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Based on 5G Internet of Things Technology (Iot), the Integrity of Agricultural Products and the Sustainability of the origin's Ecological Environment

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Abstract

The rise in population worldwide necessitates a change towards smart agricultural methods. This, along with decreasing natural resources, restricted agricultural land availability, and a rise in inclement weather, has led to making the food and essential safety as the critical element for most of the countries around the world. Therefore, it can be regarded that, the internet of things (IoT) is mainly focused in enhancing the overall performance of food production and enable in creating sustainable living. The application of wireless sensors has enabled as the critical aspect in implement the smart agriculture which will provide the ways in using the IoT in an effective manner. The different technologies like cloud computing, RFID (radio frequency) related tools has enabled in enhancing the overall IoT. Several advantages of IoT have been mentioned in this study.

It has been stated that the implementation of new generation of cellular networks and IoT told are likely to become widely available in the coming decades. On a practical basis, this is potentially good from the standpoint of IoT, as many "mainstream" IoT applications will assist in creating sustainable city management, better building efficiencies and campuses. The primary impetus support in creating better mobile connectivity, support in using the critical technologies to enhance the overall productivity and output. To allow 5G cellular technology to accommodate large data rates, the millimeter wave spectrum must be used. Millimeter wave systems, on the other hand, necessitate the use of tiny cells. In overall, a facilitator enables in applying the technologies based on the needs and requirements of the organization to attain the stated purpose.

Keywords: Internet of Things (IOT), Sustainability, Technology, Environment, Agriculture, Applications, Smart cities, 5G

1. Introduction

In an approach to correct the issue of worldwide food demand, agricultural product emigration standards, economic enhance, creating better economy, enhancing the agricultural industries has become more critical and important aspect in the integration of various activities and the new tools like Internet of Things tend to be implemented in agricultural procedures such as farming practices, farmstead analysis, irrigation, and livestock production. As developing nations' farming systems embrace increasingly complex IoT deployments in soil and water quality surveillance, intelligent greenhouses, milk and egg production, precise pest and diseases supervising, and other areas, theimportance of IoT security grows. Essentially, the major goal of IoT is to connect devices, machines, objects, and people via programs that use the web browser and phone apps. Sensors and actuators with distinct attributes and identities often communicate with one another in IoT networks to perform activities such as observation, intelligent placement, surveillance, and tracing. In an IoT network, this dynamic remote control has enabled in evolving the commonly used control system into more sophisticated aspects which will noble in increasing the overall efficiency of the process. Furthermore, the IoT network support in enhancing two-way communication which will reduce the overall security related risk, enable in transmitting the data on a real time basis for making quick decision.

It can be stated that the overall integration of the advanced sensors, enhanced two-way communication and other critical technologies support in making the agricultural operation in a more effective manner, enable in enhancing the production, creating better quality food products. As the second half of the 20th century approaches to a conclusion, we see a growth of urban environments as populations continue supporting the move from rural and some suburb regions into major metropolitan centers, motivated by financial possibilities, population changes, and generational choices. By 2050, cities are anticipated to house 70% of the world's population, and there are currently over 400 cities with populations of one million or even more. People's social mobility is a fundamental human life dynamic and one of the primary factors driving city expansion. However, cities, particularly in the Western world, frequently have outdated infrastructures, such as highways, bridges, tunnels, railway lines, and electricity distribution units. As a result, new technical alternatives are required to maximize the increasingly constrained infrastructure components, particularly inlight of population increase and the availability of necessary capital is critical for the other areas.

A smart city is a city that gathers information through different technological technologies and implementation of key sensors. It has been stated that the creation of such smart cities is mainly based on the ability to use the infraction tools in enhancing the quality of the services that are offered to the public, enable in easier maintenance and support in realizing the sustainability aspects. Moreover, the application of critical 5G network tend to support in creating better connectivity and support in transferring the information at a faster pace. This enables in creating better communication network and address the growth challenges in an effective manner.

2. An Analysis of the implementation of IoT Ecosystem for Agriculture

Inter connectivity in the Internet of Things entails the employment of many technology (devices, smart watches, sensors, controllers, and critical radio frequent tags for exchange of data and support in quicker information processing [1]. The IoT is mainly regarded as the key infrastructure which supports in easier collection of data, process them, analyses for quicker decision making. [2]. IoT sensors, including mechanical, visual, and related sensors are mainly stated as the IoT devices.

They are composed of critical tools and devices that communicate through the sensors and devices via wireless connection. They collect and collect information on environmental factors that influence growth of plants and animal’s output. The communications frequency is an information transfer method for mobile networks that can be licensed or unlicensed. There are numerous wireless communication standards. These are classified as short- range and long-range tools. It has been stated by the researchers that the overall accessibility to the IoT has been made through the critical infrastructure element which is known as internet, this enables in connecting many devices and people, support in using the different network architecture which supports in performing the task in an effective manner. The quiet farmer platform, on farm system, Farm logs, Crop, Easy farm, and KAA [3] are considered as the main systems which are being applied in the agricultural industry. The implementation of these ecosystem support in connecting the critical elements like the IoT devices, communication technologies, data storage and processing in an effective manner. 4].

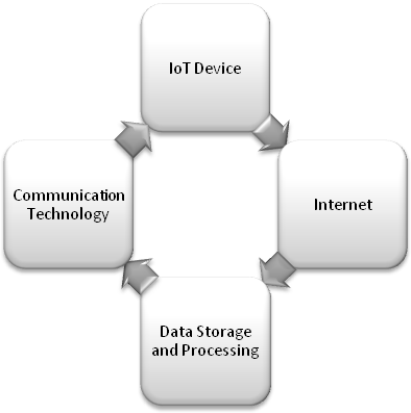

Fig 1. IoT Ecosystem for Agriculture

2.1 oT Devices

IoT devices are made up based on the entrenched technology which enable in enhancing the communication between the devices through wireless network. These gadgets are mainly classified as the IoT sensors. Furthermore, it is mainly stated as the device all through this article [5]. The integrated system ability to be aware of FPGAs or microprocessors, communication modules, storage,and related connectors

. The main aspect of the sensors is focused in monitoring and analyzing various agricultural factors (for instance, soil aspects and weather data) and production parameters. Location sensors, image devices, mechanical sensor systems, electrochemical sensors, and airflow sensor systems are the many types of sensors [6].

2.2 The Internet

The advent of wireless communication networks, smart applications, and resource utilization has prepared the path for widespread internet connectivity. The adoption of smart agricultural equipment is anticipated to increase from 13 million in 2014 and is expected to reach by more than 220 million by early 2024. The internet serves as the main network level, providing pathways for data and network information to be carried and shared between different sub-networks. Information may be accessed anywhere and at any time by connecting IoT devices to the internet [7]. Yet, data transfer through the internet necessitates sufficient security, actual data processing, and simplicity of availability. The internet has clearedthe door for cloud computing, which collects big quantities of information for storage and processing. The application of cloud computing enables in managing the overall user interfaces, support the business and coordinate the entire network in an effective manner, also it enables in analysis and collection of critical data. [8].

2.3 Information Processing

Information related to the critical agriculture entails the collecting of massive amounts of dynamic, complicated, and geographical information that must be stored and processed. The information's complexity might range from organized to unstructured, and it can take the form of text, pictures, audio, or video. The collection of past data, sensory information and other feeds are highly critical for information processing. The implementation of related cloud systems supports in

the storage of huge amounts of information acquired from sensors in the cloud. This involves hosting essential applications for offering services and managing the overall infrastructure. [9].

2.4 Communication Technology

Digital communication is critical to the effective deployment of IoT devices. Existing digital technologies may be divided into three categories: standards, spectrum, and application scenarios. The implementation of the related short-term standards and long-term aspects are mainly focused on the critical communication standards. Table 1 shows that Communication Technology The communication range is broadly categories into the licensed and unlicensed. Sensors, backup networks, and deployment possibilities may all be used in IoT deviceapplication areas [10].

Table 1 Communication Technology

Standard	There are several wireless communication protocols in use today. They are divided intotwo types: short- and long-range aspects. The implementation of the NFC support in addressing the short-term requirements effectively y which is main comprised between 100 meters of range. Whereas the Long-distance communication protocols can span lengths of up to tens of kilometers. The implementation of the (LPWA) are [11] used for long-distance communication.
Spectrum	The critical aspect of the spectrum is that they tend to support the industrial and other related radio frequency which will support in belter networking. The disadvantages of using unlicensed spectrum include security concerns, infrastructure costs, and disturbance. ISM Iot systems create electromagnetic interference, which disrupts radio communications using more similar frequency. A higher degree of security, broader coverage, and lower infrastructure costs. The disadvantage of using licensed spectrum is the expense of transmitting data subscriptions and transmit power usage for IoT devices.
Application Scenario	The implementation of the sophisticated ICT used is mainly determined by the overall implementation of the supportive IoT system. The communications technique is mainly utilized for IoT devices acting as nodesor for backup networks. However, the nodes broadcast extremely little information and traverse very small distances while consuming very little power. The backup network may be utilized over extremely vast distances and enables high data rates. Some communication systems allow for bi-directional links. The unidirectional link enables in analyzing the error detection, support in understanding the data dependability, data encryption, over-the-air software upgrades, and device communication.

3. Merits of implementing IoT in Agriculture

There exist various advantages that may be gained through the application of IoT in agriculture. Table 2 The Advantages of IoT in Agriculture

Table 2 Merits of implementing IoT in Agriculture

Awareness	In the agriculture industry, the implementation of IoT is projected to drive low-cost applications and access to wireless communication services. Mobile applications may be used to get data about markets, pricing, and services. Social programs and regulatory standards for various farm products could also be made easily accessible.
Operational Efficiency	Farmers are not the only ones that benefit from operational efficiency; decision makers in the agricultural industry, such as government and nonprofit organizations, are also affected. Agriculture monitoring data collected via IoT may be used as a reference for agricultural actions. Prevention of disease, veld fire outbreaks, compensation systems, and allocating resources are examples of such initiatives.
Asset Administration	machinery in order to prevent theft, replace things, and perform regular maintenance on schedule.
Controlling safety and preventing theft	In the agriculture industry, the task is not just to assure sufficient output, but also to maintain a safe and healthy food production. Tampering, counterfeiting, and artificial augmentation have all been reported in the context of food fraud [12]. This deception is hazardous to one's health and could have a severe financial consequence. Product consistency, processes dignity, people integrity, and data security are among the forms of food fraud that may be handled using IoT technology. The Internet of Things may be utilized to enable logistical and qualitative food tracking [13].
Cost-cutting and waste-reduction	One of the apparent benefits of IoT is the capability to remotely monitor tools and sensors [14]. When comparison to people manually examining the field using cars or walking, the usage of IoT in agricultural will assist conserve time and money when examining big fields.

4. The 5G

The implementation of the 5G network enable in offering better and enhanced advancements which is poised to alter the overall communication networks, this new technology tends to support the data providers and users in order to unleash the potential of enhancing better network access, use the internet for advantage and also support in effective application of critical tools like IoT and other systems. It has been stated that the MEC is stated to be the key element in collecting and managing the real time information and support in quicker decision processing. The application of the MEC support in enhancing the information tend to analyses the source of the information. The SDN is considered as the supportive concept which enable in designing the network in an effective manner. [15]. When compared with the present network the 5G is stated to allow between 10 to 100 times data speed and support in quicker liking of devices. [16]. Additional information on the technology utilized by 5G is outside the scope of this study. It is anticipated that by 2035, 5G would have generated $12.3 trillion in products and services throughout all sectors, supporting up to 22 million employments in the 5G value chain. 5G provides the groundwork for a productive sector, smart technologies, and new methods of communication.

5. 5G Internet of Things (IoT) Services

Worldwide IoT revenue is anticipated to grow at a 23 percent yearly pace to $1.1 trillion by 2025. As described in the next section, near-term 5G IoT characteristics essentially correspond to NB-IoT and LTE-M abilities. At the end of 2018, there were 83 operational LTE-M and NB-IoT deployments globally. Pure connection, on the other hand, will become more commoditized, making it harder for carriers to compete only on data transfer, decreasing from 9% of total IoT revenues in 2018 to 5% in 2025. Skilled professionals (consulting, systems integration, and systems integration, for example) will grow in importance and account for roughly 25% of the industry by 2025 [17].

6. Vertical Industries and 5G in a smart city

5G and smart cities are at the vanguard of a new generational revolution fueled by a variety of causes such as cultural changes, economic problems, and rising inequality. In this part, we look at the most important industry verticals that will be transformed by 5G technologies in an IoT-based smart city, as well as how 5G will be a key driver of that change. In generally, 5G technology applications in smart cities may be classified as several industry sectors, such as energy, health care, manufacturing, media and entertainment, automobiles, and public transit [18].

Fig 2. 5G in Vertical Industries

6.1 Healthcare

Because of higher life expectancy and the ageing of baby boomers, the demand for services with increasingly complicated healthcare situations has skyrocketed. These variables are projected to cause the majority of the 5 to 6% increase in yearly healthcare costs [19]. Chronic illness treatments account for 80 % of Europe's present healthcare spending. Additionally, these illnesses account for 86 percent of all fatalities, a figure that will only grow as the aging population. As per research, physician, nurse, and other healthcare professional shortages will reach 4.1 million by 2030. To overcome this divide, technologies and other flexible healthcare models will be crucial. 5G might help envision a future with border less medical treatment. 5G will transform the whole digital environment, allowing it to enhance medical research and illness diagnostics. In 2026, the impact of 5G on healthcare is anticipated to generate up to €77 billion in economic production, 51.2 billion in GDP, and 0.4 million employments.

6.2 Manufacturing

Manufacturers throughout the worldwide are under tremendous strain during a period of high instability, owing to shorter product development and market life cycles [20]. With materials becoming more complex and difficult to create, as well as an ageing workforce, manufacturing margins are more constrained than ever. In 2017, the manufacturing business had the greatest rate of damage occurrences of any private or public sector industry, accounting for 18.7 percent. Firms realize

the importance of digital changes in increasing productivity, yet only around 30% of manufacturers have used digital technology. 5G enables the construction of industrial automation that can make use of a variety of other supporting technologies.

6.3 Media and Entertainment

The entertainment business practices will be transformed by 5G. Because of the new 5G network connection speeds, yearly new media revenues will grow by $420 billion in 2028 over the following 10 years. These new business models will be adopted first by media firms. We anticipate that 5G will offer a new tactile layer to media advertising and online gaming in the future. Force that keeps marketing will be changed into animated visuals that will be integrated and adapted to an interactive experience. Eye surveillance, biometrics, and other real-time dynamics will be used to measure a variety of real-time variables. Aside from the obvious benefits of enhanced streaming and downloading, several firms are going beyond the basics to explore how 5G may transform the entertainment industry. Companies are exploring for ways to transmit live performances using augment reality everywhere in the globe and modify them in real-time, for instance, for stage performances. In the entertainment sector, there arenearly too many 5G applications to name.

6.4 Energy

The world's energy generation, transportation, and consumption modes are evolving. Traditionally, a huge centralized power production facility serviced end-user demands. However, as the use of alternative energy sources such as solar, wind, and hydro grows, we are confronted with uncertain tiny power plants. These hundreds of tiny dispersed power plants are starting to transform huge old central power production systems. As a consequence, power generating and distribution networks transition through one to two-way power flow, allowing customers become more power producers.
The goal of 5G is to concentrate on the connectivity and supervision of energy and distant power stations that make energy throughout the value chain's four components: generation, transmission, distribution, and consumption. By managing dispersed energy resources, building sophisticated monitoring systems, and increasing sensor integrations into energy production networks, 5G can enhance energy usage, capital utilization, downtime, and operational costs. 5G's influence on energy sales will increase revenues by 1.3 percent, or €73.6 billion in sales and €25.1 billion in

economic gains. Additionally, when the influence of 5G extends across the production chain, an extra €38.7 billion in GDP will be generated.

7. Conclusion

The widespread usage of the Internet of Things in agriculture has generated privacy and security concerns in the cyber realm. An examination of the Internet of Things (IoT) ecosystems for agricultural is being widely addressed in research, including in-depth assessments of current privacy and security solutions for IoT-based agriculture. In this article, we look at the benefits of IoT in agriculture. We also talk about how 5G innovations are appearing on the industry but aren't yet completely deployed. In addition, we look at the study on 5G Internet of Things (IoT) solutions. As a result, we may anticipate the adoption of numerous 5G applications to improve current services and create new and much more advanced products in the next years. The IoT, Smart Cities, ITS, and 5G based on high bandwidth and ultra-low-latency capabilities are the four primary concepts that will be pushed with 5G technology.

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