CHRIST COLLEGE OF ENGINEERING, IRINJALAKUDA
Department of Computer Science & Engineering

# CODEX

## VOL 2

Augmented Reality in Art

E Ball Technology

Project Starline

BioHacking

JUNE 2022

## Vision

Creating socially committed engineers with professional competency and excellence in Computer Science and Engineering through quality education.

## Mission

1. To achieve technical proficiency by adopting effective teaching-learning strategies which promote innovation and professional expertise.

2. To facilitate skill development of students through additional training by collaborating with industry to broaden their knowledge.

3. To promote excellence in research, development and consultancy services rooted in ethics, in order to emerge as responsible engineers.

## Program Specific Outcomes

1. Analyse and design computation systems by applying the attained knowledge in programming language and algorithms, system software, database management, data communication, networking and allied areas of Computer Science and Engineering.

2. Apply software engineering principles and practices to develop efficient software solutions for real world computing problems.

## Program Educational Objectives

CSE Graduates, within three-five years of graduation should
1. Demonstrate their expertise in solving contemporary problems through design, analysis and implementation of hardware and software systems.

2. Adapt to a constantly changing world through professional development and continuous learning.

3. Develop teamwork, leadership and entrepreneurship skills required to function productively in their profession.

# MEET OUR TEAM

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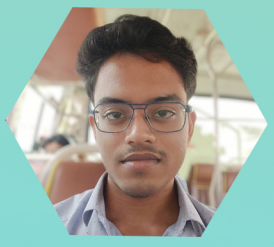

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Blessymaria Shaju
S2 CSE

We would like to express gratitude to all those who have contributed to the production of this year's magazine. Without your support, this would not have been possible. We would like to thank our editorial team for their hard work and dedication in bringing together this wonderful publication. We also extend our appreciation to our Executive Director, Rev. Fr. John Paliakkara CMI, Principal Dr. Sajeev John, Dr. Remya K Sasi, H.O.D (CSE), magazine incharges Ms. Sreelakshmy M K and Ms. Iris Jose, Terrance President (CODe), who have contributed their valuable insights and expertise. We are grateful to our staffs and students, who have submitted their articles, artwork, and photographs, which have added color and vibrancy to this magazine. "CODEX" (2021-22).

## Message from Head of the Department

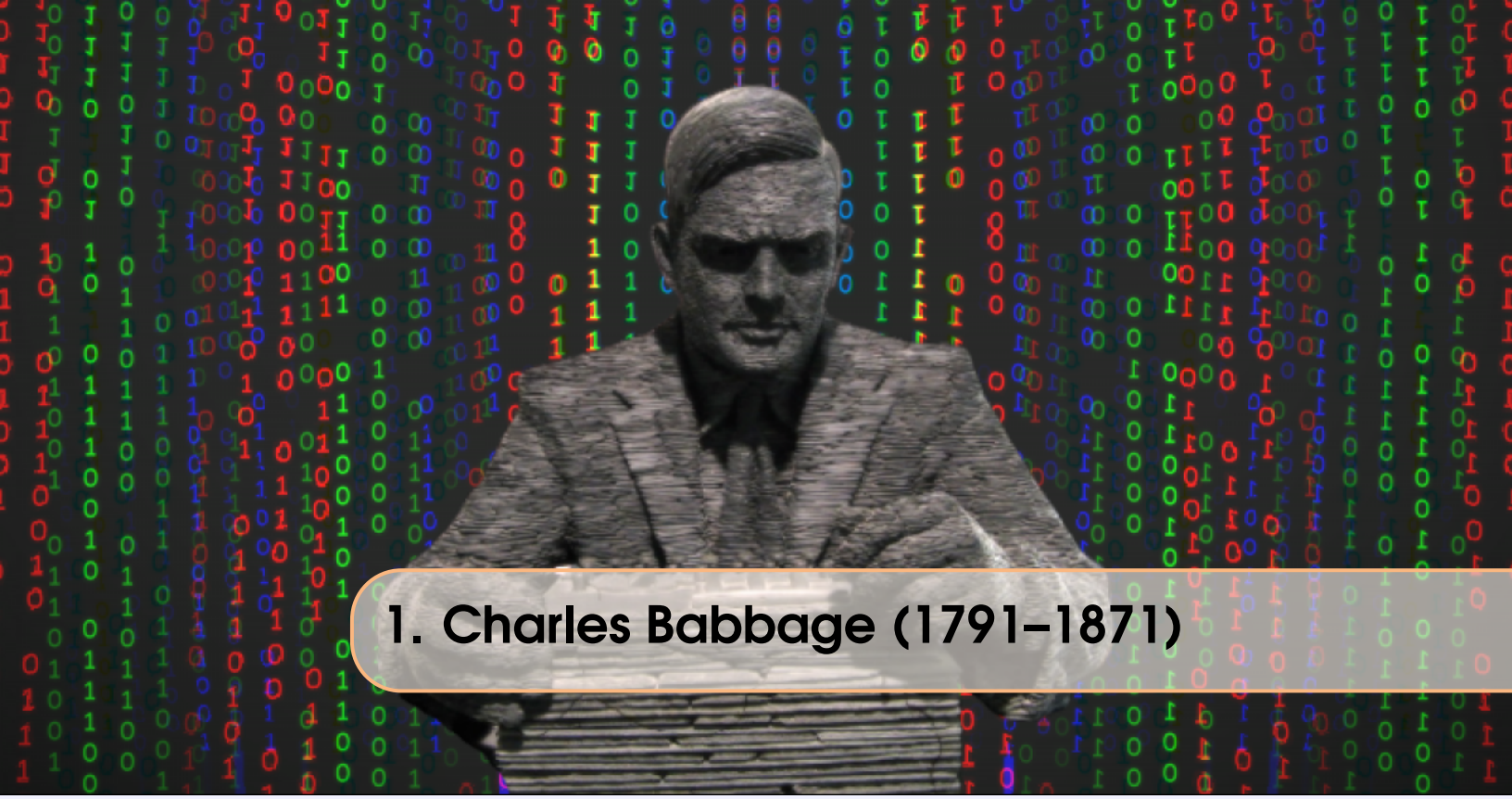
It is a great privilege and immense honour to inform you that the Department of Computer Science and Engineering is publishing its Third Annual Technical Magazine UPDATE.

This technical magazine is a platform to exhibit the technical literary skills of the students of Computer Science and Engineering Department. We dedicate this issue to Charles Babbage who originated the concept of a digital programmable computer.

This magazine have been made possible by the extraordinary vision of Father John Paliakkara, Executive Director of the College and Principal Dr. Sajeev John.

I take this opportunity to congratulate the Chief Editors Ms. Nighila Abish and Sr. Reema Jose for bringing out this magazine as per schedule, which in itself is an achievement considering the effort and time required. I would like to thank all editorial team members for providing students a platform for creative thoughts and knowledge expansion. I express my considerable appreciation to all the authors of the articles in this magazine. Once again I express my gratitude to all for their involvement, encouragement, support and guidance.

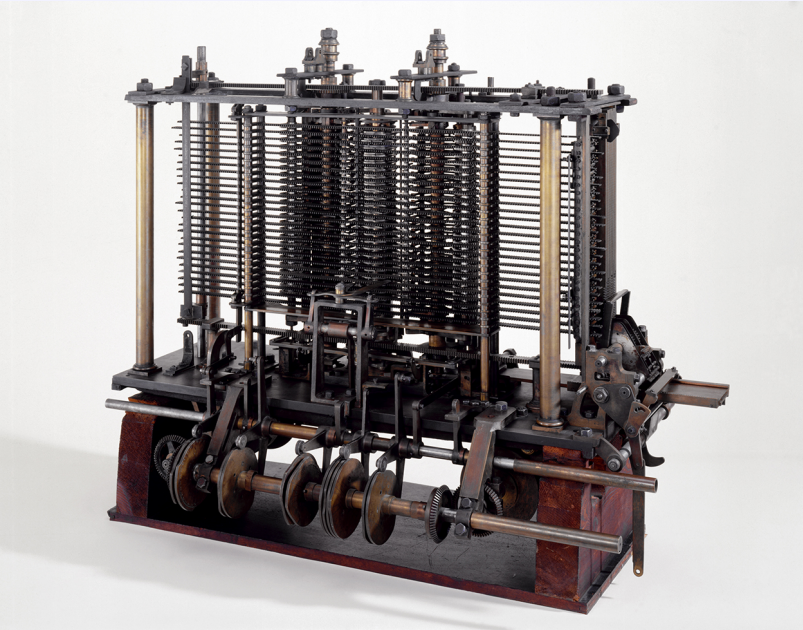
# Contents



# 1. Charles Babbage (1791–1871)

“I wish to God these calculations had been executed by steam.” (Charles Babbage)

Charles Babbage (1791–1871) was an English mathematician and inventor. Babbage is considered by some to be "father of the computer" .He is credited with designing the first digital automatic computer, which contained all the essential concepts found in the ones we use today. By the mid-1830s, Charles was already preparing plans for an improved and more complex design: the Analytical Engine, the precursor of the modern digital computer. He envisaged that it would be capable of performing any arithmetical operation based on instructions from punched cards, a memory unit to store numbers, sequential control, and many other basics found in present-day computers. The project was far more advanced than anything that had ever been built before — with a memory unit large enough to hold 1,000 50-digit numbers. It was intended to be steam-driven and run by one attendant. In 1843, Charles Babbage’s friend mathematician Ada Lovelace published a paper explaining how the engine could perform a sequence of calculations. The first computer program was born. In his twenties Babbage worked as a mathematician, principally in the calculus of functions. He was elected a Fellow of the Royal Society in 1816 and played a prominent part in the foundation of the Astronomical Society (later Royal Astronomical Society) in 1820. It was about this time that Babbage first acquired the interest in

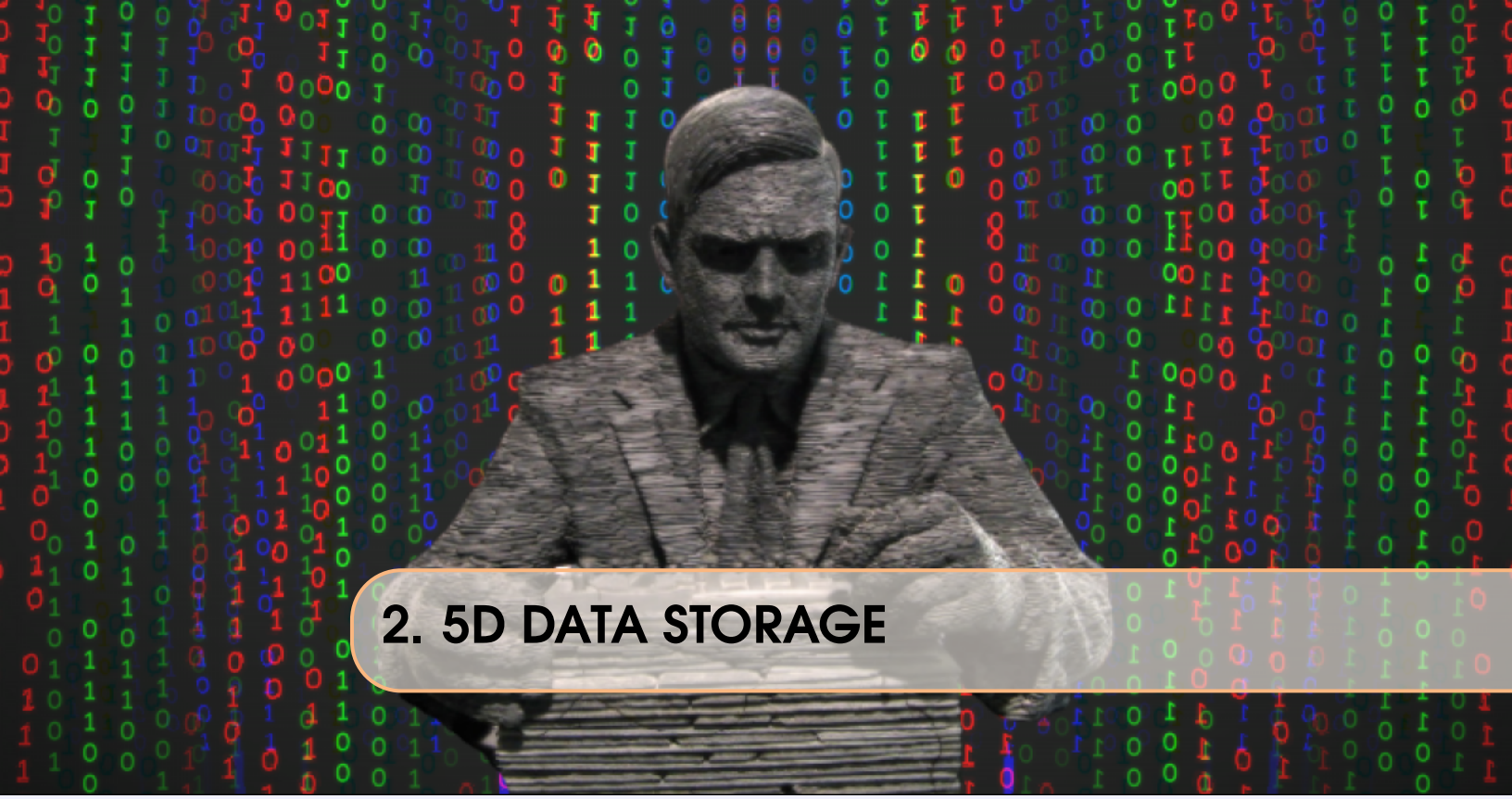


calculating machinery that became his consuming passion for the remainder of his life. In 1821 Babbage invented the Difference Engine to compile mathematical tables. On completing it in 1832, he conceived the idea of a better machine that could perform not just one mathematical task but any kind of calculation. This was the Analytical Engine (1856), which was intended as a general symbol manipulator, and had some of the characteristics of today's computers. The Analytical Engine, however, was never completed. The ambitious design was, once again, difficult to implement with the technology that existed in the 19th century. In 1991, British scientists built the Difference Engine No. 2 — accurate to 31 digits — to Charles' specifications. Their success indicates that his idea would have worked. In 2000, the printer for the Difference Engine was also built. In addition to inventing early computer concepts, Charles Babbage also helped establish the modern postal system in England and compiled the first reliable actuarial tables. He invented a speedometer, as well as the train cow-catcher to deflect obstacles on the track.

Babbage occupied the Lucasian chair of mathematics at Cambridge from 1828 to 1839. He played an important role in the establishment of the Association for the Advancement of Science and the Statistical Society (later Royal Statistical Society). He also attempted to reform the scientific

organizations of the period while calling upon government and society to give more money and prestige to scientific endeavor. Throughout his life Babbage worked in many intellectual fields typical of his day, and made contributions that would have assured his fame irrespective of the Difference and Analytical Engines.

Despite his many achievements, the failure to construct his calculating machines, and in particular the failure of the government to support his work, left Babbage in his declining years a disappointed and embittered man. He died at his home in London on October 18, 1871.



# 2. 5D DATA STORAGE

The evolution of storage during the history of mankind involves 4 eras –Painted, carved, scripted, and digitized information Through 20th century the main invention of data storage came about with the invention of optical discs CDs DVDs and blu-rays The international data corporation investigated that the total capacity of data stored is increasing by around 60 percent per year.

Today's storage technologies will soon reach their practical limits as demand for long-term cloud storage continues to grow to unprecedented levels. Most cold data is currently stored on magnetic tape, optical disks, HDDs and, to a lesser degree, SSDs. However, none of these are cost-effective platforms to handle the vast amounts of archive data that will live in the cloud. Each one was created before the cloud existed and was designed to support multiple uses. No storage technology was built specifically, to store cold data at cloud scale. First developed in 2013, five-dimensional (5D) data storage technology encodes data into a small disc made of fused quartz.

### Data recording

Data recording experiments were performed using a femto second laser system in the recording procedure, the groups of bire fringent dots were simultaneously imprinted at the designated depth. Each group, containing


from 1 to 100 dots. By using the adapted GSW algorithm, several discrete levels of intensity could be achieved.

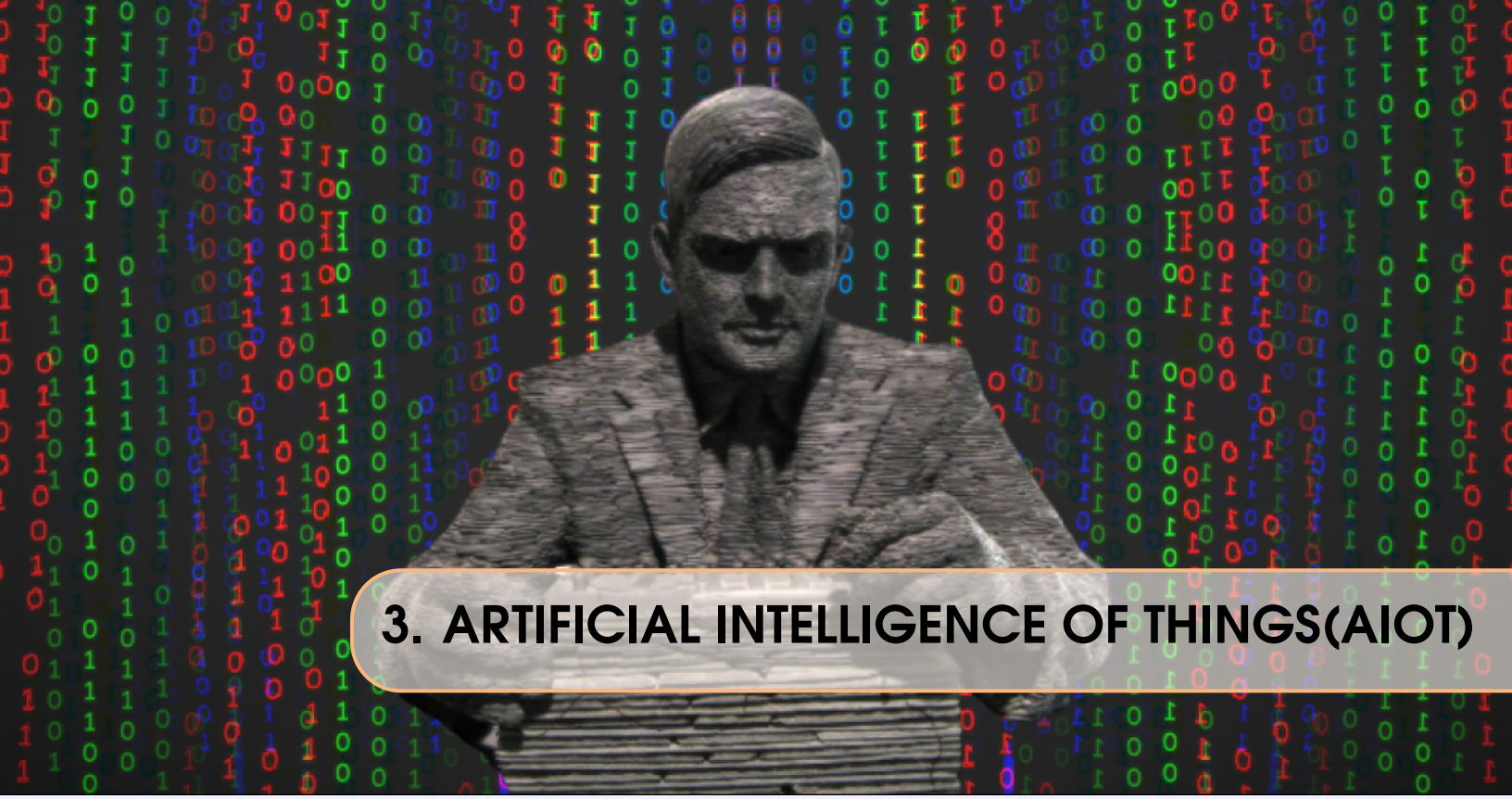
### Data Readout

The readout of the recorded information encoded in nano structured glass was performed with a quantitative bire fringence measurement system. From a halogen lamp was circularly polarized and filtered with a band pass filter of 546 nm.

### Data Rewriting

The 5d optical data based on nanograting's can be also erased and rewritten, which are two important features when considering data storage.

Vighnesh Jayan Krishna

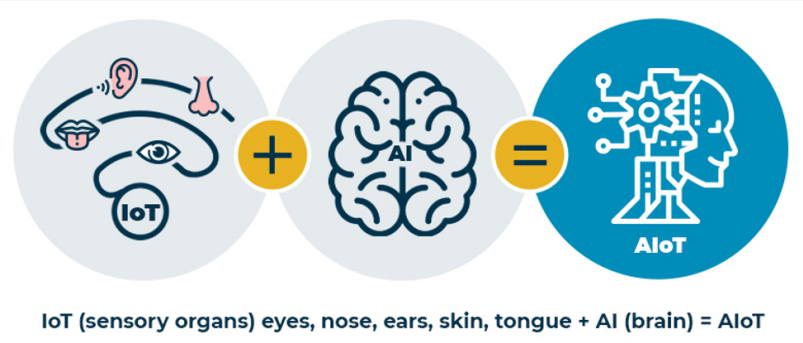


# 3. ARTIFICIAL INTELLIGENCE OF THINGS(AIOT)

Artificial Intelligence (AI) and the Internet of Things (IoT) have defined the previous decade. Ever since the massive deployment of concepts like Big Data and cloud architecture occurred, our abilities to generate, store and process data have increased manifold. This resulted in large-scale data analytics implementations across industries and geographies, which further led to the companies incorporating AI strategies. As the companies gradually uncovered the immense potential of AI, IoT and its allied automation processes became integral to businesses as well. To put things into perspective, it's important to understand that the usage of artificial intelligence technologies in the last four years alone has grown by 270 percent. Besides this, the AI development sector is also expected to be valued at around 118 billion dollars by 2025. At the other end of the spectrum is IoT. Reports reveal that in 2020 more than 30.73 billion devices will be connected to an IoT infrastructure and that by the year 2025, close to 152,200 devices will connect to the internet every minute. For the uninitiated, AI and IoT are complementary concepts of technology. Because data is at the fulcrum of everything, AI and IoT become the two sides of the same coin in most applications. The term that encompasses the integration of both is called AIoT. The two technologies work in tandem to offer optimum experiences and applications to users and businesses. Several IoT mechanisms rely on artificial intelligence and its allied concepts like deep and machine learning

from automation and predictive analytics. Artificial intelligence in IoT product development offers tons of benefits in operations, management, customer behavior analysis, and more. AIoT shows how AI can empower the IoT to make it faster, smarter, greener, and safer. While the concept of AIoT is still relatively new, many possibilities exist to improve industry verticals, such as enterprise, industrial and consumer product and service sectors, and will continue to arise with its growth. AIoT could be a viable solution to solve existing operational problems, such as the expense associated with effective human capital management (HCM) or the complexity of supply chains and delivery models.

AIoT comprises two technological concepts, AI and IoT. Moreover, it refers to the augmentation of AI in IoT technologies and devices. Hence, this seamless integration between AI and IoT is now enhancing the growth of various industries. Additionally, combining these advanced and transformative technologies enable businesses to predict changes and enhance the abilities of devices. Therefore, with AIoT, there is a significant improvement in communication and predictive capabilities. According to Tolga Tarhan, CTO at Rackspace Technology, "AI is utilized to deliver more capabilities for the connected device, by moving from purely programmed/algorithmic responses to dynamic decisions, empowered by machine learning.

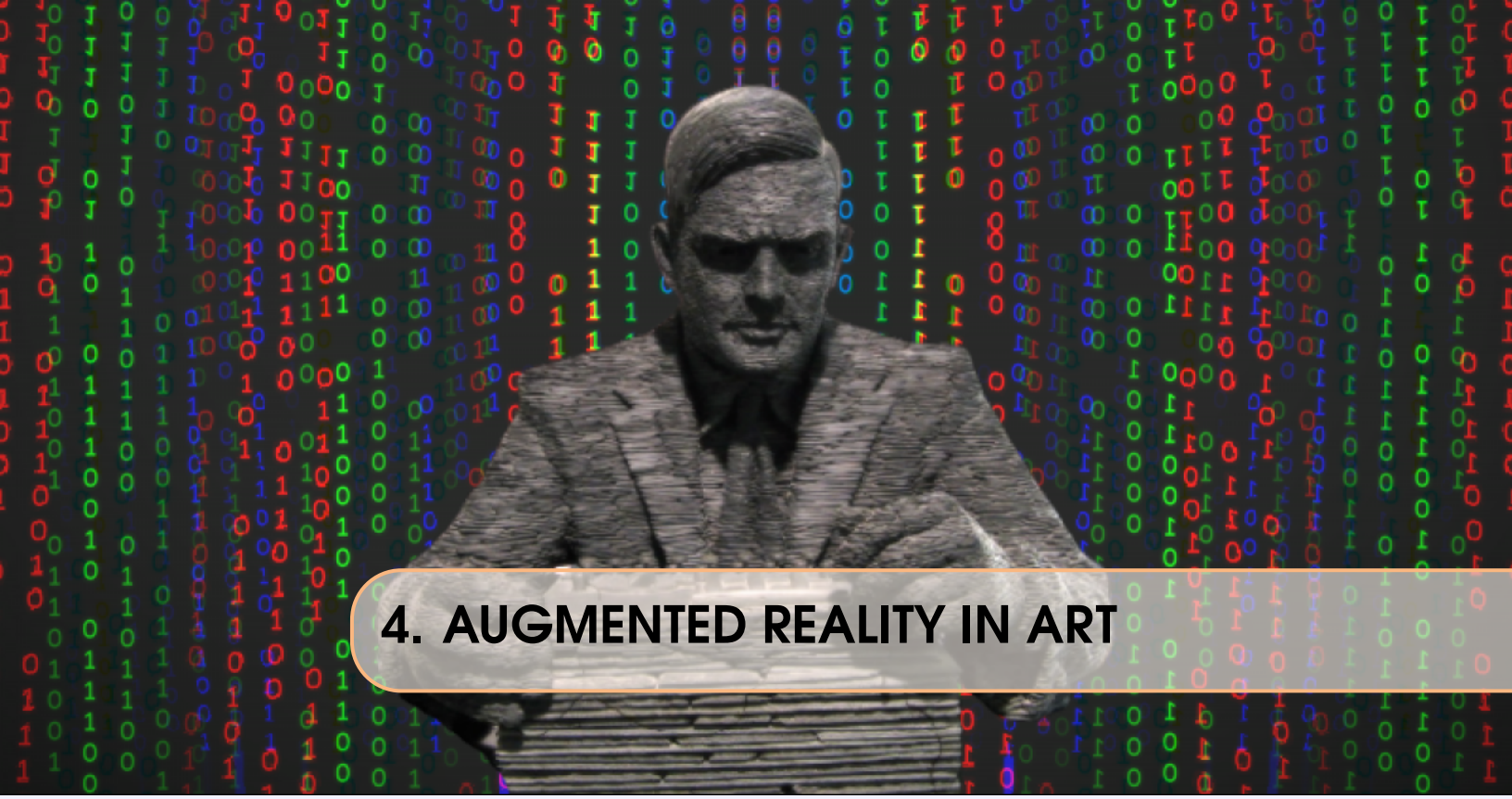



Applications of AIoT successfully define the new generation for technological achievements. Moreover, Artificial Intelligence and the Internet of Things make devices more accessible. Hence, this uncovers the immense potential of AIoT and its applications that help automate business processes. AIoT technologies certainly depend on the deployment of Big Data and Cloud Architecture. Further, it helps generate, store, and process data for actionable

insights to build AI strategies.AI is an algorithm powered by statistical models allowing the AI to “learn” through feedback loops. So rather than deterministic models where an algorithm uses predefined rules upon which to base its decisions, other models are applied. The data can be analysed and utilized with AI for problem-solving or decision-making. Without AI, IoT would have limited value. AI can multiply the value of IoT; conversely, IoT can promote the learning and intelligence of AI. However, there are many challenges while deploying AIoT in practice. For instance, machine learning is one of the key technologies to be utilized in AIoT systems. Besides, there are many other issues such as complexity, efficiency, scalability, accuracy, and robustness related to the increasing modern AIoT systems and applications. AIoT emerging as the future of Industry 4.0 Two trends that are dominating the technology industry are the Internet of Things (IoT) and Artificial Intelligence (AI). But for industrial automation, these two technologies are much more than the buzzwords or trending topics. The convergence of AI and IoT will redefine the future of industrial automation. It is set to lead the industry 4.0 revolution. IoT and AI are two independent technologies that have a significant impact on multiple industry verticals. While IoT is the digital nervous system, AI becomes the brain that makes decisions which control the overall system. The lethal combination of AI and IoT brings us AIoT - Artificial Intelligence of Things - that delivers intelligent and connected systems that are capable of self-correcting and self-healing themselves.

AI goes beyond the visualizations by acting on the patterns and correlations from the telemetry data. It plugs the critical gap by taking appropriate actions based on the data. Instead of just presenting the facts to humans to enable them to act, AI closes the loop by automatically taking an action. It essentially becomes the brain of the connected systems. By applying deep learning models based on neural networks to incoming sensor telemetry data, sophisticated IoT systems will be able to find anomalies in real-time. Current IoT systems are designed to react to an event while AIoT systems can proactively detect failures and events. The infusion of AI in IoT systems delivers the promise of predictive maintenance which will help organizations save millions of dollars in support and maintenance of equipment. The future of industrial automation lies in the convergence of AI and IoT. Artificial Intelligence of Things will impact almost every industry vertical including automotive, aviation, finance, healthcare, manufacturing and supply chain.

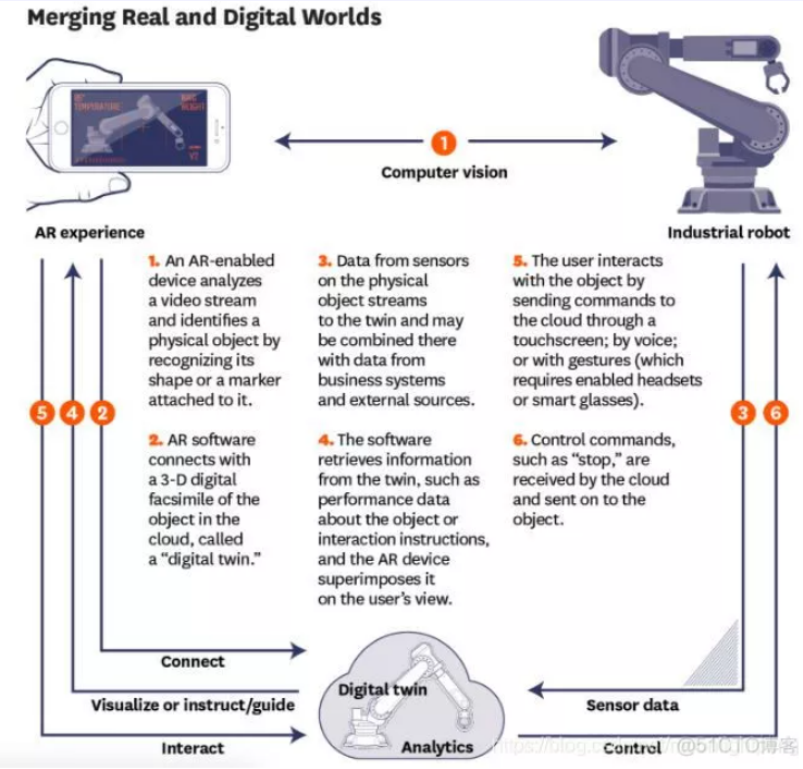
Sandra Sharon



# 4. AUGMENTED REALITY IN ART

The visual arts world requires creativity, precision and a passion for innovation. While some purists believe that technology should not play a role in art, artists are leveraging technology to approach their work in new ways.One technology that is making waves is augmented reality (AR), which adds digital content to the real world via a smartphone's camera. In fact, there are some sophisticated augmented reality apps for art that are revolutionizing the industry, allowing artists to expand their range and toolbox.An AR app called Trace and Draw lets visual artists trace the real world onto their smart device. Artists can save an image to their mobile device and incorporate it into the live camera feed. Then, the user can trace the image while it's on the screen of the mobile device. The ability to sketch real images onto a live camera feed helps streamline the process that many graphic designers go through when combining images. Users can also make adjustments such as image transparency or add filters that help to minimize busy backgrounds. Plus, the app includes guiding lines that make it easier for users to determine the horizontal and vertical lines of the world in front of them. Visual artists can use apps such as these to expand their creative endeavours or more effectively complete art for commercial applications, such as logo creation. They could even place their sketches over the real world to create graphics of historically important places in order to bolster that region's tourism across the world, or even across the street. With the introduction of AR

technology, potential buyers of artwork can visualize how pieces of work will look on their walls, in their homes, in their collections before they even take out their checkbook.AR serves to supplement, alter, and enhance reality as it already exists. It's an integration of technology into one's daily life, providing a "filter" of sorts: AR enhances things that we interact with and see, feel, and hear. What's to be done when art goes missing? In



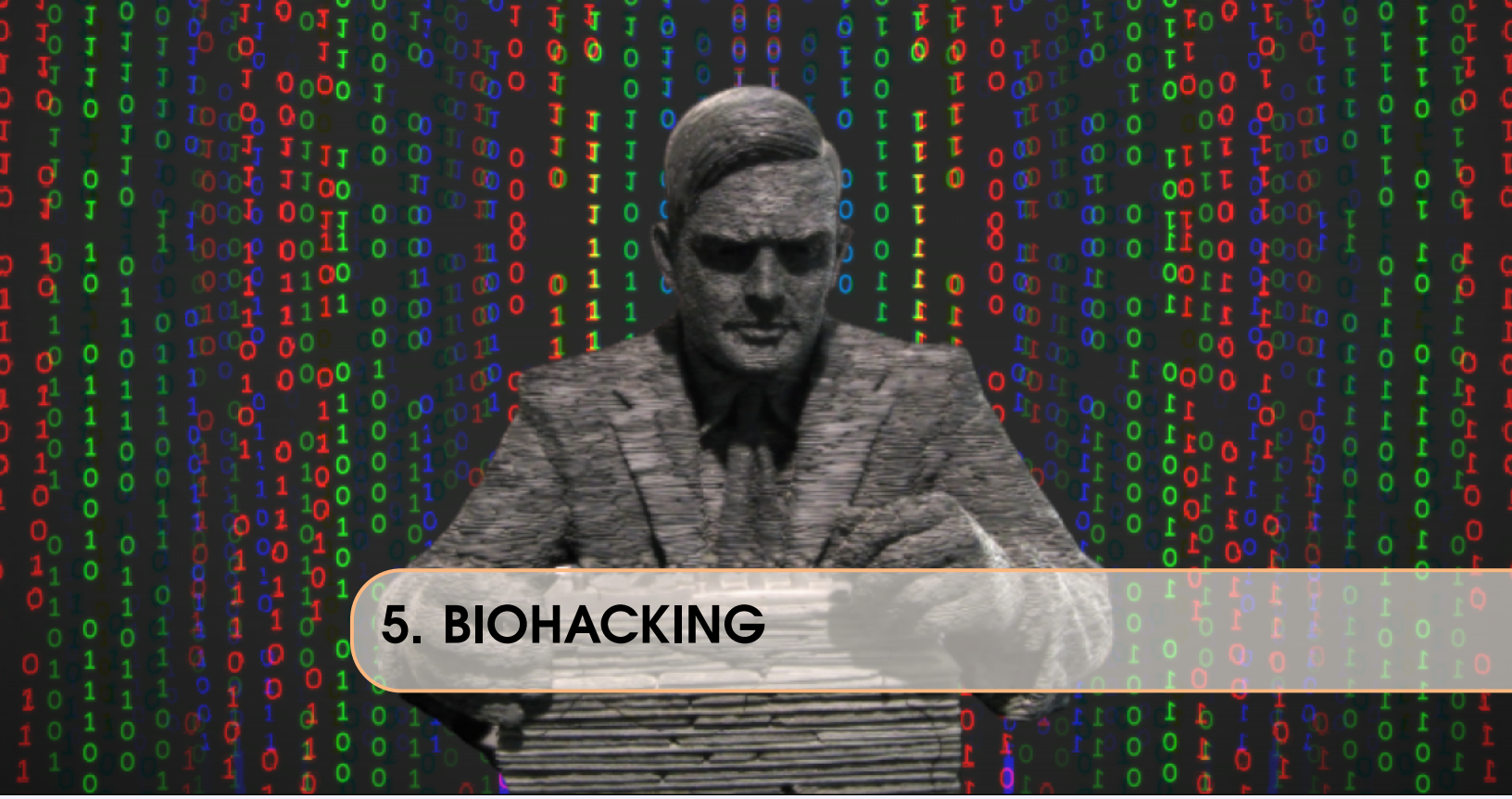

the Museum of Stolen Art, stolen or missing art takes centre stage with the adoption of AR. The gallery space consists of wall frames that display markers—these markers operate like barcodes and when viewed through a smart device, one of the missing pieces appears. This is an example of how AR does not have to utilize exceedingly complex technology in order to be impactful. By leveraging basic code to make pieces appear, the exhibition provides a look at what the galleries would look like with the missing pieces installed in their original locations. While it's certainly not the same as seeing one of these pieces in person, AR makes it possible for audiences to understand their impact. Augmented reality offers a new space for artists to express themselves, complement their artworks, or surround their work

with interactive experiences. But, AR is not for the weary! It is for the curious, experimental, and pioneering. It is for creatives who are ready to jump into the unknown and get comfortable pursuing and establishing themselves and their art within an unmanned territory. There are many possibilities for the use of AR in museums. The most straightforward way is to use it to add explanations of pieces. This means visitors will get more information when they view exhibitions using AR. Museums could even use it to display digital versions of artists next to their work. These 3D personas are then able to provide a narration. AR gives an opportunity to add a third dimension to displays, bringing objects or scenes to life. There are already many institutions around the world using AR.

These projects bring something new to existing collections and attract wider audiences. Here are some interesting ways that museums are using augmented reality. In June 2021, the Museum national d'Histoire naturelle in Paris launched an Augmented Reality experience using Microsoft's Hololens. The project called "REVIVRE" ("To Live Again") let visitors come face to face with digital animals which in the real world are now extinct. In 2021, The National Gallery in London looked to take the collections of the National Gallery, National Portrait Gallery, Royal Academy of Arts beyond their walls of the museum with an Augmented reality experience which members of the public could access through their phones. Users used an app to activate the artworks which were marked with QR codes on busy streets in central London. The National Museum of Singapore is currently running

an immersive installation called Story of the Forest. The exhibition focuses on 69 images from the William Farquhar Collection of Natural History Drawings. These have been turned into three-dimensional animations that visitors can interact with. Visitors download an app and can then use the camera on their phone or tablet to explore the paintings. In July 2017, the AGO worked with digital artist Alex May hew to create an AR installation called ReBlink.AR can even help contextualise history by blending the old and the new. For example, it can show historical scenes superimposed onto modern ones. This technology can capture people's attention and keep their focus on exhibitions for longer.

Nirmal A S



# 5. BIOHACKING

Bio-hacking is a practice of optimizing one's body and mind with the incorporation of medical, nutritional and electronic techniques. As a word itself suggests Bio and Hacking which means the application of IT hacks to the biological system. Bio- Hackers can be individuals, communities or small organizations that study biology and life science to enhance the natural condition of the human body. Bio-hacking highlights the attachment to hacker ethics and hacker culture. It belongs to the hacker ethic that is purely based on positive principles such as universal admittance to information and generic quality of life enhancement. Bio-hackers involve both professional and unprofessional scientists who believe in hacking themself. With technology hardware often called Grinders. A grinder is a type of bio-hacker that sees each part of the human body as hack-able. Then comes DIY Bio-hackers who believe in innovating tools and resources obtainable to anyone by using blogs and forums. These biohackers accompany structured experiments on themselves outside of a regulated experimental environment, like labs or medical offices and share tips and techniques to support non-experts. Nutrigenomics hackers focus on how the food you eat interacts with your genes. These hackers test different types of nutrients that affect the total genetic expression of the human body. Embedded technology within the human body, also called biohacking. Implanting gadgets inside humans is not an entirely new concept. Embeddable inserts are the following sensible

improvement of bio-hacking.

Biology and Hacking refer to all kinds of implants in and interventions to the human body to enhance performance and health. Placing heart pacemakers in humans for prosthesis is now considered a straightforward procedure. On later occasions, we have started to utilize mind pacemakers for healing purposes to battle ailments like epilepsy, Parkinson's disease, and extreme discouragement. Even Microchips are being set inside prosthetic knees and hips during therapeutic strategies to help in the get-together of post-usable investigation that can help restoration further. while medical innovations that utilize microchips abound, over in the last decade we have begun to see the potential use of microchip implants for non-medical devices in humans, namely for control, convenience and care applications. Bio-hacking or Microchip implant technology has been around for less than a decade. British professor Kevin Warwick, in 1998, is the first person to undergo an operational procedure to get a silicon chip inserted in his body. Later on, few companies implanted this microchip in their employees. Three Square Market, a technology company in River Falls and Wisconsin from the United States embedded chips in their employees. In order to make payment in ease Company president, Patrick McMullan inserted a microchip in his hands to make payments by just waving it. Sweden has been front in a row in cases of microchipping. Around 3,000 peoples from Sweden have had microchips injected into their hands that can handle entry codes, buy train tickets and access certain vending machines or printers.

N S Ananda Krishnan

# 6. CYBERSECURITY MESH

With cybersecurity mesh, companies will be able to secure any digital as- set anywhere, allowing them to address threats that have arisen thanks to the pandemic driven shift to remote work. Falling under the theme “location independence,” the need for cybersecurity mesh is largely driven by the challenges enterprises were up against in the wake of COVID-19. With more assets now existing outside of the traditional security perimeter, cybersecurity needs to be redefined around the identity of a person or thing. As perimeter protection becomes less meaningful, the security approach of a walled city must evolve to current needs. Cybersecurity mesh enables scalable, flexible, and reliable cybersecurity control via a distributed architectural approach. With more assets like Internet of Things (IoT) existing outside of the traditional security perimeter, cybersecurity mesh allows for the security perimeter to be defined around the identity of a person or thing. This approach to network security leads to a more standardized, responsive security approach that prevents hackers from exploiting different parts of a given network in order to access the broader network. The cybersecurity mesh is a key component of a zero-trust network philosophy, whereby any device is by default not trusted to access the broader network. Perimeter focused security often fails because as much as 34 percent of data leaks and breaches originate on the inside of the network itself. A distributed cybersecurity mesh that utilizes zero trust adapts to emerging threats and


changing access needs. Threats can be detected in real-time and assets such as data and devices can be protected better than simple VPN passwords. The mesh ensures that all data, systems, and equipment are treated equally and securely — it doesn't matter where they are located in (or out) of the network. Any connection to access data is by default considered "unreliable" until it is verified by the security protocol. A cybersecurity mesh architecture provides a composable approach to security based on identity to create a scalable and interoperable service. The common integrated structure secures all assets, regardless of location, to enable a security approach that extends across the foundation of IT services.

Agansha Baiju

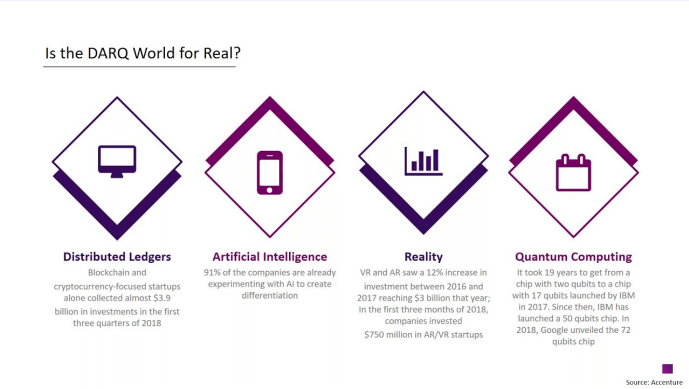
# 7. DARQ TECHNOLOGIES

DARQ stands for distributed ledger technology, artificial intelligence, extended reality and quantum computing. DARQ represents a means of grouping a certain subset of technologies together and offers a new understanding of what the post-digital world may look like. Each of the four technologies that make up DARQ will be used individually by businesses across the economy to differentiate their products and services.

Distributed ledger technology (DLT) is a digital system for recording the transaction of assets in which the transactions and their details are recorded in multiple places at the same time. Unlike traditional databases, distributed ledgers have no central data store or administration functionality. In a distributed ledger, each node processes and verifies every item, thereby generating a record of each item and creating a consensus on each item's veracity. A distributed ledger can be used to record static data, such as a registry, and dynamic data, i.e., transactions. This computer architecture represents a significant revolution in record-keeping by changing how information is gathered and communicated.

Artificial intelligence. Enterprises are now able to automate processes using artificial intelligence. Automation results in fewer errors and means that employees can spend their time on higher value projects, as opposed to menial tasks.

Extended reality (XR). Extended reality provides immersive, on-demand

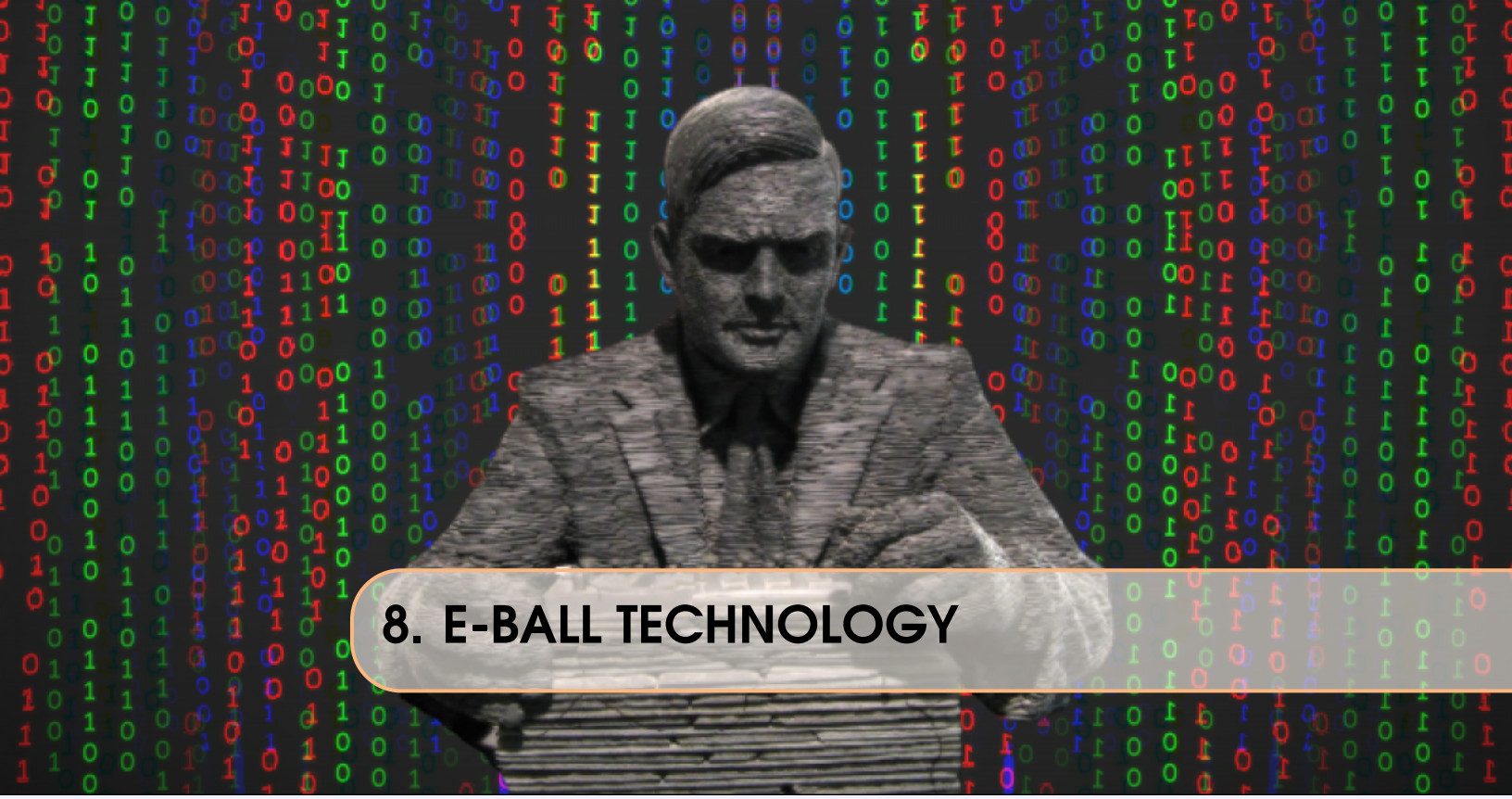



experiences. XR is commonly used to teach employees new skills, from machine operation to surgical techniques. In addition, XR can also provide improved real-time work collaboration opportunities.

Quantum computing. Although quantum computing technologies are still relatively new, they can help solve previously impossible computational problems. Affordable quantum computing systems are becoming more accessible than ever before.

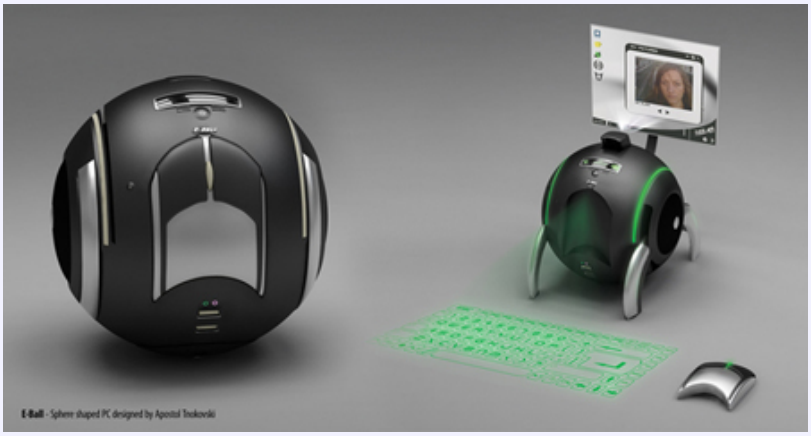
This constellation of technologies retains the power to reshape organizational policies, processes, practices and end-consumer experiences. The tech is becoming increasingly capable, reliable and relevant. Businesses that wish to remain at the forefront of innovation may benefit from continuing to investigate the businesses opportunities related to DARQ.

Aparna Ann Jude



# 8. E-BALL TECHNOLOGY

Apostol Tnokovski introduced a new pc that is called the E-Ball Concept pc. The E-Ball concept pc is a sphere-shaped pc which is the smallest design among all the laptops and desktops. This computer has all the features like a traditional computer, elements like keyboard, mouse, DVD, large screen display etc. E-Ball is designed to be placed on two stands, opened by simultaneously pressing and holding the two buttons located on each side.



The E Ball concept PC doesn't have any external display unit. It has a button when you press this button a projector will pop and it focuses the computer screen on the wall which can be adjusted with navigation keys. This concept PC will measure 160mm in diameter and it was designed for Microsoft Windows OS. For the moment there is no word on pricing or when

it's going to be available, however, I am sure that everybody would like to see a small spherical PC like this E-BALL shape is spherical because in Tnokovski's opinion this is the best shape in nature and it draws everybody's attention. E-Ball will feature a dual core processor, 250-500GB HDD, 2GB of RAM, integrated graphic card and sound card, 2 x 50W speakers, HD-DVD recorder, wireless optical mouse and laser keyboard, LAN and WLAN card, modem, Webcam and integrated LCD projector.

Rosmin Kannookadan

# 9. EYE GAZE COMMUNICATION SYSTEM

This system is mainly developed for those who lack the use of their hands or voice. Only requirements to operate the eye gaze Systems are control of at least one eye with good vision and ability to keep the head fairly still. Eyegaze Systems are in use around the world. Its users are adults and children with cerebral palsy, spinal cord injuries, brain injuries, ALS, multiple sclerosis, brainstem strokes, muscular dystrophy and Werdnig-Hoffman syndrome. Eyegaze Systems are being used in homes, offices, schools, hospitals, and long-term care facilities. By looking at control keys displayed on a screen, a person can synthesize speech, control his environment (lights, appliances, etc.), type, operate a telephone, run computer software, operate a computer mouse and access the internet and e-mail. Eyegaze Systems are being used to write books, attend school and enhance the quality of life of people with disabilities all over the world. Eye contact is a type of body language that is extremely important during communication and conversation. Our eyes speak even more than words, So using Eye gaze system we can expand the range of statistical studies and analytics, thus we can use the whole potential of this technology.

The user must be able to look up, down, left and right. He must be able to fix his gaze on all areas of a 15-inch screen that is about 24 inches in front of his face. He must be able to focus on one spot for at least ½ second. Several common eye movement problems may interfere with Eye Gaze use. The user

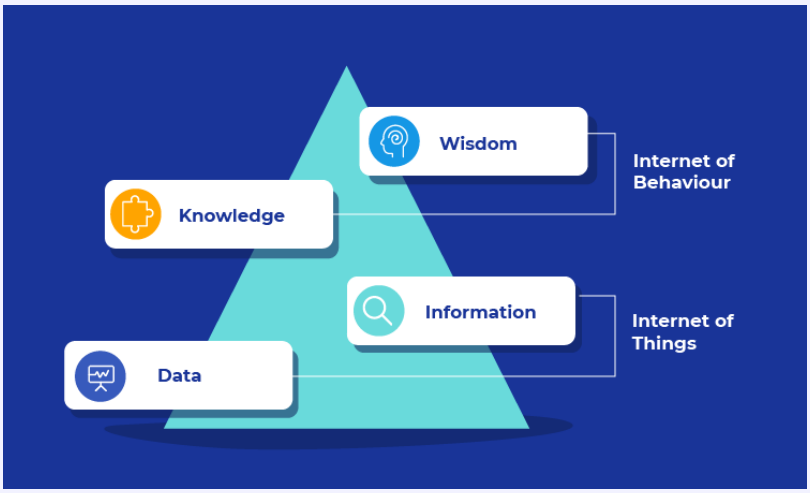
may not be able to fix his gaze long enough to make eye gaze selections. The Eyegaze System is constantly tracking the same single eye. If, for example, a user with alternating strabismus is operating the Eyegaze System with the right eye, and that eye begins to deviate, the left eye will take over and focus on the screen. The Eye Gaze camera, however, will continue to take pictures of the right eye, and the System will not be able to determine where the user's left eye is focused. When the left eye deviates and the right eye is again fixed on the screen the Eyegaze System will resume predicting the gazepoint. Putting a partial eye patch over the nasal side of the eye not being observed by the camera often solves this tracking problem. Since only the unpatched eyes can see the screen, it will continuously focus on the screen. By applying only a nasal-side patch to the other eye, the user will retain peripheral vision on that side. Several common vision problems may affect a user's ability to see text clearly on the Eyegaze monitor. These include the following: Inadequate Visual acuity, Diplopia (double vision), Blurred vision. Ability to maintain a position in front of the Eyegaze monitor is generally easiest to run the System from an upright, seated position, with the head centered in front of the Eyegaze monitor. However the Eyegaze System can be operated from a semi-reclined position if necessary. Continuous, uncontrolled head movement can make Eye Gaze operation difficult, since the Eyegaze System must relocate the eye each time the user moves away from the camera's field of view and then returns. Even though the System's eye search is completed in just a second or two, it will be more tiring for a user with constant head movement to operate the System.

Josemi Jose

# 10. GITHUB-COPILOT

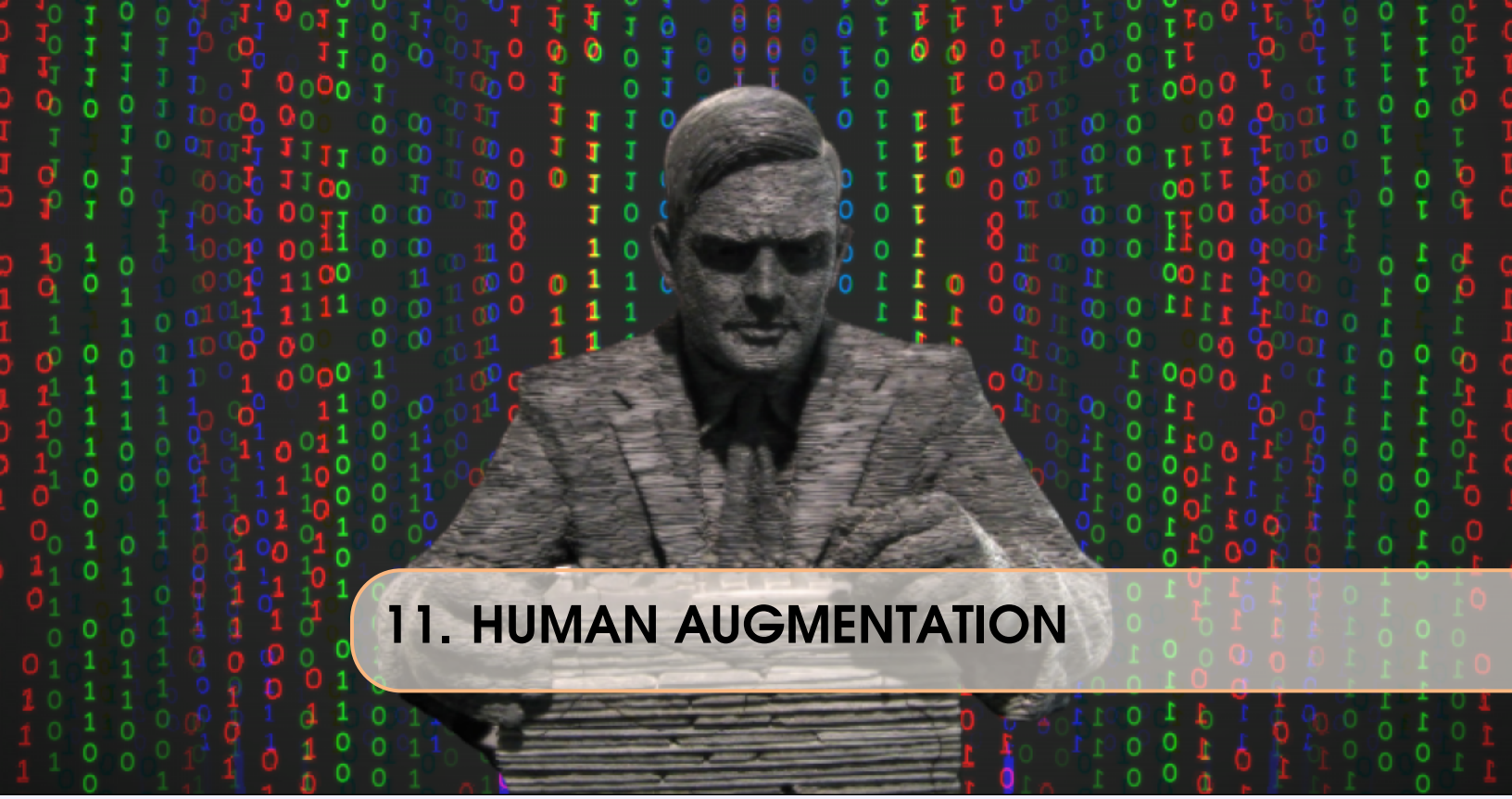
GitHub Co-pilot is an AI pair programmer that helps you write code faster and with less work. GitHub Co-pilot draws context from comments and code, and suggests individual lines and whole functions instantly. GitHub Co-pilot is powered by OpenAI Codex, a new AI system created by OpenAI. The GitHub Co-pilot technical preview is available as an extension for Visual Studio Code, Neovim, and the JetBrains suite of IDEs. GitHub Co-pilot is powered by Codex, the new AI system created by OpenAI. GitHub Co-pilot understands significantly more context than most code assistants. So, whether it's in a docstring, comment, function name, or the code itself, GitHub. Co-pilot uses the context you've provided and synthesizes code to match. Together with OpenAI, we're designing GitHub Co-pilot to get smarter at producing safe and effective code as developers use it. Skip the docs and stop searching for examples.

GitHub Co-pilot helps you stay focused right in your editor. GitHub Co-pilot is available as an extension for Neovim, JetBrains, and Visual Studio Code. You can use the GitHub Co-pilot extension on your desktop or in the cloud on GitHub Code spaces. And it's fast enough to use as you type. GitHub Co-pilot works with a broad set of frameworks and languages. The technical preview does especially well for Python, JavaScript, TypeScript, Ruby, Java, and Go, but it understands dozens of languages and can help you find your way around almost anything. With GitHub Co-pilot, you're always




in charge. You can cycle through alternative suggestions, choose which to accept or reject, and manually edit suggested code. GitHub Co-pilot adapts to the edits you make, matching your coding style. Features of GitHub include: i) Convert comments to code, i.e., Write a comment describing the logic you want, and let GitHub Copilot assemble the code for you. ii) Autofill for repetitive code: GitHub Copilot works great for quickly producing boilerplate and repetitive code patterns. Feed it a few examples and let it generate the rest! iii) Tests without the toil: Tests are the backbone of any robust software engineering project. Import a unit test package, and let GitHub Copilot suggest tests that match your implementation code.

Arjun M



# 11. HUMAN AUGMENTATION

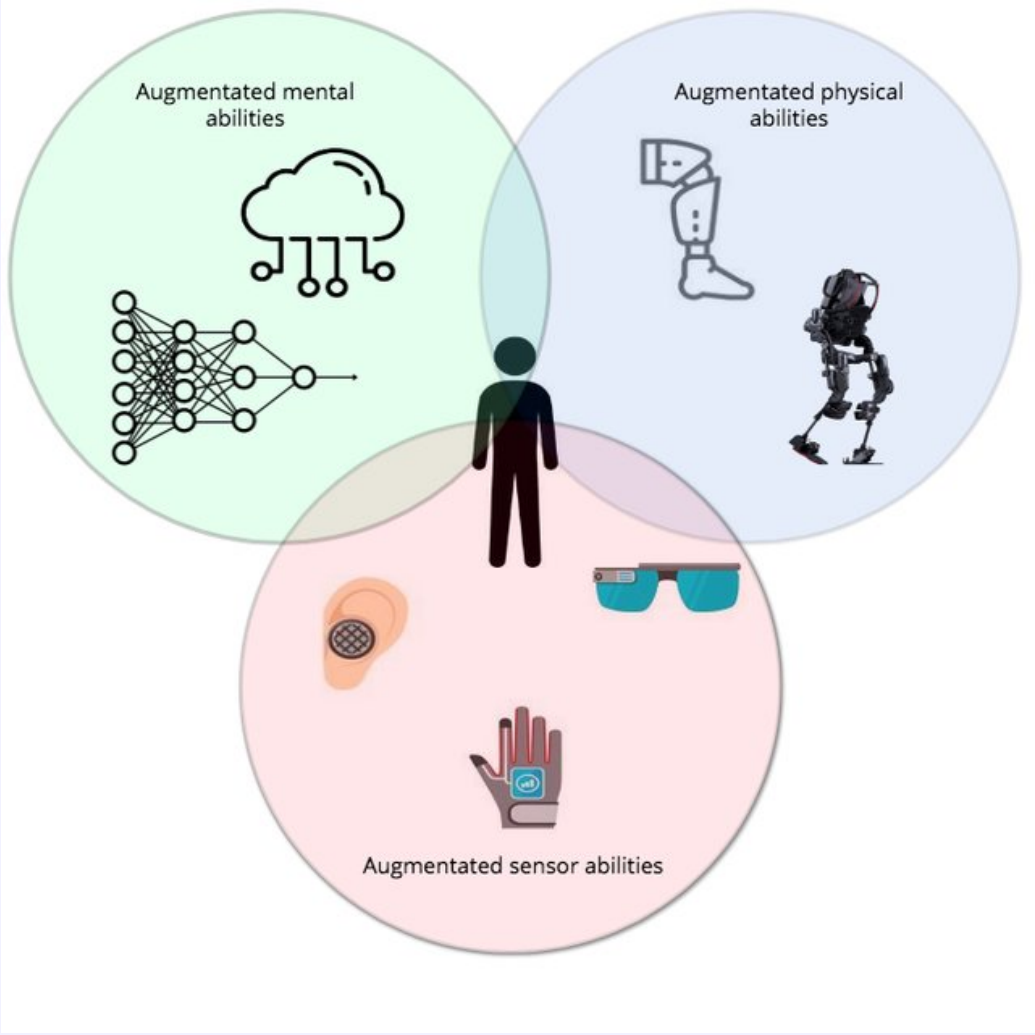
Human enhancement is additionally called human 2.0. The future is changing rapidly. New technologies will continue to emerge every year, and with the world becoming more reliant on computers and information technology this will pave the path for a better future for technology. Automation, cryptography, cloud computing, blockchain, and human enhancement are some of the biggest technology trends in the coming year that have the potential to power both transformation and optimization initiatives. Human enhancement is one of the leading technologies out of all the future technologies.

This technology can bring a massive change in society and to a country like India which has a growing population and needs a technological burst. This technological burst can be provided by proper analytical skills, data-driven results, critical thinking, and some academic debate. Human augmentations that allow us to do things that we cannot do on our own fall into the category of exceeding augmentation. This includes things like the ability to fly, breathe underwater, see ultraviolet or infrared light, and smell chemicals not currently detectable by the human olfactory sense. In the next 30 years, increasing use of autonomous and unmanned systems from the tactical to strategic level could significantly increase the combat effect that an individual can bring to bear, but to realise this potential the interfaces between people and machines will need to be significantly enhanced. Human augmentation will play an important part in enabling this interface and, if done effectively, it will


significantly alter our force structure, equipment programme and doctrine. It is important to realise that the more human augmentation is embedded into Defence planning and practice, the more likely it is to become a target itself for an adversary; thus, counter-human augmentation measures need to be considered in parallel with the adoption of human augmentation.

Human augmentation will become increasingly relevant, partly because it can directly enhance human capability and behaviour and partly because it is the binding agent between people and machines. Future wars will be won, not by those with the most advanced technology, but by those who can most effectively integrate the unique capabilities of both people and machines. The importance of human-machine teaming is widely acknowledged but it has been viewed from a techno-centric perspective. Human augmentation is the missing part of this puzzle. Thinking of the person as a platform and understanding our people at an individual level is fundamental to successful human augmentation. Industrial Age warfare saw people as interchangeable components of military units or the material with which to operate the platforms – vehicles, aircraft and ships. These platforms are routinely monitored and analysed but it is remarkable that our ability to understand our most critical capability – the human – is so under-researched. Successful application of human augmentation demands a more sophisticated approach to understanding our people and their capabilities. Defining the key elements of the 'human platform' – physical, psychological and social – provides a conceptual baseline to enable a multidisciplinary conversation. Human

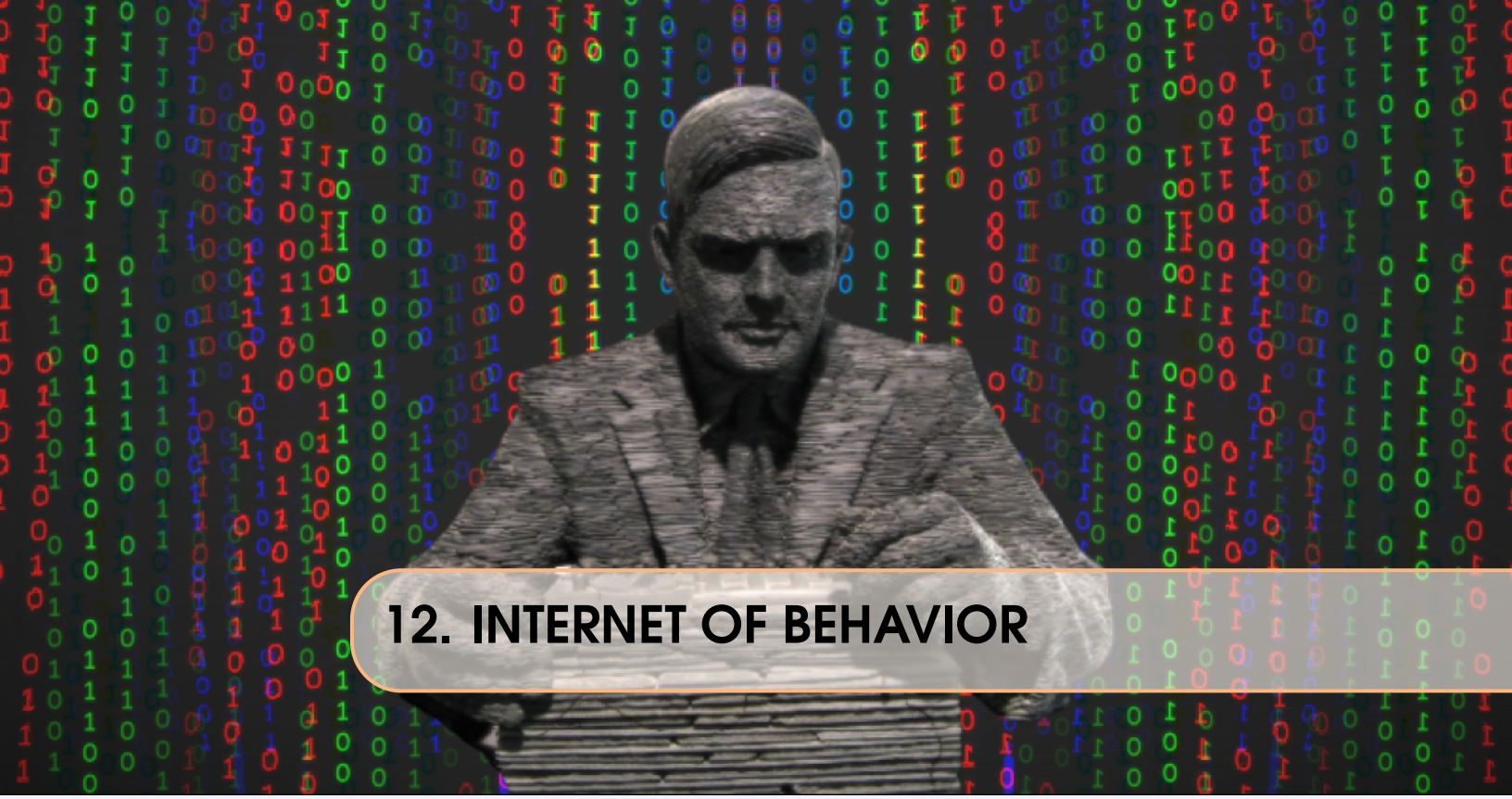
augmentation is not a shortcut – getting the basics of human physiology, biochemistry and psychology right is a prerequisite to human augmentation and will become more important in the future. Research into human augmentation has shone a stark light on how little we know about how to do the basics well. We need to do more to understand the precise effects of nutrition, sleep and hydration, and their relationship with other areas of the body to realise significant, yet untapped potential. Technology that improves monitoring will make it possible to individually optimize sleep, nutrition and other factors to deliver transformational gains across an organisation at relatively low cost and limited ethical risk. Human augmentation is not




just tomorrow's business, there are short-term and long-term opportunities that require engagement today. The following matrix illustrates the technical

maturity and the magnitude of policy considerations of human augmentation technologies. It shows that there are technologies that could be integrated today with manageable policy considerations. The most transformative technologies (for example, genetics and brain interfaces) currently sit at a low level of technological maturity but we must be prepared for this to change quickly. Bioinformatics and collection and analytics (encompassing sensors, artificial intelligence-enabled processing) are particularly important enablers for other human augmentation technologies and warrant focused research and development attention.

Aghila PV



# 12. INTERNET OF BEHAVIOR

The Internet of Behaviors (IoB) is an area of research and development (RD) that seeks to understand how, when and why humans use technology to make purchasing decisions. IoB combines three fields of study: behavioural science, edge analytics and the Internet of Things (IoT). IoB then refers to a process by which user-controlled data is analysed through a behavioural psychology perspective. With the results of that analysis, it informs new approaches to designing a user experience (UX), search experience optimization (SXO), and how to market the end products and services offered by companies. Consequently, for a company to conduct IoB is technically simple, but psychologically complex. It requires statistical studies to be conducted that map everyday habits and behaviours without fully disclosing consumer privacy for ethical and legal reasons. In addition, IoB combines existing technologies that focus on the individual directly such as facial recognition, location tracking and Big Data. It is therefore a combination of three fields: technology, data analytics and behavioural psychology.

Consumer data may be gathered from a range of sites and technologies, including a company's website, social media profiles, sensors, telematics, beacons, health monitors (such as Fitbit), and a variety of other devices. Each of these sites gathers various types of information. For example, a website may keep track of how many times a person visits a certain page or how long they remain on it. Furthermore, telematics may track how hard

a vehicle's driver brakes or the vehicle's typical speed. Data is collected and analysed by businesses for a variety of purposes. These reasons include assisting businesses in making educated business decisions, customizing marketing techniques, developing products and services, and driving user experience design, among others. Companies establish standards to aid in the analysis of this data. When a user performs a specific action(s), the firm then begins to convince the user to modify their behaviour. For instance, if a user visits a company's page selling men's slim jeans three times, the digital shop may show them a pop-up ad. Combining data from many sources and evaluating it to make a decision is another component of the Internet of Behaviors. Companies may develop in-depth user profiles for each user by combining data from a variety of sources. These profiles may then be looked at to see what the best course of action is for the person. For example, on the brand's Instagram page, a customer called Ted comments on a photo of a new sneaker. Ted visits the brand's website a few days later and looks at the identical sneaker. After a week, Ted is watching an ad for the sneaker on YouTube. In the meanwhile, the brand is keeping track of all of Ted's digital content touchpoints. Because Ted has expressed an interest in the brand's shoe, the brand may synthesize this information and devise a strategy for converting Ted into a customer. Remarketing display advertising or emailing Ted a discount coupon are examples of actions the brand might do.

Thejas P Y

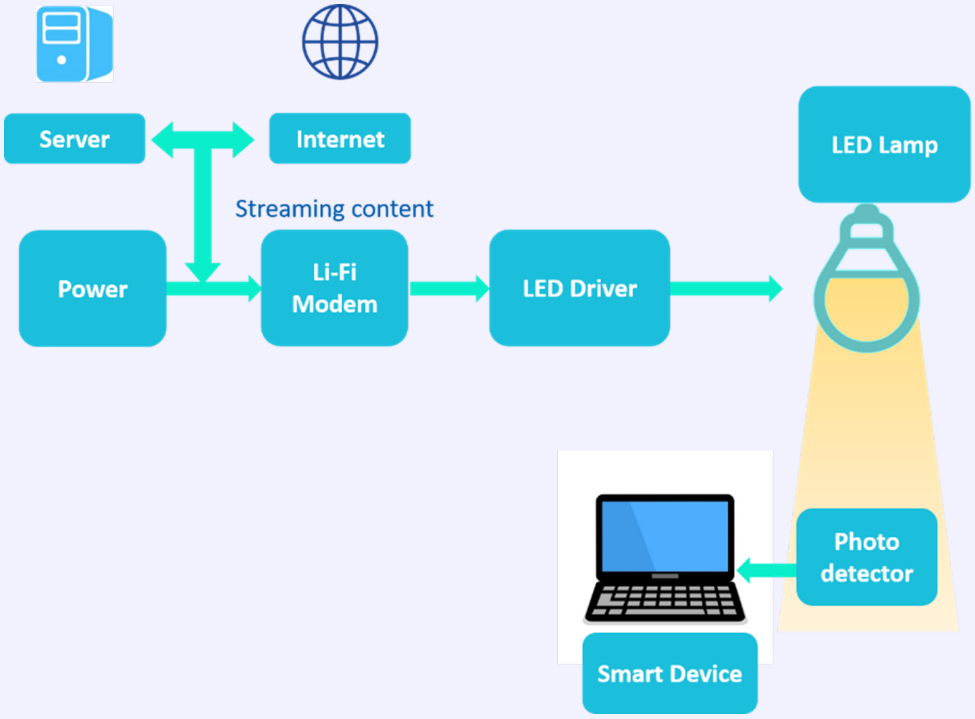
# 13. LI-FI TECHNOLOGY

Imagine, you wake up and tap your smartphone to switch on your water heater. As you get up from your bed, your home sensor sends you a text that you are out of water; with this message, there is an option to turn on the water tank, which notifies you through your smartwatch when the tank is filled. At the forefront of this connectivity miracle, known as the Internet-of-Things, is a fascinating optical wireless communication technology - Li-Fi Technology. Li-Fi is transmission of data through illumination by taking the fiber out of fiber optics by sending data through a LED light bulb that varies in intensity faster than the human eye can follow. Li-Fi is the term some have used to label the fast and cheap wireless-communication system, which is the optical version of Wi-Fi. The term was first used in this context by Harald Haas in his TED Global talk on Visible Light Communication. At the heart of this technology is a new generation of high brightness light- emitting diodes, says Harald Haas from the University of Edinburgh, UK. Very simply, if the LED is on, you transmit a digital 1, if it‘s off you transmit a 0.Haas says, They can be switched on and off very quickly, which gives nice opportunities for transmitted data.

It is possible to encode data in the light by varying the rate at which the LED’s flicker on and off to give different strings of 1s and 0s.The LED intensity is modulated so rapidly that the human eye cannot notice, so the output appears constant. More sophisticated techniques could dramatically

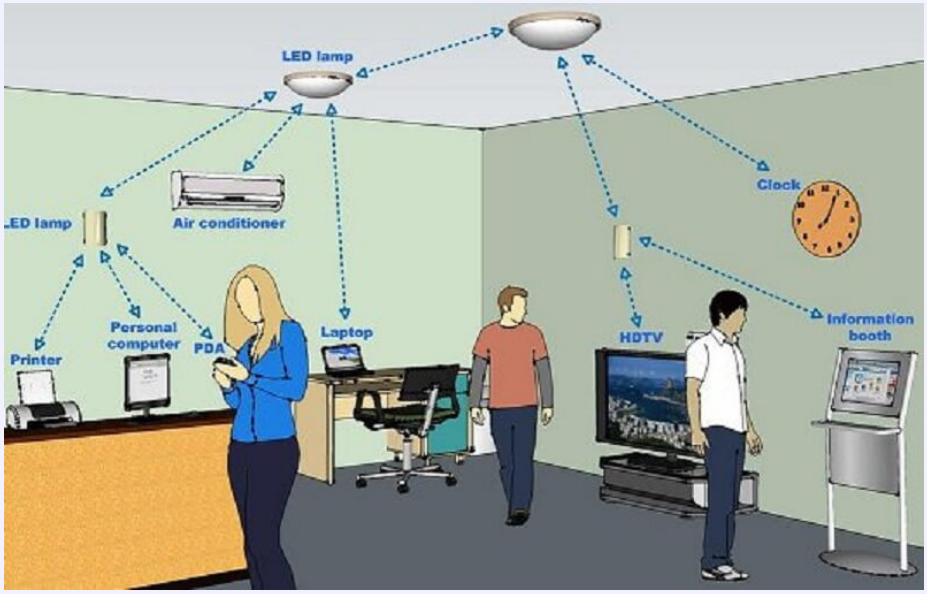
increase VLC data rate. Terms at the University of Oxford and the University of Edinburgh are focusing on parallel data transmission using arrays of LED's, where each LED transmits a different data stream. Other groups are using mixtures of red, green and blue LED's to alter the light frequency encoding a different data channel. VLC represents only a fraction of what appears to be a much larger movement towards optical wireless technologies in general. This larger word has been dubbed Li-Fi(Light Fidelity) by Dr Harald Haas of Edinburgh University and organisations such as the Li-Fi Consortium. Li-Fi is a VLC, visible light communication, technology developed by a team of scientists including Dr Gordon Povey, Prof. Harald Haas and Dr Mostafa Afgani at the University of Edinburgh. The term Li-Fi was coined by Prof. Haas when he amazed people by streaming high-definition video from a standard LED lamp. Li-Fi is now part of the Visible Light Communications (VLC) PAN IEEE 802.15.7 standard. Within a local Li-Fi cloud several data based services are supported through a heterogeneous communication system.

In an initial approach, the Li-Fi Consortium defined different types of technologies to provide secure, reliable and ultra-high-speed wireless communication interfaces. These technologies included giga-speed technologies, optical mobility technologies, and navigation, precision location and gesture recognition technologies. For gigaspeed technologies, the Li-Fi Consortium




defined GigaDock, GigaBeam, GigaShower, GigaSpot and GigaMIMO models to address different user scenarios for wireless indoor and indoor-like data transfers. While GigaDock is wireless docking solution including wireless charging for smartphones, tablets or notebooks, with speeds up to 10 Gbps, the GigaBeam model is a point-to-point data link for kiosk applications or portable-to-portable data exchanges. Thus a two-hour full HDTV movie (5 GB) can be transferred from one device to another within four seconds.GigaShower, GigaSpot and Giga- MIMO are the other models for in-house communication.

There a transmitter or receiver is mounted into the ceiling connected to, for example, a media server. On the other side are portable or fixed devices on a desk in an office, in an operating room in a production hall or at an airport. GigaShower provides unidirectional data services via several channels to multiple users with gigabit-class communication speed over several metres. Li-Fi technology could be a great solution for innovators and inventors looking for alternatives in areas that are normally sensitive to deploying existing technologies like RF communication. However, the total replacement of existing Wi-Fi technology is nearly impossible. There has been a growing need for a better alternative due to factors affecting




radio communication's efficiency and performance, such as congestion, bandwidth saturation, interference, and security concerns. The ongoing research and developments in the domain are worth observing, as the pace of developments has been fast and promising, indicated by the massive investments and soaring number of new names and products every other year.

Cynthia Thomas

# 14. MIRRORED WORLD-DIGITAL TWIN

A mirror world is a representation of the real world in digital form. It attempts to map real-world structures in a geographically accurate way. Mirror worlds offer a utilitarian software model of real human environments and their workings The Mirrored World promises visibility of the entire energy value chain. To maximize its benefit, leading utilities will collaborate with stakeholders from across the energy ecosystem. Customers, equipment manufacturers, power generators, communities, city planners, transport infrastructure, all these stakeholders and more contribute to create an overarching model of the energy system. In the Mirrored World, utilities use massive, intelligent, digital twins to represent the entire energy system, extending digital twin use cases far beyond utility asset management. It creates a network of multiple existing twins to create a living model of entire processes, all energy users, the supply chain, and much more.

A digital twin is a virtual representation of an object or system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning and reasoning to help decision-making. Digital twins are the result of continual improvement in the creation of product design and engineering activities. Product drawings and engineering specifications progressed from handmade drafting to computer aided drafting/computer aided design to model-based systems engineering. The digital twin of a physical object is dependent on the digital thread—the lowest level design and specification for

a digital twin—and the ”twin” is dependent on the digital thread to maintain accuracy. Changes to product design are implemented using engineering change orders (ECO). An ECO made to a component item will result in a new version of the item’s digital thread, and correspondingly to the digital twin. With digital twins, you can model the physical world in a digital format. Digital twins can gather, visualize and contextualize data from across their physical assets and products, bridging their physical operations and digital capabilities. Digital twins offer a risk-free playground to explore innovations, strategize for many possible futures and test limitless ”what-if” scenarios. When digital twins were initially adopted, they were championed

for their ability to monitor, simulate and streamline the data of different devices. But recently, the scale of the models, layering in of AI and increase in adoption has transformed the equation. Leaders are starting to connect massive networks of intelligent twins, linking many twins together to create living models of whole factories, product life cycles, supply chains, ports and cities. They are creating unbroken threads of data—fabrics that will soon be essential to every enterprise’s digital strategy. A digital twin is a complete and operational virtual representation of an asset, subsystem or system, combining digital aspects of how the equipment is built (PLM data, design

models, manufacturing data) with real-time aspects of how it is operated and maintained. The capability to refer to data stored in different places from one common digital twin directory enables simulation, diagnostics, prediction and other advanced use cases. It have a variety of applications like:

Manufacturing

Digital twins allow to simulate complete processes with all their stages. This allows, in turn, to optimize the entire process. It can be applied directly to products in both the design and manufacturing process. They allow to predict the operation of a product or production process before its start-up, which allows anticipating possible errors and saving costs.

Energy

Models based on real data can be developed to predict behaviors that optimize activities for power generation by analyzing large amounts of this data. The digital twins allow modeling the performance of power plants representing their status and operation. They can also help to identify energy demand, reduce the costs of implementing new plants and improve decision-making in the energy storage stages.

Automotive

These virtual representations can simulate behaviors and prevent possible failures both in production and in the subsequent operation of the vehicle. A digital twin saves costs and reduces errors in the production stages. It also allows you to identify potential bottlenecks and shorten development time. Lastly, they improve the quality of the final vehicle.

Sara Maria John

# 15. PROJECT STARLINE

Over the past several years, Google has been working hard to craft software experiences that make you feel like you're present with another human being, even if they're several time zones away. On one end of the spectrum is the Google Meet, the company's Zoom competitor. On the other, more daring end is the now discontinued virtual-reality platform Daydream, complete with goggles and hand controllers. So they built a video booth. The new prototype machine for face-to-face meetings is named Project Starline. The phrase "video booth" really is the simplest way to describe Starline in its current form: It's a large booth, like the kind you'd find in a diner, just way more technologically complex. Project Starline is an experimental video communication method currently in development by Google that allows the user to see a 3D model of the person they are communicating with. Google announced the product at its 2021 I/O developer conference, saying that it will allow users to "talk naturally, gesture and make eye contact" by utilizing machine learning, spatial audio, computer vision and real-time compression to create the 3D effect without the user wearing typical virtual reality goggles. The goal is to make the user feel as if they are in the same room with the other user. In a new research paper, Google has detailed the tech behind its impressive Project Starline demo from this year's I/O conference. Project Starline is essentially a 3D video chat booth that aims to replace a one-on-one 2D video conference call with an experience that feels like you're actually


sitting in front of a real human being. It sounds simple, but Google's research paper highlights just how many challenges there are in tricking your brain into thinking there's a real human being sitting just a few feet away from you. Obviously, the image needs to be high resolution and free of distracting artifacts, but it also needs to look correct from your relative position in the booth. Audio is another challenge, as the system needs to make it sound like a person's words are coming from their actual mouth. And then there's just the small matter of eye-contact. But, eventually, the hope is that Project Starline could offer a similar feeling of presence as virtual or augmented reality, without users needing to wear bulky headsets or trackers.

The way Google's research paper tells it, employees who've used Starline across the three sites where it's been installed think it beats traditional video conferencing when it comes to creating a feeling of presence, personal connection, as well as helping with attentiveness, and reaction-gauging. The company says that over nine months, 117 participants held a total of 308 meetings in its telepresence booths, with an average meeting time of just over 35 minutes. It all sounds very promising, but as yet there's no indication of when, or even if, the system might one day be commercialized. There's also very little information about how much Starline's extensive array of hardware will cost in reality. For now, Google says it's expanding Project Starline's availability "in more Google offices around the United States."

Project Starline applies a few things to make this possible: “research in computer vision, machine learning, spatial audio, and real-time compression.” The display in front of each recipient uses a “breakthrough light field display system that creates a sense of volume and depth that can be experienced without the need for additional glasses or headsets. The effect is the feeling of a person sitting just across from you, like they are right there.” Google VP Clay Bavor explains that one of the things Google is most proud of is that one can sit down and forget about the technology and instead focus on the person sitting in front of you.

Mohammed Nabhan P Noushad

# 16. NFT(NON-FUNGIBLE TOKEN)

A non-fungible token (NFT) is a unique and non-interchangeable unit of data stored on a blockchain, a form of digital ledger. NFTs can be associated with reproducible digital files such as photos, videos, and audio. NFTs use a digital ledger to provide a public certificate of authenticity or proof of ownership, but do not restrict the sharing or copying of the underlying digital files. The lack of interchangeability (fungibility) distinguishes NFTs from blockchain cryptocurrencies, such as Bitcoin. NFTs can also be used to represent individuals' identities, property rights, and more. The distinct construction of each NFT has the potential for several use cases. For example, they are an ideal vehicle to digitally represent physical assets like real estate and artwork. Because they are based on blockchains, NFTs can also be used to remove intermediaries and connect artists with audiences or for identity management. NFTs can remove intermediaries, simplify transactions, and create new markets. NFTs have drawn criticism with respect to the energy cost and carbon footprint associated with validating blockchain transactions as well as their frequent use in art scams Further criticisms challenge the usefulness of establishing proof of ownership in an often extra legal unregulated market.

Like physical money, cryptocurrencies are fungible i.e., they can be traded or exchanged, one for another. For example, one Bitcoin is always equal in value to another Bitcoin. Similarly, a single unit of Ether is always equal to

another unit. This fungibility characteristic makes cryptocurrencies suitable for use as a secure medium of transaction in the digital economy. NFTs shift the crypto paradigm by making each token unique and irreplaceable, thereby making it impossible for one non-fungible token to be equal to another. They are digital representations of assets and have been likened to digital passports because each token contains a unique, non-transferable identity to distinguish it from other tokens. They are also extensible, meaning you can combine one NFT with another to "breed" a third, unique NFT. Just like Bitcoin, NFTs also contain ownership details for easy identification and transfer between token holders. Owners can also add metadata or attributes pertaining to the asset in NFTs. For example, tokens representing coffee beans can be classified as fair trade. Or, artists can sign their digital artwork with their own signature in the metadata. NFTs evolved from the ERC-721 standard. Developed by some of the same people responsible for the ERC-20 smart contract, ERC-721 defines the minimum interface ownership details, security, and metadata – required for exchange and distribution of gaming tokens.

Crypto Kitties are digital representations of cats with unique identifications on Ethereum's blockchain. Each kitty is unique and has a price in ether. They reproduce among themselves and produce new offspring, which have different attributes and valuations as compared to their parents. While the crypto kitties use case may sound trivial, succeeding ones have more serious business implications. For example, NFTs have been used in private equity transactions as well as real estate deals. One of the implications of enabling multiple types of tokens in a contract is the ability to provide escrow for different types of NFTs, from artwork to real estate, into a single financial transaction.

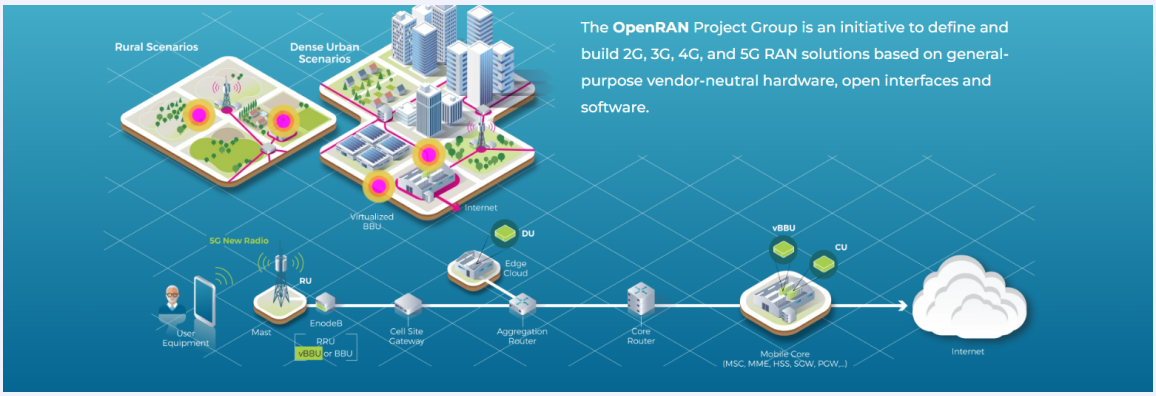
Sterin Varghese

# 17. OPEN RAN CONCEPT

Open RAN work has been motivated by perceived shortcomings in current RAN architectures, many of the issues raised in this section may be addressed by compatible changes to existing architectures or even through particular implementations of existing architectures. The intent of the OpenRAN work is to see whether all of these issues can be addressed in a comprehensive fashion, by starting from scratch and redesigning the RAN completely. By deploying a radio access network based on the OpenRAN architecture, public network operators could achieve independence of their core networks from the access network technology. This is intended to allow public network operators to leverage their core, service based network, including support for mobility, across a variety of access technologies, achieving the potential of a larger market for their services. Because the OpenRAN architecture is designed to allow the coexistence of multiple radio technologies within a single RAN infrastructure, deployment of OpenRA based radio access networks is intended to allow an operator to achieve cost-effective utilization of their expensive spectrum assets by selecting the most appropriate radio protocol. Also, duplicate wire-line infrastructure for different radio technologies is unnecessary. The OpenRAN could also contribute to cost-efficiency in other ways. By allowing the separation of the control and bearer plane functions onto different servers the control plane functions could be implemented on all-purpose server platforms while the specific real-time bearer plane

functions could be implemented on highly specialized hardware. When connected to an all-IP core, the application of existing IP protocols, interfaces, and modules, e.g. IP mobility management and AAA infrastructure, is intended to allow standard routers and servers to be used in both the RAN and core, allowing for exploitation of their economies of scale. Load sharing could reduce the cost of redundancy by avoiding duplication of each network entity.


The distributed nature of the OpenRAN could increase reliability by removing any single points of failure. Functions that in past RAN architectures were clustered into monolithic nodes are distributed in the OpenRAN. The result improves the potential for redundancy, because the cost of deploying multiple instantiations for particular RAN network elements is reduced. In past architectures, the cost of deploying redundant network elements was prohibitive and difficult because of centralization, depending on implementation. Distribution also improves scalability. Because new services are expected to become an important means for 3G operators to win over customers from competitors, the unpredictable requirements of these services on network resources and their typical introduction in hot spots call for an incremental infrastructure growth capability. In the OpenRAN, the control plane, bearer




plane and transport plane infrastructure are intended to scale independently, increasing the deployment flexibility. Because the OpenRAN admits flexible deployment scenarios, operators could select a deployment that matches the available backhaul network resources.

Past RAN architectures, based on a star topology, were optimized for cases where rich, high bandwidth backhaul network resources were not available. As growth in Internet connectivity has occurred, many metropolitan areas now support a rich variety of wire-line and fixed wireless backhaul options. Increasing backhaul bandwidth is generally coupled with lower costs for backhaul. Operators could deploy with a star topology where bandwidth is limited, or a mesh topology where richer bandwidth resources are available, the OpenRAN is compatible with both. The ability to handle multiple radio link protocols with a single radio network layer protocol facilitates interoperability between radio link protocols. In its more advanced version, some functions (mobility management, wireline QoS, security) that today are handled at the radio network layer are planned to move into the IP transport layer. As a result, these functions could be shared between radio link protocols. This has the potential to allow load balancing between different radio link protocols. For example, an operator could arrange to hand off a data call from GSM to WCDMA if the over-the-air bandwidth requirements became large enough. Finally, the OpenRAN design could allow more flexible business models to evolve around provision of wireless Internet access. The separation between core and RAN allows separation between the business entities providing core services and wireless access. For example, a public network operator could decide to organize their

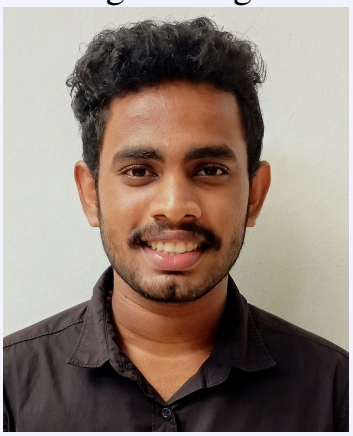
service based core network and wireless access networks into separate business units. This would allow the core unit to solicit business from other access businesses, and the access business to solicit business from other service suppliers. The potential is also available for new wireless ISPs to arise. A wireless ISP would supply wireless access only, and depend on existing service-based core suppliers for services. If the RAN is based on Internet protocols and mechanisms, ISPs are more likely to become potential customers because they already understand Internet protocols and already have existing equipment based in Internet protocols, and so they do not have as steep a learning curve or a difficult integration operation if they want to provide access.

Abhijith T S

# 18. TELEKINECT

Telekinetic is an alleged psychic ability allowing a person to influence a physical system without physical interaction. TeleKinect is a platform for collaborative interactions at a distance in the same virtual space. The framework supports the real-time video transport of foreground elements from remote locations and composites them into a merged virtual space. In this position paper we present two applications that utilize the framework for shared experiences at a distance. It is useful to distinguish two types of remote experiences. The first type is a meeting that focuses on critical decision making, while the second type is a shared experience that focuses on the collaborative creation and modification of digital content. In a decision-making session, collaborators might prefer to have a sense of being in the same room as if they were talking face-to-face thereby concentrating on the interpersonal space. In such a context, the attention lies on displaying a realistic representation of the remote person on the screen, correct as to their physical size and gaze direction, and extending the remote physical space into the local place. WaaZam is a telepresence platform that focuses on supporting creative collaboration in a composited video environment that incorporates depth analysis, object tracking, and gestural interaction. Unlike current telepresence environments, WaaZam gives users more creative control over their experiences by facilitating the creation and customization of the space during a live session. advantagesare helps rural areas: Today's

generation is all about digital progress and technological advancement. The immeasurable heights that technology has attained are a marker of growth and development. It is a benefit for the country and apparently, the whole world. No aspect of our lives is devoid of this progressive innovation. Cuts cost: cost will be reduced Reduces spread of illness: Protect Yourself With Healthy Habits. Healthy habits prevent germs and infectious diseases from spreading. Learn, practice, and teach healthy habits. Saves time: Save time for travelling Reach more people: More people can connect through this platform No need for AR/VR glass : AR glass is not necessary for the viewing of images through screen.



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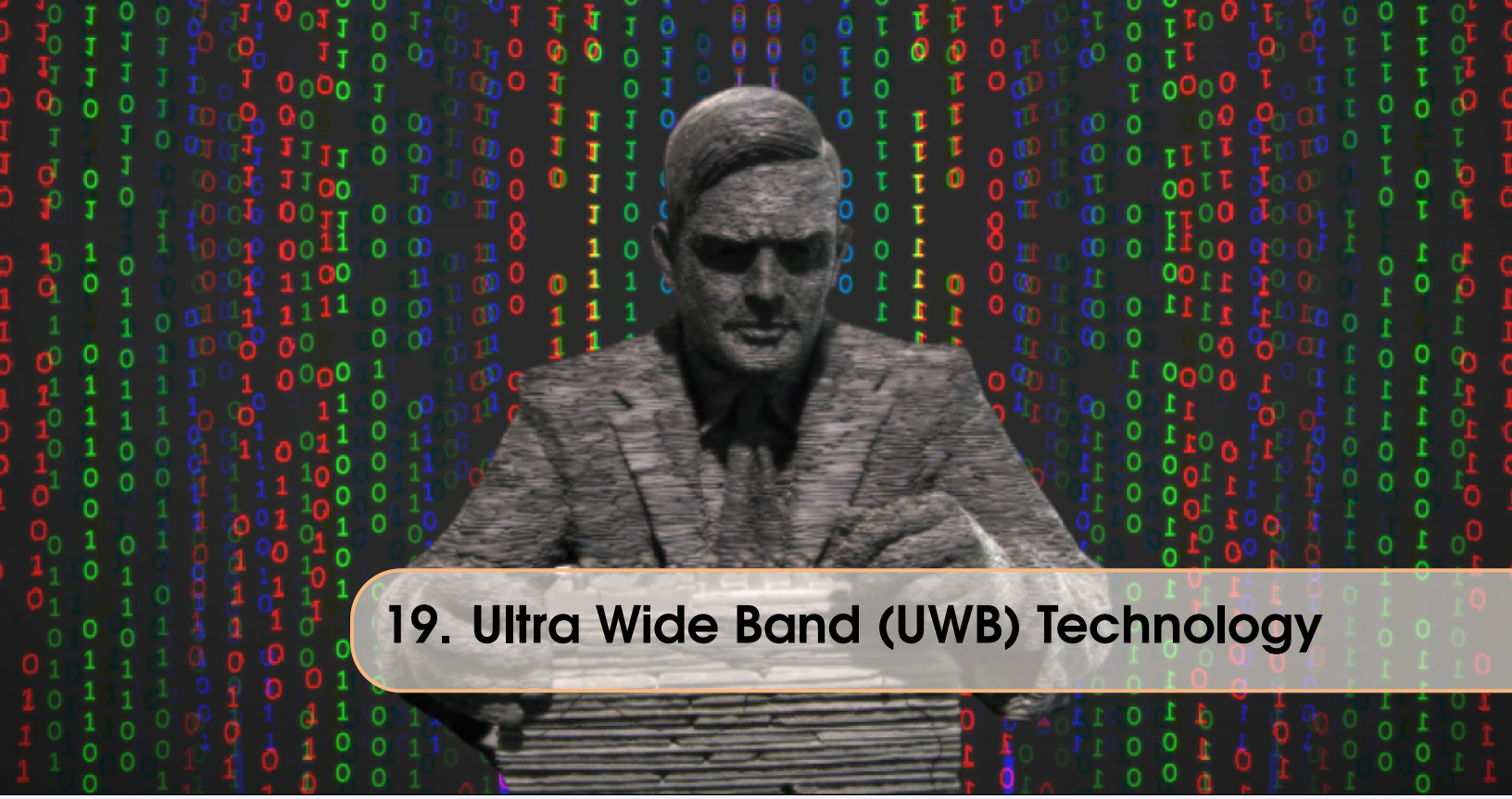
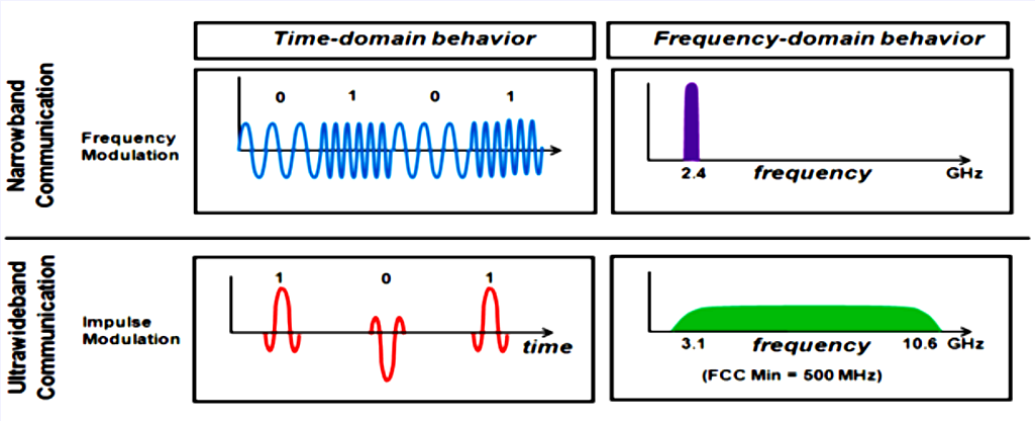


# 19. Ultra Wide Band (UWB) Technology

Ultra Wide Band (UWB) is a revolutionary technology with incomparable potential in terms of throughput, performance and low cost implementation. The uniqueness of UWB is that it transmits across an extremely wide bandwidth of several GHz, around a low center frequency, at very low power levels. UWB is like millions of very short, very fast, precisely timed bursts or pulses of energy, measured in nanoseconds and covering a very wide area. By varying the pulse timing according to a complex code, a pulse can represent either a zero or a one: the basis of digital communications. UWB is almost two decades old, but is used mainly in limited radar or position location devices. Only recently has UWB been applied to business communications. It's a different type of transmission that will lead to low-power, high-bandwidth and relatively simple radios for local- and personal-area network interface cards and access points. At higher power levels in the future, UWB systems could span several miles or more. AirTags, a tracking device from Apple Inc. really brings the technology alive. This is a method of modulation and data transmission which can entirely change the wireless picture in the near future. The diagram given below demonstrates the basic principle of the UWB: The UWB is above and the traditional modulation is below which is called Narrow Band (NB), as opposed to the Ultra Wideband. On the left we can see a signal on the time axis and on the right there is its frequency spectrum, i.e. energy distribution




in the frequency band. The most modern standards of data transmission are NB standards - all of them work within a quite narrow frequency band allowing for just small deviations from the base (or carrier) frequency. Below on the right you can see a spectral energy distribution of a typical 802.11b transmitter. It has a very narrow (80 MHz for one channel) dedicated spectral band with the reference frequency of 2.4 GHz. Within this narrow band the transmitter emits a considerable amount of energy necessary for the following reliable reception within the designed range of distance (100 m for the 802.11b). Apple has added its U1 chip to even more products, and is clearly planning to make Ultra-Wideband a major feature of its device ecosystem? Here's a breakdown of UWB, what it does now, and what it can do for you. Alongside the launch of its iPhone 12 range of smartphones, Apple introduced a number of other products over the course of multiple special events. The appearance of Ultra-Wideband support in the Home Pod mini, as well as the Apple Watch Series 6, generated more conversation about the technology and its potential future use by the company.

Sonu P S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