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Gyan Ganga
Institute of Technology and Sciences

TECH ADVISOR

2019-20

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Contact Us - +91 942 53 23089, +91 982 61 18736

Location - P.O. Tilwara Ghat, Bargi Hills, Jabalpur, Madhya Pradesh Pin No. - 482003

Connect with us:- www.ggits.org

ABOUT THE DEPARTMENT

Department of Electronics & Communication Engineering (EC) of GGITS, Jabalpur offers B.Tech. in Electronics & Communication Engineering with an intake of 120 students and M.Tech. in Embedded System & VLSI Design and Communication system with an intake of 18 each. The department has excellent infrastructure as well as well equipped laboratories so that the students come out with knowledge of latest cutting edge technology in both software and hardware. The department has been accreditated with excellence by National Board of Accreditation (NBA). The department has well experience dedicated faculty members with different specializations.

VISION OF THE DEPARTMENT

To be center of excellence in teaching-learning and employability in various fields of Electronics and Communication Engineering to produce globally competent, innovative and socially responsible citizen.

MISSION THE DEPARTMENT

- To offer high quality graduate and post graduate programs in Electronics and Communication with strong fundamental knowledge and to prepare students for professional career or higher
- studies.
  To discover and disseminate knowledge through learning, teaching, sharing, training, research, engagement and
- creative expression.
  To foster spirit of innovation and creativity among students, faculty and staff, promote environment of growth, participation in conferences, technical and community services and lifelong learning for all.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: The graduates will have strong fundamentals in mathematics, science and engineering so that they can meet industrial and global challenges and excel in the field of Electronics and Communication Engineering and also will be motivated to excel in professional career and higher education.
PEO 2: The graduates will have good scientific and engineering breadth to analyze, design and develop systems/components, problem-solving skills and aptitude for innovation.
PEO 3: The graduates will exhibit leadership qualities with strong communication skills, competence to function effectively in multi-disciplinary orientation teams, capability to assess and relate engineering issues to ethical, environmental and broader societal context.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Understand the fundamental and advanced concepts of Mathematics, Science & Engineering and apply it to design and develop Electronics and Communication Engineering applications in the field of communication system, signal processing, embedded systems and VLSI Design.
PSO 2: Learn and comprehend continuously the technological advancements with the usage of modern design tools to analyze and design variety of complex Electronics and Communication Engineering applications.
PSO 3: Possess/Acquire the skills to communicate in both oral and written forms with good Leadership, Managerial skill to work either independently or as a team, demonstrating the practice of professional ethics for sustainable development of society.

MESSAGE FROM THE CHAIRMAN

I am elated at the publication of college magazine for the academic year 2019-20. I sincerely hope that the magazine proves to be an enjoyable and useful apparatus in the hands of both students and teachers of the college. I am also confident that it will serve as a source of inspiration for the teachers as well as the students to contribute articles regularly to the magazine in future. I whole-heartedly congratulate the HOD, Editors and the committee members on their successful endeavour to bring out the magazine.

MESSAGE FROM THE PRINCIPAL

It takes me great honour in congratulating the students who have contributed for the current year's Tech Advisor magazine Acknowledging the fact that the magazine is completely created and designed by the students, I really hope this would kindle a spark in the minds of the students who are yet to contribute towards the progress of the Tech Advisor initiative in the upcoming years.

MESSAGE FROM THE HOD

Tech Advisor is a communication link between faculty members and students within and outside the department. It reports about recent development and areas of thrust in the field of Electronics & Communication Engineering. Tech Advisor tries to bridge the gap between academic and actual mode of working in the industry by providing articles on various topics of industry. At the same time magazine also serve as a knowledge booster and a helping hand to our students. We also make aware our students with the general issues related to environment, ecology, economy and rest of the society. It also helps to bring together all the students and faculty members to the same platform to share numerous ideas to think upon. Students can also share their thoughts on a particular matter as well as they can also contribute any research by means of this channel. It can be easily concluded that our departmental magazine is not only information provider but also groom the overall personality of our students.

EDITOR'S DESK

The creative minds of the Electronics and Communication department of Gyan Ganga Institute of Technology and Sciences have come together to present what they have always wanted to and we congratulate every student who has given their contribution. They can't be appreciated enough and we can't explain how difficult it was to compile all their accomplishments into a single magazine. We take pride in showing you of how our very own GGITians have imaginations which spread across the horizons. We would like to thank the Management and all the staffs who have supported the 'Tech Advisor' initiative and for having trust in the Editorial board by giving us full freedom to choose the contents and design for out magazine. The magazine should serve as a pillar of motivation for every other student who is yet to emerge as an Achiever and to carry the legacy of Tech Advisor. The students who follow in the next academic years, we advise you to do the same. Go Mad, Be Productive but at the same time Be Creative!

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STUDENT'S ARTICLES

SILICONE MEMORY

If you need a material that can literally be changed to suit you over time, look no further.

Metamaterials – meaning "beyond matter" – are engineered materials with properties not found in nature. This gives them unique scope to work outside of the realms of "normal" acquired materials. One such example has recently been reported in Nature by Tian Chen, of École Polytechnique Fédérale de Lausanne, Switzerland, who designed a metamaterial that can be reprogrammed to have different mechanical properties after it is already made.

"I wondered if there was a way to change the internal geometry of a material's structure after it's been created," says Chen. "The idea was to develop a single material that can display a range of physical properties, like stiffness and strength, so that materials don't have to be replaced each time.

"For example, when you twist your ankle, you initially have to wear a stiff splint to hold the ankle in place. Then as it heals, you can switch to a more flexible one. Today you have to replace the entire splint, but the hope is that one day, a single material can serve both functions." The material is made of small mechanical bits, called m-bits, that are reminiscent of computer bits.

In a hard drive, tiny pieces of digital information can be stored as bits. Magnetic bits can be programmed to switch between the values of 0 and 1, or on/off, by magnetising them in different directions to confer binary information. That binary code can be controlled by an external electromagnetic circuit, which changes the direction of those bits to recode the hard driver with a new memory.

So, if you're storing your favourite song on a hard drive, the direction of those bits change based on the code that is imparted, and the digital properties of the hard-drive are altered to include the memory of how to play your song.

This principal is somewhat like Chen's material, except that he used mechanical units instead. His m-bits are made of silicone and magnetic powder and have a unique shape that allows each individual cell to move between a compressed and decompressed state. These two states act as the programmable binary code, like computer bits. This essentially means that the material can contain a memory about what it is supposed to be.

"You can activate and deactivate individual cells by applying a magnetic field. That modifies the internal state of the metamaterial, and consequently its mechanical properties," says Chen. The property that can be altered in this way is the stiffness of the material. When the cells are switched on by the magnetic field, the material is stiff; when they're switched off, the material is more flexible. If that isn't incredible enough, its possible to program various combinations of the on/off cells to provide a range of flexibility, basically whenever it's needed. This is the first report that shows both programmed memory and physical change imparted by bits in a single material.

This extraordinary combination of electronics, computer science and mechanical engineering strives to find the sweet spot between static material and machine. This unlocks potential materials that might be used in a plethora of useful items, from prosthetics to aeronautics to shock absorption in orthopaedic shoes. A few things need to be sorted out before it reaches the usable stage, though.

"We could design a method for creating 3D structures, since what we've done so far is only in 2D," says Pedro Reis, the leader of Chen's lab at École Polytechnique Fédérale de Lausanne. "Or we could shrink the scale to make even smaller metamaterials." Regardless, the ability to program the memory of materials so they'll change properties is a very exciting development indeed.

HARI BHANU MISHRA
0206EC161059
(B.E.-7th Sem)

NEW SPACE-TIME 4-D CLOCK WILL BE ACCURATE FOREVER

Scientists have proposed to build the first ever 4D space-time crystal clock that they claim will keep accurate time forever, even after the heat-death of the universe.

This is the "wow" factor behind a device known as a "space-time crystal," a four-dimensional crystal that has periodic structure in time as well as space, scientists said.

Researcher Xiang Zhang from Berkeley Lab's Materials Sciences Division, who led this research, and his group, have come up with an experimental design to build a crystal that is discrete both in space and time- a space-time crystal.

However, there are also practical and important scientific reasons for constructing a space-time crystal.

With such a 4-D crystal, scientists would have a new and more effective means to study how complex physical properties and behaviors emerge from the collective interactions of large numbers of individual particles.

A space-time crystal could also be used to study phenomena in the quantum world, such as entanglement, in which an action on one particle impacts another particle even if the two particles are separated by vast distances, scientists said.

Scientists from the US Department of Energy (DOE)'s Lawrence Berkeley National Laboratory has proposed the experimental design of a space-time crystal based on an electric-field ion trap and the Coulomb repulsion of particles that carry the same electrical charge.

The concept of a crystal that has discrete order in time was proposed earlier this year by Frank Wilczek, the Nobel-prize winning physicist at the Massachusetts Institute of Technology.

While Wilczek mathematically proved that a time crystal can exist, how to physically realize such a time crystal was unclear.

CHAITANYA KASHIVE
0206EC171035
(B.Tech.-5h Sem)

HUMANOID ROBOTS

Humanoid robots are expected to exist and work in a close relationship with human beings in the everyday world and to serve the needs of physically handicapped people. These robots must be able to cope with the wide variety of tasks and objects encountered in dynamic unstructured environments. Humanoid robots for personal use for elderly and disabled people must be safe and easy to use. Therefore, humanoid robots need a lightweight body, high flexibility, many kinds of sensors and high intelligence. The successful introduction of these robots into human environments will rely on the development of human friendly components.

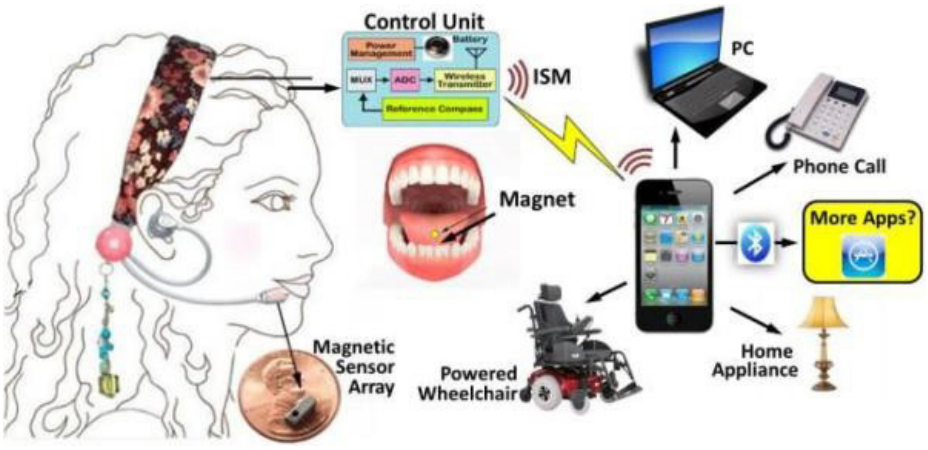
The ideal end-effector for an artificial arm or a humanoid would be able to use the tools and objects that a person uses when working in the same environment. The modeling of a sophisticated hand is one of the challenges in the design of humanoid robots and artificial arms. A lot of research activities have been carried out to develop artificial robot hands with capabilities similar to the human hand. The hands require many actuators to be dexterously moved [6,7]. However, the control system of the humanoid robot becomes more complicated if more actuators are additionally used for the hand design. This is a key aspect for the artificial arm because a handicapped person might not be able to control a complex hand mechanism with many actuators. For this reason, we propose to develop a lightweight hand driven by a single actuator. To this end we adopted a new mechanism for the cooperative movement of finger and palm joints.

Tongue Drive System (TDS) is a wireless and wearable assistive technology (AT) that enables people with severe disabilities to control their computers, wheelchairs, and electronic gadgets using their tongue motion.

According to the National Spinal Cord Injury Statistical Center, the number of people having Spinal Cord Injury (SCI) in the United States has been estimated at approximately 265,000 persons in 2010. There is a growing interest in improving the quality of life of individuals with disability by helping them to become more independent. Therefore, numerous assistive technologies (AT) have been developed, such as sip-and-puff, eye tracking system, electromyography (EMG) switches, voice recognition, brain-computer interfaces, and head arrays.

We have developed the Tongue Drive System (TDS) for people with severe disabilities to control computers and their environment using their tongue motion. TDS translates the user's volitional tongue movement into commands, which is then interfaced to external devices to give more freedom and independence in their daily lives. TDS has been evaluated with respect to its efficiency for computer access. We have developed iPhone apps as a key controlled device by TDS to dial phone numbers and as interface to control the powered wheelchairs (PWC) using tongue motion.

According to ComScore report, released in Jan. 2012, there are more than 100 million smartphone subscribers in the U.S., and it has been reported that about 500,000 apps are available in iPhone's app store (Apple, Inc.) and about 400,000 apps in Android' market (Google, Inc.). However, there are only a few ATs that can interface with smartphones, most of which are still limited to specific applications. The first example is the sip-and-puff controlling iPod [7], which prompts the user to select from the iPod menu. Another example is a commercially available AT interface for the Android called Tecla, which uses customized hardware and applications that enable certain degree of control on the main menu of the smartphone. It is a scanning based system, which moves the cursor on a soft keypad on Android phone screen. Both systems provide more independence for the users, however, they are yet to become intuitive and freely navigable.



To implement the mouse function on the smartphone, we emulated a mouse sensor inside a commercial Bluetooth mouse using TDS commands. Therefore, the TDS control is no longer limited to a certain application, and users have access to all built-in and downloadable apps, along with full navigation capabilities of the iPhone touchscreen.

Above figure shows that the TDS can be used for different tasks as a unified AT, with the next step being to access additional applications available in the market through a Bluetooth module. The new interface allows the external TDS (eTDS) headset to communicate with the smartphone and relay the sensor data to the signal processing algorithm, running on the smartphone, and turn the raw data into control commands for computers, smartphones, and PWCs.

HARI BHANU MISHRA
0206EC161059
(B.E.-7th Sem)

FACULTY'S ARTICLES

SOFTWARE DEFINED RADIO

With the exponential growth in the ways and means by which people need to communicate - data communications, voice communications, video communications, broadcast messaging, command and control communications, emergency response communications, etc. – modifying radio devices easily and cost-effectively has become business critical. Software defined radio (SDR) technology brings the flexibility, cost efficiency and power to drive communications forward, with wide-reaching benefits realized by service providers and product developers through to end users.

A number of definitions can be found to describe Software Defined Radio, also known as Software Radio or SDR. The SDR Forum, working in collaboration with the Institute of Electrical and Electronic Engineers (IEEE) P1900.1 group, has worked to establish a definition of SDR that provides consistency and a clear overview of the technology and its associated benefits. Simply put Software Defined Radio is defined as: "Radio in which some or all of the physical layer functions are software defined".

A radio is any kind of device that wirelessly transmits or receives signals in the radio frequency (RF) part of the electromagnetic spectrum to facilitate the transfer of information. In today's world, radios exist in a multitude of items such as cell phones, computers, car door openers, vehicles, and televisions.

Traditional hardware based radio devices limit cross-functionality and can only be modified through physical intervention. This results in higher production costs and minimal flexibility in supporting multiple waveform standards. By contrast, software defined radio technology provides an efficient and comparatively inexpensive solution to this problem, allowing multimode, multi-band and/or multi-functional wireless devices that can be enhanced using software upgrades.

SDR defines a collection of hardware and software technologies where some or all of the radio's operating functions (also referred to as physical layer processing) are implemented through modifiable software or firmware operating on programmable processing technologies. These devices include field programmable gate arrays (FPGA), digital signal processors (DSP), general purpose processors (GPP), programmable System on Chip (SoC) or other application specific programmable processors. The use of these technologies allows new wireless features and capabilities to be added to existing radio systems without requiring new hardware. The benefits of SDR are compelling.

For Radio Equipment Manufacturers and System Integrators, SDR Enables:

- A family of radio "products" to be implemented using a common platform architecture, allowing new products to be more quickly introduced into the market.
- Software to be reused across radio "products", reducing development costs dramatically.

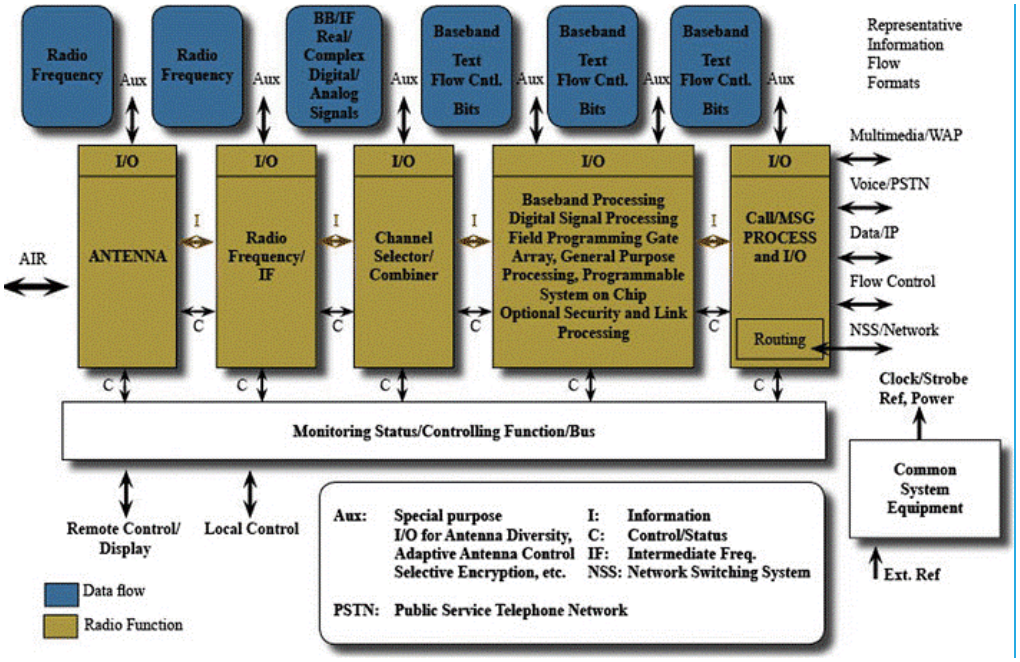


Figure: SDR Forum Generalized Functional Architecture

- Over-the-air or other remote reprogramming, allowing "bug fixes" to occur while a radio is in service, thus reducing the time and costs associated with operation and maintenance.

For Radio Service Providers, SDR Enables:

- New features and capabilities to be added to existing infrastructure without requiring major new capital expenditures, allowing service providers to quasi-future proof their networks.
- The use of a common radio platform for multiple markets, significantly reducing logistical support and operating expenditures.
- Remote software downloads, through which capacity can be increased, capability upgrades can be activated and new revenue generating features can be inserted.

For End Users - from business travelers to soldiers on the battlefield, SDR technology aims to:

- Reduce costs in providing end-users with access to ubiquitous wireless communications – enabling them to communicate with whomever they need, whenever they need to and in whatever manner is appropriate.

DR. NEETA NATHANI
HoD-EC

BUBBLE POWER

The standard of living in a society is measured by the amount of energy consumed. In the present scenario where the conventional fuels are getting depleted at a very fast rate the current energy reserves are not expected to last for more than 100 years. Improving the harnessing efficiency of non-conventional energy sources like solar, wind etc. as a substitute for the conventional sources is under research. One of the conventional methods of producing bulk energy is nuclear power. There are two types of nuclear reactions, namely fission & fusion. They are accompanied by the generation of enormous quantity of energy. The energy comes from a minute fraction of the original mass converting according to Einstein's famous law: E=mc2, where E represents energy, m is the mass and c is the speed of light. In fission reaction, certain heavy atoms, such as uranium is split by neutrons releasing huge amount of energy. It also results in waste products of radioactive elements that take thousands of years to decay. The fusion reactions, in which simple atomic nuclei are fused together to form complex nuclei, are also referred to as thermonuclear reactions. The more important of these fusion reactions are those in which hydrogen isotopes fuse to form helium. The Sun's energy is ultimately due to gigantic thermonuclear reaction. The waste products from the fusion plants would be short lived, decaying to nondangerous levels in a decade or two. It produces more energy than fission but the main problem of fusion reaction is to create an atmosphere of very high temperature and pressure like that in the Sun. A new step that has developed in this field is 'Bubble Power'-the revolutionary new energy source. It is working under the principle of Sonofusion. For several years Sonofusion research team from various organizations have joined forces to create Acoustic Fusion Technology Energy Consortium (AFTEC) to promote the development of sonofusion. It was derived from a related phenomenon known as sonoluminescence. Sonofusion involves tiny bubbles imploded by sound waves that can make hydrogen nuclei fuse and may one day become a revolutionary new energy source.

Sonoluminescence: When a gas bubble in a liquid is excited by ultrasonic acoustic waves it can emit short flashes of light suggestive of extreme temperatures inside the bubble. These flashes of light known as sonoluminescence, occur as the bubble implode or cavitates. It is show that chemical reactions occur during cavitations of a single, isolated bubble and yield of photons, radicals and ions formed. That is gas bubbles in a liquid can convert sound energy in to light. Sonoluminescence also called single-bubble sonoluminescence involves a single gas bubble that is trapped inside the flask by a pressure field. For this loud speakers are used to create pressure waves and for bubbles naturally occurring gas bubbles are used. These bubbles can not withstand the excitation pressures higher than about 170 kilopascals. Pressures higher than about 170 kilopascals would always dislodge the bubble from its stable position and disperse it in the liquid. A pressure at least ten times that pressure level to implode the bubbles is necessary to trigger thermonuclear fusion. The idea of sonofusion overcomes these limitations.

The idea of sonofusion: It is hard to imagine that mere sound waves can possibly produce in the bubbles, the extreme temperatures and pressures created by the lasers or magnetic fields, which themselves replicate the interior conditions of stars like our sun, where fusion occurs steadily. Nevertheless, three years ago, researchers obtained strong evidence that such a process now known as sonofusion is indeed possible. Sonofusion is technically known as acoustic inertial confinement fusion. In this we have a bubble cluster (rather than a single bubble) is significant since when the bubble cluster implodes the pressure within the bubble cluster may be greatly intensified. The centre of the gas bubble cluster shows a typical pressure distribution during the bubble cluster implosion process. It can be seen that, due to converging shock waves within the bubble cluster, there can be significant pressure intensification in the interior of the bubble cluster. This large local liquid pressure (P>1000 bar) will strongly compress the interior bubbles within the cluster, leading to conditions suitable for thermonuclear fusion. More over during the expansion phase of the bubble cluster dynamics, coalescence of some of interior bubbles is expected, and this will lead to the implosion of fairly large interior bubbles which produce more energetic implosions.

PROF. ABHISHEK SINGH
ASSISTANT PROFESSOR-EC

NANOROBOTICS: WHAT IT IS, WHAT IT CAN DO, AND HOW IT CAN BECOME REALITY

They're tiny machines that work on the nanoscale, being up to 100,000 times smaller than the width of a human hair. These machines, otherwise known as nanorobotics, are set to augment the human race in unforeseen ways.

However, this microscopic technology has remained in the prototype phase for the past two decades, failing to truly live up to its promise, and lagging due to difficult manufacturing processes, a lack of standardization, and scant reviews of the available literature.

Picture a scenario where you're ill and need to see your doctor. However, instead of giving you a pill or a shot, your doctor injects you with a swarm of tiny robots.

These nanomachines will then work together autonomously to scan their environment and detect your illness — after which they travel to the relevant organ to deliver a payload of slow-release medication deep within the infected area to cure you.

Sounds pretty sci-fi, right? Well, it may not be that far off.

This science is based on nanotechnology, a field of innovation concerning the building of materials and devices at the atomic and nanoscale. To give you a sense of how minute this scale is, a nanometre is just one-billionth of a meter, also known as the billionth-scale.

Because of this small scale, many of the ordinary rules of physics and chemistry no longer apply here, proffering unforeseen and alienlike properties. An example of these quantum-based properties is matter constructed in the nanoscale known as metamaterials.

One such material composed of carbon atoms is 100 times stronger than steel but six times lighter. Other metamaterials, such as quantum dots, can produce far more power than conventional solar or electrical cells despite being zero-dimensional. Remarkably, these nanoscale substances are predicted to produce an abundance of innovative materials used in manufacturing the world over, helping to end poverty and hunger, and possibly ushering in a period of peace and prosperity.

What Is Nanorobotics?

Most theoreticians credit the concept of nanotechnology to physicist Richard Feynman and his speech in 1959 entitled: "There's Plenty of Room at the Bottom". In the speech, Feynman predicted the development of machines that could be miniaturized and huge amounts of information being encoded in minuscule spaces. However, it was K. Eric Drexler's 1986 book, Engines of Creation: The Coming Era of Nanotechnology, which galvanized nanotechnological doctrine.

Drexler floated the idea of programmable, self-replicating nanodevices. In effect, these 'nanorobots' would contain a blueprint to clone and build themselves, and any other device needed to fulfill their function. As this construction would take place on an atomic scale, these nanomachines would be able to pull apart any kind of material atom by atom and manufacture never-before-seen devices. Drexler conceived of a universe where nanorobots could perform tasks such as environmental cleaning and clear the human blood capillary system of toxins. The possibilities he theorized involving nanotechnology hinted at addressing contemporary global challenges and future dilemmas, with almost limitless potential once commercialized.

In a practical sense, nanorobotics refers to nanoscale robots, which can accurately build and manipulate objects on a molecular scale. A leading study on the subject in The Frontiers journal series uses the term micro/nanorobots to refer to all nano- to micron-size programmable devices capable of traveling in the nanoscale using a power source. The process they describe there is the actuation or propulsion of nanomachines which they file into three categories.

The first category encompasses biohybrid systems integrating synthetic materials with motile microorganisms acting

as engines using their natural appendages. The next category involves chemically powered micro/nanorobots that are capable of converting chemical fuels into locomotion. And finally, the most populated category covers mechanically powered nanorobots that use external energy sources such as magnetic, ultrasound, or light fields to move.

The study also collates the percentage of nanobots within each category that have been trialed in living biological systems. They state that, as of 2018, 20% of biohybrid nanorobots, 30% are chemical nanomachines, and 50% of all mechanical systems in existence have been used inside living animals in trials.

Despite remarkable progress, many hurdles exist when manufacturing at the billionth scale, in a process known as nanomanipulation which is performed under electron or scanning probe microscopy using tools such as optical and magnetic tweezers or grippers. Here, nanodevices are being manipulated and welded or soldered together at the molecular scale making the process expensive and time-consuming, and commercialization unfeasible. As it stands, the whole field of nanotechnology, including nanorobotics, is heavily reliant on the development of nanomanipulation.

Types Of Nanorobotics

Nanorobotics falls into four broad groupings:

1. The first classification encompasses purely mechanical nanobots containing no biological material. Here, physically powered nanorobots constructed of synthetic and/or metallic material can be actuated via a chemical reaction or external energy inputs such as magnetic, ultrasound, and light fields. These nanobots are intricate on the billionth scale, containing joints and appendages to enable flexible swimming or walking capabilities.

Mechanical nanobots consist of multiple materials and coatings. The coating or the body of the machine itself is designed to degrade in bodily fluids to propel the nanorobot in the case of chemical propulsion and/or release the salient therapeutic to treat the disease. Due to the ease of actuation, by far the most popular model in this classification is the magnetic-propelled nanobot where nanorobots integrating magnetic parts are moved using an innocuous external magnetic force. Due to the magnetic torque produced, blood clots are invariably targeted by these nanomachines using a 'corkscrew' motion to drive through the embolism. Likewise, these nanobots can also be coated with a substance to elicit an immune response to help break up the clots whilst 'boring' through the thrombosis.

2. The second category of nanobots is inspired by nature and involves the synthetic biological construction of DNA computers. Also known as DNA nanorobots, they are assembled using origami, where DNA molecules are folded into a 3D configuration to expand surface area for the storage of data and to enable chemical propulsion.

The desired function or shape of these machines is achieved by 'gluing' the nucleic code at salient base-pair junctions to create various configurations. This is how appendages, cargo holds, and switches can be fashioned. Presently, scientists are using DNA origami technology to engineer DNA computers that can monitor and record their surroundings, carry out programs, and store information within its nucleic code. One such example comes from Caltech who designed self-assembling DNA computers that can carry out reprogrammable computations, in effect creating a nanorobot or six-bit 'hardware' that can run different software in this fast-moving field.

3. The third category involves both native and synthetic biologics, known as biohybrid nanorobotics. These hybrid systems integrate inorganic nanomaterials with live microscopic organisms that can propel themselves or use external sources for propulsion. Biohybrid nanorobots have many advantages over traditional artificial nanobots. The most significant advantage is their biocompatibility, with particular regard to components originating from biological organisms such as minimalized immune cells, DNA, or sperm.

Properties of native cells can also be exploited in unnatural situations. An example of this is biohybrid nanobots or neutrobots developed by the Harbin Institute of Technology capable of traversing the blood-brain barrier (BBB) by manipulating the immune system. The neutrobots do this via the E. coli bacterial membrane housing a core comprised of the Paclitaxel cancer drug mixed with a magnetic hydrogel. When the nanobots were injected into a mouse model of glioma and actuated towards the brain using an external magnetic field, they were engulfed by mouse neutrophils in vitro attracted by their bacterial membrane shell. Thus, they were then able to pass over the BBB in the bellies of the white blood cells to treat glioma tumors in the mouse brain.

Nevertheless, despite their improved biocompatibility, biohybrid microbots remain potentially harmful due to their extraneous components. Therefore, a completely natural and programmable alternative engineered from only biological tissues is highly desirable.

4. Our final classification covers the aforementioned where never before seen synthetic biological life forms are engineered. An archetypal study on the subject from the University of Vermont successfully bioengineered thousands of unknown life forms derived from frog embryos. These living exobiologics, which carried out a variety of programs, possessed no reproductive organs, and simply degraded safely to become unfunctional after 7 days.

Just recently, the same team upgraded their xenobots to move faster, navigate different environments, and live longer than the first edition. Similarly, they can still work together in swarms and heal themselves if damaged. But now the upgraded astrobiologics can record memory and use that information to modify their actions and behavior. Their read/write capability can record one bit of information, using a fluorescent reporter protein. It is in this way the alien lifeforms can 'write' their travel experience which could prove invaluable for in vivo applications.

PROF. S.U. KHAPARKAR
ASSISTANT PROFESSOR-EC

LIST OF PROFESSIONAL ACTIVITIES CONDUCTED IN THE SESSION

S.No.	Name of Professional Societies/ Chapters	Event and Title	Date of event
1	IETE	Expert talk on Emerging Trends in VLSI Design	22/07/2019
2	ISTE	Workshop on Matlab	20/09/2019
3	ISTE	A paper presentation competition	04/11/2019
4	IETE	Poster competition on “Save water”	24/02/2020
5	ISF	Guest lecture on “Verilog HDL programming”	06/03/2020
6	IETE	Hands on Training for “Digital logic circuit design using Micro wind software”.	24/04/2020
7	ISTE	Workshop on “How to Make Mini Projects using Tinkercad Software”	27/04/2020
8	IETE	Workshop on “Labview and PSpice”	04/05/2020
9	ISF	Workshop on “Raspberry pi”	15/05/2020
10	IETE	Webinar on “Virtual Lab”	20/05/2020

PLACEMENTS OF 2015-19 BATCH

S.NO	NAME OF THE STUDENT PLACED	ENROLLMENT NO.	NAME OF THE EMPLOYER
1	ANANTA GUPTA	0206EC151018	AMDOCS
2	AKARSHAN SAHU	0206EC151011	COLLABERA
3	AYUSHI SHUKLA	0206EC151047	COLLABERA
4	DEVESH RAIKWAR	0206EC151054	COLLABERA
5	ISHA TIWARI	0206EC151066	COLLABERA
6	MANSHIKHA DENGRA	0206EC151085	COLLABERA
7	NIKET PATEL	0206EC151093	COLLABERA
8	RIDDHISH MISHRA	0206EC151121	COLLABERA
9	SHANU VYAS	0206EC151136	COLLABERA
10	SHUBHAM RAJAK	0206EC151156	COLLABERA
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