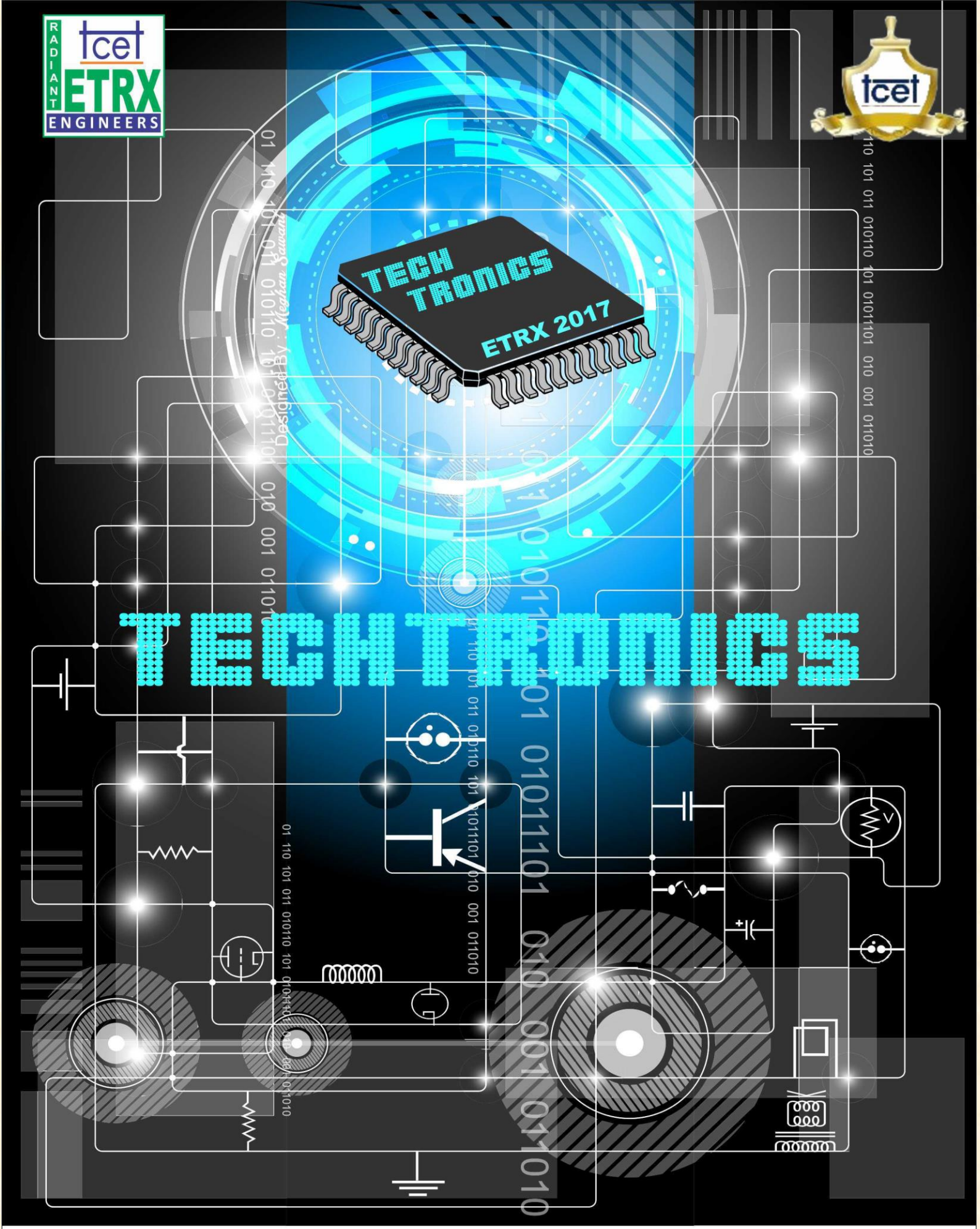

VOL-IV TCET's Technical Magazine For Dept. of ETRX ISSUE-II

TCET

DEPARTMENT OF ELECTRONICS ENGINEERING (ETRX)

Credit Based Grading System [CBGS - 2012(R)]/Choice Based Credit and Grading Scheme [CBCGS - 2016(R)]

CBCGS-2016(R)

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Principal's Message:

I have great pleasure in conveying my best wishes to the Department of Electronics Engineering for releasing the technical magazine "TECHTRONICS" which brings the students and teachers of various disciplines on a common platform to share and display their ideas and creative talents.

I wish all the faculties and students who have involved in bringing out the magazine for their greater success and career ahead!!

Dr. Mr. B. K. Mishra

Principal

Dean's Message:

It is a noble task on the part of the Department of Electronics Engineering to once again make it with their frequent issue "TECHTRONICS". I wish that this TECHTRONICS establishes to be a flint to fire the enthusiasm and excite their minds for many intrusive innovations among the faculty and students inspire passion among the members of the faculty of Electronics Magazine committee. My greeting to the editorial board to keep the good work!!!

Dr. Mrs. Lochan Jolly

Dean SSW

HOD's Message:

Once again, it's a moment of pride for the whole department of ETRX as we present the latest issue of our magazine "TECHTRONICS". This time around the magazine isn't just a regular one, it is much more exciting and much more innovative and informative. I appreciate my team for their sincere efforts in putting up such a beautiful magazine on the line. And I wish the radiance of ETRX keeps breaking old boundaries and set's up new limit, as we believe in aiming at stars…for sky is the limit for us.

Dr. Mrs. Sandhya Save

HOD ETRX

Dy HOD's Message:

The Electronics & Communication Engineering is one of the most dynamically changing and ever evolving branch since more than 100 years. Electronics is the foundation on which Information Technology and Computer Engineering has grown. All high-speed networks and computers work on the hardware designed by electronic engineers.

21st century is the century of communication as communication engineering has been growing exponentially in recent years. At TCET, department of electronics Institute developed state-of–art laboratories & centres of excellence so as to train our students in Electronics Engineering through flexible, adaptive and progressive training programs, Bridge Courses, Various project in signal System and communication Domain and other Domains along with cohesive interaction with the research organizations, academicians and industries and having experience faculties in the department. It is my pleasure to work with imminent students who egger to develop the carrier in Electronics Engineering.

Dr. S. C. Patil

Dy. HOD ETRX

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About the Department:

Department of ELECTRONIC ENGINEERING was established in the year 2008 at TCET. The ELECTRONICS branch has 14 qualified faculty members. The department has 9 well equipped labs and 3 classrooms. The course also focused on project based learning such that the students can develop skills which are beneficial for upcoming demands of the industry.

The ETRX department also has a professional body named IETE (The Institution of Electronics and Telecommunication Engineer) which is recognised all over the globe. IETE plans various technical seminars and workshops for students for nurturing the technical skills of the students.

Vision of the Department:

Electronics' Department of Thakur College of Engineering and Technology (TCET) will thrive to achieve academic excellence in electronics and electronics related technical education in Mumbai university to develop internationally competent professionals with a sense of responsibility and social sensitivity.

Mission of the Department:

Electronics' Departments mission is to achieve academic excellence by creating the right academic Ambience, Nurturing, enhancing personal and professional skills enabling the students to compete globally.

Disciplines of the Department:

POs:

1. Ability to demonstrate knowledge of electrical & electronics engineering.
2. Ability to demonstrate ability to identify, formulate and solve.
3. Ability to design electrical and electronic circuits and conduct experiments with electrical systems, analyze and interpret data.
4. Ability to design digital and analog systems and component.
5. Ability to visualize and work on laboratory and multidisciplinary tasks.
6. Ability to demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
7. Ability to demonstrate knowledge of professional and ethical responsibilities.
8. Ability to communicate effectively in both verbal and written form.
9. Understanding of impact of engineering solutions on the society and also will be aware of contemporary issue.
10. To develop confidence for self-education and ability for life-long learning
11. Ability to recognize and adapt to emerging applications in engineering and technology.
12. To participate and succeed in competitive examinations like GATE, GRE.

PEOs:

1. To provide students with a strong foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems at hand and to prepare them for graduate studies.
2. To develop the ability among students to synthesize data and technical concepts from applications to product design.
3. To provide opportunity to students to work as a team on multidisciplinary projects and to promote awareness among students for life-long learning and introduce them to professional ethics and codes of professional practice.

PSOs:

1. Should be able to clearly understand the concepts and applications in the field of Electronics such as semiconductor technology, signal processing, embedded systems, communication etc. and acquire skills to Identify, formulate & solve problems in related fields of Electronics.
2. Should be able to design electronics and computer-based components and systems for applications including signal processing, communication and control systems with the capability to comprehend the technological advancements with the help of modern design tools to analyze and design subsystems/processes for a variety of applications.
3. Should be able to understand the impact of engineering solutions in a Global, Economic, Environmental, and Societal context and co-relate the learning to derive solutions to real world problems.
4. Should be able to demonstrate skills to communicate in verbal and written form effectively and demonstrate the practice of professional ethics along with the concerns for societal and environmental wellbeing.

About IETE:

IETE-TCET student forum was formed in our institute in academic year 2011-12 and it was inaugurated by Dr. J W Bakal, Chairman I.E.T.E Mumbai Section. At present, there are 268 student members and some applications are still in process. The number of students will increase in next academic year. IETE-TCET forum has conducted several events for the overall development of students of this institute.

The following are the objectives of the IETE committee:

• To achieve learning through co-curricular activity.

• To develop skills in various activity.

• Ability to function as multidisciplinary teams for projects.

• Ability to communicate effectively in both verbal and written form.

Various activities are held under the IETE committee taking into consideration the educational aspect as well as the co-curricular and the extra-curricular performance of the students of the ETRX branch throughout the year.

The following are some of the activities taken up by the committee:

• Project Exhibition

• Small scale industry activity

• Technical seminars

• Project exhibitions

• Online bridge course examinations

• Debate competition

Our IETE Committee:

Domain In-charge (Electronic Devices & Circuits Modelling & Simulation):

This domain covers understanding of various devices used in Electronics in terms of principle of operation, applications in the field of Electronic Circuit Design. Enable students to design simple projects and perform analysis of Circuits and Systems. Also enable students to learn Computer aided simulation and synthesis tool for circuit design and simulation. With the use variety of computer hardware and software applications different projects and research can be carried out. This field is basis of electronics and has lot of research opportunities in India and abroad.

Mrs. Poorva Waingankar

Domain In-charge (Signal Processing & Communication):

The Electronics & Communication Engineering is one of the most dynamically changing and ever evolving branch since more than 100 years. Electronics is the foundation on which Information Technology and Computer Engineering has grown. All high-speed networks and computers work on the hardware designed by electronic engineers.

21st century is the century of communication as communication engineering has been growing exponentially in recent years. At TCET, department of electronics Institute developed state-of–art laboratories & centres of excellence so as to train our students in Electronics Engineering through flexible, adaptive and progressive training programs, Bridge Courses, Various project in signal System and communication Domain and other Domains along with cohesive interaction with the research organizations, academicians and industries and having experience faculties in the department. It is my pleasure to work with imminent students who egger to develop the carrier in Electronics Engineering.

Dr. S. C. Patil

Teacher's Words of Wisdom:

"Successful teaching is about shaping the information flow so that the student experiences it – moment by moment - at the right level of difficulty"

"Healthy teachers set boundaries and create healthy routines so that their work is meaningful, rich, and energetic, and they can also have healthy lives outside of their classrooms and institutes.

Mr. Vaibhav Gijare

Assistant Professor

"One looks back with appreciation to the brilliant teachers, but with gratitude to those who touched our human feelings. The curriculum is so much necessary raw material, but warmth is the vital element for the growing plant and for the soul of the child."

Mrs. Archana Belge

Assistant Professor

"The dream begins with a teacher who believes in you, who tugs and pushes and leads you to the next plateau, sometimes poking you with a sharp stick called truth."

"The task of the excellent teacher is to stimulate apparently ordinary people to unusual effort. The tough problem is not in identifying winners: it is in making winners out of ordinary people"

Dr. S. C. PATIL

Associate Prof, Dy.HOD

“If a man is to shed the light of the sun upon other men, he must first of all have it within himself.”

“True teachers are those who use themselves as bridges over which they invite their students to cross; then, having facilitated their crossing, joyfully collapse, encouraging them to create their own.”

Mrs. Shweta Gulati

Assistant Professor

Now a day’s I am surprised to see students not having a habit of reading. This not only surprises me but I also feel dreadful. Dear students it is a sincere request to you from a teacher that please develop reading habits in yourself. Books are our best friends. Also for this you need to be patient first. What I feel is that the root cause behind this is today’s generations’ impatient behaviour. This is quite obvious because from the beginning you got things readymade, let it be your toys or let it be your notes. You all are habitual of getting the things served on plate. But it is never late, still you have that energy; you just have to concentrate it. Read good books, get your topics cleared by reading. Avoid learning things only through YouTube. I hope this suggestion will be very helpful to you.

Mrs. Sonal Barvey

Assistant Professor

If we can achieve the state of self-mastery, we will more consistently have the personal power and peace of mind we need to get ahead, since we are not giving our energy, and power away to others. If we take responsibility for ourselves we will realise how much we can affect change in our lives and in the society.

Life has no meaning if we all don't live it whole heartedly. Live life with full of love, happiness will embrace you on its own.

Mrs. Sujata Alegavi

Assistant Professor

Student's Thoughts:

Although doctors heal, lawyers represent, contractors build, and bankers invest, ETRX teachers help to instil in us the huger for knowledge, the passion to learn and help ignite the flame to set ablaze our dreams.

Mr. Akshay Prabhu (TE ETRX)

Technology is neither good nor bad, nor even neutral. Technology is one part of the complex of relationships that people form with each other and the world around them; it simply cannot be understood outside of that concept - Samuel Collins, a doctor in the 17th Century.

Electronics, almost everything that surrounds us has direct link to Electronics, from the very computers we use whether it be laptops, netbooks or notebooks which has millions of tiny electronic components on it like resistors, inductors, capacitors, logic gates and the likes to the calculators, appliances, gizmos, measuring devices, and gadgets to name just a few. Electronics truly moulded our lives we have today, for without it, we might as well grimacing in the shackles of underdevelopment and stagnant society where progress is hardly felt as if we are in an isolated island. Electronics is the barometer of how far humans have gone through if we use the advancement in technology as a yardstick of progress. The dawn of the new wave of the future is bound to fascinate the world once again, the microchips which houses thousands to several millions of semiconductor components that makes our computers do their functions and features is expected to undergo major transformation in the near future. The nano-technology, will soon sweep the world and will soon break barriers between possible and impossible, and as an electronics engineer I would like to say that we work better when we are doped.

Thankyou!

Mr. Aditya Keny (TE ETRX)

As we all know our department of Electronics Engineering started in the academic year 2008-2009 and since then has been producing not only good result but good engineers as well. As the department strives to set new academic standards with wide acceptability of the graduates in the industry globally with all rounded engineers, I am assured that our case will be the same with the amount of hardworking staff here. Moulding us into internationally competent professionals with a sense of responsibility and social sensitivity!

Thank you.

Mr. Yash Patel (TE ETRX)

The electronics department is undoubtedly one of the most active departments in the college, with new motivating and energetic activities day after day. With workshops and seminars for the overall development of the students it organizes various competitions which help us to identify our abilities and also helps us identify the areas in which we need to improve on. Excellent teaching staff and ever helping non-teaching staff are there to guide and assist us round the clock. Out of all the departments in the college, the electronics department is one of the most encouraging and amazing ones.

Mr. Keyur Lodha (SE ETRX)

Electronics being a core branch has a multitude of career opportunities. Electronics department of TCET has one of the state of the art infrastructure to impart its students with practical and industry based knowledge.

Mr. Vishnu Nair (BE ETRX)

Electronics department, it is not just a department but a family of very talented and hardworking people, who are working very hard for the all-round growth of their students and to provide them quality education. From the professors to the non-teaching staff, everyone is very humble and kind. The first and foremost priority of our professors is students all round development. Teaching pattern is very well planned and it uses technology at its best. Since its inception, this department is working wholeheartedly to provide quality education to their students.

Mr. Aditya Singh (SE ETRX)

Electronic branch is an ever-green branch. Its scope doesn't end. Electronic engineering is the core branch we're you get to know about many electronic stuff. Our faculty they are truly committed towards their work and punctuality is their key of success. Even we students get to learn n no. Of things from them. Professors of our branch r always keen to help the students. And when I say help it not only means for study it is also for many co-curricular, extra co- curricular activities.

Thank you

Mr. Arunendra Singh (SE ETRX)

Teachers are helpful and there for us whenever we need them. Apart from the University syllabus they give us opportunities to discover/invent new things indigenously. The department provides us all the instruments which we need to become a skilful and practical engineer.

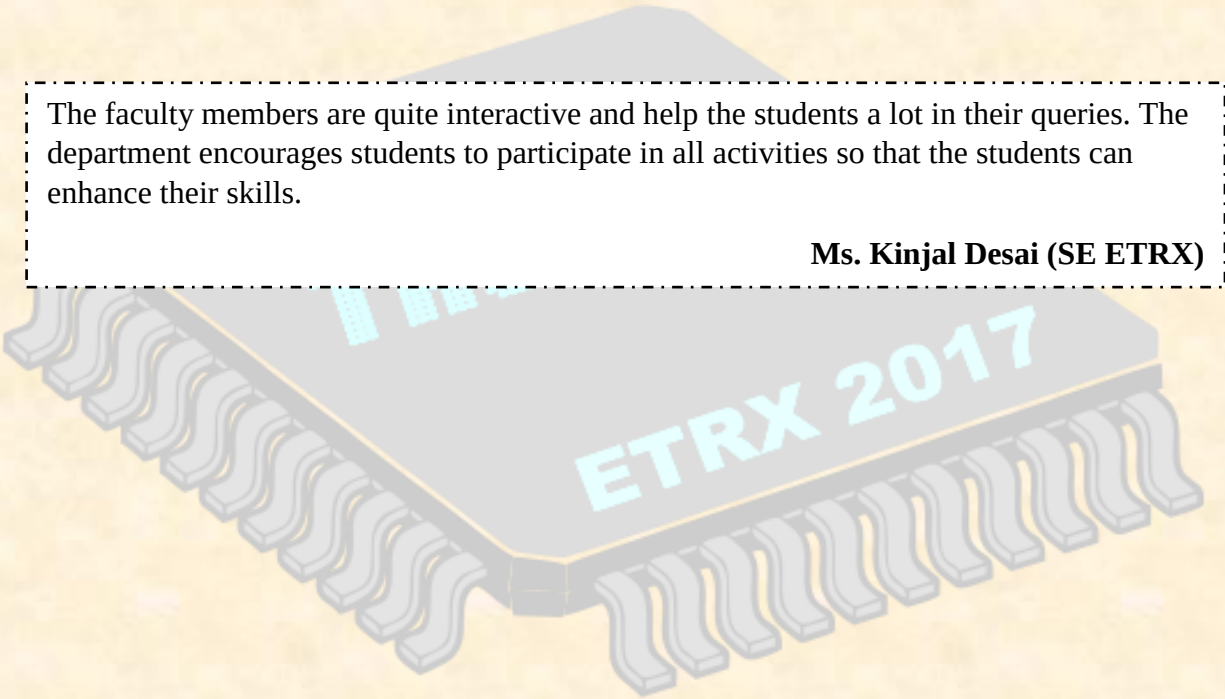
Ms. Anushka Sawant (SE ETRX)

The teachers are very helpful and explain stuff in an easy, understandable manner. The labs are well equipped and the lab assistants are understanding and help us a lot too.

Ms. Payal Narvekar (SE ETRX)

The faculty members are quite interactive and help the students a lot in their queries. The department encourages students to participate in all activities so that the students can enhance their skills.

Ms. Kinjal Desai (SE ETRX)



Our Proud ETRX Faculty:

Mini – Projects for this Semester: (Project Based Learning)

Remote Controlled Farming Bot: A Next Gen Farming Machine

Abstract: Agriculture is the backbone of any kind of economy and it is the only field where technology has not penetrated into greater depth. Without agriculture, it is not possible to have a city, stock market, banks, university, church or army. Agriculture is the foundation of civilization and any stable economy. The discovery of agriculture was the first big step toward a civilized life. Agriculture is not a job; it's a way of life. Any civilization can survive without other professions, but to survive without agriculture is impossible.

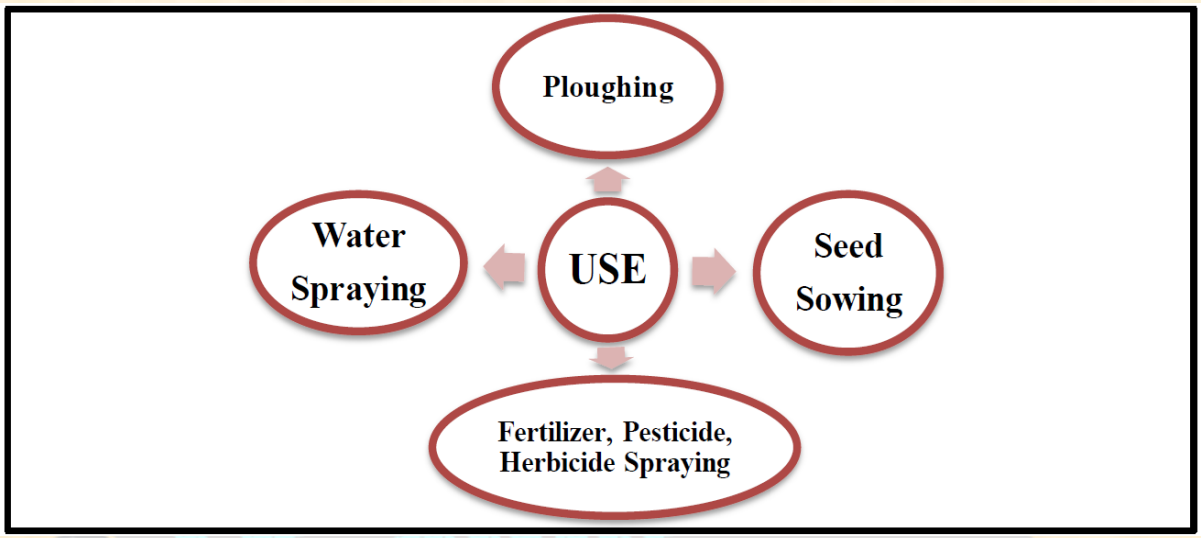
INTRODUCTION: India is an agriculture based economy. The major workforce in our country consists of farmers however the contribution of agriculture to GDP is just 17.5%. Agriculture in India in the late 1950s and 1960s was carried out without the utilization of technology. The farm size was also small and the farmers were also unaware about the variations which can be introduced in farming to increase the yield per hectare. Green Revolution was a key initiative, which aimed at modernizing the Indian agriculture system. Green revolution was the first major step where the farmers were introduced to the high yielding varieties and novel types of chemical fertilizers. Green Revolution proved that even the agricultural system cannot survive without technology and to cater the present needs agriculture has to work in sync with technology. Green revolution transformed India from the insufficiency of crops to a state of self-sufficiency.

The production rate in India is fairly good and also it is among the top producing nations in the world. Over the past few years the manufacturing and the service sectors contribution to GDP has increased but there is a constant decline in the contribution of agricultural sector; as it is decreased from 50% in 1950s to just 15.4% in 2015-2016. The major issue related to the agricultural practices in India is the low yield per hectare. As compared to other major producing nations like Brazil, China; India has low yield per hectare for the crops produced. The problems that the hinder the agricultural efficiency of India include the decrease in the size of agricultural land, depreciation in the fertility of soil, poor access to irrigation facilities and uneven access to the use of modern technology. The use of automation in agricultural is must to achieve efficiency in agricultural practices and to increase the yield per hectare. The ever-growing population of the world has put an extreme stress on the farmers to increase their yield and to feed the entire population so that the problem of food shortage is eliminated. The integration of various technologies like GPS technology, robotics technology etc with agriculture is the need of the hour to enhance the yield per hectare. Recently there are many research institutions which have already assembled robotic tractors or robotic vehicles for agricultural practices. Farming robots specific for a particular task like automatic rice transplanter, or a robot for orchard application are also developed for a particular objective.

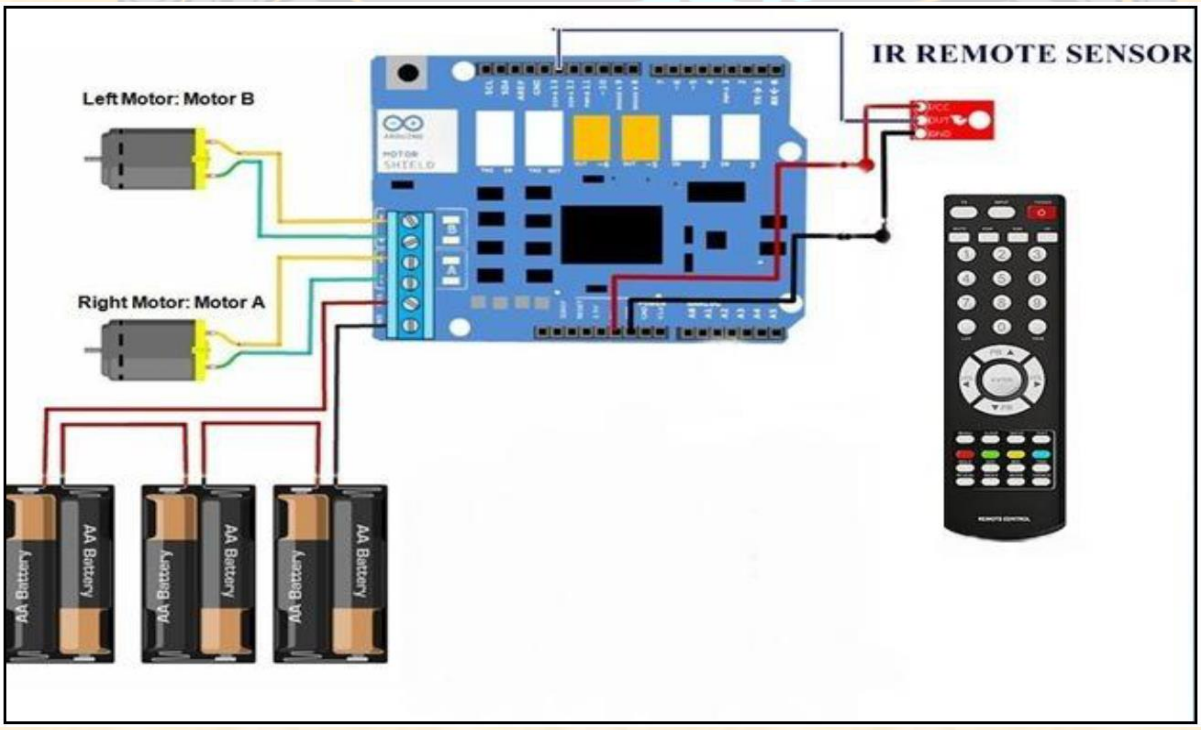
PROJECT DESCRIPTION:

Remote controlled farming bot is one such prototype which can be implemented for performing the farm activities like ploughing, seed dispersal, fertilizer/herbicide/pesticide spraying, weed

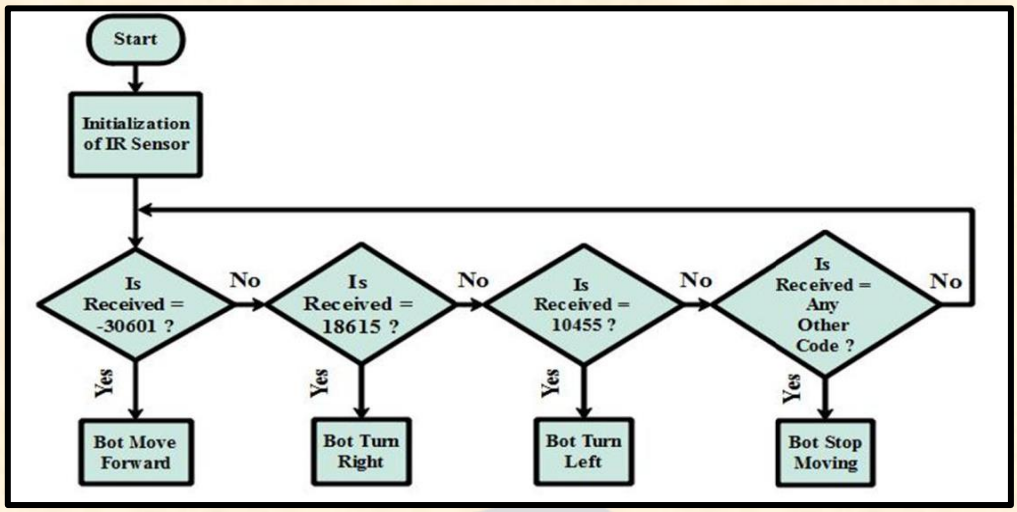
removal and harvesting. The RCF bot at present can only plough the field effectively and also disperse the seed which are placed in its container. The bot is at present in the first stage development and more improvements are yet to be implemented to make it a perfect next gen machine which is compatible for all farm activities. Currently the bot is controlled with the help of remote but with improvements it is possible to control it with help of smart phones or any other wireless controllers like RF. The use of RCF Bot can briefly explained as below:



The block diagram of the prototype is as follows:

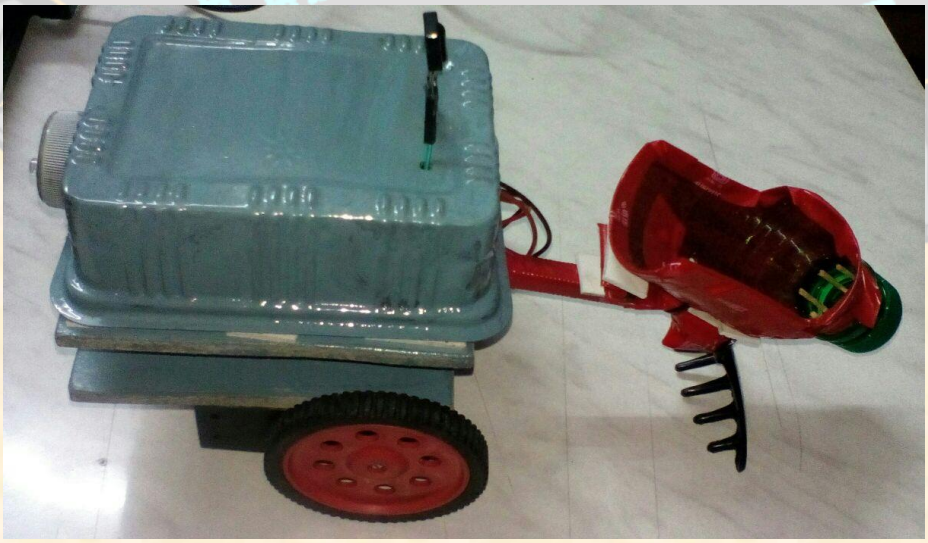


The flow of control or robot's working can be summarized with the help of following flowchart:



CONCLUSION:

RCF Bot is having a wide scope of usage in the farming sector which just automizes the farm activities by the click of a button. By incorporating all the activities of the agricultural sector, it is possible to shift the present labour intensive agricultural work to a labour less agricultural work. RCF Bot is truly a step towards the making of next gen Farming Machine and revolutionizing the agricultural field.



Conceptualized & Conceived by TE ETRX Students:

Hari Khatavkar (Roll No.19)
Rahul Kini (Roll No.20)
Yash Patel (Roll No.31)
Akshay Prabhu (Roll No.33)

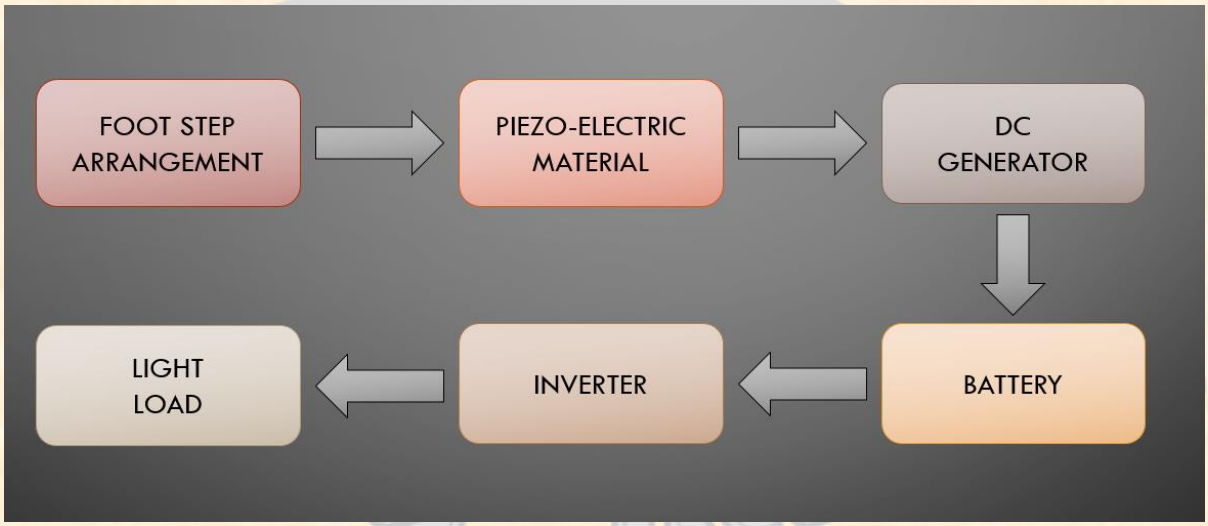
FOOTSTEP POWER GENERATION

IDEA OF WORK:

Here we are trying to harness energy generated while walking to charge electronics. The main component of our project is the piezoelectric transducer which converts mechanical stress to electrical energy which can be stored for further use. This energy can be stored in a battery and with the help of voltage regulation circuit a constant power supply can be given to the appliance to charge using a USB 2.0 connector. All these circuitries will be fabricated inside a shoe's sole and utmost care will be taken that when someone is walking wearing these shoes he/she does not limp and the circuit does not hurt them.

This project can be useful during times when there is no source to recharge your devices like camping, military, etc

BLOCK DIAGRAM:



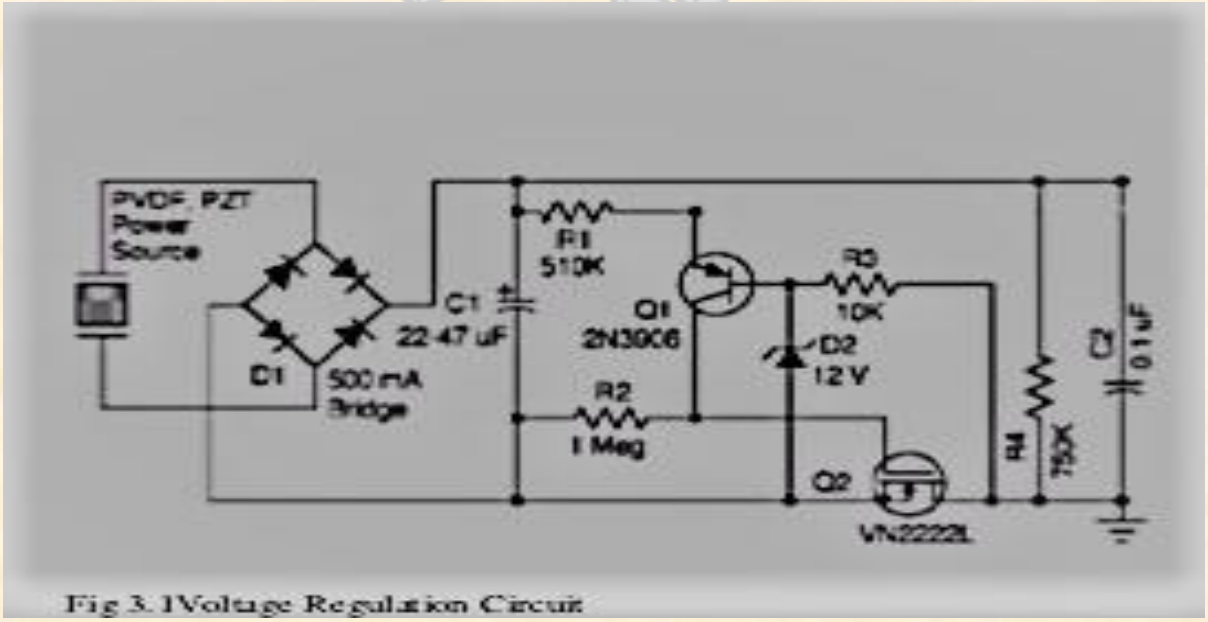
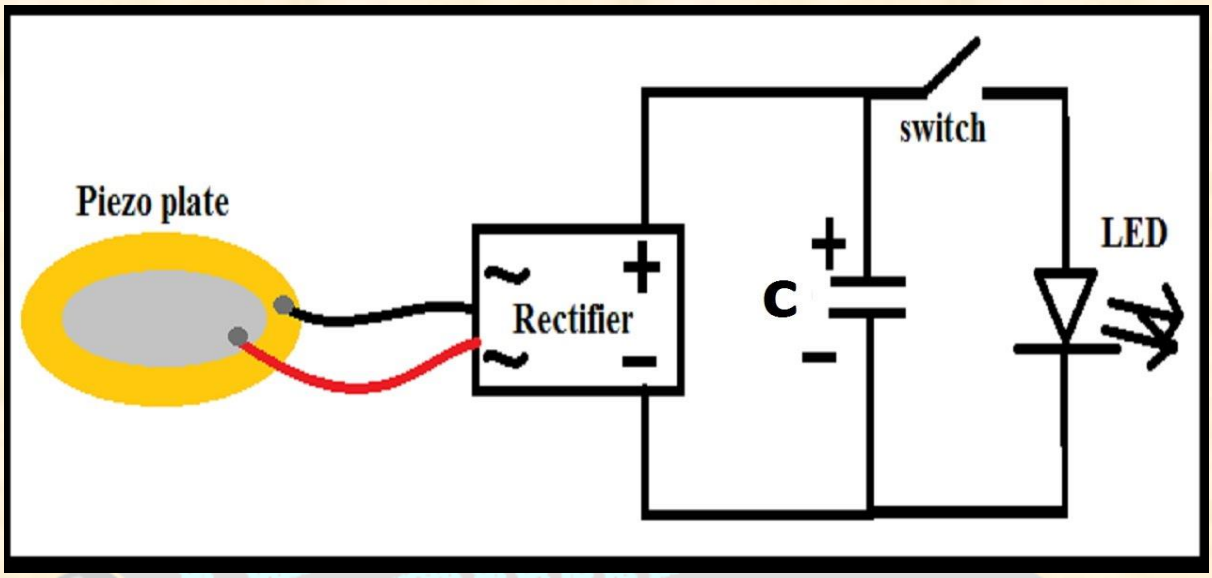


Fig 3.1Voltage Regulation Circuit

WORKING:
Whenever force is applied on piezo electric that force is converted to electrical energy is used to drive DC loads. And that minute voltage which is stored in the Lead Acid battery. The battery is connected to the inverter. This inverter is used to convert the 12 Volts D.C to the 230 Volt A.C. This 230 Volt A.C voltage is used to activate the loads. We are using conventional battery charging unit also for giving supply to the circuitry.



EXPECTED OUTCOME:

The given circuit should be able to charge electronic devices. It could be used as a source of clean and green energy. The circuit should bare the wear and tear of a shoe while walking and running. It should be maintenance free after installation.

CONCLUSION:
The project "FOOT STEP POWER GENERATION" is successfully tested and implemented which is the best economical, affordable energy solution to common people. This can be used for many applications in rural areas where power availability is less or totally absence As India is a developing country where energy management is a big challenge for a huge population. By using this project, we can drive both AC and DC loads according to the force we applied on the Piezoelectric sensor.

Made by TE ETRX Students:

Rohit Anchan (Roll No.1)
Paramjeet Singh (Roll No.2)
Ajay Jaiswar (Roll No.15)
Priyal Pandya (Roll No.30)

Technical Paper Presentation:

Quadcopters

Abstract – Robots that can fly, that have four arms with motors buzzing while they rotate, fixed on them are camera gimbals that capture everything and multiple sensors that regulate flow of information, these are Quadcopters. Classified under rotorcrafts, quadcopters are unmanned radio-controlled aircrafts popular among hobbyists and companies for their novel applications. This paper examines the features of a quadcopter, their applications, limitations and future scope.

1. Introduction – Multi-copters are unmanned aircrafts that have a central hub with electronics, power and sensors onto which are mounted arms that hold motors and propellers to provide lift and are guided by remote control or on-board computers. The number of arms gives the name: a tri-copter (three arms), quadcopter (four arms), hexa-copter (six arms) and an octocopter (eight arms).

2. Components

2.1 Airframe – Airframe is the mechanical structure of the rotorcraft minus the propulsion and technical systems. All other components – motors, propellers, batteries, computer etc. are mounted to the airframe. The most popular choices for modern quadcopter frames are carbon fibre, fiberglass, aluminium etc. These frames have a centre plate which has mounting spaces for electronics and batteries as well as arms which have motor mounting pads.

2.2 Electronic Speed Controllers – An electronic speed controller or ESC is an electronic circuit with the purpose to vary an electric motor's speed, its direction and possibly also to act as a dynamic brake. An ESC stands between the low current required to operate microelectronic flight control systems and the raw power required to turn propellers. It reads the speed the motor is turning at, takes inputs from the flight controller and applies the power to keep the motor turning at desired speed.

2.3 Brushless Motors – The motors of your drone is what your propellers are connected to which causes them to spin around and generate thrust to enable the drone to fly. In case of multi-rotors, the motors generate upward thrust which keeps the quadcopter flying. A brushless motor consists of two main sections a) Rotor – the part that rotates and has magnets mounted in a radial pattern. b) Stator – the part that doesn't rotate and has electromagnets. A general rule is that you should at least be able to provide twice as much thrust than the weight of the quad; this is the bare minimum to ensure stable hovering of the quadcopter. In general, brushless motors are specified in kV rating which is, the theoretical increase of motor RPM when the voltage increases by one volt without load or on no load.

Motor Specifications:
a. kV Rating (RPM/V)
b. Weight (g)
c. Maximum Current (A)
d. Maximum Voltage (V)
e. Length, Shaft length, Diameter (mm)

2.4 Propellers – Rotorcraft propellers come in a variety of diameters and pitches as well as materials such as plastic, carbon fiber etc. The flight efficiency of a quadcopter is closely related to the amount of air contacting the surface of the propeller and the column of air it creates around it due to its motion. For a quadrotor, four propellers are essential out of which two turns clockwise and two anticlockwise which generate the required amount of thrust needed to lift the quadcopter.

2.5 Battery – A battery pack powers the motors and provides them with the energy to generate thrust to lift the quad up. The most popular type of battery composition currently is Lithium – Polymer (Li - Po). A Li – Po battery pack consists of one or more cells each producing a nominal 3.7 volts of power. The amount of power contained in the battery is measured in milli ampere hour (mAh) ratings. Advantages of Li – Po batteries are that they are lightweight, compact and have about four times the energy density of NiCad/NiMH batteries which makes them ideal for rotorcraft operations.

Battery Specifications:
a. Capacity (mAh)
b. Cell count (S or P)
c. Voltage (V)
d. Discharge Rating (C)

2.6 Brain/Flight Controllers – The most important unit of the quadcopter is its on-board brain circuit that controls all the electronic modules and supplementary sensors. Prebuilt and pre-programmed versions of the on-board circuits are known as flight controllers which are singular units that consist of automated speed variation systems, IMU units and other sensors as per the requirement of the quadcopter. Recently, various microcontrollers along with their supported modules and sensors are being used as on-board brains. Importantly, the type of flying – Freestyle, Aerial Photography, Autonomous Missions, or utilization of the quadcopter determines the type of flight controllers.

Examples of industry standard flight controllers:
a. NAZE32: Modern 32-bit processor unit running at 3.3 V/72 MHz Up to eight channels RC input. Built in telemetry inverter.
b. KK2: An Atmel Mega 644PA 8 – bit AVR based microcontroller with 64k of memory. GUI based options for calibration of ESC's, radio, propellers and selection of craft type.
c. DJI Naza-M Lite: Has Advanced Altitude Stabilization Algorithm with Multiple Flight Control mode and built in Gimbal Stabilization Function.

2.7 Miscellaneous – Quadcopters are not just about the motors or the flight controllers they have on them, they are highly customizable starting with the frame till the different modules on it. These multi-rotors could be equipped with lights, camera modules, gas and barometric

sensors, facial recognition modules, GPS or Wi-Fi connectivity hubs, thermal imagers, display modules etc. to make them more productive.

3. Novel Applications

3.1 Aerial/Action Photography: One of the mainstream uses of quadcopters and other multi-rotors is aerial photography. Quadcopters with camera gimbals are extensively used for filming and video making. The camera modules interconnected with the on-board computer are placed either above or below the base plate for uninterrupted viewing. Also with the help of these types of quadcopters the creation of "virtual walkthroughs" is possible. Cameras with 4k recording, image optimization and stabilization and
facial recognition with real time interfacing provide the best results for filming purposes.

3.2 Agriculture: Quadcopters with miniature sprinklers or sprayers fixed on long shafts can be used to irrigate farms uniformly. A quadcopter is first fed with a mapped area and flight plan of the farm patch along with GPS coordinates and then the irrigation/spraying operation is carried out. These specialized quadcopters are lightweight, compact and have shaft arrangements on the base plate or on their booms. Advantages of this method include spraying uniformity; precision and it can possibly replace human operations of irrigation and fertilizer/pesticide/insecticide spraying.

3.3 Surveillance, Survey and Security: Using a methodical flight pattern, routine and specific surveillance spots quadcopters can provide real-time road traffic information, monitor the streets of a sector, investigate archaeological sites etc. Such quadcopters are of inverted propeller type and have cameras mounted on servos for 360° rotation for unobstructed viewing. A quadcopter of this set is also useful for monitoring activities in animal sanctuaries to ward off poaching activities and mine surveying.

3.4 Disaster Management: Medium sized quadcopters can be effective in search and rescue operations during calamities. Quadcopters are highly manoeuvrable and can fly easily into difficult access areas. For example, in a tsunami struck area, quadcopters with high definition cameras and thermal imaging can easily locate people and pass real-time image feeds to the disaster relief services. Surveillance quads can easily spot wildfires or landslides and can prove to be instant sources of information needed for effective disaster management.

3.5 Aircraft Inspections: Today, airplane inspections are done by trained engineers on the ground where inspecting the underside of the aircraft is easy, but the sides and tops prove difficult and require platforms that can be moved which is time consuming. Quadcopters can fly all around the plane within a finite perimeter, taking snapshots and videos instead of a physical inspection. This has a number of benefits:
a. Quadcopters can view all aspects of the aircraft flying in a specific perimeter around the plane which eliminates the need of special platforms
b. They can get clear snapshots of all the aircraft areas which helps in easy detection of flaws
c. Engineers can control quads in a centralized area with real time reviewing of the aircraft.

3.6 Product Deliveries: A drone delivery system is designed to deliver packages to customers in 30 minutes or less considering the average flight time a battery pack provides. It majorly depends upon two factors:

a. Route Density: Number of drop-off locations on the flight course

b. Drop Size: Number of parcels per stop on the flight route
Presently, quadcopters can only make a single package drop-off within a time frame and have to fly back to the base for recharging. Quadcopters can deliver all kinds of packages that are compatible with their thrust-weight ratio and also have been used to deliver food products and medicines.

4. Limitations

Quadcopters prominently depend upon battery technology as batteries power the motors. Presently, a Li-Po battery provides about an average 30 – 35 minutes of flight time on a single charge. These batteries are also prone to thermal damage and can get puffed up if a nominal charge is not maintained.
It requires skill and experience to properly control and manoeuvre a quadcopter which otherwise could lead to damage of surrounding property and damage to the quad itself. Proper functioning of the quadrotor can be ensured by the proper calibration of ESC's, IMU units and the flight controller. Flight controllers can sometimes malfunction due to distortion or mechanical vibrations produced by the rotating motors causing the quadrotor to fly haphazardly. Whereas accessing and properly calibrating ESC's, gyroscopes, accelerometers and other IMU units results to an increased complexity in the flight stability algorithm. The construction complexity and expenditure increases with the increase in the different modules or units mounted on the quadcopter which sometimes is commercially non-viable.

5. Future Quadcopters

Quadcopters of the future will be compact and might have foldable arms for increased storage space. Their design complexity will be reduced by the technological advancements in 3D printing and battery technology. They would no longer be controlled by joysticks and would be made completely autonomous. Quadrotors would be made environment friendly so that they could be easily disposed off if trashed or damaged. Forthcoming, there will be development of micro quadcopters that can fly together in swarms for sanitization, disease prevention and fumigation operations. Microsoft has already begun experiments with quadcopters equipped with bug collection devices to catch mosquitoes and other bugs to help prevent vector-borne diseases. Researchers at e-Volo, a German engineering firm have developed prototypes of a multirotor named Volocopter that has 18 rotors and can carry four to six people. This muti-copter will be manned, simple to fly and will be emission free. Trials and testing have begun on this multirotor which evidently states the possibility of quadrotor flying services in the future that could transport people. Also, the evolution of pet quads that are mapped to an individual that can follow them anywhere and carry their belongings from one place to another might be another future possibility.

6. Conclusion

With their increasing presence, quadcopters are being termed as the next great tech in the world. Numerous applications, design simplicity and complete customization are some aspects which make quads favourites among hobbyists, technology enthusiasts and even for commercialization. There exist some limitations that hinder the full potential of quadrotors but they will shortly be side-lined by the advancements in technology.

By: Keyur Lodha (SE ETRX)

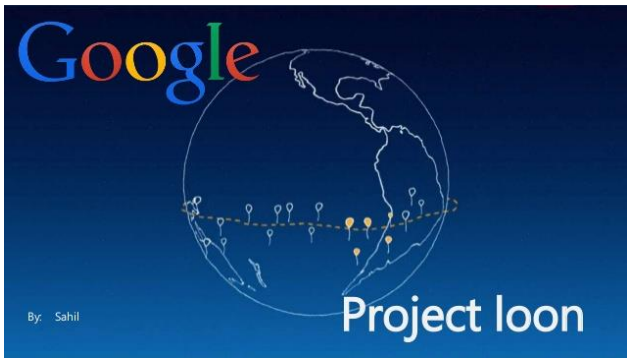
Project Loon by Google ™

Balloon Powered Internet for Everyone

Abstract **-** In the evolution of the Internet these days, a few population of the world utilizes the welfare of the Internet. To solve this global difficulty, Google™ developed an innovative project called the "LOON", to give broadband for free. Here the key concept is to set balloons at high-altitude which ascend to the stratosphere and create an aerial wireless network.

Introduction:

Most of us visualize of the Internet as a global community. But two-thirds of the world's population doesn't yet have access to the Internet. Project Loon is a network of balloons touring on the edge of space and float in the stratosphere, are carried round the Earth by winds. People can connect to the balloon network using a particular Internet antenna connected to their building. The signal bounces from balloon one balloon to other, then goes to the global Internet back on Earth. The system aims to bring Internet access to remote and rural areas poorly served by existing provisions, and to improve communication during to the regions struck by natural disasters. The technology designed in the project could allow countries to avoid using expensive underground infrastructure.



History:

Over the past couple of years, Google X has released several fabulous projects, including Google Glass, Self-Driving Cars, and other projects related to neurological networks. Google X is Google‟s concealed research and evolution lab that is leaded by Sergey Brim. The division is reported to abode hundreds of projects associated to futuristic technologies, which till now, we have only seen in movies and imaginations. "PROJECT LOON" is one such initiative taken up by Google to solve these issues of affordable Internet connection.

Diagrammatic Representation of a Balloon

In 2008, Google considered acquiring or contracting with Space Data Corp., a company that sends balloons carrying small base stations about 20 miles (32 km) up into the air for providing connectivity to trucks and oil companies in the southern United States, but it did not do so. Unofficial development on the project began in about 2011 under the incubation in Google X with a series of trial runs in California's Central Valley. The project was then officially announced as a Google project on 14th June 2013.

The loon design:

Project Loon relies mainly on 4 parts:

1) Envelope:

Inflatable part of the balloon is called a balloon envelope. A well-made balloon envelope is critical for allowing the balloon to last around 100 days in the stratosphere. Loon's balloon envelopes are made out of sheets of polyethylene plastic, & they measure fifteen meters wide by twelve meters tall when they are fully inflated. When the balloon is ready to be taken out of service, gas is released from the envelope to bring the balloon down to Earth in a controlled descent. In the unlikely event that the balloon drops too quickly, a parachute that is attached to the top of the envelope, is deployed.

2) Solar Panels:

Every balloon's electronics are powered by an array of solar panels. The solar array is a flexible plastic laminate supported by a light-weight frame made of aluminium. It uses mono-crystalline solar cells that are of high efficiency. The solar array is mounted at a steep angle to effectively capture sunlight throughout short winter days at higher latitudes. The array is divided into 2 sections facing in opposite directions, allowing to capture energy in any orientation as the balloons spin slowly in the wind. The panels produce about 100 Watts of power in full sun, this is enough to keep the Loon's electronics running while also charging the battery for use at night. By moving through the wind and charging in the sunlight, Project Loon is capable of powering itself using entirely renewable energy sources.

Network Equipment:

A small box containing the balloon's electronic circuit hangs underneath the inflated envelope, like a basket that is carried by a hot air balloon. The small box contains circuit boards that control the system, radio antennas to communicate with different balloons & with Internet antennas on ground, and lithium ion batteries to store solar power for the balloon to operate throughout the night.

Inside all box are a mini-command centre: radio sensors, satellite receivers, & Wi-Fi electronics, along with a stack of custom-made Google X circuit-boards. These computers measure the acceleration, take temperature measurements, run communications between satellite & Wi-Fi networks, etc. This is how Google Mission Control communicates to each Loon and tells it what to do.

Loon Antenna:

The loon antenna is shaped in circular manner marking the symbolism of a balloon. They are attached to households or workplaces, wherever internet connectivity needs to be established.

Picture of a Loon Antenna

Loon Antenna consists of the following parts:

- Patch Antenna
- Reflector
- Radio

The topmost part of the interior of the shell is composed of a reflector disc, a pair of parallel patch antenna (radiating elements) a few centimetres above the disc, and a pair of cables directing down to the radio, which lives at the bottom half of the bulb. The patch antenna receives reflected radio waves from the reflector disc and direct waves. The two sources interfere constructively so as to correct the wavelength to be received. The radio then transmits signals to the devices.

Initial Challenges for the Loon:

It was hard to make a super-pressurized balloon. Instead of bursting, the balloon slowly leaks helium, bringing it down after a day or two in flight. “Even a micrometer-sized hole will bring a balloon like this down in a few days,” Cassidy says. “And that’s what happened to the next 50 or 60 balloons that were made.” Google’s engineers then spent weeks trying to isolate this problem. They took balloons out of their boxes and inflated them in a hollow hangar at Moffett Field in Mountain View, California, shined polarized light through them, and sniffed for helium leaks using a mass spectrometer. Each balloon that went down was then subjected to a “failure analysis” which included poring over meticulous records of who had built it, where, and using what instrumentation, and how it had been transported.

Eventually they pinned the leaks on 2 sets of issues. One was the balloons had to be folded multiple times over to be transported, and a few developed tiny tears at the corners where they had been folded repeatedly. Google was set to work finding ways to fold & roll the balloons that would distribute the stress more equally throughout the fabric. The second problem was that some balloons were ripping slenderly when workers stepped on the fabric with their socks. The solution to that problem was “Fluffier socks,” said Cassidy. “That made a difference. Softer socks meant lesser leaks.” As the team cut down the leaks, balloons started enduring longer: 4 days, 6 six days, then several weeks at a time. As of November 2015, Cassidy says, 2 out of every 3 balloons remain in the sky for at least 100 days.

But keeping the balloons airborne is only the initial of the monumental problems that the project presented. Keeping them on track maybe even difficult. “When had Google first announced the project, I pictured brightly coloured vessels hovering in place a few hundred or thousand meters over their respective target villages, perhaps tethered to the world’s lengthened ropes.” says Cassidy. The actuality is far much complex and captivating.

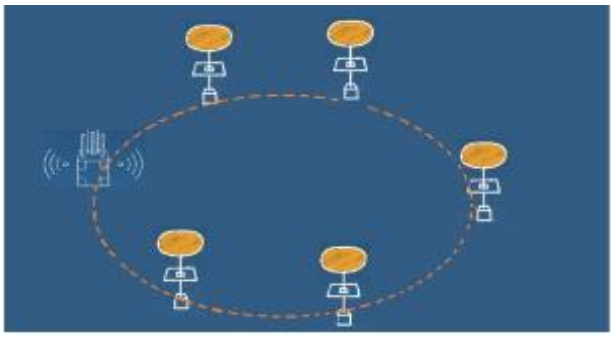
Working of the Loon:

Project Loon balloons travel about 20 to 25 km above the Earth’s surface in the stratosphere. Winds in the stratosphere are hierarchical, and each layer of wind differs in speed & direction. Project Loon uses the software algorithms to determine where the balloons need to go, then relocatees each balloon into a layer of wind blowing in the proper direction. By flowing with the wind, the balloons can be ordered to form 1 huge communication network.

Situated on the edge of the space, between 10 km and 70 km in altitude, the stratosphere presents unusual engineering quests, air pressure is 1% that is at sea level, and this gauzy atmosphere offers less protection from UV radiation and dramatic temperature swings, which can range as low as -80°C. By carefully scheming the balloon envelope to resist these conditions, Project Loon is able to take benefit of the stratosphere’s steady winds and stay well above weather events, wildlife and airplanes. The technology designed in the project could permit countries to avoid using pricey fiber cable that would have to be installed subsurface to let users connect to the Internet. Google feels this will largely increase Internet activity in underdeveloped & developing countries in regions such as Africa and Southeast Asia that can't expend to lay underground fiber cable.

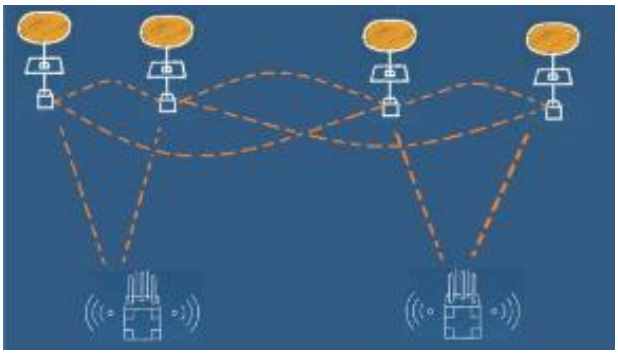
A Loon in the Stratosphere

The high-altitude polyethylene balloons fly throughout the world on the prevailing winds (mostly in a route parallel with lines of latitude, i.e. east or west). Solar panels provided by PowerFilm, Inc roughly the size of a card table that are just beneath the free-flying balloons yield enough electricity in 4 hours to power the transmitter for a day and beam down the Internet signals to the ground stations. These ground stations are separated about 100 km (62 mi) apart, or 2 balloon hops, and rebound the signal to other relay balloons that send signal back down to the ground. This makes the Internet accessible to anyone in the world who has a receiver and is within the scope of a balloon. Currently, the balloons intercommunicate using unlicensed 2.4 and 5.8 GHz ISM bands, and Google claims that the setup permits it to deliver "speeds comparable to 3G" to the users. It is puzzling how technologies that rely on short communications times (low latency pings), such as VoIP, might want to be modified to work in an environment similar to mobile phones where signals may have to relay through multiple balloons prior to reaching the wider Internet.



Ring Topology

Powering it is a 600-Watt battery, charged by solar panels on a carbon fiber frame on top of the box. These big, extra-light photovoltaic cells amorphous silicon crystals on a fabric substrate keep the weight of the balloon reduced so that the Loons can run for longer missions without landing. During the daytime, the batteries charge, and at night they discharge, to orifice the excess air and keep the computers operative.



Mesh & Star Topology Hybrid

Each Loon balloon has 3 radio frequency antennas (on 2.4 Ghz & 5.8 Ghz bands) and a ground-pointing Wi-Fi antenna, which beams Internet signals to Earth in a 10 to 15 miles radius. And though the balloons are steerable, Google has done a lot of programming to make them work on autopilot. In addition to Mission Control, Google's Loon balloons can speak to each other, and control themselves." We employ a diffused mesh network, so every balloon is pretty much independent and has jolly much identical hardware in it," said Sameera Ponda (lead aerospace engineer at the Dos Palos site). "As 1 balloon floats over a definite area, the balloon is conversing with the ground antennas, and as that balloon floats away, some other balloon comes in to takes its place, so it's a pretty seamless operation."

Experimental Implementation:

On 16th June 2013, Google began a pilot experiment in New Zealand where close to thirty balloons were launched in coordination with “Civil Aviation Authority” from Tekapo, South Island. About 50 local users in and close to Christchurch and Canterbury Region tested connections to the aerial network using specific antennas. After this first trial, Google plans on sending up 300 balloons around the world. Google hopes to eventually have hundreds & thousands of balloons flying in the stratosphere.

The Loon being Launched in New Zealand

In May-June 2014 Google tested its balloon-powered internet access project in Piauí, Brazil, marking its first LTE experiments and establish near the equator. In 2014 Google partnered with France's Centre national d'études spatiales (CNES) on the program.

Every balloon would provide Internet service for an area two times the size of New York City, approximately 1,250 square kilometres, and terrain is not a hardship. They could stream Internet into Afghanistan's abrupt and twisty Khyber Pass or Yaounde, the capital of Cameroon, a country where the World Bank estimates 4 out of 100 people are online. Google engineers studied balloon science from NASA, the Defense Department & the Jet Propulsion Lab to innovate their own airships made of plastic films akin to grocery bags. Hundreds have been built till date.

Recovery of the Balloon:

Balloons are maneuvered by raising and lowering them to a height with winds blowing in the wanted direction of travel. Google plans to take balloons down over safe recovery zones so we can easily gather them to reuse and recycle the parts. During an unexpected landing, every Loon balloon is equipped with a parachute to obtuse its descent. The Project Loon team considers several recovery specialists who track down & collect landed balloons. Google tracks their balloons continuously in the atmosphere using GPS and take note of the location when it lands. Once the landing location is known, the recovery team will be on their journey. Finally, we plan to land the balloons in assorted collection points around the globe.

Impact:

About 8 to 10 years ago, could anyone predict that smart phones would become such an constitutional part of how we live our lives or that the internet would cause such a strong influence in educational transparency & ethnic consolidation across all continents. An entire genre of jobs has burst out on the web over the past 10 to 15 years, many of which are based solely just about spreading knowledge. YouTube, for instance, has millions of "how to" videos.

The internet becoming available to millions of web privy people, there will be a drastic increase of these videos. Anticipate how websites like Wikipedia, Facebook, Twitter and other gathering sources websites would look after 5 billion more people come online and start contributing. When Google‟s chairman, Eric Schimdt proclaimed in April that "For every person online, there are 2 who are not. By the ending of the decade, each and everyone on Earth will be

connected, “no one would have imagined that such a bold statement would be carried out by Google X, the division in Google in charge of Project Loon.

CONCLUSION:

Google's vision for Project Loon is to provide schooling for those presently without education, bring doctors for people who cannot go to see one & render important weather data to assist farmers, whose harvests are struck by droughts and floods. According to Google’s Team Loon, balloons stationed so high above the earth they can only be seen with the help of a telescope.

"The materials are pretty low-cost," says Project Loon's Richard DeVaul. "The plastic of the balloons is correspondent to that in shopping bags and the electronics are not that different from consumer electronics. This is a very cost-efficient way to connect the globe together." There is near about 70% to 80% comment in the favour of project loons. As per experts there could be great success for this project in forthcoming. Google hopes that balloons could become an option for connecting rural, remote, and under-served & underdeveloped areas, and for serving with communications after natural calamity.

By: Hari N Khatavkar (TE ETRX)

A Review on Artificial Intelligence and its Application

Abstract: It is the theory and development of making machines which perform like humans and have ability like human reasoning, decision making power. This paper examines the features of Artificial Intelligence its introduction, definition, applications and social challenges.

1) Introduction

Artificial intelligence (AI) is to make computers more efficient and to develop ability like human reasoning, human decisions etc. Artificial intelligence does not deal with psychology because it studies on machines, programs and the method to create computers to be more efficient. It makes machines smarter to solve same problem more accurate if compared with humans which would cause human errors and thus smarter and more useful. Artificial Intelligence is achieved by various modern techniques like neural networks, fuzzy logic, expert systems. Artificial intelligence has its own pros and cons like other revolutions in technology. Some of its advantages are that they are more efficient and leave less room for errors unless if the machine undergo breakdown.

2) Goals of Artificial Intelligence

1. To Create Expert Systems: The systems which exhibit intelligent behaviour, learn, demonstrate, explain, and advice its users.

2. To implement decision making power in computers.

3) Needs for Artificial Intelligence

- To make computers more efficient
- To use computer's artificial intelligence
- To understand how humans think
- To avoid human errors
- To do work in more efficient ways

4) Applications of Artificial intelligence

Artificial Intelligence has its application in day today life like our personal assistants in smartphones like Siri, Google Assistant, Cortana also in other areas which include medical, remote sensing, drones and driverless cars. Google driverless cars are being under tested and have few objections in society to implement it. Recently Tesla also undertook same idea as google and is trying to make such car.

Google recently launched its self-driving car. It is being tested on road and being checked if it is safe to implement on road. The project was renamed and is now called as "Waymo". Recently Tesla is also coming up with the same concept. The basic construction includes:

1. GPS: Global positioning system (GPS) is used to find out a route from position A to B. It is linked with google maps and helps in real time traffic.

2. Collision Detecting systems: It is much similar with the collision detecting systems in aircrafts. It helps preventing accident with any other car or obstacle. The output from it is given to main computer in car which then reacts as per the data.

3. Computer: The car contains a computer which helps in control of the entire car. The driver is now replaced with computer. The computer has been coded with long sets of instructions and algorithms depending on various situations.

4.1 Gaming:

Artificial Intelligence is used in games like chess, poker, and tic-tac-toe. Here computers make large number of possible combination of positions. Games require large space and to reduce complexity heuristic technique is used. In video games, artificial intelligence is used to create intelligent behaviours primarily in non-player characters (NPCs), often resembling human-like intelligence. Path finding is another way of finding how a NPC can change its coordinates with respect to the obstacles and by avoiding collisions with the environment and other NPCs.

4.2 Artificial Intelligence in Robotics:

Robotics is a branch of Artificial Intelligence which is combination of Electrical, Mechanical Engineering, and Computer Science. Robots are used in various domains like medicine, Industry, military, entertainment, space exploration etc.

4.3 Components of Robots

The basic components of Robots include

1. **Power Supply:** The robots are powered by batteries, solar power. The batteries are generally rechargeable
2. **Actuators:** They are implemented to covert energy into movement. The common examples of actuators are electric motors which help in movement of robots.
3. **Electric Motors:** They are required for rotational movement. This can be of both AC and DC depending upon the use.
4. **Pneumatic Air Muscles:** They are used in robots to resemble like human muscles which have ability to contract or expand. This mechanism works by sucking in air and throwing out
5. **Muscle Wires:** They contract or expand like Pneumatic Air Muscles.
6. **Piezoelectric Motors and Ultrasonic Motors:** Best for industrial robots.

7. **Sensors:** They are used to obtain information about the environment. Sensors like vision sensor, tactile sensors are used. Tactile sensors are used to resemble touch receptors provide.

4.3.1 Ethics of Robotics

There is always a fear among humans that intelligent robots will dominate humans. Always with development of technology, brings new problems. Considering this fact, The Three laws of robotics were put. The Three Laws, quoted as being from the "Handbook of Robotics, 56th Edition, 2058 A.D.", are:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

4.4 Fuzzy Logic

Fuzzy Logic (FL) is a method of making decisions like human thinking and human arguing or reasoning. Fuzzy logic is used in automobiles and consumer electronics like washing machines, air conditioners, ovens.

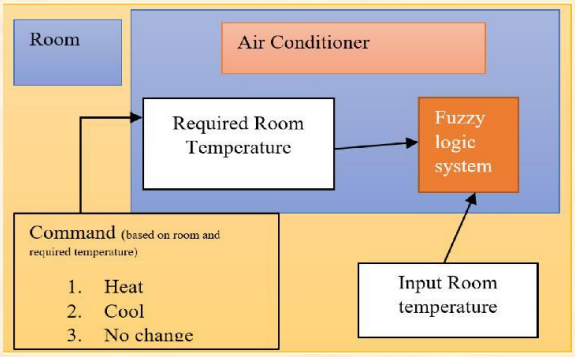
4.4.1 Pros of Fuzzy Logic

Fuzzy logic is a simple approach to problem which resembles human intelligence. It is easy to design such model comparing with human decision and thinking. Fuzzy logic has an important advantage that modification is simple. There is no need to change entire algorithm for small changes. It could be done by adding or deleting some rules.

4.4.2 Cons of fuzzy logic

Although it is a simple approach but it is not systematic manner. This method of approach can make some situations more complicated. Hence, it can be implemented and understandable if it is simple.

4.4.3 Fuzzy logic in Air conditioner



Air Conditioner is good example of Fuzzy logic

Algorithm:

1. Initialise linguistic Variables and terms (start)

2. Create membership functions for them. (start) (Membership function is the range of temperature that lies within a certain parameter, say warm. Two temperatures must be defined for warm region T5-T8.)

3. Construct set of rules.

4. Convert crisp data into fuzzy data sets using membership functions (fuzzification)

5. Evaluate rules in the rule base (inference engine)

6. Combine results from each rule (inference engine)
7. Convert output data into non-fuzzy values. (defuzzification)

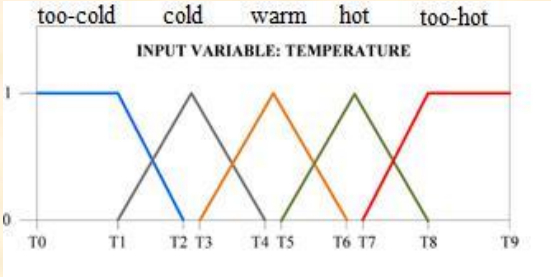


Figure 2: Membership function example

Room Temperature	Desired Temperature				
	Too-cold	Cold	Warm	Hot	Too-hot
Too-cold	No-change	Heat	Heat	Heat	Heat
Cold	Cool	No-change	Heat	Heat	Heat
Warm	Cool	Cool	No-change	Heat	Heat
Hot	Cool	Cool	Cool	No-change	Heat
Too-hot	Cool	Cool	Cool	Cool	No-change

4.4.4 Social Challenges

Self-Driving cars, assistants in smart phones, fuzzy logics in air-conditioners, Robotics are improving our way of living and making more comfortable. With new developments in technologies

brings new social problems. Artificial Intelligence applications should bring peace rather than any issues.

5) Social Issues

5.1 Unemployment

With increase in production of efficient robots there is a risk for people to be fired from their jobs as robots are highly efficient and take more work load than humans. Physical workers may be replaced with robots in near time which can lead to unemployment.

5.2 Inequality

With help of robots any company can reject human workers and would prefer robots. This would cause other firms or organisations to do the same to increase their profits at faster rate. Therefore, the companies that use robots would make more money than others which would lead to inequality.

5.3 Threat to Privacy

The more powerful a technology becomes, the more can it be used for nefarious reasons as well as good. Any of databases even of government can be misused and can lead to privacy issues.

5.4 Threat to Safety

Robots are being replaced by human soldiers or autonomous weapons. If there occurs a breakdown or if some because of technical issues can lead to dangerous situations in nations defence.

6.1 Pros of Artificial Intelligence

Artificial Intelligence is changing the way of our living. With help of Artificial Intelligence, we can get consistent and efficient performance whereas humans lack that ability of perfection. There is always room for error with respect to humans because of human error or emotions. Robots lack emotions which could be considered as an advantage over humans to achieve consistent accuracy. Artificial Intelligence can be used to perform dangerous tasks. For e.g. Robots are sent to explore. Robots supported with high definition cameras are used to capture images of earth and space. In near future, driverless cars would be a common thing on roads. Robotics surgery would help doctors for complex surgery very much easily.

6.2 Cons of Artificial Intelligence

Although, with help of robots we could achieve a greater accuracy but, it would cause a reason for unemployment. Robots would be preferred more over human labourers to maximise profit. There is always a risk of breakdown or malfunction of robots, this could be unreliable, and can cause economic losses. Also, the data would be insecure due to data hacking. Lastly, what separates a robot from humans is the emotions. Although, robots

without emotions might be helpful in industry to achieve greater profits but, humans are attached with each other because of emotions. There are also measures taken to develop "Emotional Intelligence" in robots.

7) Conclusion

Like other technologies, Artificial Intelligence brings its own pros and cons. Artificial Intelligence is being used at larger scale in various fields today. However, we have not achieved like the robots described in science fiction movies but might in near future develop such robots. Future robots would be very much different from present. Their design would be created easily with development in 3D printing. Robots completely resembling like human skin and muscles would be replaced by current Pneumatic Air Muscles. Although there are lot of social problems related with AI, but if guided properly according to ethics and three laws of robotics can lead to a bright future.

By: Akshay Nair (SE ETRX)

Academic Achievements:

B.E. ETRX:

1st Topper: Anilkumar Yadav (CGPA = 9.25)

2nd Topper: Rajat Rajput (CGPA = 8.69)

3rd Topper: Dipesh Mistry (CGPA = 8.45)

T.E. ETRX:

1st Topper: Akshay Prabhu (CGPA = 9.53)

2nd Topper: Ankita Singh (CGPA = 8.97)

3rd Topper: Yash Patel (CGPA = 8.27)

S.E. ETRX:

1st Topper: Pranav Singh (CGPA = 9.05)

2nd Topper: Keyur Lodha (CGPA = 9.02)

3rd Topper: Akshay Nair (CGPA = 8.95)

Other Achievements:

T.E. ETRX:

Department & Institute Level:

Name	Prize	Event	Level	Date
Akshay Prabhu	1st	IETE Quiz Competition	Department	Aug 2017
Ayush Mehta	1st	Hackathon Project Competition	Department	Mar 2017
Shubam Shukla	1st	Hackathon Project Competition	Department	Mar 2017
Akshay Prabhu	1st	Group Discussion	Institute	Sept 2017
Nishant Singh	1st	Boxing	Institute	Jul 2017
Aashish Yadav	2nd	IETE Quiz Competition	Department	Aug 2017
Hari Khatavkar	2nd	Hackathon Project Competition	Department	Mar 2017
Rahul Kini	2nd	Hackathon Project Competition	Department	Mar 2017
Sarvesh Sawant	2nd	Hackathon Project Competition	Department	Mar 2017
Ankita Singh	2nd	Hackathon Project Competition	Department	Mar 2017
Maruti Muthu	2nd	Hackathon Project Competition	Department	Mar 2017
Vishwajeet Satoskar	2nd	Hackathon Project Competition	Department	Mar 2017
Hari Khatavkar	2nd	Technical Poster Presentation	Department	Jul 2017
Rahul Kini	2nd	Technical Poster Presentation	Department	Jul 2017
Sarvesh Sawant	2nd	Technical Poster Presentation	Department	Jul 2017
Ankita Singh	2nd	Technical Poster Presentation	Department	Jul 2017
Maruti Muthu	3rd	IETE Quiz Competition	Department	Aug 2017
Hari Khatavkar	3rd	Student Development & Hackathon	Department	Jan 2017
Rahul Kini	3rd	Student Development & Hackathon	Department	Jan 2017
Sarvesh Sawant	3rd	Student Development & Hackathon	Department	Jan 2017
Ankita Singh	3rd	Student Development & Hackathon	Department	Jan 2017
Akshay Prabhu	3rd	Technical Poster Presentation	Department	Jul 2017

Other Levels:

Name	Prize	Event	Level	Date
Ankita Singh	3rd	Throwball	Intercollege	Mar 2017
Akshay Prabhu	Top 5%	Fibre Optics (NPTEL Course)	National	Apr 2017

S.E. ETRX:

Name	Prize	Event	Level	Date
Mahima	1st	Technical Poster Presentation	Department	Jul 2017
Nidhi	1st	Technical Poster Presentation	Department	Jul 2017
Kaustubh Rajan	2nd	Auto Hybrid (Multicon)	Institution Level	Feb 2017
Siddharth Singh	3rd	Auto Hybrid (Multicon)	Institution Level	Feb 2017
Sachin Soni	3rd	Robotics (Multicon)	Institution Level	Feb 2017
Ajay Yadav	3rd	Robotics (Multicon)	Institution Level	Feb 2017
Arunendra Singh	3rd	Robotics (Multicon)	Institution Level	Feb 2017
Kamlesh Yadav	3rd	Robotics (Multicon)	Institution Level	Feb 2017

Internship Experiences:

Mr. Hari N Khatavkar (TE ETRX)

I, Mr. Hari N. Khatavkar from T.E. ETRX was chosen to participate and contribute with my knowledge and experience towards the mobile application development. I really would like to thank Treashare Online Pvt Ltd for giving me this opportunity to gain knowledge and to contribute towards this project once again. During the course of my internship at the firm, I carefully tested each and every aspect of the application under the capacity of "User Interface (UI) & User Experience (UX)" to the finest of my knowledge by giving my positive inputs and thereby assisted for the development of the mobile application. I was a part of the Treashare pilot project team in Navi Mumbai & Mulund area, that was conducted between the period of 26th June to 7th July 2017.

This internship at Treashare Online Pvt Ltd was as follows:

1. Being involved in pilot projects I got on ground experience for the first time.
2. Understood the challenges faced by a non-technical personal to use an app.
3. Interacted with customers to fathom their needs and expectations from a business.
4. I got a chance to work with other professionals.
5. Learnt various aspects of app development and interfacing with platform.
6. Performed numerous tests to eliminate multiple bugs and enhance stability & overall performance of the app.
7. Learned to work in a professional team.
8. Pitching of the concept & ideology was an essential part of the process.
9. Understood workflow.

10. Learnt backend handling of an app.

Those 2 weeks were a unique experience for me as I worked progressively with my colleagues for the pilot project. I look forward to work professionally in further such projects soon to deepen my knowledge and adequately apply the technical skills that I learn through my engineering course.

Ms. Supriya Dhage (TE ETRX)

I completed my internship in Ashida Pvt.Ltd near thane railway station. Joining date was 16th November 2015. The duration of the whole internship was 6 months, I left the firm on 2 May 2016.

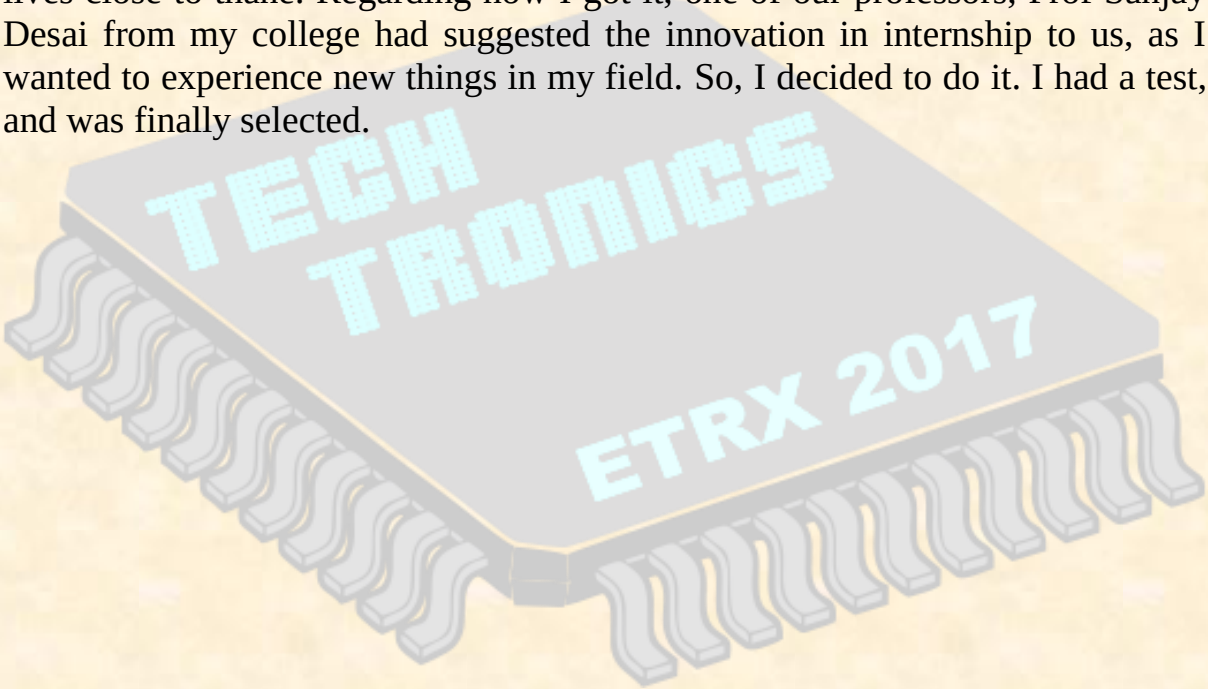
After meeting up with my mentor/project guide he briefed me about the projects I would be doing based on my interests. I was given a desk and a computer system of my own.

First things first, one needs to get a form signed by various departments inside the office like the infrastructure, library, HR office etc. The first week was very boring since all I was doing was reading research papers all day in the office, and forming some background on the work I was about to do. Also, I had to use Python, which I had never used before, so the first week went into getting the prerequisites completed. After that the interesting work started, I was able to complete the first project I was allotted in 1 week. It was an image processing based projects, I had to do a VIS classification of satellite images (multispectral images). My mentor was very helpful in completing it and also gave me a sense of satisfaction after the first week. Then my second project started, on which not much work had been done, all the research papers I found were not fully able to describe the solution to the application. I had to implement a SOAP based web service which followed OGC guidelines. After developing a basic web service, I realized that it would be impossible to make a full-fledged web service following the required guidelines within time, which is when I started looking for plugins that could do it for me, I came across one which would suit my need.

I wrote many processes inside that web service then made a web portal which used it and applied all its processes, my mentor to help me as best as he could but this was not his area of expertise, so most of the work came on me. One of these processes was my first project, hence my first project was immediately being used. The new things I learned was Python, machine learning algorithms, Web

Service and their communication methods, Image processing through Python, intensive Object -oriented programming, SQL (postgres) and database management.

Apart from the work I did, other things like the work environment was very nice. The office was well air conditioned, and was a beautiful building, from time to time there were activities like testing out a new app where they would conduct experiments with you, the mentors all seemed very knowledgeable and nice people, and most of them were very young. Office location although was pretty bad (very close to a garbage dump). There were no excursions or trips from their part, at the end I felt a little overworked, all of which was compensated by the awesome stipend they were paying. (6k per month). I would recommend this internship to anyone who has an interest in both research and development and lives close to thane. Regarding how I got it, one of our professors, Prof Sanjay Desai from my college had suggested the innovation in internship to us, as I wanted to experience new things in my field. So, I decided to do it. I had a test, and was finally selected.



Mr. Tanmay Kalal & Mr. Karan Bhadrike

Holography is a technique that enables a light field, which is generally the product of a light source scattered off objects, to be recorded and later reconstructed when the original light field is no longer present, due to the absence of the original objects.

Holography can be thought of as somewhat similar to sound recording, whereby a sound field created by vibrating matter like musical instruments or vocal cords, is encoded in such a way that it can be reproduced later, without the presence of the original vibrating matter.

Experience:

This internship was by far the most important thing I've done when it comes to my career. For the first time, I was able to experience the day-to-day newsroom environment and what it is like to produce regular content each day, and instead of feeling exhausted, I was inspired, excited and exhilarated. This internship definitely confirmed that this is exactly the kind of work I want to do.

Overall, I really enjoyed my internship. I enjoyed learning a lot about technology applications that will be advantageous in my future job search. Paired with a Indian cultural experience and travelling on the weekends, this internship was a great way gain work experience which will give a wonderful education abroad opportunity in future.

Poems & Quotes:

Broken!

He realised his life was at stake,
Sleepless nights, thinking about what was his mistake!
Sometimes he wished not to see tomorrow's rising sun,
What would they think watching him burn?
Sometimes he wondered what difference would it make,
Not to worry about anxiety, headache and heartbreak!
All he had were feelings of guilt and regret,
To his own self, he was a threat!
Social isolation, he thought it could help,
Anyway, none were there to hear him yelp.
'That's not even a thing! ‘people said,
Casually ignoring all the tears, he shed.
All they said was 'stop dramatizing and acting dumb',
Their mindset only made him numb.
To pour his heart out and be relieved he thought.
To get back his life, the last chance he sought.
Sadly, they wouldn't listen to his plight,
And instead would tell him, 'you are alright!'.
They didn't find his problems enough convincing,
Mental health issues were something beyond their thinking.
Physical pain was their only kind of pain,
Hurt was a feeling defined only by a bloodstain.
All his life, in a dark room he hid,
Trust me, it’s a life of a depressed kid.

By: Mrunal Dalvi (TE ETRX)

Quotes:

Flow Twisted Or Straight,
You Are Going To End Up In The Same State,
It's A Metter Of Choice And Fate,
You'd Better Pick The One That's Appropriate.

Life's A Long Untraveled Road.
And It's You Who Sets The Tarmac,
Smooth Or Rough.

Rise!
Rise Above Your Sorrow
Wipe Out The Grey
Think Not Of Tomorrow
Be One With Today.

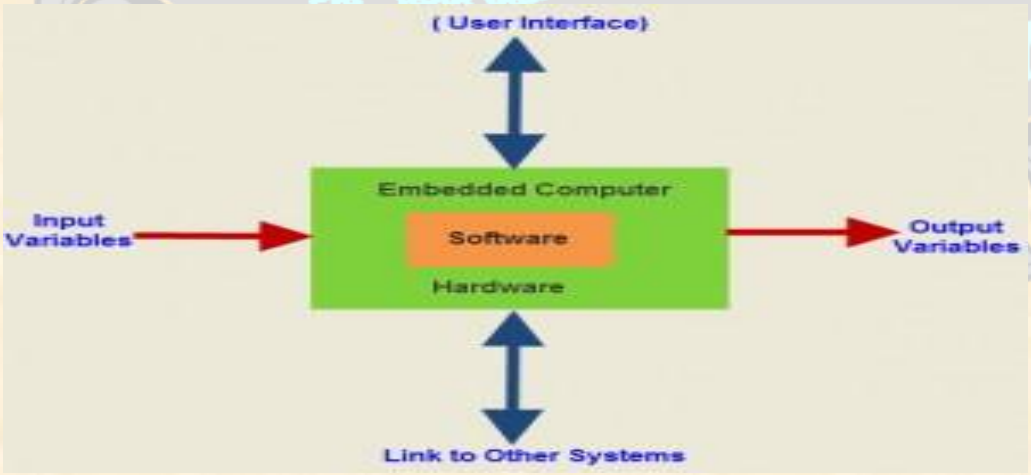
Everything is Meretricious Except Moral Values!

By: Krishndutt Shirodkar (SE ETRX)

A few Aricles:

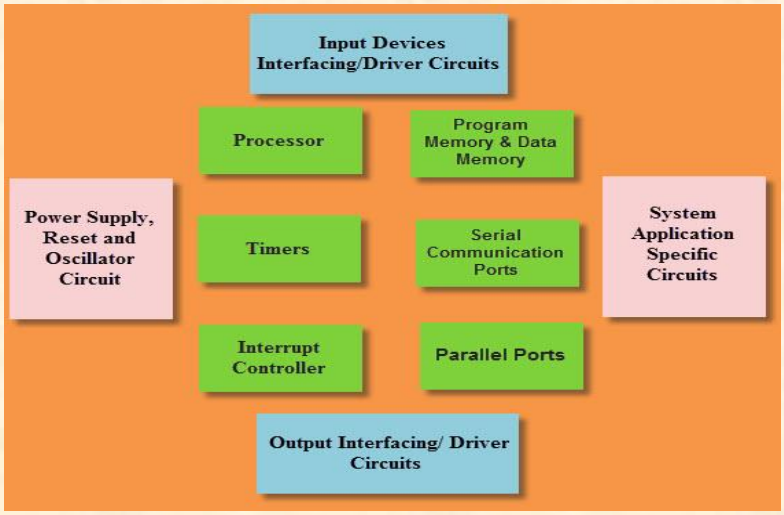
Embedded Systems

In our day-to-day life, we frequently use many electrical and electronic circuits and kits which are designed using embedded systems technology. The electrical and electronics engineering students and electronics and communications engineering students are required to design final year electronic projects to gain hands on experience with the real time embedded systems and also to fulfil the engineering graduation criteria. The engineering final year electronics projects are designed using embedded systems and applications. The computers, mobile phones, tablets, laptops, digital electronic systems, and other electrical and electronic gadgets are designed using embedded systems.



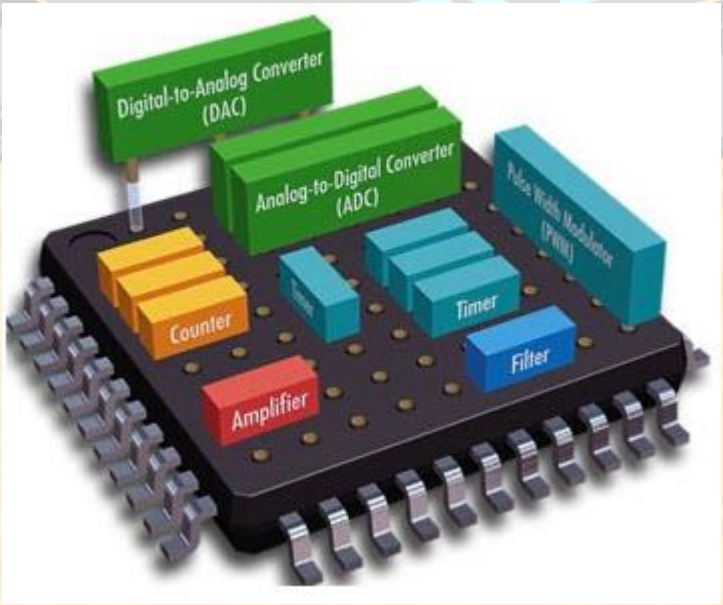
What is Embedded System?

The electronic system which integrates the hardware circuitry with the software programming techniques for providing project solutions is called as embedded systems. By using this embedded system technology the complexity of the circuits can be reduced to a great extent which further reduces the cost and size. Embedded system was primarily developed by Charles Stark for reducing the size and weight of the project circuitry.



An embedded system is basically an electronic system that can be programmed or non-programmed to operate, organize, and perform single or multiple tasks based on the application. In the real time embedded systems, all the assembled units work together based on the program or set of rules or code embedded into the microcontroller. But, by using this microcontroller programming techniques only a limited range of problems can be solved.

Embedded Systems Hardware:



Every electronic system consists of hardware circuitry, similarly, embedded system consists of hardware such as power supply kit, central processing unit, memory devices, timers, output circuits, serial communication ports, and system application specific circuit components & circuits.

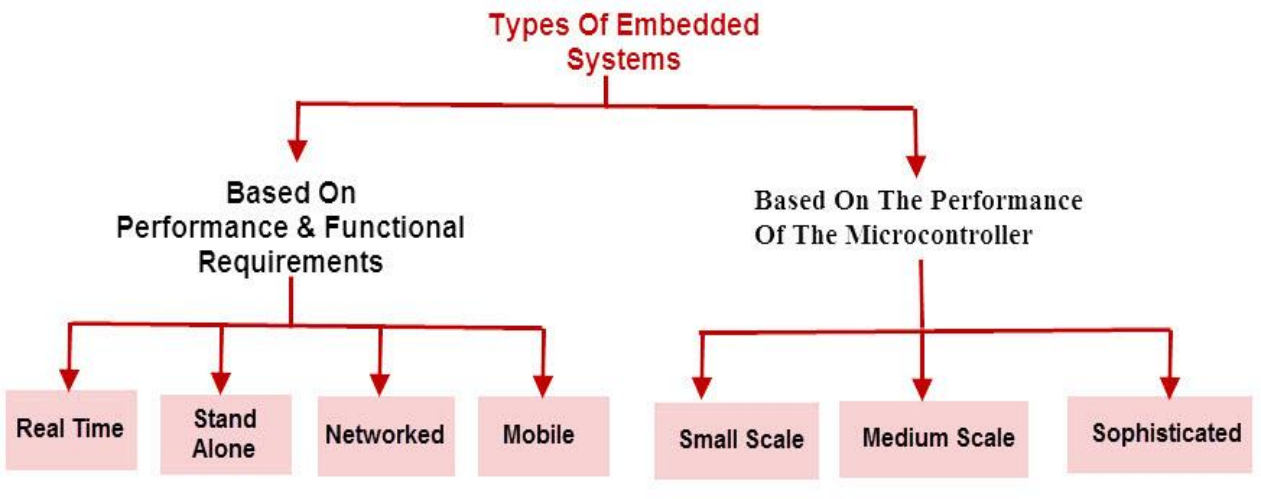
Embedded Systems Software:

Stream	Microprocessor Family	Source	CISC or RISC or Both Features
Stream 1	68HCxx	Motorola	CISC
Stream 2	80x86	Intel	CISC
Stream 3	SPARC	Sun	RISC
Stream 4	ARM	ARM	RISC with CISC functionality

Stream	Microcontroller Family	Source	CISC or RISC or Both Features
Stream 1	68HC11xx,HC12xx,HC16xx	Motorola	CISC
Stream 2	8051,8051MX	Intel, Philips	CISC
Stream 3	PIC 16F84 or 16C76,16F876 and PIC18	Microchip	CISC
Stream 4	Microcontroller Enhancements of CORTEX-M3 ARM9/ARM7 from Philips, Samsung and ST Microelectronics	ARM,Texas,Philips ,Samsung and ST Microelectronics etc	RISC Core with CISC functionality

An embedded system is integration of hardware and software, the software used in the embedded system is set of instructions which is termed as a program. The microprocessors or microcontrollers used in the hardware circuits of embedded systems are programmed to perform specific tasks by following the set of instructions. These programs are primarily written using any programming software like Proteus or Lab-view using any programming languages such as C or C++ or embedded C. Then, the program is dumped into the microprocessors or microcontrollers that are used in the embedded system circuits.

Embedded System Classification



Embedded systems are primarily classified into different types based on complexity of hardware & software and microcontroller (8 or 16 or 32-bit). Thus, based on the performance of the microcontroller, embedded systems are classified into three types such as:

- Small scale embedded systems
- Medium scale embedded systems
- Sophisticated embedded systems

Further, based on performance and functional requirements of the system embedded system classified into four types such as:

- Real time embedded systems
- Standalone embedded systems
- Networked embedded systems

Applications of Embedded Systems:

Embedded systems find numerous applications in various fields such as digital electronics, telecommunications, computing network, smart cards, satellite systems, military defence system equipment, research system equipment, and so on. Let us discuss a few practical applications of embedded systems that are used in designing embedded projects as a part of engineering final year electronics projects.

Know Your SOC

Since smartphones and tablets are basically smaller computers, they require pretty much the same components we see in desktops and laptops in order to offer us all the amazing things they can do (apps, music and video playing, 3D gaming support, advanced wireless features, etc.).

But smartphones and tablets do not offer the same amount of internal space as desktops and laptops for the various components needed such as the logic board, the processor, the RAM, the graphics card, and others. That means these internal parts need to be as small as possible, so that device manufacturers can use the remaining space to fit the device with a long-lasting battery life.

What are these?

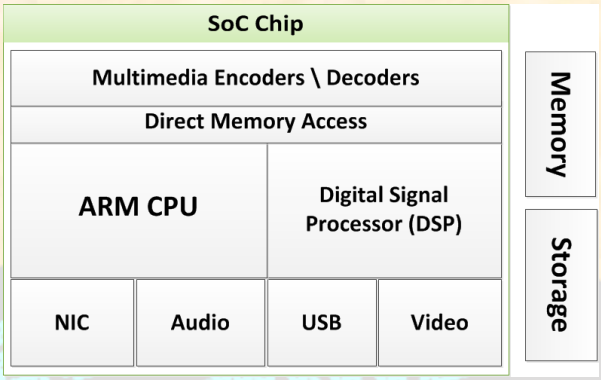
A SoC (System on Chip) is a collection of all kinds of components and subsystems that are appropriately interconnected to perform the specified functions for the end user. SoC refers the integrating all components into a single integrated chip. It may contain digital, analog, mixed-signal, and often radio-frequency functions—all on a single substrate.

A typical SoC consists of:

- A microcontroller, microprocessor or digital signal processor (DSP) core – multiprocessor SoCs (MPSoC) having more than one processor core
- Memory blocks including a selection of ROM, RAM, EEPROM and flash memory
- Timing sources including oscillators and phase-locked loops

- Peripherals including counter-timers, real-time timers and power-on reset generators
- External interfaces, including industry standards such as USB, FireWire, Ethernet
- Analog interfaces including ADCs and DACs (Analog to Digital and vice versa)
- Voltage regulators and power management circuits

SoC integrates a microcontroller (or microprocessor) with advanced peripherals like graphics processing unit (GPU), Wi-Fi module, or coprocessor. If the definition of a microcontroller is a system that integrates a microprocessor with peripheral circuits and memory, the SoC is to a microcontroller what a microcontroller is to processors, remembering that the SoC does not necessarily contain built-in memory.



Design and Architecture:

A system on chip architecture integrates several heterogeneous components on a single chip. A key challenge is to design the communication or integrated between the different entities of a SoC resulting in complexity.

A SoC consists of both the hardware, described above, and the software controlling the microcontroller, microprocessor or DSP cores, peripherals and interfaces. The design flow for a SoC aims to develop this hardware and software in parallel.

Most SoCs are developed from pre-qualified hardware blocks for the hardware elements described above, together with the software drivers that control their operation. Of particular importance are the protocol stacks that drive industry-standard interfaces like USB. The hardware blocks are put together using CAD tools; the software modules are integrated using a software-development environment

SoC Design Challenges:

- Smaller device geometries
- Higher density integration
- Low power requirement
- Higher frequencies
- Design complexity
- Verification at different levels
- Time-to-market pressure

Manufacturing

The SoC chips use a surface mount technology known as ball grid array. The SoC chips are lined with tiny interconnection pins on both the top and bottom. The manufacturers then solder the lower ones to connect the SoC to the board, and use the ones on the top to connect memory packages. This gives them more flexibility, as they can use the memory from different vendors. For example, some RPi boards have memory from Hynix and others from Samsung.

Advantages

A SoC consumes less power. Usually 90% of power consumption is in data and bus address cabling. Since all the components are on the same chip and internally connected, and their size is also very small, the power consumption is hugely decreased. A smaller size means it is lightweight and of small size. Overall, the cost of an SoC is small due to advancements in VLSI technology. As mentioned in the first point, cabling is not much required and so the cost of cabling is conserved. An SoC provides greater design security at hardware and firmware levels. An SoC provides faster execution due to high speed processor and memory.

Applications

- Speech signal processing
- Image and video signal processing
- Information technology
- Data communication
- Very common in the mobile computing market because of their low power-consumption.
- A typical application is in the area of embedded systems.
- Smart home applications

Smartphones

When buying smartphones and tablets, we often talk about their processing power, and make a big fuss of their speed, and whether they can offer single-, dual-, or multiple-core capabilities. And while we do focus on the processor most of the time, you'll have to know that things aren't as simple as that. Instead of just simple processors, we have Systems on a Chip (SoC) inside these devices that offer more complex functionality.

Thanks to the wonders of miniaturization, SoC manufacturers, like Qualcomm, Nvidia or Texas Instruments, can place some of those components on a single chip, the System on a Chip that powers your beloved smartphone.

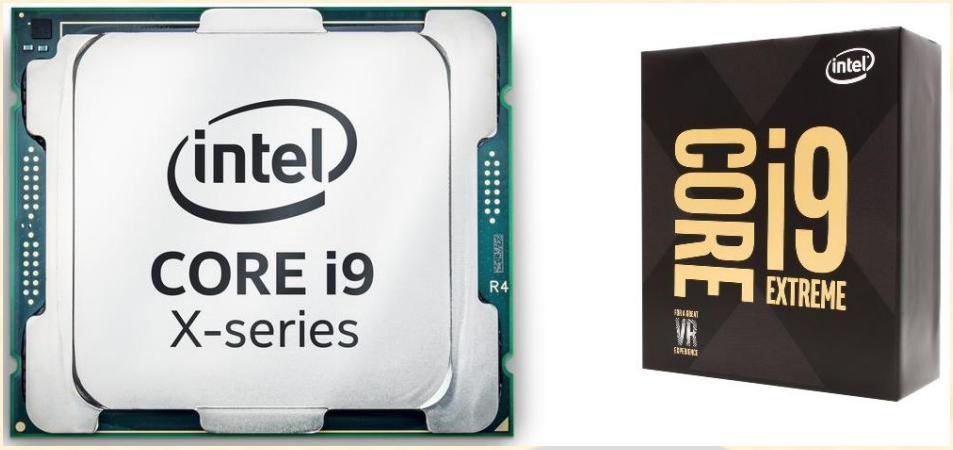
Here's the short list of significant SoC manufacturers in the smartphone industry

- **Qualcomm**

Qualcomm is one of the biggest players in the SoC market, and their designs are in many of the leading Android devices. All of the current Qualcomm SoCs are sold under the Snapdragon brand, and there are multiple performance segments.
Current flagship: Snapdragon 835 featured in Samsung S8 and OnePlus 5

- **Apple**
  Apple is next in the list, though really the top two positions are hotly contended and many would place them first. Either way, Apple needs little in the way of introduction. Apple also has the advantage of running their own software with iOS, which potentially gives them an advantage over other companies that utilize Android.
  Current flagship: A10X Fusion featured in iPad Pro 2017
- **Samsung**
  Samsung comes next in our hierarchy, and they've long been a player in the SoC market, going back as far as the early 2000s with some of their chips; they were also the SoC provider for the original iPhone in 2007. Their current SoC designs belong to the Exynos family, which has been around since 2011.
  Current flagship: Exynos 8895 featured in Samsung S8
- **Intel**
  Unlike everyone else on this list of SoC manufacturers, Intel is using their own custom architecture running the x86 instruction set instead of ARMv7 or ARMv8. Where x86 has proven to be a juggernaut in the PC space, in the mobile world where every device gets a customized software build it has not been nearly as useful – and some might even call it a handicap, though these days the difficulty of decoding x86 is relatively small. Intel has been trying to stake a claim in the mobile sector, and after a few initial forays that didn't accomplish much, their latest Atom SoCs have seen a moderate amount of use.
- **MediaTek**
  Moving over to the budget players MediaTek has been around for a while now, though like most SoC companies they didn't really get into the ARM and Android space until 2009/2010. Starting in 2013, however, MediaTek managed a ton of design wins but all of the wins are almost exclusively in lower performance, second tier parts.
- **Nvidia**
  Given the growing popularity of tablets and smartphones, there's little surprise that NVIDIA is also working to gain (and maintain) a foothold in the mobile sector. Their latest SoC found in the SHIELD Tablet.

Intel® Core™ i9



Intel's Core i9 processor is what happens when Intel begins to worry that it might not have the worst chip on the block. On May 30 at Computex, Intel formally announced the Core i9 high-end chips for PC enthusiasts.

At the high end, it's quite simple: The Core i9 family consists of what's known as the Skylake-X architecture, with processors that include 10, 12, 14, and 16 cores. The company revealed the clock speeds, TDP power estimates, and ship dates for its four most powerful Core i9 chips: the 12-core Core i9-7920X, the 14-core Core i9-7940X, the 16-core Core i9-7960X, and the 18-core Core i9-7980XE

UNLOCKED INTEL® CORE™ X-SERIES PROCESSOR FAMILY

Processor number[1]	Base clock speed (GHz)	Intel® Turbo Boost Technology 2.0 frequency[2] (GHz)	Intel® Turbo Boost Max Technology 3.0 Freqency[3] (GHz)	Cores/ threads	L3 cache	PCI express 3.0 lanes	Memory support	TDP	Socket (LGA)	RCP Pricing (1K USD)
i9-7980XE NEW	2.6	4.2	4.4	18/36	24.75 MB	44	Four channels DDR4-2666	165W	2066	$1,999
i9-7960X NEW	2.8	4.2	4.4	16/32	22 MB	44	Four channels DDR4-2666	165W	2066	$1,699
i9-7940X NEW	3.1	4.3	4.4	14/28	19.25 MB	44	Four channels DDR4-2666	165W	2066	$1,399
i9-7920X NEW	2.9	4.3	4.4	12/24	16.5 MB	44	Four channels DDR4-2666	140W	2066	$1,199
i9-7900X NEW	3.3	4.3	4.5	10/20	13.75 MB	44	Four channels DDR4-2666	140W	2066	$999
i7-7820X NEW	3.6	4.3	4.5	8/16	11 MB	28	Four channels DDR4-2666	140W	2066	$599
i7-7800X NEW	3.5	4.0	NA	6/12	8.25 MB	28	Four channels DDR4-2400	140W	2066	$389
i7-7740X NEW	4.3	4.5	NA	4/8	8 MB	16	Two channels DDR4-2666	112W	2066	$339
i5-7640X NEW	4.0	4.2	NA	4/4	6 MB	16	Two channels DDR4-2666	112W	2066	$242

1. Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See intel.com/products/processor_number for details.
2. Refers to the maximum dual-core frequency that can be achieved with Intel® Turbo Boost Technology 2.0.
3. Refers to the maximum dual-core frequency that can be achieved with Intel® Turbo Boost Max Technology 3.0

Availabilty:

Preorders for the Core i7 X-series chips and the 10-core Core i9 7900X began in the week of June 20. The 12-core Core i9-7920X launched on Aug 28 while the 14-, 16-, and 18-core Core i9 chips will ship by Sept 25. The 12-core Core i9-7920X launches August 28, while the 14-, 16-, and 18-core Core i9 chips ship on September 25.

Cost:

As you might guess from the prices, these chips aren't for everyone. You don't remotely need 18 cores and 36 threads unless you're doing resource-intensive multitasking, such as video or gaming. The least-expensive Core i9 chip will be the Core i5-7640X, at $242. The Core i7 chips will range from $339 to $599. The Core i9 chips will be priced from $999 to $1699. The most expensive will be the Extreme Edition (Core i9-7980XE) for $1,999.

Core i9 Extreme Edition:

- Core i9-7980XE: (2.6GHz, 4.4GHz burst) 18 cores/36 threads, $1,999

Core i9:

- Core i9-7960X: (2.8GHz, 4.4GHz burst) 16 cores/32 threads, $1,699
- Core i9-7940X: (3.1GHz, 4.4GHz burst) 14 cores/28 threads, $1,399
- Core i9-7920X: (3.1GHz, 4.4GHz burst) 12 cores/24 threads, $1,199
- Core i9-7900X: (3.3GHz, 4.5GHz burst) 10 cores/20 threads, $999

Core i7:

- Core i7 7820X (3.6GHz, 4.5GHz burst), 8 cores/16 threads, $599
- Core i7-7800X (3.5GHz, 4.0GHz burst), 6 cores/12 threads, $389
- Core i7-7740X (4.3GHz, 4.5GHz burst), 4 cores/8 threads, $339

Core i5:

- Core i5-7640X (4.0GHz, 4.2GHz burst), 4 cores, 4 threads, $242

Where does Core i9 fit into the Intel Core family?

Core i9 is Intel's fifth PC processor family, starting with the Core m and moving up through the traditional Core i3, i5, and i7 chips to Core i9. As the numerical sequencing suggests, Core i9 represents Intel's most prestigious chip family, offering the best performance at the highest price.

It's not exactly clear what makes a chip a Core i9. The lowest-end Core i9-7900X, for example, shares the same number of cores as the previous 10-core Core i7-6950X. Still, if you are looking to buy or build today and want the fastest Intel must offer, Core i9 is probably the easiest way to tell.

Core i9 succeeds Broadwell-E as Intel's supreme, enthusiast desktop chip family. At the top of the heap sits Core i9 Extreme Edition, part of the Core i9 family, but a supercharged subset of its own. Right now, it's just a single chip, the Core i9 Extreme Edition i9-7980XE.

New Motherboard!

Yes. All Core i9 CPUs will use a new Socket R4, a 2,066-pin LGA socket that will require a brand-new motherboard. Intel's Core i9 family is not backward-compatible with existing Skylake or Kaby Lake motherboards.

Remember that for now, every Core i9 motherboard you'll buy is based on the Socket R4, a 2,066-pin LGA socket that's incompatible with some of the older Core i5 and Core i7 microprocessors. (The Core i5-7640X, Core i7-7740X, Core i7-7800X, and Core i7-7820X all use the new 2,066-pin socket, too.) All of the new motherboards are based on Intel's X299 chipset, the only chipset for the Intel Core i9 right now.

New features:

In addition to just the raw performance, the Core i9 family includes something new:

In its earlier Broadwell-E chips, Intel included something called Turbo Boost Max Technology 3.0, which identified one "best core" among all the available cores on a chip. If and when the chip needed to be boosted, that best core would be the one selected to be dynamically overclocked. The new feature within most of the Core i9 chips is what Intel calls an updated Intel Turbo Boost Max Technology 3.0, where the chip identifies not just one, but two cores as the best cores.

While the Core i9 can turn this feature on when needed, it will be used to best advantage when playing games with multiple threads, or performing simultaneous tasks like game streaming and music playback. This feature is not available in the lower-end Core i9 chips, though—only from the Core i7 7820X (8 cores, 16 threads), on up through the 7900X, 7920X, 7940X, 7960X, and 7980XE.

INTEL® CORE™ X-SERIES GENERATIONAL PLATFORM COMPARISON

Brand	New Intel® Core™ X-Series Processor/ Intel® X299 Chipset		Intel® Core™ X-Series Processor/ Intel® X99 Chipset	Intel® Core™ X-Series Processor/ Intel® X99 Chipset
Processor family (year)	Basin Falls X-series 2017		BDW-E 2016	HSW-E 2014
CPU cores	Up to 12 cores		10, 8, and 6	8 and 6
Intel® Turbo Boost Max Technology 3.0	Yes[1]		Yes	No
Shared cache	Up to 13.75 MB[2]		Up to 25 MB	Up to 20 MB
PCIe* 3.0 lanes off of processor	Up to 44[1]		Up to 40 (6800K has 28)[3]	Up to 40 (6800K has 28)[3]
Discrete GFX configurations	2x16/4x8[3] of gen. 3 on processor	1x16/2x8 of gen. 3 on processor	2x16/4x8[3] of gen. 3 on processor	2x16/4x8[3] of gen. 3 on processor
Memory	Up to Four-channel DDR4 2666[1]		Four-channel DDR4 2400	Four-channel DDR4 2133
TDP	140W	112W	140W	140W
Socket	LGA 2066		LGA 2011-v3	LGA 2011-v3
Unlocked	Yes		Yes	Yes

Not everything new about Core i9 is found within the chip itself. The related X299 chipset provides up to 24 PCI Express 3.0 lanes vs. the 8 PCIe lanes of Broadwell-E's X99 chipset—important if you want to power your Core i9 system with multiple graphics cards. Additional PCIe lanes for high-speed PCIe NVMe

drives can also be plumbed directly into the PCIe coming from the CPU itself. On CPUs with 10 cores and up, a full 44 lanes of PCIe 3.0 lanes are available for use.

All this enables a range of options: Do you want to run four x8 graphics cards in a single Intel-powered PC? If so, you'll want a Core i9 system.

The X299 chipset supports up to eight SATA 3.0 ports and 10 USB 3.0 ports. Finally, owning a Core i9 with an X299 motherboard means you'll have access to Optane, Intel's caching drive technology that can accelerate frequently used data.

Overclocking Options:

Intel's Core i9 is tailor-made for overclocking, as the entire family comes unlocked. Intel doesn't recommend that you cool a Core i9 chip with air alone, though, so a straight fan-based solution is out. Instead, Intel recommends its own TS13X liquid-cooling solution, which will be sold separately. You can also buy your own third-party cooling solutions, as long as it's rated for the TS13X.

The TS13X uses a solution of propylene glycol to pump the heat to a 73.84-CFM fan that generates between 21 and 35 dBA, rotating between 800rpm and 2,200rpm. The TS13X will cost from $85 to $100.

Intel will maintain support for per-core overclocking and per-core voltage adjustments, using its own Intel Extreme Tuning Utility (XTU). New controllable features for overclocking include AVX 512 ratio offsets, trim voltage control of the memory control, and PEG/DMI overclocking.

Intel will also offer what it calls its “performance tuning protection plan,” a sort of insurance policy for overclockers. It’s a one-strike policy: The company will let you fry your chip once, just once, and send you a replacement.

AMD (Advanced Micro Devices)

Advanced Micro Devices, Inc. (AMD) is an American multinational semiconductor company based in Sunnyvale, California, United States, that develops computer processors and related technologies for business and consumer markets. While initially it manufactured its own processors, the company later outsourced its manufacturing, a practice known as fabless, after Global Foundries was spun off in 2009. AMD's main products include microprocessors, motherboard chipsets, embedded processors and graphics processors for servers, workstations and personal computers, and embedded systems applications.

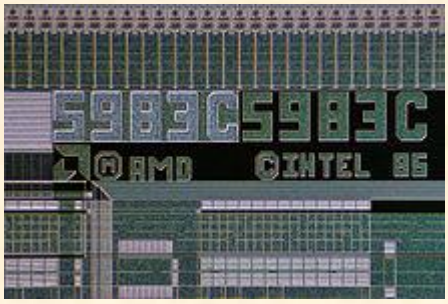
AMD Headquarters (Sunnyvale, California)

Advanced Micro Devices was formally incorporated on May 1, 1969, by Jerry Sanders, along with seven of his colleagues from Fairchild Semiconductor. Sanders, an electrical engineer who was the director of marketing at Fairchild, had like many Fairchild executives, grown frustrated with the increasing lack of support, opportunity, and flexibility within that company, and decided to leave to start his own semiconductor company. The previous year Robert Noyce, who had invented the first practical integrated circuit or the microchip in 1959 at Fairchild, had left Fairchild together with Gordon Moore and founded the semiconductor company Intel in July 1968.

Litigation with Intel:

AMD has a long history of litigation with former partner and x86 creator Intel.

- In 1986, Intel broke an agreement it had with AMD to allow them to produce Intel's micro-chips for IBM; AMD filed for arbitration in 1987 and the arbitrator decided in AMD's favor in 1992. Intel disputed this, and the case ended up in the Supreme Court of California. In 1994, that court upheld the arbitrator's decision and awarded damages for breach of contract.



AMD processor with Intel logo

- In 1990, Intel brought a copyright infringement action alleging illegal use of its 287 microcode. The case ended in 1994 with a jury finding for AMD and its right to use Intel's microcode in its microprocessors through the 486 generation.
- In 1997, Intel filed suit against AMD and Cyrix Corp. for misuse of the term MMX. AMD and Intel settled, with AMD acknowledging MMX as a trademark owned by Intel, and with Intel granting AMD rights to market the AMD K6 MMX processor.

- In 2005, following an investigation, the Japan Federal Trade Commission found Intel guilty on a number of violations. On June 27, 2005, AMD won an antitrust suit against Intel in Japan, and on the same day, AMD filed a broad antitrust complaint against Intel in the U.S. Federal District Court in Delaware. The complaint alleges systematic use of secret rebates, special discounts, threats, and other means used by Intel to lock AMD processors out of the global market. Since the start of this action, the court has issued subpoenas to major computer manufacturers including Acer, Dell, Lenovo, HP and Toshiba.
- In November 2009, Intel agreed to pay AMD $1.25bn and renew a five-year patent cross-licensing agreement as part of a deal to settle all outstanding legal disputes between them.

Production and fabrication:

Previously, AMD produced its chips at company owned semiconductor foundries. AMD pursued a strategy of collaboration with other semiconductor manufacturers IBM and Motorola to co-develop production technologies. AMD's founder Jerry Sanders termed this the "Virtual Gorilla" strategy to compete with Intel's significantly greater investments in fabrication.

In 2008 AMD spun off its chip foundries into an independent company named Global Foundries. This break-up of the company was attributed to the increasing costs of each process node. The Emirate of Abu Dhabi purchased the newly created company through its subsidiary Advanced Technology Investment Company (ATIC), purchasing the final stake from AMD in 2009.

Semi-Custom and Game Console Products:

In 2012, AMD's then CEO Rory Read began a program to offer semi-custom designs. Rather than AMD simply designing and offering a single product, potential customers could work with AMD to design a custom chip based on AMD's intellectual property. Customers pay a non-recurring engineering fees for design and development, and a purchase price for the resulting semi-custom products. In particular, AMD noted their unique position of offering both x86 and

graphics intellectual property. These semi-custom designs would have design wins as the APUs in the PlayStation 4 and Xbox One and the subsequent PlayStation 4 Pro, Xbox One S, and Xbox One X. Financially, these semi-custom products would represent a majority of the company's revenue in 2016.

CPU Technologies

As of 2017 technologies found in AMD CPU/APU products include:

Hyper Transport - a high-bandwidth, low-latency system bus used in AMD's CPU and APU products

Infinity Fabric - a derivative of Hyper Transport used as the communication bus in AMD's Zen microarchitecture

Graphics Technologies

As of 2017 technologies found in AMD GPU products include:

AMD Eyefinity – facilitates multi-monitor setup of up to 6 monitors per graphics card.

AMD FreeSync – display synchronization based on the VESA Adaptive Sync standard.

AMD TrueAudio – acceleration of audio calculations.

AMD XConnect – allows the use of External GPU enclosures through Thunderbolt 3.

AMD CrossFire - multi-GPU technology allowing the simultaneous use of multiple GPUs.

Unified Video Decoder (UVD) – acceleration of video decoding.

Video Coding Engine (VCE) – acceleration of video encoding.

Zen (microarchitecture):

Zen is the codename for a computer processor microarchitecture from AMD, and was first used with their Ryzen series of CPUs in February 2017. The first Zen based preview system was demonstrated at E3 2016, and first substantially detailed at an event hosted a block away from the Intel Developer Forum 2016. The first Zen-based CPUs codenamed "Summit Ridge" reached the market in early March 2017, Zen-

derived Epyc server processors launched in June 2017 and Zen-based APUs are expected to follow in the second half of 2017.

Zen is a clean sheet design that differs from the long-standing Bulldozer architecture. Zen-based processors use a 14 nm FinFET process, are reportedly more energy efficient, and can execute significantly more instructions per cycle. SMT has been introduced, allowing each core to run 2 threads. The cache system has also been redesigned, making the L1 cache write-back. Additionally, Zen based processors utilize the AM4 socket, bringing DDR4 support.

Zen is based on a SoC design. The memory, PCIe, SATA, and USB controllers are incorporated into the same chip as the processor cores. This has advantages in bandwidth and power, at the expense of chip complexity and die area. This SoC design will allow the Zen microarchitecture to scale from laptops and small-form factor mini PCs to high-end desktops and servers.

Guinness World Record Achievement:

On August 31, 2011, in Austin, Texas, AMD achieved a Guinness World Record for the "Highest frequency of a computer processor": 8.429 GHz. The company ran an 8-core FX-8150 processor with only one active module (two cores), and cooled with liquid helium. The previous record was 8.308 GHz, with an Intel Celeron 352 (one core).

On November 1, 2011, geek.com reported that Andre Yang, an overclocker from Taiwan, used an FX-8150 to set another record: 8.461 GHz.

On November 19, 2012, Andre Yang used an FX-8350 to set another record yet again: 8.794 GHz.

BITCOIN

What is BITCOIN?

The inventor of Bitcoin, Satoshi Nakamoto, described Bitcoin as "A Peer-to-Peer Electronic Cash System". Bitcoin is a consensus network that enables a new payment system and a completely digital money. It is the first decentralized peer-to-peer payment network that is powered by its users with no central authority or middlemen. From a user perspective, Bitcoin is perhaps best described as 'cash for the Internet', but Bitcoin can also be seen as the most prominent triple entry bookkeeping system in existence. It is also known as digital cash, cryptocurrency, an international payment network, the internet of money – but whatever you call it, Bitcoin is a revolution that is changing the way everyone sees and uses money.

Why BITCOIN?

The beauty of Bitcoin is that it requires no central servers or third-party clearing houses to settle transactions – all payments are peer-to-peer (P2P) and are settled in about 10 minutes – unlike credit card payments, which can take weeks or months before they're finally settled. All Bitcoin transactions are recorded permanently on a distributed ledger called the "blockchain" – this ledger is shared between all full Bitcoin "miners" and "nodes" around the world, and is publicly-viewable. These miners and nodes verify transactions and keep the network secure. For the electricity, they use to do this, miners are rewarded with new bitcoins with each 10-minute block (the reward is currently 12.5 BTC per block).

History of Bitcoin:

The original Bitcoin code was designed, written, and deployed by Satoshi Nakamoto under the MIT open source license. In 2008, Nakamoto outlined the idea behind Bitcoin in the Bitcoin white paper entitled Bitcoin: A Peer-to-Peer Electronic Cash System, which scientifically described how the crypto-currency would operate.

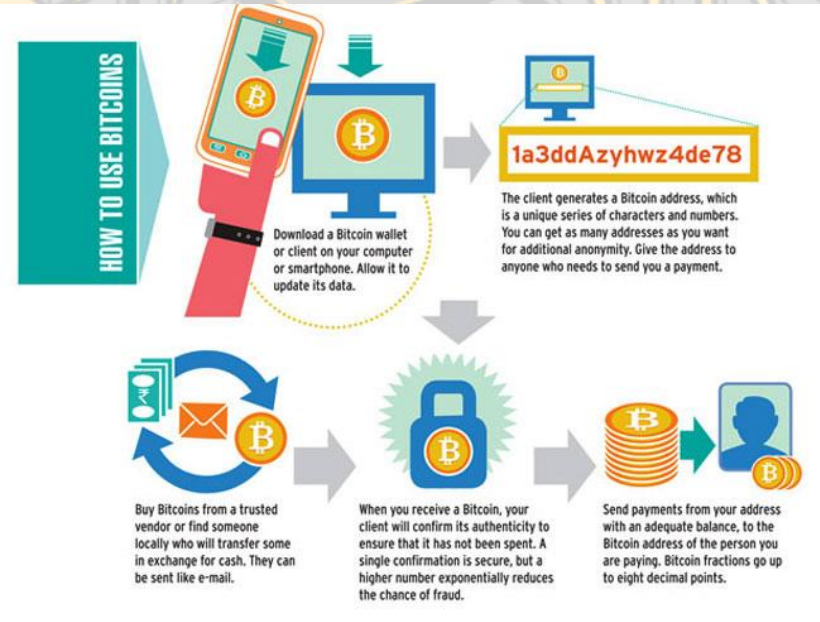
It's important to note that Bitcoin wasn't the first attempt at digital money in history. In the 1990's several people and groups tried to create their own forms of 'e-cash'. Each failed though as they weren't implemented successfully or ended up centralized. It wasn't until Nakamoto put all the pieces of the puzzle together using what his predecessors tried to build in order to create the Bitcoin protocol. Satoshi Nakamoto left the Bitcoin code in the hands of developers and the community in 2010 to continue on and make Bitcoin successful. Thus far hundreds of developers have added to the base code throughout the years making it a robust, open and secure network.

How is bitcoin different from bitcoin cash?

Bitcoin Cash was created as an answer to the years-long debate among the Bitcoin community regarding the best way to scale Bitcoin to more users. The simplest solution, and the one adopted by Bitcoin Cash, is to increase the **Max Blocksize Limit** parameter of the Bitcoin codebase. While Bitcoin's block size limit remains at one megabyte (allowing for ~250,000 transactions per day), Bitcoin Cash has increased the limit to 8MB, allowing for around two million transactions to be processed per day.

As far as the users of Bitcoin/Bitcoin Cash are concerned there is very little noticeable difference on the frontend when using either currency. The main difference between these coins is the fact that, given equal hashrate, BCC protocol allows for more transactions per second which translates to faster payments and lower fees.

Getting started with Bitcoin:



Step 1: Download a Bitcoin Wallet: A Bitcoin wallet is an app or program that allows you send and receive bitcoin. Wallets also keep track of your bitcoin balance which is held in one or more bitcoin addresses. Generally, wallets also have a feature that keeps a history of your bitcoin transactions.

Step 2: Add Bitcoin to Your Wallet: Now that you have a wallet, you probably want to add some bitcoin to your balance. Have your Bitcoin wallet address ready and visit the buy Bitcoin page. Here, you will be able to easily purchase Bitcoin with a credit card. Another option is to choose a Bitcoin Exchange where you can quickly set up an account and buy bitcoins with funds from a bank account or credit card.

Step 3: Using a Bitcoin Wallet to Send and Receive Bitcoin: Receiving bitcoin is as easy as giving the sender your public address. Sending bitcoin requires a few more steps and since bitcoin transactions are irreversible, it is important to pay attention when sending. Overall, the process for sending bitcoin is actually quite easy.

Cons of Bitcoin:

1.**Bitcoins Are Not Widely Accepted:** Bitcoins are still only accepted by a very small group of online merchants. This makes it unfeasible to completely rely on Bitcoins as a currency.

2. **Wallets Can Be Lost**: If a hard drive crashes, or a virus corrupts data, and the wallet file is corrupted, Bitcoins have essentially been "lost". There is nothing that can done to recover it. These coins will be forever orphaned in the system. This can bankrupt a wealthy Bitcoin investor within seconds with no way form of recovery.

3. **No Buyer Protection:** When goods are bought using Bitcoins, and the seller doesn't send the promised goods, nothing can be done to reverse the transaction. This problem can be solved using a third-party escrow service like ClearCoin, but then, escrow services would assume the role of banks, which would cause Bitcoins to be similar to a more traditional currency.

4. **Risk of Unknown Technical Flaws:** The Bitcoin system could contain unexploited flaws. As this is a fairly new system, if Bitcoins were adopted widely, and a flaw was found, it could give tremendous wealth to the exploiter at the expense of destroying the Bitcoin economy.

Summary:

Bitcoin is still a cutting-edge experiment in technology and economics, and like the worldwide web in 1995, its myriad potential, purposes and applications are yet to be decided. Is it just electronic money? A foundation for smart contracts and electronic shares? Is it underground and subversive, challenging the power of governments, or will it integrate into mainstream finance and go unnoticed? If you know the answers to any of these questions, or if you can figure out how to capitalize on them there may be many lucrative opportunities for you in the Bitcoin space.

The Bitcoin universe is changing fast and often – to stay ahead of the game it's necessary to follow the news almost-hourly and discuss the latest events with other members of the community.

Career Prospects:

Having a further look at the career prospects, there is bound to be huge demand for competent engineers in electronic industry to cope this demand in technology. The engineers would be involved in sustaining cutting edge technology to stay ahead in competition.

(1) An electronic engineer can find a job in Consumer electronics manufacturing organization, Telecommunication & IT industries, Health care equipment manufacturing, Mobile communication (2G,3G,4G), Internet technologies, Power Electronics, and other industries like steel, petroleum and chemical industry, directing control and testing production process.

(2) Electrical Technicians and technologists can specialize in technical sales, product representation, systems management, the design and manufacture of electronic devices and systems, or the installation, maintenance and repair of electronic systems and equipment.

(3) They may also work with computers and electronic equipment in the medical, manufacturing, industrial control, telecommunications, aeronautical and military fields.

(4) EE also have several jobs openings & good pay-packages as compared to other branches.

(5) Electronics engineers are acquired by top recruiters (both private and government) like DMRC, Siemens, Motorola, Intel, Texas Instruments, BEL, ISRO, DRDO, Accenture, Wipro, HCL Technologies, NVidia, Samsung, Tech Mahindra, Infosys, TCS, Conexant, MTNL, AIR, BSNL, Indian Air force, Indian Navy, Railways, Bharat Electronics Ltd and Flextronics and Philips Electronics

What points should be kept in mind to build an effective organization?

Following principles should be kept in mind to build an effective organization:

- Clear separation of the various functions of business should be established to avoid overlap or conflict in the accomplishment of tasks or in the issuance or reception of orders.
- Each managerial position should have a definite location within the organization, with a written job specification.
- There should be a clear distinction between line and staff operation and control.
- A clear understanding of the authority under each position should prevail.
- Selection of all personnel should be based on unbiased techniques.
- A recognized line of authority should prevail from the top of the organization to the bottom, with an equally clear line of responsibility from the bottom to the top.

IoT Predictions, Trends, and Market:

BI Intelligence, Business Insider's premium research service, expects there will be more than 24 billion IoT devices on Earth by 2020. That's approximately four devices for every human being on the planet.

And as we approach that point, $6 billion will flow into IoT solutions, including application development, device hardware, system integration, data storage, security, and connectivity. But that will be money well spent, as those investments will generate $13 trillion by 2025.

Who will reap these benefits? There are three major entities that will use IoT ecosystems: consumers, governments, and businesses. For more detail, see the Industries section below.

IoT Industries:

Several environments within the three groups of consumers, governments, and ecosystems will benefit from the IoT. These include:

- Manufacturing
- Transportation
- Defence
- Agriculture
- Infrastructure
- Retail
- Logistics
- Banks
- Oil, gas, and mining
- Insurance
- Connected Home
- Food Services
- Utilities
- Hospitality
- Healthcare
- Smart Buildings

IoT Companies:

There are literally hundreds of companies linked to the Internet of Things, and the list should only expand in the coming years. Here are some of the major players that have stood out in the IoT to this point:

- Honeywell (HON)
- Hitachi
- T-Mobile (TMUS)
- Comcast (CMCSA)
- GE (GE)
- AT&T (T)
- Cisco (CSCO)
- IBM (IBM)
- Amazon (AMZN)
- Skyworks (SWKS)
- Apple (AAPL)
- Sierra Wireless (SWIR)
- Google (GOOGL)
- Iridium Communications (IRDM)
- Ambarella (AMBA)
- ARM Holdings (ARMH)
- Texas Instruments (TXN)
- PTC (PTC)
- Fitbit (FIT)
- ORBCOMM (ORBC)
- Garmin (GRMN)
- Blackrock (BLK)
- InvenSense (INVN)
- Microsoft (MSFT)
- Control4 (CTRL)
- Silicon Laboratories (SLAB)
- CalAmp (CAMP)
- LogMeIn (LOGM)
- InterDigital (IDCC)
- Ruckus Wireless (RKUS)

- Linear Technology (LLTC)
- Red Hat (RHT)
- Nimble Storage (NMBL)
- Silver Spring Networks (SSNI)
- Zebra Technologies (ZBRA)
- Arrow Electronics (ARW)

IoT Platforms:

One IoT device connects to another to transmit information using Internet transfer protocols. IoT platforms serve as the bridge between the devices' sensors and the data networks.

The following are some of the top IoT platforms on the market today:

- Amazon Web Services
- Microsoft Azure
- ThingWorx IoT Platform
- IBM's Watson
- Cisco IoT Cloud Connect
- Salesforce IoT Cloud
- Oracle Integrated Cloud
- GE Predix

How do you see the convergence of software and electronics? (= how the introduction of hyper convergence would simplify things that the world otherwise thought was complicated.)

At CIO 100 2017, Sunil Mahale, VP and MD of Nutanix, sheds light on the concept of hyper convergence and how its introduction would simplify things for the enterprise. The main objective of introducing an entirely new idea of hyper convergence was to simplify things that were thought to be complicated. Nutanix offered its hybrid solution to Wipro which benefitted them in many ways. Wipro, a company that firmly believes in crowd sourcing, has been doing quite a few

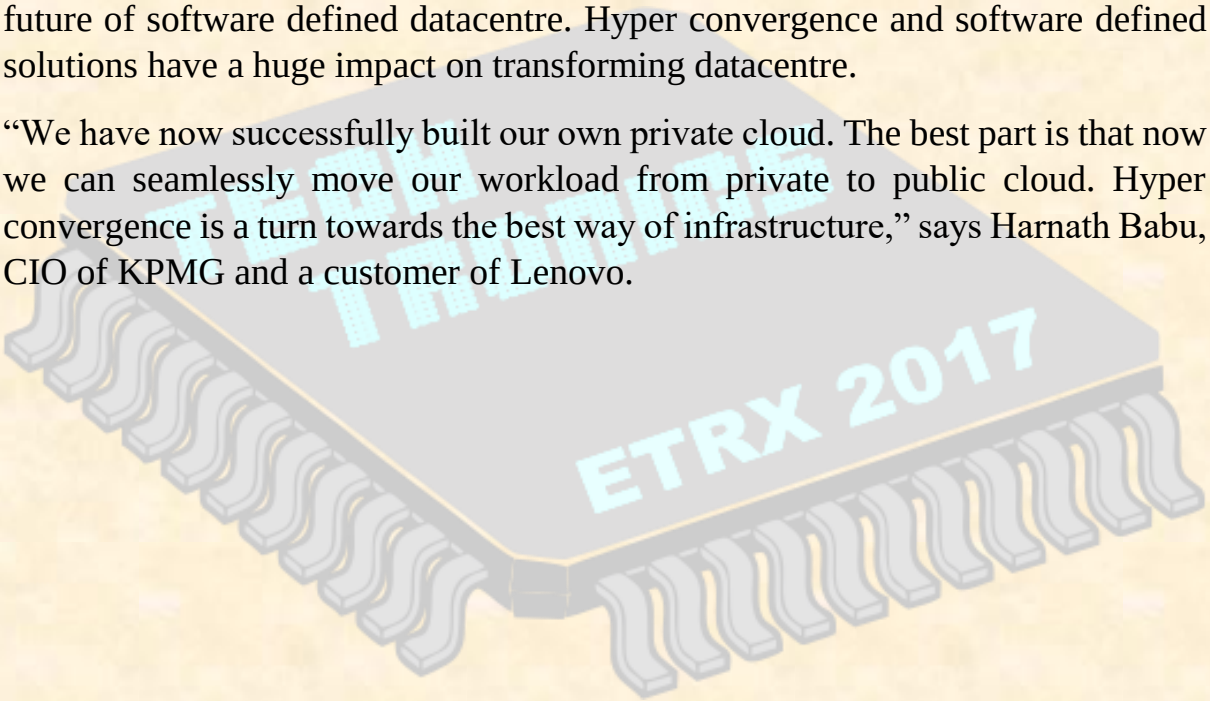
outsourcings. It had both their employees and outsiders contributing to the company's business.

“We wanted an underlying infrastructure that was quick to assemble, easy to maintain and the flexibility to scale up with a high degree of availability. The second thing we wanted was a fixed cost per seat”, says Raja Ukil, senior VP and CIO of Wipro. “Therefore, we started looking at something that was hyper converged and can be managed very easily.”

“The main objective of introducing an entirely new idea of hyper convergence was to simplify things that were thought to be complicated.”

Nutanix partnered with Lenovo and has opened several wings with this partnership. At CIO100 2017, Vivek Sharma, MD, Lenovo, spoke about the future of software defined datacentre. Hyper convergence and software defined solutions have a huge impact on transforming datacentre.

“We have now successfully built our own private cloud. The best part is that now we can seamlessly move our workload from private to public cloud. Hyper convergence is a turn towards the best way of infrastructure,” says Harnath Babu, CIO of KPMG and a customer of Lenovo.



Interaction with Industry Professional:

Mr. Prakash Hemmadi

1. Considering recent reports of automation sweeping away jobs of the IT Sector, what impact do you think will it have on the electronics industry?

- I agree that in short term jobs may tend to be lost in IT sector due to automation, but in long term this will not happen. Human intelligence is mainly required to drive the automation industry. In my opinion, almost 50% of the requirements in any automation industry are standard & the balance 50% are designed to the requirements of the specific industry. This can only be achieved by humans.
- In my field of work, almost all our competitors were multinationals offering similar systems world-wide. I used to tell my would-be clients that keeping in mind all my competitors offer similar systems to ours, the only thing we can offer was better service, which mainly depended on better trained engineers & technicians from my organization.

2. What advice would you give to the next generation of engineers with the generally rising expectations of the industry?

- My advice to the next generation of engineers will be to be sincere & dedicated with your profession. The selection of a specific branch from the engineering field of your choice will depend on the marks / rank you get at the entrance examination. However, what you learn in your institutes / colleges is basically theoretical knowledge but allows you to analyse the problems in a systematic manner and use it in the practical field as per the industry requirements. Seldom it happens that what you have learned in the institute / college can be directly be utilized in the industry. In any case, when you join the industry after successful completion of your course, it will train you & make you understand their standards & requirements.

- So, there is no specific mantra as such which can be given to individual budding engineers other than mentioning that be loyal to your profession & try to pick up the requirements of the industry.

- Be very clear in your mind what exactly you want to do with your life, like e.g. going for higher studies etc. Each company spends a lot of time, energy & money to train new engineers. So, it is not very fair on your part to ditch your new employer after a short period of time.

3. How much emphasis would you lay on practicality of the particular domain during our 4-(year?) course considering it sometimes not taken seriously?

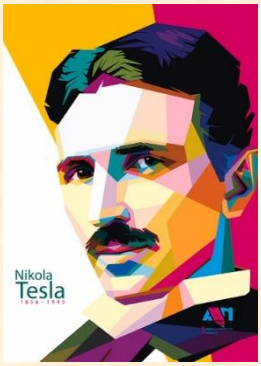
- In the end, every course can only lay a foundation on which you must build. On completion of the 4-year course, an engineer would have the analytical skills required to approach a problem and is able to absorb higher skills in the industry.
- For example, while you may learn Java or C++ when the industry has moved on to newer languages, the basics you learned in the course can easily be extrapolated to newer technologies allowing you to pick it up faster.

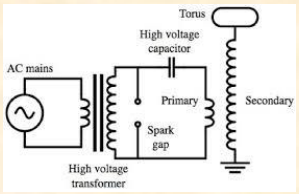
4. Are internships during the course an integral part of how an engineer shapes up to be in future?

- In my opinion internship should be an integral part of the curriculum, as it gives the budding engineer an early glimpse of how the engineering industry works, as long as he / she views the training seriously & tries to learn from it. However, what has been observed is that the would-be engineers don't consider the internship seriously & consider it as a waste of time, which must be spent to complete their graduation.
- So, in my opinion, it all depends on the individual to make use of the learning opportunity offered to him by the industry in advance.

Notable Scientists:

Nikola Tesla (1856-1943)





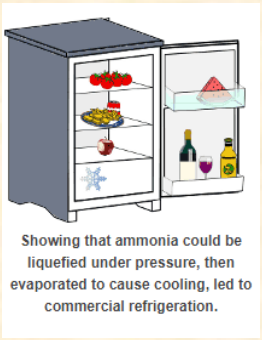
Tesla Coil (1891)

Nikola Tesla (Serbian Cyrillic: Никола Тесла; 10 July 1856 – 7 January 1943) was a Serbian American inventor, electrical engineer, mechanical engineer, physicist, and futurist who is best known for his contributions to the design of the modern alternating current (AC) electricity supply system. Born and raised in the Austrian Empire, Tesla received an advanced education in engineering and physics in the 1870s and gained practical experience in the early 1880s working in telephony and at Continental Edison in the new electric power industry.

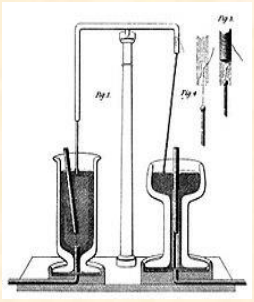
Throughout the 1890s, Tesla would pursue his ideas for wireless lighting and worldwide wireless electric power distribution in his high-voltage, high-frequency power experiments in New York and Colorado Springs. In 1891, Tesla unveiled one of his most important inventions, the "Tesla coil," a high-frequency transformer capable of creating very high voltage at low current. He built several variations of his invention. The most popular of his designs is made up of a transformer, capacitor, spark gap, main coil, minor coil and discharge sphere. Here is how it works: The transformer receives a charge of about 100 volts from an outside source and increases it to as many as 50,000 volts or more.

Although they have now been largely replaced by more modern circuitry, Tesla coils frequently show up in popular culture, most commonly in the form of high-tech guns in video games, blasting bolts of lightning at adversaries. On the big screen, a Tesla coil was used to produce lighting effects for the 1979 film "Star Trek: The Motion Picture."

Michael Faraday (1791-1867)



Showing that ammonia could be liquefied under pressure, then evaporated to cause cooling, led to commercial refrigeration.



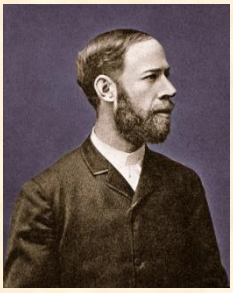
Electromagnetic rotation experiment of Faraday, ca. 1821

Michael Faraday was an English scientist who contributed to the study of electromagnetism and electrochemistry. His main discoveries include the principles underlying electromagnetic induction, diamagnetism and electrolysis. Although Faraday received little formal education, he was one of the most influential scientists in history. It was by his research on the magnetic field around a conductor carrying a direct current that Faraday established the basis for the concept of the electromagnetic field in physics. Faraday also established that magnetism could affect rays of light and that there was an underlying relationship between the two phenomena.

In 1802 John Dalton had stated his belief that all gases could be liquefied by the use of low temperatures and/or high pressures. Faraday provided hard evidence for Dalton's belief by applying pressure to liquefy chlorine gas and ammonia gas for the first time. It is not an accident that Albert Einstein used to keep photos of three scientists in his office: Isaac Newton, James Clerk Maxwell and Michael Faraday. Michael Faraday discovered benzene in the oily residue left behind from producing gas for lighting in London.

Faraday was one of the major players in the founding of the new science of electrochemistry. This is the science of understanding what happens at the interface of an electrode with an ionic substance. Electrochemistry is the science that has produced the Li ion batteries and metal hydride batteries capable of powering modern mobile technology. Faraday discovered that when an electrical conductor becomes charged, all of the extra charge sits on the outside of the conductor. This means that the extra charge does not appear on the inside of a room or cage made of metal.

Heinrich Hertz (1857-1894)



One of Hertz's radio wave receivers: a loop antenna with an adjustable micrometer spark gap

Heinrich Rudolf Hertz was a German physicist who first conclusively proved the existence of the electromagnetic waves theorized by James Clerk Maxwell's electromagnetic theory of light. The unit of frequency — cycle per second — was named the "hertz" in his honor. Heinrich Hertz's nephew Gustav Ludwig Hertz was a Nobel Prize winner, and Gustav's son Carl Helmut Hertz invented medical ultrasonography. His daughter Mathilde Carmen Hertz was a well-known biologist and comparative psychologist.
The SI unit *hertz* (Hz) was established in his honor by the International Electro Technical Commission in 1930 for frequency, an expression of the number of times that a repeated event occurs per second. It was adopted by the CGPM (Conférence générale des poids et mesures) in 1960, officially replacing the previous name, "cycles per second" (cps). In 1928 the Heinrich-Hertz Institute for Oscillation Research was founded in Berlin. Today known as the *Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, HHI*.

In 1969 (East Germany), a Heinrich Hertz memorial medal was cast. The IEEE Heinrich Hertz Medal, established in 1987, is "*for outstanding achievements in Hertzian waves* [...] *presented annually to an individual for achievements which are theoretical or experimental in nature*". A crater that lies on the far side of the Moon, just behind the eastern limb, is named in his honor. The Hertz market for radio electronics products in Nizhny Novgorod, Russia, is named after him. The Heinrich-Hertz-Turm radio telecommunication tower in Hamburg is named after the city's famous son. Hertz is honored by Japan with a membership in the Order of the Sacred Treasure, which has multiple layers of honor for prominent people, including scientists. Heinrich Hertz has been honored by a number of countries around the world in their postage issues, and in post-World War II times has appeared on various German stamp issues as well.

Ramanathan V. Guha (1965)

He graduated with B. Tech (Mechanical Engineering) from Indian Institute of Technology Madras, MS from University of California Berkeley and Ph.D. from Stanford University. Guha was one of the early co-leaders of the Cyc Project where he worked from 1987 through 1994 at Microelectronics and Computer Technology Corporation. Leaving what became KeyCorp, Guha founded Q Technology, which created a database schema mapping tool called Babel fish. In 1994, he moved to work at Apple Computer, reporting to Alan Kay, where he developed the Meta Content Framework (MCF) format. In 1997,

He joined Netscape Corporation where together with Tim Bray, he created a new version of MCF that used the XML language and which became the main technical precursor to W3C's Resource Description Framework (RDF) standard. Guha also contributed to the "smart browsing" features of Netscape 4.5 and was instrumental in Netscape's acquisition of the Open Directory Project. In March 1999, he created the first version of RSS as part of Netscape's personalized home page project. In 1999, he left Netscape and in May co-founded Opinions where he worked until 2000. Guha founded Aspire in late 2000 which created TAP, a semantic web application and knowledge base. In 2002, he became a researcher at IBM Almaden Research Centre.

Thank You!