KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS), ERODE – 638107

DEPARTMENT OF COMPUTER TECHNOLOGY AND INFORMATION TECHNOLOGY

IT Bulletin

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KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS), ERODE.

DEPARTMENT OF COMPUTER TECHNOLOGY AND INFORMATION TECHNOLOGY

IT BULLET **DATE: 04.12.2019**

ROBOTIC PROCESS AUTOMATION OR RPA

- Like AI and Machine Learning Robotic process Automation or RPA is another technology that is automating jobs.
- RPA is the use of software to automatic business process such as interpreting applications, processing transactions, dealing with data and even replying to emails.
- RPA automates repetitive tasks that people used to these are not just the menial tasks of a low-paid worker: up to45 percent of the activities we do can be totally automated but about 60 percent can be partially automated
- An IT professional looking to the future and trying understand technology trends.RPA offers plenty of career opportunities, including developer, project manager and consultant

FIELDS OF APPLICATION:

- Across the current enterprise landscape, automation is being leveraged to save not only time & cost, but empower employees to focus an activities that bring to clients
- The RPA solutions that we offer are governed by business logic and structured inputs, business process & business units

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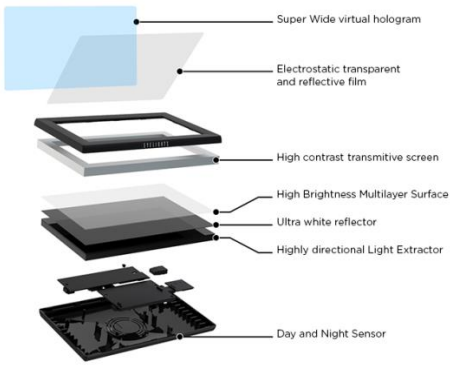
IT BULLETIN **DATE: 05.12.2019**

HOLOGRAPHIC CAR ASSISTANT

Eye Lights, a developer of augmented reality devices for mobility, has launched Eye Drive. Eye Drive turns any car windshield into a holographic surface, enabling safer navigation, music control, and phone calls, while keeping eyes away from distracting smart phones.

The Eye Drive holographic display, pre-order accessories for the full-car experience. Accessories include the Eye Drive Gesture Control, a gesture sensor that uses infrared technology to detect our hand movement and launch an action. Use various gestures to accept or decline a call, manage our music or activate the rearview camera. The Eye Drive rearview camera is also available for pre-order, a wireless and waterproof backup camera.



Eye Drive's key features include:

A bigger brighter holographic image, Voice control, Access our favorite apps, Gesture control Wireless, waterproof backup camera, Full-car compatibility.

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IT BULLETIN **DATE: 08.12.2019**

SELF-DEFENDING NETWORKS

Self-Defending Networks: The Next Generation of Network Security helps networking professionals understand how to deploy an end-to-end, integrated network security solution. It presents a clear view of the various components that can be used throughout the network to not only monitor traffic but to allow the network itself to become more proactive in preventing and mitigating network attacks.

This security primer provides unique insight into the entire range of Cisco security solutions, showing what each element is capable of doing and how all ofthe pieces work together to form an end-to-end Self- Defending Network. While other books tend to focus on individual security components, providing in-depth configuration guidelines for various devices and technologies, Self-Defending Networks instead presents a high-level overview of the entire range of technologies and techniques that comprise the latest thinking in proactive network security defences.

This book arms network security professionals with the latest information on the comprehensive suite of Cisco security tools and techniques. Network Admission Control, Network Infection Containment, Dynamic Attack Mitigation, DDoS Mitigation, Host Intrusion Prevention, and Integrated Security Management are all covered, providing the most complete overview of various security systems. It focuses on leveraging integrated management, rather than including a device-by-device manual to implement self-defending networks

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IT BULLETIN **DATE: 09.12.2019**

CLOUD COMPUTING

Cloud computing is a network of resources a company can access, and this method of using a digital drive increases the efficiency of organizations. Instead of local storage on computer hard drives, companies will be freeing their space and conserving funds. According to Forbes, 83 percent of enterprise workloads will be in the cloud by 2020, which means 2019 will show an increasing trend closing in on this statistic.

Cloud storage and sharing is a popular trends many companies have adopted and even implemented for employee interaction. A company-wide network will help businesses save on information technology infrastructure. Cloud services will also extend internal functions to gain revenue. Organizations that offer cloud services will market these for external products and continue their momentum.

Organizations will transfer their stored files across multiple sources using virtualization. Companies are already using this level of virtualization, but will further embrace it in the year to come. Less installation across company computers is another positive result of cloud computing because the Internet allows direct access to shared technology and information. The freedom of new products and services makes cloud computing a growing trend.

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IT BULLETIN **DATE: 07.12.2019**

BLOCK CHAIN

Block chain, we all know, is a distributed digital ledger, in which the stakeholders of a particular network record transactions in real-time, without involving any central or regulatory authority. Having earned recognition with the surge in the use of crypto-currencies, especially Bitcoin, Block chain is a critically acclaimed disruptive technology, which is thriving among businesses across the world. According to Deloitte, 2019 will be the year in which enterprises will further explore the potentials of Block chain.

Use Cases

Block chain offers robust security features to protect business transactions. It keeps transactions cryptographically secured, which means the hackers would require ingenious computing abilities to break through. Besides, it also involves multiple participants and leaves no room for Single Point of Failure (SPOF).

Another way which keeps the hackers at bay and helps boost security is "Permission Block chain." Permission Block chain is different from "Public Block chain," which allows all the participants in the network to view transaction details. In case of Permission Block chain, only a few of the participants are permitted to write blocks or access transaction details. This limits the chances of a breach.

Broadly, Block chain technology is a solution which is widely experimented with different use cases. For instance, Bitcoin was one of the many use cases in which Blockchain turned out to be a perfect solution. The ability to maintain digital ledgers in real-time is not what intrigues businesses. What intrigues them most is the benefits of this distributed ledger technology.

Be it healthcare, BFSI, education, travel, supply chain, real estate, or manufacturing, Block chain derives potential use case across industries. Companies are exploring this incorruptible digital ledger to devise solutions that can virtually handle diverse things such as identity management, auditing, smart contracts, stock trading, information sharing, and more.

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IT BULLETIN **DATE: 10.12.2019**

DIGITAL TWIN – FUTURE OF MANUFACTURING

Integrated processes, optimized cycle times and high quality production are the result of this new digital phase. In this scenario the 'digital twin' industry players have realized the benefits of working around this.

The Digital Twin concept is all about copying the physical assets of a product, production process or performance of a production system into the digital world. Users can make use of design, simulation, manufacturing and analytics software to create and validate these digital twins. With this, manufacturers can keep a track of the whole lifecycle of the product and this becomes convenient for them to file all the necessary information regarding the product or production system at a single location. In case there are any modifications to be carried out, It can be done smoothly as processes can be designed for significantly enhanced efficiency. This ensures optimized cycle times and high quality production.

It has to be kept in mind that the Digital Twin concept performs different functions for design, manufacturing, services and operations, and end of life. For the design, the twin focuses on establishing the performance of the product for the lifecycle. When it comes to manufacturing, the main aim of the twin is to optimize the process and reduce costs. In terms of services, it reduces the operational cost.

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IT BULLETIN **DATE: 12.12.2019**

BIO-METRICS

Biometrics is the technical term for body measurements and calculations. It refers to metrics related to human characteristics . Biometrics authentication (or realistic authentication) is used in computer science as a form of identification and access control. It is also used to identify individuals in groups that are under surveillance.

Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized as physiological versus behavioural characteristics. Physiological characteristics are related to the shape of the body. Examples include, but are not limited to fingerprint, palm veins, face recognition, DNA, palm print, hand geometry, iris recognition, retina and odour/scent. Behavioural characteristics are related to the pattern of behaviour of a person, including but not limited to typing rhythm, gait, and voice. Some researchers have coined the term behaviometrics to describe the latter class of biometrics.

More traditional means of access control include token-based identification systems, such as a driver's license or passport, and knowledge-based identification systems, such as a password or personal identification number. Since biometric identifiers are unique to individuals, they are more reliable in verifying identity than token and knowledge-based methods; however, the collection of biometric identifiers raises privacy concerns about the ultimate use of this information.

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IT BULLETIN **DATE: 12.12.2019**

SELENIUM WEB DRIVER

Selenium is a free and open-source automated testing suite for Web User Interfaces. Its tool suite provides automated testing for all types of web applications. The suites, or components, are:

- Selenium IDE: A very simple automated testing browser extension for Firefox.
- Selenium Remote Control (RC): An extensive automation testing tool for browsers.
- Selenium Grid: Used to automate tests in parallel on different machines, browsers, and operating systems.
- Selenium WebDriver: Which improves on Selenium RC, is the latest addition to the suite.

Selenium Webdriver:

The Selenium WebDriver component integrated the WebDriver API. It allows us to use a programming language to create test scripts for a web application. The supported languages are Java, C#, Python, PHP, Perl, Ruby.

The use of programming languages to write tests means one can now employ the use of conditional statements, such as if-else, and loops.

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IT BULLETIN **DATE: 13.12.2019**

7S FRAMEWORK

'The 7S framework introduced by McKinsey is one of the ways through which analysis can be done to determine the efficiency of organization in meeting strategic objective'. The 7S model is utilized to study and suggest areas within company which needs improvement, examine the effects with change in strategy, internal alignment with every merger and acquisition.

7S Framework

The 7S framework constitutes of 7 factors, which affect organizational effectiveness. These 7 factors are strategy, organizational structure, IT systems, shared values, employee skills, management style and staff. These 7 factors can be broadly categorized into Hard Elements-Strategy, Structure, Systems and Soft Elements-Shared Values, Skills, Style and Staff. Hard elements highlighted above are the ones which are under direct control of management. Soft elements are not in direct control of management and are driven by internal culture.

Usage of 7S Framework

The basis of the 7S framework is that for organization to meet its objective it is essential all the seven elements are in sync and mutually balancing. The model is used to identify which out of 7 factors need to be balanced as to align with change in organization. 7S framework is helpful in identifying the pain points which are creating a hurdle in organization growth.

Technology and 7S Framework

In digital age, technology and technology-driven information systems both are game changer as far as meeting objective for organization is concerned. Companies are moving towards automation, cloud computing, etc. This has led to technology as central nervous system of the organization.

The 7S framework is applicable across all industries and companies. It is one of the premier models used to measure organizational effectiveness. In this challenging environment, strategy of organization is constantly evolving. In such an environment, it is essential organization to look back upon its seven elements to identify the source which is hampering the growth.

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IT BULLETIN **DATE: 14.12.2019**

LACIE SAFE

Storing files on mobile hardware gives multiple levels of protection because it uses advantage encryption and biometric authentication technology. The safe uses 128-bit AES encryption (advanced encryption standard) which is the same standard used by governments to protect top secret information.

Encryption converts information that is readable into a mixture of unreadable characters .decryption processes the encrypted unreadable character back into a readable format. The algorithm that encrypts and decrypts the information is known as a cipher. The cipher allows access to the readable information when you enter a password.

Most cipher will use passwords that are four to eight characters in length but a 128-bit AES cipher uses a 16 character password which is extremely difficult to hack. The AES cipher or "Rijndael"(pronounced rein dahl) is named after the Belgian inventors Joan Daemen and Vincent Rijmen.

Biometric authentication is a technology that recognizes physical or behavioural characteristics such as fingerprints, palm geometry, retina patterns, voice and signature. Fingerprints recognition is the most popular because it is easy to use.

our finger is scanned to minutia, which are the points on fingerprint where a ridge ends or splits into two. An algorithm extracts the minute points and creates a template image that is used for authentication.

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IT BULLETIN **DATE: 14.12.2019**

ARTIFICIAL INTELLIGENCE AND SMART MACHINES

Artificial intelligence harnesses algorithms and machine learning to predict useful patterns humans normally identify. Smart machines take human decision-making out of the equation so intelligent machines can instigate changes and bring forward solutions to basic problems. Companies are rallying around artificial intelligence in the workplace because it allows employees to use their abilities for the most worthwhile tasks, along with management of these smart machines for a more successful system.

The U.S. Army is applying artificial intelligence measures from Uptake Technologies to vehicles mainly used in peacekeeping missions for repair purposes. Their predictive software will reduce irregular maintenance and hone in on machine components that are more likely to deteriorate or get damaged. Predictive vehicle repairs can grow and extend to civilian purposes in the coming years.

AI face recognition is beginning to help with missing people reports, and it even helps identify individuals for criminal investigations when cameras have captured their images. According to the National Institute of Standards and Technology, face recognition is most effective when AI systems and forensic facial recognition experts team up. AI will continue to promote safety for citizens in the future as software improvements shape these applications.

Medical AI is another trend that reflects surprising success. Given patient information and risk factors, AI systems can anticipate the outcome of treatment and even estimate the length of a hospital visit. Deep learning is one way AI technology gets applied to health records to find the likelihood of a patient's recovery and even mortality. Experts evaluate data to discover patterns in the patient's age, condition, records, and more.

Home AI systems are also increasingly popular to expedite daily tasks like listening to tunes, asking for restaurant hours, getting directions, and even sending messages. Many problem-solving AI tools also help in the workplace, and the helpfulness of this technology will continue to progress in 2019.

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IT BULLETIN **DATE: 16.12.2019**

MACHINE LEARNING

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves.

The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly.

The computational analysis of machine learning algorithms and their performance is a branch of theoretical computer science known as computational learning theory. Because training sets are finite and the future is uncertain, learning theory usually does not yield guarantees of the performance of algorithms. Instead, probabilistic bounds on the performance are quite common.

The bias–variance decomposition is one way to quantify generalization error.For the best performance in the context of generalization, the complexity of the hypothesis should match the complexity of the function underlying the data.

Machine learning poses a host of ethical questions. Systems which are trained on datasets collected with biases may exhibit these biases upon use (algorithmic bias), thus digitizing cultural prejudices. For example, using job hiring data from a firm with racist hiring policies may lead to a machine learning system duplicating the bias by scoring job applicants against similarity to previous successful applicants. Responsible collection of data and documentation of algorithmic rules used by a system thus is a critical part of machine learning.

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IT BULLETIN **DATE: 16.12.2019**

CHATBOTS

Chatbots technology is growing very rapidly with the market growing at the CAGR of 37.11%. It is forecasted to reach a booming $ 6Billon by the end of 2023.when business bots are combined with mobile app, offer a way of creating stimulating customer interaction for business. According to the statistics, in 2018-65%of us customers are likely to interact with chatbots. The mobile app industry is continuously expanding at the rapid speed with the introduction of these mobile app trends. A chatbots is a piece of software that conducts a conversation via auditory or textual methods. Such program are often designed to convincingly simulate how a human world behave as a conversation partner, although as of 2019, they are far short of being able to pass the Turing test.

Chatbots are typhically used in dialog systems for various practical purpose including customer service or information acquisition. Some chatbots use the sophisticated natural language processing systems, but many simple one scan for keywords, or the most similar wording pattern, from a database. The term “chatbots” was originally coined by Michael Mauldin in 1994 to describe these conversational programs. Today, most chatbots are accessed via Virtual assistants such as google assistant and amazon Alexa, via messaging apps such as Facebook messenger or we chat, or we chat, or via individual organization apps and websites.

Chatbots can be classified into usage categories that include conversational commerce (e-commerce via chat), education, entertainment, finance, news, productivity. Beyond chatbots, conversational AI refers to the usage of messaging apps, speech -based assistants and chatbots to the automate communication and create personalized customer experience at scale. In 1950, Alan Turing’s famous article “Computing Machinery and Intelligence”.

This criterion depends on the way and ability of a computer program to impersonate a human in a real-time written conversation with a human judge to the extent that the judge is unable to distinguish reliably- on the basis of the conversational content - between the program and a real human. The notoriety of Turning's proposed test stimulated great interest in Joseph Weizenbaum's program ELIZA, published in 1966,which seemed to be able to fool users Into believing that they were conversing with a real human. However Weizenbaun himself did not calm that ELIZA was genuinely intelligent, and the introduction to his paper presented it more as a debugging exercise.

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IT BULLETIN **DATE: 16.12.2019**

INTERNET OF THINGS

The Internet of Things (IOT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

The definition of the Internet of Things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of Things. In the consumer market, IOT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smart phones and smart speakers.

There are a number of serious concerns about dangers in the growth of IOT, especially in the areas of privacy and security; and consequently industry and governmental moves to begin to address these.

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IT BULLETIN **DATE: 18.12.2019**

WIRELESS POWER TRANSFER

Wireless power transfer (WPT), wireless power transmission, wireless energy transmission (WET), or electromagnetic power transfer is the transmission of electrical energy without wires as a physical link. In a wireless power transmission system, a transmitter device, driven by electric power from a power source, generates a time-varying electromagnetic field, which transmits power across space to a receiver device, which extracts power from the field and supplies it to an electrical load. The technology of wireless power transmission can eliminate the use of the wires and batteries, thus increasing the mobility, convenience, and safety of an electronic device for all users. Wireless power transfer is useful to power electrical devices where interconnecting wires are inconvenient, hazardous, or are not possible

Wireless power techniques mainly fall into two categories, near field and far-field. In *near field* or *non-radiative* techniques, power is transferred over short distances by magnetic fields using inductive coupling between coils of wire, or by electric fields using capacitive coupling between metal electrodes. Inductive coupling is the most widely used wireless technology; its applications include charging handheld devices like phones and electric toothbrushes, RFID tags, induction cooking, and wirelessly charging or continuous wireless power transfer in implantable medical devices like artificial cardiac pacemakers, or electric vehicles.

In *far-field* or *radiative* techniques, also called *power beaming*, power is transferred by beams of electromagnetic radiation, like microwaves or laser beams. These techniques can transport energy longer distances but must be aimed at the receiver. Proposed applications for this type are solar power satellites, and wireless powered drone aircraft. An important issue associated with all wireless power systems is limiting the exposure of people and other living things to potentially injurious electromagnetic fields.

Wireless power transfer is a generic term for a number of different technologies for transmitting energy by means of electromagnetic fields. The technologies, listed in the table below, differ in the distance over which they can transfer power efficiently, whether the transmitter must be aimed (directed) at the receiver, and in the type of electromagnetic energy they use: time varying electric fields, magnetic fields, radio waves, microwaves, infrared or visible light waves.

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IT BULLETIN **DATE: 19.12.2019**

SPINNING MULE

The spinning mule is a machine used to spin cotton and other fibres. They were used extensively from the late 18th to the early 20th century in the mills of Lancashire and elsewhere. Mules were worked in pairs by a minder, with the help of two boys: the little piecer and the big or side piecer. The carriage carried up to 1,320 spindles and could be 150 feet (46 m) long, and would move forward and back a distance of 5 feet (1.5 m) four times a minute. It was invented between 1775 and 1779 by Samuel Crompton. The self-acting (automatic) mule was patented by Richard Roberts in 1825. At its peak there were 50,000,000 mule spindles in Lancashire alone. Modern versions are still in niche production and are used to spin woollen yarns from noble fibres such as cashmere, ultra-fine merino and alpaca for the knitware market.

There were two types of spinning wheel: the Simple Wheel, which uses an intermittent process, and the more refined Saxony wheel, which drives a differential spindle and flyer with a heck (an apparatus that guides the thread to the reels) in a continuous process. These two wheels became the starting point of technological development. Businessmen such as Richard Arkwright employed inventors to find solutions that would increase the amount of yarn spun, then took out the relevant patents.

The spinning jenny allowed a group of eight spindles to be operated together. It mirrored the simple wheel; the rovings were clamped, and a frame moved forward stretching and thinning the roving. A wheel was rapidly turned as the frame was pushed back, and the spindles rotated, twisting the rovings into yarn and collecting it on the spindles. The spinning jenny was effective and could be operated by hand, but it produced weaker thread that could only be used for the weft part of cloth. (Because the side-to-side weft does not have to be stretched on a loom in the way that the warp is, it can generally be less strong.)

The throstle and the later water frame pulled the rovings through a set of attenuating rollers. Spinning at differing speeds, these pulled the thread continuously while other parts twisted it as it wound onto the heavy spindles. This produced thread suitable for warp, but the multiple rollers required much more energy input and demanded that the device be driven by a water wheel. The early water frame, however, had only a single spindle. Combining ideas from these two system inspired the spinning mule.

The increased supply of muslin inspired developments in loom design such as Edmund Cartwright's power loom. Some spinners and handloom weavers opposed the perceived threat to their livelihood: there were frame-breaking riots and, in 1811–13, the Luddite riots. The preparatory and associated tasks allowed many children to be employed until this was regulated.

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IT BULLETIN **DATE: 20.12.2020**

ROBOTICS

Robotics is an interdisciplinary reaseach area at the interface of computer science and engineering. Robotics involves design, construction, operation, and use of robots. The goal of robotics is to design intelligent machines that can help and assist humans in their day-to-day lives and keep everyone safe. Robotics draws on the achievement of information engineering, computer engineering, mechanical engineering, electronic engineering and others.

Robotics develops machines that can substitute for humans and replicate human actions. Robots can be used in many situations and for lots of purposes, but today many are used in dangerous environments (including inspection of radioactive materials, bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space, underwater, in high heat, and clean up and containment of hazardous materials and radiation). Robots can take on any form but some are made to resemble humans in appearance. This is said to help in the acceptance of a robot in certain replicative behaviors usually performed by people. Such robots attempt to replicate walking, lifting, speech, cognition, or any other human activity. Many of today's robots are inspired by nature, contributing to the field of bio-inspired robotics.

The concept of creating machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Throughout history, it has been frequently assumed by various scholars, inventors, engineers, and technicians that robots will one day be able to mimic human behavior and manage tasks in a human-like fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Many robots are built to do jobs that are hazardous to people, such as defusing bombs, finding survivors in unstable ruins, and exploring mines and shipwrecks. Robotics is also used in STEM (science, technology, engineering, and mathematics) as a teaching aid. The advent of nanorobots, microscopic robots that can be injected into the human body, could revolutionize medicine and human health.

Robotics is a branch of engineering that involves the conception, design, manufacture, and operation of robots. This field overlaps with computer engineering, computer science (especially artificial intelligence), electronics, mechatronics, nanotechnology and bioengineering.

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IT BULLETIN **DATE: 21.12.2019**

EDGE COMPUTING

Formerly a technology trend to watch, cloud computing has become mainstream, with major players AWS (Amazon Web Services), Microsoft Azure and Google Cloud dominating the market. The adoption of cloud computing is still growing, as more and more businesses migrate to a cloud solution. But it's no longer the emerging technology.

As the quantity of data we're dealing with continues to increase, we've realized the shortcomings of cloud computing in some situations. Edge computing is designed to help solve some of those problems as a way to bypass the latency caused by cloud computing and getting data to a datacenter for processing. It can exist "on the edge," if it will, closer to where computing needs to happen. For this reason edge computing can be used to process time-sensitive data in remote locations with limited or no connectivity to a centralized location. In those situations, edge computing can act like mini datacenters. Edge computing will increase as use of the Internet of Things (IOT) devices increases. By 2022, the global edge computing market is expected to reach $6.72 billion. As with any growing market, this will create various jobs, primarily for software engineers.

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IT BULLETIN **DATE: 31.12.2019**

CYBER SECURITY

Cyber Security or information technology Security is a field within information technology involving the protection of computer systems and the prevention of unauthorized use or changes or access of electronic data. It deals with the protection of software, hardware, networks and its information. Due to the heavy reliance on computers in the modern industry that store and transmit an abundance of confidential information about people, cyber security is a critical function and needed insurance of many businesses. It also protects computer systems from theft or damage.

The AAA Triad is an acronym for the basis of any security discipline. They are the core concepts on which to base the development of security systems. The components of AAA are access control, authentication, and accounting. Access control is the management of how users can interact with the system, or what resources they can access. These consist of administrator settings.

Authentication is most often seen as a password but is any way of verifying the identity of a user before allowing them to access the system. Accounting is the record keeping of what users do while connected to the system. These allow the protection of the system from access by unwanted users, limiting how they can access the system, and being able to track what happens on the system.

Authentication is a process used by a server when it needs to know exactly who is accessing trying to access information or website that its present on the particular server. Authentication can be done in several ways but the most common way of authentication is the input of a username and password into a certain system. Another means of authentication could be through the use of PIN.

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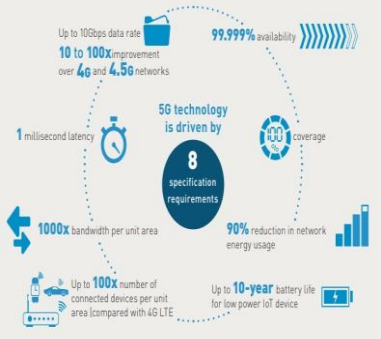
IT BULLETIN **DATE: 02.01.2020**

5G TECHNOLOGY



5G is an advanced wireless technology that has begun wide deployment in 2019. 5G speeds will range from ~50 Mbit/s to over a gigabit. Mid-band 5G, by far the most common, will usually deliver between 100 & 400 Mbit/s. In 5G, the "air latency" in equipment shipping in 2019 is 8-12 milliseconds. The latency to the server must be added to the "air latency".

"Edge Servers close to the towers can reduce latency to 10-20 ms. 1-4 ms will be extremely rare for years outside the lab.5G NR (New Radio) is a new air interface developed for the 5G network. It is supposed to be the global standard for the air interface of 3GPP 5G networks. Initial 5G NR launches will depend on existing LTE (4G) infrastructure in non-standalone (NSA) mode (5G NR software on LTE radio hardware), before maturation of the standalone (SA) mode (5G NR software on 5G NR radio hardware) with the 5G core network.

The Spectrum Frontiers Proposal (SFP) doubled the amount of millimeter-wave unlicensed spectrum to 14 GHz and created four times the amount of flexible, mobile-use spectrum the FCC had licensed to date. The maximum channel bandwidth defined for FR1 is 100 MHz, due to the scarcity of continuous spectrum in this crowded frequency range. The band most widely being used for 5G in this range is around 3.5 GHz.

Samsung Galaxy S10 5G, the first smartphone able to connect to 5G networks**.** The Telecom Regulatory Authority of India (TRAI) has issued, white paper press statement stating that 5G is set to transform communication networks and will bring massive growth in Indian economy by 2021. TRAI has also ordered telecom companies to identify specific use causes for 5G launch.

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IT BULLETIN **DATE: 02.01.2020**

CLOUD COMPUTING

Cloud computing is the on demand availability of computer system resources, especially data storage and computing power, without direct active management by the user. The term is generally used to describe data centers available to many users over the Internet. Large clouds, predominant today, very often have functions distributed over multiple locations from central servers. If the connection to the user is relatively close, it may be designated an edge server.

Clouds may be limited to a single organization (enterprise clouds), or be available to many organizations (public cloud).Cloud computing relies on sharing of resources to achieve coherence and economies of scale.

Cloud computing allows companies to avoid or minimize up-front IT infrastructure costs. Proponents also claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and that it enables IT teams to more rapidly adjust resources to meet fluctuating and unpredictable demand. Cloud providers typically use a "pay-as-you-go" model, which can lead to unexpected operating expenses if administrators are not familiarized with cloud-pricing models.

The availability of high-capacity networks, low-cost computers and storage devices as well as the widespread adoption of hardware virtualization, service-oriented architecture and autonomic and utility computing has led to growth in cloud computing. The Cloud Service Provider (CSP) will screen, keep up and gather data about the firewalls, intrusion identification or/and counteractive action frameworks and information stream inside the network.

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IT BULLETIN **DATE: 03.01.2020**

FULLY AUTONOMOUS DRIVING

Machines tend to be superior to humans in terms not only of strength and precision but also of reliability in controlling complex processes and the capacity to learn from mistakes. In motorized traffic, the advantages of fully autonomous driving are evident. Trucks driving in a densely packed convoy would greatly reduce gas consumption by reducing air resistance; autonomous cars that allow passengers to make good use of their travel time would greatly reduce time wasted. Above all, autonomous car traffic holds the promise of massive increases in safety. Especially in situations where presence of mind and reaction time are crucial, machines can be expected to perform better than humans. Instead of emotional and reflex-like reactions, a machine can analyze a situation in a split second and make decisions based on an algorithm established long in advance.

The prospect of automatized car traffic, however, confronts ethics, law, and politics with novel and far-reaching questions. Even if autonomous cars are constructed in a way that makes traffic safety the top priority, critical situations in which loss of life and limb are inevitable could still arise, requiring them to negotiate between two or more evils

Despite the enormous complexity of these tasks, the challenges are purely technical. As with a driver's test, requirements for the quality of this situation assessment can be defined and tested with real and virtual test drives.

The ethical tasks to be mastered are no less challenging. Several hard questions must be answered: How safe is safe enough? How safe is too safe? Excessive safety would paralyze road traffic and seriously hamper acceptance of autonomous vehicles. Giving leeway to risky driving styles would jeopardize the safety objectives. How egalitarian does an automatized driving system have to be? Is a manufacturer allowed to advertise with fast cars at the price of lowered safety for other road users?

Empirical studies suggest that a great majority of people prefer a decision algorithm that minimizes overall damage. At the same time, they seem to be prepared to accept reductions of their own safety as long as everyone accepts these same risks. This seems to imply that the level of acceptable risk can be calculated as a utilitarian optimum over all users, and that the risks produced by individuals is equal for all autonomous vehicles. It goes without saying that an egalitarian decision algorithm along these lines would lead to a radical shift of responsibility from the individual to the public. Neither the owner nor the passengers could be held responsible for the behavior of the vehicle any longer since risk preferences and conflict solving are determined in advance by societal consensus, leaving no room for individual intervention. The same holds for producers. Since the vehicle's decisions and reactions follow socially established norms, producers can no longer be held responsible for damages that occur as a consequence of these norms.

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IT BULLETIN **DATE: 06.01.2020**

CLOUDLET

A cloudlet is a mobility-enhanced small-scale cloud datacenter that is located at the edge of the Internet. The main purpose of the cloudlet is supporting resource-intensive and interactive mobile applications by providing powerful computing resources to mobile devices with lower latency. It is a new architectural element that extends today's cloud computing infrastructure. It represents the middle tier of a 3-tier hierarchy: mobile device - cloudlet - cloud.

A cloudlet can be viewed as a data center in a box whose goal is to bring the cloud closer. The cloudlet term was first coined by M. Satyanarayanan, Victor Bahl, Ramón Cáceres, and Nigel Davies,and a prototype implementation is developed by Carnegie Mellon University as a research project. The concept of cloudlet is also known as follow me cloud, and mobile micro-cloud.The cloudlet was specifically designed to support interactive and resource-intensive mobile applications, such as those for speech recognition, language processing, machine learning and virtual reality.

A cloudlet is a small-scale data center or cluster of computers designed to quickly provide cloud computing services to mobile devices, such as smartphones, tablets and wearable devices, within close geographical proximity. The goal of a cloudlet is to increase the response time of applications running on mobile devices by using low latency, high-bandwidth wireless connectivity and by hosting cloud computing resources, such as virtual machines, physically closer to the mobile devices accessing them. This is intended to eliminate the wide area network (WAN) latency delays that can occur in traditional cloud computing models.

Cloudlet is considered a form of cloud computing because it delivers hosted services to users over a network. However, a cloudlet differs from a public cloud data center, such as those operated by public cloud providers like Amazon Web Services, in a number of ways.

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IT BULLETIN **DATE: 07.01.2020**

TECHNOLOGY TRENDS THAT EXPLORE IN 2019

"Blockchain is gaining traction among businesses worldwide; mobile screen interactions are expected to be gradually replaced by AI-enabled conversational interfaces; enterprises are exploring use cases of Mixed Reality; and the Internet users are going gaga over the OTT content;

1. Blockchain

Blockchain, we all know, is a distributed digital ledger, in which the stakeholders of a particular network record transactions in real-time, without involving any central or regulatory authority. Having earned recognition with the surge in the use of cryptocurrencies, especially Bitcoin, Blockchain is a critically acclaimed disruptive technology, which is thriving among businesses across the world.

Use Cases - Blockchain offers robust security features to protect business transactions.

2. Internet of Things (IoT)

Another technology trend in 2019 that is expected to make headlines is the Internet of Things. Known by multiple names such as "embedded Internet" and "pervasive computing," or "web of things," IoT as a concept has been there since the 1970s. It was only in 1999 that Kevin Ashton coined the term Internet of Things. Although IoT did not gain traction until 2013-2014, the technology is underpinning for Industry 4.0.

Use Cases - IoT, in the contemporary business environment, is a key digital transformation enabler.

3. Artificial Intelligence (AI) and Machine Learning (ML)

It won't be wrong to say that the AI and ML technologies are about building cognitive abilities. "Machine Learning is a centerpiece of digital transformation strategies," when people say AI, they are basically talking about ML. These technologies came into existence during the 1940s-50s when a neural network was created. Based on that a computer program was developed which had the ability to learn and evolve from the tasks it was made to perform.

Use Cases - Infusing the high-computing capability and offering advanced techniques and models, AI and ML are playing a key role in improving Business Intelligence (BI).

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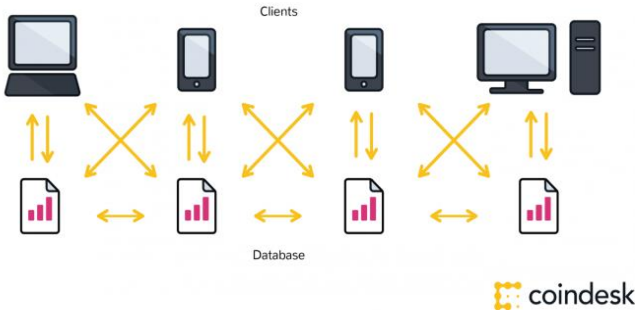
IT BULLETIN **DATE: 08.01.2020**

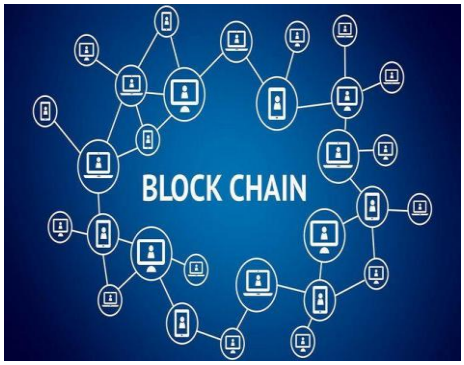
BLOCKCHAIN DATA

A blockchain, originally block chain, is a growing list of records, called blocks, that are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data (generally represented as a Merkle tree). By design, a blockchain is resistant to modification of the data.

BLOCK CHAIN ANALYSIS:

The analysis of public blockchains has become increasingly important with the popularity of bitcoin, Ethereum, litecoin and other cryptocurrencies. A blockchain, if it is public, provides anyone who wants access to observe and analyse the chain data, given one has the know-how. The process of understanding and accessing the flow of crypto has been an issue for many cryptocurrencies, crypto-exchanges and banks.





THE CONCEPT OF BLOCK CHAIN:

When two users partake in a bitcoin transaction, information about this transaction gets broadcast from their wallets to every other user (node) in the network. This information is digitally signed and time-stamped, so that anybody who looks at it knows who sent the money, who received it, how much money it was, and when. Once the nodes have looked at the information and confirmed the transaction (that is, checked that everything is legitimate), they each update their copy of the blockchain on their computers to include this new data.

The data gets packed into a block along with data of other transactions that are happening around the same moment. A block is like a 1 megabyte bundle of chronologically ordered information about transactions. These blocks will get connected together in order of creation to form the blockchain.

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IT BULLETIN **DATE: 20.01.2020**

ARTIFICIAL INTELLIGENCE AND SMART MACHINE

The U.S. Army is applying artificial intelligence measures from uptake technologies to vehicles mainly used in peacekeeping missions for repair purposes. Their predictive software will reduce irregular maintenance and hone in on machine components that are more likely to deteriorate or get damaged. Predictive vehicle repairs can grow and extend to civilian purposes in the coming years.

Artificial intelligence face recognition is beginning to help with missing people reports, and it even helps identify individuals for criminal investigations when cameras have captured their images. According to the National Institute of Standards and Technologies,face recognition is most effective when Artificial intelligence systems and forensic facial recognition experts team up. Artificial intelligence will continue to promote safety for citizens in the future as software improvements shape these applications.

Medical Artificial intelligence is another trend that reflects surprising success. Given patient information and risk factors, Artificial intelligence systems can anticipate the outcome of treatment and even estimate the length of a hospital visit. Deep learning is one way Artificial intelligence technology gets applied to health records to find the likelihood of a patient's recovery and even mortality.Experts evaluate data to discover patterns in the patient's age, condition, records, and more.

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IT BULLETIN **DATE: 20.01.2020**

BLUETOOTH TECHNOLOGY

Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands, from 2.400 to 2.485 GHz, and building personal area networks (PANs). It was originally conceived as a wireless alternative to RS-232 data cables.

Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 35,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics. The IEEE standardized Bluetooth as IEEE 802.15.1, but no longer maintains the standard. The Bluetooth SIG oversees development of the specification, manages the qualification program, and protects the trademarks.[3] A manufacturer must meet Bluetooth SIG standards to market it as a Bluetooth device.[4] A network of patents apply to the technology, which are licensed to individual qualifying devices. As of 2009, Bluetooth integrated circuit chips ship approximately 920 million units annually.[5]

The development of the "short-link" radio technology, later named Bluetooth, was initiated in 1989 by Nils Rydbeck, CTO at Ericsson Mobile in Lund, Sweden. The purpose was to develop wireless headsets, according to two inventions by Johan Ullman, SE 8902098-6, issued 1989-06-12 and SE 9202239, issued 1992-07-24. Nils Rydbeck tasked TordWingren with specifying and Dutchman JaapHaartsen and Sven Mattisson with developing. Both were working for Ericsson in Lund. In 1990, JaapHaartsen was nominated by the European Patent Office for the European Inventor Award. [7] From 1997 Örjan Johansson became the project leader and propelled the technology and standardization.

In 1997, Adalio Sanchez, then head of IBM ThinkPad product R&D, approached Nils Rybeck about collaborating on integrating a mobile phone into a ThinkPad notebook. The two assigned engineers from Ericsson and IBM to study the idea. The conclusion was that power consumption on cellphone technology at that time was too high to allow viable integration into a notebook and still achieve adequate battery life. Instead, the two companies agreed to integrate Ericsson's short-link technology on both a ThinkPad notebook and an Ericsson phone to accomplish the goal

The first consumer Bluetooth device was launched in 1999. It was a hands-free mobile headset which earned the "Best of show Technology Award" at COMDEX. The first Bluetooth mobile phone was the Ericsson T36 but it was the revised T39 model which actually made it to store shelves in 2001. In parallel, IBM introduced the IBM ThinkPad A30 in October 2001 which was the first notebook with integrated Bluetooth.

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IT BULLETIN **DATE: 21.01.2020**

SURFACE COMPUTING

Surface computing is a platform that responds to natural hand gestures and real world objects. It has a 360-degree user interface, a 30-inch reflective surface with a XGA DLP projector underneath the surface which projects an image onto its underside, while five cameras in the machine's housing record reflections of infrared light from objects and human fingertips on the surface. The surface is capable of object recognition, object/finger orientation recognition and tracking, and is multi-touch and is multi-user. Users can interact with the machine by touching or dragging their fingertips and objects such as paintbrushes across the screen, or by placing and moving placed objects. This paradigm of interaction with computers is known as a natural user interface (NUI).

Surface has been optimized to respond to 52 touches at a time. During a demonstration with a reporter, Mark Bolger, the Surface Computing group's marketing director, "dipped" his finger in an on-screen paint palette, then dragged it across the screen to draw a smiley face. Then he used all 10 fingers at once to give the face a full head of hair.

Using the specially-designed barcode-style "Surface tags" on objects, Microsoft Surface can offer a variety of features, for example automatically offering additional wine choices tailored to the dinner being eaten based on the type of wine set on the Surface, or in conjunction with a password, offering user authentication.

A commercial Surface Computer unit is $12,500 (unit only), whereas a developer Microsoft Surface unit costs $15,000 and includes a developer unit, five seats and support.

Partner companies use the Surface in their hotels, restaurants, and retail stores. The Surface is used to choose meals at restaurants, plan vacations and spots to visit from the hotel room. Starwood Hotels plan to allow users to drop a credit card on the table to pay for music, books, and other amenities offered at the resort. In AT&T stores, use of the Surface include interactive presentations of plans, coverage, and phone features, in addition to dropping two different phones on the table and having the customer be able to view and compare prices, features, and plans. MSNBC's coverage of the 2008 US presidential election used Surface to share with viewers information and analysis of the race leading up to the election. The anchor analyzes polling and election results, views trends and demographic information and explores county maps to determine voting patterns and predict outcomes, all with the flick of his finger. In some hotels and casinos, users can do a range of things, such as watch videos, view maps, order drinks, play games, and chat and flirt with people between Surface tables.

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IT BULLETIN **DATE: 22.01.2020**

AUTOMATION

Another current trend in the IT industry is automated processes. Automated processes can collect information from vendors, customers, and other documentation. Automated processes that check invoices and other accounts-payable aspects expedite customer interactions . Machine processes can automate repetitive manual tasks , rather than assigning them to employees . This increases organization-wide productivity, allowing employees to use their valuable time wisely, rather than wasting it on tedious work.

Automation can even produce more job opportunities for IT professionals trained in supporting, programming, and developing automated processes. Machine learning can enhance these automated processes for a continually developing system. Automated processes for the future will extend to groceries and other automatic payment methods to streamline the consumer experience.

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IT BULLETIN **DATE: 23.01.2020**

MACHINE LEARNING METHODS

Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves.

The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly.

Some machine learning methods:

• Supervised machine learning algorithms can apply what has been learned in the past to new data using labeled examples to predict future events. Starting from the analysis of a known training dataset, the learning algorithm produces an inferred function to make predictions about the output values. The system is able to provide targets for any new input after sufficient training.

• In contrast, unsupervised machine learning algorithms are used when the information used to train is neither classified nor labeled. Unsupervised learning studies how systems can infer a function to describe a hidden structure from unlabeled data. The system doesn't figure out the right output, but it explores the data and can draw inferences from datasets to describe hidden structures from unlabeled data.

• Semi-supervised machine learning algorithms fall somewhere in between supervised and unsupervised learning, since they use both labeled and unlabeled data for training – typically a small amount of labeled data and a large amount of unlabeled data. The systems that use this method are able to considerably improve learning accuracy. Usually, semi-supervised learning is chosen when the acquired labeled data requires skilled and relevant resources in order to train it / learn from it.

• Reinforcement machine learning algorithms is a learning method that interacts with its environment by producing actions and discovers errors or rewards. Trial and error search and delayed reward are the most relevant characteristics of reinforcement learning. This method allows machines and software agents to automatically determine the ideal behavior within a specific context in order to maximize its performance.

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IT BULLETIN **DATE: 24.01.2020**

NANOTECHNOLOGY

Nanotechnology or "nanotech" is manipulation of matter on an atomic, molecular, and supramolecular scale. The earliest, widespread description of nanotechnology referred to the particular technological goal of precisely manipulating atoms and molecules for fabrication of macroscale products, also now referred to as molecular nanotechnology. A more generalized description of nanotechnology was subsequently established by the National Nanotechnology Initiative, which defines nanotechnology as the manipulation of matter with at least one dimension sized from 1 to 100 nanometers. This definition reflects the fact that quantum mechanical effects are important at this quantum-realm scale, and so the definition shifted from a particular technological goal to a research category inclusive of all types of research and technologies that deal with the special properties of matter which occur below the given size threshold. It is therefore common to see the plural form "nanotechnologies" as well as "nanoscale technologies" to refer to the broad range of research and applications whose common trait is size.

Nanotechnology as defined by size is naturally very broad, including fields of science as diverse as surface science, organic chemistry, molecular biology, semiconductor physics, energy storage, microfabrication, molecular engineering, etc. The associated research and applications are equally diverse, ranging from extensions of conventional device physics to completely new approaches based upon molecular self-assembly, from developing new materials with dimensions on the nanoscale to direct control of matter on the atomic scale.

Scientists currently debate the future implications of nanotechnology. Nanotechnology may be able to create many new materials and devices with a vast range of applications, such as in nanomedicine, nanoelectronics, biomaterials energy production, and consumer products. On the other hand, nanotechnology raises many of the same issues as any new technology, including concerns about the toxicity and environmental impact of nanomaterials, and their potential effects on global economics, as well as speculation about various doomsday scenarios. These concerns have led to a debate among advocacy groups and governments on whether special regulation of nanotechnology is warranted.

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IT BULLETIN **DATE: 27.01.2020**

BIG DATA ANALYTICS

Big data is a trend that allows businesses to analyze extensive sets of information to achieve variety in increasing volumes and growth of velocity. Big data has a high return on investment that boosts the productivity of marketing campaigns, due to its ability to enable high-functioning processing. Examination data of markets and strategies is becoming more manageable with advances in data analytic programs.

This practice in information technology can be observed for its potential in data management positions for optimal organizations. Database maintenance is a growing sector of technology careers. To convert various leads into paying customers big data is an essential trend to continue following in 2019.

BENEFITS OF BIG DATA ANALYTICS

Enterprises are increasingly looking to find actionable insights into their data projects originate from the need to answer specific business question. With the rights big data analytics platform in place, an enterprise can boost sales, increase efficiency, and improve operations, customer service and risk management.

Notably, the business area getting the most attention relates to increasing efficiency and optimizing operations. Specifically, 62 percent of respondents said that they use big data analytics to improve speed and reduce complexity.

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IT BULLETIN **DATE: 29.01.2020**

BENEFITS OF CLOUD COMPUTING

Cloud computing is the delivery of computing services including servers, storage, databases, networking, software, analytics, and intelligence over the Internet ("the cloud") to offer faster innovation, flexible resources, and economies of scale.

Top benefits of cloud computing:

Cost : - Cloud computing eliminates the capital expense of buying hardware and software and setting up and running on-site data centers.

Speed: - Most cloud computing services are provided self service and on demand, so even vast amounts of computing resources can be provisioned in minutes, typically with just a few mouse clicks, giving businesses a lot of flexibility and taking the pressure off capacity planning.

Global scale:- The benefits of cloud computing services include the ability to scale elastically.

Productivity:- On-site datacenters typically require a lot of "racking and stacking"—hardware setup, software patching, and other time-consuming IT management chores. Cloud computing removes the need for many of these tasks, so IT teams can spend time on achieving more important business goals.

Performance: - The biggest cloud computing services run on a worldwide network of secure datacenters, which are regularly upgraded to the latest generation of fast and efficient computing hardware. This offers several benefits over a single corporate datacenter, including reduced network latency for applications and greater economies of scale.

Reliability : - Cloud computing makes data backup, disaster recovery and business continuity easier and less expensive because data can be mirrored at multiple redundant sites on the cloud provider's network.

Security :- Many cloud providers offer a broad set of policies, technologies and controls that strengthen our security posture overall, helping protect our data, apps and infrastructure from potential threats.

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IT BULLETIN **DATE: 30.01.2020**

SPATIAL COMPUTING AND DIGITAL MEDICINE

Spatial computing

Spatial computing is the next step in the bringing together of physical and digital worlds we're already seeing with virtual-reality and augmented-reality apps. As with VR and AR, it digitizes objects that connect via the cloud, allows sensors and motors to react to one another and creates a digital representation of the real world. But it goes even further, adding spatial mapping that lets a computer "coordinator" track and control the movements and interactions of objects as a person moves through the digital or physical world. This technology will bring new developments in how people and machines interact, in industry, healthcare, transportation and the home.

Digital medicine

Digital medicine won't replace doctors any time soon, but apps that monitor conditions or administer therapies could enhance their care and support patients with limited access to health services. Many smart watches can already detect if their wearer has an irregular heartbeat, and similar tools are being worked on that could help with breathing disorders, depression, Alzheimer's and more. Pills containing sensors are even being developed – these send data to apps to help detect things like body temperature, stomach bleeds and cancerous DNA.

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IT BULLETIN **DATE: 31.01.2020**

INTERNET OF THINGS APPLICATIONS

The Internet Of Things (IOT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

The definition of the Internet of Things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of Things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smart phones and smart speakers.

Consumer applications:

A growing portion of IoT devices are created for consumer use, including connected vehicles, home automation, wearable technology, connected health, and appliances with remote monitoring capabilities.

Smart home

IoT devices are a part of the larger concept of home automation, which can include lighting, heating and air conditioning, media and security systems. Long-term benefits could include energy savings by automatically ensuring lights and electronics are turned off.

A smart home or automated home could be based on a platform or hubs that control smart devices and appliances.

Industrial applications:

Also known as IIoT, industrial IoT devices acquire and analyze data from connected equipment, (OT) operational technology, locations and people. Combined with operational technology (OT) monitoring devices, IIOT helps regulate and monitor industrial systems.

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IT BULLETIN **DATE: 03.02.2020**

DATA SCIENCE

Data science is a multi-disciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data. Data science is related to data mining and big data.

Data science is a "concept to unify statistics, data analysis, machine learning and their related methods" in order to "understand and analyze actual phenomena" with data. It employs techniques and theories drawn from many fields within the context of mathematics, statistics, computer science, and information science. In 2015, the American Statistical Association identified database management, statistics and machine learning, and distributed and parallel systems as the three emerging foundational professional communities.

The term "data science" has appeared in various contexts over the past thirty years but did not become an established term until recently. In an early usage, it was used as a substitute for computer science by Peter Naur in 1960. Naur later introduced the term "datalogy". In 1974, Naur published Concise Survey of Computer Methods, which freely used the term data science in its survey of the contemporary data processing methods that are used in a wide range of applications.

The modern definition of "data science" was first sketched during the second Japanese-French statistics symposium organized at the University of Montpellier II (France) in 1992. The attendees acknowledged the emergence of a new discipline with a specific focus on data from various origins, dimensions, types and structures. They shaped the contour of this new science based on established concepts and principles of statistics and data analysis with the extensive use of the increasing power of computer tools.

In 1996, members of the International Federation of Classification Societies (IFCS) met in Kobe for their biennial conference. Here, for the first time, the term data science is included in the title of the conference ("Data Science, classification, and related methods"),after the term was introduced in a roundtable discussion by Chikio Hayashi.

In 2001, William S. Cleveland introduced data science as an independent discipline, extending the field of statistics to incorporate "advances in computing with data" in his article "Data Science: An Action Plan for Expanding the Technical Areas of the Field of Statistics," In his report, Cleveland establishes six technical areas which he believed to encompass the field of data science: multidisciplinary investigations, models and methods for data, computing with data, pedagogy, tool evaluation, and theory.

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IT BULLETIN **DATE: 04.02.2020**

INDUSTRIAL TECHNOLOGY

Industrial Technology is the use of engineering and manufacturing technology to make production faster, simpler and more efficient. The industrial technology field employs creative and technically proficient individuals who can help a company achieve efficient and profitable productivity. Industrial technology programs typically include instruction in optimization theory, human factors, organizational behavior, industrial processes, industrial planning procedures, computer applications, and report and presentation preparation.

The USA based Association of Technology, Management, and Applied Engineering (ATMAE), accredits selected collegiate programs in Industrial Technology in the USA. An instructor or graduate of an Industrial Technology program may choose to become a Certified Technology Manager (CTM) by sitting for a rigorous exam administered by ATMAE covering Production Planning & Control, Safety, Quality, and Management/Supervision.

ATMAE program accreditation is recognized by the Council for Higher Education Accreditation (CHEA) for accrediting Industrial Technology programs. CHEA recognizes ATMAE in the U.S. for accrediting associate, baccalaureate, and master's degree programs in technology, applied technology, engineering technology, and technology-related disciplines delivered by national or regional accredited institutions in the United States.

A career in industrial technology typically entails formal education from an accredited college or university. Opportunities are available to professionals with all levels of education. Those who hold associate degrees typically qualify for entry-level technician and technologist positions, such as in the maintenance and operation of machinery. Bachelor's degree-holders could fill management and engineering positions, such as plant manager, production supervisor and quality systems engineering technologist. A graduate degree in industrial technology could qualify individuals for jobs in research, teaching and upper-level management.

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IT BULLETIN **DATE: 05.02.2020**

ETHICS OF ARTIFICIAL INTELLIGENCE

The **ethics of artificial intelligence** is the branch of the ethics of technology specific to artificially intelligent systems. It is sometimes divided into a concern with the moral behavior of *humans* as they design, make, use and treat artificially intelligent systems, and a concern with the behavior of *machines*, in machine ethics. It also includes the issue of a possible singularity due to superintelligent AI.

"Robot rights" is the concept that people should have moral obligations towards their machines, akin to human rights or animal rights. It has been suggested that robot rights (such as a right to exist and perform its own mission) could be linked to robot duty to serve humanity, analogous to linking human rights with human duties before society. These could include the right to life and liberty, freedom of thought and expression and equality before the law. The issue has been considered by the Institute for the Future and by the U.K. Department of Trade and Industry.

Experts disagree on how soon specific and detailed laws on the subject will be necessary. Glenn McGee reports that sufficiently humanoid robots may appear by 2020, while Ray Kurzweil sets the date at 2029. Another group of scientists meeting in 2007 supposed that at least 50 years had to pass before any sufficiently advanced system would exist.

The rules for the 2003 Loebner Prize competition envisioned the possibility of robots having rights of their own. If in any given year, a publicly available open-source Entry entered by the University of Surrey or the Cambridge Center wins the Silver Medal or the Gold Medal, then the Medal and the Cash Award will be awarded to the body responsible for the development of that Entry. If no such body can be identified, or if there is disagreement among two or more claimants, the Medal and the Cash Award will be held in trust until such time as the Entry may legally possess, either in the United States of America or in the venue of the contest, the Cash Award and Gold Medal in its own right.

In October 2017, the android Sophia was granted "honorary" citizenship in Saudi Arabia, though some considered this to be more of a publicity stunt than a meaningful legal recognition. Some saw this gesture as openly denigrating of human rights and the rule of law.

The philosophy of Sentientism grants degrees of moral consideration to all sentient beings, primarily humans and most non-human animals. If artificial or alien intelligence show evidence of being sentient, this philosophy holds that they should be shown compassion and granted rights.

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IT BULLETIN **DATE: 06.02.2020**

IMMERSIVE EXPERIENCES IN SMART SPACE

Chatbots integrated into different chat and voice assistance platform are changing the way people Interact with the digital world, just like virtual reality (VR), augmented reality (AR), and mixed Reality (MR). The combination of these technologies will dramatically change our perception of the world that surrounds us by creating smart spaces where more immersive, interactive, and Automated experience can occur for a specific group of people or for defined industry cases.

Therefore, smart spaces are interactive environments where humans and technology can openly communicate with each other in a physical/digital setting. It enables an immersive, Interactive and automated experience for people and industry scenarios.

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IT BULLETIN **DATE: 07.02.2020**

CLOUD COMPUTING CHARACTERISTICS

Cloud computing is a general term for anything that involves delivering hosted services over the internet. These services are broadly divided into three categories: infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS). The name cloud computing was inspired by the cloud symbol that's often used to represent the internet in flowcharts and diagrams.

Cloud infrastructure has to do with the hardware and software components required to ensure proper implementation of a cloud computing model. Cloud computing can also be thought of as utility computing or on-demand computing.

A cloud service has three distinct characteristics that differentiate it from traditional web hosting:

- Users can access large amounts of computing power on demand. It is typically sold by the minute or the hour.
- It is elastic a user can have as much or as little of a service as they want at any given time.
- The service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access). Significant innovations in virtualization and distributed computing, as well as improved access to high-speed internet, have accelerated interest in cloud computing.

A cloud can be private or public. A public cloud sells services to anyone on the internet. A private cloud is a proprietary network or a data center that supplies hosted services to a limited number of people, with certain access and permissions settings. Private or public, the goal of cloud computing is to provide easy, scalable access to computing resources and IT services.

Cloud computing deployment models :

Private cloud services are delivered from a business's data center to internal users. With a private cloud, an organization builds and maintains its own underlying cloud infrastructure. This model offers the versatility and convenience of the cloud, while preserving the management, control and security common to local data centers. Internal users may or may not be billed for services through IT chargeback. Common private cloud technologies and vendors include VMware and OpenStack.

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IT BULLETIN **DATE: 08.02.2020**

CYBER INFRASTRUCTURE

United States federal research funders use the term cyber infrastructure to describe research environments that support advanced data acquisition, data storage, data management, data integration, data mining, data visualization and other computing and information processing services distributed over the Internet beyond the scope of a single institution. In scientific usage, cyber infrastructure is a technological and sociological solution to the problem of efficiently connecting laboratories, data, computers, and people with the goal of enabling derivation of novel scientific theories and knowledge. The term "cyber infrastructure" was used by a US National Science Foundation (NSF) blue-ribbon committee in 2003 in response to the question, how can NSF, as the nation's premier agency funding basic research, remove existing barriers to the rapid evolution of high performance computing, making it truly usable by all the nation's scientists, engineers, scholars, and citizens. The NSF use of the term focuses on the integrated assemblage of these information technologies with one another.

Cyber infrastructure is more often called e-Science or e-Research. In particular, the United Kingdom started an e-Science initiative in 2001. The Systems Geology initiative of the British Geological Survey is an example. Others distinguish e-Science as the work that is done using the cyber infrastructure. There are many inter-governmental advisory groups related to Cyber infrastructure aspects like E-Infrastructures Reflection Group and European StrategyForum on Research Infrastructures dealing with policies on electronic infrastructures for research, i.e. research networks, computing, software and data infrastructures that mainly serve students, researchers and scientists. They advise and recommend actions towards the European Commission (DG CONNECT), the EU Member states governments (Research or Science Ministries), e-Infrastructure providers and users.

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IT BULLETIN **DATE: 08.02.2020**

MOBILE COMPUTING

Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. The main concept involves

Mobile communication:

The mobile communication in this case, refers to the infrastructure put in place to ensure that seamless and reliable communication goes on. These would include devices such as protocols, services, bandwidth, and portals necessary to facilitate and support the stated services. The data format is also defined at this stage. This ensures that there is no collision with other existing systems which offer the same service.

Since the media is unguided/unbounded, the overlaying infrastructure is basically radio wave-oriented. That is, the signals are carried over the air to intended devices that are capable of receiving and sending similar kinds of signals.

Mobile Hardware:

Mobile hardware includes mobile devices or device components that receive or access the service of mobility. They would range from portable laptops, smartphones, tablet Pc's, Personal Digital Assistants.

These devices will have a receptor medium that is capable of sensing and receiving signals. These devices are configured to operate in full- duplex, whereby they are capable of sending and receiving signals at the same time. They don't have to wait until one device has finished communicating for the other device to initiate communications.

Mobile software:

Mobile software is the actual program that runs on the mobile hardware. It deals with the characteristics and requirements of mobile applications. This is the engine of the mobile device. In other terms, it is the operating system of the appliance. It's the essential component that operates the mobile device.

Since portability is the main factor, this type of computing ensures that users are not tied or pinned to a single physical location, but are able to operate from anywhere. It incorporates all aspects of wireless communication.

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DIGITAL WALLET APP

A digital wallet also known as "e-Wallet" refers to an online service that allows an individual to make electronic transactions. This can include purchasing items on-line with a computer or using a smartphone to purchase something at a store. Money can be deposited in the digital wallet prior to any transactions or, in other cases, an individual's bank account can be linked to the digital wallet. Users might also have their loyalty card(s) and other ID documents stored within the wallet. A digital wallet has both a software and information component. Secure and fair electronic payment systems are important issue. The software provides security and encryption for the personal information and for the actual transaction. Typically, digital wallets are stored on the client side and are easily self-maintained and fully compatible with most websites.

A server-side digital wallet, also known as a thin wallet, is one that an organization creates for us and maintains it. Server-side digital wallets are gaining popularity among major retailers due to the security, efficiency, and added utility it provides to the end-user, which increases their satisfaction of their overall purchase. The information component is basically a database of user-input information. This information consists of our shipping address, billing address, payment methods (including credit card numbers, expiry dates, and security numbers), and other information.

Digital wallets are composed of both digital wallet devices and digital wallet systems. There are dedicated digital wallet devices such as the biometric wallet by a physical device that holds cash and cards along with a mobile connection. Presently there are further explorations for smartphones with NFC digital. The mobile payments system and service has widespread use and while the application has been adopted by a number of vendors in the U.S. and worldwide.

Digital wallets are being used more frequently among Asian countries as well. One in every five consumers in Asia are now using a digital wallet, representing a twofold increase from two years ago. A mobile shopping survey among 8500 adults, aged 18–64 across 14 markets, showed that 45% of users in China, 36.7% of users in India and 23.3% of users in Singapore are the biggest adopters of digital wallets. Indian consumers are leading the way with 76.4% using a smartphone to make a purchase, which is a drastic increase of 29.3% from the previous year. This has inspired companies like Reliance and Amazon India to come out with their own digital wallet.

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IT BULLETIN **DATE: 11.02.2020**

RADIO TECHNOLOGY

Radio is the technology of signaling and communicating using radio waves. Radio waves are electromagnetic waves of frequency between30 hertz (Hz) and 300 gigahertz (GHz). They are generated by an electronic device called a transmitter connected to an antenna which radiates the waves, and received by a radio receiver connected to another antenna. Radio is very widely used in modern technology, in radio communication, radar, radio navigation, remote control, remote sensing and other applications.

In radio communication, used in radio and television broadcasting, cell phones, two-way radios, wireless networking and satellite communication among numerous other uses, radio waves are used to carry information across space from a transmitter to a receiver, by modulating the radio signal in the transmitter. In radar, used to locate and track objects like aircraft, ships, spacecraft and missiles, a beam of radio waves emitted by a radar transmitter reflects off the target object, and the reflected waves reveal the object's location. In radio navigation systems such as GPS and VOR, a mobile receiver receives radio signals from navigational radio because whose position is known, and by precisely measuring the arrival time of the radio waves the receiver can calculate its position on Earth. In wireless radio remote control devices like drones, garage door openers, and keyless entry systems, radio signals transmitted from a controller device control the actions of a remote device.

Applications of radio waves which do not involve transmitting the waves significant distances, such as RF heating used in industrial processes and microwave ovens, and medical uses such as diathermy and MRI machines, are not usually called radio. The noun radio is also used to mean a broadcast radio receiver.

Radio waves were first identified and studied by German physicist Heinrich Hertz in 1886. The first practical radio transmitters and receivers were developed around 1895-6 by Italian Guglielmo Marconi, and radio began to be used commercially around 1900. To prevent interference between users, the emission of radio waves is strictly regulated by law, coordinated by an international body called the International Telecommunications Union (ITU), which allocates frequency bands in the radio spectrum for different uses.

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IT BULLETIN **DATE: 12.02.2020**

ARITIFICIAL INTELLIGENCE

In computer science, artificial intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans. Leading AI textbooks define the field as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. Colloquially, the term "artificial intelligence" is often used to describe machines (or computers) that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem solving". Computer science defines AI research as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. A more elaborate definition characterizes AI as “a system’s ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation.”

Artificial intelligence generally false under two broad categories:

- Narrow AI: Sometimes referred to as "Weak AI," this kind of artificial intelligence operates within a limited context and is a simulation of human intelligence. Narrow AI is often focused on performing a single task extremely well and while these machines may seem intelligent, they are operating under far more constraints and limitations than even the most basic human intelligence.
- Artificial General Intelligence (AGI): AGI, sometimes referred to as "Strong AI," is the kind of artificial intelligence we see in the movies, like the robots from Westworld or Data from Star Trek: The Next Generation. AGI is a machine with general intelligence and, much like a human being, it can apply that intelligence to solve any problem.

ARTIFICIAL INTELLIGENCE EXAMPLES

- Smart assistants (like Siri and Alexa)
- Disease mapping and prediction tools
- Manufacturing and drone robots
- Optimized, personalized healthcare treatment recommendations

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IT BULLETIN **DATE: 13.02.2020**

BIG DATA ANALYTICS

Big data repositories existed in many forms, often built by corporations with a special need. Commercial vendors historically offered parallel database management systems for big data beginning in the 1990s. Teradata systems were the first to store and analyze 1 terabyte of data in 1992. Hard disk drives were 2.5 GB in 1991 so the definition of big data continuously evolves according to law. Teradata installed the first petabyte class RDBMS based system in 2007. As of 2017, there are a few dozen petabyte class Teradata relational databases installed, the largest of which exceeds 50 PB. Systems up until 2008 were 100% structured relational data. Since then, Teradata has added unstructured data types including XML, ISON, and Avro.

In 2000, system automatically partitions, distributes, stores and delivers structured, semi-structured, and unstructured data across multiple commodity servers. Users can write data processing pipelines and queries in a declarative dataflow programming language called ECL. Data analysts working in ECL are not required to define data schemas upfront and can rather focus on the particular problem at hand, reshaping data in the best possible manner as they develop the solution. In 2004, LexisNexis acquired and their high-speed parallel processing platform and successfully utilized this platform to integrate the data systems of Inc. when they acquired that company in 2008. In 2011, the HPCC systems platform was open-sourced under the Apache v2.0 License. and other physics experiments have collected big data sets for many decades, usually analyzed via rather than the map-reduce architectures usually meant by the current "big data" movement.

The methodology addresses handling big data in terms of useful of data sources, in interrelationships, and difficulty in deleting (or modifying) individual records 2012 studies showed that a multiple-layer architecture is one option to address the issues that big data presents. This type of framework looks to make the processing power transparent to the end-user by using a front-end application server. The data lake allows an organization to shift its focus from centralized control to a shared model to respond to the changing dynamics of information management. This enables quick segregation of data into the data lake, thereby reducing the overhead time.

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IT BULLETIN **DATE: 14.02.2020**

SLEEP TECHNOLOGY

CES is proving ground for the new innovations that will shape the tech world over the coming year. More than 4,400 companies exhibited at CES 2020 in early January, attracting over 175,000 people from around the world to the four-day event. One of the biggest growth areas for CES in recent years has undoubtedly been sleep technology, with the growing phenomenon getting its own sector on the massive show floor this year.

URGO night Sleep Training Headband:

French innovators URGOtech made waves at CES 2020 as they revealed the final features of a product that people can use to train their brains to sleep better. The URGO night consists of an electroencephalography (EEG) headband and smartphone app that trains the brain to produce the brainwaves clinically associated with sleep.

The device is worn during the day and uses technology that URGO tech says has been clinically proven to help people to fall asleep 40% faster and cut night-time interruptions by half. The system is designed to be used for 20 minutes a day, three days a week, and contains two electrodes that detect brain activity.

Embr Wave Bracelet :

Numerous studies have shown that being too hot or too cold can have a negative impact on the quality of sleep. Embr Labs have sought to address this issue by launching the Wave an intelligent bracelet that aims to warm or cool the body by five degrees by applying the appropriate sensations to the inner wrist.

The Wave doesn't change the body temperature as such, but it uses the body's thermoreceptors to change how warm or cool we feel.

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IT BULLETIN **DATE: 15.02.2020**

EMERGING TECHNOLOGIES

Emerging technologies are technologies whose development, practical applications, or both are still largely unrealized, such that they are figuratively emerging into prominence from a background of nonexistence or obscurity. These technologies are new such as various applications of biotechnology including gene therapy (which date to circa 1990 but even today have large undeveloped potential). Emerging technologies are often perceived as capable of changing the status quo.

Emerging technologies are characterized by radical novelty (in application even if not in origins), relatively fast growth, coherence, prominent impact, anduncertainty and ambiguity. In other words, an emerging technology can be defined as "a radically novel and relatively fast growing technology characterised by a certain degree of coherence persisting over time and with the potential to exert a considerable impact on the socio-economic domain(s) which is observed in terms of the composition of actors, institutions and patterns of interactions among those, along with the associated knowledge production processes. Its most prominent impact, however, lies in the future and so in the emergence phase is still somewhat uncertain and ambiguous.

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IT BULLETIN **DATE: 17.02.2020**

VIRTUAL REALITY

Virtual Reality is a fast growing technology adopted by many industries and people across the world for various kinds of applications, which include games, learning/training applications, marketing, virtual interactive experience and so on. Many global organisations are investing and actively working in this domain. The recent advancements in virtual reality hardware, mobile devices, computers and development software, have enabled many industries to start adopting virtual reality in their projects and thereby created many opportunities for application developers, product developers, content developers, hardware suppliers and system integrators.

AUGMENTED REALITY

Augmented Reality is an upcoming and fast growing technology. This technology can be used in variety of applications, which include games, education, marketing, entertainment, shopping, product trails, architecture etc. Many industries and people across the world are investing and actively working in this domain. The recent technology advancements in smart mobile phones, smart pads and development software, have enabled many industries to consider leveraging the benefits of augmented reality technology. The accelerated growth, business potential and benefits of augmented reality technology has created many opportunities for application developers, product developers, content developers, hardware suppliers and system integrators.

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IT BULLETIN **DATE: 18.02.2020**

OPEN SOURCE APP

The **app development** ecosystem is growing at an accelerating pace. Today, it is one of the most prominent industries with an average release of 6140 apps daily on Google Play Store and 5,092 apps on the Apple App Store.

Machine learning, Artificial intelligence and the Internet of things are some of the major innovations that are incorporated in many of the apps today. Virtual assistant is one such advancement. Whatsapp, Instagram and Tik Tok apps are topping in the list of leading apps with the highest number of downloads. Netflix and Amazon Prime rule the entertainment apps and Candy Crush rule the gaming apps.

Mobile applications have modified human life schematically. Exceptional UIs and quick navigation through the apps has become a trademark. The number of mobile phone users is expected to cross the 5 billion mark by the end of the year 2019. It will automatically bring an exponential increase in the app downloads as well. In this context, it gets more valuable to understand about the best app development software solutions prevailing in the market along with the current and future app development trends.

This article includes a detailed review of a wide range of free and open source app **development software** solutions to help you choose the best software to build an app of your choice.

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IT BULLETIN **DATE: 19.02.2020**

HYPERTEXT TECHNOLOGY

Hypertext Technology is text displayed on a computer display or other electronic devices with references (hyperlinks) to other text that the reader can immediately access. Hypertext documents are interconnected by hyperlinks, which are typically activated by a mouse click, keypress set or by touching the screen. Apart from text, the term "hypertext" is also sometimes used to describe tables, images, and other presentational content formats with integrated hyperlinks. Hypertext is one of the key underlying concepts of the World Wide Web, where Web pages are often written in the Hypertext Markup Language (HTML). As implemented on the Web, hypertext enables the easy-to-use publication of information over the Internet.

Hypertext documents can either be static (prepared and stored in advance) or dynamic (continually changing in response to user input, such as dynamic web pages). Static hypertext can be used to cross-reference collections of data in documents, software applications, or books on CDs. A well-constructed system can also incorporate other user-interface conventions, such as menus and command lines. Links used in a hypertext document usually replace the current piece of hypertext with the destination document. A lesser known feature is StretchText, which expands or contracts the content in place, thereby giving more control to the reader in determining the level of detail of the displayed document. Some implementations support transclusion, where text or other content is included by reference and automatically rendered in place.

Hypertext can be used to support very complex and dynamic systems of linking and cross-referencing. The most famous implementation of hypertext is the World Wide Web, written in the final months of 1990 and released on the Internet in 1991.

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IT BULLETIN **DATE: 20.02.2020**

3D PRINTING IN HEALTH CARE

3D printing has multiple applications in the personalised medicines space, from printed tablets to inhalers. FabRx, founded by academics from University College London, specialises in 3D printed medicines. Their Printlets technology enables precise doses to be printed, on-demand medication for hospitals and pharmacies, and can combine multiple drugs into one dose.

Although still at an early stage, the big industry players see the potential of 3D printing and are investing heavily. Malvern Panalytical, GlaxoSmithKline and Syngenta are all backing the design and development of 3D printed formulations at the Centre for Additive Manufacturing. To ensure the supply chain is in place to get 3D printed products into the clinic and market, the Northern Powerhouse is set to welcome a new 3D printing centre, to be known as the Cheshire 3D Print Hub (C3D).

Guy's and St Thomas' NHS Foundation Trust became the first in the world to use 3D printed models to prepare for an organ transplant. The team used CT scans to build 3D models of a 2-year-old boys' abdomen and his father's kidney, allowing surgeons to ensure that the transplant was feasible. The surgery was a resounding success and paves the way for 3D printing to enable surgeons to plan and practice procedures before making a single incision.

The UK Regenerative Medicine Platform has also begun exploring ways to use 3D printed tissue approaches to treat and repair eye, liver and musculoskeletal damage. The printed tissue "scaffolds" can also be used to deliver drugs straight to the target organ.

It should be no surprise that the 3D printing healthcare market is forecast to reach ~ $2 Billion by 2022.

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