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Revolution in IoT with 5G Network

Shubhangi G. Kadus[1], Sagar S. Wabale[2]
[1]*Assistant Professor at SCSMCOE, Ahmednagar, Maharashtra, India*
[2]*Sai Engineering Works, Ahmednagar, Maharashtra, India*

Abstract: Day by day Internet of Things (IoT) is gaining a huge popularity. With increase in popularity the technological advancement is required to fulfil its high data rate demand. The IoT devices will become primary need to next generation. The latest development of devices will build smaller but smart devices in field of IoT. With increase in demand of smart devices IoT architecture will become more complex. The 5G network will fulfil the need to these complex architectures. The 5G networks are expected to massively expand today's IoT that can boost cellular operations, IoT security, and network challenges and drive the Internet future to the edge. This paper will review the revolution in IoT with introduction of 5G network along with its concept, use cases and security concerns.

Keywords: Internet of Things (IoT), 5G network, Latency, Mobile Broadband, IoT Security, Short Waves

I. INTRODUCTION

5G is the fifth-generation technology standard for broadband cellular networks. It is able to offer numerous gigabytes of information speeds with low latency. A 5G network may have high-quality dependability and support greater users than the current era. Moreover, the consumer revel in may be extra steady. All 5G wireless gadgets in a cellular are connected to the net and telephone community with the aid of radio waves through a nearby antenna inside the mobile. Because of the multiplied bandwidth, it is anticipated the networks will increasingly more be used as trendy internet service providers (ISPs) for laptops and computers, competing with current ISPs together with cable net, and also will make new applications viable in Internet-of-Things (IoT) and device-to-machine areas. Three predominant utility regions for the improved talents of 5G. They're Enhanced Mobile Broadband (eMBB), Ultra Reliable Low Latency Communications (URLLC), and Massive Machine Type Communications (mMTC).

"Internet of Things," or "IoT," means to connect different devices to process and exchange data with each other. Without public network it can communicate over the Internet or other communication networks. For example, we can control light bulb connected to Wi-Fi using your smartphone. Due to advancement in multiple technologies like computing, commodity sensors, powerful embedded systems, and machine learning the filed Internet of Things evolved. The applications for IoT devices is divided into infrastructure, consumer, commercial, industrial spaces.

Due to advancement in data speed like gigabits per second, connected devices can coordinate and accomplish task faster. Addition to this, it provides an ultra-low latency network. As per research early 5G deployment showed a latency of 30ms. That will help use IoT devices to do delicate tasks such as surgery. 5G has a high bandwidth, so we can connect more devices to it without experiencing quality loss.

II. THE IOT MARKET AND 5G

Internet of Things technologies drastically changing the landscape of various industries in the era of 5G network as it impacts significantly on data analytics. The global 5G IoT market owes the rise in high-speed network supply by enabling IoT devices to communicate and faster data sharing. This is forecast to fuel the 5G IoT market growth in the upcoming years. With development in wireless technologies the 5G IoT market will grow exponentially during the forecast period [7]. Moreover, the advancement in mobile network offers remunerative opportunities for the expansion of the 5G Internet of Things market analysis. Massive 5G IoT ecosystem and critical communication services is prime factor to driving the market growth.

Thought there is massive chip shortages, the global IoT market grew by 22% in 2021 to reach almost $158 billion. In fact, this figure is expected to rise to $3.2 billion by 2023 and to $525 billion by 2027.The career in IoT-related grew by approximately 41% between July 2021 and March 2022 and expected to rise by 18.5% by 2023. In future 5G will be 10 times faster than current LTE networks, a key point for devices to communicate and share data faster than ever before.

Development in wireless technologies have strong impact on global 5G IoT market trends. The prime barrier for adoption is lack of standardization in IoT protocols, existing 4G LTE technology, this hampers the market growth [19]. The development of smart infrastructure is anticipated to provide remunerative opportunities for expansion of the 5G Internet of Things industry during the forecast period [15].

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III. BENEFITS OF COMBINING IOT AND 5G

There are massive benefits of combining Internet of Things with IoT. Few are listed below.

A. Faster Transmission Speed

The data rate of around more than 20 Gbps will enable remote applications to access files, data, and programs faster.

B. Large Number of Connected Devices

Advancement in 5G network all connected devices will be able to communicate with each other and exchange information

C. Security Enhancement

The devices will optimize processes with enhances security with greater control. This is done in smart phones or industrial facilities.

D. Product Development

Connecting companies to create new products, services, and business processes whether new or improvement in existing for advancement in existing market.

E. Lower Latency

In 5G network response time increase by 4 times than that of 4G network. 5G network also increases the use of sensors lor logistic management or for remote transportation.

F. Social Benefits

5G and IoT will help to enhance the implementation of government policies by enabling greater control of electricity, demand, and supply, or reducing resource waste.

G. Mass Mobile IoT

IoT with 5G will enable mass deployment for efficient and simple devices due to its low cost, energy efficiency, and reliable coverage.

H. Enhanced Broadband

Achieves better records conversation and higher overall performance.

I. Critical Communication

Improves facts predictability and security via presenting a quick reaction for speedy device decision-making

IV. ARCHITECTURE OF 5G IOT

IoT in a 5G framework is five layered architecture. These layers works in data collection, data processing, data analysis and information sharing between the devices and communication network. Let’s describe the layers in short.

A. IoT Sensor Layer

This is physical layer system which includes smart sensors, devices and communicates to the network layer.

B. Network Layer

Network layer in IoT comprises of low power wide area network (LPWAN) like LoRa, ZigBee, NB-IoT etc.

C. Communication Layer:

Communication layer is considered as the backbone of IoT architecture. It plays a role of information transfer within layers.

D. Architecture Layer

Architecture layer is also known as framework of IoT. Architecture likes cloud computing, Big Data Analytics are considered.

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E. Application Layer

Application layer integrates all the devices sensors and information over wireless connectivity using internet. The applications like, smart factories, homes, agriculture, transportation etc. can be realized in this layer.

Low power networks are used to connect IoT sensors to IoT gateway which are used for long distance communication [17]. The collected information from all connected IoT devices is transmitted to 5G stations through 5G communication link. The latest 5G radio technologies with different wave communication technology are used to design 5G communication links [9]. The IoT signals are processed through 5G cellular base station which has multiple inputs multiple output (MIMO). To transfer radio signals in higher frequencies greater than 6 GHz, 5G mm wave communication technologies are useful. This millimeter wave allows larger frequency operation up to 80 GHz which are preferred for communication [1]. It has capability to support maximum number of connected utilities with micro and macro base stations. IoT with 5G radio technology gives rise to many applications. The proposed architecture of 5G IoT is shown in fig 1.

5G is the first cellular community designed from the floor as much as help IoT use instances and could allow new use cases to emerge and improve the performance or exist at a larger scale than present 4G.

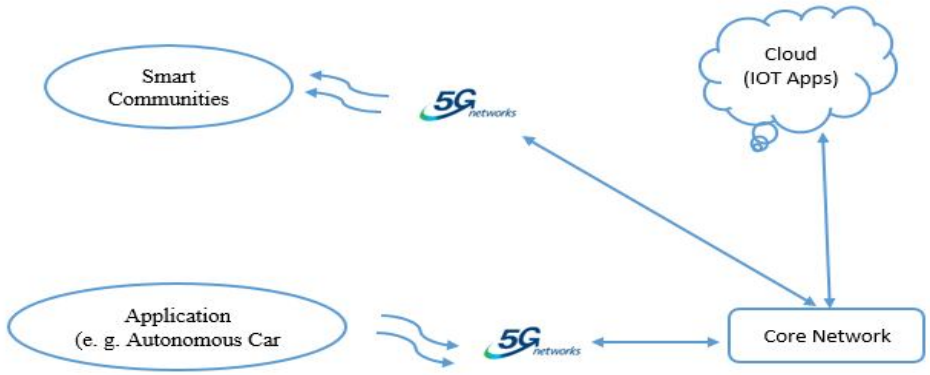


Fig. 1 Architecture of 5G IOT

V. USE CASES OF 5G AND IOT

A. Remote Industrial Maintenance

Mass cell video streaming will enable the restore and protection of complicated machinery remotely. This translates into financial savings in travel and employees charges with the aid of reducing professional travel. Those are positioned in a significant area, to help less skilled personnel, robots or aggregate of both. Speeds of up to 20Gbps will allow far off packages to get admission to documents, facts, and applications faster.

B. Medical Applications

With 5G, medical doctors will be capable of deal with patients in rural regions from afar, even performing surgery remotely.

C. 5G and IOT Security

Vital 5G conversation will enable use instances in which IoT gadgets and machines interact with every other. To make this possible, a very speedy and dependable connection is needed, which 5G brings. It'll supply a fast reaction from the cloud with a decentralized approach and smaller neighbourhood networks that improve protection with the aid of deciding on a private cloud

D. Long Battery Life Devices

5G era permits devices with simpler and greater green hardware that need long battery life. Those devices can ship statistics about their region for months or years, including sensors in smart homes, for asset monitoring, robbery protection, and so on.

E. Autonomous Vehicles

Self-sufficient motors also can gain from this speedy, reliable, and protection-better reaction way to 5G. Vehicles and robots in commercial places could be the primary to emerge, but different aspects including legal responsibility and customer privacy ought to be taken into account [8].

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F. Manufacturing

Here are 5 use case families that represent a distinctive subset of stringent necessities along production and supply chain factory automation – motion manipulate, manage to control, cell robots and so on.

VI. IOT CHALLENGES IN 5G

Industrial work are strongly impacted by 5G network [4]. Before implementing IoT with 5G researcher has to face many challenges. In 5G network tower are need to close because 5G works on short waves. Due to this we need to build more cellular towers for 5G network. But with increase in 5G components and users security risks also increases so we need to implement drastic security measures [3]. We will require more equipment to support high frequency band operation to implement security measures, but this will cost additional. We can reduce these costs by sharing hardware. Due to the some distance-reaching and transformative nature of IoT-primarily based initiatives and their intrinsic complexity, poorly implemented industrial IoT answers would possibly create infrastructural dangers for community carrier vendors. The digital infrastructure creates many interdependent processes that depend upon connectivity [11]. As 5G generation extends the gadgets' mobility with IoT technology, securing statistics is turning into greater inclined than ever before. New antennas will permit a far larger quantity of devices to connect to the identical community node, making them greater vulnerable to assaults. Therefore, proper IoT security practices should require particular authentication strategies and strict get right of entry to management at the gateways to mitigate some threats to the community. In very simple terms, the internet is a combination of networks, which are administered via numerous public and personal organizations and facilitated via a set of internet trade factors. This allotted structure makes the net resilient and sturdy, however the exponential growth in bandwidth requirements and capacity in 5G networks.

VII. CONCLUSIONS

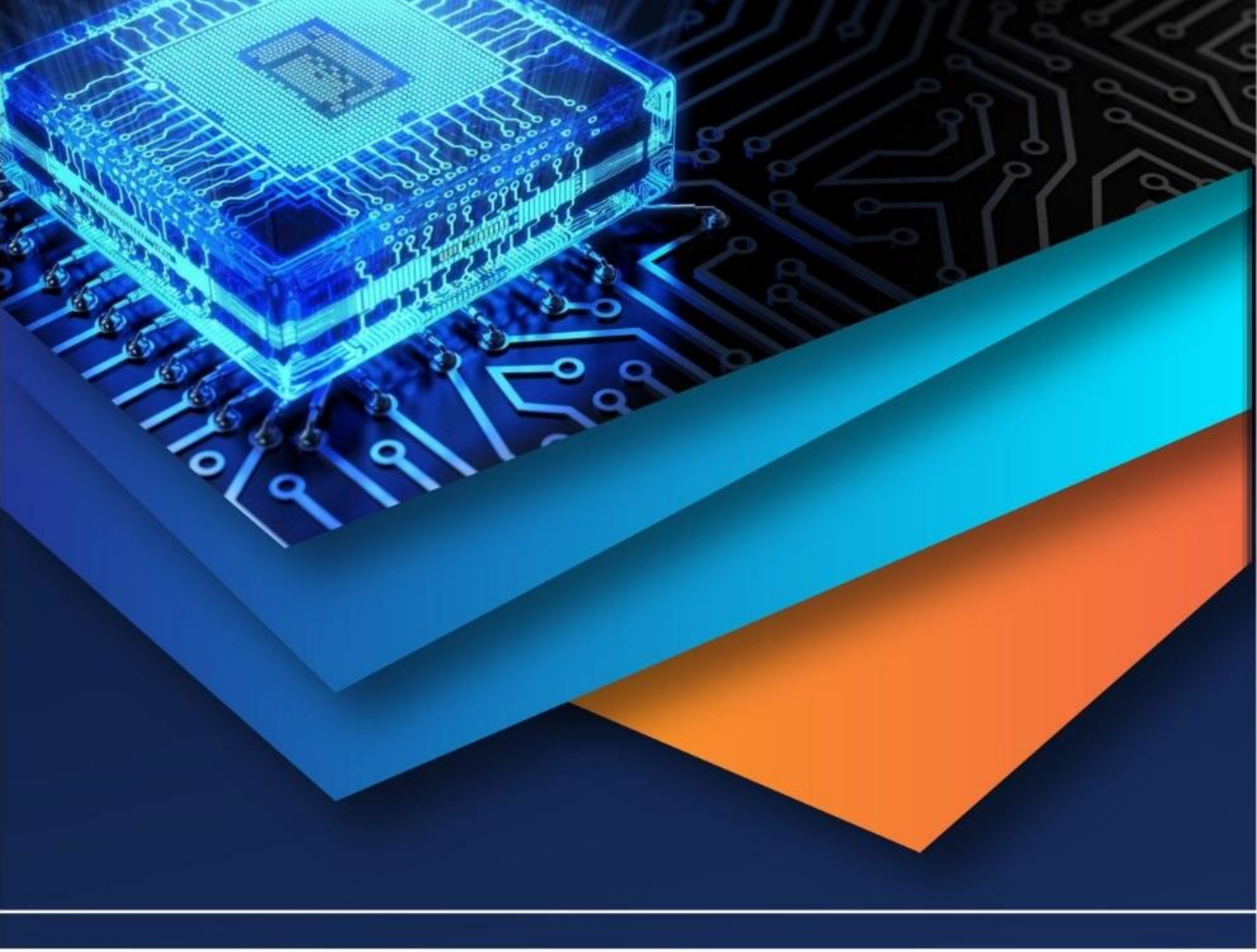
The combination of 5G and IoT makes huge impact on IoT ecosystem which will bring faster speed, lower latency rates and greater reliability, with consistent user experience. It will be capable of connecting billions of devices, nearly all IoT devices will benefit from greater speed including those with industry and healthcare applications. 5G will lead Industry 4.0 to the next level. 5G will also improve IoT data transmission performance. 5GIoT will converge main communications and change-driver for smart IoT devices and services in the future [2]. Also there is even less real 5G MR high speed mobile networking, because most of this 5G network is deployed using the non-standalone setup approach sharing the radio frequency with the 4G network. 5G will assist accelerate the advancement of wise machinery and smart manufacturing. 5G is projected to be 10 times quicker than present LTE networks, in accordance to research. IoT devices would be able to speak as a result of the expanded pace. The IoT network of the 5th generation has the functionality to link 100 billion gadgets and at the side of the use of 5G networks, it'll be the destiny era. For industrial sector the automation of production lines using private 5G IoT networks can improve productivity and reduce cost. That will make commodities cheaper, impacting the economy. Finally, because 5G has a high bandwidth, you can connect more devices to it without experiencing quality loss.

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