Impulse

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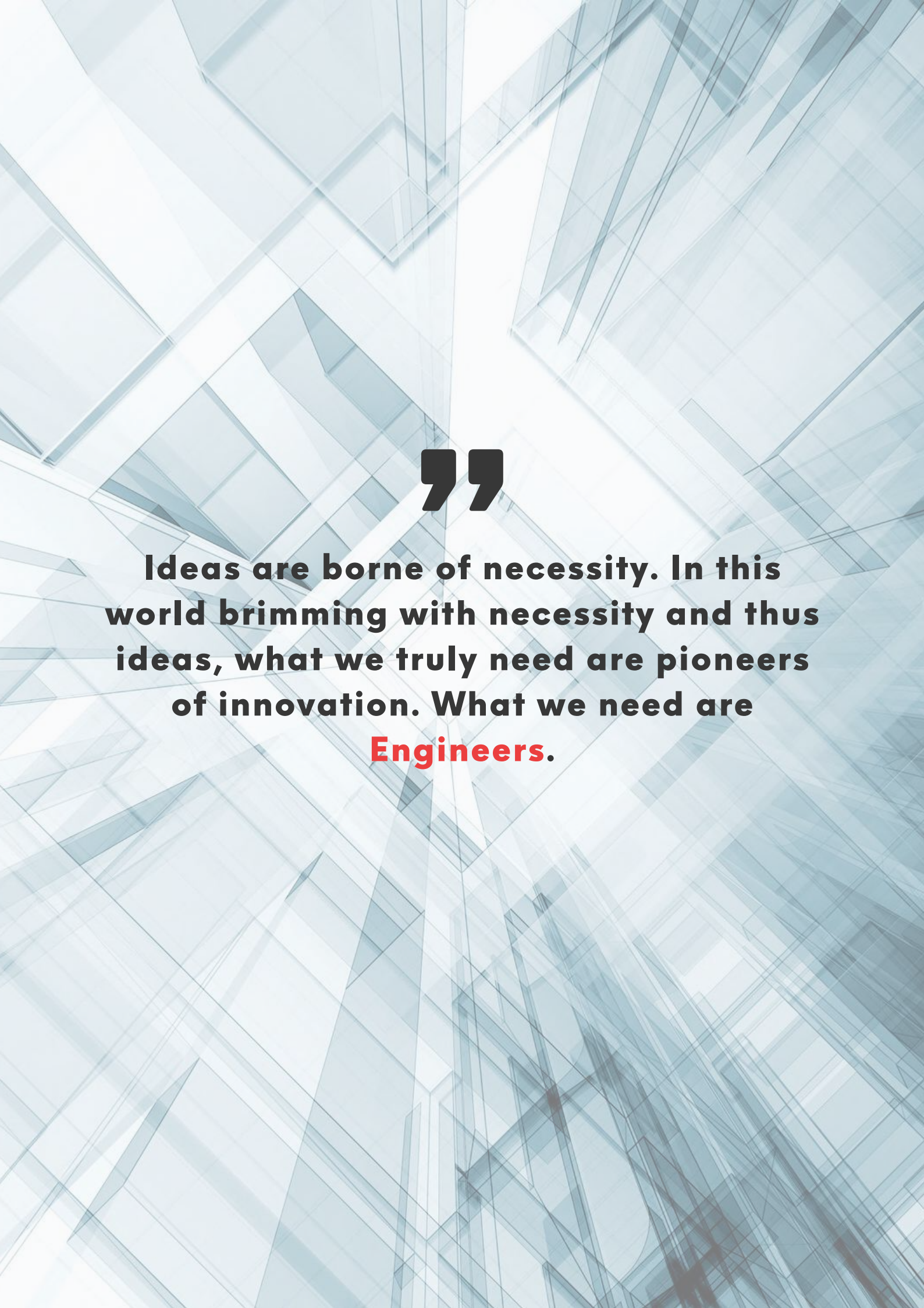
RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

IEEE PES
Power & Energy Society®

DEPARTMENT OF ELECTRICAL AND ELECTRONICS



Ideas are borne of necessity. In this world brimming with necessity and thus ideas, what we truly need are pioneers of innovation. What we need are Engineers.

DEPT. OF ELECTRICAL AND ELECTRONICS ENGINEERING, RSET

VISION

"To excel in Electrical and Electronics Engineering education with focus on research to make professionals with creative minds, innovative ideas and practical skills for the betterment of mankind."

MISSION

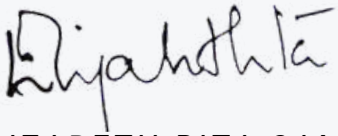
"To develop and disseminate among the individuals, the theoretical foundation, practical aspects in the field of Electrical and Electronics Engineering and inculcate a high degree of professional and social ethics for creating successful engineers."

HoD'S MESSAGE

Dr. ELIZABETH RITA SAMUEL
Head of Department

As I pen down the message for our magazine in 2020, the atmosphere speaks differently and it is not one which we have experienced in our generation. We endure the void across the department without the hustle and bustle of our students ringing through the corridors. The year has taught us that the small things which we took for granted in life were precious, that we have missed out opportunities to gather and experiment on our technical skills and talents. I believe that 'IMPULSE' will bring out the expressiveness of the Electrical and Electronics family.

I am pleased that our Electrical and Electronics Department students have once again been successful in publishing our magazine for this academic year. Our EEE students have established a joint venture along with IEEE PES in bringing out this magazine, exhibiting the department's individuality technically and non-technically. I express my compliments to the student and staff editors and their dedicated committee for their valuable efforts in bringing out this issue. I wish them all triumph!



Dr. ELIZABETH RITA SAMUEL

EDITORIAL

FACULTY IN CHARGE

Dr. RINU ALICE KOSHY
Assistant Professor

"I wish I could change the world into words..."

With much enjoyment and pleasure, I put forward the creativity and enthusiasm of the Department of Electrical and Electronics in the most elegant way of expression. It gives me immense gratification when I introduce this consummated exquisite creation-'IMPULSE'- Our Department Magazine.

Though it was a challenge, I was mesmerised seeing it transforming into an odyssey, when the entire department started pouring in their adroit ideas. The magazine etches the technical skills of the talents and it is more than just a magazine, where its pages also reveal the achievements and aptitudes of the department. We plan IMPULSE to be an e-magazine initially and we expect it to be released every six months. It publishes well written technical and non-technical works and new interpretations and compositions in a clear voice. The content also includes technically oriented art works in the form of drawings, photography etc.

I use this opportunity to appreciate and thank everyone associated with the realization of the magazine. My special thanks to the IEEE PES SBC team members, Mr. Ananthu T Mani, Mr. Aravind B.S, Mr. Eldho Babu, Mr. George Thomas Mohan and Ms. Sonal Saju, for their endearing love and support all through the ecstatic journey of IMPULSE.

My sincere gratitude to the department for having faith in me and entrusting the task of developing the magazine to one of its own. I hope you all enjoy reading it as much as we enjoyed compiling it.

Dr. RINU ALICE KOSHY

EDITORIAL

STUDENT EDITOR

ANANTHU T MANI
Secretary, IEEE PES SBC

"What makes a good engineer?"

Is it technical knowledge alone, or is it the ability to adapt? These two are often not the only parameters we think of. The word engineer presents itself as an amalgam of skills rather than a singular focus, as opposed to any other field of study out there. While knowledge and an ability to adapt are the prime foci of this discipline, factors like diligence, analytical skills and creativity too govern the quality of an engineer.

With the latest edition of 'Impulse,' we hope to create something that can both entertain and possibly influence the growth of such "good" engineers in all tangents of the world. To this end, we have made a bold move to publish this year's 'Impulse' as an e-magazine, a decision that has played a vital role in the success of this publication.

While this joint venture has a rather noble aim to achieve, it has undoubtedly come with personal benefits as well. This is the first time that Impulse has opened its doors to student entries, an opportunity that encouraged many to curate their own technical content and have their talents publicized.

I'd also like to take this opportunity to thank Dr. Rinu Alice Koshy, the faculty in charge, and the Chapter Advisor, Ms. Prathibha P K, for guiding me throughout this journey. It is quite paradoxical that even as an editor, I cannot find the right words to express my gratitude towards everyone involved in bringing this concept of ours to reality. We hope that our magazine aids you in your search for the "good" engineer within you.

ANANTHU T MANI

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CONTENTS

UPHOLDING THE MISSION AND VISION OF PES

GEORGE THOMAS MOHAN
Chair, IEEE PES SBC

A Student Branch Chapter of the IEEE Power and Energy Society was the first of its kind for us, an entity whose creation has been a historical event for RSET. 27th January 2020 has indeed marked the beginning of a long journey. The PES, being one of the largest technical societies of the IEEE, aims at propagating its mission and vision namely ***"To be the leading provider of scientific and engineering information on electric power and energy for the betterment of society, and the preferred professional development source for our members."***

As the chairperson of this SBC, I was gifted with the opportunity to create an impact within our student community. The initial steps were marked with anxiety and trepidation. Over time, our team gained the confidence to plan, chart-out and conduct events which embalmed in us the joy of leadership and volunteering. It has been an incredible journey of learning and leading, one which helped us to identify the immense possibilities that PES offers.

Our path however took an unprecedented turn as the world made a stand against a common enemy - the COVID-19 pandemic. Gone were the days when we could sit together, brainstorm ideas and conduct events that imbibed the heart and soul of our society. The first few days of the lockdown was like a dive into the unknown. The virtual world was the only platform available, and surprisingly, it offered opportunities galore. The lockdown gave us freedom to explore all facets of the virtual world. With our unbridled enthusiasm, we intend to involve ourselves with the same intensity in the future too.

I am sure that together, all of us can make the best of the PES platform.

GEORGE THOMAS MOHAN

IEEE PES: AN INTRIGUING JOURNEY

ELDHO BABU
Vice-chair, IEEE PES SBC

Realizing the benefits of the IEEE is what resulted in the formation of an IEEE Power and Energy Society in our college. Our journey kicked off with the event TechRev, an interactive session with Mr. Rahul Sivan, CEO of ATWIC R&D. The programme that gave the greatest boost to our society, however, was the PES Day 2020. This event opened doors for us to interact with engineers across the globe. Our next milestone was the first Women in Power event, an inspiring session by Ms. Aisha Nazin Mayan, who spoke about how to benefit from the diversity in Engineering. We incubated a documentation committee and conducted web development classes too, helping to nurture career oriented skills among the members of our community.

The month of June was something special for our SBC. Decov'20, our response to the COVID-19 pandemic, was proposed and organized by two of our vibrant members, Ms. Esther Thomas & Mr. Geo Agnel Manoj. This event was conducted as part of an initiative to involve all of our members in the society's activities, inspiring many to come forward with their ideas.

Over seven months, our chapter has grown into a platform where students can shape their personality and engineering skills. Besides, an active involvement with the PES gives them a chance to network with other like-minded students, young professionals and even experts from the industry. Our PES SBC not only helps in gaining knowledge as a student, but also aids in utilizing networking skills that may even land you a job or a good university. The IEEE PES also keeps you technologically updated through their wide range of publications, including its magazine and an all encompassing resource center.

ELDHO BABU

RISING AGAINST STEREOTYPES

SONAL SAJU
WIP Representative, IEEE PES SBC

Everything is changing in the power sector, the way we make it, the way we move it, down to the way we use it. Nowadays, who you should be is defined by society. Bias and misconceptions from the media tell the tale that engineering involves getting your hands dirty and fixing things, a task that is seen as something that women should not do. The yellow hard hats and the high-vis jackets themselves do not distinguish women from men. Then why do such notions exist?

The year 2020, as the Women in Power representative of our PES SBC, has been a very important year in my life. This engagement has unfurled before me the biggest learning platform I could receive so far. For us women, to step up and find inspiration to go beyond expectations is not an easy path. However, the PES Women in Power platform provides career advancement, a platform for networking, and education to women in the energy industry. The WiP excels in pointing out not only the amount of opportunities available in the industry, but also that these roles can be taken up by anyone worthy of them regardless of gender.

Excellence is doing more than what others expect of us. To excel however involves striving to pursue dreams, maintaining the highest standards, looking after the smallest details, and going the extra mile. And when excellence is met, recognition is attained and that will be what changes the course of the industry, making it habitable for every passionate engineer out there, irrespective of colour and gender.

"When women and girls are empowered to participate fully in society, everyone benefits." - Melinda Gates

Sonal..

SONAL SAJU

SECTION 1

TECHNICAL PAPERS

TORQUE RIPPLE MINIMIZATION IN DOUBLE INVERTER FED WOUND ROTOR INDUCTION MACHINE DRIVES

Ms. CAROLINE ANN SAM
Assistant professor

For industrial applications, three phase induction motors are widely used due to their simple and rugged construction, low cost and less maintenance requirements. Their performance features like high starting torque and good speed regulation makes them suitable for variable speed applications. A Voltage Source Inverter (VSI) is most commonly used to provide a three phase induction motor with a variable voltage and variable frequency supply. The control pulses for VSI are mostly generated using Pulse Width Modulation (PWM) techniques, where both voltage and frequency of the output voltages can be controlled.

Torque ripple is an effect in motors which refers to the periodic increase or decrease in the output torque as the motor shaft rotates. It is a measure of maximum and minimum torque over one complete cycle. They are generated due to the interaction of magnetic fields of rotor and stator. Torque ripples develop due to oscillations which prevent constant speed operations and cause shaft damage. Numerous researches have been focused on the analysis and reduction of current and torque ripple by varying the PWM switching sequence.

Sinusoidal Pulse Width Modulation (SPWM) and Space Vector Pulse Width Modulation (SVPWM) are the most widely used modulation techniques. Space Vector PWM (SVPWM) is a more sophisticated technique for generating fundamental sine waves that provides lower Total Harmonic Distortion(THD). It is a different approach to PWM based on space vector representation of the voltages in the d-q plane. The d-q axes components are found by transformation. It refers to a special technique of determining the switching sequence of the upper three power transistors of a three-phase voltage source inverter.

The SVPWM technique gives a higher level of fundamental voltage as compared to SPWM. Comparison of these two modulations gives the results that SVPWM is the best and most reliable modulation technique because it enables efficient use of DC voltages and smartly works with vector control, thus giving less Total Harmonic Distortion (THD), better power factor and less switching losses at high

frequencies.

A novel Hybrid PWM technique has been introduced using CSVPWM (Conventional Space Vector PWM) and ABCPWM (Advanced Bus Clamped PWM) which clamps a phase to the positive and negative DC rails over certain intervals in the fundamental cycle; these methods also switch every phase at twice the nominal switching frequency over certain other intervals. Such double-switching of a phase around the zero crossings of its fundamental voltage reduces the THD at high modulation indices. Furthermore, double-switching around the peak of fundamental voltage reduces torque pulsations and acoustic noise in induction motor drives.

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AIR QUALITY MEASUREMENT USING ADVANCED PM2.5 AND VOC SENSOR TECHNOLOGIES

DAVIN MATHEW SAJAN
S4 EEE

It is all around us, but unless there is a problem, we usually do not concern ourselves with what is in the air that we breathe. In both indoor and outdoor environments, poor air quality can greatly impact our health and well-being. Two important indicators for air pollution measurement are small particulate matters (PM) of 2.5 microns or less (PM2.5) and volatile organic compounds (VOCs). They are, for example, emitted in households by fireplaces and candles during combustion processes. Everyday objects such as cleaning supplies, furniture, or textiles can also emit VOCs.

PERSONAL PM2.5 MONITORING

Official air quality monitoring stations provide only consolidated or averaged data for the outdoor environment without the corresponding indoor air data. They do not generate personalised information and only measure air quality in their immediate vicinity that is averaged-out over a time period, and thus lack real-time information for tracking the rapidly changing environment around us and for monitoring the fluctuations in local PM levels.

With the new Bosch PM2.5 technology, it is now possible to integrate PM2.5 sensing into mobile devices for measuring a person's daily exposure to PM. The user can be shown data and trends on the local pollution levels that they are being exposed to. Monitoring the personal exposure to air pollution, e.g. with smartphones, allows users to get reliable and transparent information, which enables them to take action and minimise their PM2.5 exposure according to WHO air quality guidelines. This can help to improve people's health and well-being.

DETECTING VOC'S

Another airborne source of concern is presented by volatile organic compounds (VOCs), which is a pretty large group of chemically reactive gases that can appear in any room. With people typically spending 90% of their life indoors, the concentration of VOCs in ambient indoor air can significantly impact our well-being and health.

A VOC sensor can detect a wide range of gases both inside buildings and outdoors, such as (hydro-) carbon compounds (e.g. alcohol or CO),

sulphide compounds(causing unpleasant smells, e.g. H2S), and solvents (e.g. acetone). They come, for example, from paint, lacquers or detergents. In a smart home, VOC information helps to control multiple devices, such as turning a kitchen hood on and off, or starting an air purifier. Additionally, it can be used to generate alerts, for example by detecting a fire, or even spoiled food in a refrigerator. VOC data can also be used with other Internet of Things (IoT) applications, for example optimizing ventilation in an office building based on air quality.

To measure VOCs, Bosch has developed a compact, high performance gas sensor. The BME680 is the world's smallest solution that provides 4-in-1 air quality monitoring. It can measure ambient temperature, barometric pressure, relative humidity and gases and is housed in a 3 x 3 x 0.93 mm3 package. It works in the ultra-low power range down to less than 0.1 mA.

The sensor is able to distinguish between fresh air (i.e. clean air, mainly nitrogen, oxygen and humidity) and used air with pollutants. Typically, when people are present in rooms, the exhaled breath is one of the most important reasons for poor air quality. Knowing the amount of exhaled air contained in ambient air helps to optimize ventilation, and thereby helps to prevent airborne transmission of infections like SARS-CoV-2v. Although VOC sensors cannot directly detect viruses, they contribute indirectly to people's health and well being.

CONCLUSION

By generating accurate, real-time, personalized air quality data, these new sensor technologies will change how we assess the quality of the air around us and will enable us to respond accordingly. We will better plan when to be outdoors to adapt our commuting or sports activities. We will manage the air quality inside our homes by controlling ventilation and avoiding particle generation. When adapted on a broader scale, this will also help us to make informed decisions, for example when relocating to a new area or when deciding where to go on vacation. With the increasing awareness to keep the environment and ourselves healthy, the demand for air quality applications will continue to grow in the future.

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WHAT IS SIR MODELLING?

Dr. ELIZABETH RITA SAMUEL
Assistant professor

The strains of the novel coronavirus, SARS-CoV-2, was identified in Wuhan (Hubei), China by the end of 2019. From then on, an exponentially growing number of patients are being diagnosed with COVID around the globe.

Predictive mathematical models for epidemics are fundamental to understand the course of the epidemic and to plan effective control strategies. SIR models are used commonly for analysis of human-to-human transmission, which describes the flow of individuals through three mutually exclusive stages of infection: susceptible, infected and recovered.

In the SIR modeling process, the independent and dependent variables are first identified. The independent variable is time t, measured in days. Two related sets of dependent variables are considered. The first set of dependent variables counts people in each of the groups, each as a function of time:

S = S(t) is the number of susceptible individuals,
I = I(t) is the number of infected individuals,
R = R(t) is the number of recovered individuals.

The second set of dependent variables represents the fraction of the total population in each of the three categories. So, if N is the total population, then:

s(t) = S(t)/N, the susceptible fraction of the population,
i(t) = I(t)/N, the infected fraction of the population,
r(t) = R(t)/N, the recovered fraction of the population.

The assumptions made within the outbreak period is that no significant population change takes place (e.g., through new births, deaths, migration etc.) and N = S + I + R = Constant. The SIR model can be expressed by the following set of ordinary differential equations :

$$\frac{dS}{dt} = -bs(t)I(t) \quad \frac{ds}{dt} = -bs(t)i(t) \quad \frac{dr}{dt} = -k\,i(t)$$

Where b is the contact rate and 1/ k is the average infectious period. Below are the values published for COVID- 19 for three different states;

Parameter	Kerala	Karnataka	Maharashtra
Contact rate (β) (/day)	0.312	0.836	1.031
Removal rate (γ) (/day)	0.114	0.76	0.914
Final number of cases	449	1177	46678
Final number of susceptible	38	5449	166926
Involved population size (N)	487	6626	213604
Time between contacts (day)	3.2	1.2	1

Table 1

The present analysis of the SIR model indicates a scarily high number of peak infections for India by comparing the existing data to the model simulation. However, it must be noted that the parameters chosen for the model aren't unique. For example, with measures like lock-downs and quarantines, the contact between people will reduce drastically, indicating assumed parameter values to change. Researchers have also published the difference between a single and multiple lock-down scenario and found that a large number of deaths may be prevented by imposing multiple lock-downs with interim one month no lock-down periods.

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VEHICLE MONITORING AND SECURITY SYSTEM

TINU CHERIAN
S2 EEE

Abstract

Vehicle security means providing security to the vehicle against any possible thefts. Vehicle security has become a matter of concern these days. Security for the vehicles can be provided by the use of GPS and GSM technologies and also by analyzing the temperature. Security is provided by tracking the location of the vehicle. It can also be used to ensure the safety of the occupants. This is done with the help of the GPS satellite and the GPS module attached to the vehicle which needs to be tracked. The GPS antenna present in the GPS module receives the information from the GPS satellite in NMEA (National Marine Electronics Association) format and thus it reveals the position information. This information from the GPS antenna has to be sent to the Base station wherein it is decoded. This technology also allows the vehicle to be locked/unlocked and immobilized remotely.

Introduction

Vehicle theft has become a matter of concern these days. In most of the cases the vehicle which is stolen is not traceable by the owner of the vehicle. So there is demand for a better security system which makes use of GPS and GSM technologies.

The Global Positioning System is a satellite based communication system. The GPS satellites transmit signals at L1 and L2 frequencies containing the ephemeris data, navigation data, codes etc. which are used to determine the location of the vehicle in three-dimensional coordinates i.e., latitude, longitude, and altitude along with the precise time. The signals from GPS satellites are available free of cost which enable the GPS receivers to determine the location. The tracking sensitivity of the GPS receivers is -160dBm and it allows position coverage in all environments continuously. GPS is used in the vehicles for both tracking and navigation. Tracking systems enable a base station to keep track of the vehicles without the intervention of the driver whereas navigation systems help the driver to reach the destination. Whether navigation system or tracking system, the architecture is more or less similar. The navigation system will be convenient to the user, usually a graphic display for the driver which is not needed for the tracking system. GSM

stands for the Global System for Mobile communication. GSM provides an alternative to voice calls as Short Message Service (SMS). The GSM modem transmits the GPS parameters of the latitude and longitude values whenever there are varying values.

Description and Operation

The VMSS (Vehicle Monitoring and Security System) is designed by combining the GPS's ability to pinpoint the location along with the ability of the GSM to communicate with a control center in a wireless fashion. The system includes GPS-GSM modules and a base station called the control center. VMSS is based on a PIC microcontroller-based system equipped with a GPS receiver and a GSM Module operating in the 900Mhz band. The unit is mounted on the vehicle and connected to GPS and GSM antennas. The position, identity, heading and speed are transmitted either automatically at user-defined time intervals or when a certain event occurs with an assigned message.

The onboard GPS module receives GPS signals from satellites, computes the location information, and then sends it to the control center. With the vehicle location information, the control center displays all of the vehicle positions on an electronic map in order to easily monitor and control their routes. Besides tracking control, the control center can also maintain wireless communication with the GPS units to provide other services such as alarms, status control, and system updates. The GPS module relays the vehicle location information such as longitude, latitude, direction, and Greenwich Standard Time every five minutes. The GSM wireless communications function is based on a GSM network established in a valid region and with service providers. Via the SMS provided by the GSM network, the location information and the status of the GPS-GSM VMSS are sent to the control center. Meanwhile, the VMSS receives the control information from the control center via the same SMS. Next, the GPS-GSM VMSS sends the information stored in the microcontroller.

There are two ways to use the VMSS alarm function, which can be signified by either a buzzer or presented on LCD. The first way is to receive the command from the control center; the second is to manually send the alarm information to the control center with the push of a button. The base station consists of landline modem(s) and GIS workstation. The information about the vehicle is received at a base station and is then displayed on a PC based map. Vehicle information can be viewed on electronic maps via the Internet or specialized software. Geographic Information Systems(GIS) provides a current, spatial, visual representation of

transit operations. It is a special type of computerized database management system in which geographic databases are related to one another via a common set of location coordinates.

When the vehicle is parked somewhere with the security systems enabled, a change in the vehicle's location without the owner disabling the security systems (using the keys), the system sends a message to the owner's phone number, which is registered. If the owner sends the message to turn off the vehicle, the ignition will turn off instantly. Modern systems can be controlled using applications designed for that particular security unit. When the GPS detects the vehicle in the vicinity of schools and hospitals it issues a warning on the vehicle's onboard display unit to reduce the speed and a warning sound is issued. More advanced systems can be used to automatically regulate the vehicle's speed in lower speed zones. As the GPS-GSM unit is connected to the ECU it can issue warnings in emergency situations. For example the unit can send an SOS signal to the local emergency services whenever a crash sensor goes off in a crash.

Conclusion

In this modern, fast moving and insecure world, it has become a basic necessity to be aware of one's safety. The vehicle monitoring system discussed above will provide better security for the vehicles. It also implements the monitoring of the many other factors that affect the vehicle's operation like tire pressure, engine temperature etc. This system can deal with both pace and security.

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CLOUD COMPUTING: DATA SECURITY & CONCERNS

Ms. JAYASRI R NAIR
Assistant professor

Cloud computing is the practice of using a network of remote servers hosted on the internet to store, manage and process data, rather than a local server or a personal computer. These services are divided into three main categories: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). Moving to the public cloud or using a hybrid cloud means the potential for cloud security issues arises. It can happen as the data is prepped for migration, during migration, or potentially within the cloud after the data arrives.

The top 5 cloud platforms are:

1. Amazon Web Services (AWS)
2. Google Cloud
3. Microsoft Azure
4. IBM Bluemix
5. Alibaba

Data security has been incumbent on the cloud service providers, and they have risen to the occasion. No matter which platform you select, all of them support various compliances to multiple standards.

Eight Key Concepts for Data Security:

1. Privacy Protection
2. Preserve Data Integrity
3. Data Availability
4. Data Privacy
5. Encryption
6. Threats
7. Data Security and Staff
8. Contractual Data Security

1. Privacy Protection: The data should be protected from unauthorized access regardless of your cloud decisions, which includes data encryption and controlling who sees and can accesses your content.

2. Preserve Data Integrity: Data integrity can be defined as protecting data from unauthorized modification or deletion. In cloud, especially a multi-cloud environment, it gets tricky, because of the large number of data sources and means to access them; authorization becomes crucial in assuring that only authorized entities can interact with data. This implies stricter means of access, like two-factor authorization, and logging to see who accessed what. Another potential means of security is a Trusted Platform Module (TPM) for remote data checks.

3. Data Availability: Downtime is a fact of life, since the data is on someone

else's servers. This is where the service-level agreement (SLA) is vital and keeping a close eye on the details really matters.

4. Data Privacy: A huge raft of privacy laws, national and international, have forced more than a few companies to say no to cloud because they can't make out the heads or tails of the law or because it's too burdensome.

5. Encryption: Encryption is the means by which data privacy is protected and insured, and encryption technologies are fairly mature. Encryption is done via key-based algorithms/ tokenization.

6. Threats: Cloud service providers have a variety of security tools and policies in place but problems still happen, usually originating from human error.
a) Data breaches: It can occur any number of ways, from the usual means - a hacked account or a lost password/ laptop.
b) Data loss: Chances of data loss occur when someone logs in and erases everything. It can be mitigated by insuring your applications. Also since data is distributed across several zones, one can backup data using off-site storage.
c) Hijacked accounts: Secure, tough passwords and two-factor authentication can prevent this. It also helps to have policies that look for and gives alerts about unusual activity, like copying mass amounts of data or deleting it.
d) Cryptojacking: Cryptojacking is the act of surreptitiously taking over a computer to farm cryptocurrency, which is a very compute-intensive process. Monitoring for unusual computer activity is the key way to stop this.

7. Data Security and Staff: Most employee-related incidents are not malicious. Some are caused by careless employees or contractors/ due to imposters stealing credentials/ by malicious employees and criminals.

8. Contractual Data Security: The SLA should include a description of the services to be provided and their expected levels of service and reliability, along with a definition of the metrics by which the services are measured; the obligations and responsibilities of each party, remedies or penalties for failure to meet those metrics, and rules for how to add or remove metrics. There are multiple checkmarks for a SLA.

- Specifics of services provided, such as uptime and response to failure.
- Definitions of measurement standards and methods, reporting processes and a resolution process.
- An indemnification clause protecting the customer from third-party litigation resulting from a service level breach.

The main security risks of cloud computing are:

- Compliance violations
- Identity theft
- Malware infections and data breaches
- Diminished customer trust and potential revenue loss.

A good cloud security provider will offer a scalable solution that detects threats before they reach the data center, helping to allay the following security concerns:

1. Loss of data: By its very nature, cloud computing involves some ceding of control from the customer to the service provider. While this leaves users more time and financial resources to focus on other facets of the business, there is always the risk that sensitive data is in somebody else's hands. If the security of a cloud service is breached, hackers could potentially gain access to intellectual property or other personal files.

2. Malware infections: Due to the high volume of data stored on the cloud, which requires an internet connection to store this data, anybody using cloud services is potentially at risk of cyberattacks. An increasingly common threat is Distributed Denial of Service (DDoS) attacks, whereby hackers send unprecedented volumes of traffic to a web-based application, thereby crashing the servers.

3. Legal/ Compliance issues: With increasing legislation on data protection, staying compliant is becoming more difficult. Companies must have steadfast rules governing who can access what data and what they can do with it. With cloud computing's easy access to data on a large scale, it can be difficult to keep track of who can access this information.
In spite of these concerns, there are a myriad of security measures in cloud computing that surpass the standards of traditional IT. The security advantages of cloud computing comes down to 2 basic factors: economies of scale & division of labor.

Economies of scale

With cloud services, enterprises can spread the cost of data security for large volumes of customers across multiple cloud data centers. This means that they can allocate more human and financial resources to security measures, including physical, technical and operational security.

Division of labor

Enterprises can allocate more resources across the business to security when using cloud services. However, they can also rely on cloud providers to focus solely on delivering IT services.

Thus a managed cloud provider brings in a new level of expertise to the data security operation that cannot be matched by traditional, non-cloud based solutions.

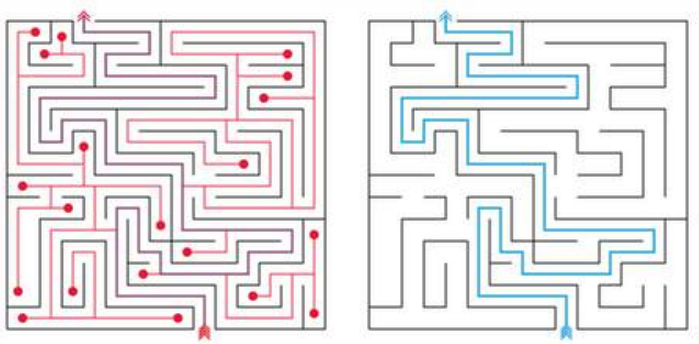
AN INTRODUCTION TO QUANTUM COMPUTERS

ALFY JOHNSON
S2 EEE

A Quantum computer is a device which uses quantum mechanical properties of superposition, entanglement and interference to manipulate the state of a Quantum mechanical bit called the qubit (basic unit of quantum information), to perform operations on the data.

Classical computers use bits to store data and perform complex functions, where each bit can either be a zero or a one. A quantum computer on the other hand uses a Qubit which is allowed three states, 0,1 and a mixed state of 0 and 1 called the coherent state, which contributes to their superior computing properties.

Consider tossing a coin, where the results are clearly either a head alone or a tail. Upon spinning the same coin, while it is still spinning, it would be impossible to denote the face you see as a head or a tail. In a way we can say that it is both head and tail at the same time. This example gives us a rough idea on the qubits. A classic example of how a quantum computer works differently than our current computer is a maze solving problem. A normal computer would try all possible paths in turn, ruling them all out until it finds the correct path. A quantum computer on the other hand would go through all possible paths at the same time and give us the best path in only a fraction of the time taken by the classical computer.



A quantum computer *A classical computer*

Fig. 1

Before we go further, it is imperative that we understand the underlying concepts of a Quantum Computer.

Quantum superposition: In in the simplest of terms means that individual units exist in two different states at the same time. The familiar example of light exhibiting both wave and particle nature.

Quantum entanglement: Entangled particles behave together as a system in ways that cannot be explained using classical logic. Going back to our coin spinning analogy, only this time take two

coins. Consider the two coins to be quantum mechanically entangled. If we were to simultaneously spin these two coins and stop them then both the coins would have the exact same outcome, i.e. either both heads or both tails. In other words, the state of one determines the other.

Quantum interference: By using constructive interference, we can increase the quantum signal strength towards the correct answer and with the help of destructive interference we can cancel the signals leading to the wrong answers.

Qubit: A normal computer has bits made from tiny transistors, but a qubit can be anything that exhibits quantum behavior like an electron, proton or even a molecule in the right environments.

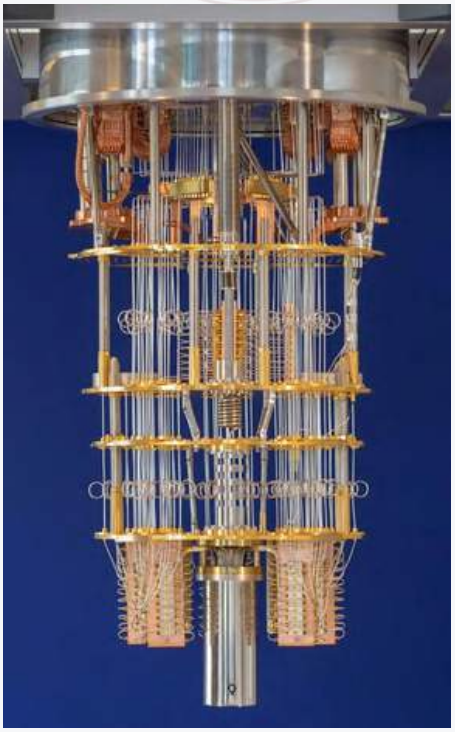


Fig. 2 - A quantum computer

These Quantum mechanical properties can only be observed at very low temperatures, even lesser than the space temperature. This necessitates the use of a dilution refrigerator to cool the quantum chips cold enough to create superpositions and entangle the qubits.

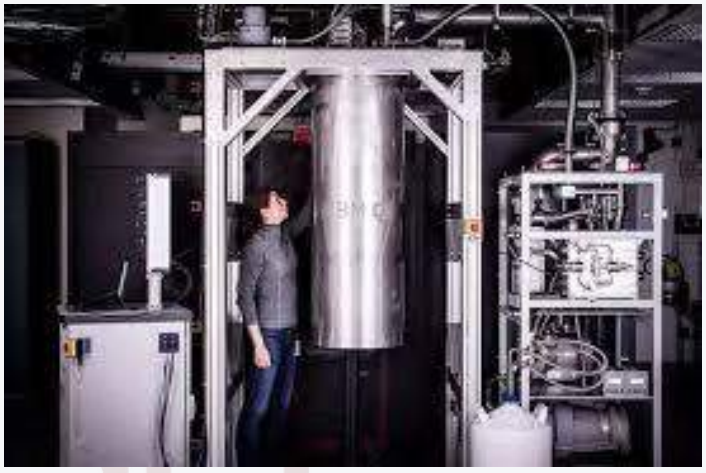


Fig. 3 - A Quantum computer enclosed by a dilution refrigerator

The best way to illustrate the difference between our current computer and a quantum computer would be to quote Shohini Ghose, an award-winning physicist and professor of Physics and computer science at Wilfrid Laurier University, who said "A quantum computer is not just a powerful version of our current computer, just like a candle is not a more powerful candle". With that being said, a quantum computer can never fully replace a classical computer. Quantum computers are not universally faster, they are only faster for special types of calculations. They are best used for problems or tasks with small input and output but almost infinite possibilities.

Examples of such problems include decryption, weather patterns, patterning stock market data, recordings of brain activity, gene analysis etc.

Another reason as to why Quantum computers may not be as ubiquitous as classical computers is because almost anything can put a qubit out of its superposition states. Hence, quantum computers have to be kept isolated from all forms of electrical interference, radiations or even quantum vibrations and chilled down to absolute zero. The next tricky aspect is to store the data in quantum state for reasonably long time periods. As of now, quantum data can only be reliably stored on a microsecond timescale. In the words of Laure Le Bars, project director at SAP research and innovation, "The quantum bit loses its quantum properties over time and as soon as it interacts with other matter. The process is called decoherence and it leads to errors. When this happens with classical computers, we correct errors behind the scenes, but for quantum bits, error correction technologies are not that advanced."

Quantum computing is not just about performing tasks at greater speeds and efficiency but also about actually doing things which are impossible to achieve with any supercomputer. They have the potential to rapidly develop artificial intelligence and change the face of data encryption as we know it today. Scientists believe the quantum simulations could even help find cures for diseases like Alzheimer's. The greatest advantage to quantum computers is that unlike the normal super computers that can only analyze the most basic molecules, quantum computers operate using the same quantum properties as the molecules they are trying to stimulate and they will be able to handle even the most complicated reactions. This will directly result in enhanced products and even be able to develop new materials for batteries in electric cars and cheaper yet effective drugs.

Most of the cryptography techniques used today rely on the difficulties in breaking down large numbers to prime numbers, a process called factoring, which might take classical computer years to break down and a quantum computer seconds. Indeed, that could put all our data at risk, but the antidote to which will be quantum encryption that relies on the principle of uncertainty - the idea that you cannot measure something without influencing the result. As a result of which quantum keys would be practically unbreakable.

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ADVANCED VEHICLE SIMULATOR (ADVISOR) FOR ELECTRIC VEHICLE SIMULATIONS

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In the present scenario of the world, the transportation sector is the largest user of energy. At the present usage rate of oil, the reserves will last hardly 35 years. Eventually it will give rise to exorbitant price hikes and thus transportation based on oil and other fossil fuels will not be economically viable. Another major concern is global warming as a result of release of greenhouse gases when fossil fuels are burnt which leads to a myriad of problems like climate change and rising sea levels which could destroy coastal cities of the world. Consequently it prioritizes the necessity to develop a clean, efficient and environment friendly urban transportation system. Thus Electric Vehicles (EVs) are attaining great importance and will dominate the clean vehicle market.

The U.S. Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) developed ADVISOR in 1994 as an analysis tool for vehicle design. It is a model written in the widely accepted MATLAB/Simulink environment which enables simulation and analysis of conventional as well as advanced vehicles. ADVISOR tests the impact of variations in vehicle components or other changes that might affect vehicle performance parameters. By selecting vehicle component types, sizes and parameters the user can alter simulation results. It is flexible enough to model specific components and vehicle configurations for the needs of most users.

In ADVISOR there are three main Graphical User Interfaces (GUIs) that guide the user in the simulation process. The GUIs enable interaction with the input and output data available in the MATLAB workspace. The vehicle model is illustrated graphically using block diagrams and the results can be obtained from the results window. In Fig.1, the ADVISOR vehicle input window is shown where the user can build the vehicle of their interest. Drop down menus are utilized to take various vehicle configurations and components. The size of a component can be changed by editing the characteristic value displayed in the boxes on the top right end of the screen. Various vehicle configuration parameters can be saved and the 'continue' button leads them to the simulation setup screen.

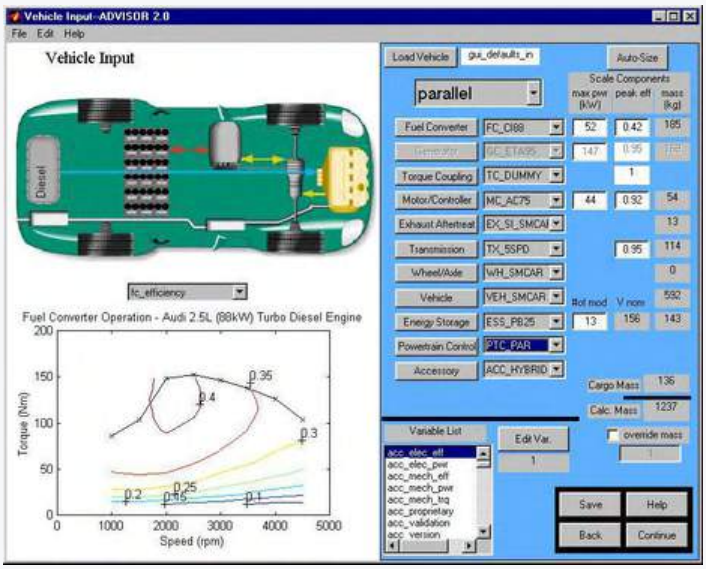

Fig.1 - ADVISOR Vehicle Input Screen

In Fig.2, simulation parameter screen is shown, where the user defines various drive cycle parameters. Major events that can be simulated include various drive cycles, and acceleration and grade tests. Again, at the right side of the window, the user can choose various drive cycles and define the simulation parameters and information about the selections which is provided at the left side of the screen.

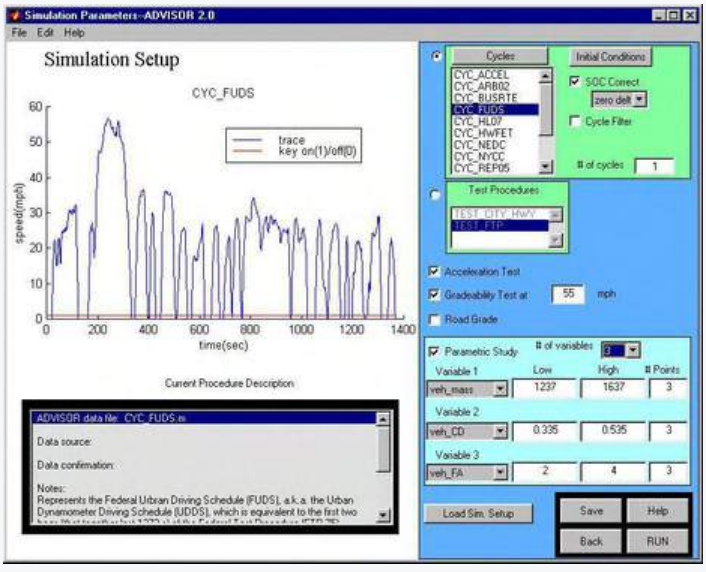

Fig.2 - ADVISOR Simulation set up screen

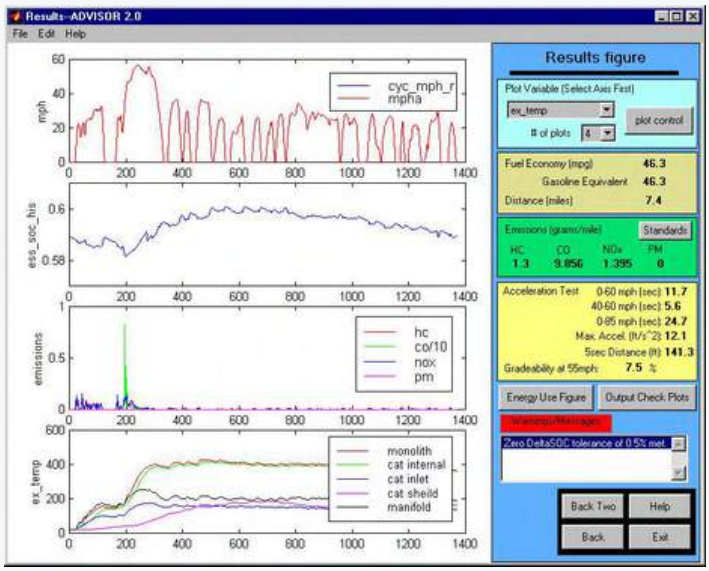

Fig.3 - ADVISOR Results screen

For any vehicle, the important performance constraints are initial acceleration, cruise speed, gradability and driving range. The above mentioned various parameters of EVs, Hybrid Electric Vehicles (HEVs) and Fuel cell EVs can be studied for various driving cycles like UDDS (Urban Dynamometer Driving Schedule) and CYC_US06HWY (Highway) with the help of Advanced Vehicle Simulator (ADVISOR) software which works in MATLAB platform. ADVISOR provides vehicle engineers an easy to use and flexible, yet robust analysis package for vehicle modeling.

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SOLID STATE BATTERIES

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A solid state battery is a battery technology that uses solid electrodes and a solid electrolyte, instead of liquid or polymer gel electrolytes commonly used in traditional batteries. The proposed materials include ceramics and solid polymers. The electrolytes are made using lithium orthosilicate, glass and sulphides. The cathodes are all lithium based. Selection of the anode material depends mainly on the choice of the electrolyte.

One popular cathode material is Li-S. This has a theoretical specific capacity of 1670 mAh/g, ten times larger than the effective value of $LiCoO_2$. An $Li/LiFeO_4$ battery shows promise as a solid state application for electric vehicles.

Solid state batteries have higher energy densities but are expensive. They have found use in pacemakers and other wearable devices.

HISTORY

The first thought of solid state batteries dates back to the 1830's when Michael Faraday discovered solid electrolytes silver sulphide and lead fluoride, which laid the foundation to solid state ionics. Scientists continued to modify the electrolyte but low cell voltage and high internal resistance remained major shortcomings.

In 2013, researchers at the University of Colorado Boulder announced the development of a solid state lithium battery with a solid composite cathode based upon iron-sulphur chemistry. In 2014, Toyota announced its solid state battery efforts and holds the most related patents. Other car makers developing such battery technologies include BMW, Honda, Hyundai Motor Company and Nissan.

ADVANTAGES

Solid state batteries do not involve the use of toxic materials, like organic electrolytes.

- They are long lasting.
- They are non flammable, so they have a lower risk of catching fire.
- They allow faster charging.
- They offer higher voltage and longer life cycles.

CHALLENGES

Cost: Solid state batteries are expensive to make. The method of production, vacuum deposition, is costly. It was estimated in 2012 that, based on then-current technology, a 20Ah cell would cost US $100,000. An electric car that requires about 800 to 1000 of such cells would thus be not able to use solid state batteries. Production Cost has also impeded the adoption of such batteries in other areas, such as smartphones.

Temperature: Operations in Low temperatures can be challenging.

Pressure Sensitivity: Solid state batteries with ceramic electrolytes require high pressure to maintain contact with the electrodes. But applying such pressure would break the battery owing to mechanical stress.

Dendrites: Solid lithium anodes tend to suffer from the formation and the growth of dendrites. They penetrate the separator between the anode and the cathode causing short circuits. This causes overheating, which may result in fire and maybe even explosion from thermal runaway. They commonly form during electrodeposition at the time of charging and discharging. Ions and electrons combine to form a thin layer of Li metal. If the deposition of this metal layer is not uniform, dendrites are formed.

OVERCOMING CHALLENGES

Instead a single block of electrolyte, replacing it with three super-thin layers would lead to safe and faster charging of batteries.

Using strong, dense ceramic electrolyte about 10 micrometers thick can overcome two issues: high electrolyte resistance and low current capability.

Researchers at the University of Maryland Energy Innovations Institute first reported the electrolyte structure in 2016. The proposed structure is as follows:

The electrolyte will have three layers. In the middle is a thin, dense layer of lithium-oxide ceramic. On either side of that layer are slightly thicker porous layers of ceramic with super thin aluminium oxide coating that will further reduce resistance. Although ceramics are brittle, the dense middle layer will add strength. It will also block dendrites, making the battery safer to use. The electrolytes could be made using the conventional ceramic manufacturing technique called tape casting, followed by sintering at high temperatures. Oxide based ceramics were preferred over sulphide-based ones, and over glass and plastic electrolytes, because oxides work well over large voltage ranges, allowing the use of lithium metal anodes and a wide variety of cathodes. The porous aluminium oxide coated layers will allow

the lithium ions to move quickly into the electrolyte.

The unique structure and interfacial treatments help in achieving very low resistance. Since lithium ions flow exceptionally well between the electrodes and the electrolyte, the battery will have a high current density. The near-zero risk of dendrites permit the batteries to charge faster, approximately in the span of 5 to 10 minutes.

The company, Ion Storage Systems that developed prototype batteries were able to bring out a fine solid state battery that had an energy density of about 300 Wh/kg, higher than the maximum of 250Wh/kg that the present day commercial lithium ion cell devices deliver.

CONCLUSION

Solid state batteries have a really great future scope, ranging from applications in unmanned aerial vehicles to commonly used devices, like mobile phones and laptops. The expense involved in the making of such battery technologies remains a major hindrance. The car company Toyota aims to release its first model of electric vehicle powered by solid state batteries by 2021. The discovery of newer materials and methods of manufacture will certainly play a vital role in marketing and increased use of solid state batteries in the near future.

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RECYCLING OF LITHIUM-ION BATTERIES

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Lithium-ion batteries (LIBs) are currently one of the most important electrochemical energy storage devices, powering electronic mobile devices and electric vehicles alike. However, there is a remarkable difference between their rate of production and rate of recycling. At the end of their lifecycle, only a limited number of LIBs undergo any recycling treatment, with the majority going to landfills or being hoarded in households. Further losses of LIB components occur because the state-of-the-art LIB recycling processes are limited to components with high economic value, e.g., Co, Cu, Fe, and Al. With the increasing popularity of concepts such as 'circular economy', new LIB recycling systems have been proposed that target a wider spectrum of compounds, thus reducing the environmental impact associated with LIB production.

Historically, the main objective of Li-ion battery recycling has been recovery of cobalt, because of its high value. Everything else has been secondary. However, as cobalt content in the batteries decreases and mandatory recycling regulations requiring recovery of over 50% of the materials come into effect in the European Union, interest has grown in recovery of additional materials. Materials make up over half of the initial cell cost, and cathode material is the largest contributor to material cost, so there is a financial incentive to recover cathode material. Further, the value of cathode material is greater than that of its constituent elements, so recovery of reusable cathode provides more revenue than recovery of its constituents.

Because Li-ion batteries are complex products, many paths of recycling is possible and the process can be broadly classified into pre-processing and mechanical, hydrometallurgical, and pyro-metallurgical methods. These processes can be combined in different ways, depending on factors like quantity and characteristics of the material available and quantity and value of the materials that can be recovered. Pre-processing is here considered to be any process which does not alter the structure of the LIB cells, e.g., sorting by battery type from mixed waste. Mechanical processing involves the use of different techniques to liberate, classify, and concentrate materials without altering

their chemistry. These techniques operate based on relative differences in the physical properties of materials, for instance density, shape, and size, and they generally occur before stages involving chemical reactions. After mechanical processing, the material obtained is refined by hydro-metallurgy, pyro-metallurgy, or a mixture of both.

Pyro-metallurgy refers to operations at elevated temperatures to facilitate the oxidation and reduction reactions in which transition metals like Co and Ni are reduced from oxides to metals, and recovered in a mixed metal alloy. The metals can then be separated (by hydrometallurgy) and used to make new cathode material. Processes relying on pyro-metallurgical steps are robust, but only capable of recovering metallic components. Hydrometallurgy involves the leaching of valuable elements from a solid matrix and their subsequent precipitation through modification of the solvent-phase chemistry. Hydrometallurgy uses acids to dissolve the ions out of a solid like the cathode, producing a mixture of ionic species in solution. These can be recovered by precipitation or solvent extraction and reacted with other recovered materials to produce new cathode material. These techniques are highly resource-intensive, and they are thus strongly influenced by economic constraints. Other techniques like membrane separation have been proposed where the different components of the black mass are separated (active material powder from shredding of cells) by physical processes, like gravity separation, which recover separated materials without causing chemical changes, enabling recovery of cathode material that is reusable with minimal treatment.

Whichever process is adopted, the recycling of Lithium-ion batteries at end-of-life is essential for many reasons. The environmental and economic advantages of second-use and the low volume of batteries currently available for recycling could stifle the development of a recycling industry in some places. In many nations, the elements and materials contained in the batteries are not available, and access to resources is crucial in ensuring a stable supply chain. However meticulous management of the resources consumed by battery manufacturing and recycling surely holds the key to the future sustainability.

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WHAT ARE QUANTUM DOTS?

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INTRODUCTION

Quantum Dot is a new revolutionary technology from the field of nano technology. They are basically nano crystals made from semiconducting nano materials. Quantum Dots, as the name infers, works on the basis of quantum theory, where each quantum dot is like an atom which has a well defined energy level and can be individually controlled. They are manufactured in laboratories, hence also called artificial atoms.

Quantum Dots are generally spherical in shape and mainly consist of a core surrounded by a layer of outer shell. Their size ranges from about 2 to 10 nano meters. A nano particle (Quantum Dot) composed of approximately 100-10000 atoms, exhibits distinct narrow optical line spectra. The fabrication of Quantum Dots requires an extremely controlled environment as its intrinsic properties depend on several factors such as size, shape, defects, impurities and crystallinity. They are made from semiconductor materials such as silicon, cadmium selenide, cadmium sulfide, or indium arsenide etc.

Quantum dots with size ranging from about 6nm and above emit light of higher wavelength (Red) and the ones with the size of about 2nm emit light of smaller wavelength (blue). This is because as the size of the nano structure decreases the band gap increases. A larger band gap requires more energy for excitation from the valence band to the conduction band. Also, since energy is proportional to frequency, light of higher frequency and lower wavelength would be absorbed. This finely tunable speciality of quantum dots makes it easier to meet specific applications in multi-disciplinary fields.

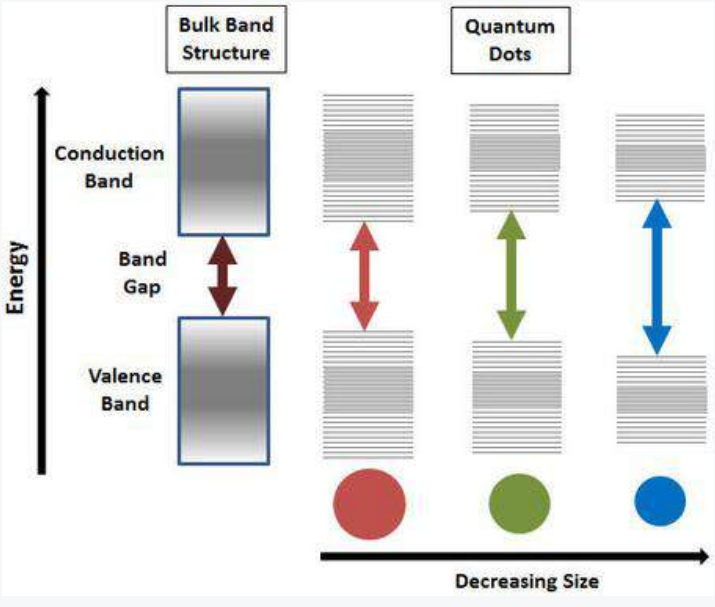

Fig. 1

HISTORY

Quantum Dots were discovered by Alexei Ekimov, a Russian physicist, in 1980. He produced the first Quantum Dots in a molten glass matrix. In 1982, an American chemist named Louis E. Brus observed the same phenomenon in colloidal solutions. He observed the change in light emitted and absorbed by the Quantum Dots over a period of days as the crystal grew and inferred that the confinement of electrons is what provides the particle quantum properties. However, it was Alexander Efros who first theorized Quantum Dots. In 2006, Alexei Ekimov, Alexander Efros and Louis E. Brus shared the Optical Society of America's R.W. Wood Prize for their groundbreaking work.

In 1993, Moungi Bawendi, one of the post-doctoral researchers under Louis Brus produced the first "high quality" Quantum Dots that had less than 5% size variation in the colloidal suspension. This enabled researchers to control the size of Quantum Dots and fine-tune the color of their fluorescence.

PROPERTIES

Quantum Confinement: The most appealing property of Quantum Dots is quantum confinement. This property is only visible in particles of size in the range of 10nm or below. Quantum Confinement is the spatial confinement of electron-hole pairs or excitons. The reduction in the number of atoms in a material results in the confinement of normally delocalized energy states. Electron-hole pairs become spatially confined when the diameter of a particle approaches the de Broglie wavelength of electrons in the conduction band. As a result the energy difference between energy bands increases with decrease in particle size. Due to these factors, semiconductors usually exhibit this phenomenon as they have an energy gap unlike metals in their electronic band structure. This distance between the electron and hole is called the exciton Bohr radius (rB). The exciton Bohr radius is a threshold value and the confinement effect becomes more predominant as the radius of Quantum Dots decrease. The major methods used for the study of these excitons are Effective Mass Approximation (EMA) model and Linear Combination of Atomic Orbital (LCAO) theory.

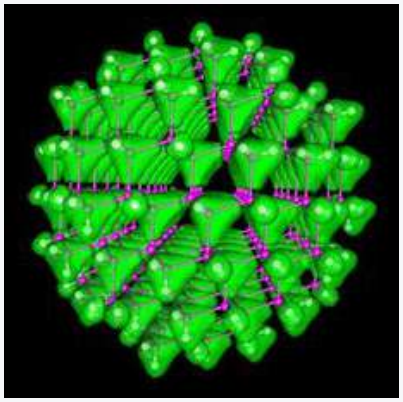

Fig. 2 - A quantum dot of gallium arsenide, containing just 465 atoms

Luminescence: When a Quantum Dot is excited using external energy there will be a transition from the ground state to the excited state and at this excited state the electrons possess a great amount of energy and may combine with holes to form an exciton i.e. electron-hole recombination occurs and the exciton will get relaxed to the ground state. The excess energy that forms due to recombination and relaxation can be either radiative or non-radiative. Radiative relaxation results in spontaneous luminescence from the Quantum Dots. Unlike radiative recombination, non-radiative recombination produces phonons i.e. vibrations or sound waves are emitted as a result.

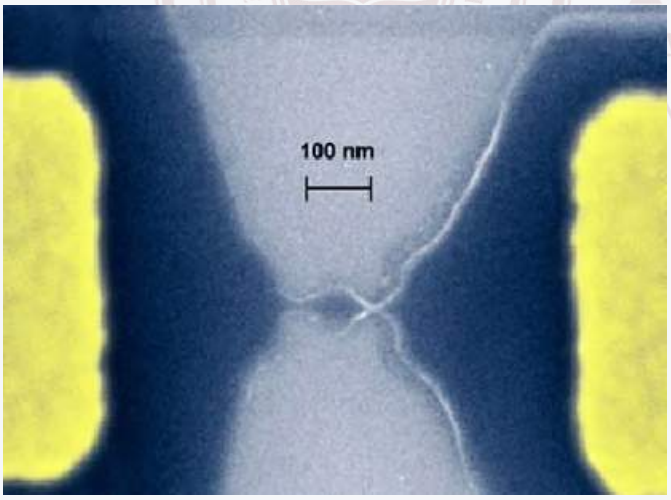

Fig. 3 - Quantum dot carved out from a graphene sheet

APPLICATIONS:

Quantum Dot Display: A normal LCD is backlit by fluorescent lamps or conventional white LEDs that are color filtered to produce red, green, and blue pixels. Quantum dot displays use blue-emitting LEDs rather than white LEDs as the light sources. The emitted light is converted into pure green and red light by the corresponding color quantum dots placed in front of the blue LED. This white light as the backlight of an LCD panel allows for more accurate color production and high quality images at a cost lower than a RGB LED display. Also due to the high thermal stability of these inorganic materials, even when using high brightness levels, the displays will have a longer lifetime.

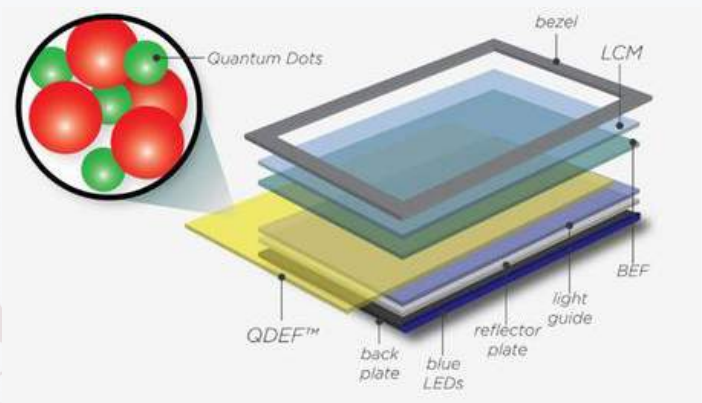

Fig. 4 - Quantum dot display

Solar Cell Fabrication: The maximum efficiency that can be obtained using a normal solar cell is about 35%. One of the reasons for this is that organic semiconductors that are used for the production of solar cells have high absorption coefficients. By using a combination of organic and inorganic materials like CdSe, TiO2, ZnO, PbS, PbSe etc., hybrid solar cells can be produced that have a much more improved conversion efficiency. Quantum Dots are more stable and resistant to oxygen, moisture and UV radiation making them more advantageous than normal solar cells.

The cost of fabrication of hybrid solar cells is also relatively less.

Medical Applications: The major imaging technology advancements in the medical field includes magnetic resonance imaging (MRI), optical imaging, nuclear imaging etc. However, they differ in complexity, resolution, sensitivity and operational cost. But most of these imaging equipment use colored dyes for their optical bioimaging process. Using Quantum Dots instead of dyes have an enormous effect on the image results. Due to high stability of dots, photo-bleaching can be reduced. Absorbance and emissions can be tuned with size which enables the quantum dots for highly sensitive cellular imaging in high resolutions. The toxicity of inorganic dyes is high but with Quantum Dots that are highly photostable under ultraviolet excitation than organic molecules, imaging of deeper tissues is possible.

The study of quantum dots has created a remarkable interest among the researchers due to its contributions to almost every technological field out there. The current interest in the study of semiconductor core-shell quantum dots is related to their possible application towards next generation light emitting devices, energy harvesting devices like solar cell manufacturing or in future generation spintronics and information processing gadgets. Mankind has always been striving to make the world a better place and with these explicit qualities of quantum dots, it has marked its role in creating a better future.

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INDIA'S FIRST 400-KV FULLY DIGITAL SUBSTATION

Ms. SANTHI B
Assistant professor

Digitization and automation have been focus areas for the Indian power grid over the last decade. During this period, the Power Grid Corp. of India Ltd. (POWERGRID), the central transmission utility for India, deployed IEC 61850-based grid substation automation in more than 100 substations across the country. The IEC standard defines a common communication protocol among intelligent electronic devices (IEDs) produced by different manufacturers to achieve extensive interoperability when installed on transmission system protection and control schemes. However, IEC 61850 is not just a protocol; it has changed how power systems are controlled, protected and monitored.

POWERGRID's initial deployment of IEC 61850-based systems focused on the peer-to-peer communication link, namely, generic object-oriented substation events (GOOSE). GOOSE protocol uses a publisher/subscriber type communication, where event messages are sent by a device that other devices can be subscribed to receive from. To start with, binary information was exchanged between IEDs for less critical applications, like the interlocking of substation switchgears, for example. The utility focused on less critical applications first to address any reliability concerns early. During this phase, the devices for digitizing analog information into IEC 61850 sampled values, the "merging units" as they are called in the standard, were under development.

By 2013, the utility had selected process bus technology as a suitable option to overcome deficiencies of point-to-point copper connections between process-level equipment and IEDs as well as to harness the digitization of data at the process level for advanced diagnosis and maintenance planning. This launched POWERGRID's journey into reimagining a future with fully digitalized substations.

POWERGRID commissioned a pilot project in 2014 using process bus technology at its 400/220-kV Bhiwadi substation in the state of Haryana. The substation is equipped with three 315-MVA, 400/220-kV transformers; 10 400-kV feeders; and eight 220-kV feeders. For the pilot project, a process bus was installed on a 400-kV ac overhead transmission line, the Bhiwadi-Hissar

No. 1 circuit. All the primary equipment associated with this circuit was digitized in the substation switchyard using IEC 61850 process bus technology.

The process-level devices, designed for the digitization of data from the primary equipment level, were installed close to the primary equipment in the substation's switchyard. Engineers specially designed the IEDs used for this project to withstand a harsh environment.

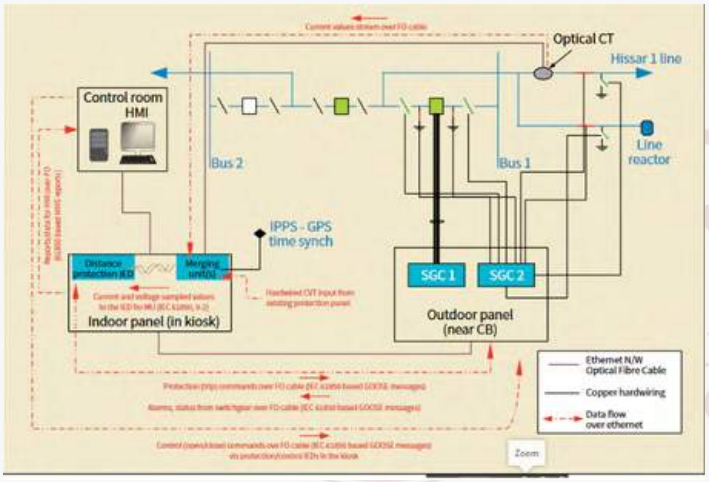

Fig. 1 - Block diagram of process bus system

Improving on the Pilot Project

POWERGRID used the pilot project at the Bhiwadi substation as a test bed for conducting performance evaluation studies on the network and devices, including examining the conformance of these devices to the IEC 61850 standard. The evaluation studies helped with refining specifications for the devices and Factory Acceptance Testing (FAT) requirements by defining the specific test requirements for GOOSE and sampled values based on the protection schemes. The issues identified were discussed in forums, called TISSUES, where technical challenges related to IEC 61850 were collected, logged, presented and resolved. Following a series of discussions with various IED manufacturers, POWERGRID was confident that its updated requirements, stemming from what it learned during the pilot project, could be met. POWERGRID hopes its experience will help to ease some of the apprehension other utilities may have as they begin to adopt IEC 61850.

First Digital Substation

Since the pilot project at Bhiwadi substation began, diagnosing issues on the upgraded circuit has been more accurate. Furthermore, the process bus technology has enabled the online testing of protection and control schemes on this circuit without a shutdown. Formerly, a shutdown was required for these procedures, which in turn had an adverse impact on the availability of the grid. POWERGRID leveraged the results of the performance evaluation studies to support India's first full-scale commercial implementation of a digital substation at the 400-kV level. This project entailed retrofitting the control and protection system of an existing 400/220-kV substation located in Malerkotla in the state of Punjab. The substation was equipped to meet the IEC 61850 standard using a process bus-

based Substation Automation System (SAS).

When commissioned in 1992, the 400/220-kV Malerkotla substation had a conventional protection and control scheme that required the extensive use of underground copper cables. The pilot project involved the digitization of a substation single bay. However, the full digitization of a substation was more challenging and complex.

The complete substation upgrade required updating the protection and control systems, including the bus bar protection system, for the entire substation. IEC 61850 process bus technology had to be installed on all feeders in the air-insulated switchyard as follows:

- 400-kV Malerkotla-Dadri overhead transmission line.
- 400-kV Malerkotla-Patiala overhead transmission line.
- 400-kV Malerkotla - Ludhiana overhead transmission line.
- 400/220-kV transformer No. 1.
- 400/220-kV transformer No. 2.
- 400/220-kV transformer No. 3.
- 50-MVAR bus reactor.

Fig. 2 - Front view and control room of Bhiwadi substation

POWERGRID incorporated advanced networking techniques, such as virtual local area networks (VLANs) and multicast filtering, for efficient network traffic management. As time synchronization was extremely stringent, the devices used were subject to rigorous validation testing. The most complicated part of upgrading the substation was the substation-wide busbar protection, as it required extensive engineering and a unique network interface. The most beneficial aspect of a fully digital substation is the ease in which online testing using simulation and test modes can be employed. These modes were explored and tested at length before formal documentation was completed for ongoing maintenance and training requirements.

The FAT of Malerkotla substation upgrade project was completed in April 2019 and the site commissioning activities are under progress. Similarly, another fully digitalized substation, the 220-kV Greenfield Chandigarh substation, is currently under construction. The FAT is complete and commissioning tests are currently underway.

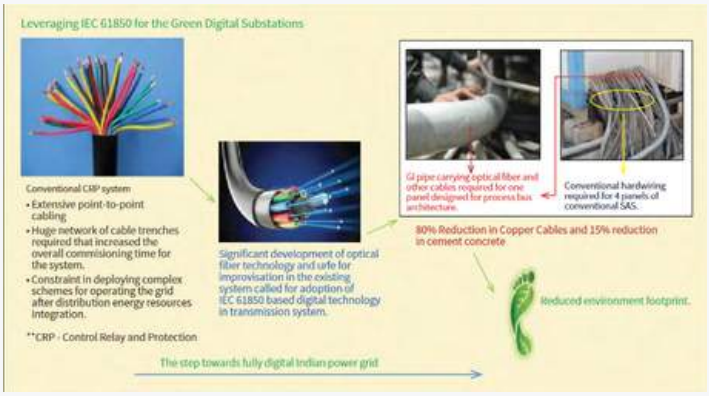

Fig. 3 - Steps toward fully digital Indian power grid

Research Facility

In anticipation of the broad adoption of this technology, a state-of-the-art laboratory dedicated to smart grid, protection and automation research has been established at POWERGRID's research facility, called the POWERGRID Advanced Research and Technology Centre. Equipped with IEDs and configuration tools from different manufacturers, the laboratory is used for conformance testing of software and advanced network switches complying with the latest fast and secure protocols, which are used in the on-site studies that prove a simulation environment for various scenarios. The laboratory has undertaken various interoperability studies with devices from several manufacturers, including conformance validation with standards before on-site deployment.

Going Digital

The implementation of full digital substations offers advanced system diagnostics, smooth online system testing, resource optimization, and reduced troubleshooting and commissioning time. With this venture into the state-of-the-art IEC 61850 systems based on digital substation technology, POWERGRID is now in a position to incorporate even more digital and communication technologies into its substations.

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SECTION 2

ARTICLES

TECHNICAL EDUCATION NEEDS IN THE POST-PANDEMIC ERA

Dr. UNNIKRISHNAN P C
Professor

INTRODUCTION

In technical education, three disruptive waves had been threatening to change the established ways of teaching and learning. Another sudden 4th disruptive wave striking worldwide, COVID-19, has resulted in an unprecedented turbulence in technical education. Those universities and institutes seeking to survive and thrive in a post-pandemic environment have no choice but to reassess and redefine their value proposition. The need to revolutionize technical education by adding human values is emphasized here.

DISRUPTION IN EDUCATION

Three disruptive waves had been threatening to change the established ways of teaching and learning in technical education. The first one is the funding crisis. Globally, Institutions' costs are rising, owing to heavy investments in infrastructure, staff salaries and high administrative costs. In Kerala, there was a time when technical institutions were under the government. The first engineering college, CET Trivandrum, was established way back in 1940 during the reign of the Travancore King, Chithira Thirunal Balarama Varma under the then Travancore University. The second engineering college, GEC Thrissur, was established after the formation of Kerala state in 1957. Slowly governments gave way to aided colleges and the first aided engineering college, TKM College of engineering, was established in 1958 followed by NSS College of Engineering in 1960 and MACE, Kothamangalam, in 1961. Infrastructure of these colleges was built by management and government paid staff salaries. Later governments stopped funding technical institutions and large numbers of self financing engineering colleges were opened from 2001 onwards. After the liberalization of the higher education sector, successive ministries have, without rhyme or reason, accorded approvals for more and more private self-financing colleges. There are currently about 120 private self financing engineering colleges in the state. These institutes have been outcompeting each other by adding more events, programs, facilities and other features while remaining tin-eared to the actual benefits that students need. The integrated structure is being artificially propped up by student loans that, in many cases, burdened the students and parents. Increased number

of technical institutions led to stiff competitions between private institutes and the declining number of students led to a crisis. Many technical institutions in Kerala now face closure. Secondly; in earlier times, engineering institutions used to educate only a tiny elite class of students but under the changing scenario they are responsible for training and retraining students throughout their careers. Thirdly a technological revolution, an explosion in online learning, is changing the technical education's business model.

A fourth impulsive disruption, COVID 19, striking worldwide has created havoc in technical education. With technical education going online, students quickly realized that they don't need to be held captive anymore to the integrated structure. Those institutes seeking to survive and thrive in a post-pandemic environment have no choice but to reassess and redefine their value proposition and revolutionize technical education.

SKILL REQUIREMENTS FOR THE 21ST CENTURY STUDENTS

The world economic forum has specified 16 essential skills needed for the 21st Century students. They are shown in Figure 1. Unfortunately our curriculum is not designed to deliver all these skills and we mostly concentrate on the competency skills only. These skills can be imparted by way of design projects done in groups. The online lectures should also take care of other skills which are normally neglected.

Fig. 1

INCULCATION OF VALUES IN TECHNICAL EDUCATION

Inculcation of values, morals and ethics in technical education is of prime importance as these values mould the next generation to responsible citizens. These values include self-care, seeing possibilities where others see problems, motivation, time management, accepting responsibility, kindness, respect, acceptance, consideration, appreciation, listening, openness, affection, empathy and love towards other human beings.

These values should be inculcated in students by way of moral and motivational stories, social experiments, social immersion projects like working in rehabilitation centers, palliative care wards, community social service, old age homes, juvenile homes, students with special needs, shelter homes for destitute women, teenage mothers, women who are victims of atrocities etc.

MY RAJAGIRI EXPERIENCE

Mr. SUNIL KUMAR K S
Technical Assistant

It's always a pleasant feeling when I think about RSET, especially when I get an opportunity to write about my beloved department. I consider this to be a privilege.

Previously, I was running an SSI unit in my native place but I had to discontinue my job due to some unforeseen sales tax related issues. That was an awful time in my life and I noticed that there was an opening in the EEE Dept. of RSET. My interview went smoothly and I joined Rajagiri in July 2007. Initially I was anxious about how to communicate with the students. But gradually I overcame those tough situations with the support of my colleagues in the department. Baby Sir, who was the HoD, when I joined and Jayasri Miss, who was a senior faculty, helped me to handle the lab meritoriously. Though my hands-on experience was good, I had very less theoretical knowledge at the time.

It was during the period when Varmah Sir became the HoD that I started developing my interest towards the concepts behind the various experiments in the Machines Lab and Power Electronics Lab. He used to visit the lab frequently, especially during the intervals, and he always found time to clear my doubts on various topics. This helped me to foster my basics in various subjects. Apart from this, my interaction with the faculty and students in the department helped me to gain confidence in imparting the practical know-how energetically.

Now, at my 14th year of service, I acknowledge that my job at RSET preserved my prestige in society too. One of the values I try to embody from these teaching days is being "student-centric" in my thoughts and outcomes. This helps to refocus my efforts on the true goal of my work – making a difference in the lives of young people. I thank the Almighty for giving me an opportunity to work among a group of wonderful people who motivated and inspired me, when I almost needed a miracle in my life.

AN ODYSSEY TO A EUPHORIC ACCOMPLISHMENT

CATHERINE JAIBEE
S8 EEE

NEENA ELSA DAVIS
S8 EEE

As the course draws to an end with graduation on the horizon, our team has come to possess a treasure trove with a social appositeness. At the onset of the seventh semester we were entrusted with a prodigious opportunity to undertake a project as a team of four guided by Dr. Rinu Alice Koshy, Assistant professor, Department of Electrical and Electronics, RSET. We were extremely exalted to have a mentor who fostered and enlightened us with her proficiency.

Our guide gave us an insight about the brisk developments being made in the domain of electric vehicles with the astonishing concept of self balancing. Though the concepts have been known for long, only meagre products are available in the market today. This left us flabbergasted, and yet encouraged us to develop a "self balancing electric two-wheeler" which is both easy to build and economical. After a quick revision of related engineering topics we were able to join the dots to frame our project. Our mentor triggered our interest with a video of a similar project at IIT Bombay which boosted our confidence. The greatest hurdle we faced was the desideratum to simplify the project so that it can be accomplished in the advised time. To this, our guide suggested that we maintain a record of all the daily developments made in the project. This fostered burgeon of the project in the right direction.

As a head start, we began with the simulation of the servomotor and the DC motor using Proteus. Once this was tested successfully, a moving prototype of the vehicle had to be established. Since we aimed at a small scale prototype, we had committed to fabricate the body of the vehicle by ourselves. Well, this was not as easy as it sounds. We had to make multiple trials involving various techniques including 3D printing before we came to a conclusion and settled with 2D printing.

Now the focus was shifted towards achieving balance. There were two technologies that had the potential to be adopted, one using a flywheel and the other with a mechanical gyroscope. After some productive discussions, we adopted the former and began with the construction of a flywheel. Our objective was to use a combination of an electrical gyroscope and an accelerometer with the intention of

calculating the tilt and other parameters which could be of use to balance the vehicle. Not long after this, we were hit with a major setback and had to recourse and adopt the concept involving a mechanical gyro. Meanwhile necessary alterations were made to the structure to accommodate the high speed gyro and auxiliary appendages. Balance was achieved by the reactive gyroscopic couple produced by the gyro assembly due to precession of the spin axis. This in simple words is called the gyroscopic effect. After some trial and error the prototype was in shape for its final testing.

Fortunately, the product was a success and was selected for the project competition 2020 organized by APJAKTU National Service Scheme Cell. Since this prototype can be scaled up to a product of great market value and immense social relevance it will certainly be a technological revolution that can fortify the posterity. This journey has ameliorated and emboldened the engineers in us and we are grateful for this indelible opportunity.

ELECTRICITY TRENDS DURING COVID'19 PANDEMIC

ESTHER THOMAS
S6 EEE

The Covid-19 virus was first discovered in China's Hubei province in December 2019. Since then it has become a global pandemic, impacting 140 countries all over the world. Most of the countries adopted social isolation policies to minimize the infection rate.

The social restriction, travel ban, unemployment and work from home policy forced most of the people to stay inside the house, which affected almost all the sectors of the economy. Industries moved to minimum manual operation which reduced energy demand from the national grid which may adversely affect the network equipment such as substations, distribution transformers and protection equipment. In India, a 10 minute nationwide lights-out event was observed to mark the people's participation in the national lockdown. This could have a serious impact on the national grid if it was not managed properly by the utility.

IMPACT ON POWER SYSTEMS - A GLOBAL SCENARIO

The power systems load can be classified as residential, commercial and industrial types. Due to large scale use of electric vehicles (EVs) in different countries, the transportation load has also become a significant load for the power grid. During the COVID-19 outbreak, the typical load demand has changed because of the increase in residential load and decline in commercial and industrial loads.

India: In India, lockdown started from March 25, 2020, and the electricity market clearing volume declined immediately as well as the market-clearing price (MCP) also dropped. The average MCP for March and April 2020 was Rs2456/MWh and Rs2448/MWh, respectively; however, it was Rs3118/MWh in March 2019 and Rs3221/MWh in April 2019 respectively.

Other countries: The demand for electricity in most European countries has reduced, especially in countries like France, Italy and Spain where the spread of the virus was severe. The decline in electrical demand in France, Italy, Spain, Portugal, Belgium, Netherlands, Germany and UK are 14.8%, 11%, 7.1%, 6.4%, 6.1%, 5%, 4.9% and 6% respectively. Energy demand reduction in some other major countries like the USA, India, Singapore, Australia and

China are 5.7%, 26%, 8%, 6.7% and 7.8% respectively.

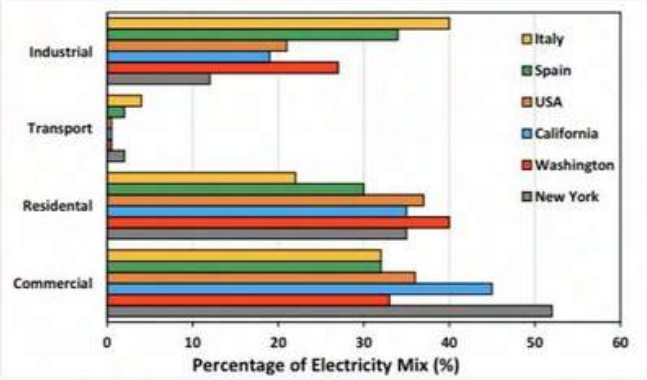


Fig. 1

SCENARIOS OF INDIAN POWER SYSTEMS DURING COVID-19

The demand for electricity is high since India is a densely populated country with 1.3 billion people. India has one of the most extensive synchronous interconnected grids in the world with an installed capacity of about 370 GW and regular base load power demand is around 150 GW. Industrial and agricultural consumption is around 40% and 20%, respectively, while commercial consumption is around 8%, whereas domestic load demand is around 30 - 32%.

Due to the COVID-19 outbreak, the government of India started taking action from the middle of March 2020. In India nationwide lockdown started from 25th March 2020 and continued till 17th May. Before the start of lockdown, the energy consumption across the country was around 3500 GWh. On 22nd March 2020, demand started to decay and energy consumption was around 3000 GWh, continued its trend, and lowered nearly to 2500 GWh on 1st April 2020. In a nutshell, the average all India daily energy consumption reduced by 1000 GWh compared to that of 2019.

INDUSTRIAL VISIT TO ResiTech

FIDHA HARISH
S4 EEE

Industrial Visits are important, especially in the field of technical education as the practice of engineering has an inherent impact on society. The purpose of industrial visits for students is to gain knowledge about technological developments in the industry and to understand the gap between theoretical and practical knowledge that could be abridged in future. The Department of Electrical and Electronics Engineering had arranged a one day Industrial Visit for 2nd semester students to "ResiTech." On 24th September 2018 ten students, including me, visited the industry. I thought of this as an opportunity to share the highlights of our visit to ResiTech, which was a wonderful experience which compared our theoretical learning with practical applications.

Fig. 1

ResiTech is a manufacturing industry located in the Industrial Development area in Aluva. It has been involved in the manufacturing of Hi-Tension current transformers, potential transformers, epoxy resin cast transformers and switchgear components for more than 20 years.

We reached the location at 1:00 pm after a 30 minute bus ride. We got an entry pass at 1:15 pm. Since we contacted the MD of ResiTech, Mr. Balachandran, on the previous day, he had arranged a guide for us.

The factory has a total area of 8000 sq. feet and is well equipped with the latest machinery for winding, 3 nos vacuum, oven oil filtering unit material handling facilities such as a 10 tonne crane, pallet truck, etc. They are equipped with a fully-fledged laboratory with all the necessary testing equipment.

The building is divided into sections working on each part of the transformer:

The winding section located on the ground floor was then working on the construction of windings for their

next transformer. The windings manufactured there used round insulated wire of either Copper (Cu) or Aluminium (Al) as basic raw material and were of circular concentric type. A coil winding machine was used to build both high voltage (HV) and low voltage (LV) windings.

In the assembly section, the core was assembled from thin sheets of cold rolled grain oriented (CRGO) silicon steel which was cut to size as per design. The components produced in the coil winding and core assembly stage are then taken into the core-coil assembly stage. The wound coils are placed in the assembled core and the primary and secondary windings are connected as per the requirement.

The tank is fabricated in the fabrication section which is taken to the tanking section along with the core-coil assembly. The bushings, tap switch drives and lug sockets are then fitted on the tank. It is filled with oil, after which the cover is placed on the tank frame then bolted down. After painting, the transformer is taken to the testing section where routine tests are conducted to measure the efficiency and performance of the transformer.

Some of the types of equipment manufactured by ResiTech are:

1. 11kV Cast Resin Distribution Transformer- both single and three phases with up to 16000kVA.
2. 11kV oil filled distribution Transformer.
3. 11kV Unitised substation.
4. 12kV Indoor vacuum circuit breaker.

We got a quick look at all the different sections and manufacturing processes in the factory and by 5:00 pm, we were on our way back. The visit helped to give an insight into the manufacturing of a transformer and the working atmosphere as well. It's our pleasure to share our experience and we acknowledge that the industrial visit was beneficial for our practical exposure. After the industrial visit the students could identify their own potentials and interests which showed the success of this visit.

AUSTRALIAN IMMERSION PROGRAM

NIKHIL JOY
S6 EEE

Fig. 1

"The gladdest moment in human life, methinks, is a departure into unknown lands." – Sir Richard Burton.

One such moment in my life was when I got the opportunity to attend the Australian Immersion Program conducted by Swinburne University, Melbourne.

We were welcomed by the cold, numbing weather of Melbourne on 14th of July, 2019. Our true journey began the next morning, after a breakfast from the hotel. We met Mr. Karan Kapoor first, who provided us with our Myki cards. We were to use these to travel during our 14 days of stay. We then took the train to the university where we were introduced to Prof. John Webb. Mr. Webb was a retired chemistry professor at Swinburne university, and he further discussed with us about his teaching experience as well as his experience in India as a diplomat.

Next day we met another great personality, none other than Mr. Stephan Manallack. He was a renowned blogger for "INTO INDIA" and had also published 4 books. He talked to us about how we could equip ourselves to compete with the others seeking employment. A particular sentence that he mentioned has stuck with me, "Employers these days are looking to hire 21 year olds with 30 years of experience." In his words, the future to getting hired is communication skills, to be able to pitch an idea in 5 minutes and make the other person understand.

After the insightful session with Mr. Manallack, Mr. Karan divided us into groups and told us about the research project that we had to do. We were to choose an existing technology that had been installed in the city of Melbourne, do market research and come up with a strategy to implement this particular technology in India. We had to follow up on the progress that we made with our research on the weekdays. After that day, our visits to

the university became scarce as now, our only task was to explore, research and present on the final day. This was the academic side of the program. During the first week, we had to take classes till 4 at the university. Then we would go out to have food or buy groceries to cook for ourselves. That was when we got the chance to experience the cultural part of Melbourne. In this diverse city, we were able to find restaurants that had cuisines from all over the world everywhere we went.

During the weekend, Mr. Karan took us to the well known Melbourne Cricket ground. We were able to walk on the grounds as well as visit the museum that lay within the cricket stadium. Here we were able to find a variety of items signed by world class cricketers and were also allowed to take photos. In the museum, there was also an area where we could play some sports like american football, cricket and some other games as well.

The very next day we had a trip planned along the coast of Australia. We booked a tour bus and were on our way to the Great ocean drive tour. It was a 4 hour feast for our eyes. We made a few stops along the way, but one spot worth mentioning was the 12 Apostles. These massive limestone structures towering 45 meters above the ocean were formed about 20 million years ago, as the sea gradually eroded the soft craggy limestone cliffs. There were only eight of the twelve apostles remaining (the rest had fallen) and forming the backdrop were these magnificent cliffs up to 70 meters high. We took many photographs with the beautiful background. We also stopped at the beaches to experience the exuberant waves.

The next Monday came along and we were worried that the fun was all over. Mr. Karan had us do our daily briefing on the advancements we made on our projects early that morning in our hotel lobby. It was then that he provided us with tickets to visit the Melbourne Zoo! Over there we got the chance to see the native biodiversity of Australia. We saw a lot of the common animals that we see at most zoos but the ones that are worth mentioning were the koalas, the penguins and of course the kangaroos.

We also got the chance to visit the Melbourne museum, where we were able to see the history of Australia as well as some archaeological findings. We also got the chance to visit the Melbourne aquarium, where we were able to see all kinds of water lifeforms and penguins.

As our final days in Melbourne approached us, we had to prepare for the presentation of our project. We

visited the town hall ourselves to try to meet the person who was in charge of establishing the smart bins in the city, but it was in vain. After speaking with the security for sometime though, he introduced us to someone who actually gave us the business card of the person who was in charge of this project.

After having a phone interview with him and visiting a few garbage collection agencies in the city, we were able to finish our presentation in time and were able to do a good job on our last day. All the teams performed really well and we received our certificates too.

Then we went to the university cafeteria and talked with some students there, getting a glance at their experience in Swinburne university. On the last day, before we boarded our flight, we went to the "Night Mart." Here we could find a lot of food stalls with cuisines from all over the world. We had a feast that night. From there we went on to dance our night off at a silent headphone party in the Night Mart where people gathered wearing headphones, and the music was synchronised so everyone could dance to the same beat without inconvenience to the people around them. It was pretty funny watching people dance to silence, but it was even more fun when we were among them.

Overall, the Australian immersion program was a great opportunity that the college gave me. It not only helped me to learn how to work on a research oriented project, but also to learn about a totally different culture as well. It was an exciting and fun filled adventure, the memories of which I shall cherish for a lifetime.

ELECTRICAL ENGINEERING IN THE NEXT DECADE

RAHUL CHERIAN
S6 EEE

Electrical Engineering powers the world today and it will power the world tomorrow. The growth of electrical engineering is wonderful. In another ten years, by the year 2030, the unbelievable growth in electrical engineering will be a big boon to the world around us. The revolution, called Industry 4.0, is aiming at boosting innovation in the industrial field. It mainly focuses on the theme of integration and connection of industrial machines to the use of Machine Learning algorithms to offer advanced preventive maintenance solutions. The electrical engineering industry is growing at a very fast pace.

Research and development departments all around the globe are working towards better ways to obtain, store, and use electrical energy. In 2030, 50% renewable energy sources, (12% wind on-shore, 10% wind off-shore, 6% solar PV, 10% biomass, 11% hydro power and 1% geothermal), 34% fossil fuels (28% gas, 6% coal) and 16% nuclear energy will be seen delivering power to the world. All non-fossil fuel sources will form 65% of the total installed power capacity in the future which is amazing. In 2030, the domestic distribution scenario will be more sustainable. People will generate their own power, and sell their surplus to the grid. As a result, the electricity delivery infrastructure will change by placing smart devices throughout their networks, right up to customer's homes, offices, and factories. The smart grid will collect valuable data to allow both consumers and suppliers a higher degree of control over multiple power sources. It will also enable them to predict surges in usage and instantly detect outages. By allowing end-to-end communication between distribution sites, power plants, and the end user's electrical point-of-presence, smart grids will raise efficiency and reduce costs.

Next let us see the evolution of the automobile industry into electric vehicles. Every automobile industry is into a paradigm shift to electric vehicles. About 7 percent of the 259 million vehicles (cars and light trucks) expected to be on the roads in 2030 are going to be electric vehicles. Annual sales of Electric Vehicles will exceed 3.5 million vehicles in 2030, reaching more than 20% of annual vehicle sales in 2030.

Experts predict that by 2030, there would be over 125 million electric vehicles on the road. Considering the millions of Electric Vehicles that are already roaming the streets, this is not really unexpected. Many Electric Vehicle manufacturers are investing hard into the technology, and consumers can expect better batteries, improved charging features, more accurate autonomous driving, solar-powered Electric Vehicles.

Revolution in charging methods will be another boon to society. In 2030 there will be better wireless charging for laptops, smart phones, earphones, and other smart devices. Wireless charging will also become the standard for electric cars. Instead of the large charging docks, drivers will be able to park on a charging spot without needing to plug in. A few years from now, it will also be possible to charge your electric vehicle while it's moving!

Innovations in wireless wearables will improve the safety of humans. In a world where a watch that can detect health conditions of the person (eg: Atrial Fibrillation) and even encourages them to visit a doctor - ultimately saving their lives is not far. Bracelets for electrical engineers with a sensor that vibrates if it gets too close to high-voltage electricity, boots that are built with temperature sensing, lighting, cloud connectivity, and GPS to provide a warning for overheating, proximity to danger, and falls are not very far. This will significantly improve the overall safety of engineers.

Electrical engineers are going to do miracles with Artificial Intelligence. They will create complex algorithms for data interpretation, generate new codes or revamping existing codes, build massive AI and machine learning platforms, develop comprehensive strategies in the field of electronics. Artificial intelligence is going to help electrical engineers with image processing. Engineers can invent complex image processing algorithms to help machines detect electrical or structural abnormalities on a framework and quickly send feedback or suggest rectifications.

Due to their energy-saving capabilities, LED bulbs save each household a lot of money per year in utility bills. With more advances in smart technology, these LED lights are expected to become even more efficient and easy to install in the near future.

IoT will impact many different areas of the electrical engineering landscape. From smart grids to smart lighting and Visible Light Communication (VLC), among many others, IoT will be an integral part of the electrical engineering industry.

Apart from the smart grid benefits like monitoring, distribution and automation implemented in electrical utilities, IoT applications in the field of electrical energy will include smart inverters, advanced metering infrastructure (AMI), remote control operation of energy consuming devices and SCADA (supervisory control and data acquisition.)

While wind and solar power are excellent sources of sustainable energy, they are not always there. Therefore, consumers can only "make hay while the sun shines." They have to do their best to save energy from the wind, the sun, or any other renewable sources for later use. To meet this demand, electrical engineers all around the world are working towards better batteries and energy storage options.

Robotics will significantly help to improve safety. For instance, remotely controlled, wireless underground cable cutters can be used instead of putting humans at life-threatening risk. In the future, line detecting robots and drones will rule the world of generation, transmission and distribution of electrical energy.

With sufficient technological advancements that are sure to come, electrical engineers can definitely make this world more comfortable, efficient, and affordable in the future with our ever growing ideas.

CYBER ATTACKS DURING COVID'19

RAHUL RAJ
S2 EEE

ABSTRACT

Cybersecurity and cyberattacks have been the most discussed and alerted parts of today's world. As we are living in a screenage world, everybody from the newborn to those in their deathbeds use some type of screen, either the mobile or television, to cope up with their loneliness.

As the usage of technology is increasing with every second, there comes a higher chance of crime to take birth. Each year the number of security incidents on the internet increases. Although technology companies are putting more and more effort to secure the global network, criminals are still able to find their way into corporate and government-owned infrastructure. Yearly growth of malware infections and other security-related incidents falls into 20-50% range, depending on the source of statistics. The U.N. disarmament chief Izumi Nakamitsu reported during the Security Council meeting on 22 May that "cyber crime is on the rise, with a 600% increase in malicious emails during the current crisis". This is the center of today's discussion. Even though the world is suffering in this pandemic situation, hackers find time to torture people through cyberspace.

INTRODUCTION

Cyber crime is a global problem that's been dominating the news cycle. It poses a threat to individual security and an even bigger threat to large international companies, banks, and governments. Today's organized cyber crimes outdo shadow lone hackers of the past. Now, large organized crime rings function like start-ups and often employ highly-trained developers who are constantly innovating online attacks. With so much data to exploit out there, Cyber security has become essential.

CYBER ATTACKS LAUNCHED DURING THIS PANDEMIC SITUATION

The times of global pandemic made an excellent opportunity for APT (Advanced Persistent Threat) groups to target employees working remotely in a home office environment where security capabilities are nowhere close to the ones deployed by system administrators in corporate networks. Although most of the attacks launched in recent months do seem to originate from criminals and hacking groups not related to any

particular state, there are indicators of attacks launched by state-sponsored groups. In the middle of February QiAnXin security researchers found a C# backdoor trojan attached to documents named "Коронавірусна інфекція COVID-19.doc" (Coronavirus infection COVID-19.doc). The document was sent to selected targets in Ukraine. Attackers tried to impersonate the Center for Public Health of the Ministry of Health of Ukraine. Opening the document and allowing the malicious macro to run allowed hackers to gain full control over the victim's computer. The analysis of code performed by researchers identified the Hades group, tied to APT28 (Fancy Bear) operating out of Russia, as the authors of the malware. It is important to note that, at the same time the above attack took place, Ukraine was hit with a huge social media disinformation raid, for which Ukrainian officials blamed Russia. Since the beginning of the coronavirus outbreak, fake news related to pandemic has spread through Ukraine like in no other European country. Russia denied those accusations.

The amount of malware distributed in recent weeks confirms the importance of Estonia's Prime Minister Juri Ratas' words. During the Security Council meeting which took place on 22nd May 2020, he said that "The need for secure and functioning cyberspace is more pressing now than ever". He also criticised cyber attacks targeting hospitals and medical research facilities, which were launched during the pandemic. "Those attacks are unacceptable," said Ratas, highlighting the most important elements for securing cyberspace. "First, the United Nations Member States have agreed long ago that existing international law also applies in cyberspace. We hold the strong view that existing international law provides comprehensive guidance for state behaviour regardless of the domain. By following this simple principle, the behaviour of states in cyberspace can become more transparent and predictable. Second, Estonia considers that a framework for cyber stability and conflict prevention has already been established by existing international law, voluntary norms of responsible state behaviour as well as confidence-building measures. It is now important to implement this framework". Except for Russia, this Security Council meeting was attended by all council member states.

HOW CAN WE PREVENT CYBER-ATTACKS LAUNCHED DURING THIS PANDEMIC SITUATION?

- Train your employees on security and work from home best practices and make sure they are aware of the risk they can inadvertently pose to the security of the organisation.

- If possible, then ensure that your employees are only using their corporate devices to access company data. Also, make sure that the devices they use have the latest security patches installed and updates enabled.
- Tweak your company's email protection settings to ensure that no phishing or spam emails can make it through to your employees.
- Train your employees in the art of spotting phishing emails and to not click on suspicious links and alert them to phishing emails that have made it through.
- Make sure remote users access SaaS applications through the corporate network instead of accessing the applications directly via the internet from home. This would ensure that your security solutions like CASBs have visibility into all traffic accessing your services in the cloud.
- Most SaaS providers facilitate such access to their services; however, you might have to enable a few settings to make it work.
- Make sure you are keeping a close eye on all your network traffic, especially SaaS traffic. Data breaches are a real threat during this crisis, and you must ensure that no unauthorized data transfers take place in the guise of "normal remote work."
- Ensure tenant access control if possible, to avoid data breaches or illegitimate data access.
- Purchase or enable DLP capabilities provided by your SaaS providers to ensure additional data protection.
- Ensure that all your employees accessing your corporate network are using VPNs to do so.

CONCLUSION

We know that prevention is always better than cure, likewise, we saw many ways of how the cyberattacks take place during this pandemic and what are all the ways of protecting ourselves from getting trapped in these attacks. Finally, as the Zero Trust model recommends, practice the principle of "trust nobody" and make sure that no user has access to data that they don't depend on for their day-to-day functions. Restrict access as much as possible, ensure that you have visibility into all your users, traffic, data and workloads and that you have uniform security policies applied across all locations to make sure no security loopholes exist. Just like a simple bar of soap can help protect you against the COVID-19, taking simple, common-sense security measures can help protect us all against the cybercriminals exploiting the chaos.

A TRIP DOWN MEMORY LANE

SANDRA MARIA BINOY
S8 EEE

After 12th I was planning to pursue Aerospace Engineering, but before that, I wanted to study something more basic like Mechanical or Electrical Engineering. After putting in a lot of thought, I chose Electrical Engineering and wanted to see where it would take me. At the same time, I was also looking for a college that gave emphasis for extracurricular activities as well. Rajagiri was not my first choice to go. I wanted to go to a Government college but nonetheless my parents wanted me to join here. However, looking back, I am thankful for choosing this college and all the more the Electrical department. The teachers were always ready to help and always urged us all not to restrict ourselves to the syllabus, but also encouraged us to read and have good practical knowledge. We had a very talented class in terms of extra-curricular activities. The department supported us in every one of our ventures.

I guess I really am going to miss my classmates a lot. All these four years, we stuck by each other amidst the laughter and small fights. We grew so close that we didn't want to leave. We wish we had one more class to just see everyone. Every one of my classmates were selfless. They helped each other in their studies, uplifted those who didn't do well. Be it be for organizing events or tackling academia, our class stayed united, always. I got to be a part of the Jesus youth in the campus as well. All the seniors, even the ones we met in our first year, still keep in touch with us. I will miss our core gatherings, the main gatherings and all the outings and celebrations we had. These people were always there for me through all my ups and downs. I was not much of a leader, so I was surprised when I was assigned to be the Assistant coordinator. I thought it was going to be nerve racking, but everyone was there to support each other. I learned that it was not about me alone, it was about just being there for others and keeping them in my prayers. They helped me to drastically improve my abilities to lead.

I met a lot of talented people here, people from whom I learned a lot. It was a beautiful sight to see all the houses competing for first place and also staying together amidst the chaos. The competitions helped me to gain confidence in singing and dancing, something that I was only an average

at. And trust me, the energy was mind blowing. We also got to meet the college alumni who had their startups. They were amiable enough to reach out to during our projects. They helped us a great deal in technical areas and gave us a lot of ideas that we wouldn't get by just reading theories alone.

I wish this phase of my life didn't end so abruptly. Yet, this pandemic has made us all grow much closer than before through virtual platforms. The thing that I regret the most is that we could not do anything for our teachers. They went to the college every day while we were sitting in the comfort of our homes, and ensured that everything academic went hassle free for us. On that note I hope to see my friends, teachers, juniors and seniors someday after all this ends. Till then let's all keep supporting each other and keep in touch.

WHY, WHAT AND WHEN...

JESUDAS DAMASIE
S8 EEE

Every answer in our life needs a question to begin with, and I had not just one, but three.

What to do with my life? Why should I do it ? When to start?

All this led me to take some of the best and worst decisions I had taken in my life .

Taking engineering as an answer to what I wanted, I joined Rajagiri to experience the engineering life, and I believe I may have discovered more than just engineering. What I wanted was a degree, but what I got was unlimited experiences. It may not have been what I really wanted, but it took me on a journey of fun, knowledge , opportunities, and friendships that mattered. I cherish every single part of this unforgettable journey.

Being a student, I started asking why I chose engineering. I dwelled on the question for a very long time, until I realised that I won't have a definite answer within a definite time. In my initial years in this stream, I was met with an urge to explore rather than confine myself to the system. That helped me to set myself apart from what was expected from an engineering student. I branched out to different areas, starting with organising events, learning some technical shenanigans, meeting new people, exchanging random ideas, etc. This phase of my life was an answer to why I chose engineering, and it occurred to me that it's a constant pursuit of know how, not just of technical problems but also a lot more.

Yes, engineering is about technology, but more than that it's about knowing a technology and understanding how to use it. But why did I start out with engineering? There were plenty of fancy degrees out there. All of them had the provision to explore, yet, engineering was what suited me because I was into it from both a technical and a managerial point of view. The answer to why I started out with engineering was that I needed to understand how things worked to solve problems. The best thing is that a degree alone doesn't make a good engineer. It's the experience of interacting with like minded people, mentoring, exchanging and discovering ideas that give value to your investment of four years. The degree is simply an acknowledgement for the efforts.

Most of my college life revolved around the pursuit of my dreams and the gateway to it was my first opportunity to conduct an event. Coordinating a talent hunt event in the name of "Voice Hunt" was fun and challenging, at the same time but it helped me discover my abilities as a manager. This event set me out on a quest for more such opportunities, which led to my membership in IEEE, a prestigious organisation which aligned with my interests. It gave me another set of answers to my three questions. Being a part of this, I understood that networking with the right people can go a long way, and some of the networks, if not all, played a significant part in my life. Networking, travelling, sharing ideas and attending conferences gave a new perspective to my life cause I started to love what I did. So, why do something that you love? Because once you start, there's no stopping it.

Realising what to pursue in life is not something that happens overnight. It takes persistence and courage to stick with your guts and know when to start with. It is my college that gave me platforms such as the students council, various exposure with countries like Malaysia, platforms to be a leader influencer etc, to dig deeper into myself and understand what my soul needed, and thus, the answer to "when to start" was right in front of me. Start when you feel like it. You may miss opportunities, but never lose the courage to grab the next one.

CAN CREATIVITY BE LEARNED?

ROHITH JOSEPH MATHEW
S6 EEE

Personally, I believe the most important skill that one would need in the post COVID-19 era will be creativity. I am sure all of us have heard things like 'You need to be creative if you need to sustain' or 'Creativity is the key.' Yet, there are so many people who come up to me and say "Rohith, I don't think I am creative enough/I cannot think creatively."

However, I have a very different view on this. I think we all are born creative.

I will share a small story of mine. When I was 9 years old, I had a simple empty carton box at my home. I used to spend all day inside this box, because I could imagine it to anything as I wanted it to be. I imagined the box to be a cockpit, with all those flight controls in front of me, and I would visualize myself as a pilot. I would simply say out the instructions "Flight 787 heavy, prepare for landing." Once I got bored of this, I would imagine the box to be a car. I would visualize the steering wheel, all the paddles and then I would call up to my dad saying "Acha, vaa let's take a round!"

But now I don't do it. I see the box just as the box itself. I am sure we all must have had similar experiences back when we were little kids. As children we were very curious and we thought expansively. But over time, we begin to think reductively because education teaches us to look for one right answer.

I am sure we all must have heard this term, "Think out of the box," at least once. It's very simple to say but it's actually very hard to do! You need to practice. You need to know how to get out of the box, where to go and how to come back inside the box because that's where we all live after all. So, if you want to 'future-proof' your career, then there is no better approach than focusing on thinking more creatively. Stop settling for solutions that have worked previously and push yourself to think of newer, better ideas. Regardless of what you might have thought before, creativity is a skill in itself. And like any other skill, you get better if you work on it.

DEPARTMENTAL ACTIVITIES

FACULTY DEVELOPMENT PROGRAM

- KTU Sponsored 5 Days FDP on “Advances in Electric Vehicle Technology”- 8th to 12th July 2019.
- 5 Days Online FDP on "Control System Applications with MATLAB Sessions - 27th to 31st July 2020.
- 2 days Webinar on “Redefining and Reassessing Value Proposition in Technical Education in a Post Pandemic Era” 15th to 16th July 2020.

HACK AWAY - STATE LEVEL HACKATHON

Hack-Away was a hardware hackathon conducted on the 15th of November, 2019, for a duration of approximately 20 hours. It was a flagship event for us, one that highlighted seamless coordination between students of all years in the Department of Electrical and Electronics Engineering.

BANDSLAM

The 16th of November, 2019 was witness to a rhythmic war. Band Slam was a musical extravaganza, one where bands from far and wide competed for the title of ‘The Best Band.’ The intent of the contest was to make a fun faceoff for the participating teams and a musical delight for the audience.

SECTION 3

ACHIEVEMENTS

OVERALL CHAMPIONSHIP

RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

- *Our college bagged first place in Exuro'20, an intercollege event conducted by TKMCE and IEEE Student Activities Committee, Kerala Section.*

- *RSET once again proved its worth by coming first in Orion, a virtual tech fest conducted by the IEEE PES Women in Power Community and the IEEE PES Kerala Chapter on 19th to 22nd June, 2020.*

DEPARTMENT ACHIEVEMENTS

- *AICTE grant of Rs 12 Lakhs under the scheme MODROB (Modernisation & Removal of Obsolescence) has been granted to DEE for modernising the Power System Lab as Renewable Energy and Smart Grid Lab.*

- *Our department has become home to yet another PhD. At the end of 2019, Dr. Rinu Alice Koshy was awarded with the degree of Doctor of Philosophy in control systems, thesis titled with "Reaching Law based Sliding Mode Controller Design for Enhanced Performance of Discrete Time Systems," from NIT Calicut.*

Dr. RINU ALICE KOSHY
Asst. Professor

INDIVIDUAL ACHIEVEMENTS

GOKUL KALESH
S8 EEE

SANJEEDH ROSHAN K V
S8 EEE

ROHIT SEKHAR
S8 EEE

2019 APJAKTU D-Zone Football Champions
2019 APJAKTU All Kerala Football Tournament Champions

ROHITH JOSEPH MATHEW
S6 EEE

SACHIN A J
S6 EEE

2019 APJAKTU D-Zone Cricket Champions
2019 APJAKTU All Kerala Cricket Tournament Runners Up

MELBIN BENNY
S6 EEE

BENSON BENNY
S8 EEE

2019 APJAKTU D-Zone Badminton Championship First Runners Up

AUSTIN ORIGIN
S6 EEE

2019 APJAKTU D-Zone Handball Champions

INDIVIDUAL ACHIEVEMENTS

YADHUNANDANAN P
S8 EEE

Bharatham 2019
Kalathilakam

BONNEY XAVIER
S8 EEE

KTU Interzone Tennis
2nd Runner Up

SHON SHAJU
S2 EEE

2019 KTU D-Zone Chess
Championship 3rd place

ALFY JOHNSON
S2 EEE

Selected as a Millennium Fellow for the Class of 2020 by the United Nations Academic Impact and MCN.

ANEETTA AGNUS T J
S2 EEE

2019 KTU Basketball D-Zone
2nd Runners Up
2019 KTU Handball D-Zone
Champions

JOEL JOY
S2 EEE

2019 KTU Inter Zone Cricket
Tournament Runner Up

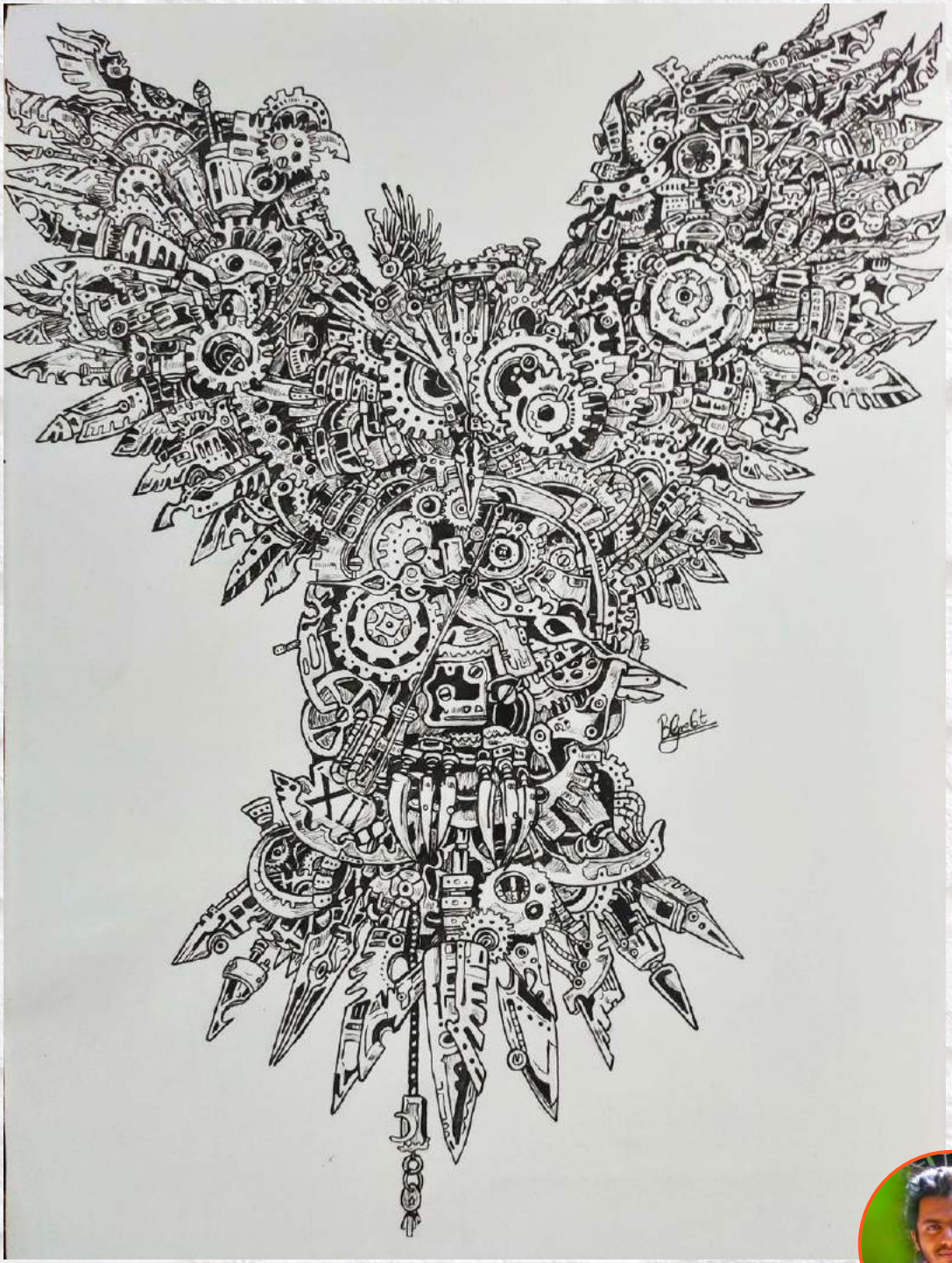
DIYA JASMIN
S2 EEE

2019 KTU Inter Zone
Badminton Champion

SECTION 4

ART WORK

DOODLE ART

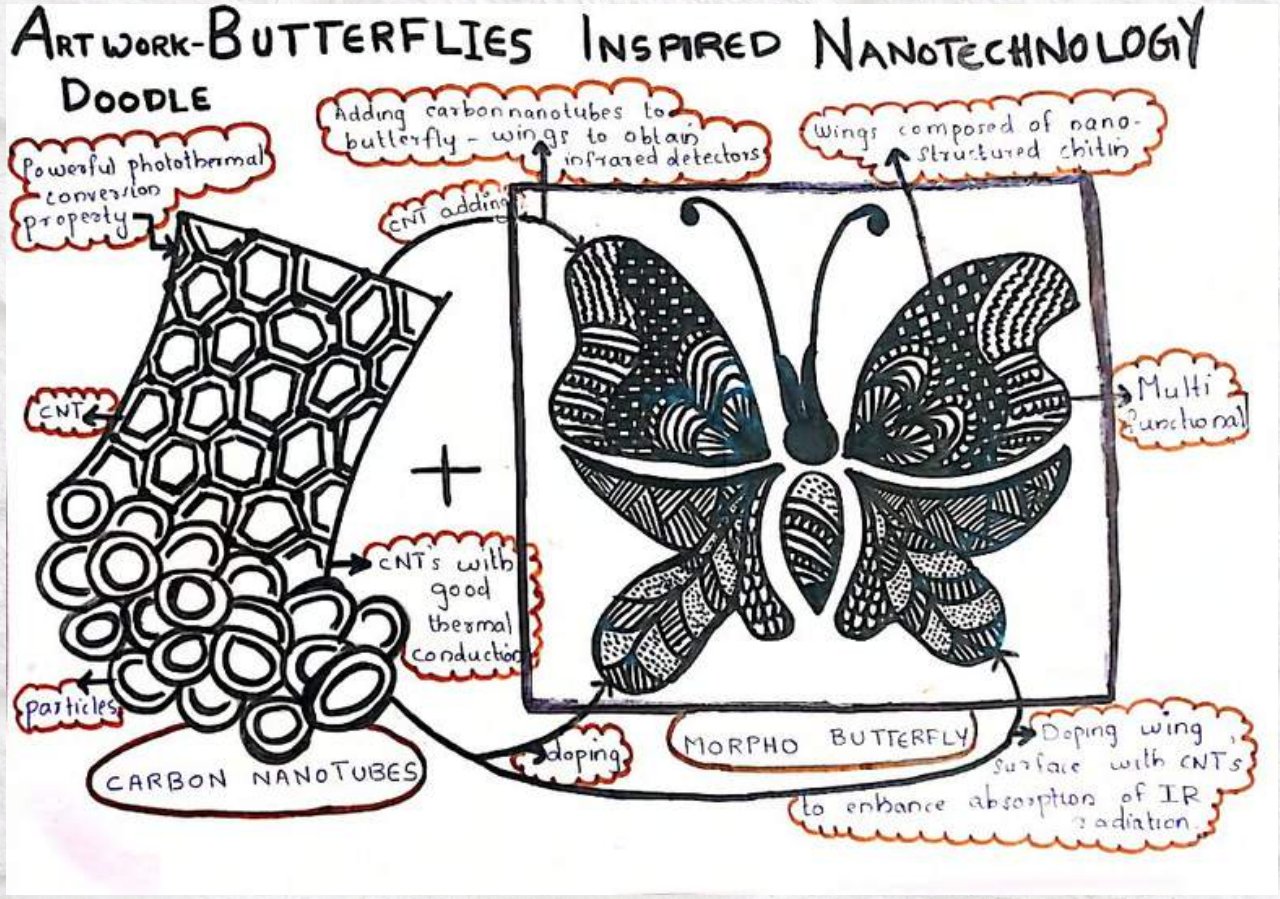


GEO BENEDICT
S6 EEE

DOODLE ART

Dr. RINU ALICE KOSHY
Assistant Professor

SANGEETHA JOSEPH
S4 EEE



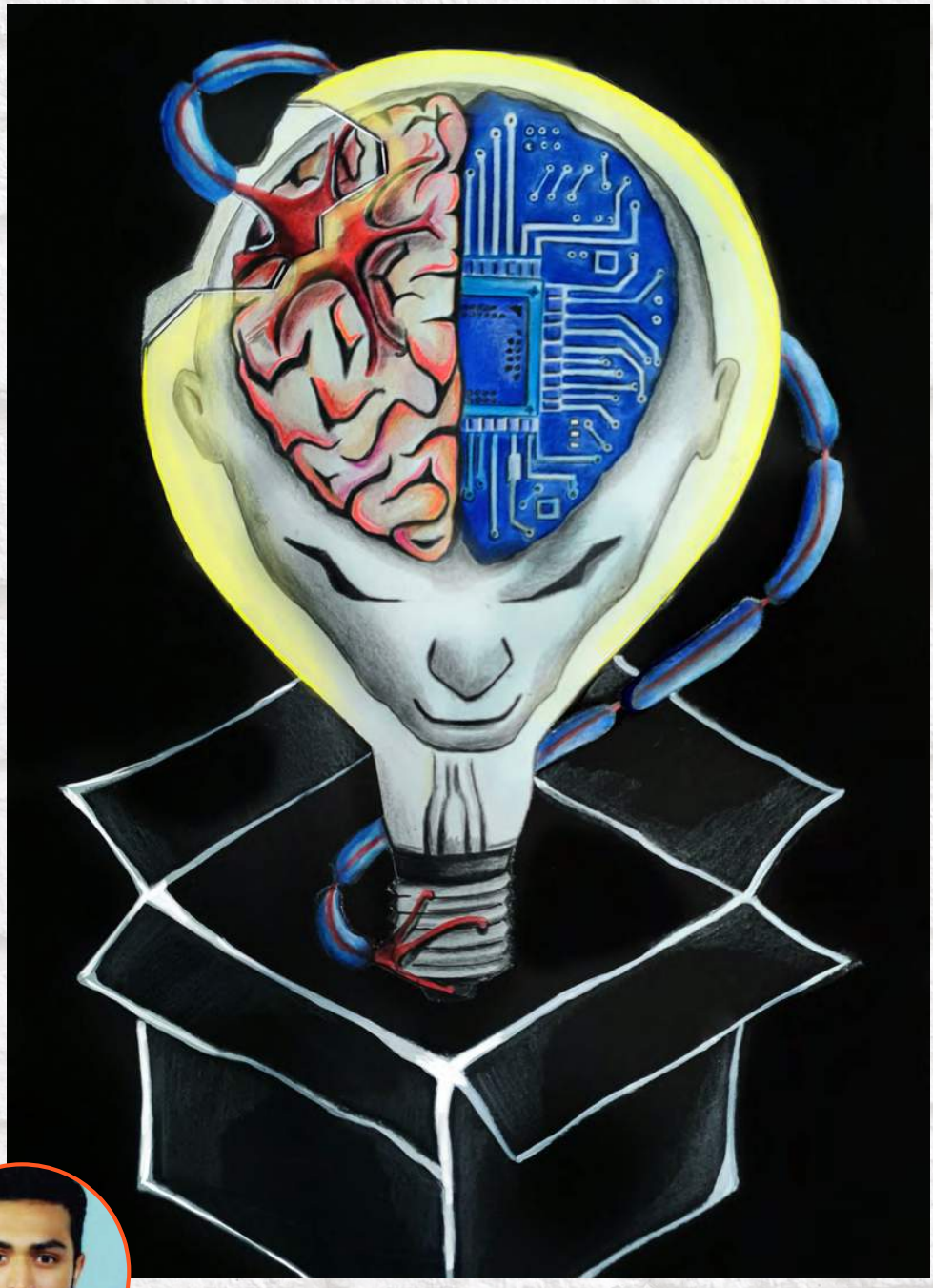
PHOTOGRAPHY

ABHISHEK NAIR
S2 EEE

PHOTOGRAPHY

JOHN T KANATT
S2 EEE

DRAWINGS



MISHAL ANWAR
S4 EEE

DRAWINGS

Dr. RINU ALICE KOSHY
Assistant Professor

SUMIL SAJU
S2 EEE

THANK YOU

"We are honoured to be a part of this venture. We hope that you enjoyed reading this magazine as much as we enjoyed compiling it."

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