 Can it DIY?

Lead Acid batteries are sealed and cannot be upgraded or modified. On the contrary, lithium-ion batteries are modular and you can build your own battery pack at home.DIY Lithium battery pack. When purchasing a lithium battery, you're actually buying multiple battery cells that are assembled together – all of which are connected to the Battery Management System (BMS).All elements constituting the lithium battery pack can be bought individually online. Manufacturers are selling prismatic lithium battery cells of various capacities (from 10Ah to 300Ah), all rated at 3.2V.For example, you can purchase four prismatic cells of 200Ah capacity each. Mount them in series, connect all the prismatic cells to a BMS, and you'll get a 12V, 200Ah lithium battery.This illustrates the great modularity of lithium batteries.

4 CHEMICAL ANALYSIS OF LI-ION BATTERIES:

Duringdischarge,lithiumisoxidizedfromLitoLi$^+$(0to+1oxidationstate)inthe lithium-graphiteanodethroughthefollowingreaction:

$$C_6Li ---- \rightarrow 6C(graphite) + Li^+ + e^-$$
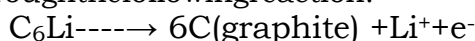
Thesereactionscanberuninreversetorechargethecell.Inthiscasethelithium ionsleavethelithiumcobaltoxidecathodeandmigratebacktotheanode,where theyarereducedbacktoneutrallithiumandreincorporatedintothegraphitenetwork. Theselithiumionsmigratethroughtheelectrolytemediumtothecathode,where theyareincorporatedintolithiumcobaltoxidethroughthefollowingreaction,whichreduc escobaltfroma+4toa+3oxidationstate:

$$Li_{1-x}CoO_2(s) + xLi^+ + xe^- ------\longrightarrow LiCoO_2(s)$$
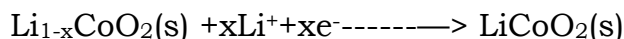
Types of Li-Ion Batteries The term "lithium-ion battery" refers to a large and diverse family of different battery chemistries, form factors, sizes, and cell constructions. At a basic level, all Li-ion battery cells have three functional layers: the positive electrode (cathode), the negative electrode (anode), and the separator. The separator is typically a polymeric membrane saturated with a liquid electrolyte that enables lithium ion transport but prevents direct contact between the electrodes. These thin layers are either rolled or stacked to increase the effective surface area available for energy storage, and then packaged in an outer cell housing . Positive electrode

(cathode) materials 1 Li-ion batteries are often classified according to the composition of their positive electrodes. Table 1 lists the major types of positive electrode (cathode) materials commercially available on the market.

4.2 Lithium Ion Battery and positive Electrode:

4.2.1 Lithium – Thermal Conductivity:

Thermal conductivity of Lithium is 85 W/(m·K).

The heat transfer characteristics of a solid material are measured by a property called the thermal conductivity, k (or λ), measured in W/m.K. It is a measure of a substance's ability to transfer heat through a material by conduction. Note that Fourier's law applies for all matter, regardless of its state (solid, liquid, or gas), therefore, it is also defined for liquids and gases.

4.2.2 Coefficient of Thermal Expansion of Lithium:

Linear thermal expansion coefficient of Lithium is 46 μm/ (m·K)

Thermal expansion is generally the tendency of matter to change its dimensions in response to a change in temperature. It is usually expressed as a fractional change in length or volume per unit temperature change.As the lithium ions "rock" back and forth between the two electrodes, these batteries are also known as "rocking-chair batteries" or "swing batteries".

4.3 Chemical Reaction as per Stoichiometry:

The following equations exemplify the chemistry. The positive electrode (cathode) half-reaction in the lithium-doped cobalt oxide is

$$CoO_2 + Li^+ + e^- \leftrightarrow LiCoO_2$$
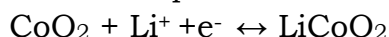
The negative electrode (anode) half-reaction for the graphite is

$$LiC_6 \leftrightarrow C_6 + Li^+ + e^-$$
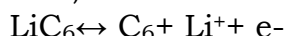
The full reaction (left to right: discharging, right to left: charging) being

$$LiC_6 + CoO_2 \leftrightarrow C6 + LiCoO_2$$
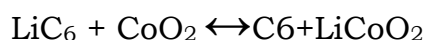
The overall reaction has its limits. Over discharging supersaturates lithium cobalt oxide, leading to the production of lithium oxide, possibly by the following irreversible reaction:

$$Li^+ + e^- + LiCoO_2 \longrightarrow Li_2O + CoO$$
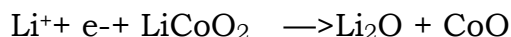
Overcharging up to 5.2 volts leads to the synthesis of cobalt(IV) oxide, as evidenced by x-ray diffraction:

$$LiCoO_2 \longrightarrow Li^+ + CoO_2 + e^-$$

In a lithium-Ion battery, the lithium ions are transported to and from the positive or negative electrodes by oxidizing the transition metal, cobalt (Co), in $Li_{1-x}CoO_2$ from Co^{3+} to Co^{4+} during charge, and reducing from Co^{4+} to Co^{3+} during discharge. The cobalt electrode reaction is only reversible for x< 0.5 (x in mole units), limiting the depth of discharge allowable. This chemistry was used In the Li-Ion cells developed by Sony in 1990.

4.4 Substrate is Solid waste and recycling (Battery recycling):

Since Li-ion batteries contain less toxic metals than other types of batteries which may contain lead or cadmium, they are generally categorized as non-hazardous waste. Li-ion battery elements including iron, copper, nickel and cobalt are considered safe for incinerators and landfills. These metals can be recycled, usually by burning away the other materials, but mining generally remains cheaper than recycling; recycling may cost $3/kg, and in 2019 less than 5% of lithium ion batteries were being recycled. Since 2018, the recycling yield was increased significantly, and recovering lithium, manganese, aluminium, the organic solvents of the electrolyte, and graphite is possible at industrial scales. The most expensive

metal involved in the construction of the cell is cobalt. Lithium is less expensive than other metals used and is rarely recycled, but recycling could prevent a future shortage.

5 CONCLUSIONS:

This is an overwhelming victory for lithium-ion batteries over Lead-acid batteries. Lithium-ion batteries offer larger capacities, are more durable, lightweight, efficient, and cheaper to use than lead-acid. Furthermore, they are modular and you can build your battery pack at home. Thanks to the rapid development of electric vehicles, lithium battery prices will continue to drop, making this technology even more attractive in the years to come. In this Lithium Batteries, There are two main categories of lithium ion batteries: primary (single-use) and secondary (rechargeable). A lithium-ion (Li-ion) battery is an advanced battery technology that uses lithium ions as a key component of its electrochemistry. During a discharge cycle, lithium atoms in the anode are ionized and separated from their electrons. ... Li-ion batteries typically use ether (a class of organic compounds) as an electrolyte. Lithium ion batteries are batteries that function based on the transfer of lithium ions between a cathode and an anode. Lithium ion batteries have higher specific energies than batteries made from other. Materials such as zinc and lead due to the relatively light weight and low density of lithium. Lithium batteries are also more stable over charge/recharge cycles due to the small radii of lithium ions, which cause fewer disruptions of the electrode structure during ion transfer .Lithium ion batteries commonly use graphite and cobalt oxide as additional electrode materials.

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ANOMALY BASED NETWORK INTRUSION DETECTION SYSTEMS FOR IOT USING ENSEMBLE LEARNING

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ABSTRACT: The advent of IoT technology and the increase in wireless networking devices has led to an enormous increase in network attacks from different sources. Enhancing the security of loT networks is trending as one of the most crucial issues the information technology community faces. With large scales of loT devices being developed and deployed, the ability for these devices to communicate securely without compromising performance is challenging. Traditional network intrusion detection systems do not serve the network environment of the IoT very well. Machine learning has become the key solution to improve intrusion detection systems. Anomaly detection mechanisms have been implemented to prevent confidential resources from malevolent users. Therefore, this paper presents ananomaly based Network Intrusion Detection System for IoT using Ensemble learning. Random Forest (RF), K-Nearest Neighbor (KNN), Naïve Bayes (NB) and Support Vector Machine (SVM) are the four machine learning classifiers which are used in this study for ensemble approach. Individual classifier performance is compared with ensemble classifier and the performance of ensemble method is better in terms of Accuracy, Precision and Recall parameters. The experiment results showed the effectiveness of our approach.

KEYWORDS: Ensemble learning, Network Intrusion Detection approach, SVM, RF, KNN, NB, loT devices.

I. INTRODUCTION

Nowadays, the systems are connected to the networks using the internet that are constantly exposed to attacks by intruders. It is important to detect intruders as quickly as possible to take the necessary actions to prevent them. Due to the variety of forms in attacks (such as information gathering, password stealing, viruses, Trojans, denial of service (DoS)), it is difficult to detect. The Internet of Things (IoT) is a network that connects different objects to the Internet according to an agreed protocol, in order for them to communicate and cooperate with each other [1].

The Internet of Things era will soon be affecting our lives with its security issues in addition to its convenience [2]. The core network of the Internet of things is still a traditional network but it has more complexities. The large number of nodes in the Internet of things makes the network more vulnerable, and the impact of attacks can be more serious than for conventional networks. The performance of traditional intrusion detection methods will be greatly reduced in this complex environment [3].

At present, intelligent, distributed intrusion detection has become a hot topic. However, traditional neural networks have their shortcomings. Overcoming these problems has become the key to improving intrusion detection. Intrusion Detection Systems (IDS) has gained a significant consideration among the best security mechanisms for safeguarding the IoT cyber infrastructures against various cyber-attacks in the last decades. That is, IDS has become one of the prominent tools to enhance security in today's IoT network-based systems.

A Network Intrusion Detection System (NIDS) is widely used for monitoring and detecting malicious activities from network traffic [4]. A typical NIDS comprises four steps, namely: a data source, data pre-processing, decision-making method and defense response. Firstly, a data source includes a set of network observations, each

of which includes features used for distinguishing between legitimate and suspicious observations. Secondly, a data pre-processing which prepares input data by eliminating unnecessary features to create a set of patterns involves the properties of legitimate and suspicious activities. Thirdly, a detection method includes a classification technique that identifies abnormal observations. Finally, a defense response is a decision taken by software or cyber administrators to prevent attack actions [5].

The methodology of NIDS is classified into misuse-based and anomaly-based and a hybrid of the two. To start with, a misuse-based NIDS monitors network traffic for matching observed instances against a well-known blacklist. Even though it produces higher detection rates and lower false positive rates, it cannot identify zero-day attacks. Conversely, an anomaly-based NIDS constructs a normal profile and considers any variation from this profile as an attack. Since it can identify both existing and zero-day attacks and does not demand any effort to create rules. An anomaly detection-based IDS identifies intrusions and malicious attacks by profiling normal network traffic behavior and then detecting any outlier by measuring a deviation from normal behavior.

II. LITERATURE SURVEY

Douglas H. Summerville et. al. [6] developed an ultra-lightweight deep packet anomaly detection approach that is feasible to run on resource constrained IoT devices yet provides good discrimination between normal and abnormal payloads. Feature selection uses efficient bitpattern matching, requiring only a bitwise AND operation followed by a conditional counter increment. We demonstrate near perfect payload discrimination for data captured from off the shelf IoT devices.

Marchal et al. [7] developed a scalable and distributed IDS via the collection of network instances from honeypot, DNS, HTTP, and IP-flow data. However, they did not provide the features used for implementing this system. Additionally, the simulated data was collected from different systems without publishing the configuration environment for evaluating the performance of new NIDSs.

Rongrong Fuet. al. [8] Internet of things (lOT) is vulnerable to malicious attacks because of opening deployment and limited resources. This paper shows an intrusion detection scheme based on the anomaly mining. The paper has two parts - (i) in the first part an anomaly mining algorithm is developed to detect anomaly data of perception layer, (ii) in the second part a distributed intrusion detection scheme is designed based on the detected anomalies. Finally our evaluation and analysis shows that our approach is accurate and extensible.

Martuza Ahmed et. al. [9] Computer networks have added new dimensions to the global communication. But intrusions and misuses have always threatened the secured data communication over networks. In this progression, here we present NIDS: a complete intrusion detection system which reduces some significant problems contained by the previous systems such as trust issues and message spreading problems. In the proposed IDS we don't need to install the system for every host. This system generates steady responses against intrusions and stops the intruder to proceed for further attacks.

Choi et al. [10] suggested a bot detection technique via the analysis of DNS flows based on generating features of DNS queries. This work was built on extracting static information from DNS queries such as source IP addresses and the query domain

name. However, these can be hidden or altered through the use of virtual private networks with no analysis of aggregated statistical network flows that involve the potential characteristics of cumulative flooding threats, such as DDoS attacks.

III.NETWORK INTRUSION DETECTION SYSTEMS FOR IOT USING ENSEMBLE LEARNING

The framework of anomaly based Network Intrusion Detection System for IoT using Ensemble learning is represented in below Fig. 1.
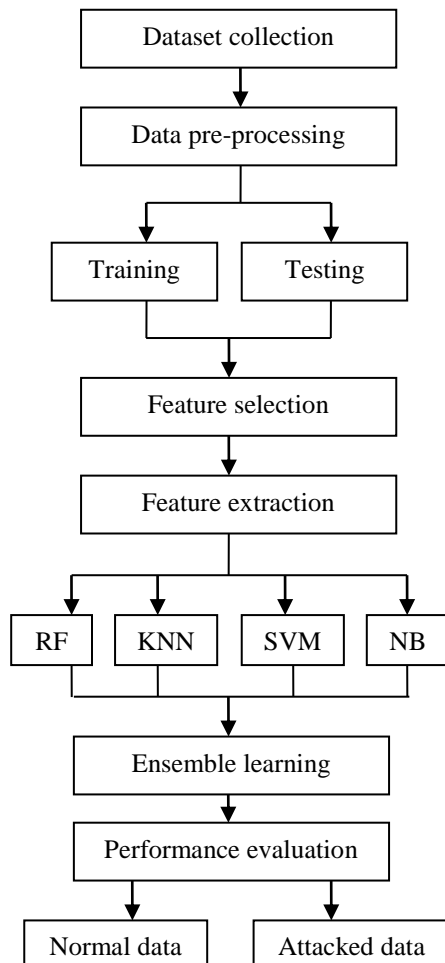
Fig. 1: FRAMEWORK OF NETWORK INTRUSION DETECTION SYSTEM FOR IOT

NSL-KDD dataset is used as the dataset in present description. NSL-KDD dataset is extracted from KDDCUP99 dataset. KDD CUP 99 is extension of DARPA dataset. Data is very much redundant and duplicated. But NSL KDD dataset eliminates the redundant duplicated records from KDD CUP 99 dataset. New type of attacks is also incorporated to enhance the richness in the dataset.

There are two types of attacks analyzed as normal and other types of attacks. The proposed system considers a total of 37 types of attacks. Further, all the attacks are classified under four categories as DoS Attack, Probe Attack, Remote to Local Attack (R2L) and Root to User Attack (U2R). Data preprocessing is most important phase of any machine learning project. It gives the clear understanding of the problem and makes an organized dataset. Since data is highly unbalanced and of two different types, therefore there is a need of preprocessing data so that data can be classified into train and test set evenly on the basis of label of attack and encoding of data in terms of numeric value can be done.

NSL-KDD dataset records are split into 80% training and 20% testing set. Splitting of the data records is done on each label of attack rather than splitting whole data. This makes it balanced splitting. After that, all labels are merged into two train and test set. Feature extraction is the process of selecting important features among 41 features that are present in the dataset. These feature sets will help the classifier to learn the behaviour and pattern of records on every attack and normal packet type. Improper feature selection will lead to performance depletion of any classifier. With the help of feature classifier will predict the behaviour and pattern of new packets. For Ensemble learning four classifiers are used in this paper and these are Support Vector Machine (SVM), Random Forest (RF), Naïve Bayes (NB) and K-Nearest Neighbour (KNN).

Support Vector Machine (SVM) makes an optimization level by isolating data from different categories. The data are modified for several classes. Based on this separation, the complex data are transformed. At that point, it finds out how to partition the data based on classes.

Naïve Bayes (NB) is a type of Bayesian Network technique that assumes that all features are independent. The basic classification method of the NB is the Bayes rule theorem to search for the maximal likelihood hypothesis that identifies the class label.

The K-Nearest Neighbor Algorithm (KNN) is a strategy that applies to Regression and Classification. In both regression and classification, the k-entry includes the most private training events throughout the domain. Hence, the output is based on the use of KNN. The KNN algorithm is used to find the k-samples in the training set (k is a positive integer, usually small).

Random Forest (RF) classifier makes a choice of trees based on randomly chosen features. Next, it manages the number of trees from each chosen tree which is the anticipated objective and helps to calculate the voting. The most elevated voting area is the last prediction and is supported in target expectation.

After the classification of all these four type of classifiers, all results are combined in Ensemble learning phase. Then the exact output or results are evaluated by using performance metrics such as Accuracy, Precision and Recall. Then finally attacked data and normal data are detected.

IV. RESULT ANALYSIS

NSL-KDD dataset is used as the dataset in present description. NSL-KDD dataset is extracted from KDDCUP99 dataset. NSL-KDD dataset records are split into 80% training and 20% testing set. Splitting of the data records is done on each label of attack rather than splitting whole data.

The performance of described Ensemble method is measured in terms of Accuracy, Precision and Recall. These metrics relies on the four terms of True Positive (TP), True Negative (TN), False Negative (FN) and False Positive (FP). TP is the number of actual anomalous records detected as attacks, TN is the number of actual legitimate records detected as normal, FN is the number of actual anomalous records classified as normal and FP is the number of actual legitimate records classified as attacks. The metrics are described as follows:

Accuracy: Accuracy is defined as the ratio of the number of properly classified anomalies and normal to the total number of all cases.

$$Accuracy = \frac{TP + TN}{TP + TN + FN + FP} \ldots (1)$$

Recall: Recall represents a relative measure of the number of anomalies properly classified to the number of anomalies that have been classified as nature (wrongly classified) and the number of correctly classified normal states, i.e. measures the percentage that the accuracy could not measure.

$$Recall = \frac{TP}{TP + FN} \ldots (2)$$

Precision: Precision is the ratio of the number of correctly classified anomalies to the number of correctly classified normal and anomalies.

$$Precision = \frac{TP}{TP + FP} \ldots (3)$$

Individual classifiers performance parameters values are compared with Ensemble learning classifier which is represented in below Table 1.

Table 1: PERFORMANCE OF INDIVIDUAL CLASSIFIERS WITH ENSEMBLE LEARNING

Classifiers	Accuracy	Recall	Precision
SVM	84.2	85.4	86.8
RF	83.7	86.5	87.6
NB	89.5	88.8	89.3
KNN	90.1	91.2	92.2
Ensemble learning (SVM+RF+NB+KNN)	98.4	96.8	97.5

The graphical representation of Accuracy, Recall and Precision of individual methods and Ensemble method is represented in below Fig. 2.
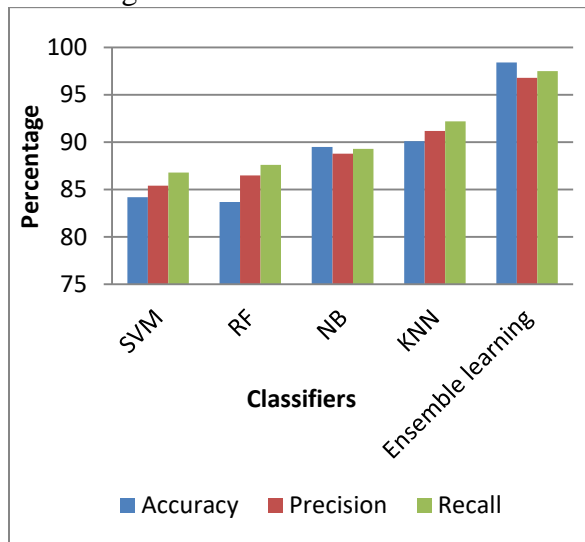
Fig. 2: COMPARATIVE PERFORMANCE OF DIFFERENT CLASSIFIERS

Therefore from results it is clear that, described Ensemble model is efficient in finding the attacks in IoT networks than the individual machine learning classifiers.

V. CONCLUSION

An Anomaly based Network Intrusion Detection System for IoT using Ensemble learning is described in this paper. Random Forest (RF), K-Nearest Neighbor (KNN), Naïve Bayes (NB) and Support Vector Machine (SVM) are the four machine learning classifiers which are used in this study for Ensemble approach. NSL-KDD dataset is used as the dataset in present description. Accuracy, Precision and Recall are the performance parameters used in this study. The Accuracy, Recall and Precision

values of Ensemble learning are 98.4%, 96.8% and 97.5% respectively. From results, it is clear that Ensemble model is efficient in finding the attacks in IoT networks than the individual machine learning classifiers.

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Impact of COVID-19 on Higher Education – Changing trends in Outcome Based Education

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ABSTRACT: The present days educational system evolved after addressing a lot of challenges. Majority of these challenges changed the dimension of Teaching – learning process over the years rather in a small and marginal ways. However, recently, there is a clear shift in Indian education from teacher centric to student centric due to the changes in teaching, pedagogy, learning resources and redefinition of learning outcomes. The students are given opportunity to involve themselves in teaching and learning process. Particularly, these days the higher education has been subjected to tremendous friction as COVID-19 posed a new threat to the education system due to lockdown of academic institutions and physical distancing norms. This threat is to be exploited as an opportunity to make use of ICT facilities in the teaching and learning process in order to realize the cherished objectives of Choice Based Credit System (CBCS). An interactive virtual classroom environment be developed using various software tools or platforms to enable the teacher and taught to have a meaningful learning experience. In this paper, an attempt made to study the impact of COVID-19 on Higher education and changing trends in Outcome Based Education in post COVID environment. The results of a sample survey are presented.

I.INTRODUCTION

Higher education globally has faced many major challenges over the years, shifting from the traditional curriculum that was subject centered, teacher oriented, didactic towards a curriculum to more learner centered, learner oriented, flexible, interactive, integrated, competency based, outcome based and gives ownership of learning to the students [1]. Many of the curricular changes are aiming to improve learning, quality of education delivery and learning outcomes. This paper is aimed to evaluate the impact of COVID-19 on teaching learning process vis-à-vis learning outcomes and also to assess the modern ICT based teaching tools.

Outcome Based Education:

The focus of the outcome base education is to organize everything in an educational system around what is essential for all students to be able to do successful at the end of their learning experiences. This means starting with a clear picture of what is important for students to be able to do, then organizing the curriculum, instruction, and assessment to make sure this learning ultimately happens [2]. (Spady,1994:1). The emphasis on Outcome based education system is measuring "outcome" rather "inputs". Each educational institution is responsible for setting its own outcomes.
It has two connotations.

- To focus on the predefined set of learning outcomes developed involving all the stakeholders around which all of the systems' components operated.
- To establish conditions and opportunities within the system that enable and encourage all students to achieve those essential outcomes.

Thus the outcomes are clear learning results that the students demonstrate at the end of the learning experiences.

Program Outcomes

Program outcomes are the statements that describe significant and essential abilities that students have achieved, and can reliably demonstrate at the end of a course or program. This approach to education means basing [3] program and curriculum design, content delivery and assessment on an analysis of the integrated knowledge, skills and values needed by both students and society. In outcome based approach to education, the ability to demonstrate learning is the key point.

The Program outcome statements that are aligned with mission statements and clearly indicate the level and type of competence that is required of graduates of a program. These outcome based statements should describe intended learning outcomes. It should describe the abilities, knowledge, values and attitude expected of students after the completion of the program.

Emphasis on use of ICT In Classroom Delivery

The use of Information and Communication Technology (ICT) in higher education is increasing day-by-day and this added a dimension to learning. Use of ICT in the field of higher education is to integrate technology for effective and efficient teaching and learning processes. The National Policy on Education 1986 as modified in 1992, emphasis upon employing technology to improve the quality of education [4]. The spirit of emphasis on skills required for graduates is continued even in National Educational Policy 2020. Information Technology (IT) that refers to the hardware and software of information collection, storage, processing and presentation. Higher education systems have grown exponentially in the last five decades to meet the demands. This aspect further gained momentum due to swift advancements in ICT.

The expansion and widespread dissemination of IT resulted in new opportunities for leaning. At the same time, lot of challenges particularly with respect to rolling out of teaching and learning. Higher educational institutions have been widely using the Internet and other digital technologies. Now thanks to Open Educational Resources (OER) digitalized material offered freely and openly for educators and students and self learns to use and reuse for teaching, learning for research. The learning content at issue is open courseware i.e. educational material organized as courses and typically distributed as PDF Files, simulations, text files, images, sound or videos in digital format, some only for use and others open also for adaptation and reuse.

ICT has also completely transformed the education scenario as the learning process today has become more interesting and creative for the students who can learn their lessons in more collaborative and interactive environment [5]. ICT provides unlimited resources to the students.

ICT now changing every aspect of education from teaching-learning to assessment and evaluation. This is also facilitating research and scholarly communication.
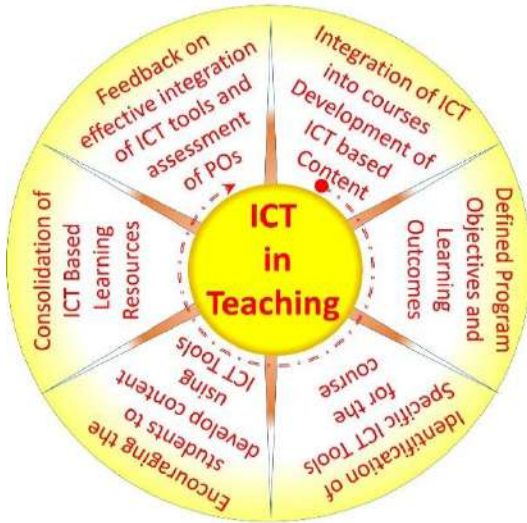
Fig. 1: ICT implementation and Effectiveness assessment wheel in HIE

However, the use of ICT in education poses certain challenges such as infrastructure, teacher preparedness, capacity building, technical support, language and content, sustainability and equality. One of the greatest challenges is teacher's attitude and belief about ICT i.e. natural resistance to change. Hence, the effective implementation of ICT in education requires commitment from the stakeholders. In particular, teachers and other staff should be aware of the importance of ICT in developing students' learning and overcome the barriers in implementation.

Virtual Classroom (VC) is an innovative and unique learning environment that imitates the physical classroom but exists completely independent of physical classrooms. The teaching-learning process evaluation achieved through networked computers and information systems.

II. VIRTUAL CLASS ROOM AS AN ENABLER OF I.C.T.

VC Integrating two or more classrooms by communication technology and making available of lecture video with help of information technology will replace the knowledge level repetitions. Transmitting

the lecture of an expert from one location to various locations at same time, and maintaining the lecture video repository that has edited lectures and discussion, will avoid repetition of the same lecture many times, and help to have more discussions in future to share ideas among teachers and learners, than to repeat the fundamentals. The operation of VC depends on three factors – its architecture, facilities for students' interaction and network used to connected location.

Fig. 2: Implementation of ICT and feedback collection for Improvement

The major benefits of VC include access toarchives of lectures and discussions on the network, recorded videos are stored after sequencing them by editing i.e. by truncating the unnecessary discussions from the video.In traditional classroom, the teacher introduces the fundamentals and then explains the concept, and finally end into discussion. Most of the precious time spent on the introduction and explanation. Less opportunity is given to share the ideas of students and clarify their doubts. But in VC, the availability of recorded videos of previous lectures will minimize the time spent for introduction and explanation unless if any new concepts are to be introduced. Automatically the lecture time is reduced and discussion time is increased.Thus, the virtual classroom facilitates the students' community to attain the higher order cognitive skillssimply listening to the lectures.

III. IMPACT OF COVID -19 ON HIGHER EDUCATION IN INDIA

Novel Corona virus (COVID-19) pandemic has significantly disrupted every aspect of human life. As the COVID-19 spread across the globe, alarm bells are sounding in the education sector too. The Covid-19 pandemic has forced all the schools and college to shutdown temporarily and causing havoc in the education sector. According to UNESCO report more than 157 crore students across 191 countries severely by closure of educational institutions due to Corona pandemic. The temporary closure of the HEIs has resulted in huge disruption in their functioning. However, the urge to influence and educate the students does not diminish as a result. This impact opened lot of opportunities to the HEIs in terms of their ability to remain active in their academic activities and on their financial sustainability. Efforts are made to continue teaching courses in virtual mode have been notable everywhere. HEIs also may or may not have sufficiently mature virtual education systems and, even in the best case scenario, it is difficult to think that they can be scaled up to the necessary dimensions without the intervention of external technical supports such as video resources and its related architecture. It is one thing to have the necessary technical infrastructure to support virtual courses for a relatively significant percentage of graduate students. The level of preparedness among the students, teachers and other administrative staff is still low.

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                 ┌──────────┐
                 │ Teacher  │
                 └──────────┘
        ┌─────────────┼─────────────┐
  ┌──────────┐  ┌──────────┐  ┌──────────┐
  │Location 1│  │Location 2│  │Location 3│
  │ Student  │  │ Student  │  │ Student  │
  └──────────┘  └──────────┘  └──────────┘
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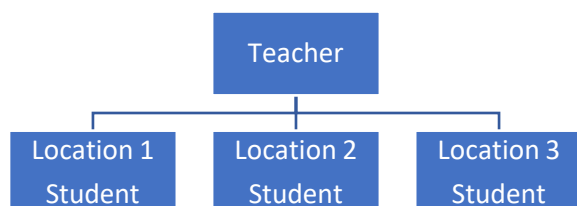
Fig. 3: Virtual Class room Model

The most evident impact on teachers is the expectation, if not the requirement, that they continue to teach using the virtual mode. In theory, at least, virtual education is present in most large HEIs.

In the wake of Covid-19 pandemic, millions of students across the globe have been driven out of their university spaces, and professors confined to their homes. Higher education stands disaggregated and faculty and students are grappling with the sudden new norm of completely tech-enabled teaching-learning.

IV. THE LONG TERM AND SUSTAINABLE TRIUMPH OF THIS TECTONIC SHIFT WILL DEPEND ON SEVER MAJOR ELEMENTS OF ONLINE LEARNING

1. Online learning is not a library of video lectures and e-books that converts class notes into PDFs. Creating high quality digitized learning content must be contextualized and 'Byte-Sized' to make learning interesting and engaging. Doing this takes a rare skill set which few organizations for their digital pivots to be successful.

2. Subject matter covered in classroom is delivered online, but with technology as intermediary. Blind repetition of the same is a bad idea; it requires a great deal of understanding & application of learning science and digital pedagogy. Every teaching faculty must be trained with this new technology, or else collaboration with experts is the way forward.

Classrooms have typically diverse learner groups. In classic pedagogy, the best of teachers and subject matter experts derive a content-context cluster as a mean of the class's collective ability and prior

knowledge. Then the teaching-learning transaction is crafted according to that constructed mean. This will not and cannot work in online learning. Institutions need to spend as much time on the context for the diverse learner profiles, as on the content, and weave it into the program design.

New technologies including the emerging sciences of artificial intelligence and deep learning models can help us create customized learning plans and methods. Higher Educational institutions must embrace these quickly to overcome the ills of current digital higher education.

Online learning is not about ONE pedagogical model but an aggregation of various models and it is indeed a specialized learning science that combines learning psychology, behavioral analytics, content delivery, and assessments to gauge and measure individual learners journey and progress. Working with specialists and 'hand stitching' a delivery mechanism is the key.

Put learning science, and not technology, in the forefront. Many models being created today seek to use technology and tools as a panacea and equate online 'delivery' with online 'learning'. The former is teacher-centric, and the latter is learner-centric. 'Learning' is about gradually inducing changes in learner's actions and behavior. The learning process, in incremental steps, induces change in thinking and mental models of the learner through deep understanding and conceptual strengthening. After each learning episode. The learner will be able to apply the acquired knowledge in practical situations in life, profession, or workplace. Each teaching faculty needs to be massively re-trained and oriented for online teaching-learning mode. While they could be content experts or great classroom teachers, they need to place equal importance to 'learning sciences in digital media'.

Even in Post Covid-19 era, offline or conventional educational models will not become obsolete. They will survive. However, blended learning (a combination of classroom and online models) will be the new norm. Institutions and teachers will blend the two judiciously according to the context and content.

In sum, the newly realized need for establishing mature online education models, can be successfully met by making these "Queen sacrifices"!.
- Faculty to let go off their existing practices of transporting classroom to online medium without applying the 'Science of digital learning'.
- Universities to let go off their academic know-all stance and become willing to collaborate with digital learning specialists to train their teachers and re-design higher education for the newest online education world.

V. A SURVEY ON FACTORS AFFECTING STUDENTS' ATTITUDES TOWARDS ONLINE LEARNING

Quality education needs to be delivered regardless of time and place and many higher educational institutions are pursuing online education to address that need. However, still there are doubts about online education and its quality compared to traditional face to face instruction. Critics still insist that courses taught on the Internet are incapable of living up to standards of the traditional brick and mortar classroom. The problems related to online education are broadly divided into two categories.
- The requirements of separate quality assurance standards

- Lack of consensus to what constitutes learning quality.

The following elements will be useful in understanding the students' perceptions in on line environments, especially the issue of quality in online teaching and learning.

- Students demands
- Organizational excellence and efficiency
- Accountability to stakeholders

Quality should be determined from the supply-side managerial approach and the demand-side consumer approach. Student perspectives and experiences can provide in-depth understanding of the effectiveness of virtual learning. It can also be said that the learner's perception offers crucial information in assessing and defining quality. Therefore, there is a need to examine the quality of online learning from a student perspective. This study is designed to explore the factors that constitute and affect the student's perceptions related to the quality of online teaching using international quality benchmarks for higher education. The benchmarks on teaching-learning, course structure, and student support are pertinent to students.

The teaching-learning benchmarks are concerned with the pedagogical activities in online teaching and learning. Benchmarks in this category set standards for student-faculty interactions, student-student interactions, feedback for students, and guidance to the students. The course structure benchmarks include policy and procedures that support and relate to teaching-learning process. Benchmarks in this category include course objectives and outcomes, access to library resources, and student expectations. The students Support benchmarks provide information regarding relevant students services. This study used online survey based on the international quality benchmarks to determine the underlying factors that contribute to those perceptions. A total of 216 students participated in this study.

VI. FACULTY PREPAREDNESS FOR ONLINE TEACHING IS THE KEY

In institutions of higher education, there are an increasing number of faculty teaching online courses. While there is a recognized need for faculty development to prepare to teach online, there are many different faculty development models being implemented with differing focus on technology, pedagogy, and course content. Some faculty teach their first online course without any prior online teaching or learning experiences, with all of their preparation completed face-to-face.

As institutions of higher learning are tasked with offering more classes online, they need to consider how they prepare and offer support for the faculty members who will be developing and teaching these courses, as teaching online is different from teaching in the traditional face-to-face setting. The better prepared faculty members are, the better experiences their students will have. Creating a meaningful and successful learning experience for online students is key to student success. Online instructors need to develop new technological skills and learn new pedagogical methods to become effective online instructors.

Professional development can be a key to success for faculty members who teach online. Many faculty members who have little to no online experiences are often asked to teach online and are faced with the challenge of converting their traditional courses to online formats. Properly preparing faculty members to teach online can not only ease the course development process but help them in preparing high quality classes, thereby creating a better

learning environment for students. Experts in this field has outlined a model for faculty development: "The protocol consists of five major steps including an introduction to navigating through online courses, learning-styles training, online course simulation experiences, review of tools for relationship-building, and finally the launching of an actual online course under the supervision of a mentor" .

In addition to learning new technologies and pedagogical methods, online instructors must also undertake different roles from those of traditional face- to-face instructors. There are six identified common roles assumed by online instructors; these included roles were related to: pedagogy, facilitation, instructional design, social, managerial, and technical assistance. These roles can guide the development of professional development for online instructors.

Other faculty participate in faculty development programs that occur partially or completely online, giving them opportunities for online experiences. Whether faculty development programs prepare faculty to teach online by providing realistic online experiences or not, it seems that most programs take faculty through a step-by-step training process

INSTRUMENTATION

An online survey was commissioned as the instrument for data collection. Questions were adopted and modified as per the international quality benchmarks. The survey instrument was comprised of three parts.

Part I contained 20 questions framed based on the quality benchmarks with answers ranging from strongly disagree to strongly agree on a 5-point scale, exploring students' online learning experiences. The scales are Teaching-learning process benchmarks, course structure benchmarks, and student support benchmarks. Part II of the survey consists of four Likert scale questions, designed to gather students' perceptions on the overall quality of online learning in which they are engaged. The rating scales range from extremely poor to excellent. Part II of the survey gathered demographic information of the participants like age, gender, area of residence etc.

Variables employed in this study

The independent variables used in this study were peer interactions, feedback from the instructors, course structure, and student support. Control variable such as gender, age, ethnicity, student rank, computer proficiency, prior online learning experience, perceived difficulty level of the online course, and expected outcome. The dependent variable was students' perceptions of online teaching quality.

Reliability and validity

The reliability and validity of this survey instrument is still to be determined. In the light of this, the experts and educators are consulted for the content validity of the instrument. The panel examined each survey question to determine if they were clear and appropriate to the subject. Confusing questions were reworded. Redundant questions were removed for final data collection.

Limitations of the study

This study has some inherent limitations. First, the study was limited to those subjects who voluntarily agreed to participate. No sampling techniques were utilized in this study. The population consisted of online students of the enrolled students of Kavitha Memorial Degree College. The results may differ if the study would have been conducted in a different state or other level.

There were insufficient samples of undergraduate students and undergraduate online courses.

The data was collected during the lockdown period of COVID-19 between April and May, 2020.

The validity of the research is limited to the reliability of the measuring instruments employed.

The relatively small number of respondents (n=216) limited both statistical power of the analysis as well as the generalizability of the results.

Without knowing much about the interventions used in each online course (i.e course objectives, content, pedagogy), it is difficult to generalize study results to other settings.

VII.RESULTS

Descriptive statistics and a series of hierarchical multiple regressions were conducted to analyze the data. The majority (69%) of the participants were aged between to 19 to 22 , and the 20% of the participants were above 22. 60% were female, 40% were male. More than 65% of the participants had stated that this was their first online learning experience. About 23% were in a zone where the connectivity issues were predominant. On a whole around 62% strongly agreed and 20% agreed for the online class work. However, due to the issues such as poor connectivity, lack of good quality gadgets etc. the rest of the students (about 18%) could not effectively utilize the online class work.

Table. 1: **Descriptive statistics**

	19 to 22 age Group	above 22 age Group	Total Participants	Strongly agreed	Agreed	Not Agreed
Girls	103	31	134	97	19	18
Boys	68	14	82	37	23	22
Total	171	45	216	134	42	40

Table. 2: series of hierarchical multiple regressions

	19 to 22 age Group	above 22 age Group	Total Participants	Strongly agreed	Agreed	Not Agreed
Girls	47.69	14.35	62.04	44.91	8.80	8.33
Boys	31.48	6.48	37.96	17.13	10.65	10.19
Total	79.17	20.83	100.0	62.04	19.44	18.52

Table. 3: **Characteristics of students**

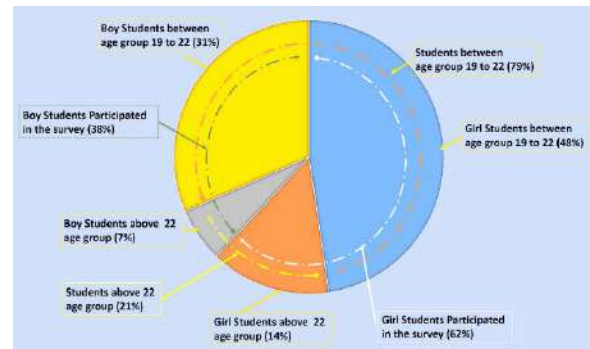|	19 to 22 age Group	above 22 age Group	Strongly agreed	Agreed	Not Agreed
Girls	76.87	23.13	72.39	14.18	13.43
Boys	82.93	17.07	45.12	28.05	26.83

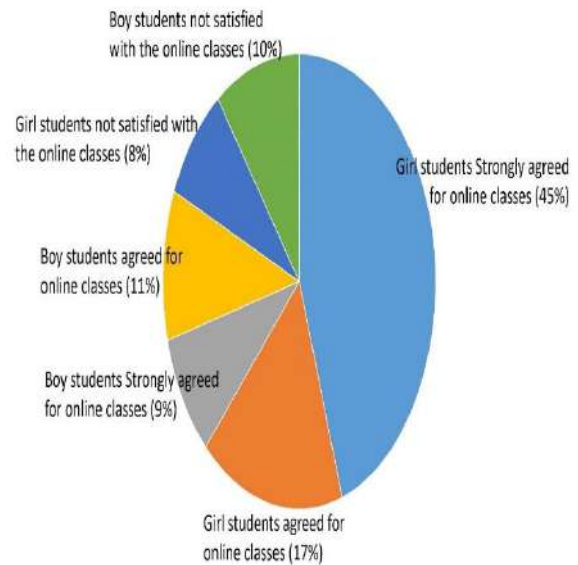#### Fig. 4: Characteristics of students' participation in the survey

Fig. 5: Analysis of students' responses in the survey

VIII. DISCUSSION

Online learning has revolutionized education and training by providing asynchronous learning opportunities through the instructional use of Zoom, Google classrooms, Microsoft team etc. New information technologies are transforming education from the perspective of learners, instructors and administrators. Examining perceptions of a target population is a widely used strategy based on the premise that perceptions matter and often influence behaviors. Therefore it is important to study student's perceptions of online instruction quality for institutions, administrators, faculty and students to succeed in an online learning environment.

Results of this study revealed that students perceived the quality of online learning was the prominent component of online course quality while also recognizing the importance of online teaching, online course structure, and online student support. The finding suggests that while the convenience of online courses attracts students, they are still interested in the learning opportunities associated with an online course. The equally distributed online teaching quality and online course structure quality in students' perceptions reflected their needs and desires for quality online instruction and course structure.

Feedback from instructors, peer interactions and course structure were found to be positive predictors of students' perceptions related to online course quality. Among these three predictors, course structure had the greatest effect on students' perceptions. Pre-study consultation, clear and straightforward course objectives and learning outcomes, convenient virtual library access, and explicitly stated course expectations could all lead to students'

positive perception of quality online teaching and learning.

The quality of the online course structure also had an impact on students' perceptions of online course quality. Course structure includes: the instructional design of online course content, navigation of the course, course availability and clarity, course expectations and objectives, required student skills and characteristics, convention on hours to spend in the course daily/ weekly and the required learning abilities.

Students characteristics, skills, study habits, goal commitment and course availability can impact students' persistence in online learning. Further female students tend to be more successful in online learning than male students.

STUDENT SUPPORT

Finally, students' perceptions of online teaching quality involve a myriad factors. As in traditional instruction, online learning is shared responsibility of instructors, students, and the institution. By examining students' perceptions of quality online teaching, institutions can link this information to what is known from the faculty and institutional perspective to prepare a productive online learning environment.

IX. CONCLUSIONS AND IMPLICATIONS

Higher education institutions are important actors in the society and can be perceived as Models for society in the pursuit of sustainable development. Higher education should not only critically reflect on learning environments and learning processes for students, they should also reflect on their role in creating an infrastructure that supports and enhances lifelong learning processes.

ICT integration in higher education brings a change in student and teacher learning behavior and develops higher order skills such as collaborating across time and place and solving complex real world problems. To gain the optimum impact of ICT in education, certain issues: why teachers integrate technology; how ICT implementation could be effective; what the requirements are to achieve effective ICT implementation need to be addressed both at government level and institutional level.

One of the key determinants of whether ICT implementation is successful is the teachers, particularly teaher mindset and knowledge level. Teacher has to adapt continuous professional development in the educational uses of technology. They needs to be shared vision among the various stakeholders and a collaborative approach should be adopted. Care should also be taken to influence the attitudes and beliefs of all the stakeholders. ICT enabled education will ultimately lead to the democratization of education. The wide adoption of ICT class for mindset and skill sets that are adaptive to change.

X. RECOMMENDATIONS

Based on these study findings, the following recommendations are presented:

1. More studies need to be carried out in the future dealing with the different approaches of teaching/learning utilizing e-learning environments in different faculties.
2. Longer teaching period should be taken into consideration when studying the effect of using e-learning approaches so students can get used to and understand their environments.
3. Further studies on female university students and different study levels are suggested to be conducted in the future.

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A STUDY ON PHYSICS OF ELECTRONIC TRANSPORT IN LOW-DIMENSIONALITY MATERIALS FOR FUTURE FETS

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ABSTRACT: In this paper the study on physics of electronic transport in low dimensionality materials for future FETS. This shows that scaling rules, quantum confinement in thin bodies, and the resulting gate leakage render imperative the use of low-dimensionality materials as channels in devices scaled beyond the 10 nm gate length. Next then consider a few examples of two-dimensional materials of great interest, graphene and bilayer graphene, and show how the dielectric environment (gate and interlayer insulators, nearby gates) has a dramatically strong effect on the electronic properties of systems such as supported graphene, nanoribbons, and graphene bilayers in which a BoseEinstein exciton condensation has been predicted to occur at high temperature. Finally, consider the novel concept of devices based on monolayer tin ('stannanane') as a topological insulator.

KEY WORDS: FET (Field Effect Transistor), Graphene and Bilayer Bose-Einstein exciton.

I. INTRODUCTION

When approaching the problem of scaling electronic devices beyond the 10 nm gate length, shorter-term industrial goals understandably focus on realistic low-to-medium-risk avenues, some already in production – such as strained Si/Ge, FinFETs, or high-κ dielectrics, some yet to be translated to products in the near future – such III-V semiconductors, tunnel- and nanowire-FETs. Longer-term avenues, however, must also be investigated even going beyond carbon-based electronics (carbon nanotubes, graphene, nanoribbons), such as transition metal dichalcogenides, silicene/ane, germanene/ane (together with other sp^2 and sp^3 hybridized monolayers), topological insulators, Weyl semimetals, and other strongly correlated fermion system as 'improbable' as they might be.

Here we will first discuss how, if we really wish to scale to 5 nm, simple electrostatic scaling laws demand that we take low-dimensionality materials very seriously, despite the daunting associated processing difficulties [1]. We will then consider whether graphene has any chance of replacing Si by looking at how the extremely promising electronic properties it exhibits in its ideal form become much less interesting when used as active layer in of some non-ideal dielectric structure (such when supported and gated and/or in nanoribbon form)[2].

Finally, we will discuss a couple of very interesting, albeit admittedly improbable, ideas: 1. The Bose-Einstein condensation in bilayer systems (motivating the concept of BiSFETs[3]) as an example of how issues of practical implementation may regrettably transform an excellent idea into a pure academic exercise; and 2. Monolayer tin (stannanane) as a 2D topological insulator with potential applications in spintronics and low-power high-performance devices[4], [5].

II. FET BACKGROUND

The Field-Effect-Transistor (FET) is another transistors type. Basically the FET have three terminals they are gate (G), Drain (D) and Source (S). FET is classified into Junction Field Effect transistors (JFET) and Insulated Gate FET (IG-FET) or MOSFET. For the connections in the circuit we also consider fourth terminal called base or substrate. The FET have control on the size and shape of a channel between source and drain which is created by applied voltage. The FET are uni-polar transistors because they perform single channel operation where

as BJT transistors are bipolar junction transistors. The FET have high current gain than BJT.

Field Effect Transistors are made up of 3 regions, a gate, a source, and a drain. Different bipolar transistors, FETs are voltage-controlled devices. A voltage placed at the gate controls current flow from the source to the drain of the transistor. Field Effect transistors have very high input impedance, from several mega ohms (MΩ) of resistance to much, much larger values. This high input impedance causes them to have very little current run through them. So FETs have very little current from a circuit's power source.
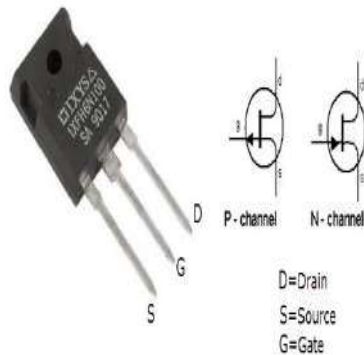
Fig. 1: FIELD-EFFECT TRANSISTOR

Thus, this is ideal because they don't disturb the original circuit power elements to which they are connected to. They won't cause the power source to be loaded down. The drawback of FETs is that they won't provide the same amplification that could be obtained from bipolar transistors. Bipolar transistors are superior in the fact that they provide greater amplification, even though FETs are better in that they cause less loading, are cheaper, and easier to manufacture. Field Effect Transistors come in 2 main types: JFETs and MOSFETs. JFETs and MOSFETs are very similar but MOSFETs have an even higher input

impedance values than JFETs. This causes even less loading in a circuit.

The FET is known as voltage controlled devices, where as the BJT is known as current controlled devices. The FET have basically three terminals, such as Drain (D), Source (S) and Gate (G) which are equivalent to the collector, emitter and base terminals in the corresponding BJT transistor. In BJT transistors the output current is controlled by the input current which is applied to the base, but in the FET transistors the output current is controlled by the input voltage applied to the gate terminal.

In the FET transistors the output current passes between the drain and source terminals and this path is called channel and this channel may be made of either P-type or N-type semiconductor materials. In BJT transistor a small input current operates the large load, but in FET a small input voltage operates the large load at the output.The BJT transistors are 'bipolar' devices because they operates with both types of charge carriers, such as electrons and holes but the FET transistors are 'unipolar' devices because they operate with the charge carriers of either electrons (for N-channel) or holes (for P-channel).

The FET transistors can be made smaller in size compared to BJT transistor and also they have less power dissipation. Due to this high efficiency the FET transistors are used in many electronic circuit applications by replacing the corresponding BJT transistors. These FET transistors are very useful in the chip designing due to their low power consumption behavior. Like BJT the FET transistors are also available in both P-channel and N-channel.The FET transistors have high input impedance where as BJT has relatively low. Due to this high

impedance values the FET transistors are very sensitive to small input voltages. The FET transistors are mainly classified into two types; they are Junction Field Effect Transistor (JFET) and Insulated Gate FET (IG-FET) or Metal Oxide Semiconductor FET (MOSFET).

III. SUPPORTED GRAPHENE AND NANORIBBONS

The outstanding intrinsic electronic properties of graphene are well known and are illustrated in Fig. 2. We have calculated the intrinsic electron-phonon interaction using the rigid-ion approximation and empirical pseudo potentials, as described in (Fig. 2, top) and calculated the electron mobility (Fig. 2, bottom left) and drift-velocity vs. field characteristics (Fig. 2, right), results in rough agreement with available experimental data.
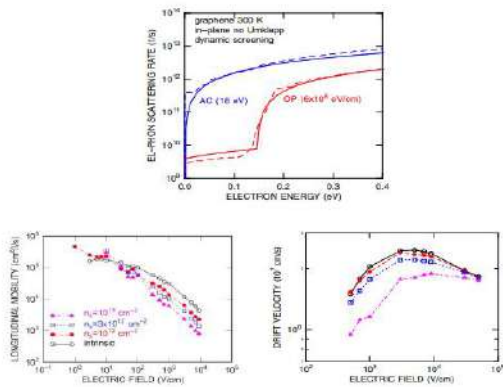
Fig. 2: REPRESENTATION OF ELECTRONS
Top: Total electron/acoustic-phonon and electron/optical-phonon scattering rates calculated using a conventional analytic expression (solid lines) fitted to the screened rigid-ion results (dashed lines). The empirical deformation potentials so obtained can be compared with those employed in the literature.

Bottom: Longitudinal electron mobility (left) and drift velocity (right) in graphene at 300 K as a function of electric field along the [10] direction calculated using the Monte Carlo method. The various curves are parametrized by the electron density.

However, the use of graphene in VLSI technology requires opening a gap (as in biased bilayer graphene or armchair-edge nanoribbons, AGNRs) and a dielectric environment consisting of a supporting substrate and gate insulators. Each of these constraints contribute to a reduction of theelectronic properties. These effects are illustrated in Figs. 3- 6.
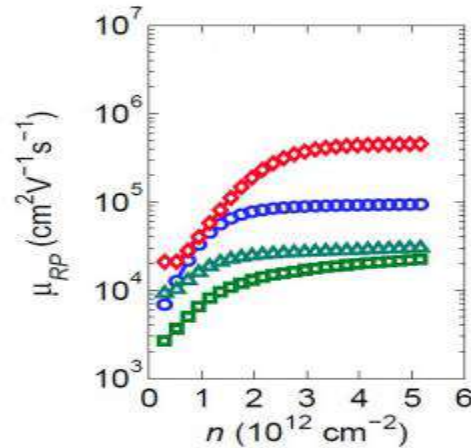
Fig. 3. CALCULATED ELECTRON MOBILITY
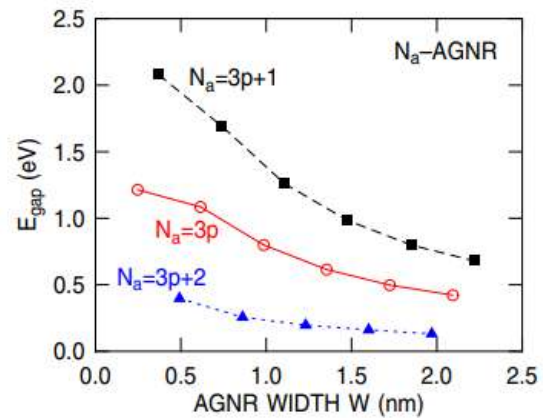
Fig. 4: DEPENDENCE OF THE BANDGAP OF AGNRS ON RIBBON-WIDTH

The first figure shows the calculated electron mobility in ideal graphene sheets supported by an insulating substrate: Scattering with the coupled plasmon/insulator-optical-phonons depresses the electron mobility, significantly so at low densities when dielectric screening is less effective. AGNRs present an even more interesting physical picture.
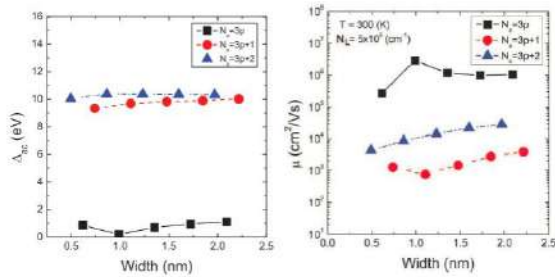
Fig. 5. LONGITUDINAL ACOUSTIC DEFORMATION POTENTIAL

Because of the 'claromatic' effects that, depending on ribbon-width, lead to different electronic properties (band gap, Fig. 4, and deformation potential for scattering with longitudinal acoustic phonons Fig. 5, left), the electron mobility shown in Fig. 5, right, can be depressed significantly to values of a few 1000s cm2/Vs unless precise control of the AGNR width is enforced.
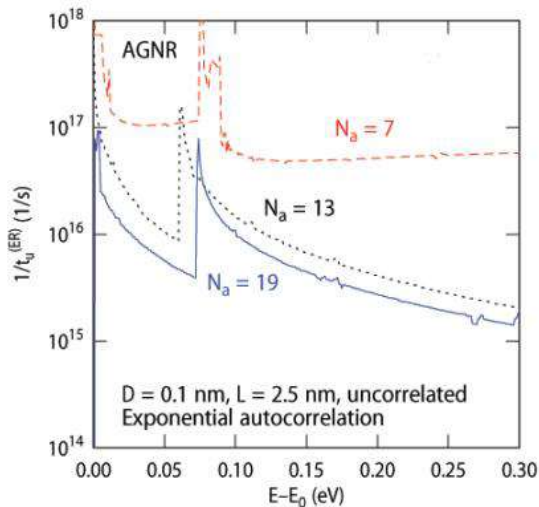
Fig. 6. VELOCITY RELAXATION TIME

Even more serious are the concerns caused by line-edge scattering in AGNRs: Because of the claromatic dependence of the band gap on ribbon-width, the roughness associated with the removal/addition of even a single atom can lead to a scattering potential so strong as to invalidate the Born approximation and lead to an extremely small electron mobility. This is illustrated in Fig. 6.

IV. TIN MONOLAYER: STANNANANE

Tin monolayers ('stannanane', with a buckled $sp3$ hexagonal structure like

graphane) functionalized by halogens, iodine in particular, have been theoretically predicted to be twodimensional topological insulators with a band gap exceeding tens of k_{BT}, so that 'iodostannanane' ribbons will possess topologically-protected edge states. Electronic transport in these edge states exhibits intriguing properties: Since spin and wavevector (velocity) are locked because of time-reversal symmetry, carriers cannot back-scatter within the same edgestate, but only to states at the other edge. In wide ribbons this is an unlikely process, because of the small overlap integral between 'far away' wavefunctions at opposite edges (see Fig. 8).
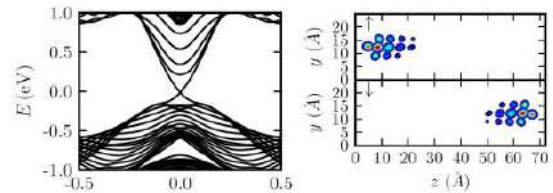
Fig. 8: BAND STRUCTURE

Left: Band structure of a stannanane nanoribbon functionalized by iodine. The band structure emerges from the folding of the 'bulk' stannanane band structure along the Γ-to-K direction, except for the edge-states with Dirac-like dispersion crossing the gap.

Right: Squared amplitude of the wavefunction for one spin component for the k

However, by increasing the gate bias, and so moving the Fermi level within the bulk band gap, it is possible to increase the overlap integral, thus dramatically reducing the conductivity of the ribbons. The mobility and conductivity of iodostannanane ribbons can thus be modulated over several orders of magnitude (see Fig. 9), thus opening the possibility of conceiving field-effect transistors that operate in a manner
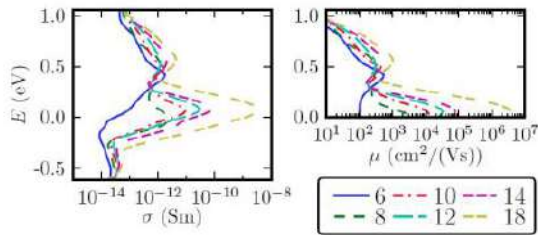
Fig. 9: CALCULATED CONDUCTIVITY AND MOBILITY FOR IODOSTANNANANE

The phonon spectrum and the deformation potential for scattering with longitudinal acoustic phonons have been obtained from DFT calculations. Note that the conductivity reaches a maximum when the Fermi level is inside the band gap and it is reduced by up to 4 orders of magnitude when the Fermi level moves into the conduction or valence band. The labels 6 through 18 in the legend indicate the ribbon-width expressed in number of atomic lines.

V.CONCLUSION

This paper have shown that it may be necessary to use lowdimensionality-materials as channel materials for 10nm FETs, despite the processing challenges their growth and quality-control may pose. We have shown, however, that even materials with outstanding intrinsic electronic properties may suffer when embedded in a realistic dielectric environment as required when designing and fabricating FETs: The effect of the insulating substrate or gate dielectric and the patterning of graphene into AGNRs degrades significantly electronic transport, although proper processing control in a mature technology may bypass these difficulties. On the other hand, we have shown that the unavoidable presence of metallic gates may depress the normal-superfluid transition temperature in BiSFETs to values so low as not to be practical. Finally, we have considered the idea of 2D topological insulators, showing the potential (only theoretical for now) of iodostannanane as the channel material in a new kind of FETs.

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DDOS ATTACK DETECTION WITH SYNTHETIC MINORITY OVER-SAMPLING TECHNIQUE FOR IOT ENVIRONMENT USING ResNet

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ABSTRACT: As the Internet of Things (IoT) era is rapidly developed in recent years, the attackers are mostly targeting IoT environments. Recently, Denial Of Service (DoS) and Distributed Denial Of Service (DDoS) attacks are reported as the most frequent attacks in IoT networks. Even though many security mechanisms were implemented for IoT devices, it is still needed to get an effective detection system for IoT environments. Moreover the modern public datasets have been most widely used in DDoS attack detection but suffers with imbalance data problem because it has a small amount of benign data and large amount attack data. In this paper DDOS attack detection with Synthetic Minority Over-Sampling Technique (SMOT) for IOT environment using residual network (ResNet) is presented. This detection system uses the public dataset which suffer with imbalance data problem so the SMOT is employed. In this work, a methodology is proposed to convert the network traffic data into image form and then trained a CNN model, i.e., ResNet over the converted data to detect the kind of attack in data. The results indicate that the proposed model can effectively detect the DDoS attack with high precision rate for IoT environment.

KEYWORDS: Internet of Things (IoT), data imbalance problem, DoS, DDoS, CNN, ResNet, attack detection.

I. INTRODUCTION

IoT technology has exponentially increased the number of heterogeneous devices linked with the Internet. One of the major challenges is to provide security to these devices, which operates with low power, limited resources, and diverse access protocol. As of usage, the numbers of IoT devices have been increasing day by day rapidly. These devices spread in an open network environment, which is easy to attract any attacker. The integration of these devices with programmable and flexible networks can help detecting any type of intrusion in the IoT network. IoT provide an infrastructure in which physical objects i.e., RFID, sensors, actuators, and other smart devices can be connected with the Internet.

IoT devices can be utilized in different areas such as smart home, smart traffic system, smart healthcare services and smart industrial manufacturing to name a few. Millions of IoT devices were connected to the Internet and are associated with the web, so it offers an opportunity for the attackers to utilize these devices for DoS, DDoS, Trojan, and e-mail pernicious. Another issue with IoT devices is lack of computation and communication, as compared to traditional computing devices. Therefore, these devices can be compromised easily and turned into a botnet to launch a DDoS attack. The DDoS attack is very harmful which exploit normal operations of the network and consumes its bandwidth or resources [1].

From some of these studies, it is known that intrusion detection on IoT is important to ensure system security, data, and connectivity, so this research will try to find a more effective and efficient approach from the model in some previous studies. Basically, several machine learning methods applied to intrusion detection have weaknesses with large volumes of datasets, and imbalance data [2].

Large dataset has an influence on the long time when training data that will become a learning model, besides the Imbalance

dataset will also affect accuracy. Through the selection of features and methods based on Ensemble Learning and Synthetic Minority Over-sampling Technique (SMOTE) approach, it is hoped that the learning model can be more effective and efficient [3]. In this paper SMOT method is used to solve the data imbalance problem. The neural network architecture is also used for implementing the attack detection system. The network traffic dataset after SMOT is converted into image format. A CNN model of ResNet18 is used in neural network architecture for the detection system to be lighter.

II. LITERATURE SURVEY

Cui et al. [4] propose SD-Anti-DDoS mechanism used in software define networking (SDN) including four modules, namely detection trigger, attack detection and attack mitigation. The detection method based on neural network is claimed to give quick response time and reduce the workload of controllers and switches. Shin et al. [5] proposed novel network anomaly detection algorithm (NADA) to detect the abnormal traffic and preprocessing network traffic predicted method (PNTPM) for prediction attack. This technique involves firstly they preprocessing network traffic by cumulatively averaging it with a time range, and using the simple linear AR model, and then generate the prediction of network traffic. Secondly, assuming the prediction error behaves chaotically, they used chaos theory to analyse it and then proposed a novel network anomaly detection algorithm (NADA) to detect the abnormal traffic. With this abnormal traffic, they train a neural network to detect DDoS attacks.

The first attempt by Limkar and Jha et al. [6] used a new approached by implement anomaly detection based on high-rate application layer DDoS attacks which are

more concentrated on web user behaviours. This technique they called probabilistic hidden Markov model (P-HMM).

Agrawal et al. [7] suggested real-time strength estimation of DDoS attacks using artificial neural network (ANN) by suppressing the effect of the attacks. This can be done by limiting or filtering the most suspicious network sources. The NS-2 network simulator is used to generate training and testing dataset. Gupta et al. [8]'s study in detection threshold to use as an input in ANN to predict a number of zombies. A real-time estimation of the number of zombies in the DDoS scenario is helpful to suppress the effect of the attack by choosing predicted number of most suspicious attack sources for either filtering or rate limiting.

Based on a study by Nguyen and Choi et al. [9], they present a framework that called anti-DDoS framework that includes two sequential stages namely detection and prevention. The anti-DDoS framework is a method for proactive detection of DDoS attack by classifying the network status to be utilised in the detection stage. The anti-DDoS framework describes the two-stage view of DDoS architecture, the control stage and the attack stage. Then, the procedures of DDoS attacks to select feature variables that are important in recognising DDoS attacks since they are to be abnormally changed whenever the attack happens is examined. Finally, the k-nearest neighbours (k-NN) method is applied to classify the status of networks for each phase of the DDoS attack.

Another one is Xu et al. [10], use HMM approach to detect botnet traffic. They applied in HMM approach for centralized botnet detection to hierarchical botnet traffic detection based on traffic timing data. Then, they attempted to infer hidden Markov

models from botnet traffic timings. They used a sequential modeling approach based on integrated monitoring source IP with hidden Markov models (HMMs).

III. DDOS ATTACK DETECTION FOR IOT WITH SMOT USING ResNet

The proposed methodology consists of five key steps which include: data Acquisition SMOT method, data cleaning, data transformation and attack pattern recognition. Fig. 1 provides the framework of SMOT based IOT attack detecting using ResNet.
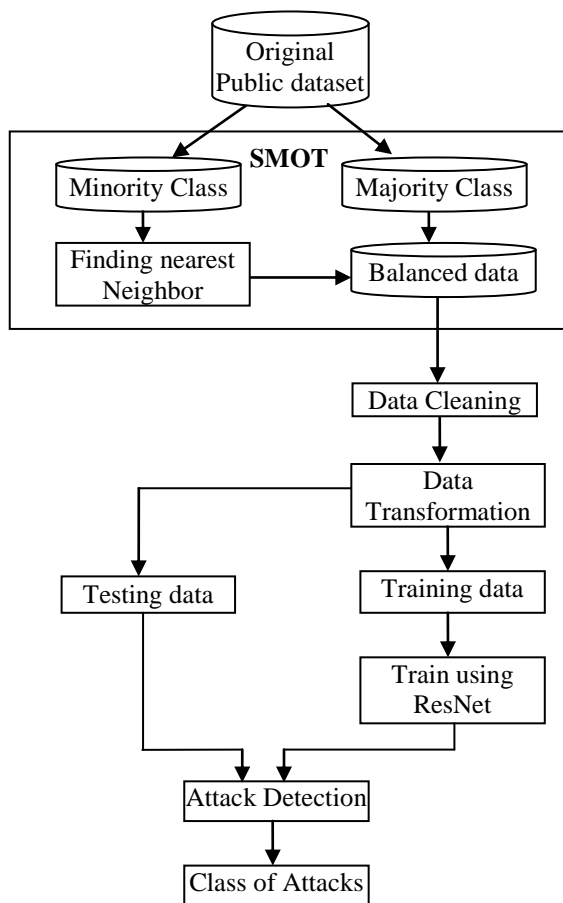
Fig. 1: FRAMEWORK OF SMOT BASED IOT ATTACK DETECTING USING ResNet

The first step of the proposed methodology is to acquire network traffic data. The publicly available dataset is considered here to acquire the data but it has data imbalance problem because of having a small amount of benign data and large amount attack data. Next, SMOT method is used for solving this data imbalance problem. Once the balance dataset is generated, it is preprocessed in order to get the refined data. During the preprocessing, we will perform two major steps, i.e., data cleaning and conversion of cleaned data into threechannel images. The final step is to train and test the CNN model of ResNet over the preprocessed data in order to evaluate the performance for detecting the DoS and DDoS attack patterns. All these steps are explained in the following subsections.

3.1 Data Acquisition

The data acquisition is the first step of methodology to acquire both normal and attack traffic. Generating extensive normal and attack traffic by setting up a real-time network is a difficult task. However, one can get rid of this laborious job by using a publicly available network traffic dataset. In order to get a quality dataset, some publicly available datasets can be analyzed based on some criteria. The dataset must consist of real-time network traffic, must be extensive and versatile, must comprise of the latest DoS and DDoS attacks, and should cover a variety of attack vectors. Based on these criteria, CICDDoS2019 dataset is selected for this work. CICDDoS2019 is the latest dataset which contains a large number of samples as compared to the other network traffic datasets. Moreover, it contains both inbound and outbound traffic of the latest DoS and DDoS attacks while most of the above-mentioned datasets are either outdated or contain limited attack scenarios of DoS attacks.

3.2 SMOT Method

This is an efficient technique to make the data to be balanced between normal and abnormal behaviors. The misclassifying problem can occur if the number of data for each class is significantly different.

Moreover, the classification model by using imbalance data can affect the performance and stability of the detection system. This technique randomly chooses the neighbors from the k nearest neighbors, depending upon the amount of data to be resampled. The scenario of this technique is as following: (1) take the difference between the feature vector and its nearest neighbor, (2) multiply this difference by a random number between 0 and 1, and (3) add it to the feature vector under consideration. For this SMOT calculates the distance between training points of minority classes aimed at defining the environment, and then an example is chosen to make points from new synthetics. The distance calculation can be calculated through manhattan or ecludean distance calculation.

There are two important steps to solve dataset problems that have high data dimensions: First, through distance calculation using Euclidean. Furthermore, Euclidean distance will assume that each attribute in the dataset is equally important to be defined in the environment of the SMOTE algorithm, but datasets that have high dimensions often have a percentage of data redundancy and variables that are irrelevant and also have noise. In the SMOTE engineering approach, synthesized child generations can be defined as follows:

$$x^{syn} = x^i + (x^j - x^x . i * y) \text{ ----- (1)}$$

Where x^i is a minority class that is considered, x^j is a randomly chosen derivative from the k-neighbor nearest minority from x^i and γ is a vector where each element is a random number from [0, 1]; as well as symbols "." shows the multiplication of elements.

3.3 Data Preprocessing

Once the balanced data is acquired, the next stage is to preprocess the data in order to bring it in a refined form. During this stage, three major steps are performed, i.e., data cleaning, data transformation, and train test and validation split.

3.3.1 Data Cleaning: In order to better train the model for attack detection, the unwanted features are removed from the dataset which are not useful for classifying the attack and normal traffic. The unwanted features are dropped and excluded them from training set. Thereafter, the whole dataset is analyzed in order to deal with missing or malformed data. As a large number of samples are present in the dataset, all those samples dropped which comprise of missing or malformed values. After that, constant features are figured out that were not useful for discriminating the attack or normal traffic and dropped that constant features also from the training set. On the other hand, the duplicate features are those which have similar values but have a different name. In the case of duplicate features, the first original feature is kept and dropped its duplicate feature. Finally, after the cleaning the data we left with 60 features which were unique and important.

3.3.2 Data Conversion: The CNN can perform well when trained on an image-based dataset. Since the network traffic dataset is captured in non-image format, i.e., either in .csv file, .txt file, or .pcap file it is require to convert such type of data into image form in order to get efficient results for network attack detection. For this purpose, the dataset is normalized w.r.t each feature using (2).

$$X' = \frac{X - Min(X)}{Max(X) - Min(X)} \times 255 \text{ ------ (2)}$$

In order to convert the network traffic into image form, first the all normal and attack samples can be separate into two data frames called attack traffic frame and Normal traffic frame. After that, let us consider the chunk of 180 samples are selected iteratively, converted them into an image of shape 60x60x3 in such a way that

first 60 samples of each chunk were converted into image matrix of channel 1, next 60 samples of each chunk were converted into image matrix of channel 2 and the last 60 samples of each chunk were converted into image matrix of channel 3 and finally, mapped these matrices into RGB channels of an image. These normal and attack samples matrices are converted to images using the OpenCV library and labelled them accordingly. The same procedure was followed for each .csv file of the dataset until all the samples were converted into images.

3.3.3 Train and Test Split: After converting the dataset into image form, the next step is to divide the dataset into a training set, validation (testing) set and testing set. In this regard, 30% of images are randomly selected from each category for testing and the images left were used for training the ResNet model.

3.4 Attack Detection
Once the data is organized into train, test and validation set, the next step is to pass this data to the ResNet model so that the model train itself on the given data, learn the attack and normal traffic patterns and validate itself. The ResNet18 model is used which consists of 18 layers out of which 10 are convolution layers and 8 pooling layers. First the train and validation set are loaded. The ResNet is designed to accept the images with size 224 x 224 while the preprocessed images had dimension 60 x 60 x 3. So, the preprocessed images are we transformed into 224 x 224 x 3. After transforming the images, the next step is to build the model.

 For building the ResNet model, it is required to set some parameters as per use case. The original ResNet model had 1000 output classes but, in our use case, output class as 1 is set for binary classification

while output classes as 12 is for multi-class classification. So, the last layer of ResNet model is changed to predict the given image according to our use case. Similarly, it also needs to set some other parameters while building a model which includes epochs, learning rate, momentum and optimizer. After building the models, training of ResNet model is started over the prescribed parameters.

While training the model, the model performance is evaluated and saved the model weights if it gives the best accuracy. This evaluation process continued until the last epoch. Finally, we come up with the two best models, one for binary classification and other for multi-class classification. Once the trained model with the best accuracy is saved, thenceforth, we need to test the trained models over the test set which remained unrevealed during the training phase. For testing the saved model, first the test images are loaded then transformed them into the dimension of 224 x 224 x 3 in a similar manner that we followed in the training phase. Afterwards, we loaded the saved models and passed the transformed images to it, so that it predicts whether the given images are normal or malicious in case of binary classification

IV. RESULTS
The attack detection architecture presented in this paper is implemented using a modern public attack dataset called CICDDoS which is including DDoS attack traffic records. Furthermore, this dataset contains more than 80 network flow-related features and eleven types of latest DoS and DDoS attacks traffic collected over a realtime network. The Resnet18 model is set with leaning rate 0.0001 with the momentum of 0.9, iterate over 10 epochs for binary classification and 50 epochs for multi-class classification. To evaluate the detection performance,

commonly used performance metrics were used such as true-positive rate (TPR), false-positive rate (FPR), precision, recall and F1-measure.

True Positive Rate (TPR) is one in which the correct classification of data has been performed.

$$TPR = TP/(TP+FN) \text{ ------- (3)}$$

False Positive Rate (FPR) is one of the main parameters to find out the effectiveness in which considered normal data as abnormal or attack type data.

$$FPR = FP/(TN+FP) \text{ --------- (4)}$$

Precision defines the ratio truly detected attacks and all packets that are classified as attacks. Mathematically, it is expressed as,

$$Precision = TP/ (TP + FP) \text{ X } 100 \text{ --------- (5)}$$
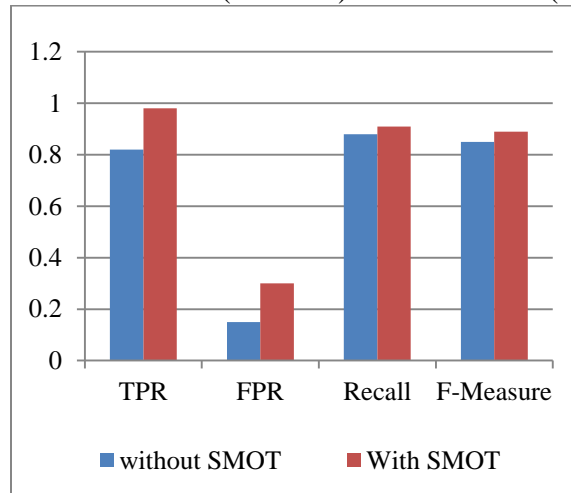
Fig. 2: DETECTION RESULT COMPARISON WITH AND WITHOUT APPLYING SMOT

The detection results comparison before applying and after applying data re-sampling technique called SMOT is shown in Fig. 2. After applying the SMOT technique, the detection results are slightly better than the results using original data, and the detection results are reached up to 90%.
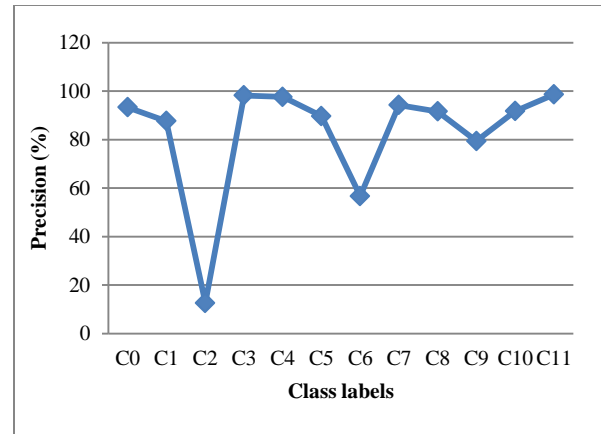
Fig. 3: CLASS-WISE PRECISION OBTAINED USING TRAINED ResNet18 MODEL

Our attack detection architecture using ResNet is actually effective for the DDoS attack detection system because the detection precision is up to more than 90 percent after solving the data imbalance problem. The class wise precision obtained using Trained ReseNet18 is shown in figure (3). Fig. 3 illustrates the percentage of correctly predicted attacks of 11 classes. Here the classes are, C0 is Syn attack, C1 is TFTP attack, C2 is UDP Lag attack, C3 is DNS attack, C4 is LDAP attack, C5 is MSSQL attack, C6 is NetBIOS attack, C7 is NTP attack, C8 is SNMP attack, C9 is SSDP attack, C10 is UDP attack and C11 is Normal traffic. It can be observed that Syn (C0), DNS (C3), LDAP (C4) attacks and normal traffic (C11) are detected with the highest precision, while UDP Lag attack (C2) is misdetected as NetBIOS attack (C6). However, in overall the all 11 classes of attacks are predicted as attacks with more than 80%.

V. CONCLUSION

A DDOS attack detection framework with SMOT method for IOT environment using ResNet was proposed in this paper. Firstly SMOT method was used on original dataset to address the data imbalance problem before applying to neural network architecture. Next, data transformation is performed to convert the non-image network

traffic dataset into three-channel image. Thereafter, CNN model, i.e., ResNet was trained over the transformed dataset and analyzed its performance for detecting the class of attacks. This framework achieved high precision rate in detecting 11 classes of DoS and DDoS attacks attacks. According to evaluation results, our system is effective for detection DoS and DDoS attack.

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A THEORETIC APPROACH ON FUZZY SOFT SET TO DECISION MAKING PROBLEMS

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ABSTRACT: In this paper, a decision making approach for fuzzy soft product topology is introduced. Fuzzy soft product topology over X×Y is defined and some properties of it are investigated. The notion of fuzzy soft point and fuzzy soft neighborhood are also studied and fuzzy soft Hausdorff spaces are considered. The problem of decision making in an imprecise environment has found paramount importance in recent years.

Key words: Fuzzy soft product topology, Decision making approach, fuzzy soft set, fuzzy soft topology, fuzzy soft point, fuzzy soft cartesian product.

I.INTRODUCTION

Topology (from Greek topos and logos can be viewed as the study of continuous functions, also known as maps. Let X and Y be sets, and f: X → Y a function from X to Y [1]. In order to make sense of the assertion that f is a continuous function; we need to specify some extra data. After all, continuity roughly asserts that if x and y are elements of X that are "close together" or "nearby", then the function values f(x) and f(y) are elements of Y that are also close together. Hence we need to give some sense to a notion of closeness for elements in X, and similarly for elements in Y.

A number of real life problems in engineering, social and medical sciences, economics etc. involve imprecise data and their solution involves the use of mathematical principles based on uncertainty and imprecision. Some of these problems are essentially humanistic and thus subjective in nature (e.g. human understanding and vision systems), while others are objective, yet they are firmly embedded in an imprecise environment [2].

In recent years a number of theories have been proposed for dealing with such systems in an effective way. Some of these are theory of probability, fuzzy set theory, intuitionist fuzzy sets, vague sets, theory of interval mathematics, rough set theory etc. and these may be utilized as efficient tools for dealing with diverse types of uncertainties and imprecision embedded in a system [3].

All these theories, however, are associated with an inherent limitation, which is the inadequacy of the parameterization tool associated with these theories. Molodtsov initiated a novel concept of soft theory as a new mathematical tool for dealing with uncertainties which is free from the above limitations [4]. The soft set introduced by Molodtsov, Pawlak, etc. is a set associated with a set of parameters and has been applied in several directions. In the present paper we present some results on an application of fuzzy-soft-sets in decision making problem.

The problem of object recognition has received paramount importance in recent times. The recognition problem may be viewed as a multiobserver decision making problem, where the final identification of the object is based on the set of inputs from different observers who provide the overall object characterization in terms of diverse sets of parameters [5].

II. LITERATURE SURVEY

To solve problems dealing with uncertainties, where classical mathematical

methods cannot be used effectively, several theories like probability theory and fuzzy set theory have been introduced. Although these theories are two powerful mathematical approaches to deal with vagueness, lack of parametrization tools restricts the application of these methods in both theory and practice. Soft set theory, originally introduced by Molodtsov, is a new approach to deal with uncertainty.

A soft set is in fact a set-valued map which is used to describe the universe of discourse based on some parameters. Due to theory of soft set is more general than the formers, it has received much attention from researchers and was developed sharply. Study on soft set theory after introduction by Molodtsov, was started by Maji et al in 2000.

In this the authors defined and studied some basic concepts like complement, union, and intersection of soft sets and then, it is applied this method to solve a decision-making problem successfully. Akta¸s and C¸ a˘gman, Sezgin and Atagun and Irfan Ali et al. improved the work of Maji et al and proposed some new operations and properties of soft set theory. Topological study on soft sets was begun by C¸ a˘gman et al.

They defined a topology on a soft set as a collection of soft subsets of it and consider some basic concepts and properties of this new space. Shabir and Naz also worked on soft topology. They proposed a new definition of soft topology which is defined over an initial universe with a fixed parameter set. However soft set theory can solve a wide range of problems, its inherent difficulty still remained. This theory can not be applied effectively to deal with real-life problems since in these situations we face imprecise environment and inexact

information which are modelled by fuzzy set theory.

The extension of the classical soft set theory from crisp cases to the world of vague concepts has been proposed by Maji et al. They combined fuzzy set theory and soft set theory to develop theory of soft set and introduced the new notion "fuzzy soft set" as a fuzzy generalization of soft sets. Then, in, they discussed practical applications of fuzzy soft sets in decision making problems.

In 2009, Kharal and Ahmad extended some operations in classical set theory to fuzzy soft set theory and, they introduced the concept of fuzzy soft map and considered some properties of image and inverse image of a fuzzy soft set under fuzzy soft maps. Topological study on fuzzy soft sets was started by Tanay and Kandemir.

They applied classical definition of topology to construct a topology over a fuzzy soft set and called this new topological space fuzzy soft topology. Furthermore, they studied some fundamental topological structures such as interior and closure of a fuzzy soft set, fuzzy soft base and fuzzy soft subspace. Besides this, they modified the definition of fuzzy soft complement as a fuzzification of soft complement which had been introduced by Irfan Ali et al.

Simsekler and Yuksel improved the concept of fuzzy soft topology, proposed, and redefined it with a fixed set of parameters. Roy and Samanta remarked the new definition of fuzzy soft topology. They proposed the notion of fuzzy soft topology over an ordinary set by applying fuzzy soft subsets of it, where parameter set is supposed fixed everywhere over the space. They also studied the concept of base and subbase for this space. Then they continued study on fuzzy soft topological spaces by

considering fuzzy soft point and different neighborhood structures of a fuzzy soft point.

III. DECISION MAKING PRODUCT SOFT TOPOLOGY PRODUCT SOFT TOPOLOGY

Definition 3.1. Let X_E and Y_{E0} be two F.S-spaces. Let $f_E \in X_E$ and $g_{E0} \in Y_{E0}$. The "cartesian product" of fE and gE0 , denoted by $f_E \otimes^{\sim} g_{E0}$, is a F.S-set over $X \times Y$ with regards to parameter set $E \times E0$ defined as below:

$$f \tilde{\otimes} g : E \times E' \longrightarrow I^X \times I^Y$$
$$(e, e') \mapsto f(e) \times g(e')$$

Such that f(e) × g(e') is the fuzzy product of fuzzy sets f(e) and g(e') where

$$f(e) \times g(e') : X \times Y \longrightarrow [0,1]$$
$$(x, y) \mapsto \min\{f_e(x), g_{e'}(y)\}$$

Proposition 3.2. Let X_E and Y_{E0} be two F.S-spaces. Suppose $f_E \in X_E$ and $g_{E0} \in Y_{E0}$. Then one has the following:
(1) $X^{\sim} \otimes^{\sim} Y^{\sim} = X^{\wedge} \times Y$ where $X^{\wedge} \times Y$ denotes the absolute F.S set $X \times Y$ with respect to parameter set $E \times E_0$.

(2) $f_E \otimes^{\sim} \Phi E_0 = \Phi E \otimes^{\sim} gE_0 = \Phi E \times E_0 = \Phi E \otimes^{\sim} \Phi E_0$

(3) $\forall e \in E, \forall e\ 0 \in E0$, $(f \otimes^{\sim} Y^{\sim})(e, e_0)(x, y) = f_e(x)$, $(X^{\sim} \otimes^{\sim} g)(e, e_0) = g_{e'}(y)$, where $x \in X$ and $y \in Y$.

(4) $[f1_E \wedge^{\sim} f2_E] \otimes^{\sim} [g1_{E0} \wedge^{\sim} g2_{E0}\ ] = [f1_E \otimes^{\sim} g1_{E0}] \wedge^{\sim} [f2_E \otimes^{\sim} g2_{E0}]$

Definition 3.3. Let X_E and Y_{E0} be two F.S-spaces. Then $X_E \otimes^{\sim} Y_{E0} = \{f_E \otimes^{\sim} g_{E0} : f_E \in X_E, g_{E0} \in Y_{E0}\}$ is called the F.S-Cartesian product of F.S-spaces X_E and Y_{E0}

Definition 3.4. Let (X1, E1, τ1) and (X2, E2, τ2) be two F.S-topological spaces. The F.S-topology τ ⊗, generated by B = $\{f_{E1} \otimes^{\sim} g_{E2} :$

$f_{E1} \in \tau1, g_{E2} \in \tau2\}$, is called F.S-product topology over X1 × X2. We denote this new topology by (X, E, τ ⊗) where X = X1 × X2 and E = E1 × E.

Definition 3.5. Let X = X1 × X2 and E = E1 × E2. Let π X i : X → Xi , and π E i : E → Ei be ordinary projection maps. Suppose that (X1, E1, τ1) and (X2, E2, τ2) be two F.S-topological spaces. The F.S-map π X,E i : $X1_{E1} \otimes^{\sim} X2_{E2} \to Xi_{Ei}$ is called a F.S-projection map such that π X,E i $(f1_{E1} \otimes^{\sim} f2_{E2}) = fi_{Ei}$.

DECISION MAKING PRODUCT SOFT TOPOLOGY

In this section we present fuzzy-soft-set and some results of it. Let U = {o1, o2,...,ok} be a set of k objects, which may be characterised by a set of parameters {A1, A2,...,Ai}.

The parameter space E may be written as E ⊇ {A1 ∪ A2 ∪···∪ Ai}. Let each parameter set Ai represent the ith class of parameters and the elements of Ai represents a specific property set. Here we assume that these property sets may be viewed as fuzzy sets. In view of above we may now define a fuzzy soft set(Fi, Ai) which characterises a set of objects having the parameter set Ai.

Definition 1.
Let P(U) denotes the set of all fuzzy sets of U. Let Ai ⊂ E. A pair (Fi, Ai) is called a fuzzy-soft-set over U, where Fi is a mapping given by Fi : Ai → P(U).

Definition 2. For two fuzzy-soft-sets (F , A) and (G, B) over a common universe U, (F , A) is a fuzzy-soft-subset of (G, B) if (i) A ⊂ B, and (ii) ∀ ∈ A, F () is a fuzzy subset of G(). We write (F , A) ⊂^{\sim} (G, B). (F , A) is said to be a fuzzy soft super set of (G, B), if (G, B) is a fuzzy-soft-subset of (F , A). We

denote it by (F , A)⊃˜ (G, B). In view of the above discussions, we now present an example below.

Example. Consider two fuzzy-soft-sets (F , A) and (G, B) over the same universal set U = {h1, h2, h3, h4, h5}. Here U represents the set of houses,
A = {blackish, reddish, green} and
B = {blackish, reddish, green, large}, and
F (blackish) = {h1/.4, h2/.6, h3/.5, h4/.8, h5/1},
 F (reddish) = {h1/1, h2/.5, h3/.5, h4/1, h5/.7},
F (green) = {h1/.5, h2/.6, h3/.8, h4/.8, h5/.7},
G (blackish) = {h1/.4, h2/.7, h3/.6, h4/.9, h5/1}, G (reddish) = {h1/1, h2/.6, h3/.5, h4/1, h5/1},
G (green) = {h1/.6, h2/.6, h3/.9, h4/.8, h5/1},
 G (large) = {h1/.4, h2/.6, h3/.5, h4/.8, h5/1}. Clearly, (F , A)⊂˜ (G, B).

Algorithm:
1 Input the fuzzy-soft-sets (F , A), (G, B) and (H, C).
 2. Input the parameter set P as observed by the observer.
3. Compute the corresponding resultant-fuzzy-soft-set (S, P) from the fuzzy soft sets (F , A), (G, B), (H, C) and place it in tabular form.
4. Construct the Comparison-table of the fuzzy-soft-set (S, P) and compute r_i and t_i for o_i, $\forall i$.
5. Compute the score of o_i, $\forall i$.
6. The decision is S_k if, S_k = $\max_i S_i$.
7. If k has more than one value then any one of o_k may be chosen.

IV. CONCLUSION

Theory of fuzzy soft sets is a new approach to deal with uncertainty. This theory can be seen as a fruitful method to formulate fuzzy information related to some parameters by applying a set-valued map. So it has a wide range of applications in both theory and practice. In this work we study fuzzy soft product topology and consider some related properties of it. We firstly introduce the concept of fuzzy soft cartesian product. Then construct a fuzzy soft topology over the cartesian product of two crisp sets and called this new topological structure "fuzzy soft product topology". The concept of fuzzy soft point is also given and Decision making fuzzy soft product topology is considered.. This paper may be the beginning for future research on fuzzy soft product topology, fuzzy soft separation axioms, and etc.

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IOT BASED SMART SECURITY AND HOME AUTOMATION SYSTEM USING WIFI TECHNOLOGY

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ABSTRACT: Internet of Things (IoT) conceptualizes the idea of remotely connecting and monitoring real world objects (things) through the Internet. Smart home has become more and more popular in recent years. This IoT project focuses on building a smart wireless home security system which sends alerts to the owner by using Internet in case of any trespass and raises an alarm optionally. A wireless solution based on Internet protocol is introduced to manage the smart home units easily. This paper provides an IoT based Smart security and Home Automation system using WiFi Technology. The microcontroller used in the current prototype is the TI-CC3200 Launchpad board which comes with an embedded micro-controller. Sensor and actuator nodes communicate to a middleware which runs home automation server and which operates as broker to facilitate the MQTT connectivity protocol. The middleware facilitates controlling of wireless nodes over local as well as remote network. An onboard Wi-Fi shield making use of which all the electrical appliances inside the home can be controlled and managed.

KEYWORDS: TI-CC3200 Launchpad, Smart home, Internet of Things (IoT), Internet, WiFi.

I. INTRODUCTION

Twenty First century is an era of digital revolution. Revolution which introduced human society with advancement in technologies. With this advent in technology, cost effective and reliable wireless technologies came into existence. The improvements offered by the wireless technologies now significantly reduces the complexity of harnessing wired transmission and facilitates the communication for internet-of-things (IOT) [1]. Utilization of such low cost wireless technologies can be made to introduce digitization in traditional homes and effectively build a Smart Home System [2].

With the development of IOT (internet of things), the concept of smart device has become more and more popular. Devices are connected to the internet and stretch their reach. Mobile phone is not the only common smart device. Smart watch, smart rings, smart TV, smart air monitor, smart sensors, all kinds of traditional devices turn to smart and have the capability to access the internet. This contributes to the promotion of wireless home automation. Since home appliances can become smart, the home or the work area can be a smart area with easy automation control. Smart home system can connect the smart units together and provide a unified interface for users to interact with the home appliances [3].

A Smart Home is usually a freshly constructed home/building that is furnished with special structured wired or wireless system that enables inhabitants to operate home appliances remotely. Most of the homes use electronic appliances such as fan, light, air conditioner, and so on. Smartphones are very common for everyone nowadays. IoT creates a bridge between these home appliances and Smartphones through wireless connectivity [4]. Smart home incorporates home automation technologies to provide occupants with information and intelligent feedback by monitoring various aspects of home. The concept of IOT is closely integrated with the popularization of home automation. By employing the network infrastructure of IOT and utilizing standard IOT protocols, the household appliances can be monitored and controlled remotely over internet. A home that is equipped with such a wireless system can be called Smart Home in context of IOT. The Smart Home concept fundamentally brings several new features to a regular home like interoperability, remote access and flexibility of expansion.

Wireless Home security and Home automation are the dual aspects of this project. The currently built

prototype of the system sends alerts to the owner over voice calls using the Internet if any sort of human movement is sensed near the entrance of his house and raises an alarm optionally upon the user's discretion. The provision for sending alert messages to concerned security personnel in case of critical situation is also built into the system [5]. On the other hand if the owner identifies that the person entering his house is not an intruder but an unexpected guest of his then instead of triggering the security alarm, the user/owner can make arrangements such as opening the door, switching on various appliances inside the house, which are also connected and controlled by the micro-controller in the system.

As with the development of the Internet, Internet based remote control solutions for home automation has been proposed. The connectivity of different devices in home local network, technologies is used such as Zigbee, Bluetooh and WiFi. The WiFi network is used to connect home network of various devices, including home appliance control and environmental monitoring. Each part contains multiple nodes. Each node is a communication terminal. Each node terminal node is independent from each other, and any node fault will not affect the operation of other nodes. Each device is installed with a WiFi node and a control to communicate with terminal.

II. LITERATURE SUREVY

M. Pandurov et. al. [6] presents design and implementation of a platform for easy extension and customization of home automation systems. The platform is intended to be a host for user-created extension plugin modules and to be deployed on home automation gateways. Platform allows those extension modules to be independent from target platform and execute them concurrently in secure and isolated environments. Developing plugin modules relies on common concept of web application development: it consists of server side part which is written in JavaScript and client side part which is written in common HTML5 manner.

Li, M. Lin, Hung-Ju, et. al. [7] presents a wireless sensor networks (WSNs) and power line communications (PLCs) are used to implement a smart home control network. ZigBee , Bluetooth and Wi-Fi are commonly used to establish the local network. Under this condition, a home gateway is needed between the internet and WLAN. In most cases, the home gateway is more like a web server with a known IP in public internet, but this is not realistic for each home owning a server. It is in the stage of experiment but far from popularity and application. Alam et. al. [8] introduces a review of Smart home which talks about the past, present, and future of smart home. It detailed introduces the definition of smart home from relative literatures and also gives an elaboration of smart home futures and compares different approaches to the implementation.

R. Piyare et. al. [9] presents the design and implementation of a low cost but yet flexible and secure cell phone based home automation system. The design is based on a standalone Arduino BT board and the home appliances are connected to the input/ output ports of this board via relays. The communication between the cell phone and the Arduino BT board is wireless. This system is designed to be low cost and scalable allowing variety of devices to be controlled with minimum changes to its core. Password protection is being used to only allow authorised users from accessing the appliances at home. Gomez et. al. [10] presents a survey on WHANs (Wireless Home Automation Networks). It elaborates main current and emerging architectures and technologies tailored to or suitable for WHANs. A non-exhaustive list of examples is provided. Some main futures are listed such as light control, remote control, smart energy, remote care, security and safety. Different system may focus on different aspects.

III. SMART SECURITY AND HOME AUTOMATION SYSTEM

The architecture of IoT based Smart security and Home Automation system using WiFi Technology is represented in below Fig. 1.

The TI CC3200 Launchpad consists of Applications Microcontroller, Wi-Fi Network Processor, and Power-Management subsystems. It uses ARM Cortex M4 Core Processor at 80 MHz. It has embedded memory including RAM (256 KB). The dedicated ARM micro-controller also has a network processing subsystem in it. Its features include:
• The board is powered through USB for the LaunchPad and external BoosterPack
• It is operated from 2 AA- batteries

• On-board antenna and U.FL connector can be selected using a capacitor re-work
• It supports 4 wire JTAG and 2 Wire SWD
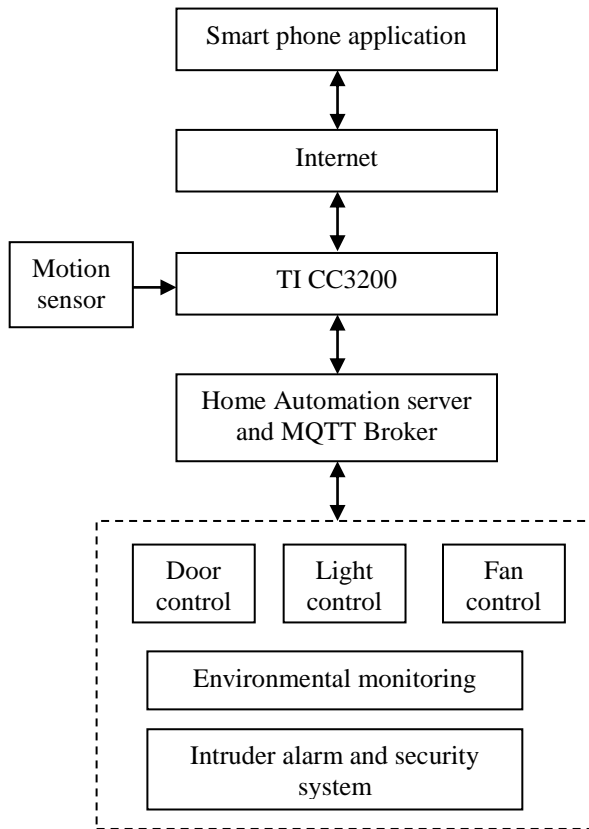
Fig. 1: ARCHITECTURE OF SMART SECURITY AND HOME AUTOMATION SYSTEM
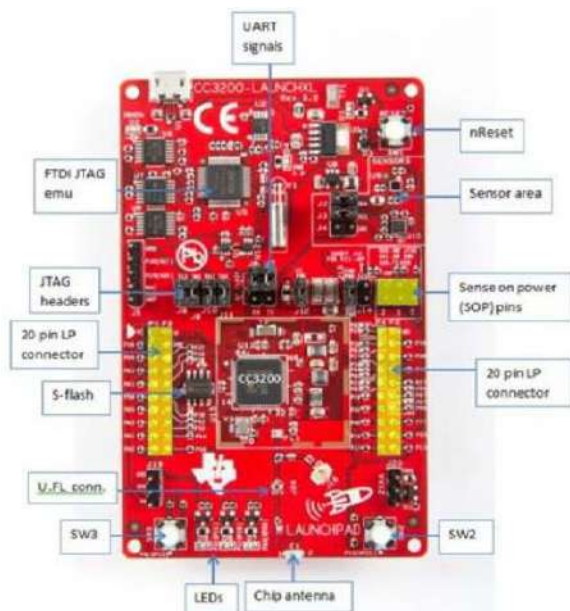
Fig. 2: TI CC3200 Launchpad Board

The motion sensor is connected to a digital in-out pin of Texas board. The board is powered up by external 12V battery or 12V adapter. The home appliances are connected to mains through relay which in turn is connected to another digital pin of the board. The board is programmed to have access to the local Wi-Fi. The voice call feature of the mobile phone should be enabled. Launchpad sends a voice call to only a particular number which is present in the web API there is no need to worry about security leakage as the system cannot be accessed by any other unauthenticated user. This in turn increases the fidelity of the security system.

The ESP8266 WiFi Module is a self contained SoC with integrated TCP/IP protocol stack. The ESP8266 is capable of either hosting an application or offloading all WiFi networking functions from another processor. It is an extremely cost effective module that has on-board processing and storage capability. This communication is based on Message Queue Telemetry Transport (MQTT) connectivity protocol which is designed for internet-of-things. The MQTT protocol uses Publish/Subscribe based messaging on the top of TCP/IP Protocol. In the MQTT mechanism, a client needing data (known as subscriber) registers its interests with a server (also known as broker). The client producing data (known as publisher) sends the data to a server and this server forwards the fresh data to the subscriber. In that context, the nodes subscribe and publish messages on a specific topic.

Pyroelectric or Passive Infrared Sensor (PIR) is an electronic device which is designed to detect this IR wavelength when a human being is in its proximity. To have a wide range for detection a simple lens is used. Sensors may also be calibrated in such a way so as to ignore domestic pets by setting a higher sensitivity threshold, or by ensuring that the floor of the room remains out of focus.

PIR motion sensors are installed at the entrances of a building. These sensors as explained earlier detect the motion of human beings. This signal which detects their presence becomes the input trigger for the micro-controller. The owner, who may or may not be present in that building, will be receiving a voice call on his mobile phone (whose number is predefined in the program) stating that 'There is an Intruder in the House'. To turn ON the lights and alarm at house so that the intruder will be warned, the owner can press '1' from his mobile keypad. Moreover if the owner finds that his building is not

safe, he can send an SMS [8] to the concerned authority in police department; explaining his situation. The module will turn OFF the alarm and lights after a fixed time delay. The call will be triggered again as soon as the module detects any unexpected motion and the owner will receive the call again and the process continues so on.

IV. EXPERIMENTAL RESULTS

The experimental setup of described home automation system with smart security is represented in below Fig. 3.
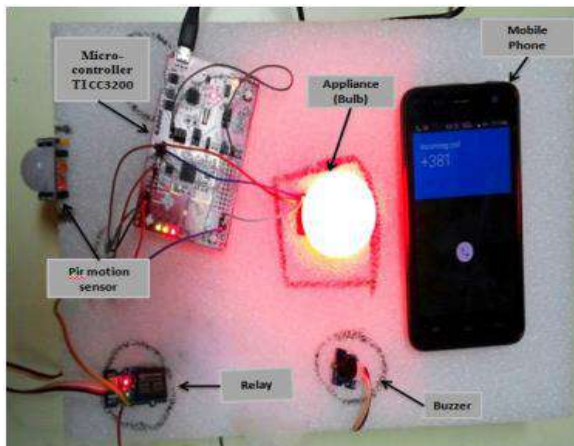
Fig. 3: Experimental Setup

If any guests come to home then the owner can adjust the home appliances like fan, TV, lights, Air Conditioner and etc according to the weather conditions through the smart phone by pressing specific key. If they went out of the room or home then owner turn off these applications through the phone. Since the appliances are connected to mains supply through a relay they can be easily controlled using micro-controller. In this way smart automation is processed.

The smart security is processed in different steps as follows:
• At initial stage it is idle.
• If any motion is detected then a voice call is done through Internet.
• Detected no intruder in the area of gate then lights, fans and AC are switched on through phones by pressing specific keys.
• Detected a intruder at gate area then alarm is blown as security alert.

V. CONCLUSION

In this paper, we proposed a flexible architecture of IoT based Smart security and Home Automation system using WiFi Technology. As the system is dependent on the user's discretion and judgeability of the situation (whether it is a guest or an intruder entering his house) the use of a camera connected to the microcontroller might help the user in taking decisions whether to activate the security system or welcome the guest. The complete system efficiently utilizes the existing network infrastructure with the help of MQTT protocol. The implemented system uses basic electronic development boards to minimize the system development cost. Further the system may be made more synchronised by integrating the voice call feature within the same smart phone application through which the user can even control his home appliances without any voice call being triggered to his phone.

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A NOVEL APPROACH FOR LOW POWER SUB THRESHOLD 6–T SRAM ARRAY USING REVERSIBLE LOGIC GATE

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ABSTRACT: With the advancement in technology and type of usage of the electronics devices in different applications, demands huge size memories to store or process the data. Typically Static Random Access Memory (SRAM) cells are used due to its low power and high speed access characteristics. The conventional approach of circuit designing consumes a lot of power and occupies much area. Thus, the concept of reversible logic in circuit designing is gathering growing attention for low-power applications. In this paper, we introduce a novel approach for low power sub-threshold 6-T SRAM array using Reversible logic.The designs are simulated on Cadence virtuoso schematic editor. The present work also concludes with some insights on the operation of conventional SRAM 6-T cell and the feasibility of reversible logic.This design achieves an average 36.11% reduction in power dissipation and achieves an average 106.60% improvement in static noise margin (SNM) for the same supply voltage.

KEYWORDS: sub-threshold, Reversible SRAM, low power, static noise margin (SNM).

I. INTRODUCTION

In the present time, the cache memories become an integral part of the memory hierarchy due to its fast processing ability. It helps the processor, with a slower secondary memory, to match the fast computation speed. Another type of memory i.e. dynamic random access memory (DRAM) looks very enticing to be used as cache memory, due to its small size and considerably good processing speed [1]. But it has not been able to replace Static random access memory (SRAM) because of complex process stepsand slow speed (high delay, due to external capacitance) than the SRAM [2].

Sub-threshold circuit design keeps the promise for the ultra-low energy requirements for the cache memory [3]. It becomes the attractive choice for the mid-to-high performance applications such as sensor-based applications where power is a limiting constraint. Highly parallel nearthreshold or sub-threshold based systems associate the penalty of the low voltage operation at the cost of the leverage of the energy benefits.

Static random access memory (SRAM) is popular among other memory cells due to its high speed characteristics. SRAM uses a simple bistable circuit to hold a data bit. Two cross coupled inverters in the conventional 6T cell forms a latch which is used to store the data. Whenever there is a need for storing other data in the same cell, previous data has to be erased which proves the irreversibility operation of the memory cell and results in the heat dissipation.

The main difference between the reversible logic gates and the conventional gates is explained through specific reversible circuit parameters such as the garbage outputs, quantum cost and some design constraints [4].An operation is said to reversible if there is no energy to heat conversion in the system. A reversible circuit has the facility to generate a unique output vector from the input vectors. The reversible logic gates have same number of inputs and outputs. The design constraints of the reversible circuits are that no fan outs are allowed, feedback from the output to the input of the same gate is not allowed.

Basically on current (Ion) of the device represents the active current across it and off current (Ioff) represent the leakage current

across the device. Low power VLSI design has gained interest in recent years due to its wide range of applications. The current ratio (Ion / Ioff) for NMOS and PMOS is very large (around 10^4) up to the supply voltage 4 volt (130nm technology), but below of that near–threshold this ratio reduces drastically, in this region difficulties arises to identify the active current. The drastic reduction in the current ratio (Ion / Ioff) observed in the near-threshold and sub-threshold regions become one of the fundamental challenges in designing the low voltage and low power memory. When this ratio is small, it becomes difficult to distinguish between the read current of the accessed cell and the cumulative leakage current of un-assessed cells, forcing the use of very small bit line.

The rest of the paper is organized as follows. SectionII elaborates literature review. Section-III presents proposed reversible SRAM cell. Section-IV illustrates the simulation results followed by section V conclusions.

II. LITERATURE SURVEY

Jae-Won Jang et. al.[5] presents 8T SRAM PUF with a back-to-back PMOS latch to improve robustness by 4X. We also propose a low-power 7T SRAM with embedded Magnetic Tunnel Junction (MTJ) devices to enhance the robustness (2.3X to 20X) while lowering the leakage power and area overhead. Physical Unclonable Function (PUF) is a cost-effective security primitive to address hardware attacks such as cloning, impersonation and Intellectual Property (IP) violation. Static Random-Access Memory (SRAM) PUF has been proposed.

Choelhwyi Bae et. al. [6] extends method to account for end-of-life aging into statistical SRAM cell design with Z-score method on 14nm FinFET technology.Importance of low voltage operation of SRAM in mobile

application is ever increasing for longer battery life. SRAM occupies a significant portion of the total area and power for the SOC ICs (>10-30MByte used in AP/CPUs). For the operation of SRAM at low voltage, proper noise margin for read, disturb and write operation is important since noise margin reduces with technology scaling and low voltage operation.Excellent Vmin behavior at both time0 and EOL satisfying 10yrs was demonstrated at the product level.

Morrison et.al., [7] has proposed SRAM design using reversible circuit design. Every gate output that is redundant is known as garbage output. The main challenge in the design of reversible circuit is to reduce the garbage output.

S. Mahammad et. al. [8] presents the following: 1) a novel universal reversible logic gate (URG) and a set of basic sequential elements that could be used for building reversible sequential circuits, with 25% less garbage than the best reported in the literature; (2) a reversible gate that can mimic the functionality of a lookup table (LUT) that can be used to construct a reversible field-programmable gate array (FPGA); and (3) automatic conversion of any given reversible circuit into an online testable circuit that can detect online any single-bit errors, including soft errors in the logic blocks, using theoretically proved minimum garbage.

Zai et. al. [9] have discussed the energy consumption for the 6-T sub-threshold SRAM and from the simulation result, they have shown the energy consumption for the inverter chain of technology 130 nm and the threshold voltage (Vth) is taken ~0.4v. From this analysis, it can be observed that the above the superthreshold voltage 0.5V; active energy consumption (Eact) dominates by the leakage energy (Eleak). It can be also observed from the result, operating the

device below Vmin will be not advantageous from the energy perspective.

B. Calhoun et. al. [10] analyzes SNM for sub-threshold bitcells in a 65-nm process for its dependency on sizing, V_{DD}, temperature, and local and global threshold variation. Recent explorations into sub-threshold operation for logic show that minimum energy operation is possible in this region. These two trends suggest a meeting point for energy-constrained applications in which SRAM operates at sub-threshold voltages compatible with the logic. The V_T variation has the greatest impact on SNM, so we provide a model that allows estimation of the SNM along the worst-case tail of the distribution.

III. SUB THRESHOLD 6–T SRAM ARRAY USING REVERSIBLE LOGIC GATE

This section discusses about the proposed reversible SRAM cell with 'read and write' signals. Fig. 1 shows the proposed reversible SRAM cell. A 3 × 3 Fredkin gate and a 2 × 2 Feynman gate is used to store the single bit of data and it is controlled by two 3 × 3 Fredkin gate.

The input to the 3 × 3 Fredkin gates are write signal, constant input logic '0' and the data input. The output of the 3 × 3 Fredkin gate are write signal, garbage and the output line. When W L =1, then the SRAM cell will be either in read mode or write mode.

If, write signal is '1' then whatever the value of data in will be stored in the SRAM cell. If the write signal is '0' and if read signal is '1' then the value stored in the SRAM cell will be the value of the data out which resembles actual functionality of the conventional SRAM cell. The quantum cost of the proposed SRAM cell with the read/write

signal is 16 and the garbage output of the proposed design is 3.
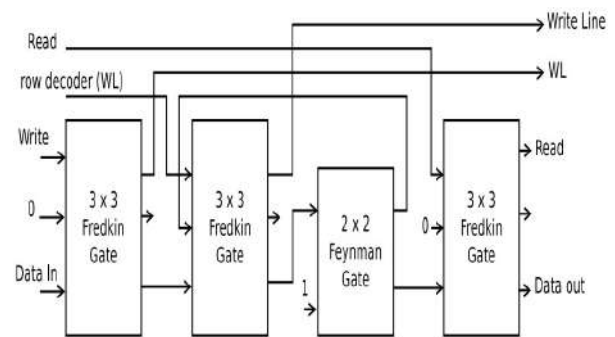
Fig. 1: PROPOSED REVERSIBLE SRAM CELL WITH READ/WRITE

Fig. 2 shows the Fredkin gate used as the access transistors. The inputs to the Fredkin gate are W L, previous data stored and bit (B) input. If W L = 0, third output will be the previously stored data. If W L = 1, third output will be the bit (B) input. During read operation the bit (B) and $\overline{bit}$ ($\overline{B}$) of the SRAM cell is connected to the sense amplifier which is used to produce the corresponding output data.
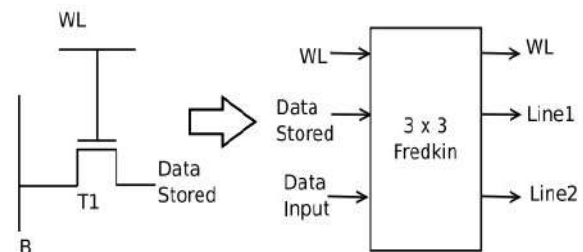
Fig. 2: FREDKIN GATE AS ACCESS TRANSISTORS

The latch was modelled by using one Feynman gate and one Fredkin gate. W L output in 3 × 3 Fredkin gate is used to enable the row cells. So, the total number of garbage output for the proposed SRAM cell is 1. Considering the line 2 in Fig. 2 if W L = 0, data stored will be the output in line 2 of the 3 × 3 Fredkin gate which resembles the hold state of the access transistor. If W L = 1, data input will be the output of the line

2. This line 2 is fed to the Feynman gate which performs the latch operation.

The schematic and layout of the 6-T memory cell are shown in Fig. 3.

(a)

(b)
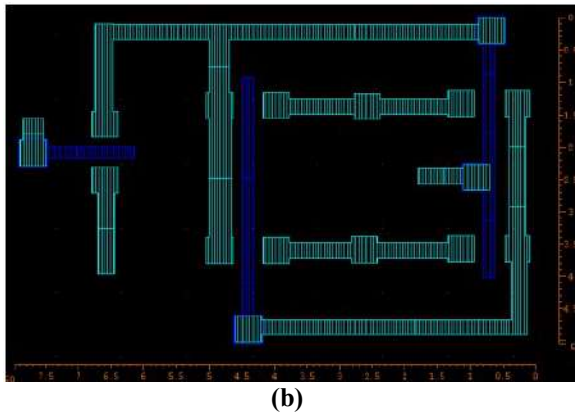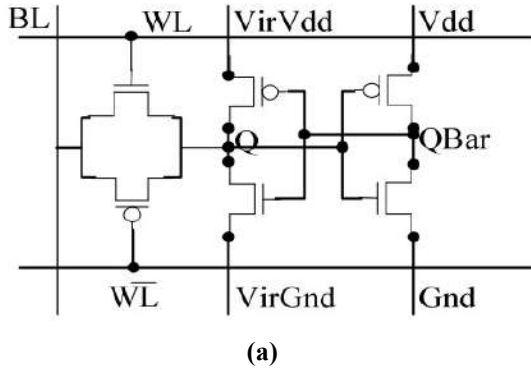
Fig. 3: (a) SCHEMATIC CIRCUIT OF 6-T CELL (b) LAYOUT DIAGRAM OF 6-T CELL

So,the input to the SRAM cell is word line signal from the row decoder, write signal, data in, read signal and the output of the SRAM cell is write line which is passed to the next SRAM cell in the same row, write line, read line and data out.

IV. RESULTS AND ANALYSIS

Cadence virtuoso analog design environment is used for simulating the design. Simulations are performed using Generic process design kit (GPDK) 45nm technology at a temperature of 27°C. All transistors used in the proposed cell have the minimum width (120nm) and minimum length (45nm).Static Noise Margin (SNM) and power dissipation are the two main

parameters used in this study for performance evaluation of 6-T SRAM array using Reversible logic.

The Static Noise Margin (SNM) is a very important parameter to estimate the stability of the device; the stable device should have the higher SNM [10]. The SNM of a CMOS SRAM cell can be defined as the minimum dc noise voltage necessary to flip the state of the cell.

The power dissipation is one of the most important parameters for designing the SRAM cell. The main challenges for the designer are not only the active power of the cell when it is in switching states but also the leakage power, which is slowly becoming comparable to the active power dissipation as the dimensions are being reduced.
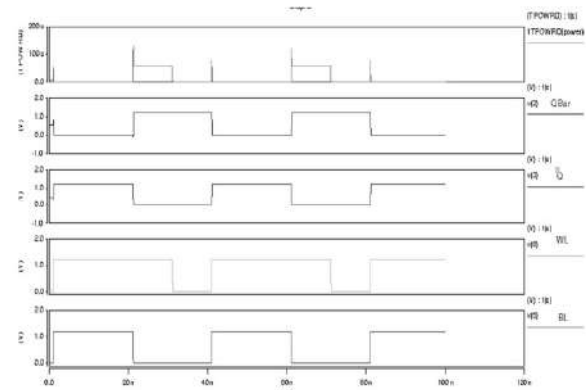
Fig.4. SIMULATION RESULT OF 6-T MEMORY CELL WRITE ASSIST OPERATION

Table 1: PERFORMANCE OF 6-T SRAM CELL

Supply voltage (V)	6-T SRAM array using Reversible logic		Conventional 6-T SRAM CELL	
	Power Dissipation (µ w)	SNM(read) (V)	Power Dissipation (µ w)	SNM(read) (V)
1.2	34.21	51	57.76	20
1.4	58.01	63	100.58	32
1.6	104.26	85	152.54	41
1.8	156.7	97	250.23	58

The performance comparison is made in between the 6-T SRAM array using Reversible logic and conventional 6-T SRAM which is described in above Table 1. From results it is clear that, power dissipation is gradually decreased and SNM is gradually increased in 6-T SRAM array using Reversible logic than the conventional 6-T SRAM.

V. CONCLUSION

In this paper, we introduce a novel approach for low power sub-threshold 6-T SRAM array using Reversible logic. Cadence virtuoso analog design environment is used for simulating the design. The analysis of 6-T arraywith reversible logic simulation was compared with the Conventional 6-T cell and we can conclude that 6-T SRAM array with reversible logic is better VLSI performance in terms of power dissipation and SNM. This design achieves an average 36.11% reduction in power dissipation for (1.2-1.8) volt supply voltage and achieves an average 106.60% improvement in static noise margin (SNM) for the same supply voltage.

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ASPECT BASED FEATURE EXTRACTION AND SENTIMENT CLASSIFICATION ON TWITTER DATA USING N-GRAM IDF AND MACHINE LEARNING

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ABSTRACT: Nowadays, people from all around the world use social media sites to share information. Twitter for example is a platform in which users send, read posts known as 'tweets' and interact with different communities. Sentiment classification in Twitter deals with analyzing the tweets in terms of their sentiment polarity. Analysis of sentiments is the method of deciding whether the sentiments in the text are positive, negative or neutral. Opinion Mining is a process of extracting and analyzing people's opinion regarding the given object and Sentiment Analysis explains about the hidden sentiments in the opinions. A most important challenge in this is to identify the sentiments and aspects and then perform the data classification based on these features and this process is called aspect based feature extraction. This paper presents Aspect based feature extraction and Sentiment Classification on Twitter Data using N-gram IDF and Machine Learning. Support vector machine (SVM) model is used in this method as Machine Learning classifier. In this paper experiments were conducted to compare the performance of one of the machine learning models as Naïve Bayes (NB) with SVM in terms of Accuracy and Precision. Described N-gram IDF with SVM based twitter data classification model is achieves the best Accuracy and Precision than the Naïve Bayes (NB) machine learning model.

KEYWORDS: Sentiment Analysis, Machine Learning, Twitter, Aspects and N-gram IDF.

I. INTRODUCTION

The enhancement in the field of web technology has changed the manner by which individuals can express their perspectives [1]. Individuals rely on this user perspective information for analyzing the items for online shopping or while booking film tickets for watching movies in theaters. Write their own opinions about products or share their moments, even influence politics and companies. The online social media such as Twitter, Face book, and Instagram allow users to communicate with the whole world [2].

Aspect based feature extraction process involves data pre-processing at the initial stage and then identify the required aspects for the feature selection, and then detect the sentiments from the sentences [3]. Apart from the extraction of opinions from text the most important aspect is to find the orientation of subjective terms present in text, that is to check if the term that carries opinionated content has positive or negative aspects. Sentiment classification process is used to find out the class labels for novel data based on information given in training data.

Sentiment analysis is mainly used to analyze the sentiments. Sentiment analysis can be considered as the use of natural language processing, text analysis and computational linguistics to identify and extract sentiment information in source materials [4]. Generally, sentiment analysis aims to find the attitude of a writer with respect to some relevant topic or the overall contextual polarity of a document.The accuracy of a sentiment analysis is based on how well it agrees with human judgments. This can be measured by using precision and recall. Machine learning method is good because it uses supervised method for computation. The goal is to increase the efficiency and accuracy of the classification model thus improves the efficiency of system. Different machine learning methods are used to analyze the sentiments of the people. This paper uses machine learning methods like Naïve Bayes Classifier and Support Vector Machine method.

Although N-gram phrases are considered to be informative and useful compared to single words, using all N-gram phrases is not a good idea because of the large volume of data and many useless features. To address this problem, we utilize N-gram IDF, a theoretical extension of Inverse Document Frequency (IDF). IDF measures how much information the word provides; but it cannot handle multiple words. N-gram IDF is capable of handling N-gram phrases; therefore, we can extract useful N-gram phrases [5].

Sentiment analysis is extensively arranged in the two kinds initial one is an information based methodology and the other classification techniques. First methodology requires an expansive database of predefined feelings and a proficient information portrayal for recognizing sentiments. Then again the Machine learning approach makes utilization of a datasets and a test informational collection to build up a classifier. It is preferably more straightforward over Knowledge base methodology. Since the improvement of calculations a few difficulties were looked in the field of Sentiment analysis. The first is that a sentiment word can be sure or negative contingent on the circumstance. The second test is that individuals don't in every case express conclusion similarly.

II. LITERATURE SURVEY

Liu, B et.al. [6] discussed sentimental analysis applications and its problems also presented types of sentimental analysis, also two relevant and important concepts of subjectivity and emotion were also introduced, which are highly related to but not equivalent to opinion.Xia et al.[7] used an ensemble framework for sentiment classification which used two types of feature sets and three base classifiers. Two types of characteristic sets are made using Part-of-speech data and Word-relations. Naive Bayes, Maximum Entropy and Support Vector Machines are selected as base classifiers. They applied dissimilar ensemble methods like Weighted combination, fixed combination and Metaclassifier combination for sentiment classification and obtained better accuracy.

Pak & Paroubek et. al. [8] worked on tweet classification as more than two class classification errands, also tried to filter tweets into positive category, negative category, or neutral category. After this, they analyzed execution of Support Vector Machine, Multiple Naïve Bayes utilizing distinctive feature set like Unigrams, Bigrams, various n-grams, & position of n-grams. The outcomes demonstrated that best mix came out to be MNB along with n-grams & POS tagging.

Tang et al. [9] talked about four issues identified with supposition mining like subjectivity classification, word sentiment classification, archive sentiment classification and capturing the feelings. After this, few approaches were presented like Naïve Bayes classifier, multiple Naïve Bayes classifier & cut-based classifier.

Alec Go et al. [10] has attempted machine learning algorithms like Naive Bayes, Maximum Entropy and SVM on Tweet data where the features being Unigrams, bigrams, POS tags etc. Their work used emoticon features to build training sets and proved that effectiveness of machine learning techniques on Twitter data with their classification accuracy being the maximum at 82.2% for unigrams.

III. ASPECT BASED FEATURE EXTRACTION AND SENTIMENT

CLASSIFICATION ON TWITTER DATA

The workflow of Aspect Based Feature Extraction and Sentiment Classification on Twitter Data using N-gram IDF and Machine Learning method is represented in below Fig. 1.
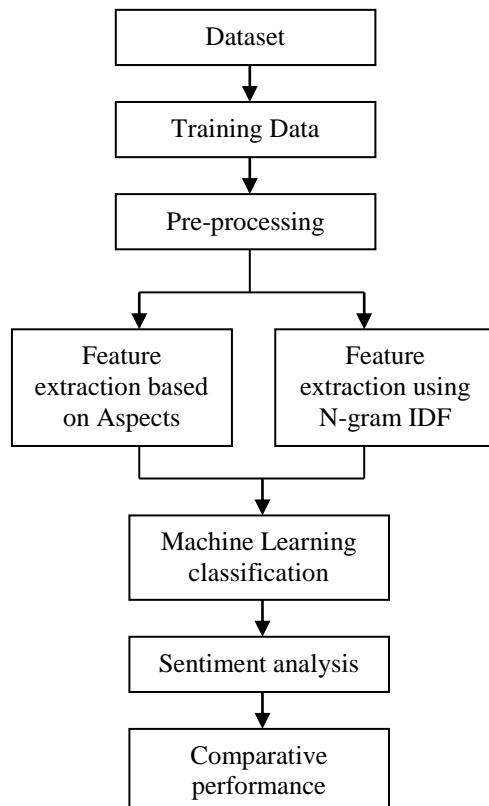
Fig. 1: WORKFLOW OF DESCRIBED METHOD

The experiment uses SemEval 2016 dataset. It is a publically available dataset for twitter sentiment analysis. A unique task of SemEval dataset corresponds to unique objective. A task is further divided into subtasks that correspond to a unique classification. We mainly focused on subtask B (tweet classification on twopoint scale i.e. two class classification) of SemEval 2016 task 4. All tasks serve different analysis purposes. In year 2016, SemEval task 4 is designed for twitter sentiment analysis.

The most important process in data mining is data pre-processing. Messages in software document sometimes contain special characters. The given data set is to be pre-processed for further processing to remove the redundant or irrelevant information. We remove characters that are neither English characters nor numbers. Stop words are also removed by using spaCy library. spaCy tokenizes text and finds part of speech and tag of each token and also checks whether the token appears in the stop word list. Many pre-processing stages are applied on the given dataset to improve the further modifications.

Aspect level feature extraction includes identifies the features and aspects based on the sentiments and opinions and then perform the sentiment classification for the given data set. . After data pre-processing the words and sentence are taken for further analysis from the pre-processed data set. These words are stored in aspect model and sentiments are compared with the sentiment model aspects and sentiments are further combined to form aspect based sentiment analysis.

A set of consecutive words or a sequence of words in a textual document is called N-gram. N-gram IDF is a theoretical extension of IDF for handling words and phrases of any length by bridging the gap between term weighting and multiword expression extraction. In the research area, unigrams, bigrams and trigrams are most commonly used for twitter sentiment analysis. Using Ngramtokenizer function, we tokenized our corpus into the N-gram features by giving the value for the desired n-gram. In this research, we have set Unigram (n=1) for minimum gram & Trigram (n=3) for maximum gram.N-gram phrases appear only one time in the whole document (frequency

equal one) are removed, since they are not useful for training.

This work is aimed for tweet sentiment classification on a three different weighting schemes (TF (Term Frequency), TF-IDF, Binary) with SVM classifier using n-gram features. SVM is a supervised machine learning method which is used for both classifications as well as a regression problem. Classification and regression both are a subcategory of supervised machine learning. Classification is something that can be defined as predicting a label whereas Regression is about predicting quantity. So the main task of the Support Vector Machine classifier is to perform classification. The power of the hyper plane created depends on the distance of the hyper plane to the nearest training data point of any class. The larger the distance, the better is the hyper plane. Classification is supervised because the class labels are well defined. Finally, we observed the accuracy of SVM classifier with combination of different features.

IV. RESULT ANALYSIS

SemEval 2016 dataset is used in this experiment. The analysis of algorithms and feature sets in text classification can be evaluated by several statistical measures such Accuracy and Precision. Experiment with SVM and Naïve Bayes (NB) classifiers with three different feature set (Unigram, Bigram and Trigram) and three different weighting schemes (TF, TF-IDF, Binary) for analyzing accuracy, Precision results.

Accuracy: Accuracy is defined as the percentage of sentiments correctly predicted of total instances are to the number of true positive, false negative, number of false positive instances and the number of true negative instances.

$$Accuracy = \frac{TP + TN}{TP + TN + FN + FP} \dots (1)$$

Precision: Precision is the fraction of the correctly classified instances for one class of the overall instances which are classified to this class.

$$Precision = \frac{TP}{TP + FP} \dots (2)$$

In above equations TP represents the True Positive, TN represents the True Negatives, FN represents the False Negatives and FP represents the False Positives.

Accuracy values of SVM and NB classification models with the combination of N-gram features and aspect based sentiment features are depictedin below Table 1 as below.

Table 1: ACCURACY PERFORMANCE OF DESCRIBED METHOD FOR 'SVM' AND 'NB' CLASSIFICATIONS

	SVM			NB		
	Unigram	Bigram	Trigram	Unigram	Bigram	Trigram
Term frequency	79.2	79.5	76.8	72.3	78.7	72.5
Binary	81.6	78.4	76.2	79.2	76.5	71.6
TF-IDF	82.4	78.1	75.8	80.1	75.8	68.4

Graphical representation of the Accuracy of SVM classifier is depicted in below Fig. 2. It is observed from the graph that in case of unigrams, TF-IDF weighting scheme works best. When talking about bigram features, TF weighting is performing well.
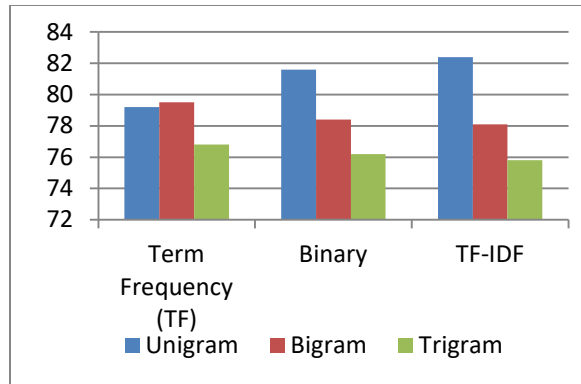
Fig. 2: ACCURACY OF DESCRIBED MODEL FOR 'SVM'

Precision values of SVM and NB classification models with the combination of N-gram features and aspect based sentiment features are depicted in below Table 2 as below.

Table 2: PRECISION PERFORMANCE OF DESCRIBED METHOD FOR 'SVM' AND 'NB' CLASSIFICATIONS

	SVM			NB		
	Unigram	Bigram	Trigram	Unigram	Bigram	Trigram
Term frequency	78.6	80.1	77.4	73.3	77.7	75.3
Binary	80.4	79.8	76.7	78.4	77.4	74.5
TF-IDF	82.6	79.6	76.3	78.6	71.4	73.8
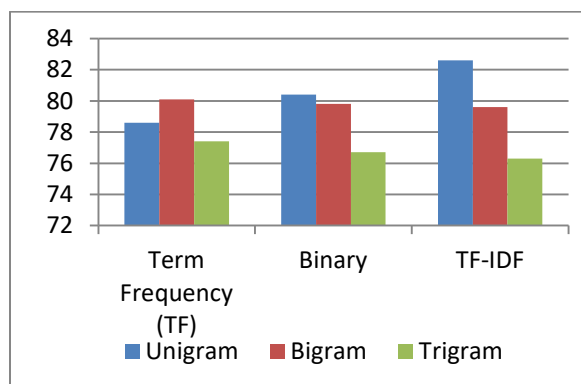
Fig. 3: PRECISION OF DESCRIBED MODEL FOR 'SVM'

Graphical representation of the Precision of SVM classifier is depicted in above Fig. 3. From results it is clear that, described combination method of aspect based sentiment features and N-gram features based Support Vector Machine (SVM) classifier is works efficiently than the Naïve Bayes (NB) classifier in terms both Accuracy and Precision parameters.

V. CONCLUSION

Sentiment analysis is vast research area and it has wide variety of issues to be discussed with several challenges. This paper explains the aspect based feature selection methods and N-gram feature IDF in combination with machine learning algorithms. We present an SVM based classifier that hybridizes N-gram based internal features with an external sentiment classification in order to improve standard N-gram based classifier. We conducted experiments with three different N-gram feature sets & three different weighting techniques for both SVM and NB classifiers in terms f Accuracy and Precision. The results explain that SVM method is much better compared to Naïve Bayes classification in all cases. The experiment includes review data sets which includes positive and negative aspects. N-gram IDF also worked well to capture dataset-specific, software-engineering related positive, neutral, and negative expressions. Because of the capability of extracting useful sentiment expressions with n-gram IDF, our method can be applicable to various software engineering datasets.

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DESIGN AND ANALYSIS OF LOW POWER BRAUN MULTIPLIER ARCHITECTURE WITH PARALLEL PREFIX ADDER FOR ARITHEMETIC PIPELINING

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ABSTRACT: Matrix multiplication is one of the most fundamental parts of digital signal processing systems and is also used as a recursive routine in many signal processing and computational problems. Power dissipation is one of the biggest challenges in VLSI design. Multipliers are the main sources of power dissipation in DSP blocks. In Very Large Scale Integration (VLSI) designs, Parallel prefix adders (PPA) have the better delay and low power performance. The circuit complexity mainly depends on the multiplication count required for developing the system. Parallel array multiplier is the solution for achieving high execution speed demands. The fundamental units to design a multiplier are adders. In this paper, the design and analysis of Braun Multiplier architecture with Parallel Prefix Adder for Arithmetic Pipelining is described. To achieve higher processing speeds, parallel multipliers are usually adopted at the expense of high area optimization. The designs are done using TANNER SEDIT tool and are simulated using TSPICE. The experimental tanner SPICE results show that the power required is significantly reduced in the proposed design over the existing design.

KEYWORDS: VLSI design, Parallel Prefix Adder, Braun Multiplier, TANNER SEDIT tool, Arithmetic Pipelining.

I. INTRODUCTION

The advances made in VLSI technology both in terms of speed and size, have made possible the hardware implementation of parallel multipliers [1]. The growth of technology further ensures enhanced performance characteristics and widespread use in DSP systems. It performs such operations as accumulating the sum of multiple products much faster than an ordinary microprocessor. The DSP architecture is so designed that it performs parallel operation and thus reduces the computational complexity and enhances the speed for repetitive signal processing required for such applications [2]. Power was mostly of only secondary importance. Nowadays, however, this trend has changed a lot; power is given primary importance than area and speed. The explosive growth in laptop and portable systems and in cellular networks has intensified the research efforts in low power electronics. High power systems often may lead to damage several circuit damages. Low power leads to smaller power supplies and less expensive batteries.

Multiplication is an essential component and dominant computational block in most digital signal processing systems. Binary multiplication consists of three main steps: (i) the generation of partial products, ii) reduction of partial productions, and iii) carry propagation addition. This multistep approach results in large on-chip area occupation in computing systems. The bitwidth of a multiplier must be at minimum as wide as the largest input operand, and is therefore, often much larger than the data represented within the operands [3]. This resource waste leads to long propagation delays, power dissipation and unused chip area. Multipliers can be determinative of the overall system performance [4]. Another issue is the variance associated with analog multiplication. While analog multipliers are of major use for near-sensor systems almost all commercial computing systems process in the digital domain. Success in analog processing systems would be transformative for nearsensor computing, but it is equally

important to develop digital computing systems as these will be immediately pervasive in modern systems.

Braun multiplier has (n-1) carry save adders for generating partial products and one ripple carry adder stage. Carry save adder is a digital adder which is used to compute sum of three or more n bit binary numbers. It is same as Full adder. The Braun multiplier is generally called as the Carry Save Array Multiplier. The architecture of a Braun multiplier consists of AND gates and Full adders. Each partial product can be added with the sum of partial product which is previously produced by using a row of adders. The carry out will be shifted one bit to the left or right and then it will be added to the sum which is generated by the first adder and the newly generated partial product. The shifting would carry out with the help of Carry Save Adder and the Parallel Prefix adder should be used for the final stage of the output. Accordingly the Braun multiplier will be implemented.

Parallel prefix adder (PPA) perform parallel addition [5]. PPA carries out three necessary and very important steps. 1) Computation of carry generation and carry propagation signals by number of input bits (pre-processing). 2) Calculating all the carry signals in parallel that is called prefix computation (Carry graph). 3) Evaluating total sum of given inputs (Post processing).

II. LITERATURE SUREVY

J.Lin et. al. [6] A 10-T Full adder design based on degenerate PTL module is presented and complementary propagate control signals are provided by 5-T XOR/XNOR logic module. In order to achieve optimal power savings at smaller geometry sizes, a heuristic approach known as hybrid adder models has been proposed. David H.K.Hoe et. al. [7] investigates three types of carry-tree adders (the Kogge-Stone, sparse Kogge-Stone, and spanning tree adder) and compares them to the simple Ripple Carry Adder (RCA) and Carry Skip Adder (CSA). These designs of varied bit-widths were implemented on a Xilinx Spartan 3E FPGA and delay measurements were made with a high-performance logic analyzer. Due to the presence of a fast carry-chain, the RCA designs exhibit better delay performance up to 128 bits. The carry-tree adders are expected to have a speed advantage over the RCA as bit widths approach 256.

T.N. Prabakar et. al. [8] presents a novel scheme for the implementation of FPGA Based Digital systems using Asynchronous Pipelining Technique. The intelligent controller has been designed using NIOS II Soft core Embedded Processor in ALTERA EP2C20F484C7 device. But, in this approach, the maximum operating frequency is limited by the excess of Logical Elements consumed by the microcontroller and the sequential execution of the C code. To verify the efficacy of the proposed approach, 8×8 Braun array multiplier is implemented as External Logic to the INTASYCON. This approach consumes lower power and also avoids the need for global clock signals and their consequences like skew problems.

Giorgos Dimitrakopoulos et. al. [9] introduces a novel framework which allows the design of parallel-prefix Ling adders. The proposed approach saves one-logic level of implementation compared to the parallel-prefix structures proposed for the traditional definition of carry lookahead equations and reduces the fanout requirements of the design. Experimental results reveal that the proposed adders achieve delay reductions of up to 14 percent when compared to the fastest parallel-prefix architectures presented

for the traditional definition of carry equations.

F. Vasefi et. al. [10] presents 4-bit Ripple Carry Adders (RCA), 12-bit Carry Select Adders (CSA), and a 4×4 Braun Multiplier, based on lowest number-of-Transistor full adders, were designed and simulated. The designed full adders consist of 10 Transistors and were used for n-bit adders with output voltage levels having a maximum of one threshold voltage (VT) degradation. The 10 Transistors adder achieved a 43.68% reduction in the power dissipation compared to the standard CMOS-28T Adder. Power consumption can be further reduced by using an extra stack transistor. A 12-Transistor Adder was also designed for low area Array Multipliers.

III. BRAUN MULTIPLIER WITH PARALLEL PREFIX ADDER

The Braun multiplier is one type of parallel array multiplier. The implementation of the Braun multiplier consists of Carry Save adders, No. of AND gates and one Ripple Carry Adder (RCA). Carry save adder is a digital adder which is used to compute sum of three or more n bit binary numbers. It is same as Full adder. A ripple carry adder is a digital circuit which produces the arithmetic sum of binary numbers. These types of multipliers having the glitching problem. To overcome these types of multipliers RCA is replaced by the PPA. The design structure of the Braun multiplier is shown in Fig. 1. The delay of these multipliers is more overcome by the PPA. This structure is used to increase the speed and reduce the delay of the system. The PPA is added at the final stage of the multiplier. The purpose of the adders is to reduce the delay of the system.
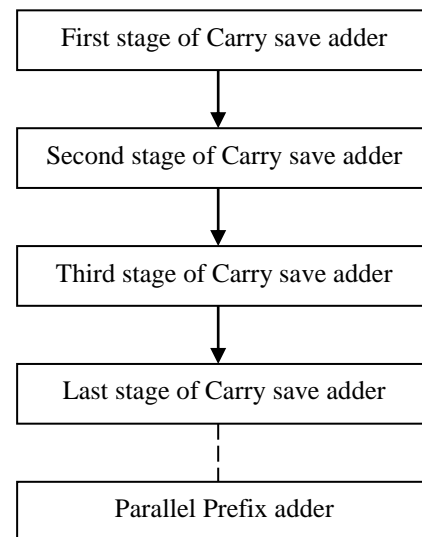
Fig. 1: Designing of braun multiplier with PPA

In Braun multiplier, the partial products are first computed in parallel, then collected through a cascade of different types of adders. It consists of an array of AND gates and adders arranged in an iterative structure which doesn't require any logic registers. Two types of Parallel prefix adder (PPA) are considered in this paper and these are Kogge-stone adder and Brent-Kung adder.

Kogge-Stone Adder is a parallel prefix adder. There are 3 stages for computing the sum bits. The computation of carry is as fast as it takes O(log n) time to generate carry. Braun multiplier is designed with Kogge-Stone adder for reducing area and increasing its speed compared to conventional Braun multiplier which is used in most of the modern DSPs. The delay of whole multiplier depends mostly on the delay of Full adders array in the last stage, where its functionality is similar to RCA. The Delay produced from the RCA can be reduced by using one of the Parallel Prefix Adders "KOGGE STONE ADDER".

A simpler tree structure could be formed, if only the carry at every power of two positions is computed as proposed by Brent and Kung. An inverse carry tree is added to compute intermediate carries. Its wire complexity is much less than that of a Kogge-Stone adder. The delay of the structure is given by [(2)(log n) - 2] and the number of computation nodes is given by 2 [2(n) - 2 - log n].

4 bit Braun multiplier contains two inputs of 4-bit i.e., A0-A3 and B0-B3 and the output is 8-bit which is P0-P8. For layout, to make the connections easier, an AND gate and a Full adder is taken as one unit. 9 of such units are placed accordingly in the layout. The top layer consists of 4 AND gates, which is taken as one instance. The remaining 3 and gates to the extreme left is taken as one more instance. All these are placed accordingly as shown in Fig. 2. The layout is successfully checked for zero DRC (Design Rule Check) and LVS (Layout vs Schematic) errors.
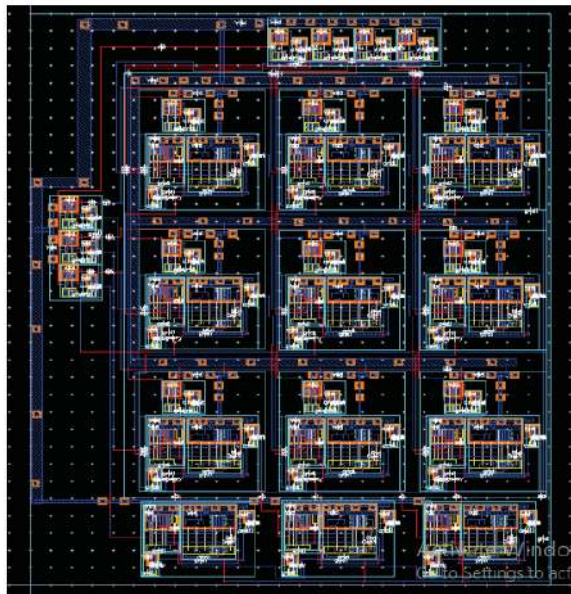
Fig. 2: 4 bit Braun multiplier layout

The circuit used in the 4-bit Braun multiplier is taken as the instance for the schematic implementation of the 8-bit Braun multiplier. Here there are two inputs each of 8-bit which is A0-A7 and B0-B7. The outputs are P0-P15 which is 16-bit. The following Fig. 3 gives the schematic of 8-bit Braun multiplier using 4-bit as an instance.
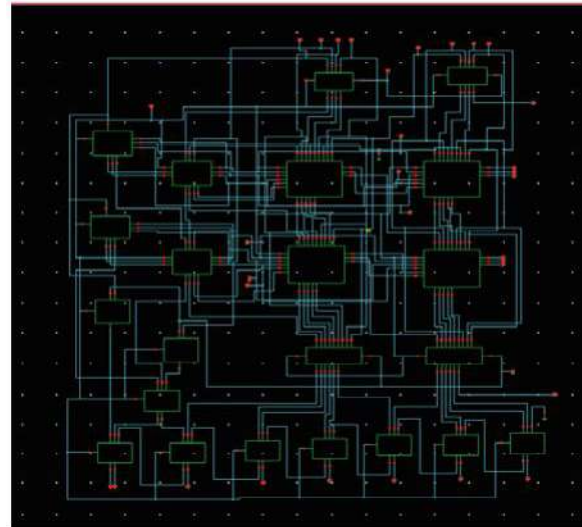
Fig. 3: 8 bit Braun multiplier schematic

IV. SIMULATION RESULTS

The designs are done in TANNER SEDIT 12.0 tool and the simulations are done and the power results are obtained in the TANNER TSPICE 12.0. The power comparisons of different units for the Conventional Braun Multiplier and Braun Multiplier with Parallel Prefix Adder values are represented in below Table 1 as follows:

Table 1: COMPARATIVE TABLE FOR POWER AND TIME DELAY

Method	Time delay (ns)	Power (mW)
Conventional Braun Multiplier	20.25	26.54
Braun Multiplier with PPA	2.84	11.2

The graphical representation of the Power Consumption for both multiplier blocks are represented in below Fig. 4.
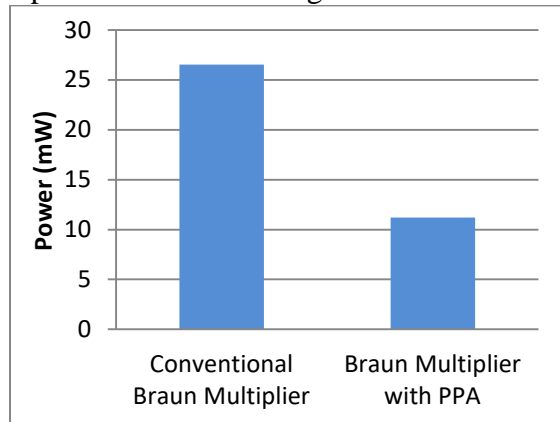
Fig. 4: COMPARISON FOR POWER CONSUMPTION

The graphical representation of the Time delay for both multiplier blocks are represented in below Fig. 5.
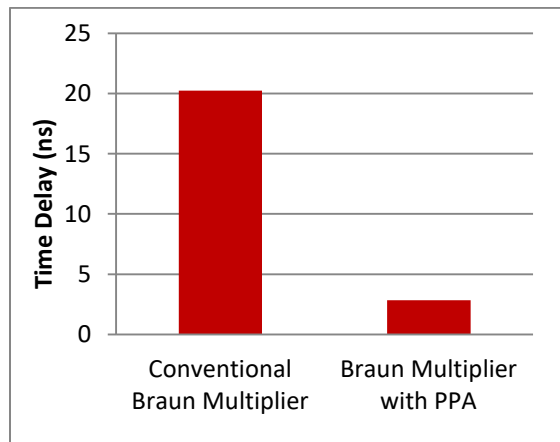
Fig. 5: COMPARISON FOR TIME DELAY

From results it is clear that, the described Braun multiplier with Parallel Prefix Adder method having less power consumption and less Time delay than Conventional Braun Multiplier.

V. CONCLUSION

In this paper, Braun Multiplier architecture with Parallel Prefix Adder for Arithmetic Pipelining is described. The Braun multiplier can be used in the application where the speed of the operation is to be increasing. The Parallel prefix adders are faster because of less delay and area efficient compared to other basic adders. By this when we added PPA in the final stage of the multipliers that have been reducing delay. From results, Time Delay of Braun multiplier with Parallel Prefix Adder method is very less and power consumption is also low. From this we conclude that the combination of both multipliers and PPA gives the best results.

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FACTORS EFFECTING ON CONSUMERS PURCHASE DECISIONS FOR MARKETING APPLICATIONS

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ABSTRACT: Online customer review is one of the most important factors that influence customer purchase decision. The purpose of this research was to study how different factors of consumer behaviour effect on decision-making. Consumer behaviour consists of four factors: cultural, social, personal and psychological. Various factors of perceived value in review content will cause different impact on purchase decision. The study identifies independent variables including demographic factors, consumer behaviour factors, and marketing mix factors. Both demographic factors and marketing mix factors do not have significant relationship with the consumers' purchasing decisions. Buyer decision is limited only to social, personal and psychological factors. The results shows that the consequence of perceived risk is a negative tendency to purchase; while that of perceived benefit has a positive tendency. This conclusion will instruct sellers to adjust their products factors to improve consumer's satisfaction and increase their purchase rate.
KEY WORDS: Purchasing decision, Consumer behaviour, and consumer purchase decision, decision-making process

I.   INTRODUCTION

With the rapid development of electronic commerce, product and service reviews have become one of the most important factors that influence consumers purchase decision. Consumers focus on specific points of a review, depending on individual differences and interests therefore different reviews; of the same product will each have a different impact on consumers purchase decision. Research on reviews and the reviews content dimension has become increasingly mature in electronic commerce, while little research about the influence of review Content dimension has been done [1].

Therefore, this study analyses review and purchase decision data using data mining and machine learning; to mine the influence that content has a decisions this Information can be used by sellers to adjust their strategies in order improve consumers Satisfaction. The purposes of this study are as follows:

(1) Research factors that are of perceived value in product reviews content
(2) Generate review features and divide them into perceived value factors.

Consumer's interest to purchase a product or service always depends on the willingness to buy and at the same time ability to pay for the product [2]. Though they are willingness and ability to pay then also the consumers change their buying decisions because of the influence of various factors such as psychological factors, personal factors, cultural factors, social factors influence on family members, economic factors and social media, etc. An individual who purchases products or services for the purpose of using for himself/herself is known as an end user or consumer.

Consumer buying behaviour always reflects why do consumers buy products with an interest? What are the factors influencing them? How do they take purchase decisions? Why should marketers know about status of consumption and impact of external environment on buyer's decision, etc.

Consumer behaviour is broadly studied field. It lets the companies understand how consumer decides about buying their product or acquiring services [3]. Marketing managers are always interested to know more about consumers' behaviour so they can prepare better communication

and advertising campaigns and messages about their products and services. Consumer makes buying decision every day and many people don't even know the factors which derive them to this decision. Usually the factors affecting consumer buying behaviour include psychological, social, cultural and Personal (Kotler and Armstrong 2011, 134). Buying the new home cleaning service involves consumers' research for the best option available and it might take various factors in account in its decision-making process.

This is about studying which factors of social, cultural, personal or psychological characteristics has the most effect on consumer decision making process when selecting home cleaning service company. The research work is carried out to highlight the important elements for customers in the household cleaning and let the service provider understand overall picture of customer behaviour towards the cleaning company with the help of understanding the factors affecting consumer behaviour for choosing a certain service provider [4].

Better understanding of consumer behaviour would let the marketers make the service structure as desired and attractive for the household customer and maintain business activities according to customer demands. This research work would let the general house cleaning customer record their voice in understanding the companies what kind of service do they want which can improve their life quality with the tailored services by the service provider.

II.   BACKGROUND

Consumer behaviour is a widely studied field. Understanding it completely is impossible, because it is related so closely to human mind. However, forecasting how a human behaves in purchasing situations can be estimated through previous purchasing decisions. Consumers make buying decisions every day and many

people do not even know the factors that drive them to this decision. Buying a coffee comes almost automatically and does not need much information search. There are characteristics behind every buying decision that can come from cultural, social, personal or psychological factors. Each of these factors includes dimensions that can be used in marketing. Marketers can use these factors so subtle that consumers might not even recognize it. Consumers might think that "I have always bought this same brand or product", but they do not recognize that the affecting factor behind this decision can come from their family.

They studies these factors behind purchasing decisions through personal, social and psychological factors of consumer buying behaviour. The author has chosen coffee brands as a research subject on this thesis. Coffee is daily used commodity and the purchasing decision can be made routinely without any conscious activity. It is interesting to study how the consumer has ended up selecting the specific coffee brand and what has been the effect of social, personal and psychological factors.

Nowadays companies are more concerned on individual consumer behaviour. It helps them to yield information about how the consumers think, feel and choose their products. Every individual is consumer. Consumer behaviour is the study of the processes involved when individual or groups select, purchase, use, or dispose of the product, service, ideas or experiences to satisfy needs and desires. The expand view of consumer embrace much more than the study of why and what consumer buy, but also focuses on how marketer influence consumers and how consumers use the products and services [5]. Customers are in a tough spot. Individuals have exposed to different window of information and varieties of products; many great deal of choices and options available in the market

place impulse their purchase decision. However the interpretation and decision making is different among individuals and also influenced by internal consumer behaviour (perception, attitude, and motivation) and external factors (family roles, peer influence and group influence).

III.   LITERATURE REVIEW

Besides that defines the consumer behaviour's main factors and performs the interaction of Environmental Factors (including marketing stimuli (MIX) and environmental stimuli), Buyer's Black Box and finally Buyer's Response. In addition, identified that purchase decision consumer is activities directly related to obtaining, consuming, and disposing of products and services, including the decision processes that precede and follow these actions. In services require time (holiday, travel, etc.), decisions are forming important part of consumer behaviour. One notice thing is that purchase decision does not finish with purchase of goods or services, but also post purchase activities are consisted of consumer behaviour.

This research considers about the meaning of Engal, Blackwell &Miniard with consumer decision-process model. Thus, purchase decision consumer includes three main actions: purchase, consumption, disposal cargo handling services. Consumer decision is the active factor of competitive theories. Several researches can be identified as centre to the job and worldview of behavioural economists and other behaviour analysis. It claims that the behaviour environment relationships observed by psychologists can be known as economic in market.

The research of consumer decision for any product is important to marketers in forming the properties of their organizations. It is vital for controlling consumption of goods and maintaining market stability. In addition, it is helpful in growing ways for the more efficient

utilization of resources in marketing. It also helps in solving marketing management challenges in more effective way. The development of consumer protection movement has made an urgent demand to understand how consumers create their consumption and purchasing decision. Consumers' tastes and favourites are rapid changing. In conclusion, consumer behaviour helps in constructing of production policy. For effective market segmentation and target marketing, it is important to have knowledge of consumers and their purchase decision.

IV.   FACTORS EFFECTING CONSUMER PURCHASE DECISION

The idea of buying some product or services does not come suddenly but carry long process of thinking, analysing options, and taking other factors in account to reach the conclusion. These days marketing decision makers spend more money than ever to understand who buys? Why do they buy? When do they buy? Where do they buy?

Consumer purchases of goods and services are highly influenced by cultural, social, personal and psychological characteristics as show in figure 1. As though it is not completely possible to keep control on these factors but marketer must keep in mind these factors into account.

CULTURAL	SOCIAL	PERSONAL	PSYCHOLOGICAL
• Culture	• Reference Group	• Age & Lifecycle Stage • Occupation	• Motivation • Perception
• Subculture	• Family	• Economic Circumstances • Life Style	• Learning
• Social Class	• Role & Status	• Personality	• Belief & Attitude

Fig. 1. Factors Affecting Consumer Behaviour

4.1. CULTURAL
Some other factors such as sub culture, social class affect the consumer behaviour significantly which is explained in the following:

A. Cultural factors

Culture has the most important impact on consumer buying decision. It comprises of all the values, wishes, observation, attitude and values from his family and important institutions. Every country of the world has different cultures and its influences on the consumer buying decision may vary from one country to another. Marketers should be highly careful in adjusting the marketing campaigns according to the cultural setup in specific part of world to avoid the misapplication.

Cultural factors also effect the decision-making power within a family and the decision-making leader vary in different parts of the world. Male dominancy is more visible in African cultures who might exercise their power in decision making process whereas in westerner culture men and woman are almost equal and decision is made impartially, possibly because both earn money to live in. It's also vital to keep a sharp eye on cultural shifts which can make room for marketers to launch new product that might be wanted. In the Muslim cultures, the month of Ramadan is considered the Holy month and different companies launch new product across the countries to add to their product line.

B. Sub culture

A part of the society in different parts of the world, comprises of people sharing similar customs, traditions and behaviour generating sub-culture within a broader culture. In India where many sub-cultures exist, culture of people from south depicts different values system from people in north, and west different from east. Similarly, the Muslim of one part of the country would be showing different level of interest from Hindu culture within a country for some product or service. Marketers are de-signing products according to the similar interest and background of the people to get the expected results.

In United States of America, companies have started different campaigns to attract people from specific ethnic groups and make them loyal towards the brands. The large group of people include Hispanic American, Asian American, and African American as well as Mature consumer. Seeking the needs of such sub-cultural groups marketing teams often make tailored products and set their marketing programme according.

C. Social class

This group of people, sharing the similarities in occupation, wealth, income, education, power and prestige, form a unique buying behaviour. In this group, people share the same values and purchase similar products or services. Those, representing this class prefer to buy similar brand and product such as clothing, leisure, car industry. Marketers are very interested in social class as it would be easy to target them with the similar marketing programme based on their common liking pattern.

4.2 SOCIAL

Some other factors such as family, reference groups etc... also effect the consumer behaviour significantly which is explained in the following:

A. Reference group

In our surrounding we see schools, universities, clubs, distinguished individuals, friends they all serve as reference group. These formal and informal group make the consumer mind by shaping attitude or behaviour of consumer. Reference groups are usually symbolized as having the people who are acting as leader for the group and they influence others in a certain way. Such leaders are considered having more expertise and knowledge about some specific point. Sometimes groups to which a person does not belong also exert great influence as ones wishes to belong to it, form aspirational group and they attract people in a unique way.

B. Family

Family members are the most important reference group in influencing the consumer behaviour. In a family all the customs, values and tradition one child learns later be-comes part of life and which set the various kind of behaviour and attitude pattern about different things (Khan 2006, 30). Another aspect of family consumer behaviour is also to know the decision maker, as in some family its husband making decision and sometimes wife purchases certain items. Whereas Children also influence a lot in buying child related accessories. To successfully influence the consumer behaviour in a family, it's crucial for marketers to know who is making decision about buying product or service in question.

4.3 PERSONAL FACTOR

A decision can be influenced by personal factors such as individual age and life cycle stage, occupation and etc.

A. Age & lifecycle stage

Over the time individual change their preferences in buying some product or service. It is the age and time in life cycle due to which we make changes in clothing, furniture, recreation, and taste in food. As the family gets mature and experienced it changes in buying pattern significantly over the time. It is common to change purchasing behaviour during family life stage and switching to brands. Typical family was consisting of young singles and married couples with children but now a day the trend is getting shifted towards more non-traditional stages of family such as unmarried couple, childless couples, same sex couple, single parents and single marrying later in life, carrying various buying behaviour pattern.
Occupation

B. Occupation

An individual's purchasing power and occupation shape his purchasing pattern for goods and services. In some societies marketers try to estimate the purchasing power of individuals with their occupation and they use occupational prestige to know the worth of people (Solomon 2006, 438). To give special service, marketer sometimes tend to provide tailored products and services to high ranked occupational groups, so they always try to understand the right groups who have interest towards their product.

4.4 PSYCHOLOGICAL

Consumer behaviour is also highly influenced by four psychological factors, i-e motivation, perception etc.

A. Motivation

A consumer can have various needs at a point of time and they might include some of biological necessities which can appear with the stressing state as hunger, thirst or discomfort. Some other needs could arise psychologically from need of recognition, belong and esteem. When intensity of desire to get something rise to a sufficient level it originates the motive, which is need pressing a person mentally to quench the satisfaction. To understand better social scientist has come up with two famous theories of motivation for human mind.

B. Perceptions

A person with some motivation is always ready to act but the way of action could be different from individual to individual influenced by his perception of the situation. There is big chance of responding differently for two individuals again some stimuli as the perception of situation might be different with both. People have a possibility to establish different perception of the same stimuli on account of three perceptual processes: selective attention, selective distortion and selective retention. In the selective attention process a person focuses only on small number of stimulus that he is exposed. Usually in this process con-summer focuses only on their current need while neglecting all other stimuli coming in the environment.

V. CONCLUSION

The aim of this study was to study that how cultural, social, psychological and personal factors affect in making purchase decision and to gain information on consumer decision making process. The theory part included the overview of these factors and

steps of the decision-making process. A questionnaire was created based on these issues. Results of the empirical study indicated that there was a relationship between social, personal and psychological factors but it was not credible. Research shows, all factors of perceived benefit have a positive influence on purchase decision.

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A HIGH PERFORMANCE AND EFFICIENT VLSI ARCHITECTURE OF MASKED AES FOR PRESENT LIGHTWEIGHT CIPHER

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ABSTRACT: In this digital era, the usage of technology has increased rapidly and led to the deployment of more innovative technologies for storing and transferring the generated data. The study of lightweight symmetric ciphers has gained interest of many researchers. Advanced Encryption Standard (AES) is a specification for electronic data encryption. This standard has become one of the most widely used encryption method and has been implemented in both software and hardware. Lightweight cryptography plays an essential role in securing the data in this emerging pervasive computing environment.This paper introduces a high performance and efficient VLSI architecture of Masked AES for PRESENT Lightweight Cipher. This paper presents an efficient 80-bit and 128-bit key lengthsAES design using a masking scheme which is resistant to a side channel attack. This masked design is implemented in TSMC 22nm technology.The resulting implementation is high in performance, low in energy and silicon area. A throughput of 416 Mbps and power consumption is about 16 mW for both key lengthsat 216 MHz frequency. The energy consumption is at 9.77pJ/bit or 1.25nJ/block.

KEYWORDS: PRESENT Lightweight cipher, Masked AES, VLSI architecture.

I. INTRODUCTION

Transactions, electronic mail, audio/video conferencing etc., secure communication is very essential. The secure communication requires a mechanism, which insures that no unauthorized person can access the communicated information over the unsecure medium [1]. Thus, to accomplish the task of information security; cryptography is must. Cryptography is a science that enables the confidentiality of communication through an insecure channel [2].

The basic cryptographic processes consist of conversion of plaintext into a ciphertext by the process of encryption and retrieval of the plaintext from the ciphertext by decryption process [3]. The cryptographic process is used for authentication in many applications such as: in bank cards, wireless telephones, e-commerce, pay-TV, etc. Encryption or decryption is also required for the access control in many systems, such as carlock systems, lifts, metro trains, etc. Nowadays it is widely used for electronic payment in prepaid telephone cards, e-cash cards etc.

The Advanced Encryption Standard (AES) is a FIPSapproved cryptographic algorithm that can be used to protect electronic data [4]. Although AES has excellent resistance against algorithmic attacks it is vulnerable under side channel attacks (SCA). A well cited SCA named Differential Power Analysis (DPA) has brought much attention in the literature. DPA is a more advanced form of side channel attack that can allow an attacker to discover the intermediate values within cryptographic computations through statistical analysis of data collected from multiple cryptographic operations. DPA has been shown in practice on ASIC AES implementation in details.

The majority of the conventional cryptographic algorithms have been developed around desktop/server centric environments. Therefore, many of these cryptographic algorithms are generally unsuitable for implementation in constrained devices which are used in the modern-age applications. In many conventional cryptographic standards, the trade-offs between security, performance and resource

requirements were optimized for desktop and server environments. This makes the implementation of conventional ciphers difficult in resource-constrained applications and their performance may not be acceptable. The shift from desktop-based applications to small-device centric applications brings a wide range of security and privacy concerns. Lightweight cryptography provides a solution tailored for resource-constrained devices and their efficient VLSI implementations.

High-performance andefficient VLSI architecture for the PRESENT lightweight cipher that completely integrates both encryption and decryption engines is described in this paper [5]. The architecture is capable of running at a clock frequency of more than 210 MHz. The dynamic power dissipation is about 16 mW when the architecture has been operated with around two thousand random input vectors. Rest of this paper is organized as follows: literature review is In Section II, described architecture and its analysis is introduced in Section III, Section V is used to provide experimental results along with a comparison with an existing architecture, finally, conclusions are drawn in Section VI.

II. LITERATURE SURVEY

L. Malina et. al. [6] a comparison of software oriented lightweight block ciphers on a smartphone platform is presented. In that work, the authors evaluate a wide set of algorithms implemented in Java using runtime as a metric and perform physical current measurement for three ciphers of the set. Van Dyken et al. [7] have proposed three schemes as well. The first scheme, known as the Direct Optimized Routing (DOR) scheme, is designed based on a repeated round block. The key expansion mechanism generates only the next round key from the current round key in each

encryption round. The S-Box utilizes the look-up table approach as well but will only operate if the input changes. The second proposed scheme is the Direct Optimized Routing with Key Storage (DOR+K) scheme. This scheme applies input bus sharing between the data input and secret key input in order to reduce the I/O ports requirement of the design and reduce power consumption.

As pointed out by Mathew et al. [8], it is a common consensus that the substitute byte transformation is the bottleneck for this encryption scheme. Naturally, we see that most of the related works have chosen to work on the AES SBox for the optimization of AES to satisfy different requirements. In this work, we are concerned about the performance parameters of a complete AES block cipher. As such, our design encompasses all the components necessary for a complete AES-128 encryption.

J. Grossschadlet. al. [9] presents the most recent case of testing for AES and PRESENT is found in this case a framework for the benchmarking of lightweight block ciphers on several embedded platforms is presented. The paper compares a wide set of block ciphers using the execution time, RAM footprint and (binary) code size as metrics for AVR, MSP and ARM platforms.

The Dandalis scheme [10] uses a separate clock for the key expansion mechanism in order to reduce key latency. The AES S-Box is implemented using the look-up table approach. The Open Core schemes shares a similar structure as the Dandalis scheme. The Open Core scheme is designed specifically to perform only AES-128 encryption. The unique characteristic that distinguishes it from other schemes is that the input buses for the data and secret key are only 64 bits wide. As such, the Open

Core scheme uses two cycles to complete the input process.

III. MASKED AES FOR PRESENT LIGHTWEIGHT CIPHER

The architecture of high performance and efficient Masked AES for PRESENT Lightweight Cipher is represented below Fig. 1.
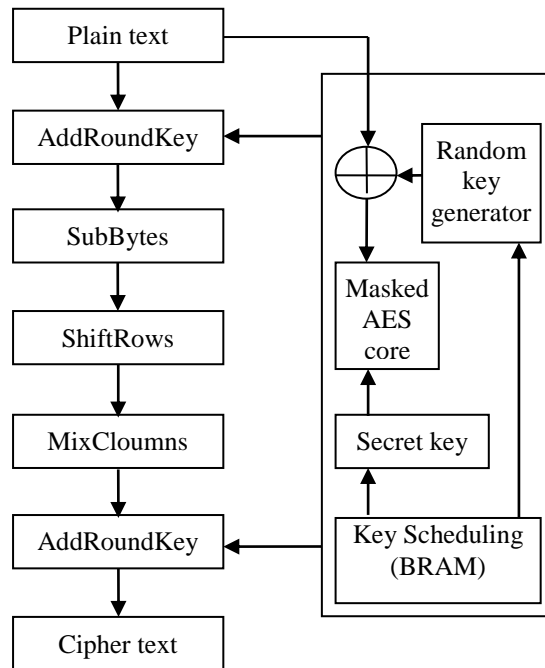
Fig. 1: ARCHITECTURE OF MASKED AES FOR PRESENT LIGHTWEIGHT CIPHER

AES is a symmetric cryptosystem based on a substitution permutation network. It is a block cipher which has a fixed plaintext of 128 bits and key size of either 128, 192, or 256 bits. It has 10, 12 or 14 rounds depending on the key length. Here, an iterative type of architecture is considered for saving the resources and computation time. To implement the PRESENT block cipher a 64-bit data path is chosen, mainly to implement the permutation operation efficiently. The architecture consists of a set of registers, multiplexers and XOR gates. To differentiate between the encryption and decryption operations, two 64-bit

multiplexers are deployed in the data path. In the proposed architecture, the inputs and outputs are registered. The output register is added to synchronize the output with the last round.

AES encryption consists of both linear and nonlinear transformations. Nonlinear transformations complicate the masking process. The idea behind masking is that before data enters a function, it must be added to a random mask. By this masking process the actual data values is hidden from any attackers. To unmask, we simply add the masked output to the transformed mask. Transformations such as Shift Rows, Mix Columns, and AddRoundKey are linear operations. Masking and unmasking processes are relatively straight forward. Sub Bytes is a nonlinear operation and will require additional effort to obtain the transformed mask.

Sub Bytes involves replacing each byte of the state with a 8-bit substitution box called the S-box which is a non-linear transformation. Shift Rows cyclically shifts the each row of the state matrix by a certain offset. In Mix Columns, the four bytes of each column is combined with an invertible linear transformation. Lastly, AddRoundKey simply adds or XORs the current state with the Round Key. In the final round, the Mix Columns step is omitted and the cipher text is obtained after completing the AddRoundKey step in the final round.

The PRESENT algorithm works on a block size of 64-bit and supports two key length variants of 80-bit and 128-bit. The principle of PRESENT cipher is based on the concept of substitution and permutation network (SPN). There are total 31 rounds and each round consists of an XOR operation, a nonlinear substitution layer operation is performed in each round and this layer

consists of a 4-bit S-box which is applied 16- times in parallel. In addition to that, there is a linear bitwise permutation layer.

The AES implementation consists of the masked AES core and a 128 bit LFSR to generate the encryption masks. The masked AES core performs 128 bit encryption. The process is done in 10 cycles, computing 1 round per cycle, with the hardware of each round being reused to save area verses a fully unrolled implementation. Here, the computed keys have been simultaneously stored in a block RAM (BRAM) so that there is no need to compute the last round key for other blocks of input. The advantage of using the integrated architecture is that there are some resources which can be used in both encryption and decryption operations.

Key scheduling unit works in the storage mode. Here, computation of the round keys is performed only for the first block of data and the computed round keys are stored simultaneously in the BRAM. This computation mode offers a reduced number of clock cycles for the decryption operation. The key storage mode is also beneficial for processing a large chunk of data which contains multiple blocks that has to be encrypted or decrypted with the same key.
There are three steps in the key scheduling process. First, the intermediate key is left-rotated by 61 bits. Then, the first leftmost 4 bits are passed through one S-box for 80-bit key length and two S-boxes for 128-bit key length.

Finally, in the third step, 5 bits of the intermediate key are XORed with the counter value and after that, the 80-bit (or 128-bit) key is written to the data_in port of the BRAM. The intermediate key is read out from the data_out port of the BRAM and first leftmost 64 bits of intermediate key i.e.,

round key is XORed with the intermediate state of that particular round. The masked plaintext and the mask are, then, fed through the "masked AES core" which encrypts the masked data with the secret key. Result masked cipher-text is input into the unmasking module to arrive at the intended cipher-text.

IV. RESULT ANALYSIS

Masked AES designs are synthesized and place and routed using TSMC's 22nm technology. ized and place and routed using TSMC's 22nm technology. The unmasked AES core uses 6754 cells and fits in a chip area of 100um x 100um. The masked AES uses 16107 cells and fits in a chip area of 130um x 130um which includes an additional 128-bit LFSR. The architecture with an 80-bit key (PRE_80) is consuming only 0.73% slices while the proposed architecture with a 128-bit key (PRE_128) is consuming 0.87% slices. The PRE_80 architecture consumes 32 80 × bit size block memory, whereas, the PRE_128 architecture needs 32 128 × bit size of memory to store the intermediate keys.

To evaluate the Side Channel Attacks (SCA) resistance of the masking scheme designed, the unmasked and masked AES are both implemented in TSMC's 22nm technology. Both designs are fully synthesized and place and routed. Post-layout netlists with RC annotation are simulated with CustomSim. The chosen attack point is the first SubBytes operation since every 8 bits of the SubBytes output is determined only by the same 8 bits of the input. The unmasked AES is successfully attacked. In contrast, the CPA results of the masked design resulted as he correct key is hidden from the attacker.

The comparative performance of the design is evaluated in terms of power dissipation, latency, maximum frequency and throughput

for described Masked AES for PRESENT Lightweight Cipher and AES for Block Cipher. For comparison, the key scheduling unit is implemented using on-the-fly mode rather than storing the computed keys in the BRAM.The architecture consumes around 16 mW power at 216 MHz frequency. Both the operations have a latency of 33 clock cycles. However, the decryption operation requires an additional 33 cycles for round key generation for the first block of ciphertext. Throughput of the design is around 415 Mbps for both the key lengths.The energy consumption is at 9.77pJ/bit or 1.25nJ/block.

Table 1: PERFORMANCE COMPARISON TABLE

Parameters	AES for Block Cipher	Masked AES for PRESENT Lightweight Cipher	
		PRE_80	PRE_128
Power dissipation(Mw)	167.9	16.58	16.94
Frequency (MHz)	180	215.5	210.4
Throughput (Mbps)	280.4	417.8	410.8

By this, we can say that the proposed integrated architecture is capable of performing both the encryption (ENC) and decryption (DEC) by the same set of hardware, which is an essential requirement in any practical lightweight cipher-based system. The results show that the masking scheme effectively hides the secret key.

V. CONCLUSION

A high performance and efficient Masked AES for PRESENT Lightweight Cipher architecture is designed in this paper.The architecture supports both the encryption and decryption operations with 80-bit and 128-bit key lengths.The architecture consumes around 16 mW power at 216 MHz frequency. Both the operations have a latency of 33 clock cycles. Throughput of the design is around 415 Mbps for both the key lengths.The energy consumption is at 9.77pJ/bit or 1.25nJ/block. The results show that the masking scheme effectively hides the secret key.The proposed architecture is area-efficient with high-performance capability for providing an adequate level of security under the resource constrained environment for IoT and cyber-physical systems (CPS) applications.

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INTEGRATING COOPERATIVE LEARNING AND CREATIVE PROBLEM SOLVING IN ENGINEERING MATHEMATICS USING FRAMEWORK

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ABSTRACT: Creative problem solving (CPS) is a multi-step method for solving problems in various disciplines that can support students in the learning of mathematics. Although CPS is cooperative in nature and is most productive when done as a team, CPS cannot utilize the full potential of teamwork to connect and share ideas among groups in the process of solving problems. Cooperative learning (CL) has additional elements designed to develop groups into a learning community. Both CL and CPS elements are combined to create a problem solving framework to guide students through the CPS cycle according to CL principles and to transform group discussions to class discussions. The main objective of this study is to propose a cooperative creative problem solving (CCPS) framework to support student problem solving in engineering mathematics. The designed framework can encourage engineering students to learn mathematics in their teams and overall class discussion.

KEY WORDS:cooperative learning; cooperative creative problem solving; creative problem solving; engineering mathematics.

I.INTRODUCTION

The main goal of mathematics learning for engineering students is the ability of applying a wide range of mathematical techniques and skills in their engineering classes and later in their professional work. Mathematics subjects are important courses for engineering students, provide them to work with several mathematical ideas and also use this knowledge in their engineering fields.

The lack of understanding of concepts in engineering

Mathematics may hinder the understanding of other concepts or even subjects. However, for most undergraduate students, specifically engineering students, mathematics is one of the most difficult courses in their fields of study.

Current trends in technology and our increasingly complex society and the workplace require engineers to have a greater variety of capabilities, skills, and a wider understanding of engineering as a discipline, if they want to succeed. It means that graduate engineering students need the skills and abilities other than those relating to the discipline they studied.

Generic skills are becoming major and important requirements set by industrial competitiveness and graduates engineers who can think critically, solve problems and communicate are highly sought by employers. Rapid change of technology in society did not produce a corresponding change in engineering education and the same material basically is taught with the same tools and methods that have been used since many years ago. The limitations of traditional teaching and

learning styles may not only be the reasons of engineering students weakness in generic skills such as communication, teamwork, and problem solving but may also had caused engineering students encounter many obstacles in the learning of mathematics.

CPS as a problem solving framework can be used to support students thinking and generic skills in engineering, science, and even mathematics courses. CPS employs different thinking skills and tools, therefore, it can fundamentally improve the way students learn and support their generic skills.

The CPS model has changed and expended in many ways since its origins around six decade ago. The framework that exists today requires problem solver to make a thoughtful and carefully planned choices and to also decide on the best tools needed in order to solve their problems. In universities, various models and approaches to CPS were developed by researchers and developers.

The most important goal in using CPS for education setting is to enable the students to increase their ability in solving actual problems successfully as well as creatively. Some researchers used CPS framework in engineering, science and even mathematics courses. Lumsdaine and

Lumsdaine explained a CPS framework in teaching and learning of mathematics for engineering students in which by invoking generic skills such as communication and teamwork can support engineering students problem solving.

However, there is very little literature reporting on the foster of CPS to help engineering students in the learning of mathematics and in using computer tools. Furthermore, there is not much study done in supporting effective communication, teamwork, and problem solving in mathematics courses by CPS and computer tools.

Thus, in this study, we shall explore what are the theoretical reasons of using CPS through computer-based tools in teaching and learning engineering mathematics to support students learning and generic skills.

II. CPS FRAMEWORK

In universities, various models and CPS approaches were developed by researchers and developers. The most important goal in using CPS in an education setting is to enable students to increase their ability to solve actual problems successfully as well as creatively. Some researchers used CPS framework to solve problems in engineering, science and even mathematics courses.

The CPS model has been changed and expanded in many ways since its origin around six decade ago. The framework that exists today requires the problem solver to make thoughtful and carefully planned choices and to also decide on the best tools

needed in order to solve the problem. The current models include four components which are portrayed in a circular rather the linear fashion: Understanding the Challenges, Generating Ideas, Preparing for Action and Planning the Approach in eight different components.

The first component is Understanding the Challenges which includes "a systematic effort to define, construct, or focus one's problem solving efforts". This component includes three stages namely Constructing Opportunities, Exploring Data, and Framing Problems. Constructing Opportunities helps to shape the principal direction in terms of problem solving efforts by generating statements. Exploring Data involves helping problem solvers to understand the current situation by generating and asking questions. Framing Problems includes seeking and focusing on a specific statement to construct creative ideas.

The second component which is Generating Ideas uses brainstorming as a specific tool to generate options for responding to problems. The third component is Prepare for Action. This requires the problem solvers to explore ways to make promising options and to prepare for successful implementation. Developing Solutions and Building Acceptance are two stages of this component.

The Developing Solutions stage places emphasis on focusing and developing promising options into credible solutions. Building Acceptance helps problem solvers to implement creative ideas successfully by considering specific ways to evaluate results and effectiveness. The final component is Planning Your Approach. This component acts as a "management" component, in which it will guide problem solvers to

intentionally select and analyze "process" components and stages.

In other words, "Planning Your Approach involves keeping track of your thinking while it is happening, to insure that you're moving in the direction you want to go".

Appraising Tasks, as a first stage of Planning Your Approach, enables problem solvers to make informed decisions about applying the method and to increase their chances of success by utilizing the best from people, resources, and methods. Problem solvers choose and use the CPS components, stages, or tools that they really need in the Designing Process stage. See Fig. 1.
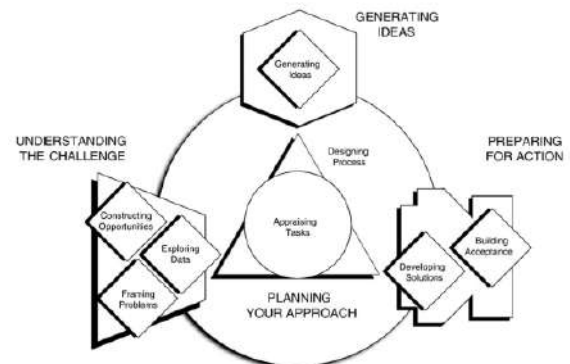
Fig. 1:CPS FRAMEWORK

CPS can even be used as a problem solving method in groups instead of individually. Students in their groups work in isolation and do not cooperate with or get ideas from other groups. In other words, team work in CPS can be considered during the problem solving process but CPS cannot utilize the full potential of teamwork to connect and share ideas among groups and even students in their groups. This means that solving mathematics problems requires a new framework to guide students in solving problem. It seems that CL has the potential to be cooperative during solving problems through CPS steps.

III. CCPS FRAMEWORK

The five CL principles that can support student learning during the CPS process are: positive interdependence, individual accountability, face to face interaction, appropriate interpersonal skills, and regular group function assessment. From the framework shown in Fig. 1, the model can be transitioned to the framework shown in Fig. 2 to emphasize the importance of ensuring cooperative work among students in the groups and the whole class. Referring to Fig. 2, there are three phases in the CCPS cycle. Phase 1 consists of the Individual Understanding the Challenges including Constructing Opportunities, Exploring Data, and Framing Problems.

After these stages students share and discuss their understanding in their own teams. The results of their teamwork are shared and discussed with other groups in overall class discussion. Phase 2 is the Team Generating Ideas stage. This phase involves sharing ideas in their groups and finally with other students as overall discussion. The final phase is Preparing for Action which consists of Developing Solutions and Building Acceptance. Findings are also shared in the group followed by overall discussion which is the last stage of this phase. In fact, sharing Understanding, Ideas, and Findings which involves Team Discussion and Overall Discussion replaces Planning Your Approach in the CPS circle.
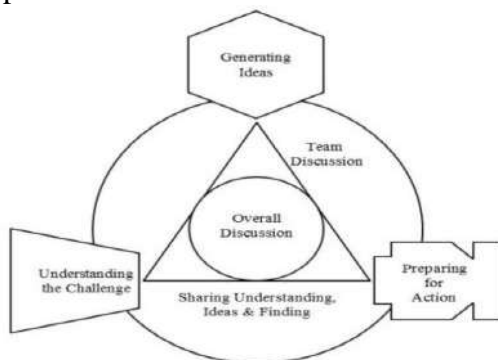
Fig. 2: THE COOPERATIVE CREATIVE PROBLEM SOLVING (CCPS) FRAMEWORK

By adopting the activities in CPBL for CCPS, the learning activities throughout the CCPS cycle which are designed to promote the principals of CL in the common elements of CCPS phases. The important component of the CCPS is Sharing Understanding, Ideas and Findings that are repeated at the end of each phase to share the understanding, ideas, and findings with the group's members followed by overall class discussion.

IV. CONCLUSION

This paper proposed a framework to determine when and how students can effectively use CL through CPS in the learning of engineering mathematics. The framework provides a coherent and balanced approach in using CCPS to enhance mathematics teaching and learning. In the CCPS framework, through the CPS process, the five principles of CL are emphasized and promoted to guide students in problem solving. The framework can be used by mathematics and engineering educators to guide their teaching practice. The framework can be tested to illustrate the power of CCPS by the use of teamwork and its potential impact on students' problem solving skills.

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INTEGRATING COOPERATIVE LEARNING AND CREATIVE PROBLEM SOLVING IN ENGINEERING MATHEMATICS USING FRAMEWORK	Khasim Pasha SD	H&S	The International journal	2019	ISSN NO: 0886-9367
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Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings

Sl. No.	Name of the teacher	Title of the book/chapters published	Title of the paper	Title of the proceedings of the conference	Name of the conference	National / International	r of publica	ISBN/ISSN number of the proceeding	Name of the publisher
1	N.ARUN BABU	NA	MICROSTRUCTURE AND MECHANICAL PROPERTIES OF AS-CAST AL7075-TUNGSTEN CARBIDE METAL MATRIX COMPOSITES	Materials Today: Proceedings; DOI 10.1016/j.matpr. 2019.06.319 Volume 18, Part 1, 2019, Pages 413-419	International Conference on Advances in Materials and Manuf acturing Engineering, ICAMME-2018, 24-25th January 2018	International	2019	ISSN: 2214-7853	Elsevier BV
2	V. Sudarsan Rao	NA	A Secure and Efficient Computation Outsourcing Scheme for Multi-users	Advances in Computing and Data Sciences. ICACDS 2018. Communications in Computer and Information Science, vol 905. Springer, Singapore	International Conference on Advances in Computing and Data Sciences ICACDS 2018: Advances in Computing and Data Sciences	International	2018	-13-1809-2; Online ISBN	Springer, Singapore
3	ARUN BABU NALLABELL	NA	EFFECT OF WELDING SPEED ON MICRO STRUCTURE AND MECHANICAL BEHAVIOUR OF FRICTION STIR WEDLDED AA 7075/WC METAL MATRIX COMPOSITES	Procedings of the 1st International Conference on Recent Trends in Engineering (ICRTEMMS-2018), Sep. 2018	1st International Conference on Recent Trends in Engineering (ICRTEMMS-2018), Sep. 2018	rnational Confer	2018	SBN: 978-93-5321-384-	SBIT

4	N.ARUN BABU	NA	MICROSTRUCTURE AND MECHANICs, Volume 5, Issue 1		International Conference on Processing of Materials, Minerals and Energy (PMME) 2016, 29-30 July 2016, Ongole, India, pp.82-88	International	2018	ISSN: 2214-7853	Elsevier BV
5	N.ARUN BABU	NA	PROCESS PARAMETER OPTIMIZATION FOR PRODUCING AA7075/WC COMPOSITES BY FRICTION STIRS WELDING	Materials Today: Proceedings, ISSN: 2214-7853, Vol: 5, Issue: 9, Page: 18992-18999	8th International Conference on Materials Processing and characterization (ICMPC 2018), 16th – 18th March 2018	rnational Confere	2018	ISSN: 2214-7853	Elsevier
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7	N.ARUN BABU	NA	EVALUATION OF MECHANICAL PROPERTIES OF AL 7075 REINFORCED WITH WC METAL MATRIX COMPOSITES, PROCEEDINGS OF INTERNATIONAL CONFERENCE ON TRENDS IN INDUSTRIAL AND MECHANICAL ENGINEERING	International Journal of Advanced Information Science and Technology (IJAIST) Vol.6, No.11, November 2017 DOI10.15623/ijaist	Trends in Industrial and Mechanical Engineering , (ICRTE 2017), ORGANIZED BY TELENGANA , PP. 8.	rnational Confere	2017	ISSN: 2319:2682	IJAIST
8	N.ARUN BABU	NA	FABRICATION AND FRICTION STIR WELDING OF ALUMINUM 7075/WC METAL MATRIX COMPOSITES	IJARSE: International Journal of Advance Research in Science and Engineering, , Vol. 6 Issue 7, July 2017, pp. 453-460	10th International Conference on Recent Innovations in Science, Engineering and Management (ICRTESM -2017) 12-13 Aug 2017	International	2017	ISSN:2319-8354	AR Research Publication
9	N.ARUN BABU	NA	Studies on Non Destructive test of friction stir welding of AA 7075-wc metal matrix composites welds	IJARSE: International Journal of Advance Research in Science and Engineering, , Vol. 6 Issue 7, July 2017, pp. 249-254	10th International Conference on Recent Innovations in Science, Engineering and Management (ICRISEM-17)	International	2017	ISSN:2319-8354	AR Research Publication

10	B. GOPAL	NA	IMPROVED PERFORMANCE OF MCUPQC WITH PV SYSTEM FOR POWER QUALITY MPROVEMENT IN DISTRIBUTED GENERATION NETWORK	INTERNATIONAL JOURNAL OF EMERGING TECHNOLOGY AND ADVANCED ENGINEERING, Volume 6, Issue 12, December	S IN ELECTRICAL AND	International	2017	ISSN 2250-2459	IJETAE
11	V.SUDARSHAN	NA	A SCHEME FOR SECURE OUTSOURCING USING ATTRIBUTE BASED ENCRYPTION	Proceedings of 4th international confrence on Science, Technology & Management (ICSTM - 2017), Institute of Electronics & Telecommunication	4th international confrence on Science, Technology & Management (ICSTM - 2017), Institute of Electronics & Telecomunication Engineering, Pune, India. 12th Nov. 2017	International	2017	SBN: 978-93-87433-00-	Conference Info
12	N.ARUN BABU	NA	HIGH CARBON FERRO CHROME SLAG-ALTERNATIVE MOULD MATERIAL FOR FOUNDRY INDUSTRY	ental Sciences 35 (2	ENCE ON SOLID WASTE	International	2016	ISSN: 1878-0296	Elsevier B.V
13	N.ARUN BABU	NA	INVESTIGATION OF PHYSIOCHEMIC	Procedings of the International Conference on Environment and Energy, Dec 2014 PP 139	International Conference on Environment and Energy, Dec 2014 PP 139	International	2014	SBN 978-93-81212-96-	ICEE
14	B.GOPAL	NA	POWER QUALITY IMPROVEMENT USING UPQC INTEGRATED WITH DISTRIBUTED GENERATION NETWORK	World Academy of Science, Engineering and Technology International Journal of Electrical and Computer Engineering Vol8 No17 2014	16th International Conference on Electrical Engineering: Theory and Application (ICEETA 2014), july 5-6 2014 pp 1-9	international	2014	eISSN: 1307-6892	World Academy of Science, Engineering and Technology

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Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number
Lock-In to the Meta Cloud with Attribute Based Encryption With Outsourced Decryption	1.V.Sudarshan,2.Dr. N.Satyanarayana,3 A.Dileep Kumar	CSE	IJCST	2014	0976-8491/2229-4333
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