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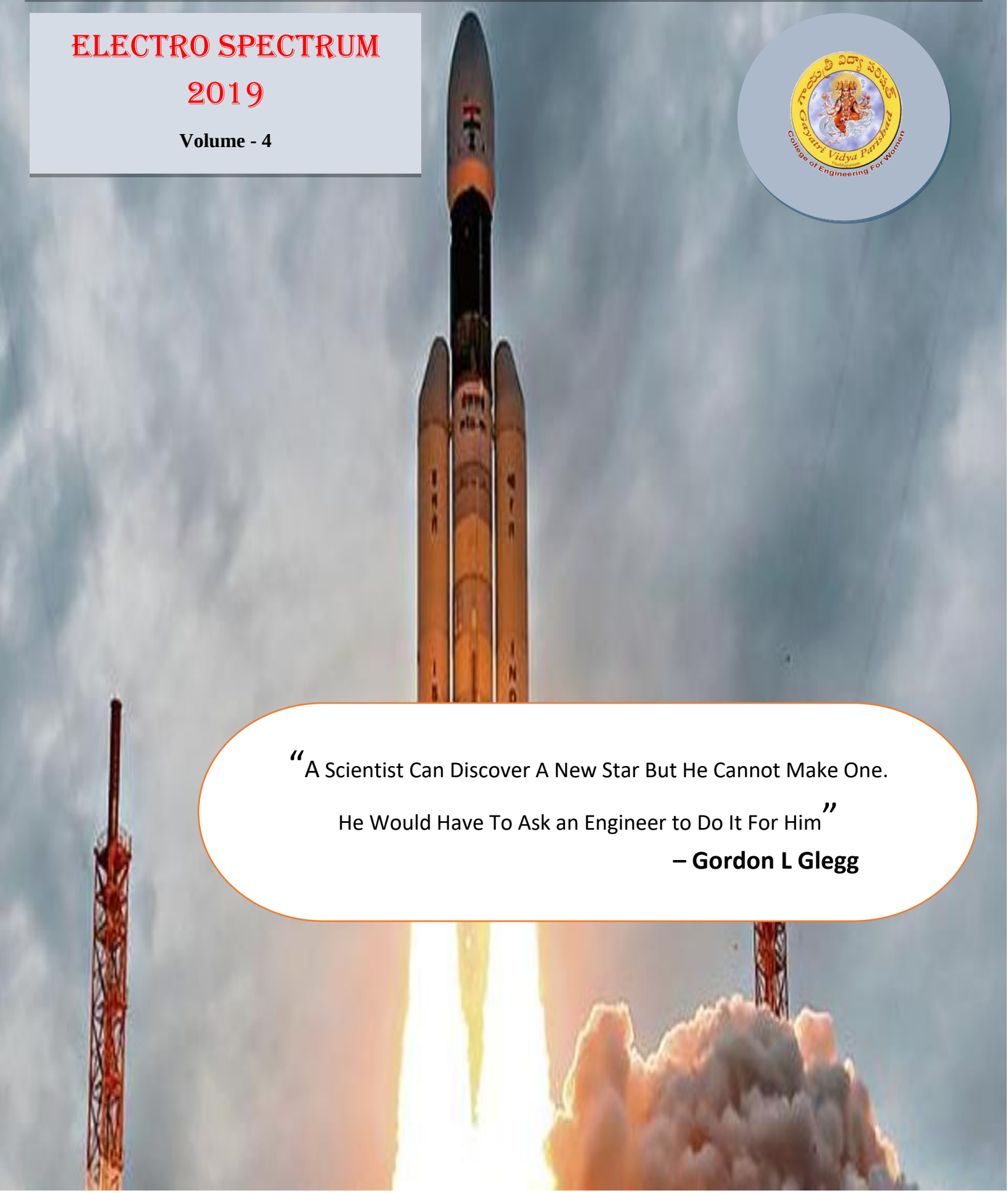

"A Scientist Can Discover A New Star But He Cannot Make One.

He Would Have To Ask an Engineer to Do It For Him"

– Gordon L Glegg

Vision of the Department	Produce competitive engineers instilled with ethical and social responsibilities to deal with the technological challenges in the field of Electronics and Communication Engineering.	
Mission of the Department		**Mission Statements**
	M1	Facilitate a value-based educational environment that provides updated technical knowledge.
	M2	Provide opportunities for developing creative, innovative and leadership skills.
	M3	Imbue technological and managerial capabilities for a successful career and lifelong learning.

	Program Educational Objectives Statements
PEO1	Analyze and apply the knowledge of Mathematics, Science, and Engineering concepts for solving Electronics and Communication Engineering problems.
PEO2	Solve complex problems in Electronics and Communication Engineering and its allied areas to attain optimum solutions.
PEO3	Excel in chosen career by exhibiting life skills and professional ethics in multidisciplinary fields through continuous learning and research.

	Program Educational Objectives Statements
PSO1	Acquire knowledge required for designing Electronics and Communication systems.
PSO2	Design, simulate and implement essential modules in the areas of Electronic circuits, VLSI, Embedded systems, Communication and Signal processing.

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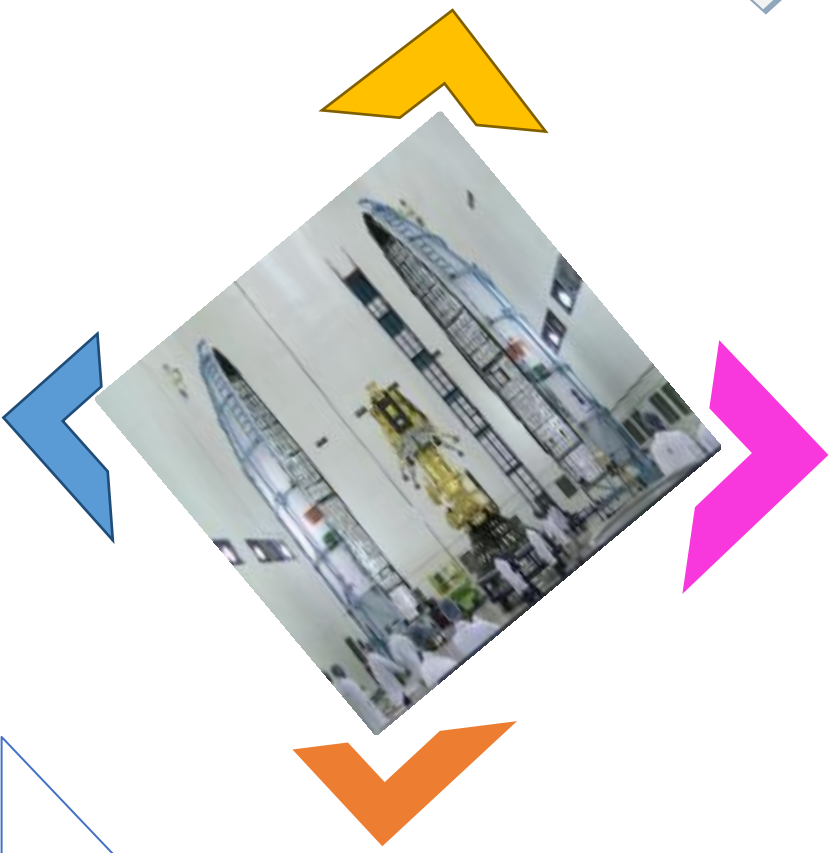
Editorial Speech

A thought that has been enduring in mind when it becomes real it is truly interesting and exciting experience. This magazine "electro spectrum" was one such cherished work this will serve to reinforce and allow increased awareness improved interaction and integration among all of us .

" launched into space a billion dreams to illuminate the dark side of the moon, a little more than usual and our journey has begun, to know the unknown, to explore the unexplored i.e. **Chandrayaan2**. *Nevertheless, it's a failure but it has brightened the nation's pride.*

This issue also includes some brain storming questions and activities which reflects student's hard work and co-operation of the faculty members to the make the year bloom like a flower. And some articles by faculty members and students.

this issue also includes faculty achievements and about a scientist in our field.



CHANDRAYAAN 2

The primary objective of Chandrayaan 2 is to demonstrate the ability to soft-land on the lunar surface and operate a robotic rover on the surface. Scientific goals include studies of lunar topography, mineralogy, elemental abundance, the lunar exosphere, and signatures of hydroxyl and water ice.

SPACECRAFT AND SUBSYSTEMS

The Chandrayaan 2 orbiter is a box-shaped craft with an orbital mass of 2379 kg and solar arrays capable of generating 1000 W power. The orbiter communicates with the Indian Deep Space Network and the lander. The orbiter will have a scientific payload comprising a visible terrain mapping camera, a neutral mass spectrometer, a synthetic aperture radar, a near infrared spectrometer, a radio occultation experiment, a soft X-ray spectrometer and solar X-ray monitor.The lander, named Vikram, has a mass of 1471 kg (including the rover), and can generate 650 W of solar power. The lander can communicate directly to the Indian Deep Space Network, the orbiter, and the rover. The lander will carry a camera, seismometer, thermal profiler, Langmuir probe, and a NASA-supplied laser retroreflector.

The rover, Pragyan (also Pragyaan), is a 6-wheeled vehicle with a mass of 27 kg that runs on 50 W of solar power and can travel up to 500 m at a speed of 1 cm per second. The rover communicates directly with the lander. the rover will hold cameras, alpha-protonX-ray spectrometer, and a laser-induced ablation spectroscopy experiment.

MISSION PROFILE

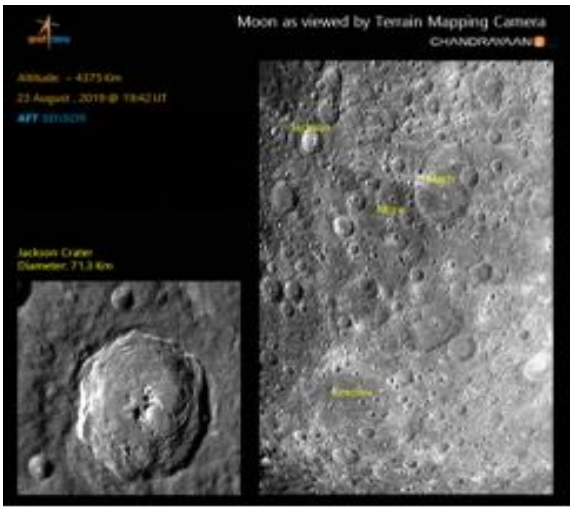
Chandrayaan 2 was launched on 22 July 2019 at 9:13 UT (2:43 p.m. Indian Standard Time) from Satish Dhawan Space Center on Sriharikota Island on an ISRO Geosynchronous Satellite Launch Vehicle (GSLV) Mark III. The lander-orbiter pair went into an initial elliptical (170 x 40400 km altitude) Earth parking orbit, followed by a trans-lunar injection on 14 August. The pair entered lunar polar orbit on 20 August. The lander and orbiter will separate on September 2. The orbiter evolves into a 100 km altitude circular polar orbit and the Vikram lander will maneuver into a 30 x 100 km orbit and then land on the surface in the high latitude areas near the south pole, between two craters, Manzinus C and Simpelius N, on 7 September. The orbiter portion of the mission is planned to last 1 year. The rover will be deployed using a ramp shortly after landing. The lander and rover portions of the mission are planned for 14-15 days, one period of lunar daylight.

Fission Theory

The Earth's rotational speed caused the Moon to split from the planet, while its gravitational pull anchored this fragment to become our natural satellite.

Capture Theory

The Moon was an untethered object before it was captured by the Earth's gravitational field during a fly by Chandrayaan-2 mission consists of Orbiter, Lander and Rover. It will be in space for 59 days before it lands in the month of September. The radar will move out and rover will carry the samples. The mission will have 14 scientific instruments (payloads), including 8 in the orbiter, 4 in the lander and 2 in the rover. One instrument in the rover is passive one from the US space agency -- NASA.ISRO has named the lander "Vikram", after India's space pioneer Vikram Sarabhai (1919-1971) and rover "Pragyan", which in Sanskrit means wisdom. "The rocket will place the orbiter in the geo-transfer orbit for its voyage to the lunar orbit, covering a whopping 385,000km from earth to moon in 50 days for the lander to have a soft landing near its south pole on 6 September," said Sivan. The rocket will separate the orbiter minutes after the launch at 170km perigee (nearer to earth) and 38,000km apogee (away from earth) and get into geo transfer orbit for its long journey (385,000km) to the lunar orbit in 16 days and descend to 100km from the lunar surface by 6 September.



Giant Impact Hypothesis: A collision between the Earth and another celestial body caused a segment of the planet to break off and become the Moon.

Co-accretion Theory: A single cloud of gas created the Moon and the Earth while orbiting a black hole.

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Under Water Target Tracking Algorithms- A Survey

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Abstract: The current article gives an overview of the modern day underwater target tracking algorithms. The ingredients of this, primarily includes a brief introduction to the concept of tracking, various algorithms (from Kalman filters to particle filters) which are available in the literature to handle the problem. Some performance comparison parameters are also introduced to judge the performance of the algorithms. The modifications incorporated in basic algorithms to deal with the various war time complications are also addressed. Finally, the issues which are yet to be resolved like multi target tracking, maneuvering target tracking with optimal performance and the possible ways to handle them are also included in the paper.

Keywords: Target Tracking, Kalman Filter, Particle Filter, Multi Target Tracking and Maneuvering Target Tracking.

1 INTRODUCTION

1.1 Introduction to Undersea Angle–only Torpedo Tracking

Tracking is a process of computation of the target position coordinates at the current instant. It also deals with the anticipation of the next position of the target with a good level of precision by utilizing the available sensor measurements.

Tracking can be done with the help of Radar and Sonar. Air or Land based Targets are tracked with Radar while the undersea targets are handled by Sonar. Radar accomplishes this task by processing the echo received from the target. However, the signal has to be transmitted by the Radar and that should be of radio frequency. The pictorial presentation is shown in Fig.1.1.On the other hand, the Sonar does the same task but with the assistance of the Sound signal instead of a radio wave. The reason behind this is, the radio waves deteriorates at a rapid pace and does not propagate long distance in the underwater scenarios. The pictorial presentation is shown in Fig.1.2.

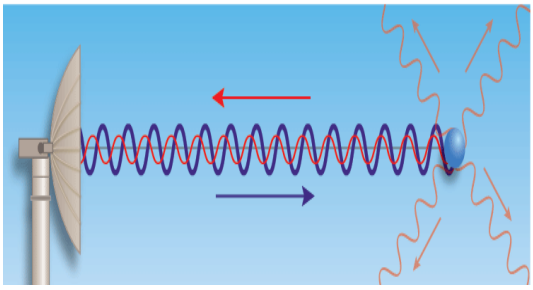

Fig.1.1 Pictorial representation of Radar operation

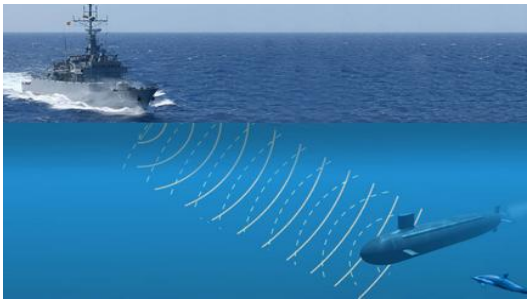

Fig.1.2 Pictorial representation of Sonar operation

The Sonar can be operated in active or passive mode. In active mode of operation, the sound signal is transmitted towards the target and after some time an echo is heard. Based on the time taken by the signal to travel towards the target and back to us, we can find the range at which the target is present and based on the direction from which the echo is heard we can find the azimuth at which the target is present. So, the advantage with the active mode of operation of sonar is that a lot of target information in the form of the range and the bearing is available to us. On the other hand, the disadvantage with this approach is, the signal which we transmit can be captured by the enemy and he can identify our position before his position is identified by us. The pictorial representation of this is shown in the Fig.1.3. In order to overcome the disadvantage of the active mode, the sonar is designed to

operate in the passive mode. In passive mode, no signal is transmitted towards the target. However, a signal from the target is captured by us. This signal is not intentionally generated by the enemy, this is the unavoidable sound signal which is developed by the propellers of the own ship which is used for the self-movement of the enemy. However, the disadvantage with this approach is that only a small information of the target, in the form of the bearing is available to us. The pictorial representation of the passive mode of operation is shown in Fig.1.4.

The passive mode Sonar can be supported by a single or multiple sensor. If the sonar uses a single sensor, then the lone sensor should be maneuvering all the time to ensure observability of the target. On the other hand the multiple sensors use the technique of triangulation to obtain the target coordinates. The multiple sensors can be classified into Hull mounted array sensors (HMA) and Towed array sensors (TA). In HMA, the sensors are placed on the Hull or body of the own-ship and in case of TA, the sensor array is towed or pulled by the own-ship. The pictorial representation of the HMA and TA are shown below in Fig.1.5.The area of tracking is shown pictorially in Fig.1.6

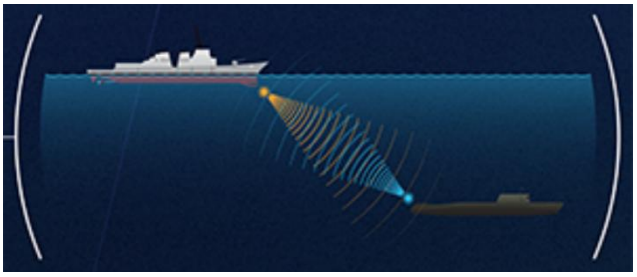

Fig.1.3 Pictorial representation of Active Sonar operation

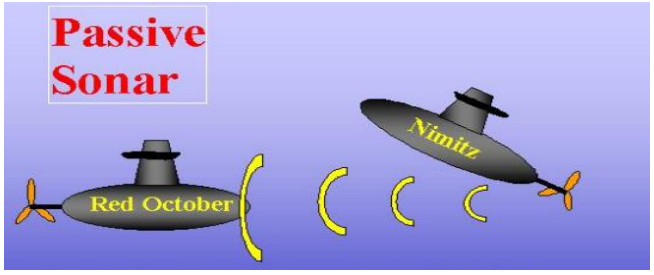

Fig.1.4 Pictorial representation of Passive Sonaroperation
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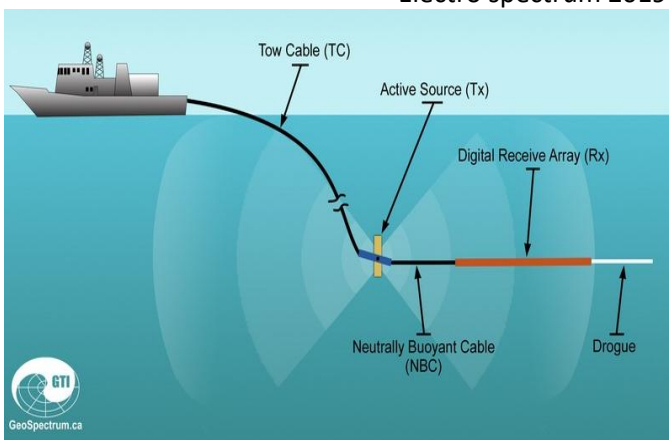

Fig.1.5 Pictorial representation of a Multi-sensor array
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1.2 Introduction to Target Tracking Algorithms

In the First generation of tracking, estimators like least square estimator(LSE), weighted least square estimator(WLSE) and Weiner filter are used to serve the purpose. However the modern generation of target tracking had started with the invention of the most advanced stochastic estimator called the Kalman filter(KF) in 1961 by R.Kalman[17].It works in 3 steps, namely initialization, prediction and updation. The Initialization of algorithm involves assigning some arbitrary values to the parameters like estimate and covariance and this step is done once at the start, while the second and third steps called the prediction and correction are done iteratively. Prediction is done before the measurements are received with the help of the state equation while the correction is done after the reception of measurements in such a way that the, mean square error is minimized. The pictorial way of this approach is shown in Fig.1.7. After the inception of basic form of KF, trails were made to fit it to the target tracking problem with active sonar measurements. But this did not happen because, the issue is a nonlinear one while the KF can handle only the linear problems. So as to tackle the issue, the hydrophone measurements are converted from polar to Cartesian form to view the problem as a linear one where the Kalman filter can be applied directly[20]. However the conversion of measurements from one form to the other leads to the additive

estimate bias issues. This problem was soon sorted out in [20] by computation and subsequent subtraction of the bias. Moreover the precise computation of measurement error covariance resulted in much better performance. The solution was extended to 3D case in [33]. Similarly the solution to the multiplicative bias issues is given in [22] . However there are some consistency issues which are revealed and latter rectified in [6].

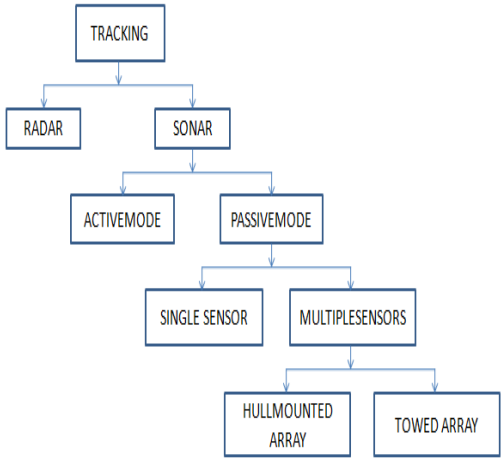

Fig.1.6 Pictorial representation of area of tracking

The nonlinear estimation issues can still be dealt by using the Kalman filter by converting the issue to a linear one with the help of the Taylor series expansion of the nonlinear state/ measurement equations or both as shown in [29]. This new form of KF called as EKF was applied to tracking problems in [20]. The conversion from polar to rectangular coordinate system is not done here. However, a hybrid coordinate system approach called as the modified polar co-ordinate EKF(MPEKF) where the state equation(SE) is left in the rectangular form and the measurement equation(ME) is kept in the polar form is handled in a successful way in[1].This EKF algorithm fails to work unless the estimate and covariance are initialized properly. Added to this, the linearization bugs can make the condition even worse and can occasionally lead to the filter divergence. The initialization issue is dealt by Range polarized EKF(RPEKF) [24] where, instead of relying on the single initialization, multiple EKFs with different initialization values sorted out the problem to a considerable extent. A different approach to achieve the same task is suggested in [11] where, the single measurement delayed initialization is performed instead of assigning arbitrary values to the parameters to be estimated. The algorithm was named as SIMDI-EKF. The linearization problem associated with EKF is minimized in [2], This is possible by identifying the nonlinearity degree using the instrumental matrix and then varying the covariance accordingly. Alternatively, another variant of EKF called as MGEKF[31] is shown to attain better performance by altering the gain function instead of the covariance and the easiest way to obtain modified gain expression is shown in[9].The computational burden on processors imposed by EKF is reduced to a great extent by replacing partial derivative matrices namely Jacobian and Hessian(used in linearization process) by alternatives in [26].

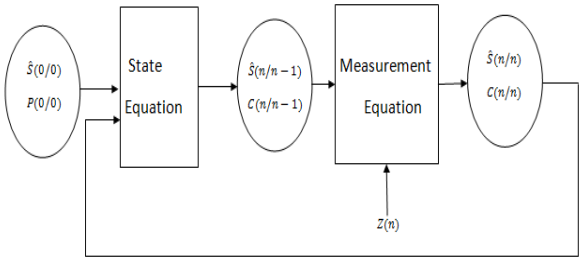

Fig.1.7 Pictorial representation of Kalman Filter operation

A much better estimator called as Unscented Kalman Filter(UKF), to deal with the non-linear estimation problems is introduced in [16] where, the magnitude of linearization errors is reduced. The relationship between the introduced UKF with the existing EKF can be found in [13].The UKF operates on the principle of "approximation of an a-posteriori estimate PDF is much better than approximation of an arbitrary nonlinear function". Here the estimation parameters namely mean and the covariance propagation is done with the help of a bunch of atoms called sigma points. The proposed UKF is used for longer range tracking in [28] and small distance object tracking in[38]. The improvement in the performance of UKF is attained by repeating the updation step multiple times instead of once in Iterative UKF(IUKF)[37].The performance of UKF is shown to reach new levels in [7],[32] and [34] by introducing a new approach to choose the carriers of

PDF(sigma points) which are normally associated with the UKF in the linearization process. In AUKF[34] the sigma point count is enhanced by appending new set to the older one to attain better approximation of the PDF. In [7] the recognizable improvements in performance are noted by varying the spread of the sigma points around the mean. A more effective adaptive spread is introduced in [32] by maximizing the logarithm of likelihood function or minimizing the mean square error is introduced to show noticeable improvements in the performance. The issue of nonlinear estimation with unknown state and sensor noise is shown to be dealt successfully in [21] by altering the covariance matrix according to the received sensor data. Another alternative of UKF is developed in [27] where the performance is improved by supplying a better initial values to the algorithm by using the range parameterization as done for EKF in [24].An advanced UKF called as Truncated unscented Kalman filter(TUKF) was proposed in [8] to handle the complicated situation of the intolerable levels of Gaussian noise . This is made real, by curtailing the noise density function during the correction phase using MMSE. Other variants of UKF with improved performance can be found in [39-49].

Like the conventional UKF, Particle filters PF[15] also believe in the technique of PDF approximation instead of arbitrary nonlinear function approximation. However, the main difference between the UKF and PF mainly lies in the sigma point (used to represent PDF) count. UKFs use 2k+1 sigma points with 'k' as the dimension of state vector, while PF uses sigma points (called as particles here) in the order of hundreds and thousands. Better PDF approximation in case of PF resulted in superior performance in terms of estimation errors. But this is achieved at the cost of increased computational burden on the processors resulted due to the enhanced particle count. In [4],[10] an advanced PF is designed by incorporating a few modifications to the basic structure of PF in such a way that the advantages of the higher order PF can be obtained at much lesser computational price(with fewer particles).This is made realistic by appending resampling step in PF framework. Here, the random choice of the particles in every iteration is avoided and the earlier used set with heavy weights will be retained and augmented with newer ones. Weights of the particles are found with the help of measurements. This technique helps in achieving faster rate of convergence because of carrying forward the more informative particles. The drawback of PF in [18] is the "degeneracy issue", a condition where only a single particle attain maximum weight while the remaining were left out with zero weights. This is a result of retaining same particles for an ample number of iterations. In [18] the remedy to the issue is given by introducing a term called the "effective sample size" which helps in monitoring the particle weights continuously. A new form of PF with much better performance is developed in [25] by early execution of re-sampling step (prior to the propagation). This helps in stopping the particle divergence and concentrating them in the high likelihood region. A much better variant of PF is obtained by elimination of the diversity loss between the particles, a well discussed problem called "particle collapse issue" in [23].The failure is found to be resulted due to the approximation of the PDF is a discrete fashion. The problem is rectified by choosing particles that approximates the PDF in a continuous fashion. This is accomplished by including the kernel density function with the kernel is chosen so as to reduce the mean square error between the actual and the approximated density functions. In addition to the above, many other forms of PF like Least-squares particle filter(LSPF) [13] ,Distributed particle filter(DPF) [36],Marginalized particle filter(MPF) [30],Gaussian particle filter(GPF) [19],Iterated Multiple particle filter(IMPF) [5], Hierarchical particle filter(HPF) [3] came and displayed their significance for dealing with tracking issues in tough conditions. The summary of the PF theory and their applications can be found in [12],[14].

In the era of KFs the algorithms like PLE, MLE and their variants came here and there and showed their importance for underwater azimuth-only target tracking. The performance of these target tracking algorithms can be accessed by comparing them with the CRLB where the CRLB

is the best possible theoretical estimator for any given estimation problem. The various issues related to target tracking which requires focus now-a-days includes tracking with multiple sensors(problem named as data fusion),tracking multiple targets, tracking manoeuvring targets and design of optimal algorithms.

1.3 Conclusion

From the paper it can be concluded that, the three main algorithms which dominate the area of underwater target tracking with bearing only measurements are EKF,UKF and PF. Many of their variants showed improvements in one or the other parameters like RMSE, computational complexity but none of the algorithms satisfied both. So a lot of space is yet to be filled to develop an algorithm with optimal performance. Moreover, the issues of multitarget tracking, manoeuvring target tracking and 3d target tracking in complicated situations are still to solved.

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Air Navigation

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Assistant Professor, Department of ECE

The basic principles of air navigation are identical to general navigation, which includes the process of planning, recording, and controlling the movement of a craft from one place to another.
Successful air navigation involves piloting an aircraft from place to place without getting lost, not breaking the laws applying to aircraft, or endangering the safety of those on board or on the ground. Air navigation differs from the navigation of surface craft in several ways:

Aircraft travel at relatively high speeds, leaving less time to calculate their position en-route. Aircraft normally cannot stop in mid-air to ascertain their position at leisure. Aircraft are safety-limited by the amount of fuel they can carry. While a surface vehicle can usually get lost, run out of fuel, then simply await rescue. There is no in-flight rescue for most aircraft. Additionally, collisions with obstructions are usually fatal. Therefore, constant awareness of position is critical for aircraft pilots.

Air navigation is accomplished by various methods. The method or system that a pilot uses for navigating through today's airspace system will depend on the type of flight that will occur (Visual Flight Rules (VFR) or Instrument Flight Rules (IFR)), which navigation systems are installed on the aircraft, and which navigation systems are available in a certain area.

Dead Reckoning and Pilotage

At the simplest level, navigation is accomplished through ideas known as dead reckoning and pilotage. Pilotage is a term that refers to the sole use of visual ground references. The pilot identifies landmarks, such as rivers, towns, airports, and buildings and navigates among them. The trouble with pilotage is that, often, references aren't easily seen and can't be easily identified in low visibility conditions or if the pilot gets off track even slightly. Therefore, the idea of dead reckoning was introduced. Dead reckoning involves the use of visual checkpoints along with time and distance calculations. The pilot chooses checkpoints that are easily seen from the air and also identified on the map and then calculates the time it will take to fly from one point to the next based on distance, airspeed, and wind calculations. A flight computer aids pilots in computing the time and distance calculations, and the pilot typically uses a flight planning log to keep track of the calculations during flight

Radio Navigation

With aircraft equipped with radio navigation aids (NAVAIDS), pilots can navigate more accurately than with dead reckoning alone. Radio NAVAIDS come in handy in low visibility conditions and act as a suitable backup method for general aviation pilots that prefer dead reckoning. They are also more precise. Instead of flying fromcheckpoint to checkpoint, pilots can fly a straight line to a "fix" or an airport. Specific radio NAVAIDS are also required for IFR operations.There are different types of radio NAVAIDS used in aviation:

- ADF/NDB: The most elementary form of radio navigation is the ADF/NDB pair. An NDB is a non-directional radio beacon that is stationed on the ground and emits an electrical signal in all directions. If an aircraft is equipped with an automatic direction finder (ADF), it will display the aircraft's position in relation to the NDB station on the ground. The ADF instrument is basically an arrow pointer placed over a compass card-type display. The arrow always points in the direction of the NDB station, which means that if the pilot points the aircraft in the direction of the arrow in a no wind situation, he will fly directly to the station. The ADF/NDB is an outdated NAVAID, and it's a system prone to errors. Since its range is line-of-sight, a pilot can get erroneous readings while flying in mountainous terrain or too far from the station. The system is also subject to electrical interference and can only accommodate limited aircraft at once. Many are being decommissioned as GPS becomes the primary navigation source.

Non directional Radio Beacon (Airport)

- VOR: Next to GPS, the VOR system is probably the most commonly used NAVAIDS in the world. VOR, short for VHF Omnidirectional Range, is a radio-based NAVAID that operates in the very-high-frequency range. VOR stations are located on the ground and transmit two signals—one continuous 360-degree reference signal and another sweeping directional signal.

- The aircraft instrument (OBI) interprets the phase difference between the two signals and displays the results as a radial on the OBI (Omni-bearing indicator) or

HSI (horizontal situation indicator), depending on which instrument the aircraft uses. In its most basic form, the OBI or HSI depicts which radial from the station the aircraft is located on and whether the aircraft is flying toward or away from the station.

Horizontal Situation Indicators (onboard aircraft)

- VORs are more accurate than NDBs and are less prone to errors, although the reception is still susceptible to line-of-sight only.
- DME: Distance Measuring Equipment is one of the most simple and valuable NAVAIDS to date. It's a basic method using a transponder in the aircraft to determine the time it takes for a signal to travel to and from a DME station. DME transmits on UHF frequencies and computes slant-range distance. The transponder in the aircraft displays the distance in tenths of a nautical mile.
- A single DME station can handle up to 100 aircraft at one time, and they usually co-exist with VOR ground stations.

Instrument Landing System (ILS at airport)

https://www.google.com/search?q=air+navigation&sxsrf=ACYBGNRH_rhcYvrsbo1LnI183Oqma64IbA:1575790479566&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiWm5n-xKXmAhU26XMBHf22DccQ_AUoAXoECBYQAw&biw=1024&bih=449

- ILS: An instrument landing system (ILS) is an instrument approach system used to guide aircraft down to the runway from the approach phase of flight. It uses both horizontal and vertical radio signals emitted from a point along the runway. These signals intercept to give the pilot precise location information in the form of a glideslope - a constant-angle, stabilized descent path all the way down to the approach end of the runway. ILS systems are widely in use today as one of the most accurate approach systems available.

Global Positioning Systems

The global positioning system has become the most valuable method of navigation in the modern aviation world. GPS has proven to be tremendously reliable and precise and is probably the most common NAVAID in use today.

The global positioning system uses 24 U.S. Department of Defence satellites to provide precise location data, such as aircraft position, track, and speed to pilots. The GPS system uses triangulation to determine the aircraft's exact position over the earth. To be accurate, a GPS system must have the ability to gather data from at least three satellites for 2-D positioning, and 4 satellites for 3-D positioning.

GPS has become a preferred method of navigating due to the accuracy and ease of use. Though there are errors associated with GPS, they are rare. GPS systems can be used anywhere in the world, even in mountainous terrain, and they aren't prone to the errors of radio NAVAIDS, such as line-of-sight and electrical interference.

Pilots will fly under visual flight rules (VFR) or instrument flight rules (IFR), depending on the weather conditions. During visual meteorological conditions (VMC), a pilot might fly by using pilotage and dead reckoning alone, or he might use radio navigation or GPS navigation techniques.

In instrument meteorological conditions (IMC) or while flying IFR, a pilot will need to rely on cockpit instruments, such as a VOR or GPS system.

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Student Articles

A Brief Introduction On 5 Pen Pc Technology

B Pallavi -- II ECE-2 -- 18JG1A0470

INTRODUCTION

When writing a quick note, pen and paper are still the most natural to use. The 5 pen pc technology with digital pen and paper makes it possible to get a digital copy of handwritten information, and have it sent to digital devices via Bluetooth This 21st century is considered to be as new world era. Talking about the communication technology these days, it is increasing rapidly. Talking about all of the generations of the computers, from the old workstations to the mainstreams and further other forms of computers, scientists and engineers have been trying to make it more and more compact. Systems are reducing from PC to Laptops and these days I pads or tablets have also replaced laptops to certain extent. This is the point where Pen computers come into spotlight. They are the type of computers in the shape of different pens each has a function of its own and when you combine them together, it can even give you the usage of a wholly full – blown computer. And of course, the computer is the main communication machine used. Since the time computer has been invented scientists and engineers have been trying making it more and more compact. Some of the results we have found in the form of Mobiles I-pods and I-phones have replaced the laptops or desktops to an extent. But the scientist is now making an effort on making it more compact even than mobile. There are computers in the shape of different pens each having a function of its own and when combined together give us the usage of a full-blown computer. It is a computer broken apart into pieces, each the size of a pen. The screen and keyboard are projected onto surfaces. Five pen pc shortly called as P-ISM ("Pen-style Personal Networking Gadget Package"), is nothing but the new discovery, which is under developing stage by NEC Corporation. P-ISM is a gadget package including five functions: a CPU pen, communication pen with a cellular phone function, virtual keyboard, a very small projector, and a camera. P-ISM's are connected with one another through short-range wireless technology. The whole set is also connected to the Internet through the cellular phone function. This personal gadget in a minimalist pen style enables the ultimate ubiquitous computing.

WORKING PRINCIPLE

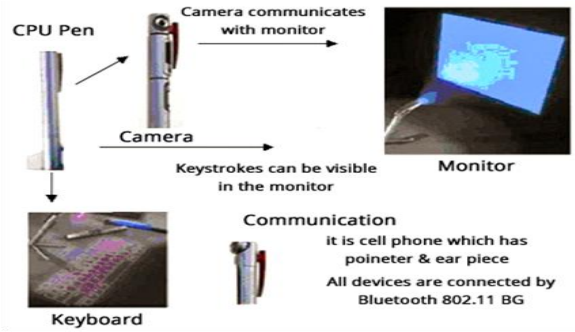
A computer that utilizes an electronic pen (called a stylus) rather than a keyboard for input. Pen computers generally require special operating systems that support handwriting recognition so that users can write on the screen or on a tablet instead of typing on a keyboard. Most pen computers are hand-held devices, which are too small for a full-size keyboard.

HOW DOES IT ACTUALLY WORK?

The P-ISM (Pen-style Personal Networking Gadget Package) consists of a package of 5 pens that all have unique functions, combining together to create virtual computing experience by producing both monitor and keyboard on any flat surfaces from where you can carry out functions that you would normally do on your desktop computer. P-ISM's are connected with one another via a short-range (Bluetooth) wireless technology. The whole set is connected to the Internet through the cellular phone function

THE FIVE COMPONENTS OF P-ISM:

Similarly, 5 Pen PC Technology is a gadget package including five functions: a pen-style cellular phone with a handwriting data input function, virtual keyboard, a very small projector, camera scanner, and personal ID key with cashless pass function. 5 Pen PC Technology are connected with one another through short-range wireless technology and the whole set is connected to the Internet through the cellular phone function. This personal gadget in a minimalist pen style enables the ultimate ubiquitous computing.



1. CPU pen: The functionality of CPU is done by one of the pens. It is also called computing engine. Dual core processor is used and works with windows operating system.

2. Communication pen: P-ISMs are connected with one another through short-range wireless technology. The whole set is also connected to the Internet through the cellular phone function. They are connected through Tri-wireless modes (Bluetooth, 802.11B/G, and Cellular) which are made small and kept in a small pen like device.

3. Virtual keyboard: The virtual keyboard works on any flat surface which uses a camera to track the finger movements. On this specific keyboard, this is done by a 3D IR sensor technology with laser technology to get a full size keyboard. You can also change the language input and the layout of the keyboard. This is more efficient than normal keyboards because you don't have to buy a new keyboard for every language. They are also easy to maintain as they are prone to damage by spills, drops and other malfunctions.

4. LED projector: The role of the monitor is taken by the LED projector. LED projectors use LCD technologies for image creation with a difference as they use an array of Light Emitting Diodes as the light source, negating the need for lamp replacement. Also it would not need as much energy to used and with a longer lifetime. The size of the screen is approximately 1024 × 768 px which is a size of an A4 paper.

5. Digital camera: We had digital camera in the shape of pen. It is useful in video recording, videoconferencing; simply it is called as web cam. It is also connected with other devices through Bluetooth. The major advantage it is small which is easily portable. It is a 360- Degree Visual Communication Device. We have seen video phones hundreds of times in movies. Conventional visual communications at a distance have been limited due to the display devices and terminals. This terminal enables showing of the surrounding atmosphere and group-to-group communication with a round display and a central super-wide-angle camera.

Advantage of 5 pen PC technology

- It is Very feasible that means it is easily executable and workable
- It is Portable that means can be carried easily
- Can be present easily anywhere and everywhere
- It supports the Wi-Fi technology and you can get any information or communication by spinning the world with this device
- It produces both the monitor as well as the keyboard and can be projected on any flat surfaces from where you can easily carry out the functions.

Disadvantages of 5 pen PC technology

- It is expensive as compared to other gadgets like individual cameras or cell phones
- Battery life cannot be varied much and at present cannot be elongated more, it is around 6 + but I think it is sufficient.
- The Keyboard concept is not new as of now. Projected keyboards already exist.
- It is tough to do the right positioning of this product.

CONCLUSION

The communication devices are becoming smaller and compact. This is only an example for the start of this new technology. We can expect more such developments in the future. It seems that information terminals are infinitely getting smaller. However, we will continue to manipulate them with our hands for now. We have visualized the connection between the latest technology and the human, in a form of a pen. "The design concept uses five different pens to make a computer. One pen is a CPU, another camera, one creates 13a virtual keyboard, another projects the visual output and thus the display and another communicator (a phone). All five pens can rest in a holding block which recharges the batteries and holds the mass storage. Each pen communicates wireless, possibly Bluetooth."13Seriously speaking it is mostly useful for the travelers, corporate personnel and of course researchers and scientists. I am sure that the five pen PC technology will have a great impact on the computer field hence we can expect many more such developments to occur in the future.

Reference:

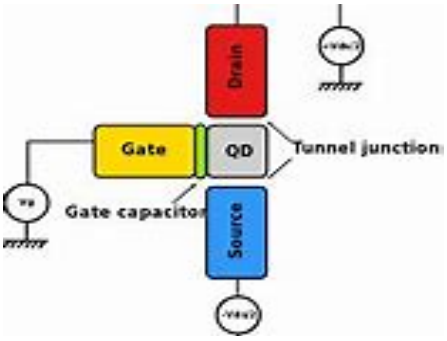
https://www.academia.edu/10314425/FIVE_PEN_PC_TECHNOLOGY

Single Electron Transistor

Kavuru Geethanjali -- III ECE-1 -- 17JG1A0451

ABSTRACT:
In today's world increasing relevance of the **internet of things** and the healthcare applications give more relevant impact to the **electronic device power** consumption. For this purpose, ultra-low-power consumption is one of the main research topics into the current **ELECTRONICS** world. The amazing number of tiny computers used in the present world, e.g. mobile phone, desktop computers and home electronics, implies a significant power consumption level by the implemented devices. In this scenario, the single-electron transistor (SET) is a key element of current research area of nanotechnology which has appeared as a suitable candidate to achieve this low power range with a high level of device integration. The goal of this paper is to discuss about the basic physics of nanotechnology device **single electron transistor** which is capable of controlling the transport of only one electron and focuses on some basic device characteristics like orthodox theory, tunneling effect, coulomb blockade, quantum dot and coulomb staircase on which it works and the applications and limitations of SET.

INTRODUCTION:
The MOSFET has since become the basic element in modern electronic equipment, and is the most widely used electronic device in the world. And the Single-electron transistor (SET) is a key element of present research area of **nanotechnology** which can offer **low power consumption** and **high operating speed**. What exactly the SET is a new type of switching device that uses controlled electron tunneling to amplify current.



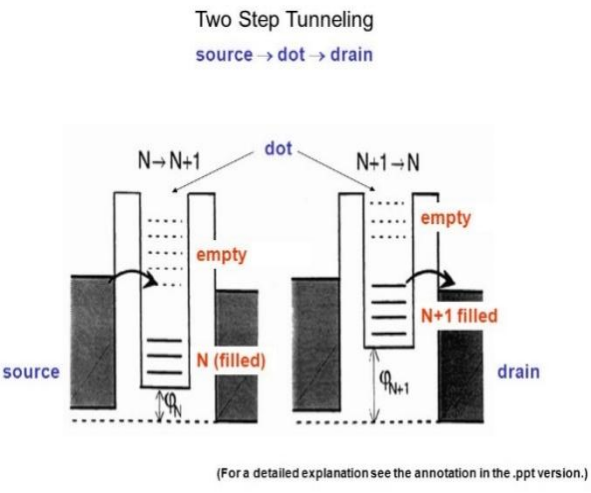
Now the main technological difference between the well-established MOSFET (metal-oxide-semiconductor field-effect transistor) and the SET (single-electron transistor) lies in the device channel concept.

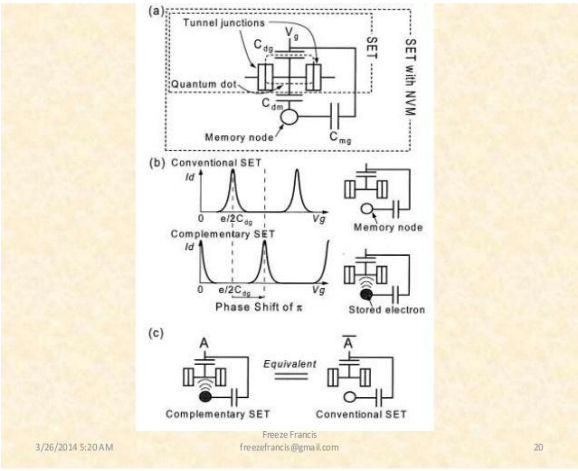
THEORY:
The research on SET is mainly supported by "orthodox theory" based on three assumptions:

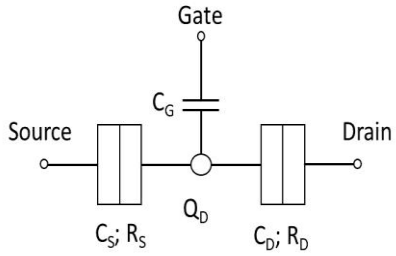
1. The electron energy quantization inside the conductors is ignored, i.e. the electron energy spectrum is treated as continuous, which is valid only if , where k_B is Boltzmann's constant and T is the temperature.
2. The time (τ_t) of electron tunneling through the barrier is assumed to be negligibly small in comparison with the other time scales. This assumption is valid for tunnel barriers used in single-electron devices of practical interest, where $\tau_t \sim 10^{-15}$s.
3. Coherent quantum processes consisting of several simultaneous tunneling events, i.e. co-tunneling, are ignored. This assumption is valid if the resistance of all the tunnel barriers of the system is much higher than the quantum resistance (~26 KΩ), to confine the electron

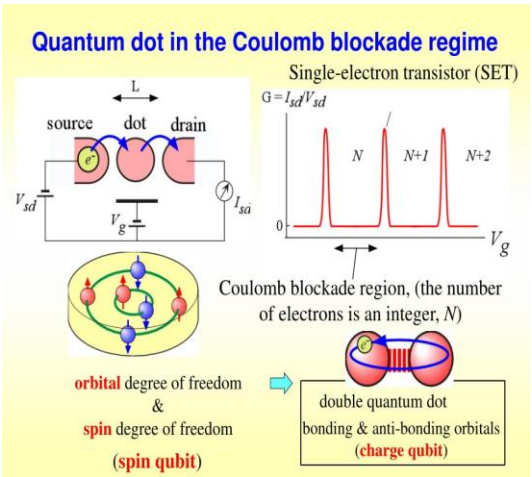
As in the case of SET, the conduction channel does not allow further reductions in its length, this channel is replaced by a small conducting "island" or Quantum dot (QD). Quantum dots are tiny semiconductor particles a few nanometer size, having optical and electronic properties that differ from larger particles a new nanometers in size, having optical and electronic properties that differ from larger particles due to quantum mechanics. They are a central topic in nanotechnology. They operate like single electron transistor and show the coulomb blockade effect. When the quantum dots are illuminated by UV light, an electron in the quantum dot can be excited to a state of higher energy. In the case of a semiconducting quantum dot, this process corresponds to the transition of an electron from the valance band to the conductance band. The excited electron can drop back into the valance band releasing its energy by the emission (photoluminescence) is illustrated in the figure on the right. The color of the light depends on the energy difference between the conductance band and the valance band. Potential applications of quantum dots include single-electron transistors, solar cells, LEDs, lasers, single-photon sources, second-harmonic generation, quantum computing and medical imaging and their small size allows for some QDs to be suspended in solution, which may lead to use in inkjet printing and spin coating. These processing techniques result in less expensive and less time-consuming methods of semiconductor fabrication.
SET is a sensitive electronic device based on the coulomb blockade effect. In this device the electron flows through a tunnel junction between source/drain to a quantum dot (conductive island). Moreover, the electrical potential of the island can be tuned by a third electrode, known as a gate, which is capacitor like coupled to the island. The conductive island is sandwiched between two tunnels junctions, which is

modeled by a capacitance (Cd and Cs) and a resistor (Rd and Rs) in parallel is shown in the figure.









APPLICATIONS:

The transistor mode of operation occurs when the bias between the source and drain is less than the coulomb gap voltage. In this regime, when the gate bias is increased to the point corresponding to the maximum slope on the coulomb staircase, the configurations on the island with zero or one excess electron have equal energies, removing the coulomb barrier and allowing tunneling to occur. This maximum point occurs when the gate is charged with exactly minus half an electron. When another minus half an electron charge is put on the gate, the coulomb barrier is reinstated, resulting in an oscillation in conductance of transistor with maxima at half integer multiples of e electron transistor to be use either as a transistor or as an extremely precise device for measuring charge.

There are a variety of materials chosen for single electron transistors based on the particular properties desired in the system. Relevant properties include the capacitance of the material, the ease of fabrication, crystalline structure, electron mobility, and ease of growing oxide layers. There are two classes single electron transistors used today, “metallic” and “semiconducting”. This refers to the material they are commonly fabricated from as opposed to describing in any way their operation. Both function through the process of tunneling junctions.

1. **Charge Sensor**: The Single-electron transistors (SETs) are efficient charge sensors for reading out spin or charge qu bits confined in quantum dots (QDs). To investigate their capacitive parameters, which are related to the signal-to-noise ratio (SNR) during qubit readout, twin silicon single QDs were fabricated using a lithographic process on a silicon-on insulator substrate. Since the configuration and dimensions of the QDs could be determined by direct imaging, the theoretical capacitive parameters could be compared to the measured values. Good agreement was found between the calculated and measured value, which confirms the validity of the calculation method. The results indicated that decreasing the SET diameter reduces the capacitive coupling between qubits but increases the signal-to-noise ratio for both dc and radio frequency single shot measurements. Since these results are independent of the device materials, they are useful for establishing guidelines for the design of SET charge sensors in lateral QD-SET structures based on a two-dimensional electron gas.

2. **Detection of Infrared Radiation:** The single-electron transistor can also be used to detect infrared signals at room temperature. By exciting electrons over an electrically induced energy barrier, both the range of detectable wavelengths and the sensitivity of the device can be controlled. The sensor works when an infrared signal excites conduction-band electrons in a 25-nmdeep electron reservoir. A silicon insulator channel measuring 40 × 400 nm is placed next to the reservoir to increase the number of excited electrons. A poly-silicon lower gate then turns off the transistor and electrically

forms an energy barrier, creating a storage node on the other side. Electrons with energy greater than the height of the barrier are injected into the storage node, where they are read as changes in current flowing through the transistor.

3**. Detection of Infrared Radiation:** The single-electron transistor can also be used to detect infrared signals at room temperature. By exciting electrons over an electrically induced energy barrier, both the range of detectable wavelengths and the sensitivity of the device can be controlled. The sensor works when an infrared signal excites conduction-band electrons in a 25-nmdeep electron reservoir. A silicon insulator channel measuring 40 × 400 nm is placed next to the reservoir to increase the number of excited electrons. A poly-silicon lower gate then turns off the transistor and electrically forms an energy barrier, creating a storage node on the other side. Electrons with energy greater than the height of the barrier are injected into the storage node, where they are read as changes in current flowing through the transistor.

4**. Ultrasensitive Microwave Detector:** Another application of Single Electron Transistor can be as an Ultrasensitive Microwave Detector; island is weakly coupled to a bias circuit through two small capacitance tunnel junctions and a capacitive gate. At low bias voltages and temperatures, a single quasi particle may only be introduced to the island through photon-assisted tunneling. Once this occurs, the quasi particle is trapped on the island because it takes a relatively long time for this specific quasi particle to tunnel off. While it is trapped, charge is transported through the system two electrons at a time. Since the photon-assisted transition merely switches the detector current on, this device is not limited to one electron tunneled through the system per absorbed photon. This makes the device an extremely sensitive and potentially useful detector of microwave radiation.

5. **Temperature Standards:** Theoretical analysis based on the orthodox theory has shown that $\Delta V = 5.44NkBT/e$ is surprisingly stable with respect to almost any variations of the array parameters (with the important exception of a substantial spread in the junctions' resistances), providing a remarkable opportunity to use the arrays for absolute thermometry, since the fundamental constants are known with high accuracy. Each particular array may give high (1%) accuracy of within less than one decade of temperature variations, but for arrays with different island size (and hence different), these ranges may be shifted and overlap. Thus, it is possible to have an absolute standard of temperature with a very broad (say, two-decade) total range from several circuits fabricated on a single chip. This development is very encouraging, but since all this work is recent, some time is needed to see whether these new devices will be able to compete with (or even replace) the established temperature standards.

6.**Supersensitive Electrometer:** The technology of fabrication of tunnel barriers for single-electron devices is still in its infancy, they apparently contain many electron trapping centers and other two-level systems capable of producing "telegraph noise"- random low-frequency variations of the barrier conductance. The high sensitivity of single-electron transistors have enabled to use them as electrometers in unique physical experiments. For example, they have made possible unambiguous observations of the parity effects in superconductors. Absolute measurements of extremely low dc currents (~10-20 A) have been demonstrated. The transistors have also been used in the first measurements of single-electron effects in single-electron boxes and traps. A modified version of the transistor has been used for the first proof of the existence of fractional-charge excitations in the fractional quantum hall effect.

7.**Single-Electron Spectroscopy:** Another application of single-electron electrometry is the possibility of measuring the electron addition energies (and hence the energy level distribution) in quantum dots and other nano scale objects. There are two natural ways to carry out such measurements. The first is to use the quantum dot as the island of the single-electron box, capacitively coupled to the single electron transistor or other sensitive electrometer. The second is to use the quantum dot directly as the island of a weakly biased single-electron transistor and measure the gate voltages providing the sharp increase of the source-drain conductance

Limitations in Set Implementations

1. Back Ground Charge: The first major problem with the single electron logic circuits is the infamous randomness of the background charge. A single charged impurity trapped in the insulating environment polarizes the island, creating on its surface an image charge Q0 of the order of e. This charge is effectively subtracted from the external charge Qe.

2. Room Temperature: The another big problem with all the known types of single electron logic devices is the requirement Ec~100kB T, which in practice means sub-nanometer island size for room temperature operation. In such small conductors the quantum kinetic energy gives a dominant contribution to the electron additional energy even small variations in island shape will lead to unpredictable and rather substantial variations in the spectrum of energy levels and hence in the device switching threshold.

3. Out Side Environment: Linking with SETs The individual structures patterns which function as logic circuits must be arranged in to larger 2D patterns. There are two ideas, first is to integrate SET as well as related equipments with the existing MOSFET, this is attractive because it can increase the integrating density. The second option is to give up linking by wire, instead utilizing the static electronic force between the basic clusters to form a circuit linked by cluster, which is called quantum cellular automata (QCA). The advantage of QCA is its first information transfer velocity between cells via electrostatic interaction only, no wire is needed between arrays and the size of each cell can be as small as 2.5 nm, this made them very suitable for high density memory and next generation quantum computer.

4. Lithography Technique: Another major problem with single electron devices is the requirement Ec~100kB T, which in practice means sub-nanometer island size for room temperature operation. In VLSI circuits, this fabrication technology level is very difficult. Moreover, even if these islands are fabricated by any sort of nanolithography, their shape will hardly be absolutely regular.

5. Co-tunneling: The pressure essence of the effect is that the tunneling of several electrons through different barriers at the same time is possible as a single coherent quantum mechanical process. The rate of the process is crudely less than that for the single electron tunneling.

Conclusion: This research paper focuses the theoretical discussion of basic principle of Single electron transistor, its applications and limitations with importance of Single electron transistor in the age of nanotechnology to provide low power consumption and high operating speed in the field of VLSI design for the fabrication of various electronic devices. SET has proved its value as tool in scientific research. Resistance of SET is determined by the electron tunneling and the capacitance depends upon the size of the nanoparticle. The main problem in nanometer era is the fabrication of nanoscale devices.

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Faculty Achievements

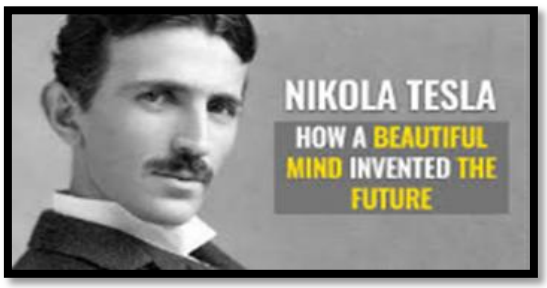
DOCTORATES AWARDED

Mr. D V A N Ravi Kumar

Mrs. B Vijaya Lakshmi

Mr. B P V DILEEP

Know a Scientist



Nikola Tesla (10 July 1856 – 7 January 1943) was a **Serbian-American inventor**, **electrical engineer**, **mechanical engineer**, and **futurist** who is best known for his contributions to the design of the modern **alternating current** (AC) **electricity supply** system. After having learned of **Heinrich Hertz**' (1886–88) experiments that proved the existence of **electromagnetic radiation**, including **radio waves**. Tesla tried powering a **Ruhmkorff coil** with a high speed **alternator** he had been developing as part of an improved **arc lighting** system but found that the high-frequency current overheated the iron core and melted the insulation between the primary and secondary windings in the coil. To fix this problem Tesla came up with his **Tesla coil** with an air gap instead of insulating material between the primary and secondary windings and an iron core that could be moved to different positions in or out of the coil.

#1 HE PATENTED THE POLYPHASE ALTERNATING CURRENT INDUCTION MOTOR IN 1887-88

Based on the principal of rotating magnetic fields, his first induction motor generated ¼ horsepower at 1800 revolutions per minute and weighed only 20 pounds, which was a fantastic achievement at the time.

#2 HIS ALTERNATING CURRENT EMERGED WINNER IN THE BATTLE OF CURRENTS

#3 HE DEVELOPED TESLA TURBINE AS AN ALTERNATIVE ENGINE FOR MECHANICAL MACHINE

#4 HE WAS INSTRUMENTAL IN BUILDING ONE OF THE FIRST HYDROELECTRIC PLANTS

#5 HE INVENTED THE TESLA COIL LEADING TO THE POSSIBILITY OF WIRELESS TRANSMISSION

#6 HE INVENTED AN ELECTRO-MECHANICAL OSCILLATOR

#7 HE MADE IMPORTANT CONTRIBUTIONS IN RADIO TECHNOLOGY

#8 NIKOLA TESLA CREATED ONE OF THE WORLD'S FIRST WIRELESS REMOTE CONTROLS

#9 HE PLAYED A KEY ROLE IN THE DEVELOPMENT OF X RAYS

#10 NIKOLA TESLA HAD CLOSE TO 300 PATENTS

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K. Harshitha
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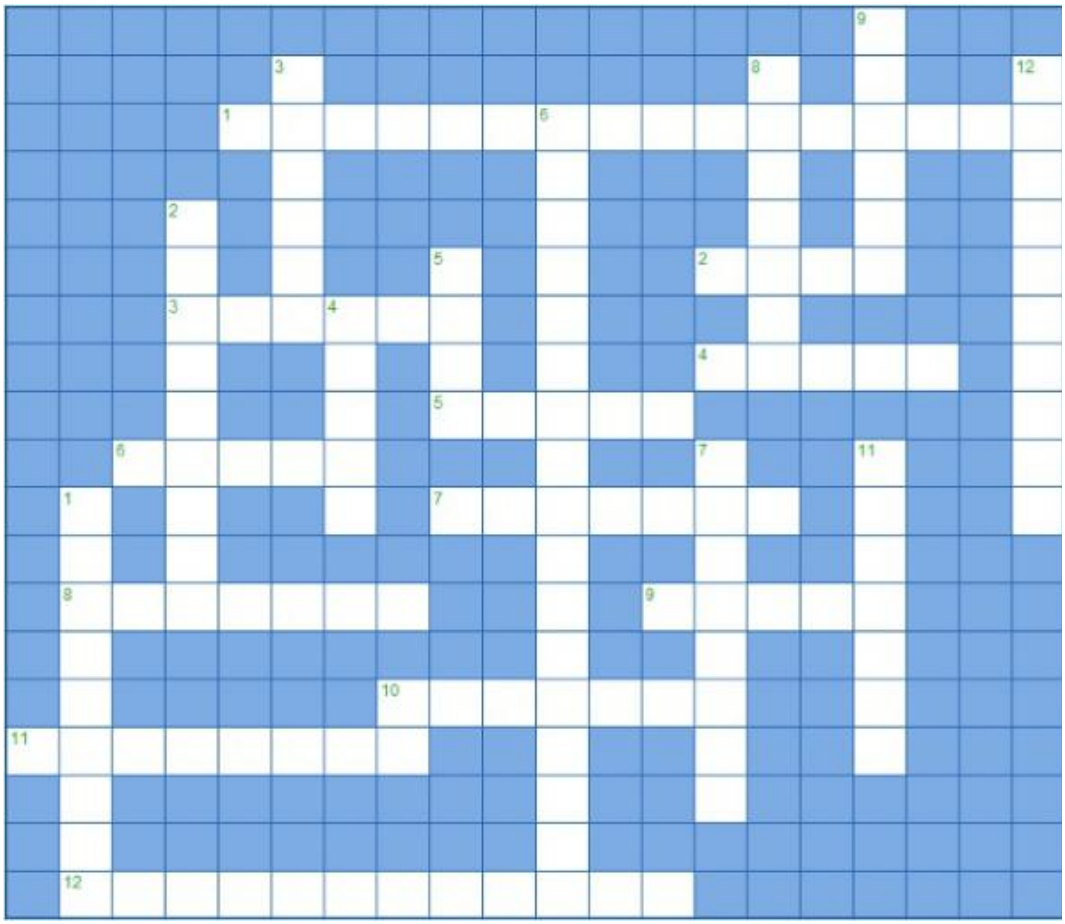
Riddles

Crossword



Across	Down
1. Two resistors connected together, across a power supply (9,7)	1. Shape of the schematic symbol for a resistor (9)
2. Process used to remove unwanted copper from a PCB (4)	2. Stores charge (9)
3. Color band used to indicate the number 7 (6)	3. Electrically joints components to a PCB (6)
4. Color band used to indicate the number 0 (5)	4. Energy that allows the electronics to work (5)
5. Connects the components together on a PCB (5)	5. Check the board works, after construction (4)
6. A component which allows current to flow only in one direction (5)	6. A chip / part with two row of pins (10, 7)
7. Makes a sound (7)	7. Component with coloured bands to determine it's value (8)
8. A collection of components, connected together (7)	8. Something that can only be true / false, 0 or 1 (7)
9. The L in LED (5)	9. Used to turn things on and off (6)
10. Flows through a circuit (7)	10. Letters used to mark commercial electronics sold in Europe (2)
11. Electronics that works with real voltages (9)	11. Measured across components such as batteries (7)
12. Type of capacitor, which is polarized (12)	12. A component that acts like an electronic switch (10)

B.Roshini and Uma Maheshwari

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Ans in pgno:23

Departmental activities

Guest lecture by industrial expert (16-02-2019)

Mr. A Venkata Krishna stated the importance of silicon material for VLSI industry, and he also focused on the extent to which VLSI industry has grown in our country.

Hands on workshop on IOT (23-02-2019)

A Workshop on IoT was conducted by Mr. P V K Chaitanya and Mr. V V V Satyanarayana, wherein the students are introduced about IoT and hands-on session was conducted thereafter

Poster Presentation on Emerging Technologies

Our Professor Dr. B.S.Murthy and Head of The Department Dr. K.Srinivasa Rao and other faculty attended The Poster Presentation conducted on Emerging Technologies by The Students.

Guest Lecture on The Topic Electro Magnetic Waves and Transmission Lines (07-03-2019)

An informative guest lecture on EMWTL was delivered by Dr. K. Chandra Bhushana Rao, Professor of ECE in UCEV, JNTU Kakinada.

A motivational talk on "Loving to learn and learning to lead-Building your own brand" by Mr.Krish Dhanan from Skylife Success, USA (25-06-2019)

Mr. Krish Dhanam Inspired the Students by Sharing His Experiences and Motivated to Create Our Own Brand. He Suggested Students to Complete the Work with Interest and Suggested Ways to Enjoy the Work.

Guest Lecture on"Career through Gate" by Devendar Singh Negi Managing Director, Engineers HUB (29-06-2019)

He explained eligibility and qualifications required for gate exam and pattern of the exam. He mentioned the companies which are recruiting students through the gate exam

Guest lecture on "Opportunities in Electronics and Communication Engineering" by Prof.N. Bala Subhramanyam, Department of ECE. GVPCEW (A) (06-07-2019)

Prof.N. Bala Subhramanyam listed the Streams Where an ECE Student Can Work and Explained the Importance of Practical Knowledge In Today's World

Workshop on Advanced Manufacturing Technology by Managing &Technical Team, Centre of Excellence in Maritime & Shipbuilding (CEMS), Visakhapatnam (25-07-2019)

Commander Gopi Krishna Chief Operating Officer, CEMS, Visakhapatnam Motivated the Students to Participate in Various Events Irrespective Of The Branch As It Develops Interest Towards Development And Innovation. It Was an Interactive Session as The Students Answered All the Questions Enthusiastically. He Invited to Do Internships in CEMS Visakapatnam.

One day seminar on "The Role of IT in New Age Broadcasting" by Managing &Technical Team, Broadcasting Engineering Society (INDIA), Hyderabad Chapter organized by department of ECE, GVPCEW (27-07-2019)

Sri K.Gnaneswara Rao, Senior Engineer, EMMRC, OU, Hyd explained about MOOCS and their role in higher education.
Dr.D.Ranganadham, DDG, Doordarshan, Hyderabad explained about the importance of IT in media.

One Day Workshop on "PCB Designing and Fabrication" organized by IEEE Student Branch, GVPCEW for all IEEE members of GVPCEW (24-08-2019)

Technical Seminar on "Photonic System for Real Time Monitoring of Air Quality" by Dr. Rao Tatavarti, Director (Engineering Research & Consultancy) GVP-SIRC organized during ECLAT-A inaugural function by department of ECE, GVPCEW(06-09-2019

Speech by chief guest professor Dr. V S N Rao Tatavarti, director and dean of industrial consultancy and sponsored research GVP(A) Visakhapatnam on "Photonic System for Real Time Monitoring of Air Quality" on opening lines Dr. Tatavarti said that photonic system is capable of real time remote monitoring on various air parameters simultaneously it arrives at the in suite air quality at particular location he also mentioned the uniqueness and novelty of the system lines in its ability to innovatively apply the contents of laser back scattering ,AI and ML to identify classify quantify various air pollutants simultaneously

Guest lecture on "Antenna Basics" by Prof. K. Chandra Bhushana Rao, HOD, Department of ECE, JNTU Vijayanagaram (20-9-2019)

He inspired the students by giving his experience in the field of electronics and communication. He explained the subject and also some unknown logics to students. he provided realistic examples to make students to understand the concepts.

Riddles:

1. the army
2. explosion
3. Brazil and Paraguay
4. A telephone
5. Computer mouse
6. electricity

Crossword

Down:	**Across:**
1. Rectangle	1. potential divider
2. Capacitor	2. Etch
3. Solder	3. Purple
4. Power	4. Black
5. test	5. Track
6. Integrated circuit	6. Diode
7. Resistor	7. Speaker
8. Digital	8. Circuit
9. Switch	9. Light
10. CE	10. Current
11. Voltage	11. Analogue
12. transistor	12. Electrolytic

Vision of the Department	**Produce competitive engineers instilled with ethical and social responsibilities to deal with the technological challenges in the field of Electronics and Communication Engineering.**	
Mission of the Department		**Mission Statements**
	M1	**Facilitate a value-based educational environment that provides updated technical knowledge.**
	M2	**Provide opportunities for developing creative, innovative and leadership skills.**
	M3	**Imbue technological and managerial capabilities for a successful career and lifelong learning.**

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