

Autonomous & Near Autonomous Vehicles

Vehicles which can be manipulated with little or no human intervention are creating a buzz worldwide. Drones and driverless cars have either pre-programmed travel path or use on-board systems for real-time maneuvering. Driverless cars are said to reduce accidents. Unmanned aerial vehicle (UAVs) can stay aloft for many hours and provide intelligence, surveillance and reconnaissance capabilities, provide near-real-time, high-resolution images of large geographical areas, in all types of weather, help in wildlife protection, monitor crops, assist in disaster relief and many more. Some retail outlets have also used them for delivery of goods.



- track of tigers and poachers.
- In 2013, UAVs were deployed to scan areas that rescue and relief workers could not reach in flood-hit Uttarakhand.
- In December 2013, the DHL parcel service subsidiary of Deutsche Post AG tested a 'microdrones md4-1000' for medicine delivery.

Where we stand

Though autonomous vehicles technology is in experimental and development stage, UAVs are already being used for military and surveillance purposes in a big way. India too has seen increasing use of drones for surveillance in Maoist affected areas, as well as for rescue operations in difficult terrains. However, its large-scale use for improving city safety and emergency services can only take off after the Directorate General of Civil Aviation comes out with a guideline on the same.

\$10,573mn
UAV market by 2020
(Source: Markets and Markets)

Use case

- In Madhya Pradesh, the Panna Tiger Reserve tested drones for keeping

Massive Open Online Course

A Massive Open Online Course (MOOC) is a method of providing online education to a very large number of students across the globe, free or at a very negligible cost as compared to conventional higher educational methods. MOOCs typically involve a MOOC platform, wherein students can access educational content in the form of lectures, reading material and related assignments, all online, thus reducing physical, financial and even time zone related difficulties. According to The New York Times, 2012 became "the year of the MOOC" as several well-financed providers associated with top universities emerged, including Coursera, Udacity, and edX. Also, around ₹100 crore was allocated for virtual classrooms and MOOCs in Indian budget 2014-15.



- MOOCs with overseas partners. IIT Kanpur is developing its own platform for MOOCs called MOOKIT.
- Coursera, a US-based service provider, offers in excess of 300 courses in 20 subjects which includes designing, arithmetic, humanities amongst other designed by 60+ varsities based out of 16 nations.

3,842+
MOOCs worldwide as of January 2015
(Source: EC's Open Education Europa initiative)

Where we stand

In India, e-learning is in a nascent stage and the initial efforts by the private sector nosedived after a few years' bull run. The lack of accreditation has led to non-acceptance of online courses. However, as part of the e-Kranti and Digital India initiative, the government is planning to develop a pilot MOOC for its e-education programme.

Use case

- IIT Bombay and IIM Bangalore have already announced the launch of

Wearable Devices



Wearable devices offer a variety of applications in the field of healthcare and medical, fitness and wellness, industrial, military and infotainment. The devices are available in many forms, such as glasses, watches, smart badges, bracelets, earpieces and headsets. Fitness bands, smart watches and other wearables are already established in the market. The rise of wearable devices will also open new avenues of marketing. The devices will primarily cater to niche markets, but eventually governments and industries are expected to utilise it in full swing.

Use case

- Copenhagen airport has given Google Glass to its staff on pilot basis, enabling them to provide information and other help to passengers on a real-time basis.
- Researchers are testing wearable devices that can help with blood tests or drug administration. This can help reduce the pain associated with the use of needles.
- Intel, along with the Michael J Fox Foundation, is using wearable devices to monitor and treat diseases.

\$11.61bn
size of wearable devices market by 2020
(Source: Markets and Markets)

Where we stand

While wearables are still in their infancy and not much has happened on the enterprise-grade wearable front, the use of Google Glass by Copenhagen airport is an encouraging first step. Researchers now believe that wearable solutions can be created for the government. And the use can range from public safety applications to devices that can help in real-time translation and as communication tools. Besides, medical breakthrough such as nano-imaging and high throughput microscopy is already on its way. However, price, privacy and data security are main apprehensions for this technology.

Crossbar Memory

California-based startup Crossbar is developing a unique non-volatile resistive random access memory (RRAM) that can store a terabyte of data on something the size of a postage stamp. RRAM is non-volatile, meaning that it can keep and store data even if the power is cut off. The company says that the new chip technology consumes less energy (approximately 20 times less), extending battery life in devices to weeks, months, or years. Due to its simple three-layer structure, Crossbar technology can be stacked in 3D, delivering multiple terabytes of storage on a single chip.

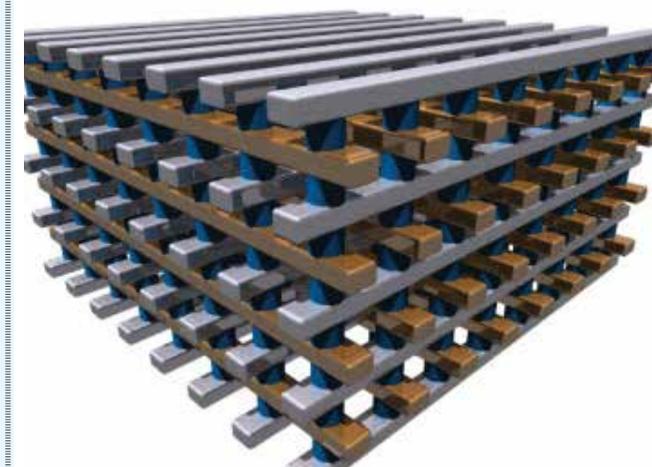
Use case

- Crossbar says it will enable a new wave of electronics innovation for consumer, enterprise, mobile, industrial, and connected device applications. With Crossbar chips, mobile phones and tablets would have significantly faster storage. It will give a boost to Internet of Things and the industrial internet.

\$48.4bn
non-volatile memory market in 2016
(Source: Webfeet Research)

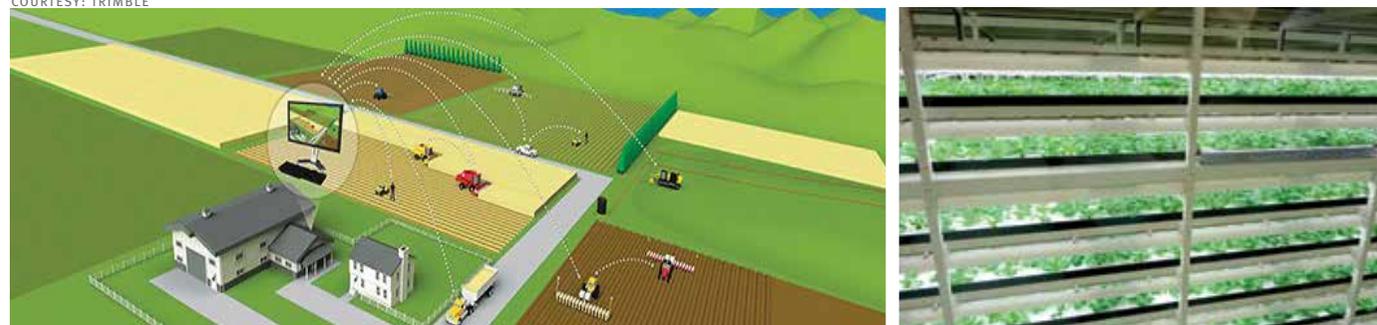
Where we stand

Crossbar is currently completing the characterisation and optimisation of this device. For a country like India, which aims to deliver citizen services at the doorstep in the remotest village, the RRAM technology can be a boon, especially since power is a major hurdle in delivering citizen services electronically. The technology can also come handy for implementation and monitoring of various rural schemes, including the ambitious pradhan mantri jan dhan yojna.



AGRICULTURE TECHNOLOGIES

COURTESY: TRIMBLE



Precision Farming

Under precision farming, a wide variety of technologies, especially location-based technologies, are utilised to maximise farm outputs. Technologies like GIS, GNSS, remote sensing, sensors and allied technologies help farmers to get a clear picture of their land, crops and management practices. They are able to better allocate inputs like seeds and fertilisers to specific cropland areas based on soil type, fertility levels and other characteristics of that site. This increases their productivity and return on investment. These tools can also help in achieving sustainable food production.

Use case

- Precision agriculture tools helped Guaira Sugar Mill in Brazil increase its crop yield and optimise the performance of workers and machines through improved production and plantation designs based on available land, topography and ideal planting time.
- Tamil Nadu Agricultural University is helping farmers in the state to utilise precision tools. As a result, farmers have reported to achieve high yield and quality farm produce through optimum utilisation of water and fertilisers.

\$4.55bn
size of precision farming market by 2020
(Source: Markets and Markets)

Where we stand

Precision agriculture is yet to take off on full scale in developing countries like India, where farms are small and machinery is expensive.

Plant Factories

This water-based technique or hydroponics is increasingly being used to control environment in agriculture as a safeguard against unusual weather, contamination of land, environmental pollution, shortages of water, fossil fuel and plant biomass resources. The technology is also known as soilless agriculture as it uses water as a medium to supply essential nutrients needed by plants to grow, both indoors and in greenhouses. Also, since the indoor plant factories use vertical stacks as the base for growing plants, it also increases the average cultivation area, thereby making it suitable for urban farming as well. The indoor factories also use artificial lights, and controlled environment to ensure better quality produce.

Use case

- In April 2014, Japan's Mebiol Inc set up a 5,000 sq metre film-based tomato farm in the desert of Al Ayn in UAE.
- The plant factory at Kashiwa-no-ha smart city in Chiba produces 10,000 heads of lettuce per day.
- Hero MotorCorp is setting up a plant factory in its facility in Rajasthan.

Global scenario

While there are over **170** plant factories with artificial lights (PAFL) in Japan, there are **40** PAFLs in Taiwan, **10** in USA and one in Mongolia. *(Source: Dr. Toyoki Kozai, Professor Emeritus, Chiba University, Japan)*

Where we stand

Though the technology is already on its maturity curve and can be adopted in India, the high cost of setting up a commercially viable plant factory is a stumbling block since agriculture in India is primarily family driven. An initiative by the ministry of agriculture to create a low-cost funding mechanism for hydroponic agriculture, including PAFL, will help local farmers adopt the technology.

Ocean Energy Technologies

A lot of work has been done to tap the potential of ocean as a source of renewable energy. Ocean energy resources include ocean surface waves, tidal currents, tidal range, deep ocean currents, thermal gradients, and changes in salinity.



THE DEEP SEA WATER OCEAN THERMAL ENERGY CONVERSION (OTEC) DEMONSTRATION FACILITY IN OKINAWA PREFECTURE OF JAPAN.

Ocean energy technologies seek to convert these renewable energy resources into a useful form – typically electricity. Of these the ocean thermal energy conversion (OTEC) is considered to be the most promising. OTEC harnesses the solar energy absorbed by the oceans to generate electric power. The temperature gradient between the sea surface water and the colder, deep seawater – generally at depths below 1,000 metres – can be harnessed using different processes.

Use case

- Tokyo Electric Power Company built and deployed a 100 kW closed-cycle OTEC plant on the island of Nauru that became operational on October 14, 1981.
- A 50kW OTEC facility in Okinawa Prefecture is the world's first fully operational electricity generation plant.
- Lockheed Martin along with Makai Ocean Engineering has a functioning 1-MW plant off Hawaii, which it intends to scale up to 10 MW.

80,000 terawatt-hours
electricity per year can be generated using ocean energy
(Source: IRENA)

Where we stand

While India has experimented with a 150-kW wave energy system in Thiruvananthapuram (1983), its 1 MW floating OTEC pilot plant near Tamil Nadu proved unsuccessful due to a failure of the deep sea cold water pipe. Besides, the National Hydro Power Corporation (NHPC) is setting up a 3.75 MW demonstration tidal power plant at Durgaduani Creek in Sunderbans. In the long run, the technologies can help India meet its commitment of 24x7 electricity to all.

E-tailing/E-commerce

E-tailing or electronic retailing is the process of selling retail goods via the internet. E-tailing has taken India by storm and is expected to grow manifold in next five years. It has added a whole new perspective to the shopping experience by providing virtual stores to consumers. It gives quick and easy access to a shopping space at any time and from any place.

It saves time of the customer that is spent on travelling to a shopping place in real world. M-commerce or shopping via smartphones has further boosted the e-tailing market.



Use case

- India's e-tailer giant Flipkart will launch 'Flipkart Kaarigar ka Dwaar' initiative under which it will sell the products of weavers of Varanasi online. All logistical and technical support will be given to the weavers. This move will provide the much-needed boost to the traditional weavers.
- With its customer-friendly services and discounts Amazon is regarded as the king of e-tailing worldwide.

\$6.7tn
B2B e-commerce market by 2020
(Source: Frost & Sullivan)

Where we stand

While India has a plethora of e-tailing sites, there is no policy and regulatory framework to safeguard consumer interest and regulate FDI investment in the sector.

SOLAR TECHNOLOGIES

Nantenna



Developed by Patrick Pinhero, an associate professor in the University of Missouri, the Nantenna (Nano Antenna) is a nanoscopic rectifying antenna or rectenna that can convert solar radiation to electricity. The technology is based on antenna theory but uses thin, moldable sheet of small antennas that can capture more than 90 percent of available light. This is a major breakthrough in harvesting solar energy as the existing solar panels can collect only 20 percent of the light. His team is also working to extend this concept to a direct solar facing nantenna device capable of collecting solar irradiation in the near infrared and optical regions of the solar spectrum.

Use case

- While the technology is still in its nascent stage researchers believe it can help utilise the untapped infrared parts of spectrum – solar radiation and thermal earth radiation.
- Since the Nantenna is fabricated using the nanotechnology using flexible film it could be easily fitted on variety of surfaces, including roofs of vehicles and power them.
- Researchers also see its usage for developing cancer-fighting lasers.

Where we stand

With a total installed capacity of 1,46,753 Mw, the country's power shortage at the moment are estimated at about 11% of total requirement and 15% of peak capacity requirements which are likely to increase in the coming years. With the ministry of renewable energy (MNRE) being asked to scale up India's solar power capacity to 1,00,000 Mw by 2019, the country is well poised to adopt newer technology like nantenna and concentrated solar power in a big way.

Solar Power

Concentrated Solar Power (CSP) technology uses mirrors or lenses to concentrate the sunlight into a relatively small area, where this light is converted into heat. This heat then creates steam that drives steam engines to generate electric power. CSP systems have very wide ranges from remote power systems as small as few kilowatts up to grid-connected power plants of 100s of megawatts (Mw).

Use case

- Shams-I, the largest CSP project in the world with a capacity of 100 Mw, was installed in Abu Dhabi in March 2013.
- The PS10 solar power plant was the first commercial concentrating solar power tower operating near Seville, in Andalusia, Spain.



Global scenario

The worldwide installed capacity of CSP increased by **36** percent in 2013 – up from 0.9 gigawatt (Gw) to more than **3.4** Gw. As of January 2014, Spain with a total capacity of **2,204** MW leads the space followed by USA, UAE and India.

(Source: Renewables 2014 Global Status Report)

Where we stand

Of the seven CSP projects, with total capacity of 470 Mw, launched under the Jawaharlal Nehru National Solar Mission in 2010, the country has so far commissioned only two 50 Mw projects – Godawari Solar Project in Rajasthan and MEIL Green Power in Andhra Pradesh. While the biggest hurdle in the uptake of the project was insufficient direct normal irradiance (DNI) data, the project also suffered due to higher cost of finance and government's unclear position on subsidies.

Social Media



It is not just a tool for communication with friends and relatives, but it has been used widely to bring about social and political changes in societies. It has enhanced the outreach of governments worldwide. Today, with the presence of citizens on social media reaching swelling proportions, governments have the opportunity to actively involve citizens as programme evangelists and champions. It has been used by governments for effective citizen engagement and communication with all stakeholders

in real-time. It also creates new possibilities for community-driven initiatives.

Use case

- Social media was widely used by democracy protestors during uprisings in Tunisia and Egypt (popularly known as Arab Spring) that led to the resignation of the country's dictatorial leader Hosni Mubarak.
- A massive social media campaign launched on Facebook, Twitter and WhatsApp helped in mobilising the masses who demanded justice in the December 2012 Nirbhaya rape and murder case in New Delhi.

70% companies worldwide use social technologies
(Source: McKinsey & Company)

Where we stand

The DeitY has drafted a social media framework for all central line ministries enabling most of the ministries and important departments to set up their social media accounts and pages. The government has also created its own 'mygov' portal that aims at engaging citizens in the decision-making process. State governments are also using social media to reach out to people and engage them in policy making.

Data Analytics



Data analytics is the science of analysing data in volumes and identifying common patterns and trends through techniques such as data mining, predictive analysis and clustering. It has been used by various governments in facilitating decision making. Data analytics has already been used by the Indian government in the

recent elections to assess the public mood. The uses of data analytics vary from the government to the private, where in businesses use it. It has its uses in healthcare, retail and finance too.

Use case

- With 700 million registered

users, the Aadhaar database is the biggest database in the world, which has been linked to the public distribution system database, the MNREGA database among others to weed out false beneficiaries.

- Singapore Land Transport Authority deals with 20 million fare transactions daily. Analysing these transactions, the authority has been able to understand the citizen's transport needs and plan cost-effective routes.

\$125bn global big data and analytics market in 2015
(Source: International Data Corporation)

Where we stand

The government will commission a project which will use analytics in a big way. While the government intends to harness unstructured data from various sources, including the social media

for understanding people's mood, the technology is particularly important for predictive analytics in various sectors – healthcare, security, weather, agriculture and even for overall financial planning. India is also looking at sharing of data among various agencies, as well as using various cutting-edge technologies, including the Internet of Things, that will be generating a huge amount of data. An analytical layer can be put on top of this data to build intelligence for faster decision-making.

Cloud Computing

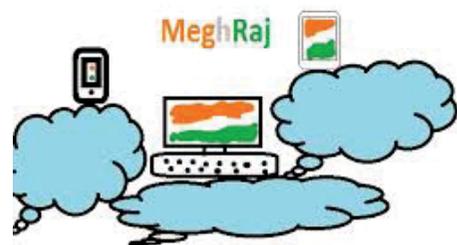


Photo: Globindian Blog
Visit: Globindian.wordpress.com

One of the most recent technologies to emerge, cloud computing allows groups of computers, software and computer resources to be connected in networks, that allow centralised data storage and online access to computer services or resources or the metamorphic central 'cloud'. The technology allows

access to computer services or resources online using web interface. There are three types of clouds – private, public and hybrid. The private cloud services are delivered through a business data centre, while the public cloud services are delivered via a third party.

Use case

- USA launched its federal cloud strategy in February 2011 and has since then adopted the Cloud First policy in various government services.
- The United Kingdom launched its G-Cloud in 2012 to ease procurement by public sector bodies in the country. It adopted the Cloud First policy in February 2014.

Internet of Things

The Internet of Things (IoT) allows all physical objects to be connected through a network and their virtual representation on the internet. The technology depends on sensors that can be embedded in objects or living beings, which can then be monitored and even controlled remotely. Since the sensors or actuators help in identifying the objects, the technology can also be used for collecting data on user habits, weather condition, quality of water and numerous such things. The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields while also enabling advanced applications like a smart grid for utilities.



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Use case

- Apple has introduced its home automation technology, HomeKit

As part of the national e-governance plan (NeGP), India launched its cloud infrastructure Meghraj in December 2013.

\$1.7tn-\$6.2tn
annual economic impact of cloud technology by 2025

(Source: McKinsey & Company)

Where we stand

The DeitY has introduced a strategic roadmap for boosting cloud computing across government and private verticals. The department will soon introduce a policy framework which would lay out security norms and standards for public, private and hybrid cloud. Simultaneously, the department is also encouraging states to cloud-enable their state data centres set up under the national e-governance plan. Cloud is also at the centre of e-kranti, the second phase of NeGP. The government plans to provide infrastructure, network, storage, computing, and application on a cloud platform.

network protocol. It is designed to allow people to control connected devices in their homes via applications.

\$15bn
IoT industry in India by 2020

(Source: DeitY)

Where we stand

IoT is one of the main technologies that India is planning to use in its 100 smart city projects. While the department of electronics and information technology (DeitY) has already come out with a draft policy paper on the same, it is presently seeking feedback from all stakeholders and is expected to come out with standards and guidelines for the use of IoT in the country soon. The technology also holds promises for the Digital India project that includes eHealth, use of technology for agriculture and security as well.

Language Computing



Language computing essentially means computing in a specific language, where not only the content is in that language, but also the computing tools, like the browser and all the computer software in that language. In the case of India, everything is available in 22 languages. Until now the government had some websites available which could be viewed in both English and Hindi. But now with heightened interest in this regard, with the Digital India, and a need to reach out to more people, the government has come out with a separate mission mode project (MMP) – e-Bhasha – to develop computing in Indian languages. Private players, such as Google and Computer Society for India, are also involved in similar initiatives.

Use case

- China and North Korea have been driving language computing at an international level making it mandatory for all IT companies to have local language interface.
- Google, along with other private players, launched Internet Alliance of Indian Languages initiative where online content will be available in both Hindi and English. The initiative aims to introduce internet to 50 million more people by 2019.

Where we stand

While DeitY has already included e-Bhasha as an MMP under the national e-governance plan (NeGP), the department, along with bodies like CDAC and TDIL, is developing tools that will help the government departments formulate content in Indian languages, giving access to government services to a higher number of people. The objective is to deliver all government services in all Indian languages. The project is likely to be approved in a couple of months.

Broadband

Broadband is the technology that allows the transfer and transportation of data through specified bandwidth. Broadband or internet can be delivered through several mediums, including balloon internet, laser internet, optical fibre and coastal internet. In case of optical fibre, underground cables help deliver the technology to the doorstep. In case of laser internet, laser pulses are used to transmit high capacity broadband to the required destination. This technology was used by NASA to capture broadband on the moon. As for balloon internet, it was conceptualised by Google as a developmental project under the name, Project Loon,

wherein high altitude balloons were placed in the stratosphere creating a network that provided high-capacity broadband to rural areas.



Use case

- The national optical fibre network (NOFN) project was launched by the UPA government to provide last-mile connectivity to 2,50,000 village panchayats in India.
- In September last year, NASA launched a project where they used laser pulses to transmit high-capacity broadband to the moon.

2.9bn
internet users in 2014

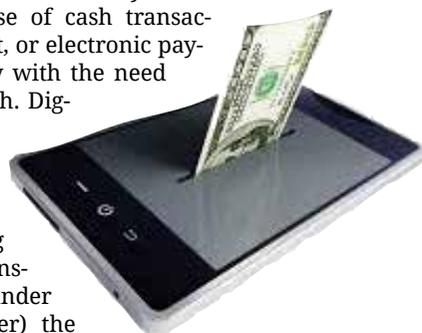
(Source: The State of Broadband Report)

Where we stand

In terms of its reach, broadband penetration in India is very poor. There are only seven crore subscribers in the country, that too mainly confined to urban areas. Despite the intent, the government is struggling to implement the national optical fibre network and hopes to complete it by 2016.

Digital Payment

There is a huge cost attached to printing and securing cash. Corruption and black economy have been thriving because of cash transactions. Digital payment, or electronic payment, has done away with the need for transacting in cash. Digital payment has made e-commerce and other online transactions easier and popular. Using electronic cash transfer and Aadhaar (under direct benefit transfer) the government has fixed pilferages and saved substantial money which was otherwise siphoned off by intermediaries. Mobile banking has already become popular. As message banking will become popular and used by people for routing transactions, including grocery shopping, cash percentage in the economy will reduce and money would be more traceable.



Use case

- Internet-based businesses like Flipkart, Amazon, Snapdeal, Ola and Uber are among the biggest users.
- Banks are promoting digital transaction as it reduces the operational cost vis-a-vis manual transaction.

₹85,500cr
market size of online payments
in India in 2013
(Source: IAMAI)

Where we stand

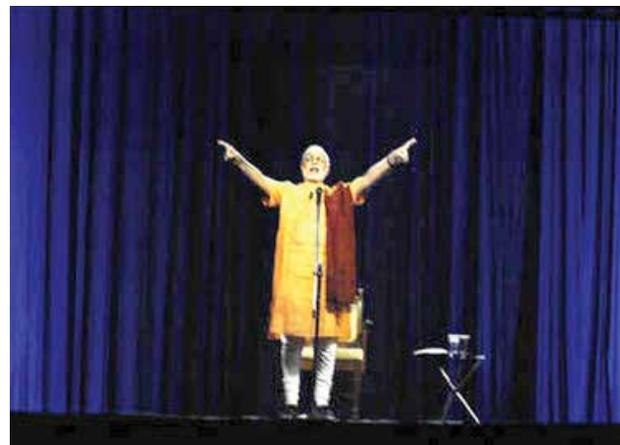
RBI has already issued guidelines for operations of pre-paid payment instruments (smart cards, magnetic stripe cards, internet accounts, internet wallets, mobile accounts, mobile wallets and paper vouchers). The government has created RuPay payment gateway for facilitating financial transactions.

Holographic Telepresence

With the help of holographic telepresence systems one can project realistic, full-motion, real-time 3D images of distant people and objects into a room, along with real-time audio communication, with a level of realism rivaling physical presence. Images of remote people and surrounding objects are captured, compressed, transmitted over a broadband network, decompressed, and finally projected using laser beams. This technique is being used extensively by the entertainment and media industry, healthcare sector, business organisations, distant education among others.

Musion uses a system called 'Pepper's Ghost'. This effect is popular among illusionists, to beam moving images onto sloped glass. Musion has already digitally resurrected rapper Tupac Shakur at a music festival.

- In 2013, Cisco rolled out the next generation of video conferencing



Use case

- Prime minister Narendra Modi extensively used holographic telepresence while campaigning for Gujarat elections in 2012.
- Britain-based company

with holographic displays that make it look like people who are thousands of miles away are actually in the same room.

Where we stand

The technology is definitely taking video conferencing to a next level. With its recent example, India has shown a way in which the technology can be used effectively. The technology also holds promise in healthcare and education sectors that are the key pillars of the Digital India programme. Combined with telemedicine, the technology can be used to provide medical advice from experts at far-off locations. Besides, interactive methods of teaching can be introduced using the technology that can also help experts to reach out multiple locations at the same time.

Biometric Identity

Owing to its uniqueness and non-replicable characteristic, biometric identity has emerged as a standard mode of authentication world over. The biometric identifier includes fingerprint, iris, retina scans or DNA. Biometrics is used to identify targeted beneficiaries for social security programmes. It is also used by police and security agencies to track prisoners, criminals and terrorists. It is also used for authenticating financial transactions.

Use case

- Unique identification authority of India (UIDAI) has enrolled over 70

crore Indians for its unique identification programme, Aadhaar. It has been linked to service delivery. The government has also created a biometric based attendance system



for all central government employees in 2014. This system is linked with Aadhaar.

\$21.9bn

worth of global biometrics
market by 2020
(Source: 6Wresearch)

Where we stand

While India has the largest database of citizen biometric, the government is yet to pass legislation related to Aadhaar and privacy, the lack of which has led to several litigations and opposition by civil society and rights activists. The country also needs to revise its IT Act to deal with the privacy and data security issue.

Smart Grid

This is a software-controlled electrical grid which brings efficiency in electricity supply network. It provides information about where losses are occurring and how these losses can be reduced through appropriate technical measures. According to the ministry of power, it will provide access to reliable and quality power to all at affordable cost. In some states aggregate technical and commercial (AT&C) losses exceed 30%. This loss is managed by increasing the power tariff; the cost is eventually borne by consumers. The government is implementing restructured accelerated power development and reforms programme (R-APDRP), which aims to use ICT for reducing the 30% AT&C losses. Automation of transmission will help in creating smart grid. Smart meters are an integral part of smart grid system which provides data about the consumption pattern.

Use case

- The power ministry has allocated 14 smart grid projects that will be implemented by state-owned distribution utilities.



The Maharashtra electricity regulatory commission has constituted a smart grid coordination committee. The Delhi regulatory commission is seeking suggestions and objections from various stakeholders on the proposal on net metering and connectivity of rooftop solar PV projects.

Where we stand

There are enabling provisions in the Electricity Act, 2003. The central electricity authority has issued specifications for a low-cost single-phase smart meter. With the country also focusing renewable energy sources and power portability, an enabling smart grid is the only way forward. The technology will also pave way for sharing of power between the SAARC nations, a project that is already being taken forward by the member countries.

\$1.9bn
India's smart grid market
by 2015
(Source: NEC)

Speech Recognition

The internet has largely remained outside the purview of illiterate and visually impaired. Google has made some search voice-enabled. Some smartphones have this feature too. The Centre for Development of Advanced Computing (CDAC) is also working in this area. Speech recognition application, when provided in different languages, will help more people access internet.



Use case

- ☞ The technology has found its military use, with the F-35 pilot-aircraft of the US Air Force using speech recognition system that has an accuracy of 98%.
- ☞ Using this technology, Standard Life (UK) increased its overall call handling capacity by over 25% and reduced misdirected calls by 66%.
- ☞ UK-based Suncorp introduced natural language speech recognition to replace its original push button IVR, enabling the customers to simply say what they wanted.

Global scenario

The global voice recognition market will grow at a CAGR of **9.4%** during 2014-19.

Where we stand

As of now there is no policy related to speech recognition. However, with the creation of department of disability under the ministry of social justice, the country can soon expect a policy to support the technology for Indian languages and local accent. Unfortunately, the Digital India plan does not mention it separately, something that would have helped the country push for inclusive knowledge society. The technology also has a role to play in delivering health-care, education, citizen service and in defence.

Augmented Reality

The technology offers a live view of a physical, real-world environment whose elements are enhanced by computer-generated sensory input such as sound video graphics or spatial data. A key measure of AR systems is how realistically they integrate augmentations with the real world. It can be used in defence, education, health, construction, and various other sectors. It blurs the line between real and virtual by enhancing what we hear, see and touch.



Use case

- ☞ The Defense Advanced Research Projects Agency (DARPA) has developed a programme called Urban Leader Tactical Response, Awareness and Visualisation (ULTRA-Vis) that helps visualise the location of other forces, vehicles, hazards and aircraft in the local environment.
- ☞ Several augmented reality applications allow medical students to have a better understanding of the human body and how it functions.

\$1bn
annual augmented reality revenue
expected in 2015
(Source: Juniper)

Where we stand

The technology draws concerns related to law that governs use of spatial data, including collection, use and transfer of location and other such individual data. This includes concerns about privacy, intellectual property rights, data quality and its liability and security and the same needs to be made part of the IT Act to create a legal framework for use of this technology. At present, India has no legal or policy framework for augmented reality.

Energy Storage

The development of energy storage technology will help redefine the energy landscape of 21st century. Energy storage is conversion of electricity into a form that can be stored and converted back into electrical energy for later use, providing energy on demand. Some of the common technologies for energy storage are solid state batteries, flow batteries, flywheels, compressed air energy storage, thermal energy storage

and pumped hydro energy storage (PHES). It will allow nations to decarbonise their economies by integrating renewable energy into their grids, reduce peak power demand and make all forms of power generation more efficient.

Use case

- ☞ In October 2013 California made it mandatory of electric utilities

Quantum Computing

Based on the principle of quantum physics, it is a method of computing which stores information as a 1 or a 0 or a superposition of both simultaneously unlike the conventional computing which is binary, storing information only as a 1 or a 0. Quantum computers will be thousands and million times faster than the present supercomputers. They will be able to solve algorithms or perform tasks much faster. According to reports, scientists at IBM Research have succeeded in reducing errors in elementary computations and retaining the integrity of quantum mechanical properties. This is being considered an important milestone that will drive implementation of a commercial, full-scale quantum computer.



Use case

- ☞ As of now D-Wave is the only commercial Quantum Computer available, however, with very limited computing power. Since it would help in solving mathematical problems faster, it could be applied across all sectors.

\$26bn
quantum computing
market by 2020
(Source: Quantum Computing Market Forecast 2015-20)

Where we stand

With the country already moving to the version 2.0 of its national e-governance plan (NeGP) and newer programmes like Digital India, smart cities, health surveillance infrastructure and smart grids, any technology that can help improve computing power is a boon. However, the technology is still rather a theoretical concept than a ready-to-implement solution.

to meet specific targets for energy storage, targeting 1,325 megawatts of storage by 2020.

- ☞ Bakken Hale, a private estate off Hawaii's Kona Coast, is installing a 1 megawatt-hour battery that will help store electricity from a 176KW solar energy system and create its own microgrid.

Where we stand

The India Energy Storage Alliance (IESA) was launched in 2012 to assess the market potential of energy

storage technologies in the country, through an active dialogue and subsequent analysis among the various stakeholders to make the Indian industry and power sector aware of the tremendous need for energy storage in the near future.

\$15.6bn
revenue expected
from energy storage
by 2024
(Source: Navigant Research)

Biofuel

A biofuel is a fuel that is derived from biological materials, such as plants, animals and fish. It can also be seen as a fuel derived from organic matter (obtained directly from plants, or indirectly from agricultural, commercial, domestic, and/or industrial wastes). They not only help in reducing the carbon footprint, but also help in saving recurring energy costs. Development and use of biofuels is being promoted globally as they make little or no contribution to climate change. Among the various biofuels like ethanol, power,



biodiesel, green diesel, biofuel gasoline, and vegetable oil, the most promising biofuel today is biodiesel.

Use case

- ☞ Indian Railways will promote use of alternative fuels such as biodiesel in a big way. It plans to start using biodiesel up to 5% of the total fuel consumption in diesel locomotives.
- ☞ In the US, the NFESC, with several biodiesel industries, is developing biodiesel technologies. Another group of Spanish developers have announced a new biofuel made from trash.

\$185.3bn
global biofuel market
in 2021
(Pike Research)

Where we stand

India is taking many steps to promote production and use of biofuels. Offering the biggest advantage of partially to fully replacement of the fossil fuels with clean and ecological fuels, biofuels face technical challenges. Besides cost, the size of land needed to produce mass biofuels is very large.