POTENTIA

Volume 14

EEE *at a glance*

HYPERLOOP TECHNOLOGY

FIFTH MODE OF TRANSPORTATION

GAMES IN POWER SECTOR IN INDIA

CIMON

WORLD'S FIRST AI ROBOT TO FLY IN SPACE

Department of Electrical and Electronics Engineering
T.K.M. College of Engineering

OUR FOUNDER

Janab A Thangal Kunju Musaliar

Standing live at the forefront of Engineering Education with the vision of excellence in education and research with socio-economic and environmental outlook, ever since its inception in 1958 by the great visionary, philanthropist and social reformer Janab A Thangal Kunju Musaliar, TKM College of Engineering has never failed in instilling colour to the dreams of all those who dwell in. Over the years of existence, the institution has emerged as a kaleidoscope of diversity and vibrancy, transfiguring the way technical education is imparted and practiced.

Through the ever growing number of alumni spanning over the globe, managing variant roles in different domains, the institution is always involved in the process of betterment of this world. Team Potentia pays respect to this campus, our abode, which has offered a better future to the nation, in its sixtieth year of excellence and glory.

Celebrating 60 years of Excellence

T. K. M. College of Engineering, Kollam

Message from HOD

Greetings from the Department of Electrical and Electronics Engineering of TKM College of Engineering, Kollam!!!

Congratulations to the Editorial Board!!!

This is the 14th version of POTENTIA, the technical magazine published by the department since 2004. The students, faculty and staff have always strived to improve the quality of POTENTIA from version to version. The current version is undoubtedly a perfect blend of topics from energy, environment, computation, data science and e-mobility. The articles are compiled by the editorial board from the contributions of students from all the batches and the faculty of the department.

This is the era when the scientists and technologists proclaim sustainability as the need of the hour. Our department is also taking a bold step to move towards the “green strategy”. This version of POTENTIA is published as an e-magazine avoiding the wastage of paper and the delay in printing and publishing by a print- media. This magazine will be available in the department website for any visitor to read. The complete list of activities in the previous year is also included in POTENTIA for verification by all accreditation agencies. The gallery has a collage of photos of various events for future reference too. Hope, this e-magazine brings content to all readers.

With Regards
Dr. Bijuna Kunju K
Professor and Head
Department of Electrical and Electronics

STAFF EDITOR

'POTENTIA', the in-house technical magazine of the Department of Electrical and Electronics Engineering was envisaged to provide a platform to instill technological focus and also to improve the literary and managerial skills of the students. The budding technocrats get an opportunity to experience the modus operandi involved in technical documentation which will be of use to them later in their professional career.

In the present scenario of Outcome Based Education, the National Board of Accreditation (NBA) has very clearly specified the (12) attributes an Engineering graduate should attain on completion of the Program. Among these, few attributes namely, The Engineer and Society (6), Environment and Sustainability (7), Ethics (8), Individual and Team work(9), Communication (10), Project Management and Finance (11) and Life-Long Learning (12) are attained to a larger extent through Learning beyond the class room through co-curricular activities. 'POTENTIA' is an element of the co-curricular activities which significantly contribute in attaining the above mentioned attributes.

Every single edition of 'POTENTIA' was theme based. In this 'POTENTIA', volume 14, the focus is on emerging prospective technologies in Electrical Engineering which include topics such as Energy management in the context of climate change, Electric vehicle -propulsion motors, Batteries, Power game, String theory, Smart meter, Wireless power transfer, Hyper-loop, AI based flying robots etc. A consolidation of the department activities and student achievements is also presented.
The Editorial team has strived its best to come out with yet another glorious edition in digital format which will be a silky feather in the golden cap of the Department. It was indeed a privilege for me to be part of this team as Staff Editor. I am thankful to the faculty, staff and students of the Department who supported and contributed in making this a success.

With Regards
Prof. Shanavas T.N.
Staff Editor

The Team

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Editorial

"When I was in college, I wanted to be involved in things that would change the world"

These were the words quoted by a sci-fi visionary hero "Elon Musk" who made SpaceX, Tesla Inc, Neuralink and The Boring Company and today he is overseeing the research, engineering and management of the companies. Our college and the Department have always served a platform to showcase the flair and mastery of young minds. Thinking out of the box and cultivating an innovative approach has always been a prime focus for us.

Dear Readers

Welcome back to reading another carefully crafted issue of EEE Department magazine –"POTENTIA";Volume14. Potentia 14 mainly focuses on the emerging top-notch technologies in Electrical and Electronics Engineering. Inclusion of diversified application of electrical technology and the recent innovations adds zeal and zest to our magazine. Most of the articles strike a propinquity in dealing with unique ideas; that can pave way to the invention of novel technologies in the future.

Furthermore, as an attempt to invigorate the readers, Potentia 14 comprises the brief introduction of some admired softwares, annual association report covering the plethora of activities organised by the Department, " EEE @ a glance" which brings forth the achievements of our students in various arena and finally an image gallery of the exuberant moments.

"Unity is strength.When there is teamwork and collaboration, wonderful things can be achieved."

- Mattie Stepanek

Our venture through this alley has been victorious only because of the team members who
committed their heart and soul to bring this to the completion. The team also
extends their sincere gratitude to every student, staff and faculty members of Electrical and
Electronics department for their timely support to make this a successful one.

Happy Reading!
The Editorial Board
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Contents

Role Of **Energy Management In Climate Change** And **National Development**

By **K.Sivadasan**
FIE, FIV, Former Deputy Chief Engineer, KSEBL

Competition is the hallmark of civilizations across the world today. History teaches us that whoever commands larger energy could stand tall among the competitors and lead the world. Regions in the world were colonized by nations who commanded larger energy. The oldest reference on energy is related to the Sun. The Rig Veda declares that "Surya is the Soul, both of the moving and unmoving beings". Civilizations were evolved to higher levels based on efficient use of energy. Higher generation and better management of energy constitutes the main criteria to win over competitors. This line of thinking took man to the present day practice of generation and consumption of electricity, choosing various sources of energy such as fossil fuel, Uranium, and renewables.

Energy and civilization

The progress of civilization, in the present day definition, has an intrinsic relationship with GDP. There is a correlation between energy generation and GDP of a nation. To raise GDP every nation tries every possible means to generate maximum energy. In this wild run for energy, nations turned to fossil fuels and Uranium. Incidentally, fossil fuels and Uranium are limited in availability.

Climate change and industrialization

Climate change agreement ParisCOP21 was the result of the realization of a precarious level of carbon pollution as per the Keeling Curve shown in Fig 1. Findings of Dr.Keeling lead to the study of historic CO2 concentration. CO2 concentration increased fast from 260 ppm after 1750 (Industrial Revolution). Note the gradual rise in carbon pollution from use of steam engine (1770), IC engine (1870) and electric motor (1890). It gets faster with the invention of electricity grid. The abnormal rise after 1960 is due to global competitive mode of industrialization. It was 315 ppm in 1960. It has crossed 414.96 ppm on 25.5.2019 and moving towards 450 ppm

when temperature is expected to rise by 2 degree from the pre- industrial period.

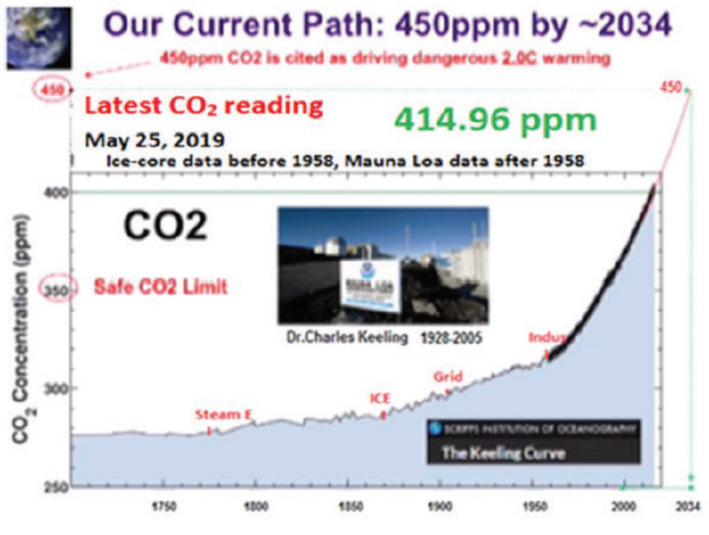
The rise of earth's temperature causes unpredictable and violent climate mishaps - rise of ocean temperature, melting of ice, rise of sea level, heat waves and extreme weather events like hurricanes, torrential rain, floods and landslides. Scientists predict catastrophes after 1.5 Degree C rise.

Science tells us that if we go above 1.5°C, we could experience an 'extinction tsunami' resulting in the collapse of many key ecosystems. The Paris summit reached a consensus to curtail a global rise in temperature to 2°C while trying to achieve a more ambitious target of 1.5°C by 2100. The agreement calls for carbon neutrality after 2050 and reducing the use of fossil fuels in favour of renewables.

Since 1980, greenhouse gas (GHG) emissions have doubled, raising average global temperatures by at least 0.7 degrees Celsius – with climate change already impacting nature from the level of ecosystems to that of genetics. There is a campaign 'Global Deal for Nature' (GDN) initiated by the NGO, 'One Earth'. Their aim is to get back the level of GHG concentration to the level of pre-industrial period. Appears impossible, but has to be accomplished by all means!

India's mitigation strategies

India's action plan emphasized striking a balance between emission reduction and sustainable development. India voluntarily pledged it's "Intended Nationally Determined Contribution" (INDC) to UN on 1st October 2015 according to which India is committed to reduce its emission intensity of GDP by 30-35% by 2030 from the 2005 level. An ambitious target!! Mitigation strategies are enumerated in the pledge. Among several programmes under the strategy, India has to achieve 40% renewable capacity in the energy mix by 2030. India has an ambitious programme for renewable generation. It aims to add 175 GW renewable capacity by 2022, and 500 GW by 2030.



Power System Planning

Plant Load factor (PLF) of thermal plants declined from 75% in 2011 to 60% in 2018. It will decline further when more renewables are added to the grid. Decline of PLF compel thermal producers an upward revision of tariff to keep plant running without loss. An acute shortage of coal is imminent. The Central Electricity Regulatory Commission (CERC) has allowed power companies to renegotiate PPAs signed with Discoms to compensate additional cost involved in imports etc. This results in sharp increase in grid tariff with the use of imported coal. Imported coal costs around Rs7100 per ton while Indian coal costs Rs2800 per ton (2018). Resource nationalism will play havoc in future price of imported coal.

The cost of renewable power (Solar and wind) takes a downward path and the cost of conventional power takes an upward path. Renewable energy sources (Solar and wind) have passed grid parity in India. India has to regulate energy mix of grid to keep grid tariff low. This is to keep unit price of industrial products competitive.

KSEBL's contribution to climate change mitigation

Kerala has to raise renewable generation to support India's ambitious programme. 70% of consumption in Kerala comes from fossil fuel. Kerala has to revise the energy mix to enable supply of power at reasonable cost.

Kerala has a rooftop solar potential of 30000 MW as estimated by WISE, a consultant engaged by KSEBL. According to Dr.Kalam, Kerala can become energy independent in 16 years by exploiting rooftop potential. He said it in 2014. With a vibrant rooftop solar policy, Kerala can raise solar generation fast enough. It is doubtful whether the proposed 'Kerala Power Policy 2019' can accomplish the target. KSEBL has to change its business model in line

with the changes in the global energy sector. Accommodation for technology disruptions in energy sector should also be looked into.

Conclusion

Energy is a primary input to industry. It is unfortunate the vested interests argue in favour of depleting fossil resource. Let us not get trapped in the ditch that is dug discreetly on the path to industrialization. There is no greater threat to our security, to our economic growth, to the survival of future generations than Climate Change. Pairing the GDN10 and the Paris Climate Agreement11 would avoid a catastrophe. Let our industrial policy stick to mitigation of climate change. Let us transfer the gift (Nature) we received from our forefathers to future generations unaltered.

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Electric Motors for EV Application

By **Shanavas TN**
Associate Professor, Dept. of EEE

This article gives an insight into the electric drives used as propulsion system in both hybrid and battery operated electric vehicles.

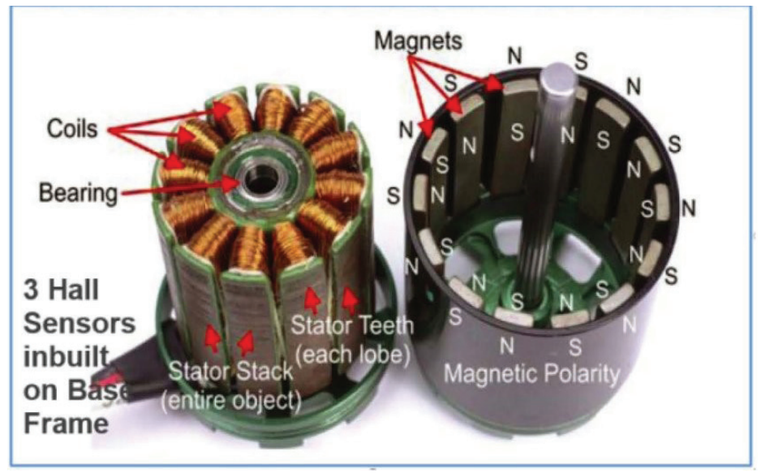
Radial Flux Motor

The commonly used electrical propulsion at present for both type of vehicles is a permanent magnet, synchronous radial flux traction motor, also called as synchronous brushless DC (BLDC) motor. Its design is derived principally from pump and industrial motor designs. For robust design it uses rare-earth magnets located along the outer edges of a plate, called the rotor magnets with much greater magnetic strength than standard iron magnets. They are formed by alloying rare earth materials, such as neodymium and dysprosium, into iron.

To produce rotation in a synchronous BLDC motor, windings of copper wire—called the stator—surround the rotor and interact with the magnetic fields of the permanent magnets. By carefully energizing different regions of the stator at exactly the right time, a rotational force can be imparted to the rotor and the motor spins. This is done by sophisticated power electronics circuits.

The drawback of a radial flux BLDC motor is its size and weight. For an EV with even modest performance, such a motor can weigh well over 100 pounds.

On a radial flux BLDC motor, the magnets are positioned such that their poles lie radially at the outer edge of the rotor. The magnetic flux from the magnets interacts with the windings of the stator. The flux loop starts at the

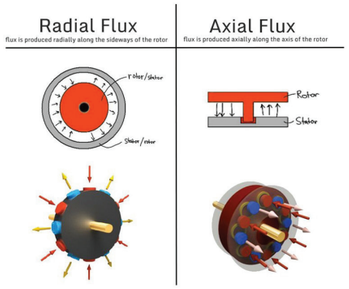


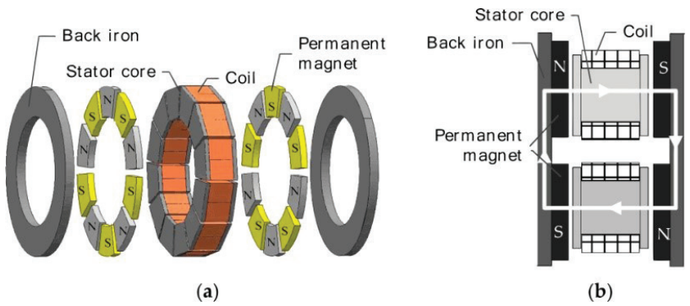
first permanent magnet on the rotor, crossing the air gap between the rotor and stator. It then passes through the first metal tooth on the stator. The flux flows along the steel core of the stator until it passes through a second tooth on the stator, then flowing back to the second magnet on the rotor.

Axial Flux Motor

An axial flux motor places the permanent magnets on the face of the rotor, and puts the stator in front of the rotor. To balance the magnetic forces, two rotors are often used—one on either side of the stator. The flux loop starts at a magnet on the rotor and passes through the air gap between rotor and stator. The flux passes axially through the first stator tooth and immediately arrives at a second magnet (when dual rotors are used). Unlike the radial flux motor, the flux path is one-dimensional, allowing the use of grain-oriented magnetic steels for greater efficiency.

Axial flux motors were studied by British inventor and EV enthusiast Cedric Lynch as early as 1979. Because the rotor and stator windings face each other, the axial flux motor can be short. The larger the diameter of the rotor, the greater is the torque produced. Axial flux motors are of large diameter and short length. They can be stacked together on a common shaft to produce greater power outputs. Lightweight, compact and powerful motors are also of advantage in aviation.





Games in Power Sector in India

By **Dr. Mathew P. Abraham**
Asst. Prof., EEE Dept., TKMCE

For a technocrat person, games are nothing beyond a leisure time activity. Through this article, I would like to bring the attention of the readers that infact we all are knowingly, at the same time pretend to be unknowingly, playing some games in life. It's not just the physical effort that makes a game win, but the mental calculations that one performs before and during the game. Consider a scenario where the supervisor has mailed the student to meet up immediately because of not updating about their work on time with the supervisor. The student will do a lot of mental calculations before meeting the supervisor. Similarly supervisor has already done some calculations, which resulted in that mail. During meeting, supervisor and student will implement their strategies to get maximum benefit for each of them. So a small game is indeed happening during project progress discussion meetings, with student and teacher as the players. There is a branch of mathematics which study about the theory of games called as game theory. In this article, I would like to give a very brief introduction to the basic concepts in game theory, what is the solution in a most commonly occurring class called non-cooperative games and finally focus on various games currently happening in Indian power sector.

What is a game and the expected outcome ?

A game must have at least the following components:

•**Players :** They are the ones who are involved in the games. It need not be humans always. For example, it can be cancer cells and chemotherapy medicine. Suppose there are 1,2,...,N players in a game.

•**Strategies:** For each player, there is a set of strategies from which, they can choose any one. Let S_i denote the set of strategies of player i.

•**Objective function of a player:** This is a function of strategies of all players. This function will tell whether a player is getting better or worse from the game. Suppose f_i denotes the objective function of player i, then

$$f_i : S_1 \times S_2 \times \cdots \times S_N \to R.$$

This means that an objective function of a player maps the set of strategies

of all players to a real number. It is important to note that in a game, the objective function not only depends on his strategy, but also on other players' strategy as well.

So, in a non-cooperative game, each player tries to maximize his objective function thinking that other players will also do the same. Please see that if there is only one player involved in a game, then it is nothing but an optimization problem. Hence game theoretic problem can be viewed as a generalized version of the optimization problem. Now, the question, what can we say about result of a game problem. The trivial answer is one cannot say what other players think in a game theoretic situation. Now the question is slightly modified as follows: as an observer of a game between two players, what is the most probable outcome of the game? The answer to this question is it is most likely that the game ends in a Nash equilibrium solution. For example, consider a two player non-cooperative game.

Suppose $s_1^* \in S_1$ and $s_2^* \in S_2$ is a Nash equilibrium solution, then,

$f_1(s_1^*, s_2^*) \geq f_1(s_1, s_2^*), \forall s_1 \in S_1$ and $f_2(s_1^*, s_2^*) \geq f_2(s_1^*, s_2), \forall s_2 \in S_2$.

The first condition says that suppose player 2 plays s_2^*, then s_1^* is the best strategy for player 1. Similarly the second condition says that if player 1 plays s_1^*, then s_2^* is the best strategy of player 2. If both the conditions are satisfied together, then

$$s_1^*, s_2^* \in S_1 \times S_2$$

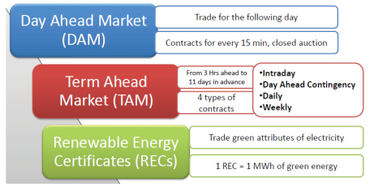
is a Nash equilibrium solution of the two player non-cooperative game. What the equilibrium says is that once the game is in Nash equilibrium, there is no incentive for any player for a unilateral deviation. That means, if a player drifts to some other strategy from the equilibrium strategy. It will be a lose for him and hence he will not deviate. The same is the case with the other players. Ultimately, both players must converge to the Nash equilibrium solution.

Power Sector in India

The Electricity Act, 2003 has been brought about to facilitate private sector participation and to help cash strapped state electricity boards (SEBs) to meet electricity demand. The Electricity Act, 2003 envisages competition in electricity market, protection of consumer's interests and provision of power for all. The Act recommends the provision for National Electricity Policy, rural electrification, open access in transmission, phased open access in distribution, mandatory state electricity regulatory commission, license free generation and distribution, power trading, mandatory metering, and stringent penalties for theft of electricity. One more welcome step the Indian electricity market has seen is the implementation of Availability Based Tariff (ABT) which brought about the effective day-ahead scheduling and frequency sensitive charges for the deviation from the schedule for efficient real-time balancing.

To promote power trading in a free power market, CERC (Central Electricity Regulatory Commission) approved the setting up of Indian Energy Exchange (IEX) which is the first power exchange in India. IEX has been modeled based on the experience of one of the most successful international power exchanges, Nordpool. Later, one more exchange by the name Power exchange India Limited (PXIL) is step up by CERC. These exchanges has been developed as market based institution for providing price discovery and price risk management to the electricity generators, distribution licensees, electricity traders, consumers and other stakeholders. The participation in the exchange operations is voluntary. At present, IEX/PXIL offers day-ahead contracts whose time line is set in accordance with the operations of regional load dispatch centers. IEX/PXIL coordinates with the National Load Dispatch Centers/RLDCs and SLDCs for scheduling of traded contracts' to get up-to-date network conditions. The main market sectors currently running are Day Ahead Market, Term Ahead Market and Renewable Energy Certificate Market, which are briefly explained below.

Most of the details are obtained directly from IEX official website.



Day Ahead Market

Day-Ahead-Market (DAM) is for trading in physical delivery of electricity from midnight to 24 hours ahead. The price and quantum of electricity traded is determined through a double sided closed auction bidding process.

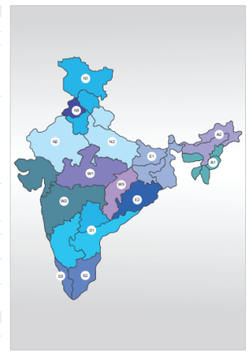
Main Features:

- Trading of 15 minute contracts
- Double-sided closed anonymous bidding process
- Clearance obtained from State Load Despatch Centre (SLDC) by buyers and sellers based on availability of network and ABT meters.
- Bids can be placed at regional periphery through portfolio orders or block orders:
  - Portfolio Orders: 15-minute bids for different price and quantity pairs. Partial execution is possible.
  - Block Orders: Relational block bid for 15-minute block for the same day. No partial execution possible (all or none).
- Market Clearing Price (MCP), common for selected buyers and sellers, determined as a function of demand and supply.
- Congestion Management through market splitting and determining the Area Clearing Price (ACP) specific to a bid area.

DAM TIMELINE

D-1 (one day before delivery)	
Time (IST)	**Activities**
09:30 Hrs	Initial Margin Check
10:00 - 12:00 Hrs	Bid-Call Session • Double sided closed bidding. • Member can submit, edit, modify or delete buy and sell bids.
12:00 - 13:00 Hrs	• Exchange calculates MCP and provisional obligations of the members. • Communication of unconstrained solution to National Load Despatch Centre (NLDC). • Communication to bank to confirm and block the funds for pay-in from buyer member's settlement account.
13:00 - 14:00 Hrs	NLDC checks for transmission availability on ISTS. In case of congestion, NLDC intimates the period for congestion and available margins.
By 14:30 Hrs	Buyers pay to IEX (Pay-in)
By 15:00 Hrs	IEX calculates ACP based on transmission network availablity and sends 'scheduling request' to NLDC.
By 17:30 Hrs	NLDC confirms acceptance. IEX sends detailed schedule to SLDCs.
By 18:00 Hrs	RLDCs/SLDCs incorporate collective transactions in the daily schedule
D+1 (one day after delivery)	
Time (IST)	**Activities**
By 14:00 Hrs	IEX makes payments to seller (Pay-outs)

IEX BID AREAS



Term Ahead Market

Term-Ahead-Market (TAM) encompasses a range of contracts varying from same day to one week in advance to help participants manage their electricity portfolio.

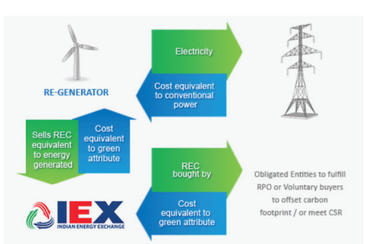
TERM-AHEAD MARKET CONTRACTS:

Intraday	• Duration	: Twenty hourly contracts for the same day
	• Bid Matching	: Continuous trading
	• Trading Time	: 00:30 to 20:00 Hrs; every day
	• Delivery Period	: 04:00 to 24:00 Hrs; same day
Day Ahead Contingency	• Duration	: Twenty-four hourly contracts for the following day
	• Bid Matching	: Continuous trading
	• Trading Time	: 15:00 to 23:00 Hrs; every day
	• Delivery Period	: All hours of the following day
Daily	• Duration	: All or block of hours in a single day
	• Bid Matching	: Continuous trading
	• Trading Time	: 12:00 to 15:00 Hrs; every day
	• Delivery Period	: For rolling seven days; starting after 4th day
Weekly	• Duration	: All or block of hours in a week
	• Bid Matching	: Double sided open auction
	• Trading Time	: 12:00 to 16:00 Hrs; every Wednesday and Thursday
	• Delivery Period	: Next week (week starts from Monday to Sunday)

Renewable Energy Certificates (REC) Market

CERC introduced REC mechanism to ease the purchase of renewable energy by the state utilities and obligated entities, including the states which are not well endowed with RE sources. REC framework seeks to create a national level market for renewable generators to recover their cost. One REC (Renewable Energy Certificate) represents 1 MWh of energy generated from renewable sources.

Under the REC mechanism, a generator can generate electricity through the renewable resources in any part of the country. For the electricity part, the generator receives the cost equivalent to that from any conventional source while the environment attribute is sold through the exchanges at the market determined price. The obligated entity from any part of the country can purchase these RECs to meet its RPO compliance.



Conclusion

The introduction of the electricity Act 2003 and setting up of the power exchanges like IEX and PXIL, opened way for playing a lot of games in power sector. Those who understand the game scenario and analyze the outcome based on game theoretic analysis comes out as profit makers in the power sector. At the same time, it is always challenging to perfectly model these markets as games. With this I encourage the academicians and students of electrical engineering to study how the power scenario in India is drifting to the new paradigm of competition and how it improves the reliability and performance of the power sector.

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Human Detection System In Collapsed Buildings

By **Harikrishnan S**
3rd Year EEE

Natural disasters are "natural" they are not manmade; neither man can stop nor control them. Only thing he can do is to control the after effects of this phenomenon. In the last one and a half decade approx. 801,629 people were reported dead due to earthquakes only while the number crosses 15 million when other natural disasters are taken in to account. But still in this century where man stands in the pinnacle of success in the field of science and technology, it would be shocking to know an established fact that 28% of the dead, had met their end 20-30 minutes later to the occurrence of the last shake.

Most people in this lot had died due to suffocation, trapped undetected in the collapsed building. The simple and logical reason that any layman can address to this scenario is the lack of a proper organized rescue mission. The techniques of rescue adopted in most parts of the world are still primitive in nature which accounts to the hike in death toll.

An overlook to available technology and rescue tactics are given below :

Feeding a camera on the end of a flexible pole into the collapsed building - this shows where people are and how much of the building's structure is left, (the usability of such devices and their efficiency depends on the structure of collapsed building besides, when the victim is detected it is difficult in most cases to determine its actual position).Trained sniffer dogs are deployed in the disaster area. They detect presence of victims efficiently by smell, but information about their actual positions or quantity cannot be indicated. Moreover, dog is likely to indicate the presence of dead person which distracts rescuers from locations where alive people can still be found. Other existing ways used are optical devices and acoustic life detector. The optical devices have limited number of angles of freedom to perform the function, require expert operators and cannot be used in inaccessible area. Acoustical detector like geophones are easy to use but they need quiet working surrounding; it cannot reach in critical situations. Moreover,the recent advancement in the use of microwave transmission and reception as a means of human detection finds its limitation due to attenuation of the microwaves in concrete,thus failing in most cases.

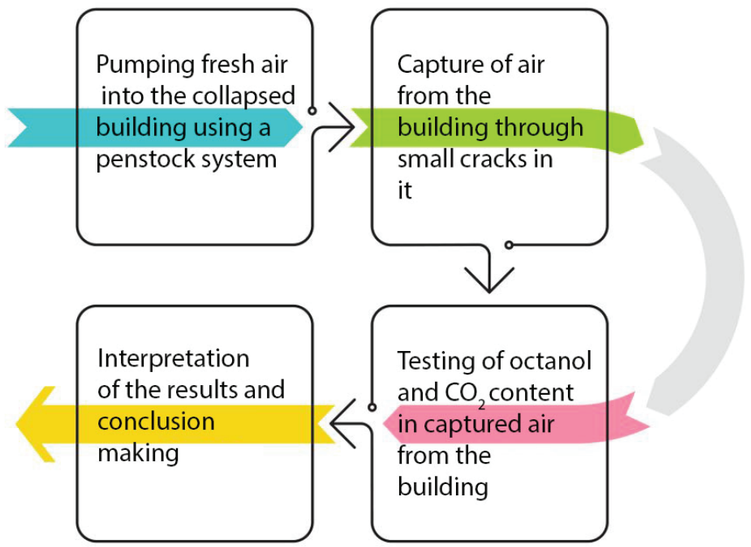
In rescue operation and also in some surveillance operations there is not only the need to detect life signals but also to identify the people in a particular area to facilitate rescue team operation.

Proposed Methodology

Till date , the available technology in this field have failed to strike its mark in respect that some failed to do assigned function while some were too complex in operation. This article discusses a simple and easy technique utilizing the available reasons in an economic way in a manner that the outcome is highly reliable and mode of operation is quite simple. The article addresses the technology of identifying the human presence in a building by detecting the presence of volatile compounds present in human sweat and also by identifying the concentration of CO_2 present inside the building. An average human trapped inside the building sweats above the normal level because of excitation, anxiety and atmospherical conditions. The proposed technology takes advantage of this situation thus making the process of detection more easier. The methodology followed is shown pictorially below:

As shown the methodology consists of four main parts. Initially the collapsed building is analyzed and various cracks and holes of considerable size are taken into consideration. Through one of the biggest crack using a penstock model, fresh air is pumped into the building. This is done so that the air which was already present in the building gets pushed outwards through other cracks. Under this situation where the human perception are at a greater level, the sweat so created, interacts with staphylococcus like bacteria in air resulting in production of volatile compounds in air. Due to the phenomenon of diffusion the volatile compounds so produced are equally distributed in air. Thus pumping in fresh air helps in pushing out this air which is then collected, allowing us to test the human presence through testing these volatile compounds present in it. Further this process has another boon in respect that pumping of fresh air helps in providing an ambient air condition for the trapped person which would be a great help for him.

Also strong flexible tubes would be pushed deep into other cracks for facilitating the collection of air from the building.



The receptors have a cup-like structure at one end where the air is collected and then tested.

The testing of air is done for two volatile compounds: octanol and CO_2, where the latter is produced due to interaction of staphylococcus like bacteria with human sweat and CO_2 is produced to due to human respiration. The testing and analyzing of air is done at different collection stations around the building. This process is simple and not time consuming such that it will not cause any such time lag or delay in the process of rescue operation. The results so obtained are analyzed and various inferences can be made from it.

If the receptors detect the presence of octanol, it is conclusive that there is a human presence in the building. This can be again viewed in different scopes. Just by analyzing the values of octanol content present in air obtained from different collection stations, the hike in octanol value in some stations can be inferred in a way that the trapped person is located somewhere near to this station or the trapped person is located elsewhere but the obstacle free path for rescue work can be ascertained from it as along this direction most of the air has escaped , as air always escapes through the shortest and easiest path, which in turn means that obstacles are less along this direction. Thus making the rescue work more easy and less time consuming.

Now considering the value of CO_2, if its concentration is more than the normal concentration (0.04% of air), then it is conclusive that there is a person trapped inside the building. If the person is so trapped naturally due to the do or die situation his breath level will increase beyond the normal count, due to the pump in of adrenaline. Thus in an average there will be 12-20 breathing cycle per minute, thus according to established data a normal human will exhale about 500ml of air of which 4% will be CO_2. So approximating, about 20ml of CO_2 will be exhaled out. Thus this would result in the hike of concentration of CO_2 beyond a limit. In the case if the person is unconscious, his breath count will naturally be less, but still he exhales out CO_2 which will clearly bring forth a rise in CO_2 level beyond the standard value in air. Thus his/her presence in the building can be detected in it.

Now if the person trapped in the building unfortunately met his/her end due to the accident, in that case the receptors will show some value for octanol but CO_2 value will be almost normal. Dehydration of the body results in sweat formation. Thus dead persons can also be detected in this sensor.

Socio Economic Impact

With the situation in hand that humans can never control or be responsible for a natural disaster that results in vast destruction, the best thing he can adopt is to reduce the outcomes of the same. Each human has his own identity, if this simple technology is responsible for a natural disaster that results in vast destruction, the best thing he can adopt is to reduce the outcomes of the same. This article proposes to introduce this technology or idea to common fire stations and rescue team. When these guys are trained in this field of action they become an integral part of the rescue mission such that they would be the first to reach the location in time and start the operation before the army arrives. Thus many lives can be saved in this way. It is hoped that this technology would be a great help to human kind and become a revolutionary approach in the field of rescue operation.

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An Introduction To **Hyperloop Technology**

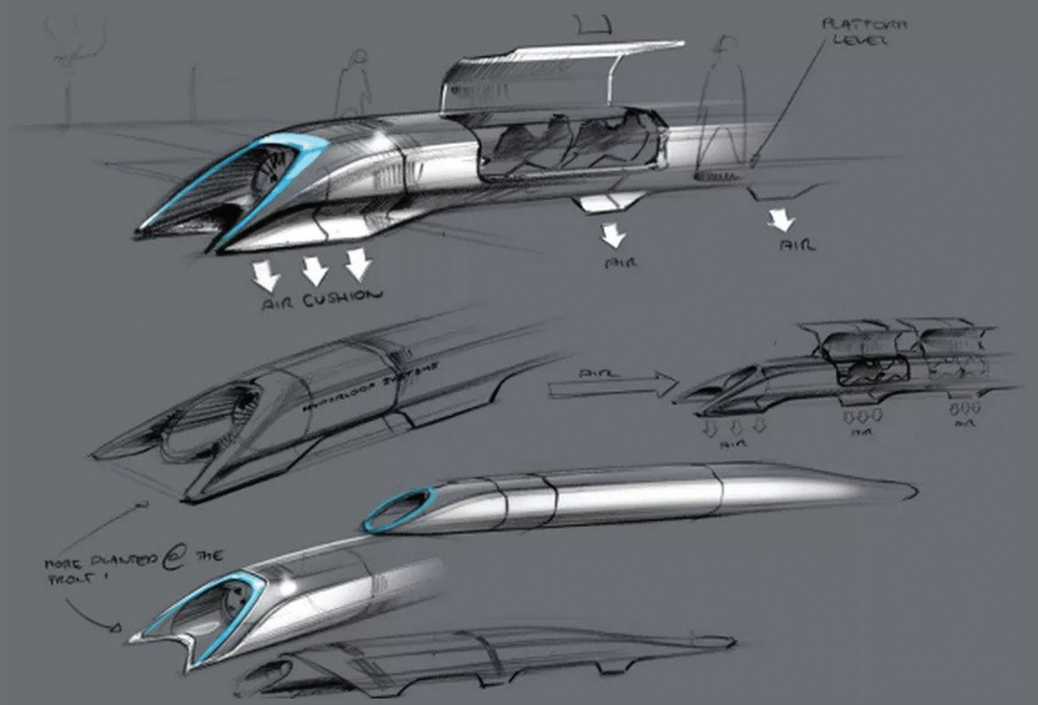
By **Malavika M**
4th Year EEE

Hyperloop is considered as the fifth mode of transportation, after car, rail, air and boat. It is an ultra-high-speed transportation system, proposed by Elon Musk in 2013. Musk proposed this system, in reaction to the California high speed rail system, which he claims to be one of the most expensive per mile and one of the slowest in the world. Hyperloop transportation technology is proposed for high traffic city pairs, less than 1500km apart. In his open design concept, 'Hyperloop Alpha', Musk proposes the system for connecting Los Angeles, California, and San Francisco, California in 35 minutes. The Hyperloop could revolutionize mass transit, shortening travel times on land and reducing environmental damage in the process.

Design

The idea is to build a partially evacuated tube through which capsules full of people or cargo can be accelerated, either with externally applied air pressure or through the use of magnetic induction coils. When a capsule is moving at high speed through a tube containing air, there is a minimum tube to pod area ratio below which the movement will be difficult. Nature's top speed law for a given tube to pod area ratio is known as the Kantrowitz limit. To overcome the Kantrowitz limit, an electric compressor fan is mounted on the nose of the pod that actively transfers high pressure air from the front to the rear of the vessel. Further, it creates a low friction suspension system.

There are two tubes, in which the motion is in opposite direction i.e., capsules move from Los Angeles to San-Francisco through one tube, and back through the other. The tube diameter is 2.23 m. The passenger capsule has dimensions: 1.35 m in width, 1.1 m in height and 25-30 m in length. The passengers in the capsule sit in individual seats. The tablet accommodates two rows of seats with 14 seats in each row, i.e., 28 passengers. The road will be able to provide the passenger traffic in the amount of 840 people/hour, which allows achieving values of the throughput of the drive at 7.4 million people/year. Each capsule departs at an



average of 2 minutes during off peak time, and 30 seconds during peak time. Distance between capsules is approximately 37km. The capsules are supported via air bearings that operate using a compressed air reservoir and aerodynamic lift. The capsule can be either a passenger only version or a passenger plus vehicle version in which three vehicles are also transported along with the passengers. The tube is made of steel. Two tubes will be welded together in a side by side configuration to allow the capsules to travel both directions. The tubes are not rigidly fixed at any points, hence avoiding the risk of earthquakes and expansion joints. Pylons are placed every 30 m to support the system. Solar panels are mounted on top of the tubes to power the system. The movement of the vehicle is carried out using linear electric motors. The rotor is located on the capsule and the stator on the tube. The engine uses an aluminium sheet as a rotor. The stator windings produce a linearly moving magnetic field acting on

conductors in the field., The aluminium sheet, which is placed in this area has eddy currents induced in it, thus creating an opposing magnetic field. The two opposing fields repel each other, generate motion of the capsule. It is possible to realize acceleration of the capsule and its slowdown. Maximum speed is acquired in straight in roads.

Conclusion

The hyperloop transportation technology is a recent advancement in which wide research is being done. SpaceX and Tesla have organised several project contests to add on to this hyperloop model. Several criticisms are also arising regarding the feasibility of the project. However, technocrats are eagerly waiting for the fifth mode of transportation.

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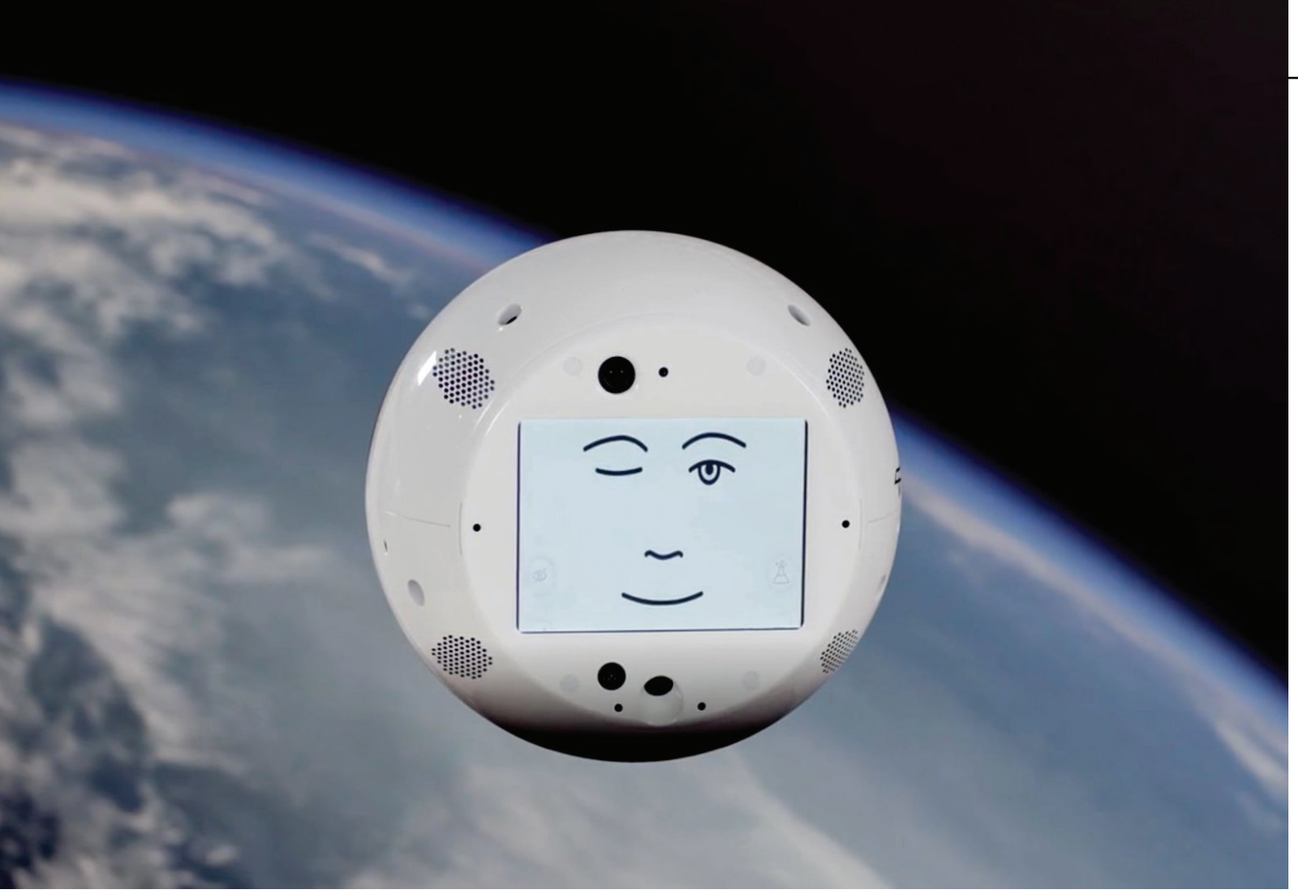


World's First AI Robot to Fly in Space

By **Aparna Ajayy**
1st Year EEE

A year back, the space witnessed the first AI Robot , Cimon.

On June 29th , this ball - shaped robot joined the crew members for the SpaceX 15's launch of Falcon 9 , aboard the International Space Station (ISS). Though 'CIMON' (short for Crew Interactive Mobile companiON) is only about the size of a basketball, the contributions that it could do for the world are plenty.

"Having AI - having that knowledge base and the ability to tap into it in a way that is useful for the task that you're doing - is really critical for having humans further and further away from the planet. We have to have autonomy. We'll have to have tools to have the species successfully live far away from earth", quoted Kirk Shireman , NASA's ISS Program Manager during a prelaunch news conference.

Digging deep

Cimon was developed by Airbus and IBM in conjunction with the German Aerospace Centre (also known as DLR) to be used as an interactive astronaut assistance system (something like a specialised spaceflight cross between Amazon's Alexa and Microsoft's Clippy). This AI Robot is IBM's Watson Technology(a question - answering computer system that is capable of answering questions in human language) . Watson AI technology helps accumulate information and recognise its human co-workers.The computer provides a ready- made answer to an Astronaut's question and this answer , after converting into speech is beamed back to the ISS. 'CIMON' is always connected to the ISS Wi-Fi network that transmits data via satellite connections to the earth.

Features of CIMON

· CIMON is able to see, hear , understand speak and fly. It is equipped with sensors , cameras and a speech processor. It uses voice queries and a natural language user interface.

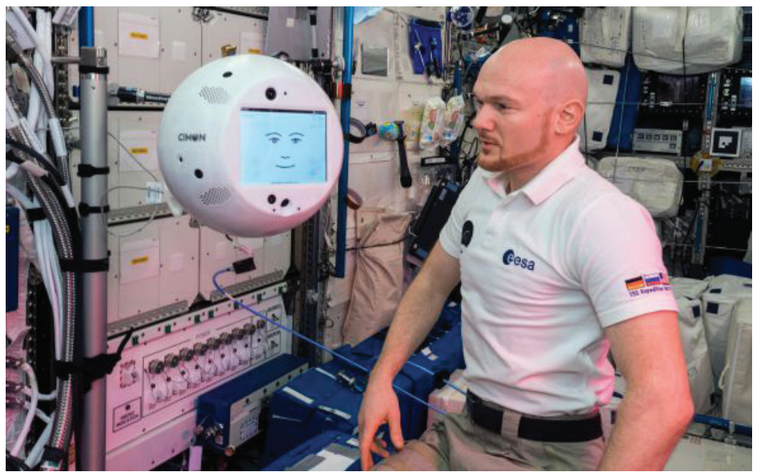
· This 3D printed robot has 14 internal fans , which allow it to move in multiple directions while floating in the microgravity conditions of space. This robot also has the ability to search for objects.

· It is also a source of entertainment. It is not just a music hub but also seems to provide some comic relief at the very least. Also, it can quote dialogues from famous movies like E.T. the extraterrestrial.

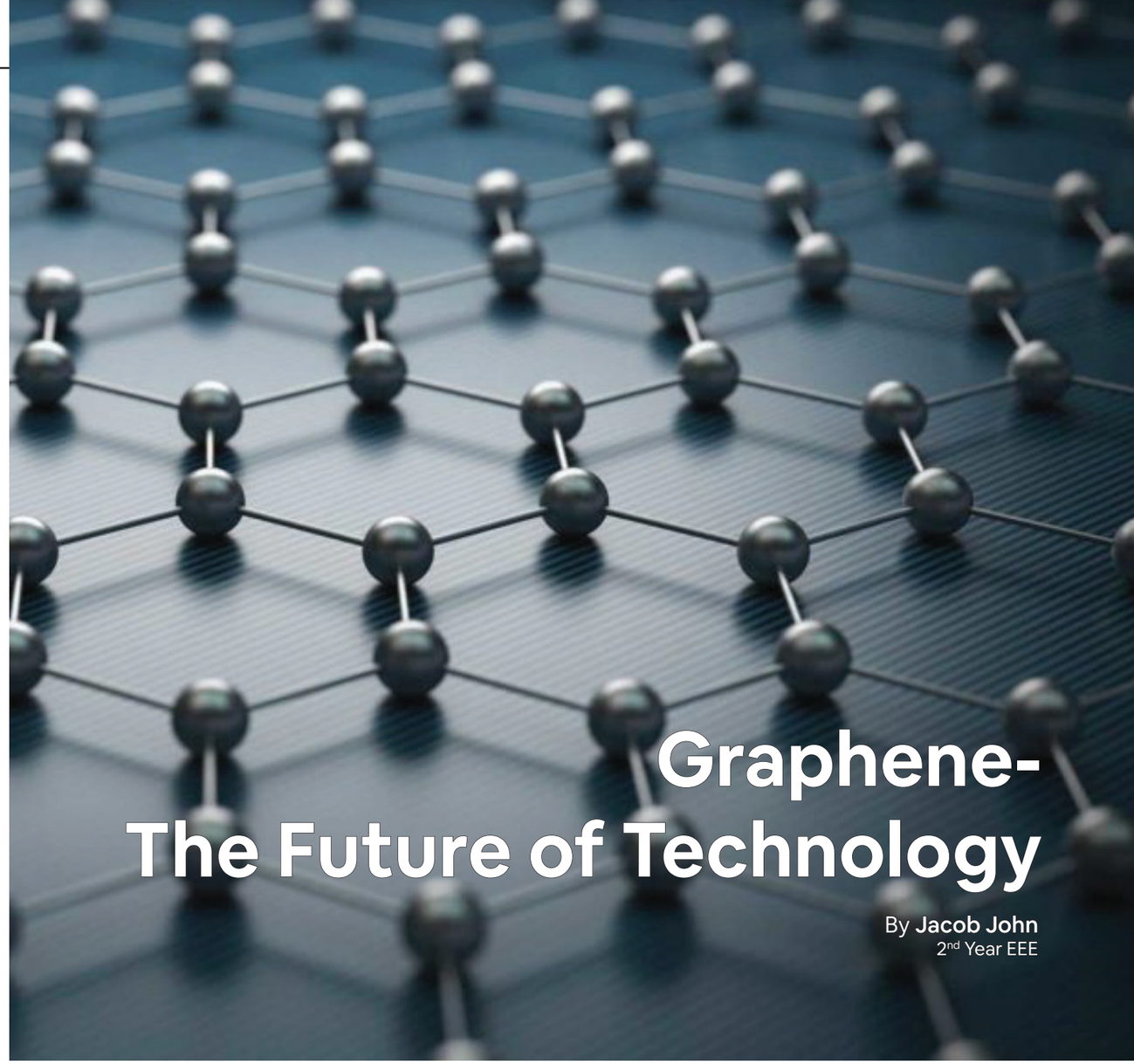
· Cimon, being a voice controlled assistant gives full access to documents and media thus navigating astronauts through operating and repair procedures for experiments.

· Its 'eyes' are two cameras and also has an extra camera for face recognition. Gestures and facial expressions are also possible for this robot. Ultrasonic sensors measure distances for collision detection thus ensuring safety.

· It comes equipped with a kill switch. (A safety mechanism to shut down machinery as quick as possible in an emergency ,when it's not possible to do so in the usual manner.)



Artificial Intelligence is one side of life that has always surprised us with new ideas, innovations , etc and one such amazing product was CIMON. Though it had errors in the very beginning, it has developed all the way to being astronauts' best friend. CIMON is one best example of advancements in AI and in the coming days, we can hopefully expect to see more of CIMONs.



Graphene- The Future of Technology

By **Jacob John**
2nd Year EEE

If the 20th century was the age of plastics, the 21st century seems set to become the age of graphene— a new material that has the potential to alter the future. Dubbed a "super material," graphene has researchers all over the world over scrambling to better understand it. The materials' long lists of superlative traits make it seem almost magical, but it could have very real and drastic implications for the future of physics and engineering.

It's just about the lightest, strongest, thinnest, best heat- and electricity- conducting material ever discovered. It promises to revolutionize everything from computing to car tyres and solar cells to smoke detectors.

What Exactly Is Graphene?

The simplest way to describe graphene is that it is a single, thin layer of graphite — the soft, flaky material used in pencil lead. Graphite is an allotrope of the element carbon, meaning it possesses the same atoms but they're arranged in a different way, giving the material different properties.

Interestingly, when graphene is isolated from graphite it takes on some miraculous properties. It is a mere one-atom thick, the first two-dimensional material ever discovered. Despite this, graphene is also one of the strongest materials in the known universe. With a tensile strength of 130 GPa (gigapascals), it is more than 100 times stronger than steel.

Graphene's incredible strength despite being so thin is already enough to make it amazing, however, its unique properties do not end there. It is also flexible, transparent, highly conductive, and seemingly impermeable to most gases and liquids. It almost seems as though there is no area in which graphene does not excel.

The History of Graphene: A Roll of Tape, And a Dream

Graphite has been a known quantity for a long time. Its atomic structure is well documented, and for a long time, scientists pondered whether single layers of graphite could be isolated. Until recently, however, graphene was merely a theory, as scientists were unsure if it would ever be possible to slice graphite down to a single, atom-thin sheet.

The first isolated sample of graphene was discovered in 2004 by Andre Geim and Konstantin Novoselov at the University of Manchester. One might expect that they isolated the fabled substance using some massive, expensive piece of machinery, but the tool they used was amusingly simple: A roll of scotch tape.

When using tape to polish a large block of graphite, the researchers noticed exceptionally thin flakes on the tape. Continuing to peel layer and layer from the flakes of graphite, they eventually produced a sample as thin as possible. They had found graphene. The discovery was so bizarre, the scientific world was skeptical at first. The popular journal Nature even rejected their paper on the experiment twice. Eventually, their research was published, and in 2010 Geim and Novoselov were awarded the Nobel Prize in Physics for their discovery.

Production of Graphene

Graphene is indeed very exciting, but producing it is not easy, especially if you are aiming towards high-quality sheets. Several Companies are producing Graphene today in small volumes (most companies are using CVD based processes), and there's a lot of research going into developing new ways to mass produce the material in an affordable manner.

Most of the graphene produced today is used for R&D in Universities and companies. Some graphene based products are entering the market, but mass production of graphene hasn't been achieved yet.

Applications of Graphene - The New Era in Technology

Four years ago, a thin, strong material called graphene was being eyed as an eventual replacement for silicon in circuit boards and processors, and it has since found applications in everything from futuristic contact lenses to headphones. Now researchers at the University of Glasgow are using graphene to create next-generation flexible batteries — more accurately, supercapacitors — that are capable of recharging using solar energy, as well as discharging enough energy to power advanced wearable devices.

As explained in the journal Advanced Science, the researchers used layers of graphene and polyurethane to create an inexpensive, flexible supercapacitor that passes solar power through the top layer to similar storage surfaces below. Unlike a traditional battery, the supercapacitor doesn't include a lithium-ion cell or other means to hold its power for months at a time, but would be able to rapidly recharge when exposed to the sun.

· Graphene-based wearables for health monitoring, food inspection and night vision

The first of devices developed by The Institute of Photonic Science (ICFO) on display will allow customers to monitor their level of exposure to sunlight through a UV sensor. Designed as a flexible, transparent and disposable patch, it connects to a mobile device and alerts the user once he or she has reached a defined threshold of sun exposure.

Using the same core technology as the UV patch, ICFO's fitness band is being developed to measure heart rate, hydration, oxygen saturation, breathing rate and temperature, while monitoring the user when he or she is exercising, for example. However, the fitness band does more than simply measure physical activity.

Consider the following scenario. A person is trekking in the remote amazon jungle with limited access to water. By measuring the skin hydration of their body with ICFO's fitness band, the user can optimize water intake, preventing any sort of dehydration. Similarly, an explorer hiking to the peak of Mount Everest could use the band to accurately monitor oxygen saturation in blood. The high altitude can severely effect oxygen saturation in the body. Using the band, the hiker could monitor these levels and emit a warning if oxygen

saturation in the blood decreases drastically below a certain level.

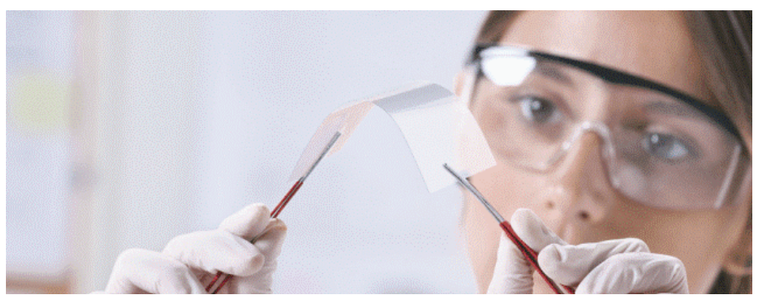
In addition to these prototypes being exhibited at MWC 2019, ICFO will also showcase two other light-based graphene technologies. These include the world's smallest single pixel spectrometer and a graphene-enabled hyperspectral image sensor, both with broadband capabilities; beyond to what was once perceived possible without the use of costly and bulky photo detection systems.
By enabling spectroscopy in such small dimensions, consumers could now be equipped with tools that previously were only available to highly specialized laboratories.

· Flexible Electronics

In addition to its powerful electrical properties, graphene is also highly flexible and transparent. This makes it perfect for use in portable electronics. Smart phones and tablets could become much more durable using graphene, and perhaps could even be folded up like paper. Wearable electronic devices have been growing in popularity recently.

With graphene, these devices could be made even more useful, designed to fit snugly around limbs and bending to accommodate various forms of exercise.

Graphene's flexibility and microscopic width provide opportunities beyond mere consumer devices, however. It could also be useful in biomedical research. Small machines and sensors could be made with graphene, capable of moving easily and harmlessly through the human body, analyzing tissue or even delivering drugs to specific areas.



· Solar Cells

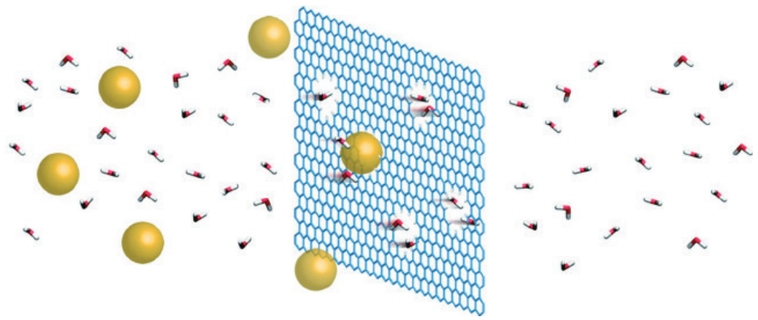
Graphene is both highly conductive and transparent. As such, it has great potential as

a material in solar cells. Typically, solar cells use silicon, which produces a charge when a photon hits the materials, knocking loose a free electron. Silicon only releases one electron per photon that hits it.

Research has indicated that graphene can release multiple electrons for each photon that hits it. As such, graphene could be far better at converting solar energy, with a projected 60 percent efficiency compared to the roughly 25 percent efficiency that current silicon cells are capable of.

· Water Filtration

Graphene's tight atomic bonds make it impermeable for nearly all gasses and liquids. Curiously, water molecules are an exception. Because water can evaporate through graphene while most other gasses and liquids cannot, graphene could be an exceptional tool for filtration. Researchers at the University of Manchester tested graphene's permeability with alcohol, and were able to distill very strong samples of spirits, as only the water in the samples was able to pass through the graphene. Of course, graphene's use as a filter has potential beyond distilling stronger spirits. Graphene could also be immensely helpful in purifying water of toxins. In a study published by The Royal Society of Chemistry, researchers showed that oxidized graphene could even pull in radioactive materials such as uranium and plutonium present in water, leaving the liquid free of contaminants. The implications of this study are massive. Some of the biggest environmental hazards in history, including nuclear waste and chemical runoff, could be cleansed from water sources thanks to graphene. Graphene filters have immense potential to improve water purification, increasing the amount of fresh water available.



· Other Applications:

1. Super strong Body Armor
2. Recharging Gadgets
3. Flexible Smart Phone Displays

The Future of Technology

Given graphene's seemingly endless list of strengths, one would expect to see it everywhere. Why, then, has graphene not been widely adopted? As with most things, it comes down to money. Graphene is still extremely expensive to produce in large quantities, limiting its use in any product that would demand mass production. Moreover, when large sheets of graphene are produced, there is increased risk of tiny fissures and other flaws appearing in the material. No matter how incredible a scientific discovery may be, economics will always decide success.

One has to wait and see if this method makes it into large-scale production, but it's a promising breakthrough as tech and other industries look to graphene to produce a new wave of ultra-durable, highly conductive and incredibly lightweight products.

Graphene truly is a, disruptive technology with applications in everything from smartphones to batteries to sports cars. A large sector across the business and manufacturing world is eyeing this latest development closely.

Betavoltaic Batteries

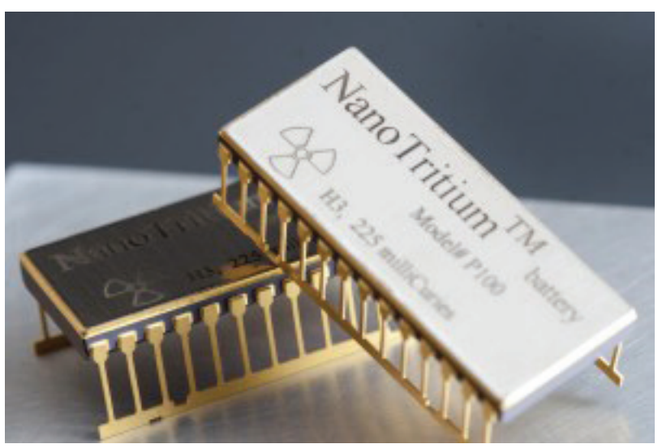
The Next Generation Batteries

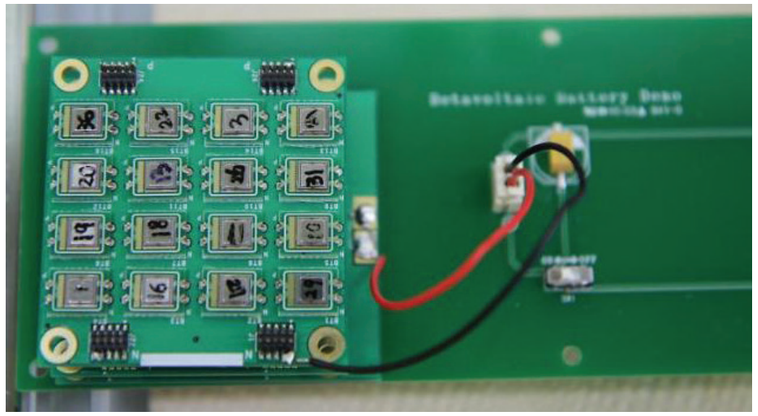
By **Aswathy Ajay**
3rd Year EEE

A battery that has a 20+ year lifetime of continuous power without needing a replacement or recharging.Is it possible?Betavoltaic battery is the answer. They perform like photovoltaic cells, which are semiconducting diodes, in which current flows when a photon strikes the diode junction, freeing an electron. In a betavoltaic cell, an electron, is generated by a small radioactive source (called beta emitters), which triggers the diode rather than a photon. This technology is essentially safe as the beta particles that the isotopes emit have very low energy and can be easily shielded.

Batteries powered by radioactive materials are not new. They have been around for more than a century. Now, a new kind of power source, which combines a novel structure with a nickel isotope puts out ten times more power than an electrochemical cell of the same size. The term betavoltaic is interchangeable with atomic battery, nuclear battery, tritium battery and radioisotope generator. They are used to designate a device, which expends energy from the decay of a radioactive isotope to produce electricity. Like nuclear reactors, they generate electricity from atomic energy, but the batteries do not have a chain reaction.

Batteries based on electrochemistry do not last very long. Eventually,





they need to be recharged or replaced, whereas, a nuclear battery, which is not based on its reactivity, but the half-life of its decay is different. It's not measured in hours or days, but their possible durations can be decades or even centuries.The primary use is for long term battery requirements, such as in a spacecraft, which requires electrical power for a decade or more. Betavoltaics would be used to trickle-charge traditional batteries in consumer devices, such as cell phones and laptops.

They don't produce heat. They get their charge from beta particles emanated by an isotope, which knocks electrons from another material. While betavoltaics use a radioactive material as a power source, the beta particles that are utilized are low energy and can be stopped by a few millimeters of shielding. With proper shielding and containment, a betavoltaic device would not emit dangerous radiation.

As radioactive material discharges, its half-life slowly decreases. Therefore, a betavoltaic device will deliver less power as time goes by. For practical devices, this decrease happens over many years. For nuclear devices, the half-life is 12 years. The device's design must account for what battery characteristics are required by its end-of-life, and to make sure that the beginning-of-life properties consider the desired usable lifetime.An easy way to understand the basic operation of a betavoltaic device is to consider it as the nuclear analog to the common solar cell. Instead of the sun, a beta-emitting isotope provides the source of ionizing radiation. When the semiconductor material is inundated by high energy beta particles, electron-hole pairs are generated by impact ionization. Just like photovoltaics, electron-hole pairs that are separated by the built-in electric field drift apart. Nuclear batteries are limited to just certain applications, basically those functions that need low power and long autonomous lifetime requirements. The battery produces power at a rate, that slowly decays with time. The power cannot be increased and if the power is not used, the power is lost.

The platform inside this betavoltaic battery comprises of layers of silicon carbide and metal foil implanted with the radioactive isotope tritium. When high-energy electrons released by the decay of tritium strike the silicon carbide, it produces an electrical current

that leaves the cell through the metal pins. This battery is designed to last 25 years.An obstacle that researchers have faced is that diode junctions are made up of a two-dimensional plane. Therefore, the possible surface area that the beta electrons could hit is limited.The answer is to utilize silicon carving technology to fashion multiple three-dimensional diode junctions that look like pillars, on top of a silicon carbide substrate, within a sealed device. The space between the pillars is filled with a radioactive beta emitter such as tritiated water.

This three-dimensional junction significantly improves the volume of beta electrons striking the diode. As a result, the potential power output of the cell is increased.Betavoltaic batteries, containing Tritium, have a power of approximately 24 watts per kilogram with a full load operating life of 10 years, and an efficiency of around of 25%. Because of this, we will see cheap, extended life, high energy density, and low-power batteries.

The military could use the batteries to power electrical circuits that protect military systems from tampering by destroying information stored in the systems. In the defense market, betavoltaics could be used to power up encryption keys in Field Programmable Gate Arrays.

Medical device manufacturers are improving batteries that could last 20 years or more for life-saving devices that require implantation in the body. Numerous opportunities exist for pioneering small, scalable, long-lasting, low-power devices into such applications such as cardiac pacemakers and defibrillators, cerebral neurostimulators, chemical delivery infusion pumps, in vivo drug delivery systems, cochlear implants, intraocular implants, brain-to-computer interface devices, and in vivo electronic medical tags or IDs.

As with all new technology there are many challenges that need to be overcome. The power output of a betavoltaic cell may not be uniform over its lifetime. As the internal beta emitter decays, gradually declining in activity, it will output less and less power. They could suffer internal damage from the electron's activity within. This type of battery may be politically controversial because of the radioactive material, which will require new recovery procedures for spent betavoltaic batteries.As engineers it is our duty to bring modifications in the technology resulting in laptop or cell phone battery lasting 30 years. Betavoltaic batteries will revolutionize the small device industry. In the future, we can even enhance them to power the vehicles!!!

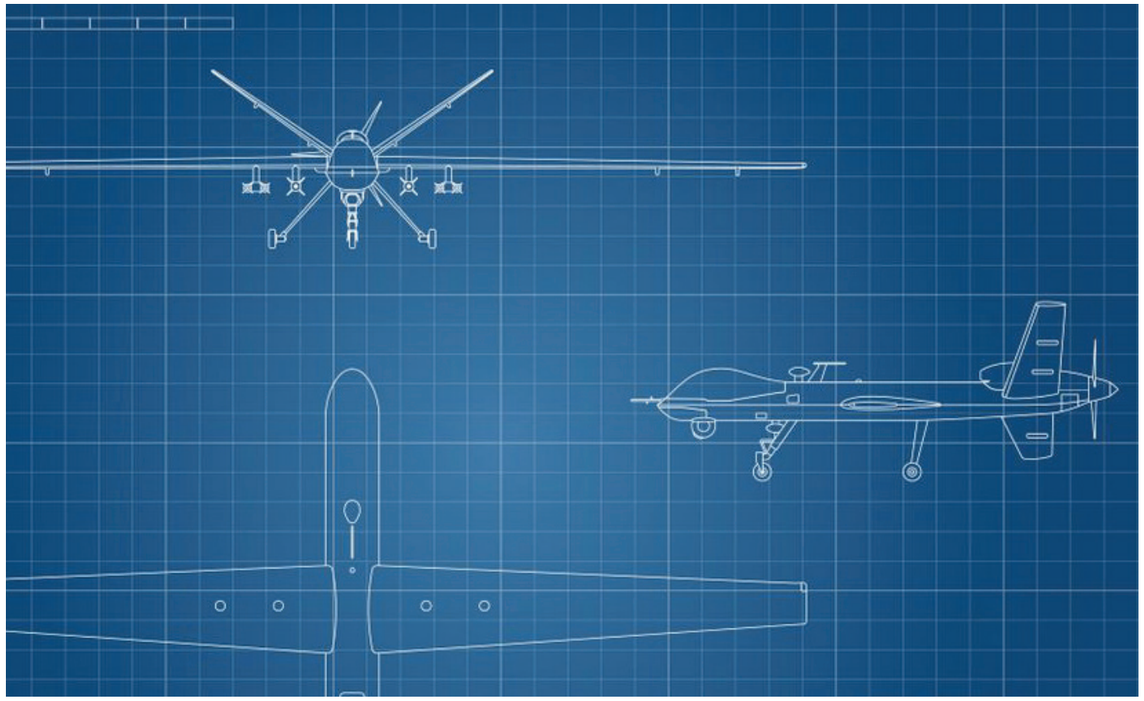
Drones In Military

By **Aswin Nair**
3rd Year EEE

Unmanned aerial vehicles have already become an integral part of military, security and rescue services. They are commonly used even for leisure activities. However, due to lagging legislation, the UAVs have not yet officially joined the common airspace for piloted vehicles and hence they still cannot be deployed for wider commercial use – for example by logistic companies.

Scientific-research teams, students, professionals as well as amateur enthusiasts drive this aviation field forward. Groups of skilled (or less skilled) aircraft engineers, programmers, operators and UAV users are growing rapidly all over the Europe and the whole World as well. As analysed and then stated, 'The world of unmanned aviation is a very impatient innovative world'. This generates new options for scientific development.

Due to the undisputable advantages, the UAV technologies are widely used for military



purposes. Aside from regular military utilisation, they are being used with increasing frequency by paramilitary and guerrilla (criminal) organizations. It should be noted that the negative exploitation of the unique features of the UAVs is not happening in the criminal groups only. People trying to take an original selfie, tabloid journalists disturbing celebrities, or individuals capturing extreme adrenaline video shots can endanger e.g., aircraft take-off procedures. And even here – in the field of protection and defence against such exploratory and invasive UAV activities – there is a wide range of scientific disciplines that could be driven forward by this phenomenon.

Air Surveillance

Air surveillance and the information acquired about the aerial situation constitute the primary conditions for counter measures. The gathered information is ideally without gaps in sensor coverage and distributed in real time. Nano, micro, mini and small UAVs have specific qualities with respect to their detectability – small physical dimensions, minimal effective radar cross-section (RCS), low emissions of thermal and acoustic energy and flight envelope (flight in low altitudes, relatively low speed, high maneuverability).Kratky & Far lik: Countering UAVs– are the Mover of Research in Military Technology.

C-UAV Sensor Technology

Devices for small UAV detection must, therefore, include the widest possible range of the electromagnetic spectrum (and possibly the acoustic and optical). Their deployment must also be adapted to detection-influencing factors.

For the detection, localisation, and identification of small UAVs, the following technologies can be generally used:

- Active radars capable of detecting targets with a small RCS
- Passive radar systems using various methods (such as passive coherent location (PCL)
- Infrared sensors.
- Laser devices.
- Optical surveillance aids and devices.
- Equipment operating with image recognition technology.
- Acoustic device.
- Devices capable of detecting and localising UAV remote control signals.
- A human air observer, possibly also equipped with any of the technology mentioned above.

The processing of initial information about the possible location of the UAV can often be highly challenging, since the size of signals containing this information is often only barely above (or even below) the threshold of a clutter. The problems are especially in the urban area.

To increase detection probability during air surveillance, the deployment of a spatially distributed multispectral sensor framework is expected.

C-UAV Sensors

Based on the list of sensor types listed above and with respect to UAV categories, we can define tasks that need to be solved. Then, for each task, we have to define a clear research goal (or goals) in order to meet the desired final goal– elimination of the enemy UAV.

Among the most important tasks related to the detection, localisation and identification of small UAV are:

- Measuring RCS.
- Selecting proper radar frequency band.
- Optimising methods of suppressing the radar clutter.
- Optimising passive radiolocation methods.
- Selecting detection equipment parameters in the visible and infrared spectrum.
- Improving methods for range measurement with optical rangefinders.
- Improving methods of selecting useful signals and suppressing acoustic clutter on the background of the UAV flight.
- Developing electromagnetic signal scanners in UAV remote control bands, including location identifiers.

· Developing automated (or even automatic) analysers and fusion algorithms for better UAV tracking.
· Optimising fields of sensors to detect UAVs in a given combat environments.

Command and Control

In principle, command and control systems suitable for the defence against small UAVs are similar to standard C2 systems, already used in the Air Forces.

For further analysis, let us assume that in the 'surveillance segment, the true target is successfully isolated from the clutter, correctly localised and identified, and the C2 system receives already pre-processed information containing all necessary characteristics of the target.

Command and Control Technology for C-UAV

While countering the air threat, the task of the system is to acquire information from the sensors, fuse it, determine the (if possible) optimal task distribution for its effectors, assign a specific task, supervise its completion, and possibly take follow-up measures depending on the task assessment. Next task for C2 technology is the direct preparation of fire and fire control.

C-UAV Information and Communication Technology

The above-mentioned tasks and requirements of the C2 also lead to the other issues.

- Fusion of target data, which is often incomplete and being transmitted over a relatively short time.

-Optimising the decision-making process affected by:
· Terrain configuration.
· Sudden appearances of a UAV - often when it is no longer possible to effectively intervene.
· Short period when the UAV is present in the Effector Kill Zone.
· The complexity of decision-making process about target allocation to available effectors, such as anti-aircraft machine guns, cannons, directed energy weapons (DEWs) and electronic warfare (EW) devices.
· Collateral damage, for example the impact zone of fired projectiles, where own troops or civilian population can be expected.

- Completing the often fragmented information about the results of tasks carried out by effectors, e.g. the need of the quick determination, if the UAV was hit or not.

- Information encryption- and confidentiality.

Several methods and corresponding means can be used to eliminate an AT in the form of a small UAV. In principle, methods of elimination can be divided into destructive and non-destructive.

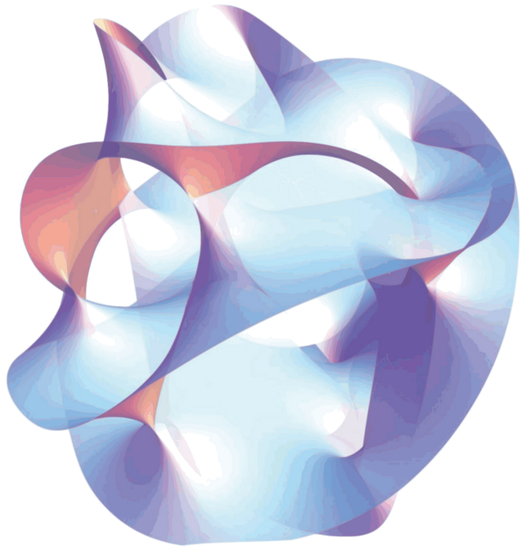
- Data flow problems
· Maximum data flow of effector control channels.
· Frequency compatibility of different sources of information
· Compatibility of data links

- Minimising the number of elements (levels) in the fire control loop and the C2 chain itself.

- Assigning competencies and delegating them to the lowest degree (preferably to fire units).

The String Theory

By **Sany Shaji**
2nd Year EEE



This complex world ,as we say is very wonderful and we are curious about it all along . On the way a lot questions arise like why we are here and where did we come form ; where did the world come from? Or what is the world made of? We are ought to know about these things as we live in such a vibrantera . What if we are close to an answer!!!THE STRING THEORY .

Our world , the vey fine ordinary matter around ,as we know is made of atoms, which are in turn made of the three basic components: electrons, neutrons and protons. The electron (whirling around a nucleus)is the fundamental particle (it is one of the family of particles , known as leptons). Neutrons and protons are made of smaller particles, known as quarks. Quarks are truly elementary (minute portion).

The entire content of subatomic composition of universe is summarized to “Standard Model of particle physics “ where both (i)the fundamental building blocks out of which the world is made, and (ii)the forces through which these blocks interact are being discussed .

There are twelve building blocks .Six being, quarks - up, down,charm, strange,bottom and top. Another six , Leptons-electron ,muon and tauon and three neutrinos . The four fundamental forces in the universe include gravity, electromagnetism,and the weak and strong nuclear forces. The fundamental particles act as carriers of these forces. The most familiar of these is the photon, a particle of light, which is the mediator of electromagnetic forces. (a magnet attracts an iron particle because both of them exchange photons.) The graviton is the particle associated with gravity. The strong force is carried by eight particles known as gluons. The weak force is transmitted by three particles, the W+, the W- , and the Z.

To formulate a quantum theory of gravity has been, for many years one of the most important problems in theoretical physics . The gravitation force is very much difficult to prove it microscopically and everything other than gravity is explained with great precision in the Standard Model.

The string theory has come out as a promising note explaining the microscopic theory of gravity. It provides a complete, unified, and consistent description of the fundamental structure of our universe. (the ‘Theory of Everything’).

‘ Fundamental ‘ particles of the Standard Model are really just different manifestations of one basic object: a string - this holds the essential point . According to string theory ,under an extremely powerful ‘microscope’ we would assume electron not as a point(electron being pictured) but a tiny loop of string. A string can do something better than a point - it can oscillate in different ways depicting the varied existence of electron photon or a quark . So according to string theory, the entire world is made of strings .

What exactly is String Theory !!

Depending on how the string is plucked and how much tension is in the string in a guitar, different musical notes will be created by the string . Similarly , in string theory, the elementary particles we observe could be thought of as the “musical notes” or excitation modes of elementary strings. The strings in string theory are floating in space time, they aren’t tied down to as in a guitar.

String theories are classified according to whether or not the strings are required to be closed loops, and whether or not the particle spectrum includes fermions.

The average size of a string should be somewhere near the length scale of quantum gravity, called the Planck length, about a millionth of a billionth of a billionth of a billionth of a centimetre. This would mean that strings are way too small to be seen by current or expected particle physics technology and thus theorists must devise more clever methods to test the theory than just looking for little strings in particle experiments.

It should also be made clear that , there is no direct experimental evidence that string theory itself is the exact description of Nature. This is due to the fact that string theory is still under development.

Solar Cars

By **Jithin T Augustin**
3rd Year EEE

Interest in green vehicles has increased in the recent times due to their pollution free characteristics,and thus solar cars are becoming relevant nowadays. Even though solar cars are still not available for public use many researches are going in this field . One of the main world wide events which helps to promote such vehicles are the world solar challenges,wherein solar cars compete against each other to complete a specified distance in the shortest time possible.

Now let us see what are solar cars? Solar cars are any vehicles which use sun's radiation as the main source of fuel. These cars use photo voltaic cells to convert sun's radiation into electric currents,which are then used to run a motor which inturn turns the wheels.The motors are not directly supplied by the solar cells but through a controller which determines the amount of current to be passed to the motor,and this controller helps us control the speed and torque delivered to the motors.

Many of the solar cars also use a battery, as the sun's radiation gathered by these cells may vary from time to time. This could be due to clouds blocking the radiations or dust collected on top of the cells etc. When the energy received from the sun's radiation is greater than the energy required by the vehicles , the surplus energy is used to charge the battery and when the amount of energy is lesser than what is required the battery provides the rest of the energy. The type of battery that was being used were the lead acid batteries which is replaced by lithium ion batteries.

The motors that are usually used in solar cars are typically about 2 to 3 horse powers. But some of the light solar cars can reach a maximum speed of 120-140 km similar to a family car. The kind of motor that is used in solar cars are BLDC motors or brushless dc electric motors. These are actually synchronous motors powered by dc electricity via an inverter. The advantages of this motor are high power to weight ratio, high speed and electric control. They also find applications in places such as computer peripherals, hand held power tools, and vehicles ranging from model aircraft to automobiles.

Solar cars use a microcontroller, a digital signal processor, or a dedicated driver IC. Some of the controllers contain integrated power MOSFETs capable of providing a continuous drive current of up to 2 Amperes. Another integral component that is used in most

modern solar cars are MPPTs or maximum power point trackers. This MPPTs were originally used by satellites to optimize the output of solar cells even when they are under shade. This MPPTs continuously measure the voltage supplied by the solar cells, compares it with the fixed battery voltage, and determines the best voltage to charge the battery. In this way the energy from the solar cells are kept constant and efficiency greater than 95% can be obtained.

In a world that depends upon non-renewable petroleum products as the fundamental fuel for transportation, a change to a renewable fuel is so crucial.Thus solar cars become one of the most important field of study. Solar cars have actually gone so far from a 15 inch mini car designed by William G Cobb in 1955 to Merdeka 1 the first solar car to participate in a WSC competition in 2007 covering a distance of 320 km with an average speed of 30 km per hour to Nuna the most successful solar car yet which completed the grueling 3000 km race with an average speed of nearly 100 km per hour solar cars have evolved dramatically. But a solar car which could be used by the public is still a dream. But taking into account the research going on in this field we could expect to see a few solar cars roaming around in our streets by the next couple of decades.

Smart Meters

By **Sariga S**
3rd Year EEE

Smart Meters –

"Advanced meter devices that can collect information about energy usage at various intervals and transmit the data through fixed communication networks to utility, as well as receiving information like pricing signals from utility and conveying it to consumer."

Smart meters are the talk of the day. Smart meters can directly communicate with the energy supplier and give instant information about our energy usage. Smart meters work with the motto- "The less energy you use, the less you pay".

A smart energy metering system records how much energy you use, and sends meter readings to the supplier remotely. This will eliminate estimated billings and manual meter readings. Smart meters can report consumption in real time by wireless transmission in radio frequencies.

The bills will be totally based on actual usage. Smart meters will encourage consumers to use electricity wisely and efficiently.

The main components of a smart electricity meter are a smart meter, a communication hub and a smart energy display. The meters are

provided with a multifunctional consumer display interface with interactive controls and consumer port for personal energy management. The smart meters will be based on TOD tariff (Time of the Day). Here, different rates are applicable for use of electricity at different time of the day. TOD tariff is implemented to reduce the consumption of electricity during peak hours (6 p.m. to 10 p.m.) by increasing the cost per unit energy consumed during peak hours.

Energy consumption is based on a prepaid payment system in which the consumer has to pay in advance for the power he is going to consume. Consumers will get alerts on the mobile phone when the electricity consumption nears the payment made by the consumer. With the implementation of smart meters in all households, it is expected to reduce the power usage rates, eliminate power thefts and increase the efficiency of power distribution systems.

The advantages with smart meters are online prepaid payment options, automatic recharge, and usage data information including consumption charts.

SPECIFICATIONS of smart meters- Single Phase/ Three Phase

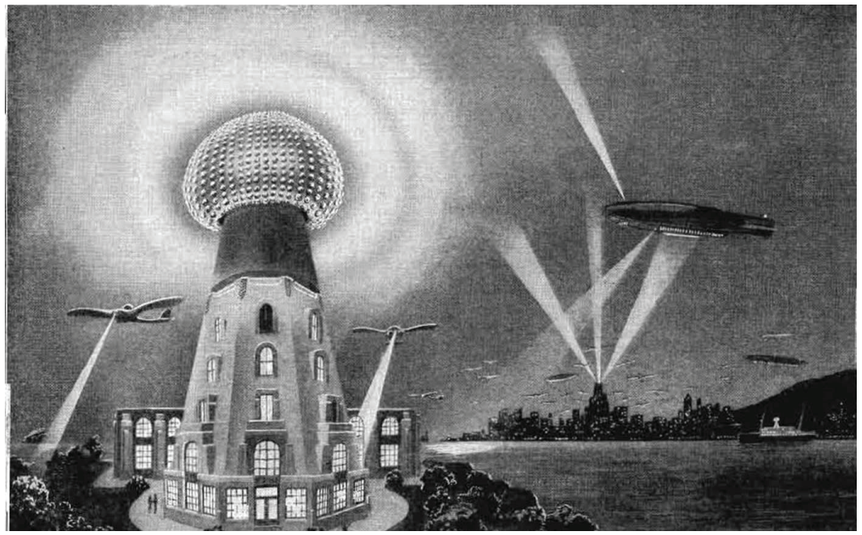
- Connection Type: 2 wire (Single phase), 4 wire (Three phase) direct connection
- Standards : IS 16444, IS 15959(1), IS 15959(2)
- Metrology Accuracy : Class 1
- Rated Current : Single phase- Ib (Imax)A = 5(30)A , withstands 120% Imax. Three phase- Ib (Imax)A = 10(60)A, withstands 120% Imax
- Rated Voltage : 240 V (-40% to +20%) Single Phase
- Starting Current : 0.2% Ib
- Frequency : 50 Hz +-5%
- Load Contactor : Latching relays
- Display : LCD
- LED indicators : Line, Tamper, Export, kWh
- Communication port/methods : GSM-GPRS/WiFi
- Communication protocol : DLMS COSEM

The government of India is accelerating the adoption of smart meters to ensure efficient management of electricity by checking data-entry errors, billing inefficiencies, and cutting the costs of manual meter reading through web-based monitoring systems.

Implementation of smart meters will help to obtain real time energy consumption data of each consumer and will pave way for initiating various smart measures like Time Of Day (TOD)/Time Of Use (TOU) billing, prediction and management of peak demand, prepaid billing facility, remote connection and disconnection of load, accurate billing, etc. Installation of these meters will also obviate the need for the meter reader's visit to each and every consumer.

Tesla's Wireless Future Arrives

By **Jithin J**
2nd Year EEE



Wireless Transmission of electricity is not a new concept in the field of technology.It dates back to the time of the wisest of all time engineer

- Nikola Tesla.

Nikola Tesla envisioned supplying power to the world without the need for a tangle of wires strung everywhere. The closest he ever came to realizing wireless transmission was the Tesla coil, which he created in 1891. However, his dreams were much bigger, encompassing a global wireless power grid that any home,business, or vehicle could tap into at will. Even though he successfully created a prototype, further research was stopped due to his high debt and illness. He died without fulfilling his last project.

Even after many years of his death we are still using wires for energy transmission. No one ever put forward a successful idea to achieve this.

Now, researchers at Stanford University think they may have gotten the wireless charging technology right, as they've been able to transmit electricity wirelessly to a moving object nearby. If their technology is scalable, they may have discovered a way to allow electric cars

to recharge as they're in motion, eliminating issues of charging station availability and EV battery range. If that final hurdle is truly overcome, electricity could easily become the standard vehicle fuel worldwide.

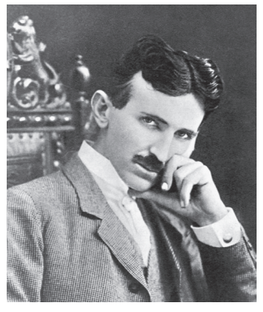
Senior study author and professor of electrical engineering Shanhui Fan said in an interview for Stanford News, "We still need to significantly increase the amount of electricity being transferred to charge electric cars, but we may not need to push the distance too much more."

As the team described in their recently published Nature study, the transmission achieved was much smaller than that would be needed to power vehicles. However, they did reach a kind of mid-range wireless power transfer based on magnetic resonance coupling. Electricity coursing through wires creates an oscillating magnetic field, and it's this field that causes the nearby coils' electrons to oscillate. This in turn transmits power wirelessly. However, it's a complex process and is only efficient when the oscillating coils are tuned with respect to the moving object.

Until now, this has been one of the primary problems for wireless energy transmission, because there hasn't been a way to get the coils to automatically tune to moving objects. The researchers solved this problem by using a feedback resistor and voltage amplifier system to detect where it should be tuned to without help from humans.

The current research is part of an overall push towards a safer and clean energy highways with more manageable traffic that will eventually support self-driving cars.

"In theory, one could drive for an unlimited amount of time without having to stop to recharge. The hope is that you'll be able to charge your electric car while you're driving down the highway. A coil in the bottom of the vehicle could receive electricity from a series of coils-connected to an electric current embedded in the road."-Fan explained.



With coils embedded in the roads, we could eventually enjoy a totally automated highway system. Self-driving electric vehicles could be wirelessly charged en route, and GPS and other navigation systems would also be powered wirelessly. How different is this outcome compared to Tesla's vision of the global power grid?

His "World Wireless System" would have dotted the globe with wireless towers that transmitted power — along with data — to each other, and individual users could tap into the network with antennae. Although his plan never got past the first tower, which was demolished exactly 100 years ago, his vision of the future was really very accurate. Now that the Stanford team has this piece in place, hopefully we'll see the rest of it happening soon.

What it means to "see" the Black Hole?

By **Jovin Johns**
3rd Year EEE

Scientific communities across the world received the news of very first picture of black hole in awe on 10th April ,2019. The reason why an irregular shaped orange ring is considered as one of the millennial breakthrough in astrophysics is the fact that "black holes are invisible". This ground breaking feat was achieved by the hard work of 200 scientists, 8 telescopes and post processing of 5000TB of data over 2 years.

Black holes are cosmic sites of immense gravitational attraction that they distort space time fabric. The

gravitational force exerted by the singularity at the centre of black hole is so strong that not even light can escape it. The general misconcept surrounding black hole is that they suck the matter like a vacuum but the fact is matter falls into the void due to gravity. Black holes can test physics theories such as the General Relativity theory of Einstein formulated in 1916, which relates the motion of bodies due to gravity with the curvature of spacetime. Black holes were predicted by Einstein, which showed that when a massive star dies, it leaves behind a small, dense remnant core. If the mass of the core is more than about three times the mass of the Sun, the equations showed, the force of gravity overwhelms all other forces and produces a black hole. The solution to the equations was given by Karl Schwarzschild which describes the gravitational field of a point mass or singularity. He coined a parameter known as Schwarzschild radius given by

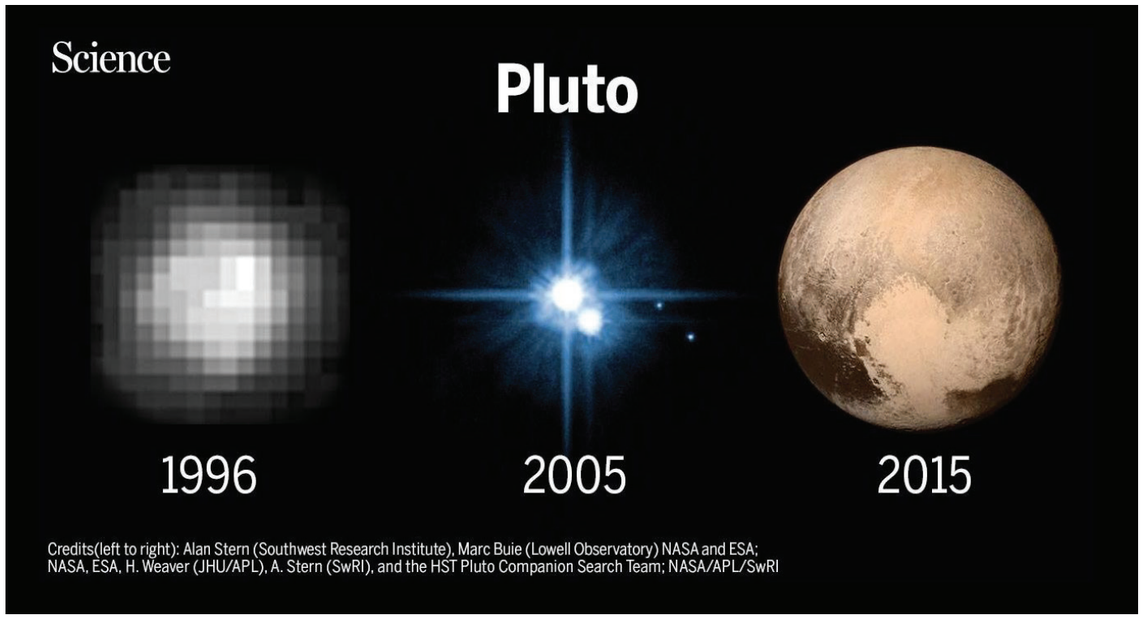
$$r_s = \frac{2GM}{c^2}$$

G is the gravitational constant, M is the object mass, and c is the speed of light.

In 1935, physicist Subrahmanyan Chandrasekhar hypothesized that a star might become so massive that it would collapse under its own gravity. Theoretically, any amount of matter will become a black hole if compressed into a space that fits within its corresponding Schwarzschild radius.In practice, the minimal mass required for a star to be able to collapse is the Tolman-Oppenheimer-Volkoff limit, which is approximately three solar masses. Further it can be said that Schwarzschild radius is the radius of event horizon. The event horizon of a black hole is the boundary around the mouth of the black hole where light loses its ability to escape. When matter approaches a black hole’s event horizon it forms an orbiting disk known as accretion disk. Matter in this disk rotates near the speed of light and convert some of its energy to friction as it rubs against other particles of matter. This warms up the disk ,the closer the matter, the greater the friction. Matter closer to the event horizon glows brilliantly bright with the heat of hundreds of suns and emits radiations. Anything, matter or radiations coming short of event horizon or less than Schwarzschild radius falls into the blackhole and is lost forever. Till date it is unknown what lies beyond event horizon. Laws of classical mechanics and physics tends to break at the edge of event horizon and this paved way to quantum physics and general relativity to explain the behaviour. Therefore quantifying existence of a black hole was a hard task. Scientists analysed the radiations and interaction of matter around the black hole to predict its existence. The first definite proof of binary black hole was found by LIGO on 2015 by identifying gravitational waves, which were distortion in the space time fabric.

Achieving such a tremendous peak required height of human ingenuity. An international collaboration of scientists and an array of telescopes known by the name Event Horizon Telescope took the initiative. They identified two supermassive black holes for the observation, one in the centre of the Milky Way and other at the centre of a galaxy M87, 55 million light years away with mass about 6.5 billion times that of sun. Finding something at this distance was compared to finding an orange at the surface of moon. It required a telescope as big as that of the size of the Earth to get the resolution to see the black hole. This was achieved by selecting 8 millimetre wavelength radio telescopes across the world to integrate into one huge telescope.The timing of the clocks were synchronized with that of telescope to simultaneously picture the centre of galaxy. The rotation of earth was accounted to increase the resolution. The data were stored in helium cooled hard disks and flown to MIT where it was processed using latest machine learning and image processing softwares. Around 5000TB of data was processed using super computers for over 2 years. To eliminate the errors ,the data was distributed to various groups which worked on them to produce a common picture. One name closely heard along with the discovery was that of Katie Bouman an MIT undergraduate from Computer Science department, who with no prior knowledge in astrophysics wrote the algorithm for image processing using machine learning.

The next question arose was, what the picture meant?Why was it so irregular? The photograph had an angular resolution of about 20 micro arc seconds. In the image, the dark circle represents the “shadow” of the black hole and its boundary about 2.8 times Schwarzschild radius, created by the



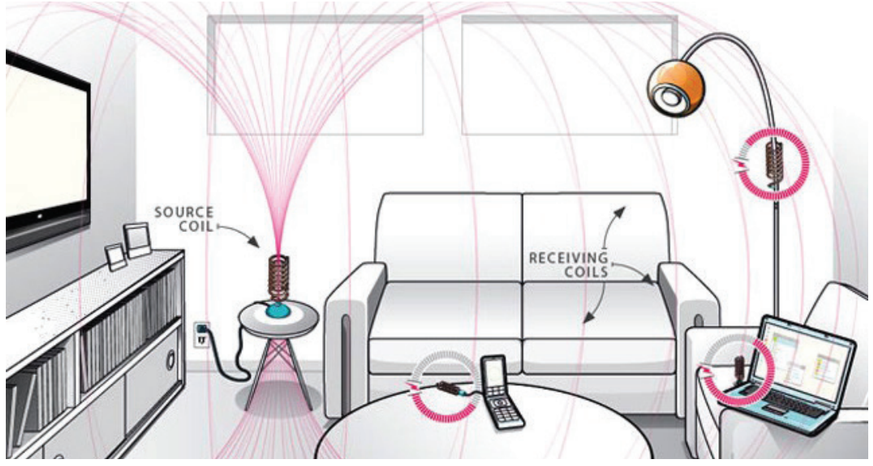
glowing material that surrounds it. However, the colours of the bright ring in the image aren’t the actual hues of the gas; rather, they represent a colour map chosen by EHT researchers to depict the brightness of the emissions and radiations. The ring of fire in the EHT image is light from the gas falling into the event horizon, whose shadow is the dark hole in the centre. The exact shape of the ring is due to the way the incredible gravity of the black hole bends the light around it causing gravitational lensing and Doppler effect,the orbital speeds and orientation also causes the back side of the blackhole to be simultaneously visible. The plasma nearer shines brighter than the other. A set of 6 papers were published stating the discovery of black hole along with the photograph.

Many Scientists including Stephen Hawking made tremendous contributions in the search of black holes. He proposed the fate of black holes and radiations it emitted : Hawking Radiation due to the separation of particle antiparticle due to tremendous gravity. The energy released is supposed to escape black hole as radiation. This image can closely be related to that of Pluto when once it was thought to be an unknown object.

It is known that humanity pales into insignificance in the vast abyss of space. To see something that was 55million years ago and marvel at it,we might be limited by the technology of our time, we may be of no significance among this big universe but it’s the idea that no matter how terrifying, how profound or obscure it may be, nothing is beyond our grip. The greatest wealth humanity has is its knowledge and curiosity to gaze into unknown; to see what once thought was “impossible”.

Wireless Power Transmission

By **Faud Ahamed**
2nd Year EEE



Wireless power transmission is the process of transmitting electrical energy to an electrical load, from a source emitting power without interconnecting wires. The wireless transfer of electromagnetic energy as in different forms like audio format, video format and data format is common nowadays but wireless power transfer technology is still years ahead. Even though the idea was developed 100’s of years ago and scientists are still working on the topic, an efficient way for wireless transfer of power is yet to be developed. The development of highly efficient WPT technology will be a breakthrough in the history of wireless transmission as it allows lots of portable devices to be charged without plugging on to a socket or docked to a charging station.

The development of WPT serves to be useful in many ways, as transmission of power in hazardous environment is inefficient and dangerous. The WPT differs from the wireless transmission of telecommunication signals as the WPT takes into consideration the efficiency parameter where as in the latter the energy parameter is significant only if the signal is distorted in such a way that it cannot be distinguished. The WPT is economical if and only if the receiver receives the same amount of energy transmitted by the source.

The direct induction method is the most common method used for the WPT and is being used for short distance WPT, but it had disadvantages and was overcome by later technologies developed like the resonant magnetic induction method, electromagnetic radiation methods like microwaves and lasers. In the modern era where the ideology of high efficiency in practical circuits comes to existence, the WPT technology proves wrong due to the low efficiency of the developed technologies. The WPT technology in industries by electromagnetic radiation is possibly only remote in the design and most of the industries are looking forward for better designs for better efficiency in power transfer. Most of such desigs lag the property of safe human environment for living and the economic barriers. A design of WPT system which overcomes these factors is still to be worked out and is being experimented throughout the world.

Why Wireless Power Transmission (WPT)?

The studies throughout the world has proven that most of the electrical energy transfer is done through the interconnection wires and lots of energy is lost during the transmission due to various internal and external factors like the resistance of the wires ,the material of the conduction wires, the size of the wires, the atmospheric conditions like temperature, humidity etc. On an average basis, the loss of power due to transmission through wires is calculated to exceed more than 30%. This is where the WPT comes into action, the WPT is highly reliable, fast, low cost for the maintenance and can also be used for short range and long-range distance transmissions. These factors pop-in the idea for WPT.

History of WPT

The WPT history can be traced from the early 19th century. The first electromagnet was developed in the year 1825 by William Sturgeon which paved the way for the discovery of principles of magnetic induction in the year 1831. This was followed by the demonstration of transmission and reception of electrical energy without wires to connect the point of origin and termination by Nicholas Joseph Callan using the above two developments. These experiments even though demonstrated was successful but in practical cases was always kept under suspicion which was due to the interpretance that it was not possible for long distance transmission and fear of safety.

The invention of transmission of very and ultra-high frequency radio waves dedicated to Heinrich Hertz followed the revolutionary development of the wireless electricity transfer by Nikola Tesla in the year 1891, on which he took the patent-ship for illuminating the bulbs wirelessly. Nikola Tesla is called as the pioneer of the induction techniques as his technique was based on induction method. His vision of "WORLD WIRELESS SYSTEM" which inculcated the idea of people accessing the free energy. He even planned to set working a 187 feet tall tower for broadcasting energy but was put down due to lack of funds. The experimentation in early 20th century was successful in transmitting power over a distance wirelessly but was not able to solve the problem of power loss due to hindrances. In the 19th century WPT passed through various phases of technological developments. Even after 100 years the idea of Tesla is being used by the MIT scientists led by Soljacic for their project named "WiTricity".

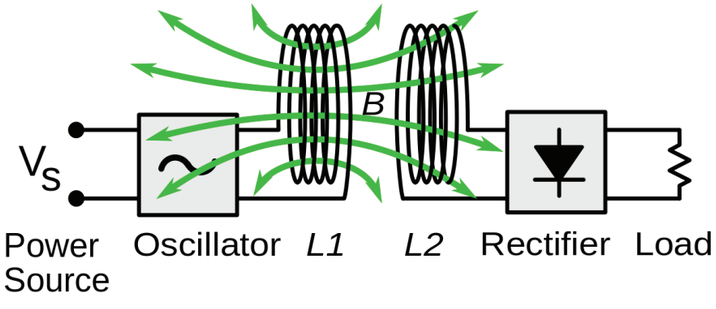
Different technologies of WPT

Near-field techniques: The techniques for short distance transmission of power wirelessly. Mostly the induction methods are used for near-fields. These techniques are as follows.

· Inductive coupling

Electromagnetic induction is a process whereby a conductor placed in a changing magnetic field results in the production of voltage across a conducting plate. This voltage in-turn generates an electrical current called the induced current because the current on the second conductor is induced by the first. In the inductive coupling technique the primary and the secondary are not connected by wires but the energy is transferred by mutual induction. Mutual induction refers to the generation of EMF in circuit due to a change of current in nearby circuit.

Electromagnetism increases with the increase in current, the voltage in the conducting plate responsible for the magnetic fields and also the increase in the frequency. The energy is transmitted from the conducting plates which is responsible for the fields to another conductor termed the secondary where the fields impinge on. A part of the energy on the primary is passed inductively through space decreasing the energy in the primary and imparting energy into the secondary. High frequency currents are not liable to pass the current for long distances but transfers energy by induction rapidly to the adjacent or neighboring conductors. Lower the frequency of the current less preponderant becomes the effects of induction. The phenomenon is classified as more local, if the energy decreases rapidly in the circuit causing the current



in the circuit to die-out. In the space outside the conductor the phenomena result in dielectric stress and steady magnetic condition for continuous current and alternating for alternating current input. For the telecommunication channels the magnetic and electric fields outside conductor is only considered for the transmitting and receiving of messages. Transformer working is the simplest example for WPT.

A current which is varying in the primary generates a varying magnetic flux in the core of the transformer which results in the varying magnetic field in the secondary. This field induces a varying voltage or EMF (electromotive force) in the secondary. This is termed as mutual induction. It should be noted that most of the energy transferring devices are usually air-cored. There are many examples of air-cored devices, such as the wireless charging pads, electric brushes etc.

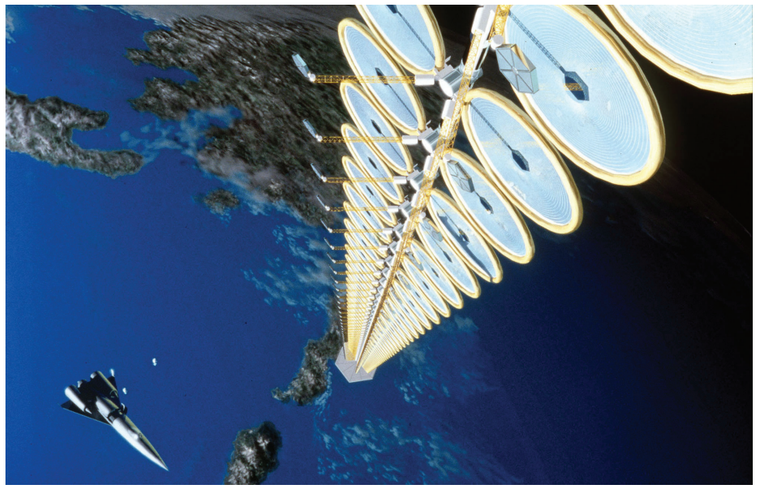
Induction coupling is the underlying principle of charging of an electric toothbrush. The input current through the primary winding creates a magnetic flux thus a magnetic field. When the toothbrush is placed in the charger, a current is induced in the secondary by the magnetic field, which is connected to the battery of the brush and thus recharges the battery.

The wireless charging of the portable devices is of great advantage as it is comfortable to use, shock proof and less usage of wires which is more economical. The principle to recharge several devices at a time is similar to that of the charging of electric brush. The Splash power recharging mat and Edisions Electric PowerDesk are few examples. The WCP (wireless charging pads) are devices that are devised for charging the battery automatically when placed on it. There is no connection with the wires between the charging pad and the device battery to be charged. The technique of induction to transfer energy is utilized in this and air acts as core.

• Microwave wireless power transfer

The electromagnetic waves that are arranged in between the infrared spectrum and the radio wave spectrum are termed as microwave. Their frequency ranges from 300 Mega hertz to 300 Giga hertz. They are used for a wide range of applications such as Bluetooth, wifi, microwave Owen etc. The frequency range of microwave is in between 1 and 40 GHz which is generally used for applications.

For long distance transfer of power, microwave is one of the best medium used. The microwave band is generally used because antennas of convenient sizes that are able to transmit and receive the microwave signals and also the metal waveguides for carrying the radio power works are available. Besides this, the technologies in electronics where millimeter waveband is required, the microwave proves to be helpful. This is because in millimeter wavelengths the radio waves are attenuated while the microwaves are not. The microwave was used for transmission of power for various applications such as running of the unmanned helicopter developed by Americans, powering the outer space vehicles etc.



There are mainly three steps involved in the transmission and reception of power by MPT.

Step1: The conversion of electrical energy into microwave. After this process the microwave is emitted with very-high power emitters called the cavity magnetrons.

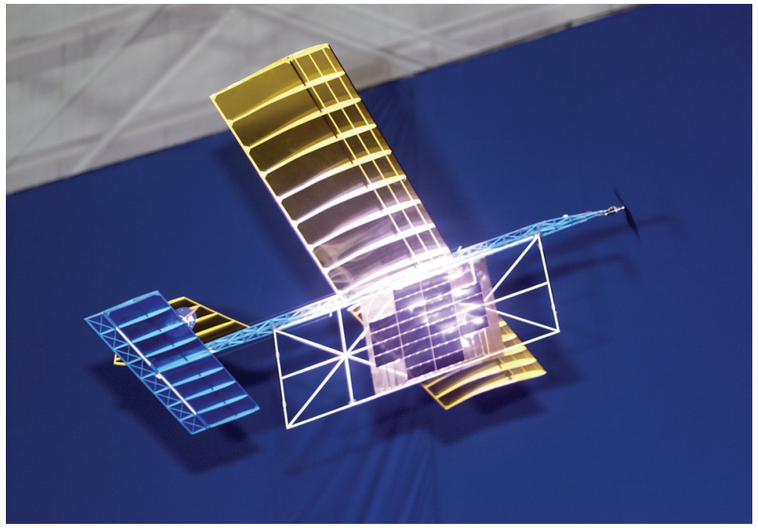
Step2: The microwave is then captured using a rectenna. The rectenna is a combinational circuit consisting of rectifier and an antenna.

Step3: Microwave energy is converted to electrical by the rectenna.

In the process of transmitting microwave, the AC supply needs to be converted to DC as it is not possible to convert the AC directly to microwave. The process of conversion of DC to microwave is done by magnetron. The magnetron is a highly powered vacuum tube structure that is responsible for the production of coherent microwaves. The rectenna can also be called as rectifying antennae as it converts the microwave directly into DC electricity. Rectenna consists of elements that are sorted in multi element array and consists of pattern reflector element mesh to give directionality. It is easily constructed by placing Schottky diode in between the antennae dipoles. The DC is converted back in the next process using an inverter circuit. Considering the receiver to be a photovoltaic cell, the microwave system for earthbound applications exceeding an area limit of diameter size 10 Km, the arrays in the receiving station has large power levels in total , limiting the exposure of electromagnetic radiations which is considered for human safety. A density of power equal to or less than 1mW/cm2 is considered safe for human environment, and with this density of power for a diameter of 10 km 750 megawatts of power can be generated. This standard value is utilized by several modern power plants in the world.

Laser transmission of power

A device emitting electromagnetic radiation by the process of optical amplification on the basis of



stimulated emission is termed as laser. Laser has high directivity and high degree of temporal and spatial coherence which is a unique property of laser that cannot be attained by any other technologies. The laser beams do not get dispersed for long during the time of transmission. The disadvantage of the laser is that it gets attenuated while propagating through the atmosphere because of hindrance due to the dust particles prevailing in the atmosphere.

The receiver designed for the laser power transmitter and receiver is simple in design and construction. The laser system is a cost-efficient system due to the simple design and structure. These points form positive side for the implementation of the laser system. The receiver in the case of laser system is a photovoltaic cell.

The laser system is mainly used when electromagnetic radiation in the spectrum near to visible region that is 10s of nm or microns are to be transmitted, power is transmitted changing electricity in the form of laser beams and then projected onto a photo-voltaic cell which acts as the receiver. The receiver then turns it back to electricity. This is called the “power beaming” mechanism. This is so called because power is forced or beamed at the receiving end to convert the power into useful electric energy.

Projects established on the basis of wireless power transfer

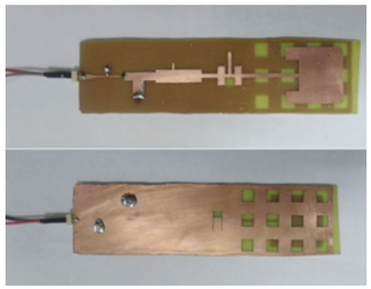
Wi-Tricity

This was a project done in Massachusetts Institute of Technology on wireless transfer of energy based on the resonance inductive coupling method. The team was led by Marin Soljacic. The team was able to transfer energy wirelessly for a distance of 2m. The coils used for the experiment was helical in shape and they never used any capacitor in the experiment. The energy received at the receiving terminal was almost 40% of the total input power from the supply.

The frequencies used for the transmission of power were 1MHz and 10MHz. The field strengths were safer at 1 MHz frequency for the human environment. The usage of 10MHz frequency, created fields of strength above the ICNIRP (International Commission on Non-Ionizing Radiation Protection) standards.

Rectenna in US

The rectenna built in USA worked on the microwave method of wireless energy transfer. The rectenna which was spread over one and half mile in diameter was able to generate electric power of



5000MW. The range of frequency of microwave used is compactable to the ICNIRP standards.

Alaska ’21

WPT can be used for supplying power to rural areas. Alaska ’21 project was presented in the year 1993, for supplying power to villages in Alaska. The other sources of energy were not possible to be used because of the limited infrastructure. The price estimate of $40/kWh was done for energy produced by other sources, which is too high to accommodate. Even cabling to this area was not possible due to extremes of climatic conditions. So a pilot project was conducted which was passed on WPT, not only to supply energy but also to avoid pollution. The system consisted of 2.45 GHz design array and could bridge around 1 to 15 miles. Present status is unknown.

Grand Basin project

This project aims in supplying electricity to an isolated mountain village in the remote area of the La Reunion Island. This project was developed for making Grand Basin to a tourist village. The project was given complete support by CNES, which is the French space centre. WPT was used as the underlying basis of the project. Planning to build a microwave link which operates at 2.45GHz frequency working over a distance of 700 meters delivers 10kW and had an efficiency of 57%. The whole system worked in combination with the photovoltaic panels and the batteries. Capital of 1 million dollars for 10 kW was proposed and the project was put down.

Meet TheTechnology-LoRa

By **Suhaib J**
2nd Year EEE

LoRa/LoRa WAN (Long Range Wide Area Networking) is a patented digital wireless data communication technology developed by Cycleo of Grenoble, France and acquired by Semtech in 2012. LoRa uses license-free sub-gigahertz radio frequency bands like 169MHz, 433 MHz, 868 MHz and 865 MHz to 867 MHz in India.

Semtech's LoRa devices and wireless radio technology is a long range, low power wireless platform that has become the technology of IOT networks world wide. LoRa solves some of the biggest challenges faced by our planet: energy management, natural resource reduction, pollution control, infrastructure efficiency, disaster prevention and lot more. With over 50 million devices connected to networks in 95 countries and still growing, LoRa technology is the DNA of IOT.

Why LoRa?

LoRa fills the technology gap. LoRa technology has revolutionised IOT by enabling data communication over a long range while using very little power. When connected to a non-cellular network, these devices accommodate a vast range of IOT applications by transmitting packets with useful information. LoRa WAN fills the technology gapof cellular and WiFi based networks that require either high bandwidth or high power, or have a limited range or inability to penetrate deep indoor environment. In effect, LoRa technology is flexible for rural and indoor use. They find immense applications in smart cities, smart homes and buildings, smart agriculture and smart metering.

Like WiFi, LoRa operates in the unlicensed band and supports indoor applications like cellular. This technology is highly secure from end devices to application server and is suitable for outdoor applications. It combines features of WiFi and cellular networks to offer an efficient, flexible and economical connectivity solutions ideal for IOT applications and are installed in public, private and hybrid networks.

Applications and future of LoRa WAN technology

• Smart City

LoRa WAN together with IOT will be an inevitable technology in future smart city applications like

• Industrial applications

·Radiation and leak detection
·Smart sensor technology
·Item location and tracking
·Shipping and transportation

·Smart home applications

·Enhanced home security
·Home automation forIOT enabled smart appliances

Healthcare

·Health monitoring devices and management
·Wearable technology

Agriculture

·Smart farming and livestock management
·Temperature and moisture monitoring
·Water level sensors and irrigation control

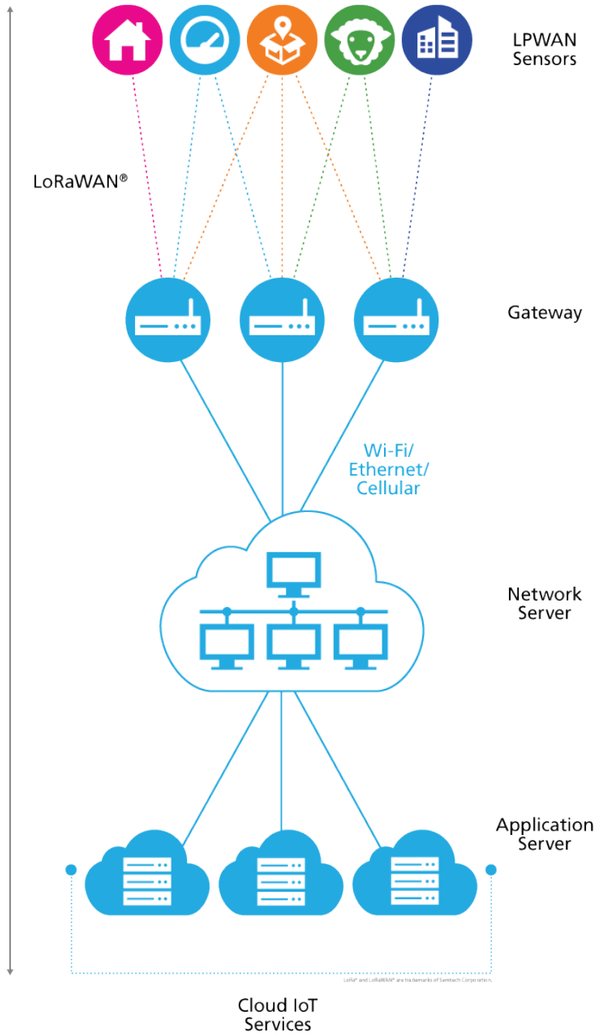
LoRa technology: A boon or a bane???

LoRa technology is highly beneficial. Some of the advantages are as follows.
·Less complexity in programming
·Support future upgrades
·Ease of access and connectivity to cloud applications
·Remote management and control access
·Highly intelligent architecture
·Has long range connectivity
·Enables geo-location or GPS
·Requires low power
·Maintains communication with devices in motion without strain or power consumption
·Offers a secure transmission network
·High capacity of communication
·Low cost

Limitations of LoRa technology

·Data Rates: It is not able to deliver HD video streams over a 10km range. The maximum bit rate is 50Kbps at these distances
·Emerging standards: The standardisation of LORa is only on the way. Many countries are yet to establish a legalised standard.

In future, our global, national and regional networks have to support billions or even trillions of devices. LoRa can play a significant role in providing a smart, low cost and highly efficient network for future applications. It has an association of more than 400 companies globally to contribute, improve and implement smart networks for future needs.



Engineering Excellence Awards

By **Athira Manikandan, Deepika Krishna and Devika M**
4th Year EEE

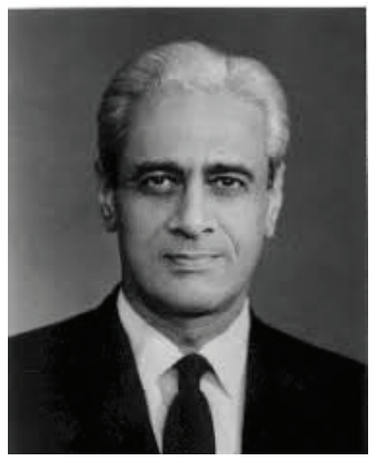
Have you ever heard of engineering excellence awards? If not, this article can take you through the various awards that an engineer is honoured with!!!Let us begin with the INAE. The Indian National Academy of Engineering (INAE), found in 1987 comprises India's most distinguished engineers, engineer-scientists and technologists who cover the entire spectrum of engineering disciplines. The Academy is registered under the Societies Registration Act 1860 and is an autonomous institution supported partly through grant-in-aid by Department of Science & Technology Government of India. It is the only engineering academy of the country. The main objective of INAE is to encourage and promote the pursuit of excellence in the field of Engineering. With an objective to promote Engineering Excellence, INAE has instituted the following awards.

1.Life Time Contribution Award in Engineering

The purpose of the award is to recognise life time contribution in engineering made by eminent persons to any branch of engineering within the purview of the Academy.
This being the highest recognition from INAE – is given every year to two eminent Indian citizens who have made most distinguished contribution in the field of engineering/ engineering research/ engineering education/ technology/engineering management which has brought prestige to the nation and are regarded as landmarks of technological development of the country. The award consists of Rs.5 lakhs in cash and a Citation. The last date of receipt of nominations is 15th day of May each year.

First recipient of Life Time Contribution Award

1.Prof. Satish Dhawan



Born in 1920, Late Prof. Satish Dhawan is considered by the Indian scientific community as the father of experimental fluid dynamics research in India. He was an outstanding Indian rocket scientist who obtained his BE in Mechanical engineering from University of Minnesota, USA; MS in Aeronautical Engineering from California Institute of Technology and PhD in Aeronautics and Mathematics. He was the chairman of ISRO in 1972. He was also the Chairman of the Space Commission and Secretary to the Government of India in the Department of Space. The book,"Boundary Layer Theory" by Hermann Schlichting presents his contributions. He was a professor at Indian Institute of Science, Bangalore and he set up the first supersonic wind tunnel in India at IISC. He carried out experiments in remote sensing and satellite education which led to operational systems like INSAT, Indian Remote Sensing satellite and PSLV that placed India in the league of space faring nations.

2.Prof Jai Krishna

Born on Feb 14th ,1912, Late Prof Jai Krishna was an eminent educationist, researcher and academic administrator. He obtained his Bachelor's degree in Science. Later he studied Civil Engineering at Thompson College of Engineering, Roorke. He obtained his doctoral degree in Civil Engineering from University of London in 1954. Later he joined Thompson College as Lecturer in 1939 and rose to the rank of Professor. He was appointed as Vice Chancellor of the University of Roorkee. He conducted pioneering research on Structural and Earthquake Engineering. He even established a school for research in the field of Earthquake Engineering at the University of Roorkee. His contributions include: evolution of simple methods of strengthening buildings, bridges, water towers and dams; design and fabrication of seismic instruments and evolution of concepts of iso-acceleration studies pertaining to seismic energy distribution. His expertise was utilized for preparing Codes of Practice relating to earthquake resistant construction in India and by the International Association of Earthquake Engineering in the preparation of the guidelines for seismic zoning of countries and determining fundamental design parameters. Later, in International Conference in Tokyo in 1983, he was awarded for his services to Earthquake Engineering studies. He was honoured with Padma Bhushan in 1972. He was also awarded the Shanti Swarup Bhatnagar Prize.

2.Prof. Jai Krishna and Prof. SN Mitra Memorial Awards

The motive is to institute awards in memory of late Prof. Jai Krishna, Foundation President and Prof SN Mitra, first Honorary Secretary, a Past Vice- President and a Foundation Fellow of the Indian National Academy of Engineering.

Prof Jai Krishna Award shall be given each year in the disciplines of Engineering Section I (Civil Engineering), Engineering Section III (Mechanical Engineering), Engineering Section IV (Chemical Engineering), Engineering Section VII (Aerospace Engineering) and Engineering Section VIII (Mining, Metallurgical and Materials Engineering)
First recipient of Prof Jai Krishna Memorial Award

Prof Ajay K Ghose

Prof Ajay K Ghose was born on 13th April 1934. He was graduated in 1956 and holds eminent academic records at Patna University and at the Indian School of Mines, Dhanbad. He was a recipient of India Overseas Scholarship and moved to United Kingdom in 1957. He worked as a management trainee with the National Coal Board up to 1959. After serving as a Senior Lecturer in coal mining and mining machinery at Indian School of Mines, he joined the Central Mining Research Station as Senior Scientific Officer Grade I in 1960. He set up Rock Mechanics and Hydraulic Stowing laboratories there. Then he evolved research work on coal mine ground control and roof bolting. At the early age of 28, he was appointed as a Senior Professor at Regional Engineering College, Srinagar in 1962. He was also assigned with the responsibility of setting up a new mining engineering programme. In 1966 he re-joined Indian School of Mines as a Professor of Mining Engineering where he established a strong school of research and teaching in geo mechanics and rock excavation engineering. He was the first one to set up the centre of Rock Excavation Engineering in India. He became the director of Indian School of Mines in 1991 and retired in 1994. Along with this, he was an Exchange Scientist at the University of Ostrava in 1971, a Visiting Professor under Commonwealth Fellowship Programme at the University of Newcastle-upon-Tyne in 1974 and also a Visiting Faculty at the University of Nottingham and the Academy of Mining and Metallurgy Cracow

Prof S N Mitra Memorial Award shall be given each year, in the disciplines of Engineering Section II (Computer Engineering and Information Technology), Engineering Section V (Electrical Engineering), Engineering Section VI (Electronics & Communication Engineering), Engineering Section IX (Energy Engineering) and Engineering Section X (Interdisciplinary

Engineering and Special Fields)

INAE Fellows who are eminent engineers, engineer scientists or technologists of high achievements and standing will be eligible for the subject awards. They are expected to have made contributions of a high order to Indian Engineering and Technology and acquired a high level of eminence and respect in the engineering community.
The Award shall carry Rs.2 lakhs in cash and a Citation. The last date of receipt of nominations is 15th day of May each year.

First recipient of Prof S N Mitra Memorial Award

Prof Amalendu Bhushan

Prof Amalendu Bhushan Bhattacharya was born on 19th September 1937 in West Bengal. He holds B.Sc., M.Sc in Electronics and Ph.D in Radio Communication. He is an alumni of Banaras Hindu University. Later he joined the Electrical Engineering Department of B.H.U and then Indian Institute of Technology, Delhi.

3.INAE Outstanding Teachers Award

The award aims to recognize and honour teachers in Indian Colleges, Universities, and Institutions, who have provided guidance. They must have inspired students to take up careers in Engineering and Technology. All disciplines of Engineering and Technology will come under the purview of this award. There will be a maximum of two such awards per year. The awardees shall receive a citation, a cash award of Rs. 1.0 lakh and a onetime book grant of Rs.25,000/-. The last date of receipt of nominations is 15th day of May each year

4.INAE Young Engineer Award

Young Engineer Awards, instituted in 1996, are given for engineering research, excellence in engineering design, technology development and technology transfer. The Scheme has attracted nominations of bright young talent in the country and has become a prestigious National Award since then. So far, 228 young engineers have been conferred this Award and their early recognition has encouraged the best upcoming talent to make innovative engineering and technological contributions for our national development. It targets to recognize outstanding achievements / contributions made by Young Engineers in any branch of engineering. The award consists of Rs.1 lakh in cash and a citation. All INAE Young Engineer Awardees will also become INAE Young Associates" on the conferment of the award and shall continue to be "INAE Young Associates" till attaining 45 years of age. The last date of receipt of nominations is 31st day of March each year.

5.INAE Innovator Entrepreneur Award

In order to increase the involvement with the industry; Indian National Academy of Engineering (INAE) has instituted the Innovator Entrepreneur Award with a view to encourage and recognize innovation and entrepreneurship among Young Engineers. The engineering innovations/inventions/concepts that have been actually realized and implemented in industry either in new processes or products would be given weightage. It is instituted to encourage and recognize innovation and entrepreneurship among Young Engineers. The engineering innovations/ inventions/concepts that have been actually realized and implemented in industry either in new processes or products would be given preference. The award carries a cash prize of Rs 2 lakhs. The last date of receipt of nominations is 30th day of June each year.

6.Innovative Student Projects Award

There is a need to encourage research and development culture amongst engineers during the formative years of their undergraduate and postgraduate training, so that they begin their professional career well prepared with ideas and innovative skills. Innovative Student Projects Awards, instituted in 1998, are given to identify innovative and creative projects undertaken by students at three levels, viz., B.E./B. Tech, M.E./M.Tech and Ph.D. in Engineering Colleges. This Award recognizes innovative and creative projects and thesis of students and research scholars in engineering institutions, since an early recognition of merit and talent can often mark the beginning of a brilliant career.
The Award shall comprise a certificate and Rs.25000/- in cash for the awardees selected at Doctoral Level; Rs.15000/- in cash for the awardees selected at Master's Level; and Rs 10,000/- in cash for the awardees selected at Bachelor level to each team member, subject to a maximum of four team members. The last date of receipt of nominations is 7th day of July each year.

A Brief Introduction to
LabVIEW

By **Deepesh EV**
4th Year EEE

Laboratory Virtual Instrument Engineering Workbench (LabVIEW) is a system-design platform and development environment for a visual programming language from National Instruments.

National Instruments Corporation, or NI, is an American multinational company with international operation. Headquartered in Austin, Texas, it is a producer of automated test equipment and virtual instrumentation software. (http://www.ni.com/Common) applications include data acquisition, instrument control and machine vision. The graphical language is named “G” not to be confused with G-code. Originally released for the Apple Macintosh in 1986, LabVIEW is commonly used for the following applications

1.Data acquisition
2.Instrument control
3.Industrial automation

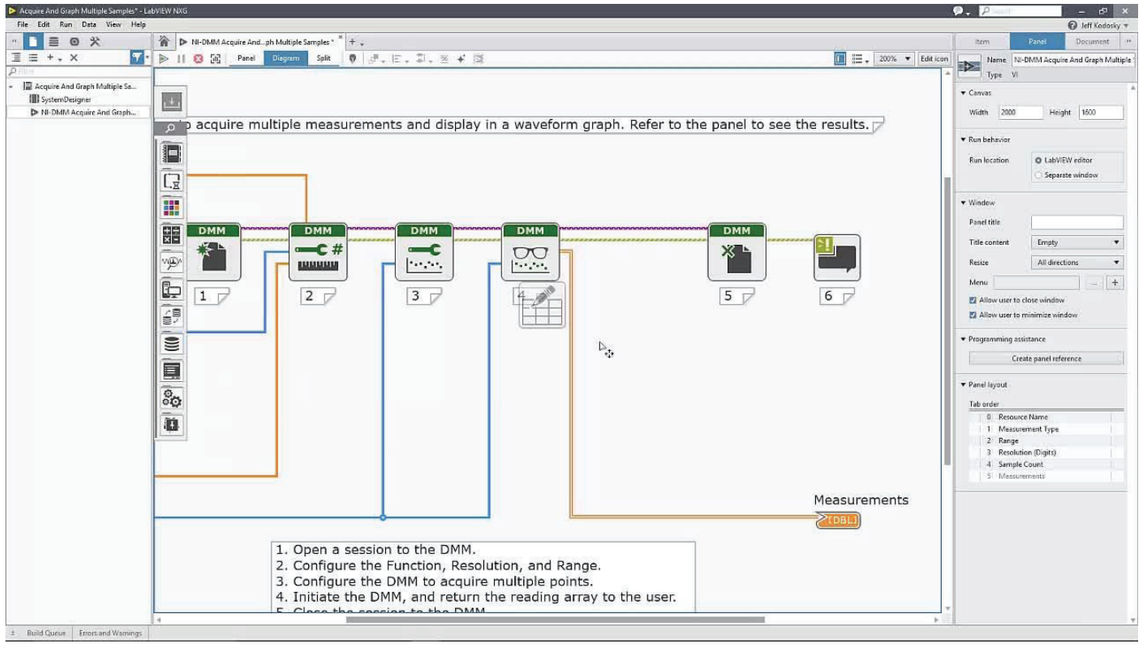
It operates on a variety of operating systems (OSs), including Microsoft Windows, various versions of Unix, Linux, and macOS. The programming paradigm used in LabVIEW, sometimes called G, is based on data availability. If there is enough data available to a subVI or function, that subVI or function will execute. Execution flow is determined by the structure of a graphical block diagram (the LabVIEW-source code) on which the programmer connects different function-nodes by drawing wires. These wires propagate variables and any node can execute as soon as all its input data become available.

The methodology of programming

LabVIEW integrates the creation of user interfaces (termed front panels) into the development cycle. LabVIEW programs-subroutines are termed virtual instruments (VIs).

Each VI has three components
1. A block diagram
2. A front panel
3. A connector pane.

The last is used to represent the VI in the block diagrams of other, calling VIs. The front panel is built using controls and indicators. Controls are inputs: they allow a user to supply information to the VI. Indicators are outputs: they indicate, or display, the results based on the inputs given to the VI. The back



panel, which is a block diagram, contains the graphical source code. All of the objects placed on the front panel will appear on the back panel as terminals. The back panel also contains structures and functions which perform operations on controls and supply data to indicators. The structures and functions are found on the Functions palette and can be placed on the back panel. Collectively controls, indicators, structures, and functions are referred to as nodes. Nodes are connected to one another using wires, e.g., two controls and an indicator can be wired to the addition function so that the indicator displays the sum of the two controls. Thus, a virtual instrument can be run as either a program, with the front panel serving as a user interface, or, when dropped as anode on to the block diagram, the front panel defines the inputs and outputs for the node through the connector pane. This implies each VI can be easily tested before being embedded as a subroutine into a larger program. The graphical approach also allows non-programmers to build programs by dragging and dropping virtual representations of lab equipment with which they are already familiar. The LabVIEW programming environment, with the included examples and documentation, makes it simple to create small applications. This is a benefit on one side, but there is also a certain danger of under estimating the expertise needed for high-quality G programming. For complex algorithms or large-scale code, it is important that a programmer possesses an extensive knowledge of the special LabVIEW syntax and the topology of its memory

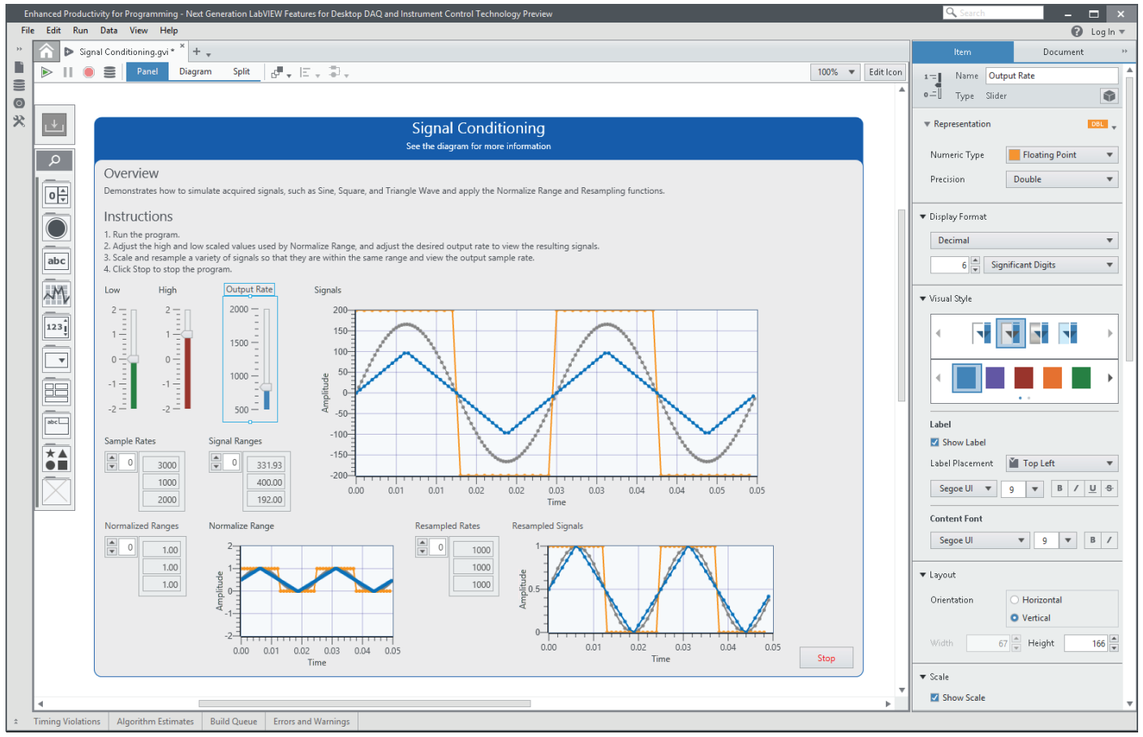
management. The most advanced LabVIEW development systems offer the ability to build standalone applications.

The mode of interfacing
LabVIEW includes extensive support for interfacing to devices, instruments, camera, and other devices. Users interface to hardware by either writing direct bus commands (USB, GPIB, Serial) or using high-level, device-specific, drivers that provide native LabVIEW function nodes for controlling the device. LabVIEW includes built-in support for NI hardware platforms such as CompactDAQ and CompactRIO, with a large number of device-specific blocks for such hardware, the Measurement and Automation eXplorer (MAX)and Virtual Instrument Software Architecture (VISA) toolsets.

Code Compiling
LabVIEW includes a compiler that produces native code for the CPU platform. This aids performance. The graphical code is translated into executable machine Code by a compiler. The LabVIEW syntax is strictly enforced during the editing process and compiled into the executable machine code when requested to run or upon saving. In the latter case, the executable and the source code are merged into a single file. The executable runs with the help of the LabVIEW run-time engine, which contains some pre-compiled code to perform common tasks that are defined by the G language. The run-time engine reduces compiling time and provides a consistent interface to various operating systems, graphic systems, hardware components, etc. The run-time environment makes the code portable across platforms. Generally, LabVIEW code can be slower than equivalent compiled C code, although the differences often lie more with program optimization than inherent execution speed.

Libraries
Many libraries with a large number of functions for data acquisition, signal generation, mathematics, statistics, signal conditioning, analysis, etc., along with numerous for functions such as integration, filters, and other specialized abilities usually associated with data capture from hardware sensors is enormous. In addition, LabVIEW includes a text-based programming component named MathScript with added functions for signal processing, analysis, andmathematics. MathScript can be integrated with graphical programming using script nodes and uses a syntax that is compatible generally with MATLAB.

Parallel programming
LabVIEW is an inherently concurrent language, so it is very easy to program multiple tasks that are performed in parallel via multithreading. For example, this is done easily by drawing two or more parallel while loops and connecting them to two separate nodes. This is a great benefit for test system automation, where-it is common practice to run processes like test sequencing, data recording, and hardware interfacing in parallel.



Ecosystem
Due to the longevity and popularity of the LabVIEW language, and the ability for users to extend its functions, a large ecosystem of third party add-ons has developed via contributions from the community. This ecosystem is available on the LabVIEW Tools Network, which is a market place for both free and paid-LabVIEW add-ons.

User community
There is a low-cost LabVIEW Student Edition aimed at educational institutions for Learning purposes. There is also an active community of LabVIEW users who communicate through several electronic mailing lists(e-mail groups) and Internet forums.

PSPICE

By **Mohamed Amal A**
1st Year EEE

Introduction to PSPICE

·PSPICE stands for Program Simulation with Integrated Circuit Emphasis.

·The Electronics Research Laboratory of the University of California developed it and made it available to the public in 1975.

·PSPICE is a computer-aided simulation program that enables you to design a circuit and then simulate the design on a computer.

·It is used extensively by electronic design engineers for building a circuit and then testing out how that circuit will simulate.

·PSPICE is largely popular because of its user-friendly interface, extensions that support modeling of digital circuits and its no-cost basic version.

Basics of PSPICE

PSPICE is a general purpose program designed for a wide range of circuit simulation including the simulation of nonlinear circuits, transmission lines, noise and distortion, digital circuits, mixed digital and analog circuits. It can perform dc analysis, steady-state sinusoidal (AC) analysis, transient analysis, and Fourier series analysis.

·PSpice is not case sensitive

·All element names must be unique

·There must be a node designated “0” (Zero). This is the reference node against which all voltages are calculated.

·If any change is made in circuit make sure you create netlist again before simulating it.

The general procedure for using PSPICE consists of 3 basic steps.

Step 1
The user draws the circuit in schematic form which he wants to simulate.

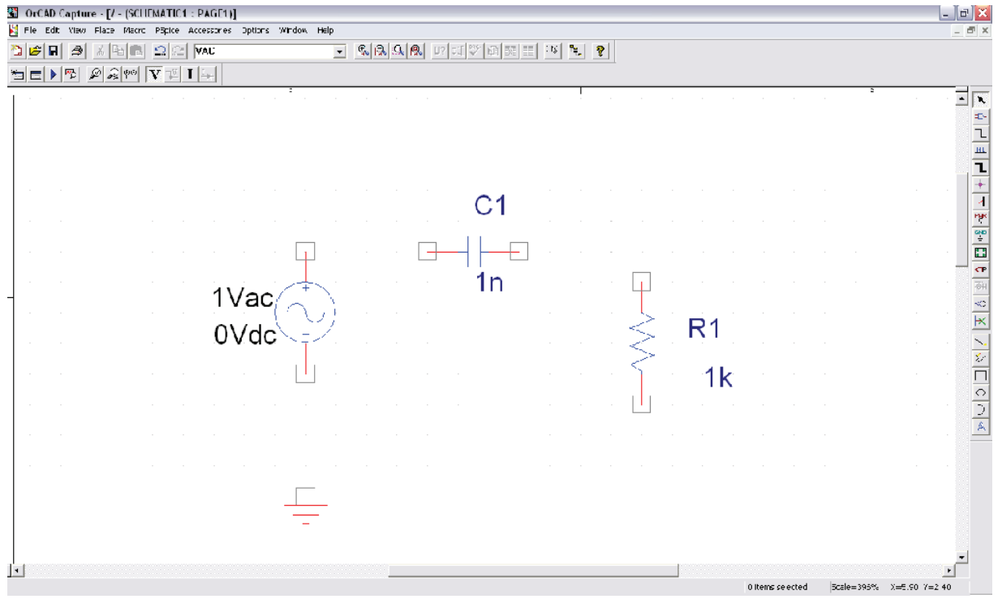
Step 2
The user specifies the type of analysis desired, and directs PSPICE to perform that analysis. This can be DC analysis, AC analysis, transient analysis etc.

Step 3
The user instructs the computer to print or plot the results of the analysis. In this step, the user sees the graphical results of the analysis done. For example, he can see the graph of the output voltage vs. output current (V vs. I), or any data which he wants to analyze.

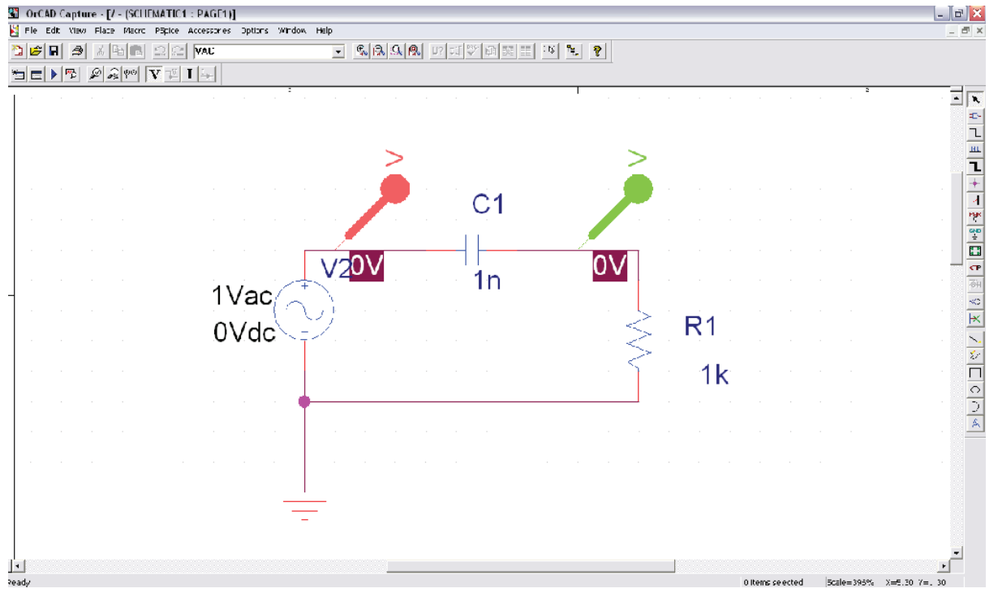
DEMO

We are taking the example of HIGH PASS FILTER(RC)

STEP 1: PLACING THE COMPONENTS,SOURCE AND GROUND

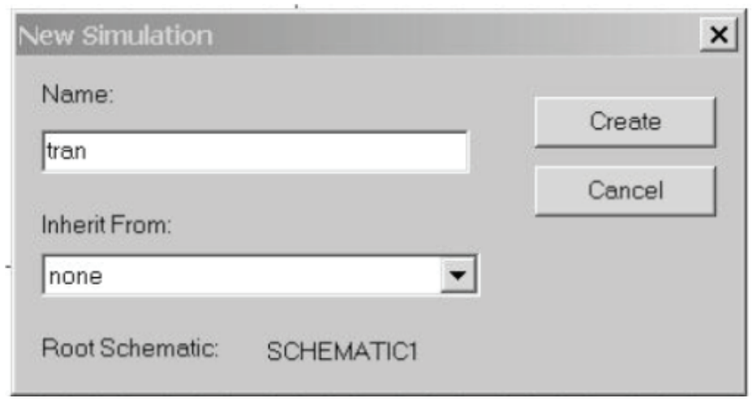


STEP 2: ADD PROBES



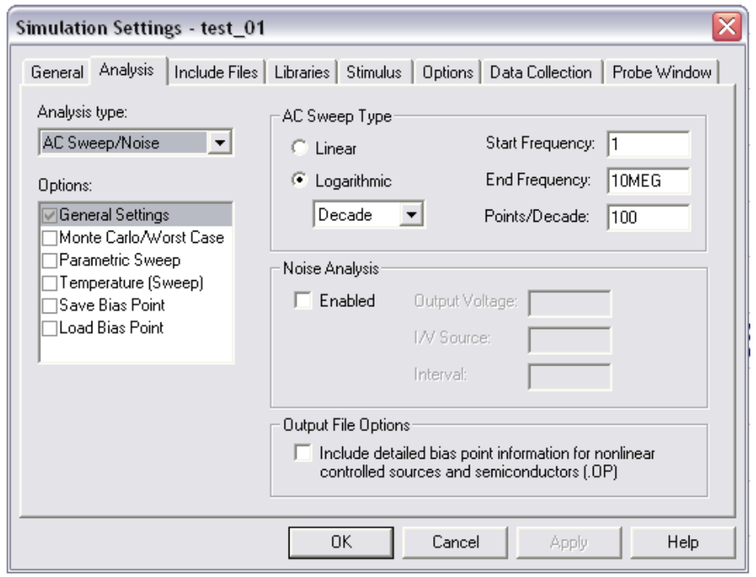
STEP 3: CREATE NEW SIMULATION PROFILE

•Go to PSPICE New Simulation Profile
•Give a name for the profile and click create



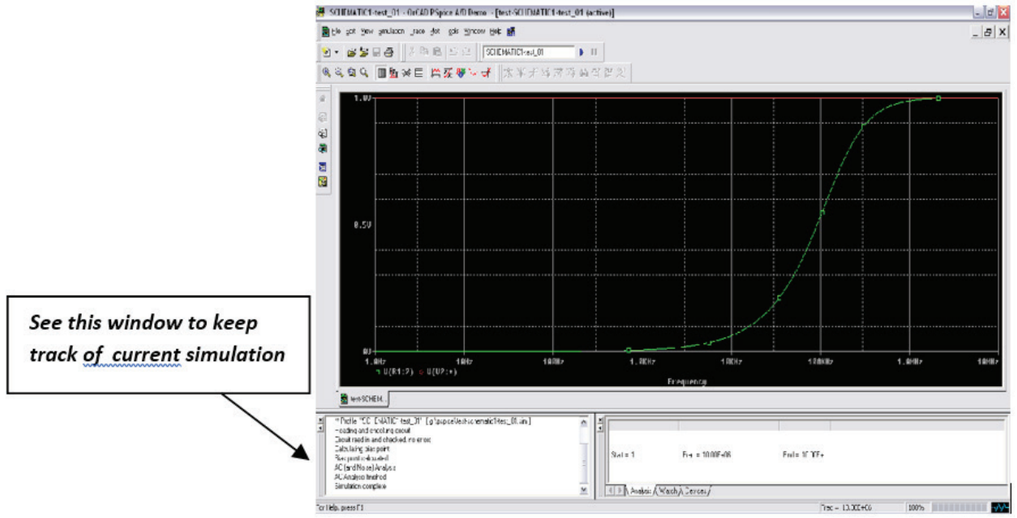
STEP 4: AC ANALYSIS

•We can choose any of the analysis and options
•Here AC analysis is done to see operation of filter

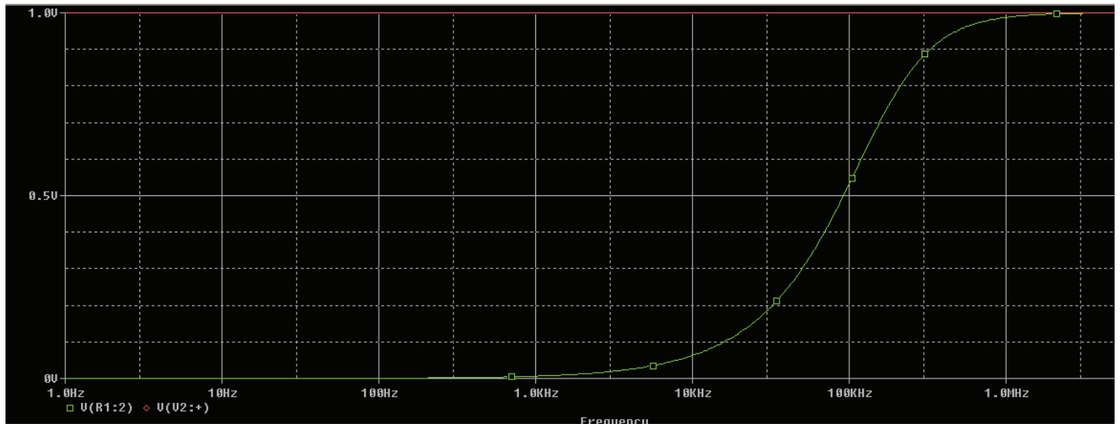


STEP 5:RUN

•Go to PSPICE , Run
•Another waveform window will come up



STEP 6: RESULT



CONCLUSION

PSPICE is a widely available easy and efficient software for simulations and analysis of circuits.

Electrical and Electronics Engineering Association Annual Report 2019

The Electrical and Electronics Engineering association was inaugurated on 15th February, 2019, Friday, by Dr. Jayaraju M, Principal, College of Engineering, Munnar. The inaugural ceremony was organised at the college auditorium. The function was presided by Dr. Bijuna Kunju K, HOD, Electrical and Electronics department. Prof.Shanavas T N delivered the welcome address. The presidential address by Dr. Bijuna Kunju K mesmerised the audience.

Dr. Jayaraju M inaugurated the activities of the association by lighting the lamp. In the inaugural address, he elucidated the importance of energy conservation and the judicious use of resources. The use of non-conventional energy resources, role of sustainability, future of energy sector in India where the main bulletins projected by him. The exuberant audience where urged to mull on the energy conservation techniques and to come up with innovative ideas to ameliorate the energy conservation sector.

Sri. Jithu N S, CEO, Kasperob Robotics, launched the 13th edition of Potentia, the yearly magazine of Department of Electrical and Electronics Engineering. HOD, Prof. V Gayathri, Prof. Sunitha Beevi K, staff editor of Potentia and students of the magazine team were present.The 13th edition of Potentia attempts to be a minimalistic expression of recent advancements in research and innovations in the field of Electrical and Electronics Engineering.

The function was followed by a speech by Sri. George Mathew,Executive Engineer,KSEB. He is also the project manager of a special task force set up by Kerala State Electricty Board.He talked about the transmission sector of power system and also the reasons for the transmisson losses.

Dr.Imthias Ahamed T P felicitated the ceremony. He asked the students to be an integral part of the association. He shed light on the vitality of electrical engineers. He focused on elaborating the responsibilities and duties that each student should carry to become a socially responsible engineer. He blessed the students for having a bright future.

The students who had brought laurels to the department and college in various fields were lauded with the certificate of excellence.

The inaugural ceremony was followed by an interactive talk by Sri. Jithu N S, CEO, Kasperob Robotics. He talked on the emerging technologies and gave a glance into the industrial world. An aura of exuberance was filled in the auditorium throughout his session.

Technincal Workshop

Understanding the importance of technical knowledge in a field that requires the most of it, the association organized multiple workshops incorporating topics relevant and significant to the same.

Rooftop Solar Design

Department of Electrical and Electronics organised a one day workshop on rooftop solar design on 21st February, 2019 at Electrical seminar hall.The workshop was inaugurated by Dr. Bijuna Kunju K, HOD, Department of EEE. The workshop was handled by Er Ajith Gopi, Technical Head, ANERT. Students of final year and pref-final year participated enthusiastically. Altogether there were 130

student participants. The session began with an introduction to non-conventional energy resources, their importance, PV technology and the future scope in the arena. He gave a brief description on the projects undertaken by him. Students were taught to calculate the feasible area and the way of implementation of solar plants. He also shed light on the various pros and cons of the design. The students were divided into eight batches and each batch was assigned a portion of rooftop of college and hostel bulidings. Each batch took the measurements, marked the coordinates, orientation, shady regions and the number of neighbouring trees. Everyone enjoyed working to the hilt. In the noon session, an awareness was given on the vivid softwares used for the rooftop solar design. He demonstrated on how to implement a design using PV sys software by taking the measurements of one of the batches. The session was really an eye opener to many students who wished to pursue a career in this sector. The workshop was starked successfully.

Android Development

A one-day workshop on Android Development was conducted exclusively for the first year students of Electrical and Electronics Engineeering department. The workshop was handled by Harkirishnan S of third year, EEE. The students could peep into the task of an android developer. All the participants tried their hands on creating the apps in smartphones and tabs. The session was very interactive.

Internet of Things

A one-day workshop on Internet of Things was conducted under the Electrical & Electronics Engineering Association, by final year student, Akhil U on 12th August, 2018 at the Microprocessor Lab of the Department of EEE. Almost 48 students from second year participated enthusiastically. The students received individual attention and were quite happy with the content and intent of the workshop. Moreover, proper utilization of IoT and its future were discussed in the session.

Aurdino Workshop

A two-day workshop on Aurdino was conducted exclusively for the first year students of Electrical and Electronics Engineeering department. The workshop was handled by Harkirishnan S of third year, EEE. The students were provided with the Aurdino kit. The budding engineers were introduced to the world of Arduino programming.

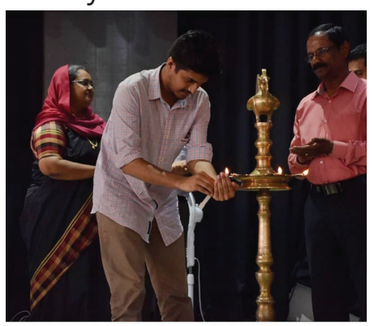
Technical Talk

A talk on “Beyond the B-Tech wall” was conducted by Mr. Hazeeb Habeeb Rawther on 1st March,2019 at EEE Seminar Hall. Mr. Hazeeb is the Assistant Manager at Larsen & Toubro, UAE and a TKM alumni (2009-2013 batch). The talk was conducted exclusively for eighth-semester EEE students. It was a friendly ‘focuz talk’ on the opportunities, challenges and technical aspects of Middle East Electrical Sector. Middle East has always been a hub of engineers from different parts of the world. In this context, he emphasised the role of an Electrical Engineer in the fast growing scenarios of technology and construction. The talk was very interactive and the audience were enriched with opportunities in the Middle East.

A talk was conducted for final year students by Mr. Sreekumar, Air Commodore in Indian Air Force and a TKM alumni. The session mainly focused on the opportunities of an Electrical Engineer in the defence sector. He also urged the audience to think practically and gave tips on approaching situations in the coolest way possible. Students aiming to pursue a job in the defence sector were enriched with all the vital information in a special interactive session after the talk.

Science Quiz

A science quiz was conducted by the EEE Association on the birth anniversary of C V Raman in collaboration with the TKM Quiz Club. Since the students showcased their keen interest in the field of science and technology, there was immense participation. More than 25 teams participated in the quiz and there was a tight competition till the end of the event. The winners were awarded a prize money of Rs.1000.



Tech Fest-“Nega+ive”

HESTIA - A name which evokes awe and zest in every TKMian, an event that instilled countless memories in one and all. At Hestia’19, ‘“Nega+ive” organised by the Department of Electrical and Electronics Engineering remarkably stood out as one of the best with its exquisite gala of competitions, workshops, exhibitions, project presentations and informals. Among that, the one that caught the eye was the exhibition at the stall which showcased the flair and mastery of the young minds. Comprising of products designed by students ranging from marvellous robots to automated smart systems the stall had lots of surprises on store. The exhibit was set up as three different sections - a ghost house, an exhibit room and the dark room. The exhibits included bladeless fan which blew air from a ring with no external blades, a smart mirror, a dual purpose mirror displaying information in the form of widgets and lots more. Addressing the rising call for energy conservation, the students created a

solar tracking system and an irrigation system. The stall was equipped with LiFi, a wireless communication technology that utilized light to transmit data. The stall also had in line, a variety of bots such as fire extinguishing robot, a maze solving robot, a Mars roving robot car and a robotic hand controlled via mobile. The dark room housed a number of impressive exhibits such as a giant face with lights which roars, hologram, LED cube and several automated systems like voice controlled light system, LED matrix which lights on touching and motion sensitive lights. Moreover it also had Tesla coil, Jacob's ladder and 2D Lumens cube. The stall also enlivened the spirits of the visitors by engaging them in a memory game of reproducing the pattern shown by 4 Led lights. Thus the stall was indeed amusing and also reflected the zeal and enthusiasm of the students and faculties.

Humanitarian Activity

Mission Reconnect

During the 2018 monsoons when Kerala was ravaged by an unexpected and devastating deluge of floods, what every keralite wondered was how they could help. Fortunately, for us, Electrical and Electronics students of TKM, the path was paved by Mission Reconnect, an initiative of the KSEB to restore electricity connection in the Kuttanad area. Students flocked back to college leaving the comfort of their homes, eager to contribute to the cause. The time had come to give back.

Volunteers gathered in workshops equipped with workspaces and all the materials required to assemble the emergency distribution boards. Dedicated groups were formed to perform the various tasks such as fixing the switches, sockets and protective equipments, wiring the circuits, earthing the devices etc, all under the supervision of teachers and lab staffs. Assembled distribution boards were handed over for testing before being tagged and approved for use. By the time the hundredth distribution board was completed, it well past college hours. But the satisfaction was palpable. A 100

distribution boards were assembled and packed, ready to be transported to those in need. The students and teachers had raced against time to make this possible.

Not only was it an enriching experience for all the volunteers but also an educative one. It was a hands-on experience that allowed students to explore beyond the scope of the syllabus.

For all the students who had come together for the cause, the realisation that their hand made DB's would be lighting up homes which had been deprived of electricity connection for days, no incentive could have surpassed that. It also gave what the numerous semesters and lectures could not - the realisation of what a noble profession engineering is and its power to transform lives. And that each had that power in their hands.

The initiative turned out to be a hugely successful event due to which the department was instilled with the task of making 300 additional distribution boards to be used in the flood affected

regions. The initiative which continued for several days saw more students gathering to be a part of it. By the end of day 4, the students and teachers had managed to assemble 400 distribution boards ready to be dispatched to the flood affected areas and light up the lives of several families in need. Literally.

SEMESTER TOPPERS

First Semester

Binitha Merlin Philip
CGPA 10

Second Semester

B Lakshmi Priya
CGPA 10

Krishnapriya U
CGPA 10

Binitha Merlin Philip
CGPA 10

Dany Varghese
CGPA 10

Third Semester

Adwaitha Pradeep
CGPA 10

Aswathy G
CGPA 10

Fathima Shijad
CGPA 10

Nandini J Nair
CGPA 10

Fifth Semester

Caroline Maria John
CGPA 9.8

Fourth Semester

Aswani Gopan S
CGPA 10

Greeshma M G
CGPA 10

Induja S
CGPA 10

Sixth Semester

Caroline Maria John
CGPA 9.74

Seventh Semester

Deepika Krishna
CGPA 9.8

KTU RANK HOLDERS

Deepika Krishna
Rank 1
CGPA 9.78

Athira T
Rank 2
CGPA 9.65

Devika M
Rank 3
CGPA 9.6

Akhila
Parameswaran
Rank 6
CGPA 9.48

Nirupa Maria
Rank 7
CGPA 9.47

Archa S
Rank 9
CGPA 9.45

EEE *at a glance*

EEE students get selected for internship at Kookmin University ,Seoul,-South Korea

Athira Manikandan and Deepika Krishna were selected from EEE Department for internship at Kookmin University, Seoul, South Korea for a period of 45 days. The internship program was supported by Kookmin University and Alumni association, TKMCE. Kookmin is the first national private university in South Korea, established in 1946. Athira and Deepika were admitted to Smart Grid Laboratory and Integrated Systems Laboratory respectively. They also participated in the two day IoT Bio camp organized by the Biomedical Engineering department of the university. They were familiarised with the concept of mobile microscopy through the camp.

Research paper of Electrical students get selected in IEEE TALE 2018 Sydney,Australia

Paper titled “Virtual lab using markerless reality’ was presented by final year students: Aswin P S, Abhishek M T, Ali Souban and Akhil Nihal C at IEEE TALE 2018 held at University of Wollongong, Sydney, Australia and was published in the IEEExplore. The same team had also conducted a session about Augmented Reality at Mindswitch, an All Kerala IEEE event held at Mar Baselios College of Engineering, Nalanchira.

Electrical student represents India at IEEE WIE International Leadership Conference at San Fransisco,USA

Irene Tenison, final year EEE students was one among the three to represent India at IEEE WIE International Leadership Conference held at San Fransisco, USA. She was also A GHC India scholar in 2017 and 2018.

Research paper of Electrical students get selected in ICSIMA 2019 Kuala Lumpur,Malaysia

Anita Maria Sunny, Arjay J, Mohammed Ali Sajid and Nabeel Harris's paper on 'Power Electronic Interface for Low Voltage DC Link using Photovoltaic Cells with ANN based MPPT' was selected for presentation and publication at International Conference on Smart Instrumentation, Measurement and Application (ICSIMA)2019 in Kuala Lumpur, Malaysia from 27th to 29th August,2019.

Final year student gets chance to attend WePOWER

Anita Maria Sunny was selected to attend WePOWER (Women's Professional Network for Power Sector in SAR), the first Regional Conference in Nepal on 20th and 21st February,2019.

EEE Students become finalist of Startup Yathra competition

Final year students: Aswin P S, Abhishek M T, Ali Souban and Akhil Nihal C became the finalists of Startup Yathra competition conducted by Kerala Startup Mission. Their topic was Augmented Reality.

Final year student gets selected for direct admission for phD at SysCon, IIT Bombay

Nirupa Maria is currently a research scholar at IIT Bombay. She obtained her BTech in EEE (KTU-Rank 7) from TKMCE in June, 2019. She secured direct admission for phD at SysCon, IIT Bombay. SysCon is an interdisciplinary group which offers post-graduate education in Systems and Control engineering. She was shortlisted based on GATE score and was offered admission for PhD after clearing test and interview conducted by SysCon.

Final year EEE student gets placed in Flytxt with highest package

Irene Tenison is currently working as a Senior Software Engineer in the R&D Data Science at Flytxt, securing the highest placement offer of 2018-19 from TKMCE. She also co-founded the startup, Agrivator, which received special mention at the UN HQ for being one among the best millennial projects.

Team "Echelon" gets selected as the best Startup idea

Echelon is a company developed by second year students:Jithin J, Jasim Ali M, Devika K R and Krishnendhu M ,that designs and produces speed control system for induction motors to be used in electrical vehicles. Echelon was selected as the best startup idea from the Kollam district by Start India and Kerala startup mission and received cash prize of Rs. 50000.

Final year student takes home the prestigious Mar Baselios Youth Excellence

Irene Tenison, final year EEE student, was awarded the prestigious Mar Baselious Youth Excellence award for the most promising innovative engineering graduate of the year 2019. The award consists of a scholarship of Rs.1,00,000, a certificate and a memento.

Electrical students become part of team Black Mamba racing

Third year students; Varun S Prakash and Abhiraj P were part of the Team Black Mamba that secured 39th rank in All India and 2nd in Kerala in a National Level Effi-Cycle Competition 2018, organized by Society of Automotive Engineers(SAE)-North India Section. A total of 78 teams participated in the event out of the 120 registered teams. Black Mamba cleared the technical and electrical inspections along with 40 other teams.

First year students come up with a startup "VECTOR"

Vector is a startup by first year EEE students; M S Ali, Muhammad Salmun S, Amal Udayakumar and Mohammed Sajith A, currently incubated under IEDC, TKMCE. The company provides products and services from multidisciplinary levels of technology by following latest trends. Their remarkable achievements include development of a new variant of proximity sensor, designing IoT Node, creation of Buck Boost circuit, assistance in electrical wiring at two sites, distribution of door bell alarm and Iot more.

Third year electrical students become part of Team Jager

Team Jager bagged 23rd position in National Electric Kart Championship, Ist in Kerala and 3rd in South India. The team comprised of 20+ students and seven students were from the EEE Department. Jameel, Raihan, Dilshad, Umar, Akhil, Ananthu and Abhinendu of third year Electrical were part of the Team Jagar.

Electrical students develop electric vehicle for differently abled people

As part of the final year B.Tech project, a team of eight students developed an electric vehicle for differently abled people. The designed tri-wheeler was fully hand controlled and satisfied the needs of a differently abled person to travel from one place to another. The team members are Shafeeque K, Rabeen Abdul Rahim, Niyasudeen Chukken, Afsal C K, Thejus C K, Sreehari A, Aditya Raj Nair and Jithin J A.

Technical paper gets selected at TENCON 19

A paper titled ”Feynman machine: A cortical intelligence for automated driver assistance systems” was presented at IEEE International Conference,TENCON 2019 by a group of final year students. The group members are Don Kurian, Irene Tenison, Jerin Sam Rajan and Rahul P Bharathan.

Technical papers get selected at ICICIT 2019

Papers entitled “Modelling and Fourth-order consensus of Flexible Link Manipulators” and “Achieving consensus from formation pattern of Multi-Agent Systems” were presented by final year students: Deepika Krishna, Malavika M, Sneha K and Thamanna N at IEEE 2nd International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT 2019) held at Vimal Jyothi Engineering College, Kannur.

Sports

Sruthi Marium Jacob, second year EEE student was part of the college Badminton team which became the inter-zone champions

Joys Joseph, second year student was the member of college Basketball team that won KTU –B Zone Championship. The team also bagged second place in Kollam District Basketball Championship.

Ajai Kumar, Faheem Faizal, Bhagath Azhchath (final year students) and Amjith Hissan (first year student) were the members of college Football team that won the zonal level and became the runner up in the inter-zone championship.

Dona Thomas, 2nd year EEE student secured first place in KTU Inter Collegiate (B Zone) Chess Tournament.

Fasil Jabbar, third year EEE student, was part of the college Basketball team that won the zonal championship. The team also won the district level 2nd Ashoka Championship.

Sagar Dattaji Salunkhe, third year EEE student was part of the college Cricket team that won the Zonal championship.

Mammen Varghese, third year electrical student, was the champion in KTU Zonal level Tennis Championship and runner up in KTU interzone Tennis final.

Jain G Jacob, third year student,bagged the award for the overall individual champion in the annual atheletic meet of TKMCE

Gallery

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BTech 2015-19

BTech 2017-21

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