



E – Journal: Tech on Tap
Dept of MCA

Issue 4
November 2022

IoT Applications – Part 1



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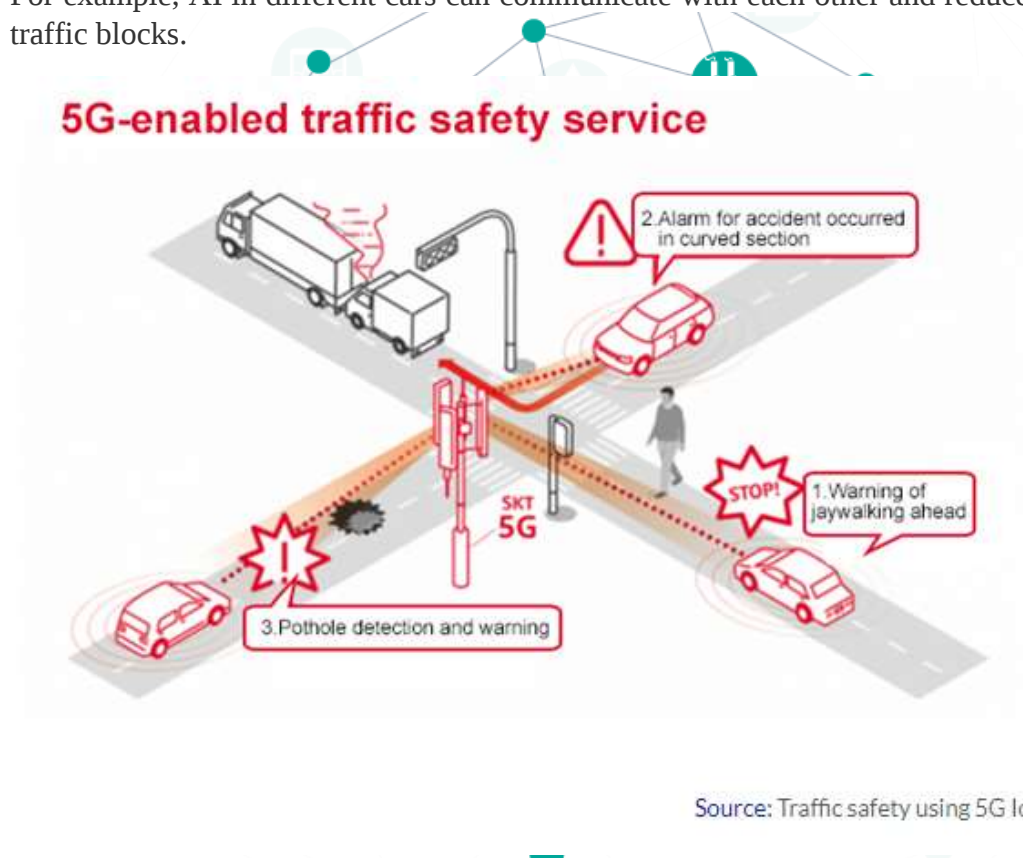
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5G in IOT

C. H. Chandana (21MCA10)

5G IoT networks can monitor HVAC systems, water levels, and cleanliness. Therefore, there will be a vast 5G IoT monitoring devices market. Industries focused on AI will also benefit hugely from 5G IoT devices.

They would now be able to integrate their AI with IoT devices seamlessly. In cities, 5G will enable enhanced traffic management - meant by supporting a massive number of IoT connections to traffic lights, cameras and traffic sensors. Smart meters - supported by 5G low cost IoT sensors and connections - will monitor energy usage and help reduce consumption. For example, AI in different cars can communicate with each other and reduce accidents and traffic blocks.



5G massive mobile IoT technology will enable low cost-devices with 10+ years of battery life and enhanced coverage even underground and in remote areas.

According to 3GPP specifications, the 5G standard for Massive IoT will support up to 1 million connected devices for every 0.38 square miles (roughly 1 square kilometre). The automation of production lines using private 5G **IoT networks** can improve productivity and reduce cost. That will make commodities cheaper, impacting the economy.

5G and IoT will have a lot of applications:

- People can use a 5G **IoT network** to park their cars without going to a parking spot.
- Farmers can use the IoT network to monitor crops and livestock and control equipment remotely.

- Doctors can perform surgeries remotely with low latency equipment.
- People can monitor and maintain their houses while they are on vacation.

References:

<https://www.stl.tech/blog/5g-technology-and-its-impact-on-iot-internet-of-things/#:~:text=5G%20IoT%20networks%20can%20monitor,AI%20with%20IoT%20devices%20seamlessly.>

<https://www.stl.tech/blog/5g-technology-and-its-impact-on-iot-internet-of-things/#:~:text=5G%20IoT%20networks%20can%20monitor,AI%20with%20IoT%20devices%20seamlessly.>

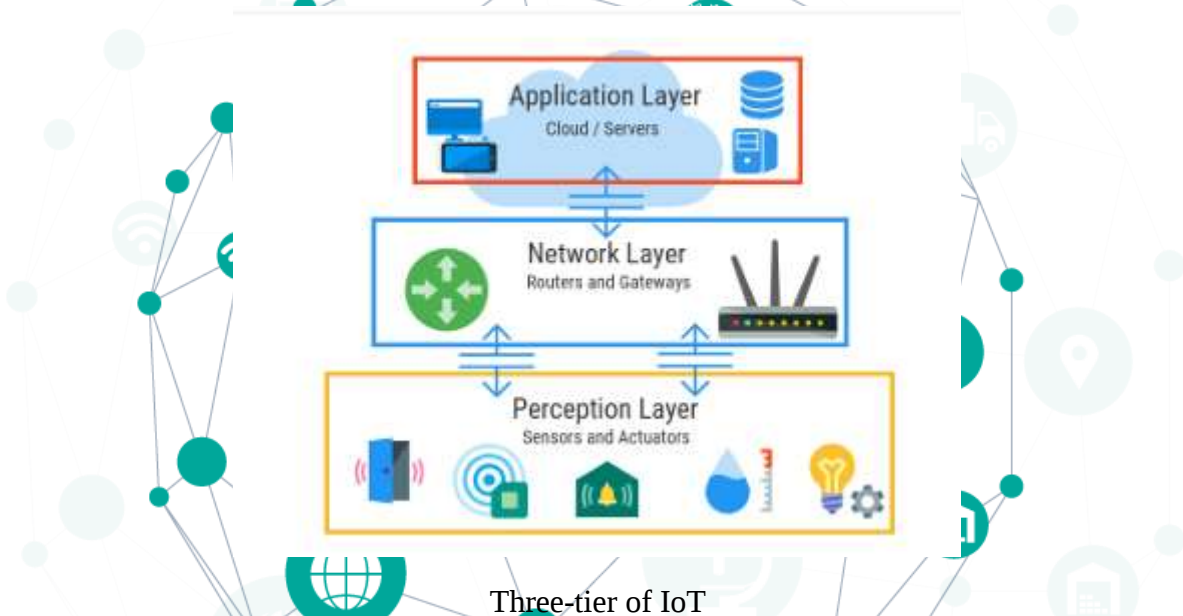


IOT SECURITY

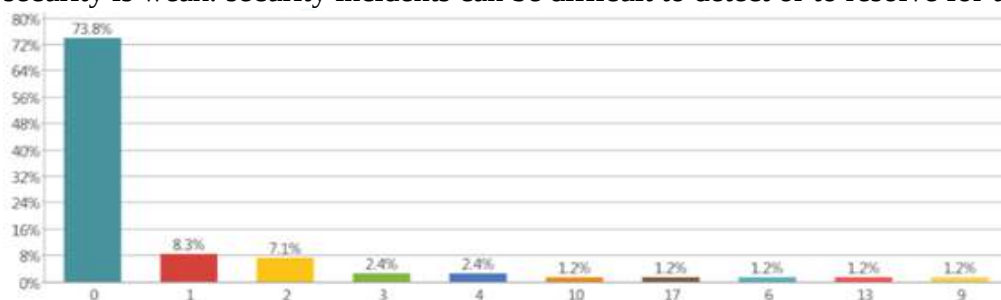
Arunodaya P (21MCA06)

IoT security can be related as a cyber-security strategy and protection mechanism that safeguards against the possibility of cyber-attacks which specifically target physical IoT devices that are connected to the network.

The twenty-first century is known as the era of interconnectivity and wireless communication where the world has witnessed some major technological revolutions in computer networking. The term Internet of Things (IoT) was coined by Kevin Ashton in 1999. The IoT provides a way of connectivity of things to things. The “thing” refers to all the things around us that are connected to the network. Due to the massive accessibility and interconnection of IoT devices, systems are at risk of being exploited by hackers. Therefore, there is a need to find an advanced security framework that covers data security, data confidentiality, and data integrity issues.



- **Data Security in IoT:** Currently, data security and privacy protection should be adopted equally to offer robust data security. Accessing and securing data by a static approach has become unacceptable because it fails to address the scalable data security IoT. The security support is not always maintained. Consumer knowledge of IoT security is weak: security incidents can be difficult to detect or to resolve for usage.



Data security in IoT

- **Data Integrity in the IoT:** Data integrity is necessary for up-to-date and accurate data. It is very important to store data by any person or organization for integrity. It is significant that data integrity in the IoT is measured, as data need to be secure and every transaction of data needs to be secure. Defining the integrity of data is easy but it is hard to ensure.
- **Data Confidentiality in the IoT:** To keep data private in the public domain is called 'data privacy'. Data privacy terms can be applied to any organization or a person. Data are always limited and related to any person's life and existence. Data security and data privacy are used in many situations in the same context, but there is a distinct difference; data security is broadly thought to be about protection and saving your data from other unknown persons, whereas data privacy is to control where your data are collected, shared, and used for which, and for what, purpose.
- **Data Validity in the IoT:** Data validity ensures that IoT services are practically available. If these services are unavailable, total progress can be decreased, it will also facilitate and provide help to hackers and attackers who are working in different smart industries, smart cities, and smart home etc. With the development of connected objects, users entrust part of their privacy to improve their environment and make their living environment more efficient and safer. There are risks to the person and his data. For example, a hacked surveillance camera lets you know if the owner is away or not from their home, a smart electricity meter, the meter can quickly become a spy if you are not careful.

Current IoT Security Framework

It consists of sensors, actuators, and other embedded systems. Fog set of connections: A class of exchange ideas, technologies, and protocols by several IoT policies with the prerequisite to expand and enforce an entire confidence policy. Core Complex: It provides a set of connection center platforms and IoT devices. The issues at this time are individuals confronted with conventional fundamental networks. The measureless number of endpoints act together and get by to create a considerable precautions burden. Thus, based on the suggestions made in previous research papers, the current study proposes a security framework for the IoT in terms of data confidentiality, availability, and integrity.

AUGMENTED REALITY WITH IOT

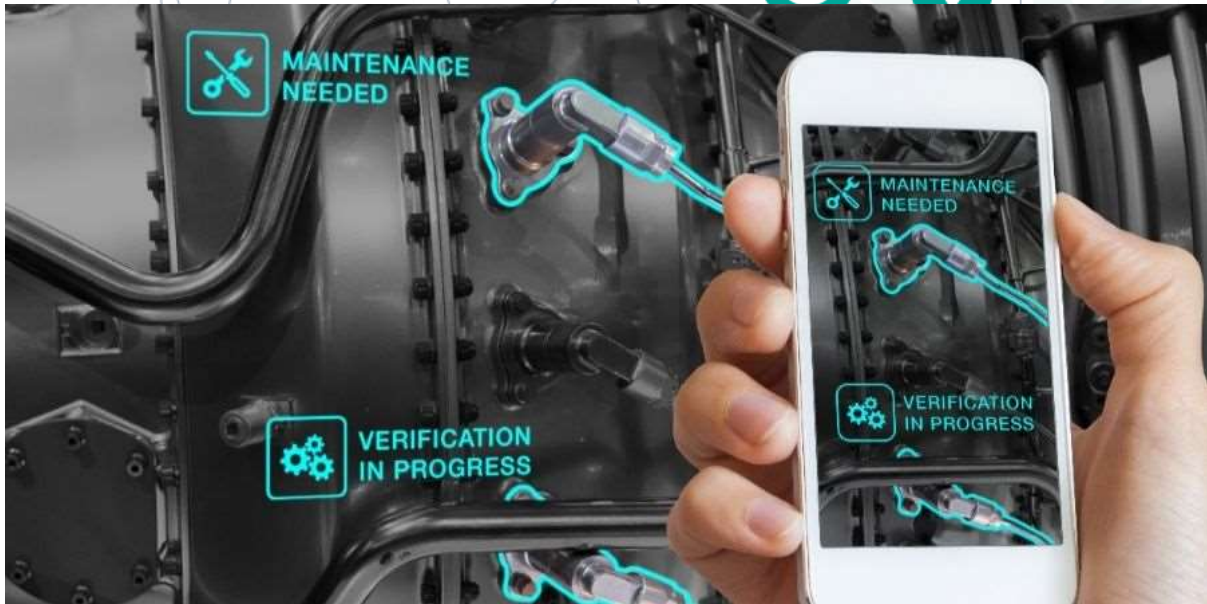
Amritha Balakrishnan (21MCA02)

IoT combines real-world things with digital representations and services. By overlaying virtual information about intelligent objects and services on a user's perception of the real environment, augmented reality offers a perfect interface to IoT applications. In addition to obtaining extra context-aware information about the object, such as its size, speed, and temperature, as well as details about other things close by, this enables a user to interact with the actual object.

The growth of Internet of Things (IoT) technology has made it feasible to connect different smart devices. Forecasts indicate that the number of IoT-connected devices will increase exponentially.

These gadgets will open up the possibility for a wide range of services from many sources, including monitoring sensors, security cameras, and actuators. The management of the services offered by these devices is acknowledged as one of the most crucial areas of future technology. It has attracted significant attention from research organisations and businesses in a variety of fields, including transportation, healthcare, and emergency response.

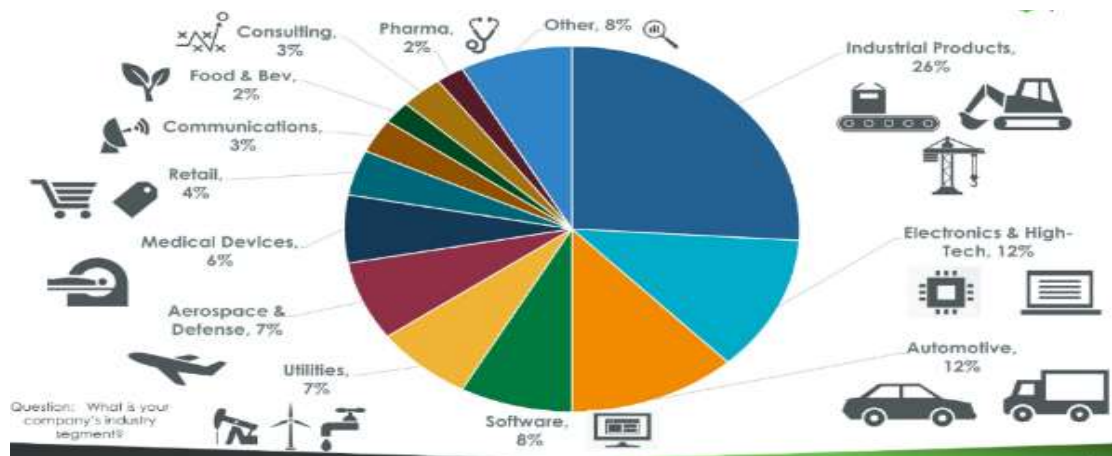
The development of AR experiences is now possible due to a wide range of commercially available gear and software. The ability to create AR experiences is now made possible via a range of consumer-level APIs, the majority of which leverage mobile technology like smartphones or tablets.



Top IoT + AR Capabilities, Use Cases, and Device Adoption

For a variety of use cases, AR offers a fresh perspective to examine this real-time data in situ, thereby enhancing the productivity of front-line workers. In addition to IIoT deployments, augmented reality (AR) is also finding a place in the industrial sector. According to our most recent State of Augmented Reality survey data, 20% of respondents work in the industrial

sector, compared to 9% in the automotive, 7% in the electronics & high-tech, and 6% in the aerospace & defence sectors.



A crucial step in creating a business case is determining precisely how and where IoT & AR will affect these verticals and the potent use cases they'll enable. The predicted IoT + AR use case adoption from respondents was compiled by BCG & PTC across three capabilities:

Visualize & Interact (36%): Product design, Consumer navigation, Training

Diagnose (35%): Equipment monitoring & diagnostics, Buildings/facilities inspection, Insurance claims

Act (30%): Operator work instructions, Order picking, Heads-up displays.

Operational intelligence, which enables end-to-end visibility of industrial activities and the monitoring of important efficiency measures, is the IIoT's equivalent of "managing spaces" for manufacturing (downtime, overall equipment effectiveness etc.). Using IIoT use cases for asset monitoring and maintenance, predictive maintenance, and services use cases for smart connected devices, including remote monitoring and remote service, "managing equipment/objects" can be applied in the manufacturing industry.

While innovative technologies like IIoT and AR generate a lot of excitement, success and avoiding solid evidence purgatory depend on connecting the technology to inclusive digital transformation strategy with business goals and intended outcomes.

75% of respondents to the BCG/PTC survey anticipate seeing a return on their IoT + AR investments in three years, and 50% of those who have adopted or almost deployed these integrated technologies have already shown their internal value.

According to this, the PTC State of respondents is rapidly leaving pilots, with 68% of AR responders and 89% of IIoT adopters wanting to migrate to production in less than a year. Industrial organizations are recognizing yet more that change is necessary and that technology

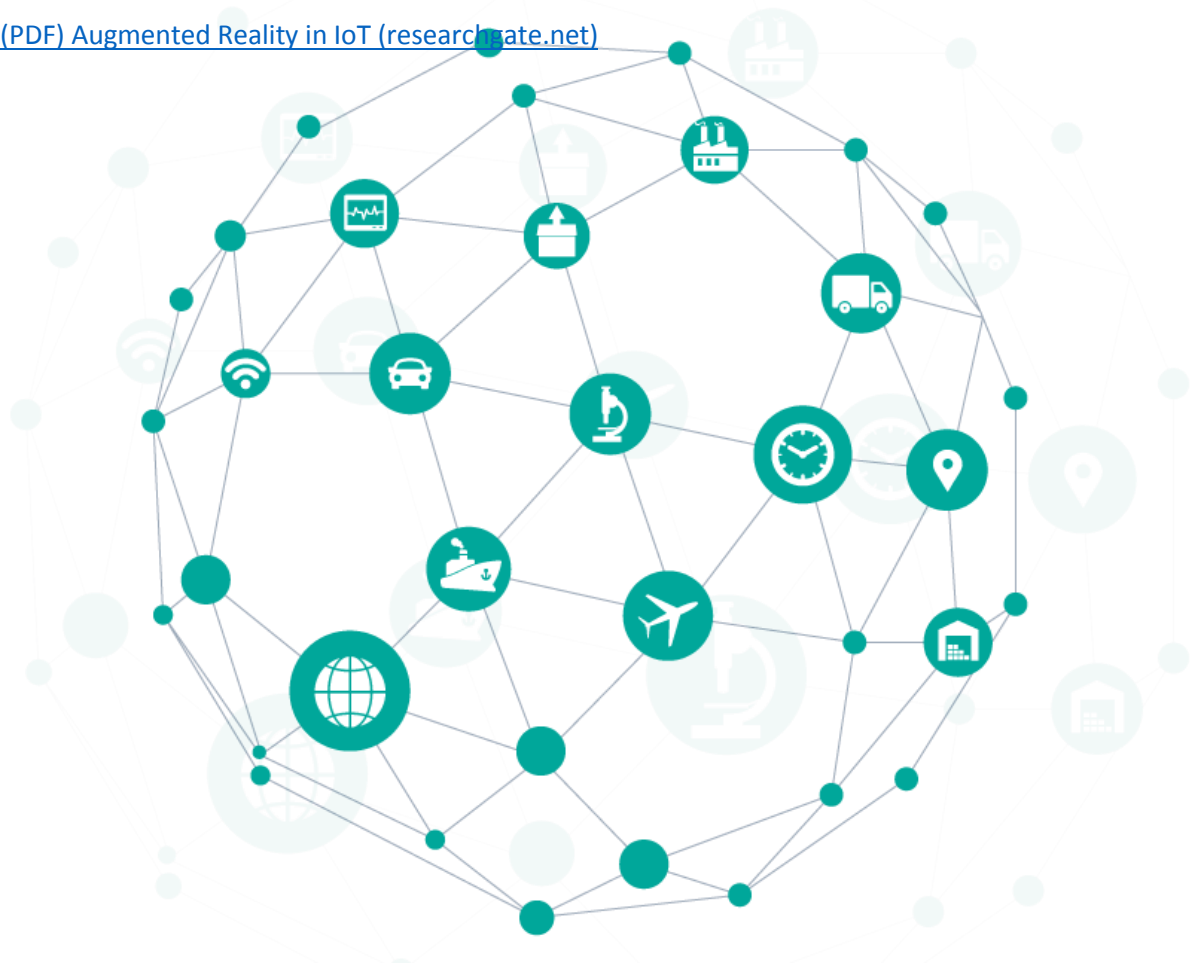
offers the best opportunity to do so. As they quickly move beyond pilots and into practical use cases, IIoT and AR are both proving to be of enormous value to lighthouse adopters. However, the chance to combine the two will bring about a level of value that will transform industrial enterprises and enable seamless communication between the physical and digital worlds.

REFERENCES:

[IIoT and AR: The Where, How, and Why | PTC](#)

[Augmented play: An analysis of augmented reality features in location-based games - Kati Alha, Dale Leorke, Elina Koskinen, Janne Paavilainen, 2023 \(sagepub.com\)](#)

[\(PDF\) Augmented Reality in IoT \(researchgate.net\)](#)



CENTER OF EXCELLENCE IN INTERNET OF THINGS

(COE – IOT)

Dipika (21MCA14)

The Centre of Excellence in near future will be able to enable it as an innovation hub with proper standardization, the realization of prototypes, and provide complete support to the solutions for IoT applications. It will help entrepreneurs by providing ideas, research, and development facilities to build up the Atmnirbhar Bharat.

Mission:

The mission of the CoE-IoT is to enable India as the innovation hub in the emerging technology of the Internet of Things through the democratization of Innovation, Standardization, Realization of prototypes, products before deployment of the IoT devices in the public domain/ infrastructure, and support Government Initiatives on IoT solutions for specific areas like water, energy, agriculture, health, security, and privacy of data.

Objectives of IOT RC

The main objective of the centre is to create innovative applications and domain capability by harnessing the innovative nature of the start-up community and leveraging the experience of corporate players. The other objectives are as follows:

- To create innovative applications and domain capability across verticals for the country's needs such as Smart City, Smart Health, Smart Manufacturing, Smart Agriculture, and others.
- To build industry-capable talent, start-up community, and entrepreneurial ecosystem for IoT.
- To provide an ecosystem for innovation to thrive and embrace entrepreneurship.
- To energize research mind-set and reduce cost in Research and Development by providing neutral and interoperable, multi-technology stack laboratory facilities.
- To reduce import dependency on IoT components and promote indigenization.
- To promote Indianization by providing development facilities to researchers as well as to those who need to develop prototypes using reverse engineering and the required library of equivalent components.

Benefits of Centre of Excellence of IOT

Start-up/Small Medium Enterprise

- Use of Open Technology Stack,
- Access to Industry experts /Consultants
- Showcasing the prototype/project to companies. Access to students to work on projects.

Investors

- Future products for cross-functional business process enhancement in various industry verticals.

Engineering Service providers, Global MNCs

- “Risk-free” demand technology lab on demand proficiency centre for skill up-gradation.
- Access to industry-ready talent, technical experts, and consultants

Academia / Researchers

- Availability of technology lab for faculty/researchers.
- Industry-standard proficiency courses for upgrading skills
- The platform for offering the special course/consulting projects
- Innovative ideas from stack holders, start-up starters, self, etc.
- Access to current research papers related to their work.
- Team of experts helping them to find research solutions.

Industry

- Trained Industry ready students
- Innovative Ideas
- Prototypes for new products.

Students/job seekers

- Internships on IoT projects
- Access to Industry experts/courses/showcase of talent

References:

<https://www.skit.ac.in/research/centers-of-excellence/coe-in-iot.html#:~:text=The%20mission%20of%20the%20CoE,domain%2F%20infrastructure%2C%20and%20support%20Government>

<https://www.robolab.in/center-of-excellence-in-internet-of-things/>

DATA MANAGEMENT AND IOT

Devika K (21MCA13)

Introduction

Billions of things with sensors surround people and their lives. These Internet of Things (IoT) interact with people, homes, factories, workplaces, cities, farms, and vehicles. IoT promises useful information, allowing health issues to be detected sooner, fitness to be monitored, goods to be tracked better and more safely, and food produced more efficiently. However, all these things create a lot of noise by sending large volumes and varieties of information at almost light speed. Managing all this IoT data means developing and executing architectures, policies, practices, and procedures that properly meet the full data lifecycle needs, which poses unique challenges.

Common Problems in IoT Data Management

The three typical Data Management problems:

- **Scalability and Agility:** The sheer size of IoT data traffic and its immediacy makes this Data Management issue most pressing. Given that the number of IoT devices will increase with time, say from 40 to 400 devices, how can an IoT architecture accommodate this? How can IoT be connected, allowing for real-time processing and analysis by people and things, as IoT data has a short shelf life? Once IoT data gets somewhere, how can it be stored, ensuring enough space for new information? How can inputs and outputs flow through sensors, without becoming clogged? Should IoT data need access to non-sensor data (e.g., metadata about users and passwords), then how can the thing gain and understand such information?
- **Security:** Gartner's survey shows that security is a significant challenge for organizations planning and implementing IoT solutions. It estimates that through 2022, half of all security budgets for IoT will go to fault remediation. Preventing unauthorized access has become forefront. Newsweek reported that nearly half of all U.S. firms using IoT have been hit with security breaches, and the costs can be staggering — over 20 million for large firms.
- **Filtering:** How should sensor data be filtered and effectively? What types of data filters should be used for what types of sensors? What about incorrect information recorded by a sensor (e.g. recording a pedestrian as another car)? How can such false data be discarded? How can the IoT's data be checked for quality?

IoT Data Management: Strategies and Solutions

- **Edge Computing:** In edge computing, data is processed near the data source or at the edge of the network, while in a typical cloud environment, data processing happens in a centralized data storage location. By processing and using some data locally, IoT saves storage space for data, processes information faster, and meets security challenges.
- **Data Governance:** Data Governance mitigates security risks by defining access to information. Data Governance describes the authority and control over managing data

assets. Previously, Data Governance described an IT centric service. In the IoT world, Data Governance becomes more essential to every user.

- **Metadata Management:** For IoT data to be useful, metadata plays an essential role. Metadata describes “data in context,” Good metadata cues a device on what information to use at what point and how to use it. Metadata also provides a core for automated systems to do deep learning

IOT Data Management in the Future

While edge computing, Data Governance, and Metadata Management will help firms deal with scalability and agility, security, and usability, this provides only a start.

One-third of IoT solutions will be abandoned before deployment due to lack of Data Management and analytics capabilities adapted for IoT. And also organizations need to modernize in several key areas, including adopting new Data Management technologies and platforms, in addition to creating new Data Governance policies. For IoT to thrive, Data Management must include more modern infrastructures and the technologies to support them.



INTERNET OF THINGS IN SPORTS

Harshitha Patil (21MCA19)

Today's IoT presence in sports it's not just about the game anymore. An increasingly digital world is forcing the sports industry to adapt, and the Internet of Things (IoT) can bridge the gap between the physical world and the digital space.

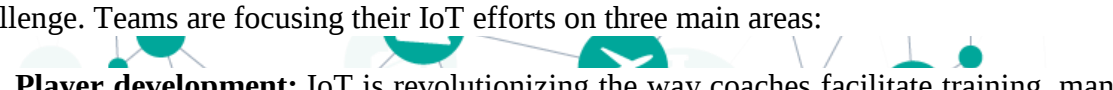
The technology in the sports industry, and it is still among the latest trends. We can witness that in the European Union alone, the number of IoT units in wellness and sports surged to almost 133 million in 2020, up from 68.4 in 2017. The number is projected to reach over 170 million units in 2025.



IoT-enabled devices contribute to professional sports. For football players, there is a dedicated **Catapult Player Smart Football Tracker** that can drastically improve individual and team play. The FIFA authorized device records players' speed, total and sprint distance, and other metrics. Users can also get access to training designed by professional coaches to work on their performance. The technology is also suited to track the full team's progress and contribute to better team play.

Although smart fitness devices can't replace a regular check up or a visit to a specialist, they may still assist consumers in taking care of their physical health and self-training. Hopefully, these examples have inspired you to make the sports and fitness industry even more productive and fun.

Many organizations are utilizing IoT today in specific areas to address a particular need or challenge. Teams are focusing their IoT efforts on three main areas:

- 
1. **Player development:** IoT is revolutionizing the way coaches facilitate training, manage players, and address key situations in each game. Combining advanced analytics with sensors and game video, coaches can easily process vast amounts of data to obtain metrics on player efficiency, player performance, and opponent weaknesses to better develop in-game strategy.
 2. **Player safety:** IoT is shaping the way that sports physicians, physical therapists, and team doctors are reducing injuries and helping players heal faster. Embedded devices such as smart insoles and built-in chips offer real-time tracking that provides a holistic view of the athlete, allowing organizations to make the best decision for their longevity and health.
 3. **Fan engagement:** IoT is being used in smart stadiums, improving digital engagement and ultimately the in-arena experience. The stadium of the future is here, allowing fans to engage with their favourite teams and athletes like never before. Many organizations are investing billions of dollars on new stadiums and stadium improvements to focus on the fan experience to get fans off the couch and into the venue.

REFERENCES

<https://www2.deloitte.com/us/en/pages/consumer-business/articles/internet-of-things-sports-bringing-iot-to-sports-analytics.html>

<https://easternpeak.com/blog/iot-solutions-in-sports-and-fitness/>

<https://one.catapultsports.com/us/>



IoT Based Smart Farming

Steffi P (21MCA41)

INTRODUCTION

Internet of Things Smart technology enables new digital agriculture. Today technology has become a necessity to meet current challenges and several sectors are using the latest technologies to automate their tasks. Advanced agriculture, based on Internet of Things technologies, is envisioned to enable producers and farmers to reduce waste and improve productivity by optimizing the usage of fertilizers to boost the efficiency of plants. It gives better control to the farmers for their livestock, growing crops, cutting costs, and resources. It is a high-tech system to grow crop cleanly and sustainably for the masses. It is the application of modern Information and Communication Technologies in agriculture.

Benefits of Smart Farming

- Automatic adjustment of farming equipment made possible by linking information like crops/weather and equipment to auto-adjust temperature, humidity, etc.
- In large farmland, Internet of Things equipped drone helps to receive the current state of crops and send the live pictures of farmland.
- Analyzing farmland from the land using its Solutions you will know the current situation of fields and crops in.
- **According to studies:**
- 86% of the studied farmers use some kind of "precision farming".
- 95% acknowledged that "precision farming" is very helpful to use.
- 70% plan to expand their usage of "precision farming technologies".

Solutions for Building IoT based Intelligent Farming

Smart Farming has enabled farmers to reduce waste and enhance productivity with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automation of irrigation systems. Further with the help of these sensors, farmers can monitor the field conditions from anywhere. Internet of Things based Advanced Farming is highly efficient when compared with the conventional approach. The applications of intelligent Agriculture solutions not only targets conventional, large farming. With operations, but could also be new levers to uplift other growing or common trends in agricultural like organic farming, family farming (complex or small spaces, particular cattle and/or cultures, preservation of specific or high-quality varieties, etc.), and enhance highly transparent Farming.

Applications of Internet of Things in Smart Farming

In Internet of Things based smart agriculture, a system is formed to monitor the farmland with the help of sensors, which senses components like temperature, light, humidity, soil moisture, etc. Then, automate the irrigation system and allow farmers to monitor their field conditions

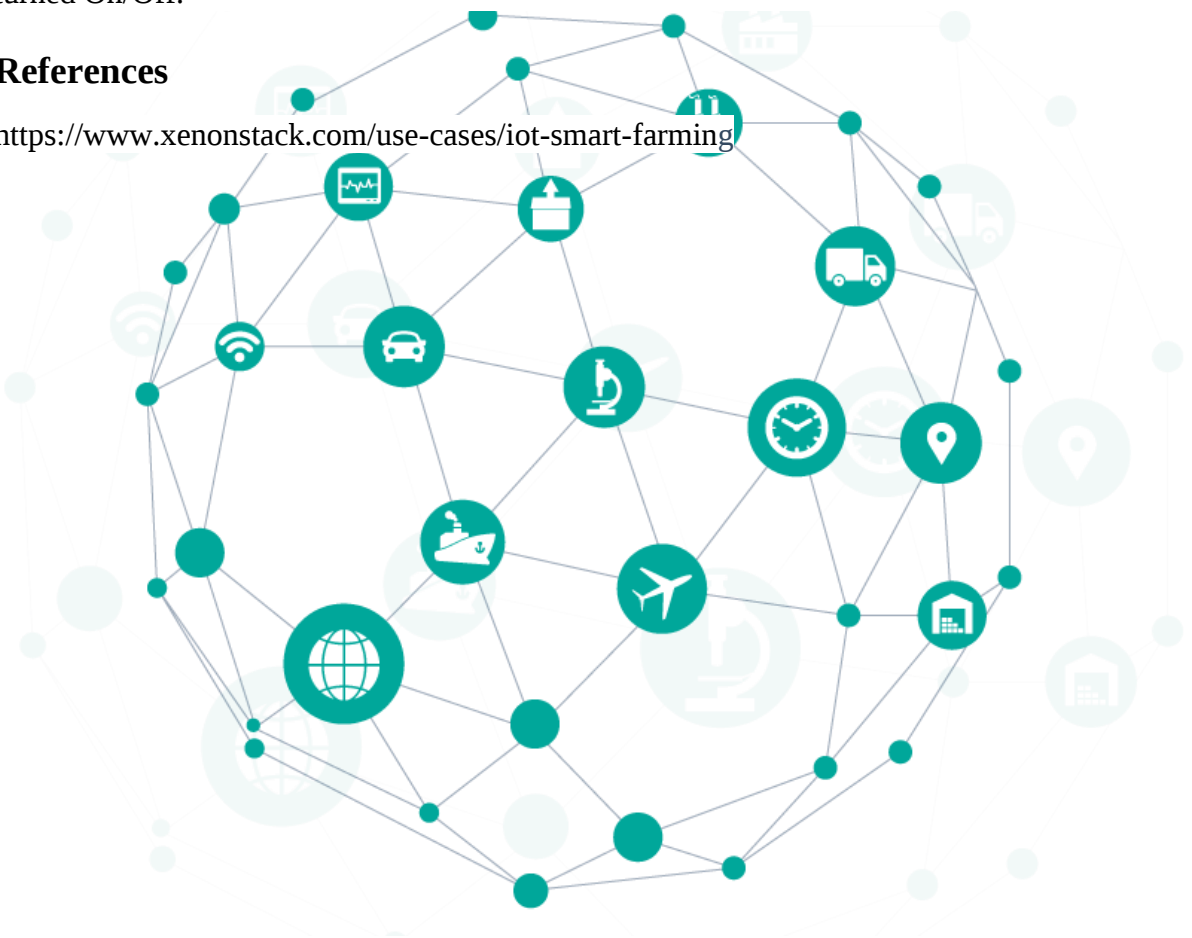
from anywhere through IoT Analytics Platform. To make the agricultural process even smarter and accurate, precision agriculture is used. This makes agricultural practice more controlled and precise in terms of raising livestock and farming. Internet of Things based Advanced Farming plays a vital role when it comes to the use of IT and other elements like sensors, agricultural drones, autonomous vehicles, control systems, automated hardware, robotics, variable speed technology, and others.

Smart Irrigation on Agriculture Land

In smart irrigation, automated sprinkler systems or intelligent pumps are used. Soil moisture sensors are used in different areas to get the moisture of the soil in agricultural land. Based on the results from the soil moisture sensors, the intelligent pumps or intelligent sprinklers are turned On/Off.

References

<https://www.xenonstack.com/use-cases/iot-smart-farming>



IIOT CLIMATE ACTION AS A SERVICE AND THE FUTURE

- Chithra AV (21MCA12)

Climate change is a pressing global issue that requires immediate action. This article discusses three exciting IIOT climate-focused innovations. In recent years, numerous parts of the world have experienced the brutal outcomes of climate change. From wildfires in Australia and California to persistent cyclones in Madagascar, the cost of climate inaction is exerting a heavy toll on economies and communities.

IIOT developers have been broadening horizons beyond smart homes and wearable devices and into solutions that improve sustainability in pollution-prone sectors like manufacturing, energy, transportation, construction, and agriculture. Internet of Things is set to bolster climate action significantly this time.

Three exciting IIOT solutions

- ❖ Smart City Lighting - The Climate Group advocates for all cities to switch to LED lighting for streets and public spaces. According to the NGO, widespread LED adoption could reduce carbon emissions by 1.4 million tons annually.
- ❖ Smart Grids - The smart grid adoption could reduce greenhouse gas emissions by 3.9% over the next eight years. This steadily developing IIOT-powered electricity supply network, which can detect demand and supply fluctuations and adjust output automatically, provides numerous conservation benefits.
- ❖ Renewable Energy - The green energy sector is growing at breath-taking rates. The world's renewable electricity capacity will register a 60% growth between 2020 and 2026, achieving a capacity equivalent to the current output of fossil fuels and nuclear combined.

IIOT Climate Action Sensors as a Service and the Future

IIOT solutions for climate action are expected to do a lot more data collection and analytics than merely monitoring conditions and triggering automated system responses. IIOT will provide actionable insights that improve climate action outcomes across all avenues.

Considering the wealth of IIOT technology already in existence, the world could quickly pivot to a connected and responsive global network that provides all relevant parties with accurate, real-time climate and environmental data. Researchers are proposing a standardized sensor network powered by IIOT, which would support proactive, collaborative efforts toward preserving our planet.

References:

<https://www.iiot2market.com/newsView/iiot-for-climate-change-top-three-exciting-innovations-for-2022>

IOT in Construction Market

Prity Kumari (21MCA30)

Internet of Things (IoT) has permeated virtually every significant industry and aspect of human life. Utilizing new technology in construction tasks such as plastering, bricklaying, and surveying, as well as in construction site management, asset tracking, labor tracking, and risk management, has significantly transformed the construction industry.

The use of internet-connected devices, such as equipment monitoring sensors, smart wearables, building information modeling (BIM) software, RFID tagging & tracking, and others, has decreased resource waste, reduced the number of accidents and fatalities on construction sites, and enabled remote monitoring and data collection, thereby increasing productivity and optimizing financial resources.

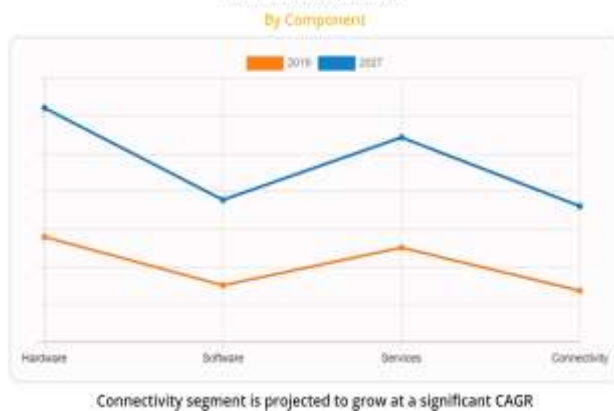
Proper Safety Management on Construction Sites to Drive the Global IoT in Construction Market

Active monitoring of data with (smart glasses, wearble sensors, safety vests, wearable hexoskeletons, smart helmets, etc.) such wearable technologies allow measurement of breathing rate, heart rate, as well as active monitoring of worker's body response to certain work environment. Therefore, the advantages such as microsleep prevention, fall prevention, smart monitoring of hazardous gases, vital sign tracking, and others can boost the demand for IoT based wearables on construction sites, which drives the growth of IoT in construction market.

Risk of Using IoT Applications in Construction Market

However, information technology systems and networks are mainly managed by third party companies related to the business activities. Processing and maintenance of data collected through the IoT connected devices is prone to cyber-attacks, which maybe targeted and coordinated. This compromises the confidentiality and integrity of the data.

In addition, such cyber-attacks not only cause informational damage, but also reputational damage with consumers, which may lead to penalties, government enforcement actions, litigation with third parties, and others. Such vulnerabilities are a major threat for the implementation of IoT especially in construction industry; thereby, restraining the growth of the IoT in construction market.



The global **IoT in construction market** is segmented on the basis of application, end user, component, and region. Based on application, the market is fragmented into machine control, site monitoring, fleet management, wearables, and others. According to end user, it is categorized into residential and non-residential. By component, the market is classified into hardware, software, connectivity, and services.

IoT Benefits and Applications in the Construction Industry

- Safety
- Performance
- Maintenance
- Resource Management and Budgeting
- Concrete Curing
- Structural Health Monitoring
- Waste Management
- BIM Optimization and Digital Twins

The global IoT in construction market size is expected to reach \$19,039.8 million in 2027, from \$8,179.9 million in 2019, growing at a CAGR of 14.0% from 2020 to 2027.

*CGAR – Compound Annual Growth Rate

References:- <https://www.alliedmarketresearch.com/iot-in-construction-market-A07565>

<https://www.indovance.com/knowledge-center/iot-applications-in-the-construction-industry>

