All India Shri Shivaji Memorial Society's
Institute of Information Technology,
Kennedy Road, Near R.T.O, Pune-411016

TELESCAN

Department of E&TC

TECH AUTOMATION INNOVATION ROBOTICS INDUSTRY MACHINE

Volume - 6

August 2016

We are much honoured and happy to present you ‘TELESCAN 2016’, our Departmental Magazine.

As TELESCAN is a technical magazine, it provides a platform to the students to express their advanced technical knowledge. Students get inspired to do study on latest technology before submitting their articles. It is surely beneficial for students.

We would like to thanks Mrs M.P. Sardey (HOD), Mrs D.M. Yewale & Mr S.R. Pawar for their support and encouraging us to represent such a wonder. This year we have got good response from students and we have made our best to make TELESCAN the gem.

Editorial Team:
Staff Co-ordinator:

Harshal Gothankar (BE-A)
Mrs D.M. Yewale

Rashmi Dusane (BE-A)

Divyasha Nair (BE-B)

Rucha Bhange (BE-C)

Monish Khandelwal (TE-A)

Shrikar Sawant (TE-B)

Tushar Rewatkar (TE-C)

Prachi Kolte (SE-A)

INDEX

VISION OF E&TC DEPARTMENT

- To provide quality education in electronics & telecommunication engineering with professional ethics

MISSION OF E&TC DEPARTMENT

- To develop technical competency, ethics for professional growth and a sense of social responsibility among students

"The Leader of Leaders"

The Virtual Mirror-Augmented Reality Applications

Virtual Mirror enhances visualization of customized consumer articles like clothes, shoes, jewellery, etc. Instead of viewing yourself in a real mirror, highly sophisticated 2D and 3D image processing techniques are now used to visualize the look of new products without any need to actually put them on. A camera captures the real world and outputs the mirrored images onto a large display which replaces a real mirror. Your movements are tracked in real-time and the computer graphics models of the consumer articles are augmented in the video so that you really seem to be wearing the virtual objects.

The Virtual Mirror framework uses high-end augmented reality techniques that combine real video content with computer-generated material in real-time. The concept of a mirror realizes augmentation without the customer needing to wear glasses. No additional equipment has to be used as you can just step into the application and move freely like in front of a real mirror. This significantly enhances acceptability and impressiveness while also reducing the effort needed for supervising such an application. Since computer graphics models of the objects are exploited, individual customizations can easily be performed and checked for appearance. It also means that a broad palette of different products can effectively be tried on without any need for continual dressing and undressing. Possible applications of the system are visualization of customized shoes, clothes, jewellery, glasses or hairstyles. In marked contrast to existing approaches, the system works three-dimensionally and shows all virtual equipment from the correct viewing angle and pose. Output is not restricted to a fixed frontal view as in other 2D systems, giving users a much more vivid feeling of being in a real environment.

Fig. Virtualization and Augmentation of clothes in real time

Challenges:

- Combination of real and virtual parts in one world

- Visualization and augmentation of personalized objects, rigid and/or deformable
- Motion, deformation and illumination recovery
- Real-time capability

Benefits:

- Augmented reality visualization without glasses or other technical aids
- Sophisticated image processing and tracking techniques allow real-time experience
- Simple hardware architecture for greater reliability
- Visualization and customization of virtual products in real environments

Competencies:

- The Computer Vision & Graphics group works on enhanced algorithms and software implementation in the field of 3D image and video processing
- Face analysis and animation
- 3D rigid and flexible object tracking n 3D reconstruction
- Virtual and augmented reality

Mrs Deepali Yewale,
Assistant Professor,
E& TC Department.

Approach Lighting System

An approach lighting system, or ALS, is a lighting system installed on the approach end of an airport runway and consisting of a series of light bars, strobe lights, or a combination of the two that extends outward from the runway end. ALS usually serves a runway that has an instrument approach procedure (IAP) associated with it and allows the pilot to visually identify the runway environment and align the aircraft with the runway upon arriving at a prescribed point on an approach.

Modern approach lighting systems are highly complex in their design and significantly enhance the safety of aircraft operations, particularly in conditions of reduced visibility.

Operation:

The required minimum visibility for instrument approaches is influenced by the presence and type of approach lighting system. In the U.S., a CAT I ILS approach without approach lights will have a minimum required visibility of 3/4 mile, or 4000 foot runway visual range. With a 1400-foot or longer approach light system, the minimum potential visibility might be reduced to 1/2 mile (2400 runway visual range), and the presence of touchdown zone and centreline lights with a suitable approach light system might further reduce the visibility to 3/8 mile (1800 feet runway visual range). The runway lighting is controlled by the air traffic control tower. At non-towered airports, pilot-controlled lighting may be installed that can be switched on by the pilot via radio. In both cases, the brightness of the lights can be adjusted for day and night operations. Depth perception is inoperative at the distances usually involved in flying aircraft, and so the position and distance of a runway with respect to an aircraft must be judged by a pilot using only two-dimensional cues such as perspective, as well as angular size and movement within the visual field. Approach lighting systems provide additional cues that bear a known relationship to the runway itself and help pilots to judge distance and alignment for landing.
History

After World War II, the U.S. Navy and United Airlines worked together on various methods at the U.S. Navy's Landing Aids Experimental Station located at the Arcata, California air base, to allow aircraft to land safely at night and under zero visibility weather, whether it was rain or heavy fog. The predecessor of today's modern ALS while crude had the basics — a 3,500 foot visual approach of 38 towers, with 17 on each side, and atop each 75 foot high tower a 5000 watt natural gas light. [2] After the U.S. Navy's development of the lighted towers it was not long before the natural gas lights, were soon replaced by more efficient and brighter strobe lights, and then called Strobeacon lights. The first large commercial airport to have installed a strobe light ASL visual approach path was New York City's John F. Kennedy International Airport. [3] Soon other large airports had strobe light ASL systems installed.

Decision bar:

All approach lighting systems in the United States utilize a feature called a decision bar. Decision bars are always located 1000’ farther away from the threshold in the direction of the arriving aircraft, and serve as a visible horizon to ease the

transition from instrument flight to visual flight. Approach lighting systems are designed to allow the pilot to quickly and positively identify visibility distances in Instrument meteorological conditions. For example, if the aircraft is at the middle marker, and the middle marker is located 3600 feet from the threshold, the Decision Bar is 2600 feet ahead. If the procedure calls for at least half a statute mile flight visibility (roughly 2600 feet), spotting the Decision Bar at the marker would indicate enough flight visibility to continue the procedure. In addition, the shorter bars before and after the Decision Bar are spaced either 100 feet or 200 feet apart, depending on the ALS type. The number of short bars the pilot can see can be used to determine flight visibility. Approaches with lower minimums use the more precise 100-foot spacing systems for more accurate identification of visibility.

Configurations

Several ALS configurations are recognized by the International Civil Aviation Organization (ICAO); however, non-standard ALS configurations are installed at some airports. Typically, approach lighting systems are of high-intensity. Many approach lighting systems are also complemented by various on-runway light systems, such as Runway End Identifier Lights (REIL), Touchdown Zone Lights (TDZL), and High Intensity Runway Lights (HIRL). The most common approach light system configurations include:

MALSR: Medium-intensity Approach Lighting System with Runway Alignment Indicator Lights MALSF: Medium-intensity Approach Lighting System with Sequenced Flashing lights SALS: Short Approach Lighting System SSALS: Simplified Short Approach Lighting System SSALR: Simplified Short Approach Lighting System with Runway Alignment Indicator Lights SSALF: Simplified Short Approach Lighting System with Sequenced Flashing Lights ODALS: Omnidirectional Approach Lighting System ALSF-1: Approach Lighting System with Sequenced Flashing Lights configuration 1 ALSF-2: Approach Lighting System with Sequenced Flashing Lights configuration 2 CALVERT I/ICAO-1 HIALS: ICAO-compliant configuration 1 High Intensity Approach Lighting System CALVERT II/ICAO-2 HIALS: ICAO-compliant configuration 2 High Intensity Approach Lighting System LDIN: Lead-in lighting REIL: Runway End Identification Lights RAIL: Runway Alignment Indicator Lights

In configurations that include sequenced flashing lights, the lights are typically strobes mounted in front of the runway on its extended centreline. These lights flash in sequence, usually at a speed of two consecutive sequences per second, beginning with the light most distant from the runway and ending at the Decision Bar. RAIL are similar to sequenced flashing lights, except that they end where the white approach light bars begin. Sequenced flashing lights and RAIL do not extend past the Decision Bar to avoid distracting the pilot during the critical phase of transitioning from instrument to visual flight. Sequenced flashing lights are sometimes colloquially called the rabbit or the running rabbit.

Pawan Kumar
T.E (B)

A Closer Look at Metal 3-D Printing

In the wee hours of a Saturday morning, Professor of Materials Science and Engineering Tony Rollett and graduate students Ross Cunningham and Tugce Ozturk sit in Sector 2 of the mile-wide Advanced Photon Source at the Argonne National Laboratory in Chicago, Illinois. In front of them is an enormous synchrotron x-ray machine, powerful enough to see through heavy metals down to one millionth of a meter, roughly one hundredth of a human hair. The unique equipment is in such high demand that the team has just forty-eight hours to use the x-rays before they must pack up and carry their data back to Pittsburgh. Scientists who are able to secure time with the synchrotron study the internal structure of materials including polymers, biomedical biopsies, and alloys. The synchrotron takes detailed, 3-D images that are used to characterize materials. The images are so precise that researchers often turn to synchrotron technology to identify ancient insect fossils, which can barely be seen under a microscope.

Instead of leveraging this powerful technology to learn about ancient materials, Rollett's group seeks to gain elusive information about 3-D printed metals. By looking deep inside thin slices of 3-D printed titanium parts, the group examined defects in the printed metal that are difficult to detect even with current laboratory-grade equipment. These defects, called pores, make the part more susceptible to breakage when the part is exposed to repeated weight or stress. Potential for breakage might not be

Big deal for your 3-D printed toothbrush holder, but it is significantly more important when it comes to a 3-D printed part for a jet engine.

Although 3-D printing, or additive manufacturing, is currently used for rapid prototyping, it may become the mainstream manufacturing process for grander applications such as aerospace parts, custom biomedical implants, and high performance automobiles. Improving the internal structure of 3-D printed metal parts is a challenge that must be

met in order for this manufacturing process to become more mainstream. Rollett's team published a paper in the Journal of Minerals, Metals, and Materials Society in collaboration with Professor of Mechanical Engineering Jack
Aerospace is one of the possible applications for which 3-D printing may become the mainstream manufacturing process.
Beuth, which showed that a majority of the porosity in 3-D printed titanium could be eliminated by making adjustments to the process parameters of the machine.
Less porosity means stronger, more reliable end-parts. "Having a strong understanding of the fundamental science of additive manufacturing materials is necessary in order to use them in aerospace and other demanding applications," says Beuth. "The ability to visualize porosity and flaws in 3-D with such high precision is a breakthrough capability in additive research." Rollett and his team plan to continue their research to determine if it is possible to eliminate all remaining porosity from 3-D printed titanium and other metals. This is an important goal because it is currently thought that some amount of porosity will always exist in 3-D printed materials. "In a conventional material like steel, there aren't any of these pores," says Rollett. "In additive manufacturing materials, there they [pores] are. You have to figure out how to understand them and deal with them. It is a new challenge in the field of materials science."
Carnegie Mellon's Next Manufacturing Centre, where Beuth serves as director and Rollett as associate director, has focused its attention on materials science projects like this one. As one of the world's leading research centers for additive manufacturing, the center is advancing the field of additive manufacturing by meeting the research challenges of the industry.

VENKATESH
MAHINDRAKAR
TE-A

How Lithium-Metal Doubles the Energy Density of Rechargeable Batteries

A new generation of rechargeable lithium-metal batteries have double the energy capacity of lithium-ion batteries.
Solid Energy Systems, a company founded by Qichao Hu in 2012, has announced a new rechargeable lithium-metal battery which offers two times the energy capacity of a conventional lithium-ion battery for a given battery size and weight.

The new battery is as safe and long-lasting as a lithium-ion battery. Considering the widespread use of lithium-ion batteries in smartphones, electric cars, drones, and more, the invention is a big stride. The battery can make these devices work twice as long or make their miniature version feasible.

The Holy Grail of Battery Industry

Researchers have known the advantages of lithium-metal batteries (i.e., a higher energy density and a smaller size) for decades. However, these batteries have been so far non-rechargeable and have been known to burst into flame. These two characteristics stem from the reaction which takes place between the lithium metal and the battery's electrolyte.

This reaction not only produces compounds which increase the resistance in the battery and reduce the cycle life, but also forms mossy lithium-metal bumps on the anode which leads to short circuits. A short circuit generates high heat and ignites the flammable electrolyte.

Generally, the measures taken to make these batteries safer degrade its energy performance.

This new generation of lithium-metal batteries combats this issue by altering the materials inside the battery in order to change the chemistry, itself.

Lithium-Metal Foil Anodes

To increase the energy capacity, Solid Energy utilizes a very thin high-energy lithium-metal foil instead of the conventional anode material, graphite. This doubles the energy density due to the increased number of ions held by the lithium metal.

In addition, using the ultrathin lithium-metal foil—which is five times thinner than the traditional lithium-metal anode and several times thinner than traditional graphite, carbon, or silicon anodes—researchers have reduced the battery size by a factor of two.

The first working prototype of the new battery, presented in October 2015, was half the size of a lithium-ion battery for an iPhone 6. It provided 2.0 amp hours, whereas the lithium-ion battery provides 1.8 amp hours. This successful debut earned $12 million of investment for the company.

The lithium-metal battery compared to a lithium-ion battery seated in an iPhone. Image courtesy of Business Wire.

A Rechargeable and Safe Lithium-Metal Battery

Hu employed an ultrathin lithium-metal foil as the anode to significantly reduce the battery size. However, the achieved battery worked only at 80 degrees Celsius or higher and could not be used in many commercial applications.

Lithium-metal batteries are often more volatile and short-lived than the lithium-ion ones. In order to arrive at a rechargeable and safe solution, the company had to make chemical modifications to the electrolyte. Their solution was to develop a solid and liquid hybrid electrolyte.

Hu utilized a solid electrolyte as a coating for the lithium-metal foil to bring the operating temperature of the battery down. Moreover, he introduced a novel quasi-ionic liquid electrolyte which is inflammable and does not adversely react with the lithium metal.

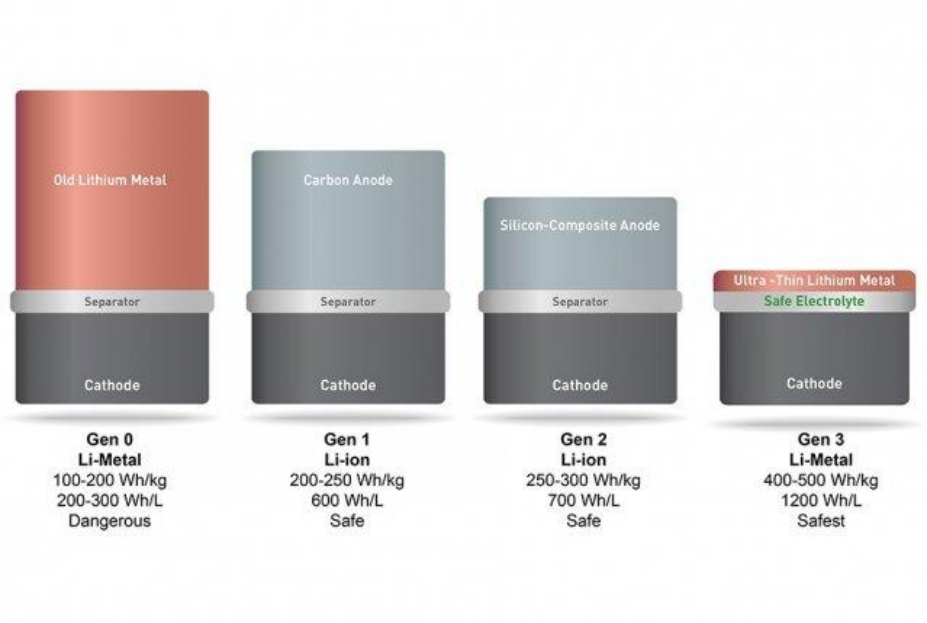
The outcome was a battery which offered the energy capacity of lithium-ion batteries at room temperature and had the safety and longevity of lithium-ion batteries.

Manufacturing Scalability

Another impressive feature is that the manufacturing equipment required to create these batteries is the same as that of lithium-ion batteries. This means that they could be commercially available relatively quickly.

Achieving this manufacturing capability is actually a story of circumstance influencing design.

When Hu was establishing Solid Energy in 2012, the well-known MIT battery startup A123, which had been developing lithium-ion batteries, was filing for bankruptcy. At first, this was intimidating for Solid Energy. However, Hu ended up using A123's then-idle manufacturing line to build the first generation of lithium-metal batteries.



The development of the lithium-metal battery. Image courtesy of the MIT Technology Review.

Since Solid Energy had no facilities, no funding, and no labs to build batteries, the company was forced to adapt its prototyping with the existing lithium-ion manufacturing equipment. The final result was a new technology manufactured with commercially available tools.

According to Hu, many battery companies do the opposite by mainly concentrating on the materials and building their own labs based on the materials they are going to work with. Since they do prototype using completely new manufacturing processes, their battery cannot be easily adapted to the commercial manufacturing line.

Target Markets: Starting with Drones

Solid Energy has an incredibly aggressive timetable to sell batteries for smartphones and wearable's in early 2017 and for the electric cars in 2018. The company's first target, though, is the drone market which they aim to cover this November.

Considering the increasing interest of some companies to provide internet access to rural areas using drones and balloons, Solid Energy plans to offer its first series of batteries for drone applications. Selling batteries for drone applications could be a good strategy for introducing the new battery to the market. Note that there are battery companies which have failed because of the established battery providers such as Panasonic which, as an example, has a multi-billion-dollar contract with electric car manufacturer Tesla. However, the recently growing specialized drone market could give Solid Energy the chance to attract the attention of other customers and bring the technology to market. Unfortunately, the company has not released many details such as a cost per kWh figure for the battery. However, if the technology hits the market, it will have a huge societal impact. As an example, an electric car, which now goes 200 miles on a single charge, will be able to either go 400 miles per charge or reduce its battery size and weight by a factor of two. A development of that import could finally help consumers overcome the largely overblown fear of "range anxiety" when it comes to electric cars. In short, these batteries could change the way the world views energy. And with the manufacturing and investment behind lithium-metal batteries, it might not be long until we find out.

Harshal Gothankar
B.E. –A

Recovering Data from Ever-Shrinking Disk Drives

Digital devices have come a long way in the last few decades, particularly as they continue to shrink in size. Many advances, including new recording media, disk drive heads, and disk architectures, have contributed to making today's computer drives compact while being able to store and read amazing amounts of data. But as the size of disk drives became relentlessly smaller and were able to store tremendously more data, a major challenge developed.

How can the computer successfully recover and read the bits of data stored on miniature disk drives? Over the last 30 years, Carnegie Mellon engineers have contributed in many different ways to the progress of disk drive storage and, in particular, significantly contributed to solving the challenge of accurately reading bits of data crammed into miniscule places.

Back in the 1950s, a typical computer disk drive was approximately five feet in diameter and could store no more than 1 million bits, or a megabyte (MB), of data. For reference, an MP3 audio file a few minutes in length, or a 10 million-pixel image from a digital camera, typically take up several tens of megabytes. Fast forward to present day where disk drives are a few inches in diameter and can store terabytes (TB) of data (1 TB = 1 million MB).

As disk drives decreased in size and the amount of data being stored increased exponentially, researchers became concerned about the ability to accurately recover and successfully read the stored bits of data. Carnegie Mellon's Data Storage Systems Center (DSSC) is a world-leading academic research institution in data storage that focuses on magnetic data storage technology for hard disk drive applications.

In the early 1990s, José Moura, a professor in Carnegie Mellon's College of Engineering, along with his then Ph.D. student Aleksandar Kavcic, now a professor at the University of Hawaii, set out to find an innovative way to accurately recover bits from the ever-shrinking storage disk drives of the future.

Kavcic and Moura invented and patented a detector that could safely and accurately extract recorded data from disk drives. When the early 2000s recording technology changed to perpendicular recording, their detector algorithm invention became a must-have technology. "Alek Kavcic and I chose to target the limitations that were sure to arise in reading bits in magnetic recording in the future," says Moura. "Instead of looking for quick payoffs from incremental improvements, we invested our efforts in understanding and abstracting the fundamentals. In a moment of serendipity, we were able to develop a simple, fundamental new way to account for the main physical limitations of magnetic recording and to invent a detector that outperformed all others."

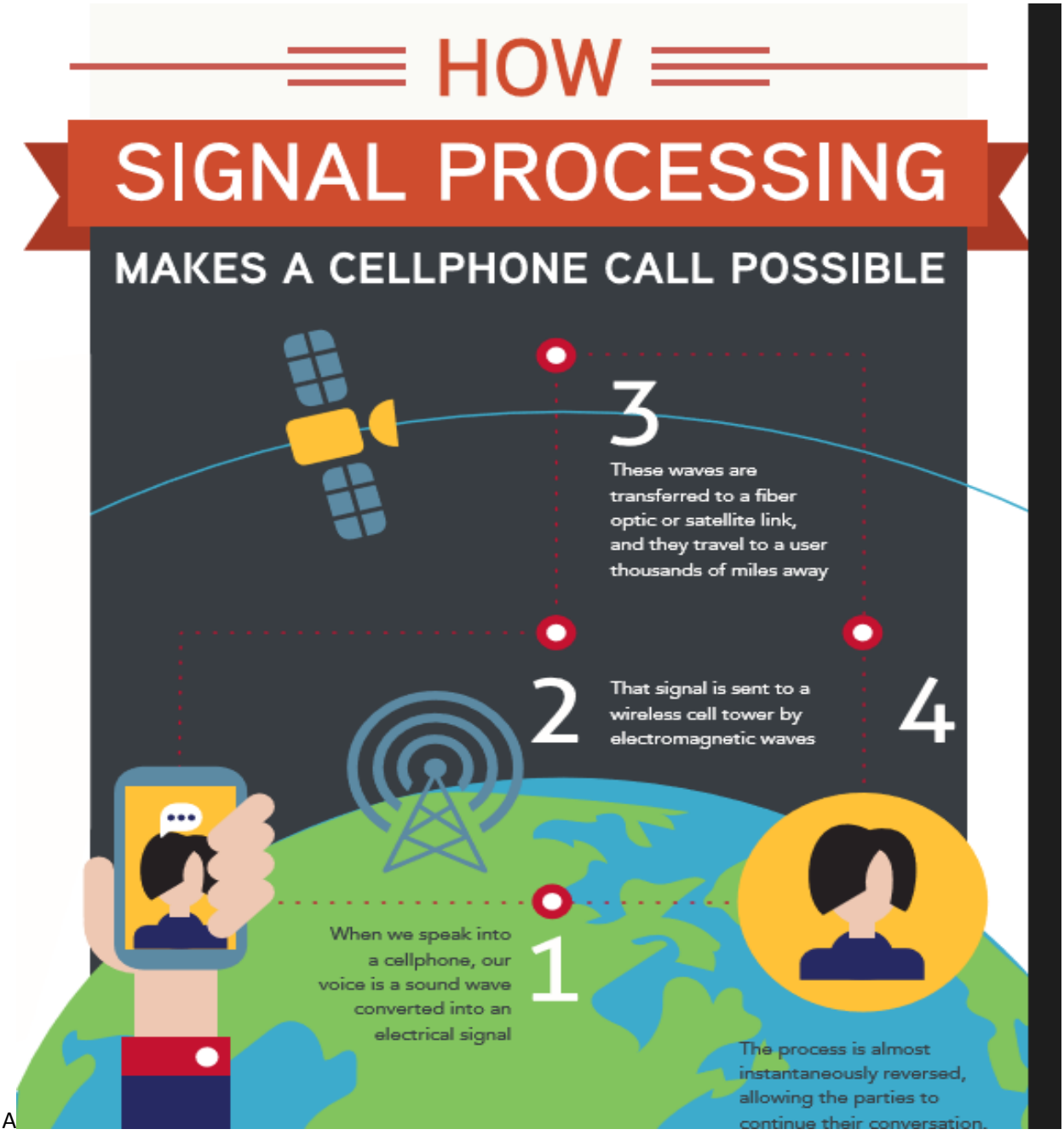
It is estimated that the disk drives in 60% of computers (over 3 billion) made in the last 14 years contain this detector technology enabling users to recover saved data. "Our patience paid off in the 2000s when industry faced the inevitability of its own success," says Moura. "It needed a fundamentally new approach that was simple to implement

and could read back the enormous amount of data being packed in very small spaces. The rest is history, and our patents became crucial to read channel chip manufacturers."

Looking to the future, Moura is developing algorithms that digest the tremendous amount of data being collected from multiple sources in everyday life. Nowadays, cities are covered in sensors that monitor security, weather, traffic patterns, energy consumption, pollution levels, and more. The data from these sensors allow us to understand the normal social behaviour in a particular city. By addressing these data-rich environments, Moura hopes to understand the normal—and abnormal—behaviours of cities, from traffic jams to inconspicuous sources of pollution to unbearable sources of noise. Ultimately, Moura's data analytics may help urban planners rethink the way they envision cities. "If urban planners better understand city bottlenecks, they could reimagine a city and have major social and environmental impact," says Moura. "It would give city dwellers a more pleasant day-to-day life. I think we live in interesting times. For the past few decades, society has shaped technology. Moving forward, technology is helping to shape society. And that is pretty amazing."

Monish Khandelwal
TE A

THE IMPACT OF SIGNAL PROCESSING



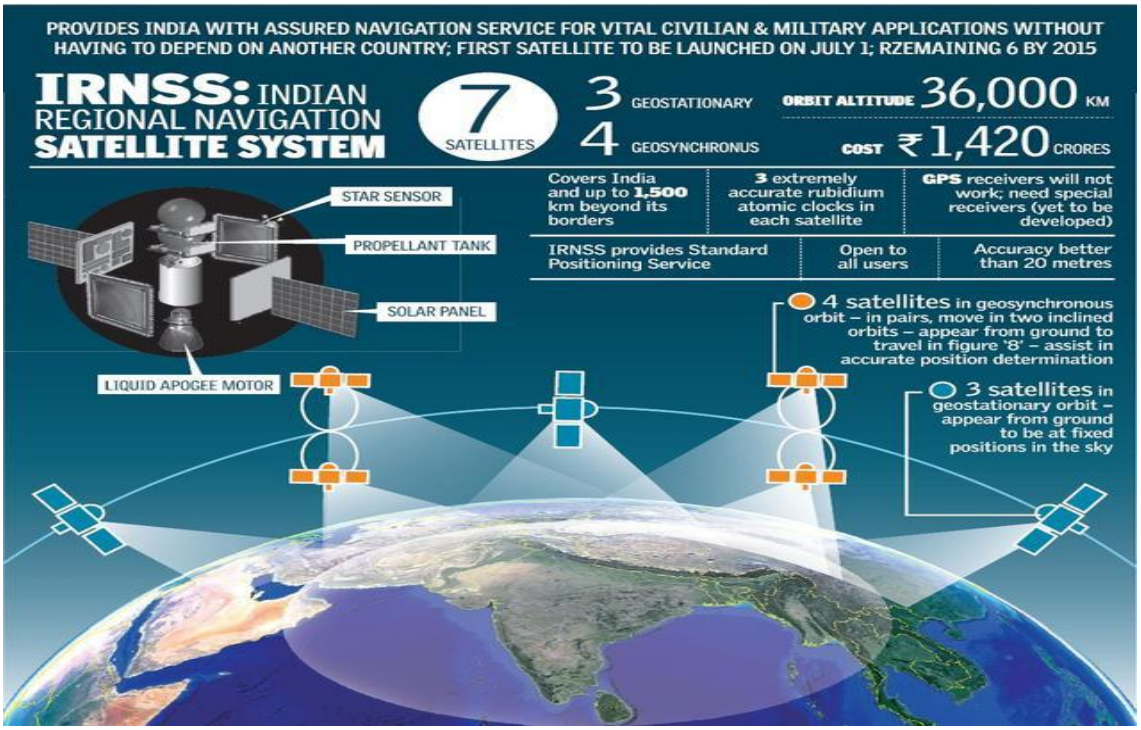
A

Signal processing is the technology behind technology. Signal processing involves developing algorithms to process the massive amounts of data generated, collected, and stored in disk drives and extracts knowledge and actionable wisdom. This enabling technology is vital in many fields, including wireless communications, smartphones, medical MRI/CAT scans, drilling for oil, aviation, cable and broadcast TV, radar, or sonar. A simple cell phone conversation is a prodigy of successful technologies; but having that conversation would not be possible without the algorithms derived from signal processing. When we speak into a cell phone, our voice is a sound wave converted into an electrical signal that, in turn,

is sent to a wireless cell tower by electromagnetic waves. These waves are transferred to a fiber optic or satellite link, then travel around the world to be delivered to a user thousands of miles away. The process is almost instantaneously reversed, and the parties can continue the
Conversation. Signal processing is a behind-the-scenes enabler in all these steps.

Monish Khandelwal
TE A

Indian Regional Navigation Satellite System (IRNSS)



Country of origin	India
Operator(s)	ISRO
Type	Military, Commercial
Status	Operational
Coverage	Regional
Precision	10 m (public) 0.1 m (encrypted)
Total satellites	7
Satellites in orbit	7
First launch	1 July 2013
Last launch	28 April 2016 12:50 PM IST
Total launches	7 (All Successful)
Regime(s)	High Earth
Orbital height	36,000 km (22,000 mi)[1]
Cost	$212 million

IRNSS is an independent regional navigation satellite system being developed by India. It is designed to provide accurate position information service to users in India as well as the region extending up to 1500 km from its boundary, which is its primary service area. An Extended Service Area lies between primary service area and area enclosed by the rectangle from Latitude 30 degree south to 50 degree North, Longitude 30 degree east to 130 degree east.

IRNSS will provide two types of services, namely, Standard Positioning Service (SPS) which is provided to all the users and Restricted Service (RS), which is an encrypted service provided only to the authorised users. The IRNSS System is expected to provide a position accuracy of better than 20 m in the primary service area.

The space segment consists of the IRNSS constellation of seven satellites, NavIC. Three satellites are located in suitable orbital slots in the geostationary orbit and the remaining four are located in geosynchronous orbits with the required inclination and equatorial crossings in two different planes. All the satellites of the constellation are configured identically. The satellites are configured with I-1K Bus to be compatible for launch on-board PSLV.

Satellites	Launch Date	Remark
IRNSS-1A	1 July 2013	IRNSS-1A is launched on 24 Sep 2014 satellite in the Indian Regional Navigation Satellite System (IRNSS). It is one of the seven spacecraft constituting the IRNSS space segment.
IRNSS-1B	4 April 2014	IRNSS-1B is the second satellite in the Indian Regional Navigation Satellite System (IRNSS).
IRNSS-1C	16 October 2014	IRNSS-1C is the third satellite in the Indian Regional Navigation Satellite System (IRNSS).
IRNSS-1D	28 March 2015	IRNSS-1D is the fourth satellite in the Indian Regional Navigation Satellite System (IRNSS).
IRNSS-1E	20 January 2016	IRNSS-1E is the fifth satellite in the Indian Regional Navigation Satellite System (IRNSS).
IRNSS-1F	10 March 2016	IRNSS-1F is the sixth satellite in the Indian Regional Navigation Satellite System (IRNSS).
IRNSS-1G	28 April 2016	IRNSS-1G is the seventh and final satellite in the Indian Regional Navigation Satellite System (IRNSS).

NUCLEAR POWER IN INDIA

Nuclear energy means the energy released by controlled nuclear reactions. Nuclear energy can be either natural or man-made. Natural nuclear energy is that which is produced naturally. For example, heat and light produced by the sun and other stars through nuclear reactions is natural nuclear energy. Man-made nuclear energy is one generated with the help of nuclear reaction operations under human control. For example, the energy generated by explosion of atomic and hydrogen bombs are man-made nuclear energy.

Man-made nuclear energy is obtained either by splitting of heavy atoms or by the joining of light atoms. Usually, nuclear energy is produced with the help of a nuclear power plant which makes a controlled atomic chain reaction for producing heat. Nuclear energy, also known as atomic energy, serves as an important source of power.

Generally, nuclear energy is used for the production of electricity. In U.S. the nuclear energy is the second largest source of electricity and it constitutes a significant contribution to U.S. energy security. The advantages of nuclear energy are:

- It produces more energy when compared to hydro and wind energy. Currently about 18% of the world's electricity is generated through nuclear energy;
- it does not emit carbon dioxide or other air pollutants from the operation of its reactors; and
- It uses uranium as its fuel which is abundantly present in the earth.

The disadvantages of nuclear energy are:

- it can be used for production and expansion of nuclear weapons which may case large-scale devastation;
- it requires large capital cost;
- it produces unstable waste elements that are highly radioactive; and
- It is dangerous to the environment as well as human health because of the radiation that it produces and lack of economical and safe disposal of radioactive nuclear wastes.

Nuclear Power in India

India has a flourishing and largely indigenous nuclear power program and expects to have 14.6 GWe nuclear capacity on line by 2024 and 63 GWe by 2032. It aims to supply 25% of electricity from nuclear power by 2050.

- Because India is outside the Nuclear Non-Proliferation Treaty due to its weapons program , it was for 34 years largely
- 2009.
- Due to earlier trade bans and lack of indigenous uranium, India has uniquely been developing a nuclear fuel cycle to exploit its reserves of thorium.
- Since 2010, a fundamental incompatibility between India's civil liability law and international conventions limits foreign technology provision.
- India has a vision of becoming a world leader in nuclear technology due to its expertise in fast reactors and thorium fuel cycle.

Nuclear power for civil use is well established in India. Since building the two small boiling water reactors at Tarapur in the 1960s, its civil nuclear strategy has been directed towards complete independence in the nuclear fuel cycle,

necessary because it is excluded from the 1970 Nuclear Non-Proliferation Treaty (NPT) due to it acquiring nuclear weapons capability after 1970. (Those five countries doing so before 1970 were accorded the status of Nuclear Weapons States under the NPT.)

Reactor	State	Type	MWe net (each)	Commercial operation	Safeguards status*
Tarapur 1&2	Maharashtra	GE BWR	150	1969	Item-specific, Oct 2009
Kaiga 1&2	Karnataka	PHWR	202	1999, 2000	nil
Kaiga 3&4	Karnataka	PHWR	202	2007, 2012	nil
Kakrapar 1&2	Gujarat	PHWR	202	1993, 1995	December 2010 under new agreement
Madras 1&2 (MAPS)	Tamil Nadu	PHWR	202	1984, 1986	nil
Narora 1&2	Uttar Pradesh	PHWR	202	1991, 1992	From Jan 2015 under new agreement
Rajasthan 1&2	Rajasthan	Candu PHWR	90, 187	1973, 1981	Item-specific, Oct 2009
Rajasthan 3&4	Rajasthan	PHWR	202	1999, 2000	March 2010 under new agreement
Rajasthan 5&6	Rajasthan	PHWR	202	Feb & April 2010	Oct 2009 under new agreement
Tarapur 3&4	Maharashtra	PHWR	490	2006, 2005	nil
Kudankulam 1	Tamil Nadu	PWR (VVER)	917	December 2014	Item-specific, Oct 2009
Total (21)			**5302 MWe**		

As a result, India's nuclear power program has proceeded largely without fuel or technological assistance from other countries (but see later section). The pressurised heavy-water reactor (PHWR) design was adopted in 1964, since it required less natural uranium than the BWRs, needed no enrichment, and could be built with the country's engineering capacity at that time – pressure tubes rather than a heavy pressure vessel being involved. Its power reactors to the mid-1990s had some of the world's lowest capacity factors, reflecting the technical difficulties of the country's isolation, but rose impressively from 60% in 1995 to 85% in 2001-02. Then in 2008-10 the load factors dropped due to shortage of uranium fuel.

India's nuclear energy self-sufficiency extended from uranium exploration and mining through fuel fabrication, heavy water production, reactor design and construction, to reprocessing and waste management. It has a small fast breeder reactor and is building a much larger one. It is also developing technology to utilise its abundant resources of thorium as a nuclear fuel.

The Atomic Energy Establishment was set up at Trombay, near Mumbai, in 1957 and renamed as Bhabha Atomic Research Centre (BARC) ten years later. Plans for building the first Pressurised Heavy Water Reactor (PHWR) were finalised in 1964, and this prototype – Rajasthan 1, which had Canada's Douglas Point reactor as a reference unit, was built as a collaborative venture between Atomic Energy of Canada Ltd (AECL) and NPCIL. It started up in 1972 and was duplicated Subsequent indigenous PHWR development has been based on these units, though several stages of evolution can be identified: PHWRs with dousing and single containment at Rajasthan 1-2, PHWRs with suppression pool and partial double containment at Madras, and later standardized PHWRs from Narora onwards having double containment, suppression pool, and calandria filled with heavy water, housed in a water-filled calandria vault.
The Indian Atomic Energy Commission (AEC) is the main policy body.

The Nuclear Power Corporation of India Ltd (NPCIL) is responsible for design, construction, commissioning and operation of thermal nuclear power plants. At the start of 2010 it said it had enough cash on hand for 10,000 MWe of new plant. Its funding model is 70% equity and 30% debt financing. However, it is aiming to involve other public sector and private corporations in future nuclear power expansion, notably National Thermal Power Corporation (NTPC) – see subsection below. NTPC is very much larger than NPCIL and sees itself as the main power producer. NTPC is largely government-owned. The 1962 Atomic Energy Act prohibits private control of nuclear power generation, and 2016 amendments allowing public sector joint ventures do not extend to private sector companies, nor allow direct foreign investment in nuclear power, apart from the supply chain.

In December 2014 the 40% of nuclear capacity under safeguards was operating on imported uranium at rated capacity. The remainder, which relies on indigenous uranium, was operating below capacity, though the supply situation was said to be improving.
The two **Tarapur** 150 MWe boiling water reactors (BWRs) built by GE on a turnkey contract before the advent of the Nuclear Non-Proliferation Treaty were originally 200 MWe. They were down rated due to recurrent problems but have run reasonably well since. They have been using imported enriched uranium (from France and China in 1980-90s and Russia since 2001) and are under International Atomic Energy Agency (IAEA) safeguards. However, late in 2004 Russia deferred to the Nuclear Suppliers' Group and declined to supply further uranium for them. They underwent six months' refurbishment over 2005-06, and in March 2006 Russia agreed to resume fuel supply. In December 2008 a $700 million contract with Rosatom was announced for continued uranium supply to them. In 2015 a further contract was signed with TVEL for pellets which will be incorporated into fuel assemblies at the Nuclear Fuel Complex in Hyderabad. However, frequent maintenance shutdowns have made them unprofitable, so DAE may shut them down.
The two small Canadian (Candu) PHWRs at **Rajasthan** nuclear power plant started up in 1972 & 1980, and are also under safeguards. Rajasthan 1 was down-rated early in its life and has operated very little since 2002 due to ongoing problems and has been shut down since 2004 as the government considers its future. Rajasthan 2 was down rated in 1990. It had major refurbishment 2007-09 and has been running on imported uranium at full capacity.
The **220 MWe PHWRs** (202 MWe net) were indigenously designed and constructed by NPCIL, based on a Canadian design. The only accident to an Indian nuclear plant was due to a turbine hall fire in 1993 at Narora, which resulted in a 17-hour total station blackout. There was no core damage or radiological impact and it was rated 3 on the INES scale – a 'serious incident'. Under plans for the India-specific safeguards to be administered by the IAEA in relation to the civil-military separation plan, eight further reactors were to be safeguarded (beyond Tarapur 1&2, Rajasthan 1&2, and Kudankulam 1&2): Rajasthan 3&4 from 2010, Rajasthan 5&6 from 2008, Kakrapar 1&2 by 2012 and Narora 1&2 by 2014.

NPP Operating and Under Construction in India

Source: World Nuclear Association

Ajinkya Milind Sawant
TE C

Engineering Sand

One researcher would like to place sand into your PC. It is not beached sand, but one made with silicon dioxide nanoparticles layered with a great dielectric regular polymer to cost-effectively offer enhanced cooling for increasing energy consuming electrical devices.

The researcher, Baratunde Cola would be interested in placing sand into your PC. The sand is based on silicon dioxide and does not offer to cool by its own. Rather, the special surface properties of the layered Nano-scale material generate the heat at potentially better efficiency than the current heat sink substances. The bookish physics behind the procedure is intricate, involving Nano scale electromagnetic effects generate on the surface of the minute silicon dioxide substances acting altogether.

The main line could be the potentially novel class of huge thermal conductivity substances useful for dissipating heat from power gadgets, LEDs and other applications with great heat fluxes. “We have identified for the very first time that you can take a packed nanoparticle bed that could typically perform as an insulator and by making the light amalgamate powerfully into the substances by structuring a big dielectric constant mode, like ethylene glycol or water at the surfaces, you can transform the nanoparticle bed into a conductor,” says Cola, an associate lecturer at the Woodruff School of Mechanical Engineering.

“With the use of such collective surface electromagnetic ability of the nanoparticles, the thermal conductivity can be boost by 20-fold, enabling it to disperse heat.” Although the scientists could not conventionally measure the heat flow from the surface of phonon polarities because of experimental troubles, they have witnessed their wave movement when the light comes in contact with the surface of nanostructure material, suggesting a powerful role in heat dissipation. In addition to the very first calculation of heat flow, Cola, and his associates also explored that the effect can happen when thermal energy is performed to a filled bed of nanoparticles.

“We are also revealing for the very first time is that when you incorporate nanoparticles of the precise type in a packed bed that you do not have to Sheen light on them,” he explained. “You can also heat up the nanoparticles, and the thermal self-emission triggers the effect. You can perform an electronic field around the nanoparticles from this current radiation.”

The scientists decided to analyse with those unique properties, foremost utilizing water to layer the nanoparticles and transform the silicon dioxide nanoparticle bed into a conductor. But the coating of the water was not robust, so the scientists shifted to ethylene glycol, a liquid commonly utilized in vehicle antifreeze. The novel combination boosted the heat transfer by a proportion of 20 to around 1-watt per meter Kelvin, which is bigger than the potion of ethylene silicon dioxide or glycol nanoparticles could generate alone and competitive with costly polymer composited utilized for heat dissipation. Further experimenting would be required to ensure the long-term efficacy and to settle confirm that there are no controls on the reliability of the electrical gadgets with the method, says Cola.

Monish Khandelwal
TE A

Invisibility Cloak

Scientists from the QMUL's School of Computer Science and Electronic Engineering, who have worked with the UK industry to validate for the very first time a practical cloaking gadget that allows curved surfaces to seem smooth to electromagnetic waves.

While the experiment might not result in the invisibility cloak showcased popular in J.K Rowling's Harry Potter novels quite yet, this is a practical illustration that could lead to a step-transformation in how antennas in distinct sizes and shapes to be linked to unique places and extensive types of materials.

The co-author, Professor Yang Hao from the QMUL's School of Computer Science and Electronic Engineering, says "Our designs are crafted by transformation optics, which is an idea behind the idea of an invisibility cloak. Past experiments have revealed that this method functions at a single frequency. However, we can illustrate that it functions at a better speed of frequencies making it highly useful for distinct engineering applications, like aerospace and Nano-industry."

The scientists coated a curved layer with a Nano composite material, with seven different layers, known as graded index Nano composite, where the electrical property of every layer varies according to the position. The effects would be 'cloak' the object, like structure that can hide an object that would ordinarily be causing the waves to scatter.
The underlying technique has many extensive applications, spanning from optics to microwave for the regulation of any surface electromagnetic waves. The very first author, Dr. Luigi Spada, who also belongs from the QMUL's School of Computer Science and Electronic Engineering says, "The study and analysis of surface waves are the central points to develop industrial and technological solutions in the creation of virtual platforms, for distinct application niches.

"We illustrated a practical possibility to utilize Nano composites to regulate surface wave propagation through technologically advanced stabilizing manufacturing. In fact, most importantly, the technique is useful for other physical procedures that are demonstrated through wave equations, like acoustics. For this reason, it is considered that such work has an excellent industrial impact."

Conclusion – While truly, it is an excellent research work that has resulted in lucrative outcomes that are useful to serve numerous applications. The results from the experiments are expected to be useful for serving multiple rigid applications. It is the result of the years of hard efforts of the researchers and their team. It is an extremely close step towards preparing an invisibility cloak, and hence, scientists are planning other future experiments to avail more similar results that could lead to the better serving of varying rigid applications.

Monish Khandelwal

TE-A

TRACKING WI-FI SIGNALS

With dedication and a creative approach, University College London (UCL) research is helping to address the world's most urgent problems. Whether designing healthier cities or grappling with issues such as global health and climate change, the challenges of daily life inspire UCL students and academics. Based at UCL, our team of electrical engineering researchers is investigating passive radar technologies that can see through walls using WiFi radio waves. Our novel research required a real-time, passive (non-cooperative) wireless target detection demonstration system capable of tracking moving bodies through walls and obstacles. Much like traditional radar systems, our approach still relies on detecting the Doppler shifts in radio waves as they reflect off moving objects. However, unlike traditional radar systems that actively transmit radio waves, our passive system relies on the existing WiFi signals that already swamp our airwaves. The complete lack of spectrum occupation and power emission ensures our radar is undetectable, making it ideal for military or security surveillance in urban settings.

Aside from public defence applications, our passive detection could be applied in a broad range of scenarios, including crowd and traffic monitoring and human-machine interfacing. Different types of wireless signals can be applied to different situations. For example, our system could acquire IEEE 802.11x (b, g, n, ac) signals to detect indoor moving targets for security purposes, such as hostage situations. Alternatively, the same system could monitor cellular signals, such as Global System for Mobile Communications (GSM) or Long-Term Evolution (LTE), to detect direction and velocity of moving vehicles before triggering an appropriate machine response to the detected movement.

Maximising the versatility of our devised radar system requires multiple channels for compatibility with multiple frequency bands. The system should be flexible enough to work with almost any type of WiFi signal (IEEE 802.11 b, g, n, ac), as well as FM and cellular signals. This relies on flexible RF hardware that can accommodate wide frequency ranges, in addition to easily reconfigured signal-processing software.

Passive Wireless Detection System Based on USRPs

At the heart of our system were two USRP-2921 RF transceivers used to receive the reference and surveillance signals. Not only did the USRPs meet our accuracy and frequency range requirements, but their software-defined nature helped us rapidly iterate our algorithm designs.

From a software perspective, we chose Lab VIEW as being an inherently multithreading development tool; it naturally reduced our code complexity. This, combined with other features of Lab VIEW, including intuitive graphical programming and built-in design patterns, reduced our development time by weeks.

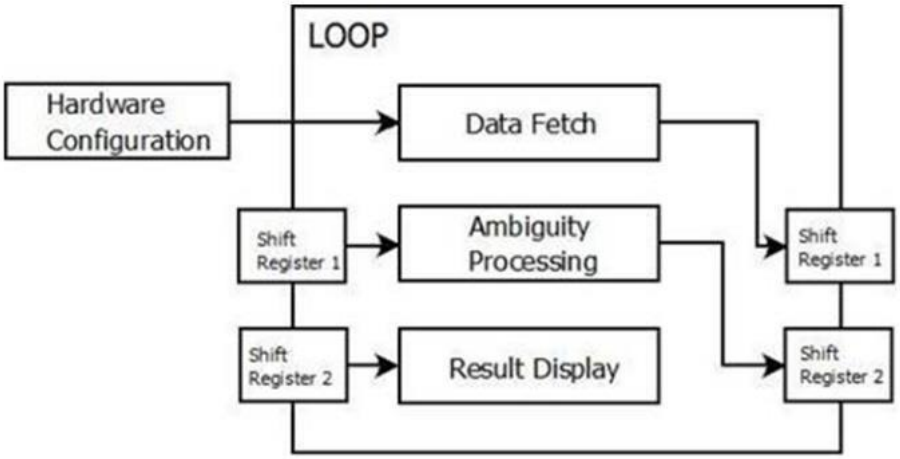


Figure 1. Software Architecture Overview

The NI USRP platform is available on multiple frequency bands, covering 50 MHz to 5.9 GHz, so our passive radar system could cover a huge range of wireless signals, including FM, GSM, LTE, IEEE 802.11x, IEEE 802.16, and digital audio broadcasting (DAB) or digital video broadcasting (DVB).

Besides wide-frequency band coverage, another advantage of USRP is that it includes a dedicated port for daisy-chaining and synchronising advanced multiple input, multiple output (MIMO) systems. This will be very useful as we extend the radar system for future research.

To program the USRP, Lab VIEW provides an API that allowed us to quickly open, configure and initiate receiver sessions; set parameters such as centre frequency, IQ sampling rate, channel gain, and length of samples; and receive data from the air.

With USRP and Lab VIEW, we built and tested the passive wireless detection demo very quickly. Using functions built into Lab VIEW, we can efficiently implement a series of vector operations, such as array subset, indexing array, array reshaping and analysis, in a single block.

Proving the Concept with Real-World Experimentation

The scenario to demonstrate the capabilities of the designed system is to detect a walking person using WiFi signal emissions from a common WiFi access point (AP) which has 15dBm. In the experimental setup, a 25cm-thick brick wall separated the reference and surveillance antenna from the person and the WiFi AP (see Figure 3). Both reference and surveillance signals are digitised by the USRPs and processed in Lab VIEW.

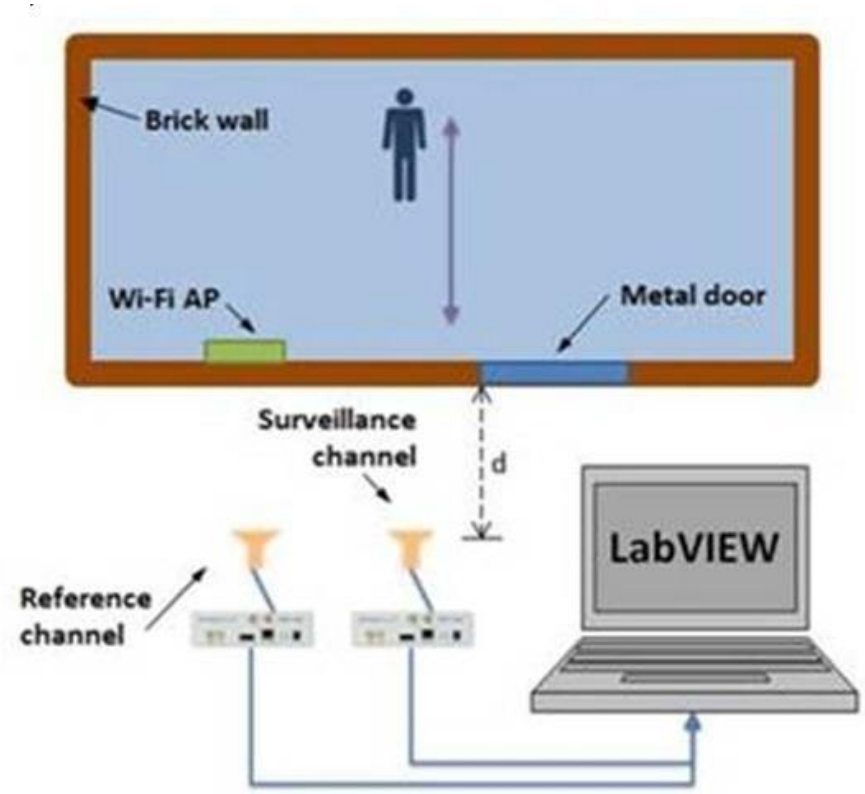


Figure 2. Our Experimental Setup for Movement Detection Beyond Walls

Experimental results gained via our USRP-based radar system have definitely proven the concept of through-wall passive WiFi sensing. In addition, with the high sensitivity of the NI solution, we can detect smaller movements than we initially thought possible.

Conclusion

Lab VIEW and NI USRP are an ideal choice for rapidly prototyping wireless signal transmission, reception and processing. The wide frequency bands and ready-made signal processing libraries helped speed up code development and real-world experimentation.

We are truly excited about how our novel approach to passive radar can be used in the future, including public security (hijack or hostage situations), health (a monitoring system for the aged) and new human-machine interfacing (for both industry and entertainment).

Aside from being a strong proof of concept, our demonstrative passive detection system will be used as a highly engaging teaching platform for engineering students and a tested for future passive detection algorithm development.

SURAJ SHAHA

BE-B

BEYOND THE LABORATORY: THE 'SMART CITY' PLAYGROUND

The Internet of Things is not a one size fits all concept and, as cities become more complex, new devices and applications will need to be tested in the real world.

According to the United Nations, some 70% of the global population is expected to be living in cities by 2050. This will mean that large population concentrations will have to be provided with a broad range of stable and sustainable public services which, in turn, will have to be delivered in a safe environment.

Another striking figure is that more than 60% of the world's economic growth in the next 10 years is expected to come from city areas.

Cities are having to address these pressures in a sustainable and economic way and this has given rise to the concept of the 'Smart City' or, perhaps more accurately, the City of Things.

The Smart City is focused on delivering better use of resources, making transport systems smarter and providing more efficient and effective water, waste management, heating and lighting services.

Increasingly, however, rather than a 'top down' governmental approach, many of the cities that are embracing the 'Smart City' concept do so by taking a radical 'bottom up' approach to the development of new, innovative services that, in turn, bring government, citizens, academia and industry together.

In Antwerp, this approach is described by Professor Steven Latré, an assistant professor at the University of Antwerp and iMinds in Belgium, as 'the quadruple helix' that is intended to 'combine and safeguard public interests while at the same time facilitating and supporting creativity'.

"We want people, through the intelligent use of Internet-based communications and applications, to have far more control over their lives," he says.

Much like Antwerp, Bristol is determined to turn itself into a 'high tech testbed for innovation' and, according to Prof Simeonidou: "We have a 30Gbit/s fibre broadband network powering it.

"Discussions around Bristol is Open started a few years ago. I lead the High Performance Network Group at the university and was focused on open programmable networks, open software and hardware for networking. Prior to Bristol is Open, we had been working on a number of projects around the world looking to open up infrastructures to both technical and vertical market users.

"In Bristol, we are looking to use big data to solve a variety of problems – from air pollution to traffic congestion, as well as assisted living for the elderly."

"It's not just about new technology," suggests Hilton. "People in Bristol are concerned by the quality of air. If we are to improve it, people also need to behave differently and make different choices. We have to be able to connect data to the individual in order to highlight then influence the choices they can make. We need to nudge people towards more sustainable activities."

The city's fibre network fibre runs across several miles of council owned BNet ducts and has been upgraded to a 144 fibre core. In addition, the city is deploying a mile of wireless connectivity which, in turn, will be complemented by an RF mesh canopy covering Bristol.

This is the Brunel Mile, named after the illustrious Victorian engineer Isambard Kingdom Brunel, who left a significant physical imprint on Bristol – from the Clifton suspension bridge to the Temple Meads railway station and the Great Western Railway itself.

The Brunel Mile connects the city's Temple Meads rail station to the SS Great Britain, anchored in the dock area of the Bristol, and provides an experimental test bed for wireless technology such as 5G mobile broadband.

Crucially, in order to manage the mass of data, that is and will be generated by the network of sensors being deployed, the network is being sliced, with each application handed a portion of the available bandwidth.

The Bristol Brain

Bristol has also developed an emulator to assist in future developments in the City, but which will also be available to help other smart cities around the world.

“The Bristol Brain,” according to Hilton, “is situated in the city’s 360 spherical planetarium, which was originally a 2000 Millennium project. It’s been retrofitted with 4k projectors, has a fibre link connecting it to a high performance super computer at Bristol University and will be able to project real time data in a 3D environment.

“Open to an audience of 180 people, it will enable them to experience new city scenarios at the same time through 3D visualisation. While we are currently unable to render the city to highest level of detail, we see the data dome as a place where people will not only be able to visualise, but also experience, different models.”

The project is aiming to create a 3D printed large scale city model on top of which real time data and sophisticated analytics can be projected. “We will be able to show real time pedestrian and traffic flows; the energy use of buildings or the air quality in the city at different times of the day,” enthuses Hilton. “We want people to be able to leap into the city model, to experience an immersive digital environment that will use virtual reality, augmented reality and haptic technologies to allow people to experience new developments before they are built – meaning that future different scenarios for the city can be explored and their impact on transport, air quality, noise, light and other factors fully understood before any physical development takes place.” The Bristol Brain could fundamentally change the way the city is planned, enabling citizens and planners to work more closely together to make better decisions “It will provide a single, holistic planning tool that will be open for all,” says Hilton. According to Hilton, projects like Bristol is Open are intended to help people to better understand he city they live in and to help cities address some of the biggest challenges of modern urban life. He concludes:

“We need to avoid allowing big business, which will look to standardise technology in order to optimise services, to dominate the smart city concept. A very efficient city is a sterile city and we want to use Bristol is Open as a platform that encourages not only big business, but creative and innovative start-ups to contribute.”

SURAJ SHAHA

BE-B

Integrated Things that can drive Internet of Things

The consumer marketplace is flooded with a lively assortment of smart wearable electronics that do everything from monitor vital signs, fitness or sun exposure to play music, charge other electronics or even purify the air around you -- all wirelessly.

Now, a team of University of Wisconsin-Madison engineers has created the world's fastest stretchable, wearable integrated circuits, an advance that could drive the Internet of Things and a much more connected, high-speed wireless world. Led by Zhenqiang "Jack" Ma, the Lynn H. Matthias Professor in Engineering and Vilas Distinguished Achievement Professor in electrical and computer engineering at UW-Madison, the researchers published details of these powerful, highly efficient integrated circuits today, May 27, 2016, in the journal Advanced Functional Materials. The advance is a platform for manufacturers seeking to expand the capabilities and applications of wearable electronics -- including those with biomedical applications -- particularly as they strive to develop devices that take advantage of a new generation of wireless broadband technologies referred to as 5G.With wavelength sizes between a millimeter and a meter, microwave radio frequencies are electromagnetic waves that use frequencies in the .3 gigahertz to 300 gigahertz range. That falls directly in the 5G range. In mobile communications, the wide microwave radio frequencies of 5G networks will accommodate a growing number of cellphone users and notable increases in data speeds and coverage areas. In an intensive care unit, epidermal electronic systems (electronics that adhere to the skin like temporary tattoos) could allow health care staff to monitor patients remotely and wirelessly, increasing patient comfort by decreasing the customary tangle of cables and wires. What makes the new, stretchable integrated circuits so powerful is their unique structure, inspired by twisted-pair telephone cables. They contain, essentially, two ultra-tiny intertwining power transmission lines in repeating S-curves.

This serpentine shape -- formed in two layers with segmented metal blocks, like a 3-D puzzle -- gives the transmission lines the ability to stretch without affecting their performance. It also helps shield the lines from outside interference and, at the same time, confine the electromagnetic waves flowing through them, almost completely eliminating current loss. Currently, the researchers' stretchable integrated circuits can operate at radio frequency levels up to 40 gigahertz.

And, unlike other stretchable transmission lines, whose widths can approach 640 micrometers (or .64 millimeters), the researchers' new stretchable integrated circuits are just 25 micrometers (or .025 millimeters) thick. That's tiny enough to be highly effective in epidermal electronic systems, among many other applications. Ma’s group has been developing what are known as transistor active devices for the past decade. This latest advance marries the researchers' expertise in both high-frequency and flexible electronics. “We’ve found a way to integrate high-frequency active transistors into a useful circuit that can be wireless," says Ma, whose work was supported by the Air Force Office of Scientific Research. "This is a platform. This opens the door to lots of new capabilities."

Radar jamming and deception

Radar jamming and deception (electronic countermeasures) is the intentional emission of radio frequency signals to interfere with the operation of a radar by saturating its receiver with noise or false information.

There are two types of radar jamming:

Mechanical and Electronic jamming.

Mechanical jamming

Mechanical jamming is caused by devices which reflect or re-reflect radar energy back to the radar to produce false target returns on the operator's scope. Mechanical jamming devices include chaff, corner reflectors, and decoys. Chaff is made of different length metallic strips, which reflect different frequencies, so as to create a large area of false returns in which a real contact would be difficult to detect.

Modern chaff is usually aluminium coated glass fiber of various lengths. Their extremely low weight and small size allows them to form a dense, long lasting cloud of interference. Corner reflectors have the same effect as chaff but are physically very different. Corner reflectors are many-sided objects that re-radiate radar energy mostly back toward its source.

An aircraft cannot carry as many corner reflectors as it can chaff. Decoys are manoeuvrable flying objects that are intended to deceive a radar operator into believing that they are actually aircraft. They are especially dangerous because they can clutter up a radar with false targets making it easier for an attacker to get within weapons range and neutralize the radar.

Corner reflectors can be fitted on decoys to make them appear larger than they are, thus furthering the illusion that a decoy is an actual aircraft. Some decoys have the capability to perform electronic jamming or drop chaff. Decoys also have a deliberately sacrificial purpose i.e. defenders may fire guided missiles at the decoys, thereby depleting limited stocks of expensive weaponry which might otherwise have been used against genuine targets.

Electronic jamming

Electronic jamming is a form of electronic warfare where jammers radiate interfering signals toward an enemy's radar, blocking the receiver with highly concentrated energy signals. The two main technique styles are noise techniques and repeater techniques. The three types of noise jamming are spot, sweep, and barrage. Spot jamming occurs when a jammer focuses all of its power on a single frequency.

While this would severely degrade the ability to track on the jammed frequency, a frequency-agile radar would hardly be affected because the jammer can only jam one frequency. While multiple jammers could possibly jam a range of frequencies, this would consume a great deal of resources to have any effect on a frequency-agile radar, and would probably still be ineffective. Sweep jamming is when a jammer's full power is shifted from one frequency to another. While this has the advantage of being able to jam multiple frequencies in quick succession, it does not affect them all at the same time, and thus limits the effectiveness of this type of jamming.

Although, depending on the error checking in the device(s) this can render a wide range of devices effectively useless. Barrage jamming is the jamming of multiple frequencies at once by a single jammer. The advantage is that multiple frequencies can be jammed simultaneously; however, the jamming effect can be limited because this requires the jammer to spread its full power between these frequencies, as the number of frequencies covered increases the less effectively each is jammed. Base jamming is a new type of Barrage Jamming where one radar is jammed effectively at its source at all frequencies. However, all other radars continue working normally. Pulse jamming produces noise pulses

with period depending on radar mast rotation speed thus creating blocked sectors from directions other than the jammer making, it harder to discover the jammer location.

Cover pulse jamming creates a short noise pulse when radar signal is received thus concealing any aircraft flying behind the EW craft with a block of noise. Digital radio frequency memory, or DRFM jamming, or Repeater jamming is a repeater technique that manipulates received radar energy and retransmits it to change the return the radar sees.
This technique can change the range the radar detects by changing the delay in transmission of pulses, the velocity the radar detects by changing the Doppler shift of the transmitted signal, or the angle to the plane by using AM techniques to transmit into the side lobes of the radar.

Electronics, radio equipment, and antenna can cause DRFM jamming causing false targets, the signal must be timed after the received radar signal.
By analysing received signal strength from side and back lobes and thus getting radar antennae radiation pattern, false targets can be created to directions other than one where the jammer is coming from.
If each radar pulse is uniquely coded it is not possible to create targets in directions other than the direction of the jammer

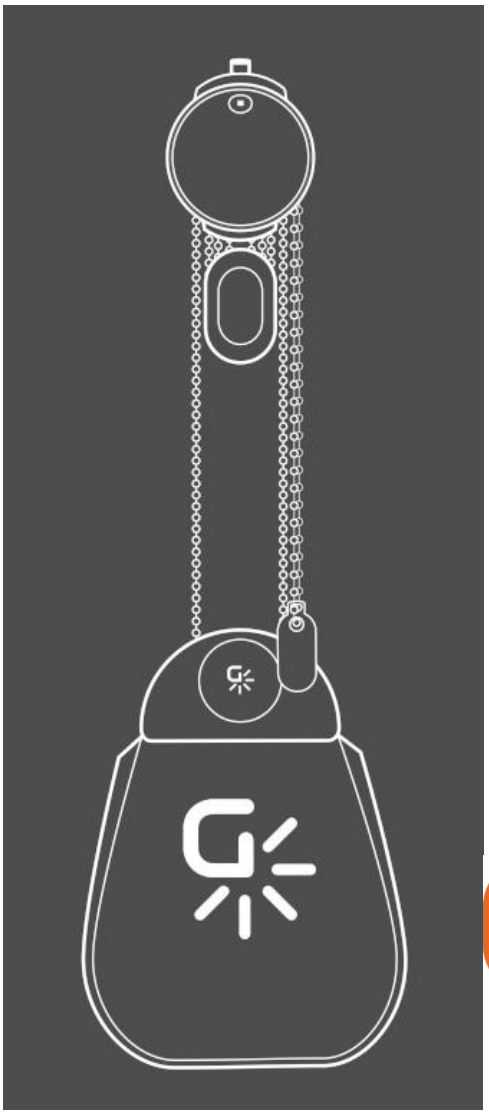
Deceptive jamming uses techniques like "range gate pull-off" to break a radar lock.

Shrikar Sawant
TE-B

GRAVITY LIGHT

Gravity Light is a gravity-powered lamp designed by the company Deciwatt for use in developing or third-world nations, as a replacement for kerosene lamps. It uses a bag filled with rocks or earth, attached to a cord, which slowly descends similar to the weight drive in a cuckoo clock. This action powers the light for up to thirty minutes.

There are no operating costs after the initial purchase of the appliance. A standard Gravity Light kit comes with an adjustable lamp and a ballast bag. The light can be turned on by filling the bag with approximately 20 pounds weight [9] (10 kg) and lifting it up to the base of the device; the weight falls over a period of 25 minutes, pulling a strap that spins gears and drives an electric generator, which continuously powers an LED. [10] This creates enough energy to last 25 minutes whenever it is needed. [8]



THE GRAVITYLIGHT FOUNDATION

Gravity Light is installed to provide a 6ft/ 1.8m drop of a 12kg weight. This weight is lifted and on release starts falling very slowly (about 1mm / second).

Kinetic Energy

This movement powers a drive sprocket, which rotates very slowly with high torque (force). A polymer gear train running through the product turns this input into a high speed, low torque output that drives a DC generator at thousands of rotations per minute.

Electricity and Light

This generates just under a tenth of a watt, a Deciwatt, to power an on-board LED and ancillary devices. Given the ever-increasing efficiency of LEDs, this produces a light over 5 times brighter (lux) than a typical open-wick kerosene lamp.
Once the weighted bag reaches the floor, which depends on how high it was installed, it is simply lifted to repeat the process.

Subham Mittal
TE C

HOLLOW FLASHLIGHT

Ann Makosinski is a 16-year-old student who competed against thousands of other young inventors from around the world to win first prize and a $25,000 scholarship at Google's International Science Fair.

She invented a battery-free flashlight. A free energy device that is powered by the heat in your hand.

While visiting the Philippines, Ann found that many students couldn't study at home because they didn't have electricity for lighting.

Unfortunately, this is a common problem for developing regions where people don't have access to power grids or can't afford the cost of electricity.

Ann recalled reading how the human body had enough energy to power a 100-watt light bulb.

This inspired her to think of how she could convert body heat directly into electricity to power a flashlight. She knew that heated conductive material causes electrons to spread outwards and that cold conductive material causes electrons to condense inwards.

So, if a ceramic tile is heated, and it's pressed against a ceramic tile that is cool, then electrons will move from the hot tile towards the cool tile producing a current.

This phenomena is known as the thermoelectric effect.

Ann started using ceramic tiles placed on top of each other with a conductive circuit between them (known as Peltier tiles) to create the amount of electricity she needed for her flashlight.

Her idea was to design her flashlight so that when it was gripped in your hand, your palm would come in contact with the topside of the tiles and start heating them.

To ensure the underside of the tiles would be cooler, she had the tiles mounted into a cut-out area of a hollow aluminium tube.

This meant that air in the tube would keep the underside of her tiles cooler than the heated topside of the tiles. This would then generate a current from the hot side to the cold side so that light emitting diodes (LEDS) connected to the tiles would light-up.

? But although the tiles generated the necessary wattage (5.7 mill watts), Ann discovered that the voltage wasn't enough. So she added a transformer to boost the voltage to 5V, which was more than enough to make her flashlight work.

Ann successfully created the first flashlight that didn't use batteries, toxic chemicals, kinetic or solar energy, and that always works when you picked it up.

RASIKA KHOPADE
SE A

Electronic Pills - Collecting Data inside the Body

After years of investment and development, wireless devices contained in swallow able capsules are now reaching the market.

Companies such as Smart Pill based in Buffalo, New York and Israel-based Given Imaging (PillCam) market capsules the size of vitamin tablets.

These pills contain sensors or tiny cameras that collect information as they travel through the gastrointestinal tract before being excreted from the body a day or two later.

These new electronic inventions transmit information such as acidity, pressure and temperature levels or images of the oesophagus and intestine to your doctor's computer for analysis.

Doctors often use invasive methods such as catheters, endoscopic instruments or radioisotopes for collecting information about the digestive tract. So device companies have been developing easier, less intrusive ways, to gather information. Digestive diseases and disorders can include symptoms such as acid reflux, bloating, heartburn, abdominal pain, constipation, difficulty swallowing or loss of appetite. “One of the main challenges is determining just what is happening in the stomach and intestines." says Dr. Anish A. Sheath, Director of the Gastrointestinal Motility Program at Yale-New Haven Hospital. Doctors can inspect the colon and peer into the stomach using endoscopic instruments. But some areas cannot be easily viewed, and finding out how muscles are working can be difficult. Electronic pills are being used to measure muscle contraction, ease of passage and other factors to reveal information unavailable in the past.

Prachi Kolte
SE-A