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Volume 1

शेह्जार

SHEHJAR

(The Soothing Shade)

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GALGOTIAS
EDUCATIONAL INSTITUTIONS

ZION

Department of Electrical & Electronics Engineering

Galgotias College of Engineering and Technology

SHEHJAR

(The Soothing Shade) Issue-2017

OUR MENTORS

Mr. Suneel Galgotia

Mr. Dhruv Galgotia

Dr. V.K. Dwivedi (Director - GCET)

Chief Editor Pens Down…

Message

I am very honored and pleased to unveil the Volume-1 of our departmental magazine SHEHJAR (The Soothing Shade). I am glad to pen for this wonderful magazine as an appreciation of the commendable efforts put forth by the team. I wish that this magazine establishes to be a flint to fire the enthusiasm and excite the minds of the students for many intrusive innovations. Being the HOD, it is an indispensable responsibility to take all those endeavors at its pinnacle and hopefully this magazine will be its epitome. I extend my hearty congratulations to the entire faculty and students of Department of Electrical and Electronics Engineering for their enthusiasm and effort to achieve success.

Dr. Prabhakar Tiwari
HOD, EEE Department
Galgotias College of Engineering & Technology

Department of Electrical and Electronics Engineering

Vision of the Department

To be recognized as a premier department in producing quality technocrats, innovators, entrepreneurs and researchers contributing to the society ethically.

Mission of the Department

DM-1: To provide quality education through state-of-art facilities in exploring new ideas and technical challenges.

DM-2: To promote research, innovation and entrepreneurship through industry-institute collaboration.

DM-3: To inculcate social, ethical and moral values among the students leveraging them to be global engineers.

Program Educational Objectives of the Department

The graduates shall be able to:

PEO-1: Excel in their career by gaining knowledge using modern tools and technologies in the area of Electrical & Electronics Engineering.

PEO-2: Analyze real life problems and produce solutions through their entrepreneurship and innovative skills.

PEO-3: Exhibit ethical attitude, good communication skills and team work in core engineering through professional development and lifelong learning.

PSO of the Department

PSO-1: Simulate and develop the models for controlling and contriving of different electrical circuits and systems.

PSO-2: Design and develop electronics and communication circuits to provide solutions for complex engineering problems in the field of Electrical Engineering.

Contents

Application of IOT (Internet of Things) in Future

Divyanshi Tiwari
B.Tech. EEE IV Year

Internet of things finds applications in several fields, including electrical, medical, information technology, universal space research, and so on. To understand better about IOT, we must know about M2M, which stands for machine to machine, machine to man, man to machine, and machine to mobile connections that are used for connecting the human beings, electrical and electronic devices, and various systems intelligently.

If we consider the application of the internet of things in the electrical field, then we must know about:

A smart object that can be used for physical interfacing and computing environment based interacting with people as well as with other smart objects. RFID embedded electronic tags are being used as smart objects in several electrical applications such as RFID based attendance systems. A smart thermostat is another example of smart object which can be used for automatic remote controlling the air conditioners based on home's heat.

A smart device is an electronic device that is being used for connecting to other electronic devices or network systems through various available protocols. Android based smartphones, tablets, etc. are examples of smart devices.

A smart grid is an advanced electrical grid that is automatically controlled based on the gathered information about the behavior of generation and consumption, such that to improve efficiency, reliability of the system. Different types of sensors, smart objects, smart devices, and internet of things are used for designing and controlling the smart grids with the application of digital signal processing and communication systems.

Application of IOT is going to be making a revolution like the cell phone of the last decade. It is going to make inroads in our day to day life in all most all possible fields whether it is health, industry, home, agriculture, traffic, pollution, calamity etc.

Biocompatible Magnetic Skin

Akansha Dwivedi
B.Tech. EEE IV Year

Researchers at King Abdullah University of Science and Technology have recently developed a flexible and imperceptible magnetic skin that adds permanent magnetic properties to all surfaces to which it is applied. This artificial skin, presented in a paper published in Wiley's *Advanced Materials Technologies* journal, could have numerous interesting applications. For instance, it could enable the development of more effective tools to aid people with disabilities, help biomedical professionals to monitor their patients' vital signs, and pave the way for new consumer tech.

"Artificial skins are all about extending our senses or abilities," Abdullah Almansouri, one of the researchers who carried out the study, told TechXplore. "A great challenge in their development, however, is that they should be imperceptible and comfortable to wear. This is very difficult to achieve reliably and durably, if we need stretchable electronics, batteries, substrates, antennas, sensors, wires, etc. We decided to remove all these delicate components from the skin itself and place them in a comfortable nearby location (i.e., inside of eye glasses or hidden in a fabric)."

"The magnetic skin we developed is made of an ultra-flexible, wearable magnetic material," Almansouri explained. "Its unique advantage is that it eliminates the need for any electronics on the skin itself, hence reducing the complexity arising from wires, on-chip batteries, antennas, etc. The magnetic skin can be used to perform relatively sophisticated applications, such as tracking physiological movements (i.e., tracking the eye movement by attaching the magnetic skin on the eyelid) or contact-free user-machine interfaces and device control."

The artificial skin, developed under the supervision of Prof. Jürgen Kosel, is magnetic, thin and highly flexible. When it is worn by a human user, it can be easily tracked by a nearby magnetic sensor. For instance, if a user wears it on his eyelid, it allows for his eye movements to be tracked; if worn on fingers, it can help to monitor a person's physiological responses or even to control switches without touching them.

Most existing artificial skins require additional electronic components and elaborate micro-fabrication processes. In contrast, the magnetic skin developed by the researchers is easy to assemble, as it is made by mixing an elastomer matrix with magnetic powder and then drying this mixture at room temperature.

When this simple and effective fabrication process is complete, the material is magnetized with electro or permanent magnets, following a specific procedure that is tailored around its intended application. The system is then finalized by integrating a simple, off-the-shelf magnetic sensor.

"Another feature of the magnetic skin is that it can be fabricated in any shape or color, which means it, could be shaped and colored like your favorite emoji, a company or research team's logo, etc.," Almansouri added.

The artificial skin developed by Almansouri and his colleagues is lightweight, yet it maintains a magnetization of up to 360 mT. Due to its simple design and fabrication process, it eliminates the need for electronics, batteries and other components.

As it does not require any wiring or other integrated hardware, the material is very easy to implement and use. According to the researchers, just a few minutes of basic training should allow any user, even someone with a basic knowledge of the technology, to start his/her own artificial skin project.

The biocompatible and imperceptible material enables the development of a wide variety of useful and innovative tools, both for monitoring physiological responses and for remote gesture control. One of its most impactful implementations would be as an integration for new technologies to assist people with disabilities. For instance, combining the magnetic skin with smart home applications would allow physically disabled individuals to carry out actions (e.g., switch on the lights, turn on the washing machine, etc.) remotely.

"We believe that this imperceptible magnetic skin has a great potential to improve the quality of our life," Prof. Kosel said. "For example, it could enable the development of comfortable methods for tracking sleep quality and eye movement, which is of interest in sleep laboratories or to monitor eye diseases, magnetic hands for virtual reality and augmented reality applications, magnetic gloves for contact-free switching and control in sterile environments, and to track vital signs in biomedical applications."

Ultrathin 3-D-printed Films

Anurag Singh

B.Tech. EEE III Year

MIT researchers have developed a simple, low-cost method to 3-D print ultrathin films with high-performing "piezoelectric" properties, which could be used for components in flexible electronics or highly sensitive biosensors.

Piezoelectric materials produce a voltage in response to physical strain, and they respond to a voltage by physically deforming. They're commonly used for transducers, which convert energy of one form into another. Robotic actuators, for instance, use piezoelectric materials to move joints and parts in response to an electrical signal. And various sensors use the materials to convert changes in pressure, temperature, force, and other physical stimuli, into a measurable electrical signal.

Researchers have been trying for years to develop piezoelectric ultrathin films that can be used as energy harvesters, sensitive pressure sensors for touch screens, and other components in flexible electronics. The films could also be used as tiny biosensors that are sensitive enough to detect the presence of molecules that are biomarkers for certain diseases and conditions.

The material of choice for those applications is often a type of ceramic with a crystal structure that resonates at high frequencies due to its extreme thinness. (Higher frequencies basically translate to faster speeds and higher sensitivity.) But, with traditional fabrication techniques, creating ceramic ultrathin films is a complex and expensive process.

In a paper recently published in the journal *Applied Materials and Interfaces*, the MIT researchers describe a way to 3-D print ceramic transducers about 100 nanometers thin by adapting an additive manufacturing technique for the process that builds objects layer by layer, at room temperature. The films can be printed in flexible substrates with no loss in performance, and can resonate at around 5 gigahertz, which is high enough for high-performance biosensors.

"Making transducing components is at the heart of the technological revolution," says Luis Fernando Velaśquez-García, a researcher in the Microsystems Technology Laboratories (MTL) in the Department of Electrical Engineering and Computer Science. "Until now, it's been thought 3-D-printed transducing materials will have poor performances. But we've developed an additive fabrication method for piezoelectric transducers at room temperature, and the materials oscillate at gigahertz-level frequencies, which is orders of magnitude higher than anything previously fabricated through 3-D printing."

Electrospraying nanoparticles

Ceramic piezoelectric thin films made of aluminum nitride or zinc oxide can be fabricated through physical vapor deposition and chemical vapor deposition. But those processes must be completed in sterile clean rooms, under high temperature and high vacuum conditions. That can be a time-consuming, expensive process.

There are lower-cost 3-D-printed piezoelectric thin films available. But those are fabricated with polymers, which must be "poled"— meaning they must be given piezoelectric properties after they're printed. Moreover, those materials usually end up tens of microns thick and thus can't be made into ultrathin films capable of high-frequency actuation.

The researchers' system adapts an additive fabrication technique, called near-field electrohydrodynamic deposition (NFEHD), which uses high electric fields to eject a liquid jet through a nozzle to print an ultrathin film. Until now, the technique has not been used to print films with piezoelectric properties.

The jet is naturally inclined to break into droplets. But when the researchers bring the tip of the needle close to the substrate—about a millimeter—the jet doesn't break apart. That process prints long, narrow lines on a substrate. They then overlap the lines and dry them at about 76 degrees Fahrenheit, hanging upside down.

Using microscopy techniques, the team was able to prove that the films have a much stronger piezoelectric response—meaning the measurable signal it emits—than films made through traditional bulk fabrication methods. Those methods don't really control the film's piezoelectric axis direction, which determines the material's response. "That was a little surprising," Velaśquez-García says. "In those bulk materials, they may have inefficiencies in the structure that affect performance. But when you can manipulate materials at the nanoscale, you get a stronger piezoelectric response."

Automatic Garbage Detection and Collection System

Nivedita Chaurasia
B.Tech. EEE III Year

Numerous countries worldwide are currently facing major problems related to waste collection, particularly in urban areas, due to the large amount of waste generated daily by the population. Technology could play a significant role in tackling these issues, for instance, through the development of more effective tools to gather and collect garbage.

With this in mind, researchers at Vishwakarma Government Engineering College in India have recently created a cheap and effective system for automatic garbage detection and collection. Their system, presented in a paper pre-published on arXiv, uses artificial intelligence (AI) algorithms to detect and locate waste in its surroundings, and then picks it up with a robotic gripper.

"Contemporaneous methods find it difficult to manage the volume of solid waste generated by the growing urban population," the researchers wrote in their paper. "We propose a system that is very hygienic and cheap that uses AI algorithms for detecting the garbage."

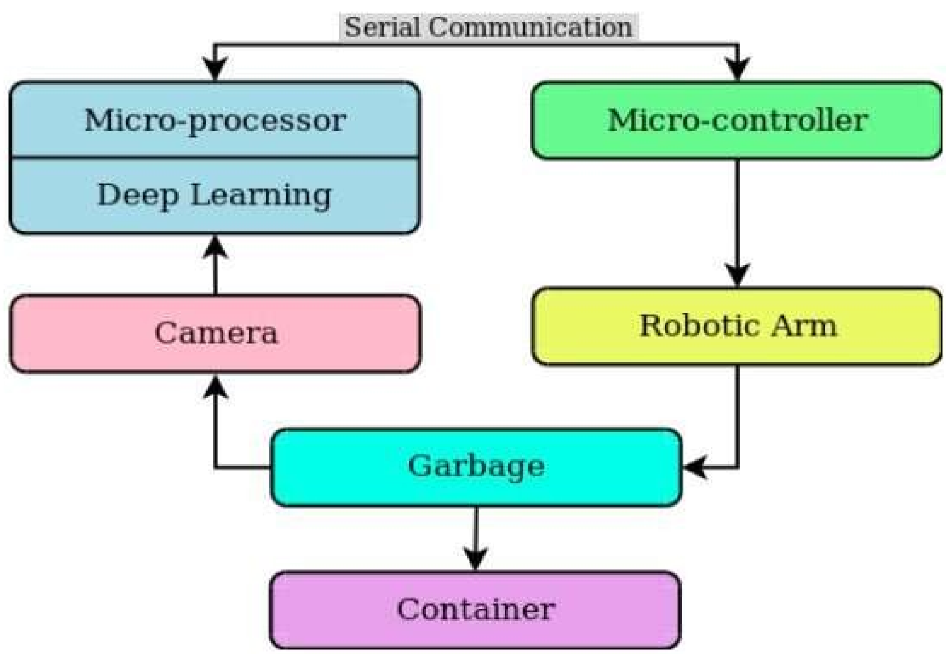
The waste management system, which the researchers refer to as AGDC (automatic garbage detection and collection), is composed of a robotic body (i.e. a base, a robotic arm and a drawer) and several machine learning algorithms. The system uses convolutional neural networks (CNNs) to detect rubbish on the ground and in its vicinity. Once it detects a piece of rubbish, it calculates its position by analyzing images collected by an integrated camera.

"Object detection refers to identifying instances of objects of a particular class (such as bottles, cat, dog or truck) in images and videos in digital format," the researchers explained. "AGDC uses object detection for classifying the garbage with the rest of the objects in the image/video. The object detection algorithm enables AGDC to identify places in the image or video where the object of interest (i.e. garbage) is resting."

Once the system's CNNs detect a piece of rubbish in its vicinity, another algorithm estimates the distance between the robot and the rubbish, while also generating instructions for the robot to reach the target location. The position of the debris and these instructions are then fed to a microcontroller, which essentially controls the robot's movements.

"After completing the task of object detection, the next task is to identify the distance of the object from the base of the robotic arm, which is necessary for allowing the robotic arm to pick up the garbage," the researchers explained.

Once the microcontroller receives information about where a piece of refuse is located, it moves the robot toward that location. When the robot finally reaches the garbage detected by the CNNs, it uses a robotic arm to collect it and drops it into a container (i.e. drawer) that is attached to its body.



"The design of the garbage collector can be split into three major parts: base, robotic arm and drawer," the researchers wrote. "The base drives the robot toward the garbage, the robotic arm collects the garbage and the drawer stores the garbage collected by the robotic arm."

The researchers have already developed a prototype of their waste detection system, which can currently collect up to 100-200g of garbage. In their future work, they plan to expand on this prototype, so that it can collect two to three kilograms of rubbish before emptying its drawer.

In addition, the team is thinking of developing and training a new CNN model that would allow AGDC to detect multiple pieces of rubbish simultaneously. Eventually, connecting the robot to the internet could also enable wider-scale implementations, for instance, creating an automated network of systems.

To A Friend

I call myself a friend,
The end,
Every friend has it's end,
It is nearer than you think,
For I am the friend who cared too much,
And you,
Too little,
I tried,
You cried,
Screaming "how could you,"
I question your intentions,
For you think I cared too less,
But it was you indeed,
For I went on years no sleep,
Watching,
Waiting,
Making sure I would wake up with a best friend,
And I cried,
When it rang true,
The end of you had come too soon,
For I was the friend who had lost what I loved,
And you were the friend who lost everything,

Kumari Indrani
B.Tech. EEE III Year

Robotic Thread

Md. Ashhar Faridi
B.Tech. EEE III Year

MIT engineers have developed a magnetically steerable, thread-like robot that can actively glide through narrow, winding pathways, such as the labyrinthine vasculature of the brain.

In the future, this robotic thread may be paired with existing endovascular technologies, enabling doctors to remotely guide the robot through a patient's brain vessels to quickly treat blockages and lesions, such as those that occur in aneurysms and stroke.

"Stroke is the number five cause of death and a leading cause of disability in the United States. If acute stroke can be treated within the first 90 minutes or so, patients' survival rates could increase significantly," says Xuanhe Zhao, associate professor of mechanical engineering and of civil and environmental engineering at MIT. "If we could design a device to reverse blood vessel blockage within this 'golden hour,' we could potentially avoid permanent brain damage. That's our hope."

In a tight spot

To clear blood clots in the brain, doctors often perform an endovascular procedure, a minimally invasive surgery in which a surgeon inserts a thin wire through a patient's main artery, usually in the leg or groin. Guided by a fluoroscope that simultaneously images the blood vessels using X-rays, the surgeon then manually rotates the wire up into the damaged brain vessel. A catheter can then be threaded up along the wire to deliver drugs or clot-retrieval devices to the affected region.

Kim says the procedure can be physically taxing, requiring surgeons, who must be specifically trained in the task, to endure repeated radiation exposure from fluoroscopy.

"It's a demanding skill, and there are simply not enough surgeons for the patients, especially in suburban or rural areas," Kim says.

The medical guidewires used in such procedures are passive, meaning they must be manipulated manually, and are typically made from a core of metallic alloys, coated in polymer, a material that Kim says could potentially generate friction and damage vessel linings if the wire were to get temporarily stuck in a particularly tight space.

Threading a needle

Over the past few years, the team has built up expertise in both hydrogels—biocompatible materials made mostly of water—and 3-D-printed magnetically-actuated materials that can be designed to crawl, jump, and even catch a ball, simply by following the direction of a magnet.

In this new paper, the researchers combined their work in hydrogels and in magnetic actuation, to produce a magnetically steerable, hydrogel-coated robotic thread, or guidewire, which they were able to make thin enough to magnetically guide through a life-size silicone replica of the brain's blood vessels.

The core of the robotic thread is made from nickel-titanium alloy, or "nitinol," a material that is both bendy and springy. Unlike a clothes hanger, which would retain its shape when bent, a nitinol wire would return to its original shape, giving it more flexibility in winding through tight, tortuous vessels. The team coated the wire's core in a rubbery paste, or ink, which they embedded throughout with magnetic particles.

Finally, they used a chemical process they developed previously, to coat and bond the magnetic covering with hydrogel—a material that does not affect the responsiveness of the underlying magnetic particles and yet provides the wire with a smooth, friction-free, biocompatible surface.

They demonstrated the robotic thread's precision and activation by using a large magnet, much like the strings of a marionette, to steer the thread through an obstacle course of small rings, reminiscent of a thread working its way through the eye of a needle.

Kim says the robotic thread can be functionalized, meaning that features can be added—for example, to deliver clot-reducing drugs or break up blockages with laser light. To demonstrate the latter, the team replaced the thread's nitinol core with an optical fiber and found that they could magnetically steer the robot and activate the laser once the robot reached a target region.

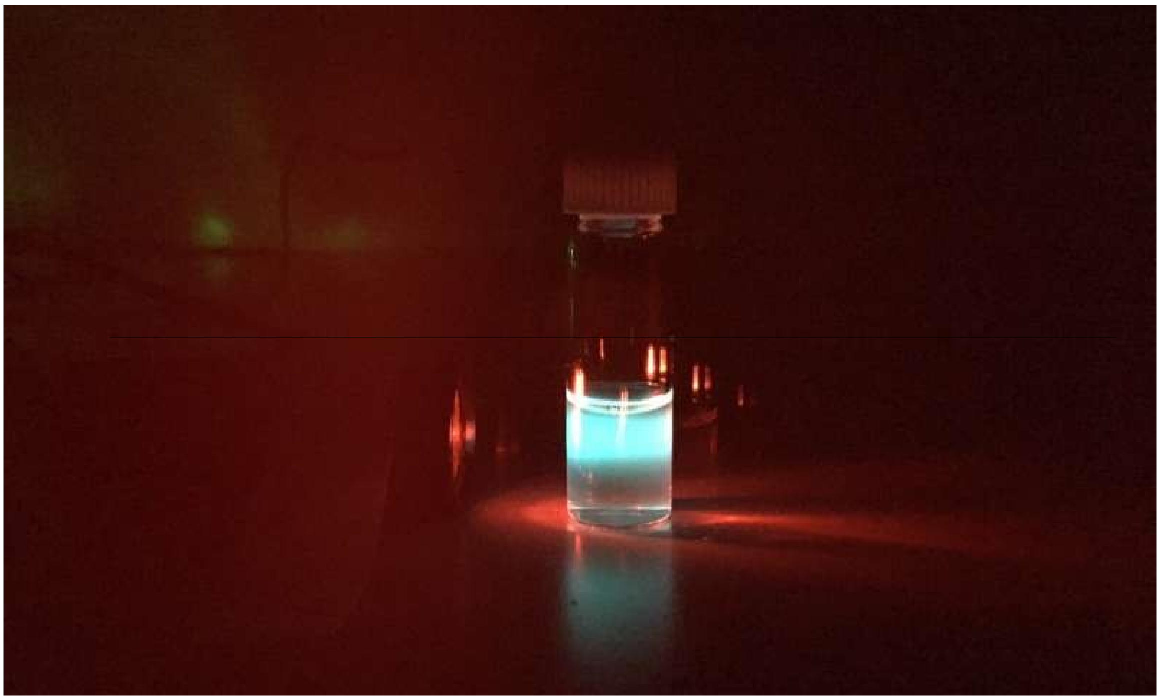
When the researchers ran comparisons between the robotic thread coated versus uncoated with hydrogel, they found that the hydrogel gave the thread a much-needed, slippery advantage, allowing it to glide through tighter spaces without getting stuck. In an endovascular surgery, this property would be key to preventing friction and injury to vessel linings as the thread works its way through.

And just how can this new robotic thread keep surgeons radiation-free? Kim says that a magnetically steerable guidewire does away with the necessity for surgeons to physically push a wire through a patient's blood vessels. This means that doctors also wouldn't have to be in close proximity to a patient, and more importantly, the radiation-generating fluoroscope.

In the near future, he envisions endovascular surgeries that incorporate existing magnetic technologies, such as pairs of large magnets, the directions of which doctors can manipulate from just outside the operating room, away from the fluoroscope imaging the patient's brain, or even in an entirely different location.

Nanoparticles as built-in night vision in Humans

Rashi Joshi
B.Tech. EEE III Year



Movies featuring heroes with superpowers, such as flight, X-ray vision or extraordinary strength, are all the rage. But while these popular characters are mere, flights of fancy, scientists have used nanoparticles to confer a real superpower on ordinary mice: the ability to see near infrared light. Today, scientists report progress in making versions of these nanoparticles that could someday give built-in night vision to humans.

The researchers will present their results at the American Chemical Society (ACS) Fall 2019 National Meeting & Exposition.

"When we look at the universe, we see only visible light," says Gang Han, Ph.D., the project's principal investigator, who is presenting the work at the meeting. "But if we had near-infrared vision, we could see the universe in a whole new way. We might be able to do infrared astronomy with the naked eye, or have night vision without bulky equipment."

The eyes of humans and other mammals can detect light between the wavelengths of 400 and 700 nanometers (nm). Near-infrared (NIR) light, on the other hand, has longer wavelengths—750 nm to 1.4

micrometers. Thermal imaging cameras can help people see in the dark by detecting NIR radiation given off by organisms or objects, but these devices are typically bulky and inconvenient. Han and his colleagues wondered whether they could give mice NIR vision by injecting a special type of nanomaterial, called upconversion nanoparticles (UCNPs), into their eyes. These nanoparticles, which contain the rare-earth elements erbium and ytterbium, can convert low-energy photons from NIR light into higher-energy green light that mammalian eyes can see.

In work published earlier this year, the researchers, who are at the University Of Massachusetts Medical School, targeted UCNPs to photoreceptors in mouse eyes by attaching a protein that binds to a sugar molecule on the photoreceptor surface. Then, they injected the photoreceptor-binding UCNPs behind the retinas of the mice. To determine whether the injected mice could see and mentally process NIR light, the team conducted several physiological and behavioral tests. For example, in one test, the researchers placed the mice into a Y-shaped tank of water. One branch of the tank had a platform that the mice could climb on to escape the water. The researchers trained the mice to swim toward visible light in the shape of a triangle, which marked the escape route. A similarly lit circle marked the branch without a platform. Then, the researchers replaced the visible light with NIR light. "The mice with the particle injection could see the triangle clearly and swim to it each time, but the mice without the injection could not see or tell the difference between the two shapes," says Han.

पुल

Shubham Garg
B.Tech. EEE III Year

सपने अपने होते हैं, हकीकत बेगानी होती हैं
जो मिल जाये ये दौनो तो महान जिंदगानी होती हैं !

वैसे ये ज़िन्दगानी भी किसी नदी की तरह होती हैं
इसके एक किनारे पर सपने तो दूजे पे हकीकत होती हैं !

दौ किनारों को मिला सके ये हुनर तो खुदा में भी नहीं
हम इंसानों की कोशिश तो इन किनारों पर पुल बनाने की होती हैं !

मिट्टी सपनो की होती हैं, पत्थर हकीकत के होते हैं
और जो जमा दे इन दोनों को वो पकड़ इरादों की होती हैं !

कमबख्त ये बहाव, उलझाव इरादों को पकड़ बनाने भी नहीं देता
जिस पत्थर को उठाओ उसकी मंशा बह जाने की होती हैं !

बस बहती नहीं हैं तो ये ख्वाहिश पुल बनाने की
इसकी इच्छा तो हरदम वक़्त को मुँह चिड़ाने की होती हैं !

पर ये वक़्त ये बहाव किसी का हमदम नहीं दोस्त
इसकी फितरत भी बस बह जाने की होती हैं !

“ठाकुर” वक़्त रहते अपना ये पुल बना लीजिये
ना जाने कौन सी घड़ी साँसों के बिखर जाने की होती हैं !

Building Computers the Way Our Brains Work

Shafqat Ali
B.Tech. EEE III Year

We are approaching the limit for how much more microprocessors can be developed. Gunnar Tufte proposes building computers in a completely new way, inspired by the human brain and nanotechnology. Gunnar Tufte is a professor of computer technology, but his research has taken him in some surprising directions. He's now head of a project that is rethinking how tomorrow's computers should be built—inspired by neuroscience and physics.

Tufte calls computers a miracle in the modern world but thinks their transistors are approaching retirement age.

"It's time to rethink computers. In principle, they're still being built the same way they were 60-70 years ago," says Tufte.

Tufte believes that the structure of the human brain can inspire the architecture for the computers of the future: self-organizing and built from non-traditional materials.

He's not talking about a cyborg, which is a mix of technology and biology.

For over 50 years, microprocessor speeds have doubled every two years. Tufte believes it won't be possible to keep up that aggressive pace much longer. Reducing the number of components makes machines unreliable. Increasing the number of parts makes them energy intensive. A typical data center consumes as much power as 40 000 households, and the machines' increasing complexity makes them too expensive to manufacture.

Look to the brain

The NTNU professor believes the brain has characteristics that computers should have.

"The brain provides stable performance even though these parts are unstable; it requires very little energy and has a self-organizing design process. If we manage to transfer properties like these from neural networks to computers, we'll be able to revolutionize the way we make computers," he said.

"A cell is both constructed and constructor. Neural networks are complex but start out simple. The organism adapts to the environment and the world. When we construct machines it's the opposite," he said. "We build a computer of parts that are precisely planned and produced, and they're assembled according to a large plan to do a specific task. The machine is complicated from the start, but doesn't have the ability to develop."

The art of learning

And whereas we have to program a computer to perform new tasks or adapt to other technologies, the brain has the ability to learn.

He says constructing this type of computer will require completely different hardware than is used in today's machines, an idea that is being pursued in a five-year research project that ends in 2022 partially funded by the Research Council of Norway called SOCRATES.

Nanomagnets might offer an approach, for example.

"Magnets are easy to make, and they're easy to scale because they're so simple and require little energy. By enabling self-organization, we aren't dependent on the individual component. One or more components can differ without the result being incorrect," he says.

Nanomagnets already here

Nanomagnets have been produced in the NTNU Nanolab, and Tufte and his group are running simulations of how magnets can behave in a self-organizing fashion.

The researchers are collaborating with colleagues at ETH in Switzerland, the University of Sheffield, the University of Ghent, Oslo Metropolitan University and the University of York. Interest in financing research on alternatives to the silicon processor has taken off in the last five to six years, Tufte says. Internationally, current research includes using carbon nanotubes and various molecular solutions.

Ignores small errors

But how can results be correct if the hardware is allowed to fail?

"Errors occur when you scale down. So you have to compensate with technology that will detect errors. At some point, you'll end up using more resources on discovering errors than solving the problem. The brain has an underlying self-organization that doesn't depend on whether a single brain cell is reliable. We have to try to copy that," Tufte says.

Tufte says the world would surely survive even if today's computers don't become more powerful, but that developing more efficient computers has clear environmental consequences, on top of everything else.

"We would avoid imploding the planet. But the impact on economics and politics would be huge. Everything is based on growth. Personally,

Art by Hemant Sengar

Art by Ashish Ojha

Art by Ashish Ojha

Art by Hemant Sengar

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