SPECTRA HORIZON

AN INITIATIVE OF SRIJAN - THE SOCIETY OF ELECTRONICS

PREFACE

This magazine is an initiative of **"Srijan" – The Society of Electronics**. It aims at bringing together the electronic advancements of the current age to all its readers. All the articles aim at going beyond the bounds of the curriculum and step into the real world. We aim at introducing any advancements and problems that concern the electronics world to our readers, which will broaden their perspective. This will help to gather the perspectives and problems of the industrial world which will aid them in their professional careers. We want all the readers to have a look at electronics through the eyes of a trouble-shooter, so that they can analyse modern problems.

On behalf of the entire editorial team, I would like to thank everyone who contributed in any way in the formation of this magazine.

Thank you to all the readers for being a part of this journey.

MESSAGE FROM CHAIRMAN'S DESK

Er. R.D. SINGH

CHAIRMAN – KIPM TECHNICAL CAMPUS

Dear students, the four years of engineering are crucial and will be a key factor in shaping your future. There will be plethora of choices in front of you and you will hold the power to steer your life the way you want. This will require determination as you will need to persevere through enormous challenges to gain success in both professional and personal endeavour.

THINK…DECIDE…AND ACT.

MESSAGE FROM MANAGING DIRECTOR DESK

Mr. VINOD KUMAR SINGH

MANAGING DIRECTOR – KIPM TECHNICAL CAMPUS

My dear students, KIPM is not elitist in its approach. While we do try to select brilliant students, we also accept those who are potentially sound. KIPM rather than restricting itself to the quality of students coming in, emphasizes on the quality of students going out from the Institution. A strong academic orientation lays the foundation for life-long learning. Thus, all activities at KIPM are oriented towards creating opportunities for students to discover, explore and learn not just within the confines of their curriculum but also outside the boundaries of classroom.

I welcome you all at KIPM which is not only an institute, but also a place of culture that strives at producing the new breeds of professionals.

YOUR REVOLUTIONS START NOW…

MESSAGE FROM DIRECTOR DESK

DR. SURYAKANT PATHAK

DIRECTOR – KIPM TECHNICAL CAMPUS

My dear students, every endeavor for this college will be dedicated towards advancement of knowledge and educate our students in Science, Technology, and other distinguish areas of scholarship that will best serve the community, society, Nation and the world in the 21st century at large.

SUCCESS COMES IN CAN NOT CANT'S…

MESSAGE FROM HOD

Er. BHASKER PANDEY

HEAD OF DEPARTMENT

ELECTRONICS AND COMMUNICATION

Electronics and Communication Engineering is an exciting stream that yielding very good career opportunities in different areas of technology. Here we provide healthy environment to every student and teacher to carry out inter department collaborative research in fields like VLSI Design, digital communication, internet of things, robotics, etc. The department conducts various workshops, expert talks and additional training programmes on recent trends in Electronics and Communication Engineering. I am sure that all passing out students of the department are capable of visualizing, planning and developing big projects of commercial and research interests in their respective fields of expertise. The graduates of the Electronics and Communication stream have been selected by some of the leading software and hardware companies of the country.

LOOKS IN THE THAT'S YOUR COMPETITION…

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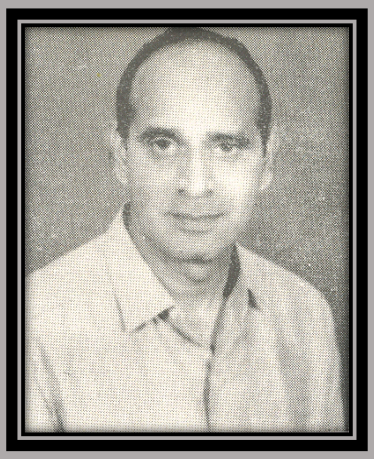


M. S. Sanjeevi Rao

(3rd August, 1929 – 3rd September 2014)

Dreams of changing society are dreamt from all around the globe but most dreams don't live long enough to turn into realities. But some people are built different, one such man was, M.S. Sanjeevi Rao, often referred to as ***"India's father of electronics".*** Born on 3rd August, 1929 in Bhiminupatnam, Andhra Pradesh. His father was an Indian Independence Activist, who went ahead to become a Member of Parliament in independent India. Rising from the aftermath of the British Rule, India as a nation, was lagging behind in the technological race. The baton to charge to the future was handed to M.S. Sanjeevi Rao as India's first ***"Electronics Minister"*** in 1982-84 and went on to become a crucial factor in India's future as an IT power hub.

He did a diploma in electronics and telecommunications from the Imperial College, London. He returned to India after his education and worked as a technical officer in All India Radio. Three years later, he joined the Defence Research Development Organization (DRDO) and went on to envision and develop complex electronics systems for the Indian Army. He worked as a scientist at the Electronic and Radar Development Establishment, Bengaluru and further at the Defence Research Electronics Laboratory, Hyderabad.

The Institute of Electronic and Telecommunication Engineers elected him as an honorary fellow, which added his name the list of nine scientists with this title. Apart from the set of such scientific achievements, he was a dynamic personality. He also founded a company named ***"Micro Ceramics"***, which was India's first company that was set up to make electronic grade ceramic compounds

Apart from electronics, during his time as chairman of Andhra Pradesh Fisheries Corporation, he developed Kakinada into a productive fishing community. He also pursued Shaw Wallace & Co and the state government to set up Di-Ammonium Phosphate (DAP) production units, which is a fertilizer that was used by rice growers. He also set up India's first TV transmission station in Kakinada, in 1982. He also laid the foundation to National Informatics Centre (NIC)- the present-day centre for the Union government's IT functions.

Former president Pranab Mukherjee describes his friend and colleague Sanjeevi Rao as a person who ***"outlined vision of India as a modern scientific and technical power"***. He lived a life that can inspire every engineer in our country to chase after their visions for the future. Now, it's our time to dream and carry the baton that was handed to him once, with a strong will and unassailable vision.

By-Ayush Dubey

ECE- 3rd Year

ONGOING GLOBAL CHIP SHORTAGE

The Year 2021 was welcomed with the expectations of relief from the ongoing COVID-19 pandemic. The world will definitely feel the after-effects of the pandemic for years to come but many felt that the economic conditions were bound to recover at high rates. But a significant part of businesses all around the world are facing enormous losses due a global semiconductor chip shortage.

This cause of this crisis can be explained as the culmination of a few major events: the COVID-19 pandemic, the US-China trade war and the 2021 drought in Taiwan.

The COVID-19 pandemic and the lockdowns that ensued are the primary cause of this global chip shortage. A considerable share of chip production facilities was shut down during the lockdowns. But, the demand of chips grew as a large portion of population had to work from home. In Q4 of 2020, traditional computer sales grew about 26.1% over the previous year.

In September 2020, as a part of the trade war between USA and China, the US Department of Commerce imposed various restrictions on China's largest chip manufacturer, Semiconductor Manufacturing International Corporation (SMIC), which made it harder for them to sell to companies with American ties. This led to many companies to use other manufacturing plants like the Taiwan Semiconductor Manufacturing Company Limited (TSMC) and Samsung. But these companies were already producing at their maximum capacity and were not able to meet the demands of the industries.

Taiwan is the leader of the global semiconductor industry, with TSMC alone controlling for more than 50% of the global wafer foundry maker in 2020. In 2021, Taiwan suffered through its worst drought in over 50 years, leading to problems among the chip manufacturers as ultra-pure water is required in these factories. TSMC's facilities used more than 63,000 tons of water a day, which is more 10% of the supply of two local reservoirs.

Among other reasons for the shortages is the lack of raw materials, in this silicon. Due to the mass production of COVID- 19 vaccines, a substantial amount of silicon was used in manufacturing of vials that carries the vaccines, which lead to shortage in silicon for chip manufacture. Among the most effected is the automobile industry, which is expected to face losses of about US $210 billion in revenue in 2021.

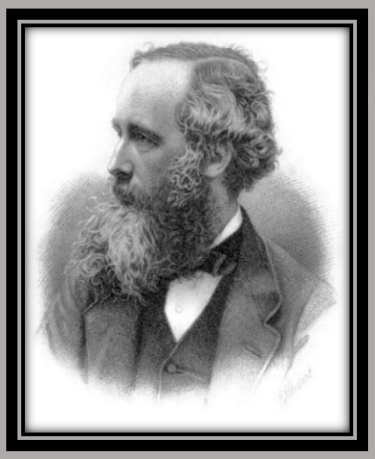
In an effort to solve and such crisis in the future, the European Union on September 15, 2021, trailed a forthcoming ***"European Chips Act"***. It was announced that the EU will use legislation to build a resilient and sovereign regional semiconductor supply chains. Taiwan's TSMC has already made plans to invest in its plants to increase production capacity. Intel also plans to expand with its advanced chip making capacity and the plants are to be built in Arizona, US.

Of Course, these plans will take time to come into fruition but one of the key takeaways is for countries to work on regional manufacturing plants that can support the industries just in case the imports take a hit.

By-Ayush Dubey

ECE- 3rd Year

The Father of Electronic



John Ambrose Fleming is renowned as the father of electronics. He is one of the world's most famous and beloved electronics and electrical engineer.

John Ambrose Fleming born in Lancaster, England on the 29th of November 1849. John Ambrose took a position as an ***"electrician"*** at the Edison Electric Light Company in 1882. His time with Edison would proof to be very fruitful. Here he was introduced to the so – called Edison effect. It was found that an evacuated light bulb with a second electrode would allow current to flow from one electrode to the other, but only in one direction. While Fleming didn't use the idea immediately, he took a keen note of it and designed the radio transmitter with which the first transatlantic radio transmission was made, and also established the right-hand rule used in physics. 1904 probably the most significant year in Fleming's life. After tinkering for years, Flemings successfully finalized his designed for a two-electrode vacuum tube rectifier. His device would build on previous work by his former mentor, James Maxwell. John dubbed it the oscillation valve and he received 16 patents for it. His invitation is widely considered to be the true beginning of electronics as this was the first true vacuum tube. This was used for many decades afterward finding applications in radio receivers, radars, and other devices. It was only superseded 50 years later with the advent of solid-state transistors.

By-Purvi Asthana

ECE- 3rd Year

TELECOMMUNICATION

Telecommunications, also known as telecom, is the exchange of information over significant distances by electronic means and refers to all types of voice, data, and video transmission. This is a broad term that includes a wide range of information-transmitting technologies and communications infrastructures, such as wired phones; mobile devices, such as cell phones; microwave communications; fibre optics; satellites; radio and telecommunications circuit consists of two stations, each equipped with a transmitter and television broadcasting; the internet; and telegraphs. A complete, single a receiver. The transmitter and receiver at any station may be combined into a single device called a transceiver. The medium of signal transmission can be via electrical wire or cable also known as copper optical fibre, electromagnetic fields, or light. The free space transmission and reception of data by means of electromagnetic fields is called wireless communications.

Data is transmitted in a telecommunications circuit by means of an electrical signal called the carrier or the carrier *wave*. For a carrier to convey information, some form of modulation is required. The mode of modulation can be categorized broadly as analog or digital. In analog modulation, some aspect of the carrier is varied in a continuous fashion. The oldest form of analog modulation is amplitude modulation (AM), which is still used in radio broadcasting at some frequencies. Digital modulation predates AM; the earliest form was Morse code.

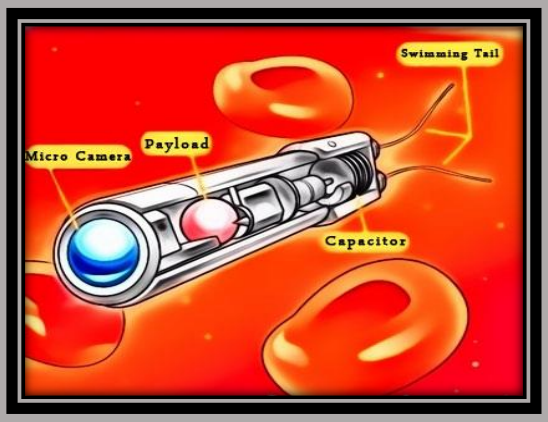
By-Shivam Upadhayay

ECE- 3rd Year

NANO ROBOTICS

Nanorobotics is an emerging technology field creating machines or robots whose components are at or near the scale of a nanometre (10^{-9} meters). More specifically, nanorobotics (as opposed to micro robotics) refers to the nanotechnology engineering discipline of designing and building nanorobots, with devices ranging in size from 0.1 to 10 micrometres and constructed of nanoscale or molecular components.

The terms nanobot, nanoid, nanite and nanomachine or nano mite have also been used to describe such devices currently under research and development.



Nanomachines are largely in the research and development phase, but some primitive molecular machines and nanomotors have been tested. An example is a sensor having a switch approximately 1.5 nanometres across, able to count specific molecules in the chemical sample. The first useful applications of nanomachines may be in nanomedicine. For example, biological machines could be used to identify and destroy cancer cells. Another potential application is the detection of toxic chemicals, and the measurement of their concentrations, in the environment. Rice University has demonstrated a single-molecule car developed by a chemical process and including Buckminsterfullerene's for wheels.

By-Saurabh Kumar

ECE- 3rd Year

Machine Learning

Machine Learning Introduction: -

Machine learning (ML) is a type of artificial intelligence (AI) that allows software application to become more accurate at predicting outcomes without being explicitly programmed to do us. Machine learning algorithms use historical data as input to predict new output values. Simply put, machine learning allows the user to feed a computer algorithm an immense amount of data and have the computer analyse and make data-driven recommendation and decisions based on only the input. Supervised learning, Unsupervised learning, Reinforcement Learning, Sentiment Analysis of Product Reviews, Stock Prices Prediction, Sales forecasting, Movie Ticket Pricing Prediction, Music Recommendation, Handwritten Digit Classification and Fake news Detection.

Machine learning used in everyday life: -

Machine learning also helps in estimating disease breakthroughs, driving medical information for outcomes research, planning and assisting therapy, and entire patient management big data, machine learning (ML) and artificial intelligence (AI) applications are revolutionizing the models, method and practices of Electronics & Communication Engineering, Speech Recognition, Traffic prediction, Product recommendations, Virtual personal Assistant, Self-driving cars, Online Fraud Detection, Single Processing, Control Engineering and Computer Engineering. VLSI design Engineering, Telecommunication Engineering, Instrumentation engineering and Machine learning the Future Basically, it's an application of artificial intelligence. Also, it allows software application to become accurate in predicting outcomes.

Moreover, machine learning focuses on the development of computer programs Google says ***"Machine learning is the future"***, so future of machine learning is going to be very bright, Wide Range of Application, Scope of Improvement, Data Acquisition, Algorithm selection, Efficient Handling of Data, Best of Education and Online Shopping.

By-Shreyansh Pandey

ECE- 2nd Year

Embedded system

An **embedded system** is a computer system—a combination of a computer processor, computer memory, and input/output peripheral devices—that has a dedicated function within a larger mechanical or electronic system.

The most common definition is **"It is a combination of hardware and software to perform a specific task "**

"Any electronic system which gives capability to a device or a machine to perform fully automatic and semi-automatic tasks is an Embedded System"

It consists of 3 things: 1. Input Device 2. Microcontroller (The Brain) 3. Output Device

Input device collects input from user or environment. It could be done via a sensor or a remote control. Microcontroller is the brain; it is the processing unit. It collects information from input device and perform the output as per the logic defined inside it. Output device collects the instructions from microcontroller and perform accordingly.

An embedded system combines mechanical, electrical, and chemical components along with a computer, hidden inside, to perform a single dedicated purpose. An embedded system typically controls physical operations of the machine that it is embedded within, it often has real-time computing constraints. In 2009 it was estimated that ninety-eight percent of all microprocessors manufactured were used in embedded systems.

An embedded system on a plug-in card with processor, memory, power supply, and external interfaces.

Modern embedded systems are often based on microcontrollers (i.e., microprocessors with integrated memory and peripheral interfaces), but ordinary microprocessors (using external chips for memory and peripheral interface circuits) are also common, especially in more complex systems.

In either case, the processor(s) used may be types ranging from general purpose to those specialized in a certain class of computations, or even custom designed for the application at hand. A common standard class of dedicated processors is the digital signal processor (DSP).

Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance.

Embedded systems range in size from portable personal devices such as digital watches and MP3 players to bigger machines like home appliances, industrial assembly lines, robots, transport vehicles, traffic light controllers, and medical imaging systems.

Large installations like factories, pipelines and electrical grids rely on multiple embedded systems networked together. Generalized through software customization, embedded systems such as programmable logic controllers frequently comprise their functional units.

Embedded systems range from those low in complexity, with a single microcontroller chip, to very high with multiple units, peripherals and networks, which may reside in equipment racks or across large geographical areas connected via long distance communications lines.

Every industry needs some artificial intelligence into it and artificial intelligence can be given by embedded systems only.

According to a survey embedded systems industry will reach $360 billion by end of 2020. Jobs in embedded industry will reach to 12 Lac by 2020. Companies like TCS, Wipro, TATA, Alexis, Infosys, Zensar, Tech Mahindra, Volvo, Airbus and Toshiba are investing heavily in their embedded systems. In India Mobile manufacturers like Foxcon are setting up their plant in India. Experts say what IT was in 90s is where Embedded Systems stands now and is ready to explode.

By-Sreya Singh

ECE- 3rd Year

VLSI Architectures for image interpolation

In digital image scaling image interpolation algorithms are used to convert an image from one resolution to another resolution without losing the visual content in the image. In the colour, image interpolation is the process of estimating the missing colour samples to reconstruct a full colour image. For example, a video source with a 640 X480 video graphics array resolution may need to fit the 1920 X 1080 resolution of the high-definition multimedia interface (HDMI). Image up scaling methods are implemented for a variety of computer equipment's like printers, digital television, media player, image processing system, graphics renderers, and so on. On the other hand, high resolution image may need to be scaled down to a small size in order to fit the lower resolution of small liquid crystal display panels. That is the image scaling is a challenging and very significant issue in image processing. The hardware architecture of image interpolation includes the coordinated accumulator, line, buffer coefficient generator, vertical interpolator, and horizontal interpolation. Each of the unit performs specified operations for the interpolation. The hardware architecture with its different unit. The different image interpolation algorithms such as winscale, bi-cubic, linear, polynomial convolution, bilinear, and adaptive scaling algorithms. The hardware characteristics such as area utilization and speed and power consumptions are mainly focused upon. The quality of the interpolation algorithms can be expressed in dB with peak signal to noise ratio of scaled image and the original image. Digital Image scaling algorithms. Winscale Image interpolation. VLSI design of winscale for digital image scaling. Bi-cubic Convolution interpolation. Real time FPGA Linear Convolution Interpolation. Extended Linear Interpolation. Efficient Architecture of Extended Linear Interpolation. Piecewise Linear Convolution Interpolation. A Novel Interpolation Algorithms. Parallel Bilinear Interpolation. Adaptive Scaling Bilinear Interpolation. SL Chen's Image Scaling interpolation. Digital image interpolation algorithms are widely used in many fields of digital image video application. These applications require improved image quality and high processing performance of hardware requirement.

By-Gaureesh Kumar

ECE- 2nd Year

IOT (Internet of Things)

The Internet of Things (IOT) describe the network of physical objects – ***"things"***- that are embedded with sensors, software, and other technologies The Internet of things (IOT) is an emerging that enable the Communication between Electronics Devices and Sensors through the Internet in Order to facilities our lives. The Internet of Things (IOT) refers to a vast number of ***"things"*** that are connected to the internet so they can share data with other things- IOT application, connected devices, industrial machines and more. ***"Kevin Ashton"***, father of IOT, talked at the event ***"Industry of Things"*** in Berlin on 18 September about the future of manufacturing. Devices and objects will build in sensors are connected to an internet of Things platform, which integrates data from the different devices and applies analytic to share the most valuable information with application built to address specific needs. However, all complete IOT systems are the same in that they represent the integration of four distinct components: sensors/devices, connectivity, data processing, and a user interface.

How do IOT devices work?

IOT devices contain sensors and mini-computer processors that act on the data collected by the sensors via machine learning. Essentially, IOT devices are mini computers, connected to the internet, and are vulnerable to malware and hacking. The future of IOT is virtually unlimited due to advances in technology and consumers desire to integrate devices such as smart phones with household machines. A Networking and connectivity protocol has made it possible to connect people and machines on all platforms. Today IOT is mainly used in the scope Internet of Things application outside of the consumer space and enterprises IOT market, as an umbrella term for application and use cases across several industrial sectors. IOT is beneficial because it makes our work easy and is very less time-consuming. Let's, take in to account the smartphones we use, has made a lot of work can be done in just fingertips. IOT has easied the lives of humans. Imagine a hospital connected with all the smart devices. Internet-of-Things (IOT) Example- Connected appliances, Smart home security systems, Autonomous farming equipment, Wearable health monitors, Smart factory equipment, Wireless inventory trackers.

By-Adarsh Dubey

ECE- 2nd Year

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