CHALLENGES, BENEFITS AND IOT ACTUAL APPLICATIONS IN SMART CITIES

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ABSTRACT

Smart cities have advanced substantially in recent years, greatly increasing their potential. The Internet of Things (IoT) is a network that connects numerous devices and tools without the need for humanoid intervention. As a result, smart (or smarter) cities can be built all over the world. By hosting numerous skills and allowing interactions crossways them, the IOT has hastened the growth of smart city schemes for sustainable living, amplified comfort, and output for residents. The goal of this article is to give a broad overview of the many concepts involved in the Internet of Things and its different applications. The overall design of the IoT environment, as well as the major obstacles faced in the development of the IoT ecosystem, are also discussed. The main goal of this study is to discuss the Challenges, Benefits and IoT Actual Applications in Smart Cities.

Keywords: Smart, City, Internet, world, technology, etc.

1. INTRODUCTION

The growing growth and use of IoTand Internet of all technologies is a key enabler in today's smart city scenery, propelling the smart city example into the big statistics realm. Urban areas are stubbornly growing, and the number of individuals relocating to cities has surged sixfold in the last 20 years. People who live in cities confront more immediate issues such as traffic congestion, waste removal, aquatic supply, and so on. In the urban setting, IoT technology might be used to produce spectacular IoT solutions that deliver value-added digital facilities to the public and businesses. The IoT is being applied to urban areas as part of the creation of smart cities.

Developing IoT projects to develop modern cities benefits the state, the business sector, and inhabitants, and as a result, a number of such projects have already been implemented around Russia. Cities are increasingly competing for the greatest available people and financial resources. IoTtechnology used in urban areas allows for the establishment of "smart cities," which increase budget efficiency, quality of life, and investment attraction of any city. Public utilities, transit, and resident services are the key areas of application for IoT solutions in urban contexts. Many diverse models for implementing these technologies have been observed around the world. Every year, the

number of successful implementations in Russia grows. However, there have been a number of ventures that have failed. Failures are frequently caused by an insufficient estimate of required resources and benefits during the planning phase, the complicated structure of the technology provider market, and ineffective implementation.

2. SMART CITY

A smart city is defined as "one that makes best use of all the interconnected information available today to better understand and govern its operations and optimise the utilisation of limited resources," according to IBM. In instant, smart town usages an info and communication skill framework to shape, deploy, and endorsegrowth plans in order to talk urban challenges and make a linked, technologically allowed, and long-term substructure. **[S. Pellicer, 2013]**. Because greatest of the effort required creating and maintaining a data-driven setting lies outdoor the purview of native governments, the achievement of a smart urban is depending on public-private teamwork. Aside after the skillcastoff by a smart urban, data experts are needed to education the statistics generated by the smart city organizations in order to determine any difficulties and brand improvements.

3. IOT

The IOT is a system that connects a variety of devices, including computers, microchip technology, and a variety of additional software devices, to provide animproved alternative to existing systems and networks.**[L. Atzori, A. Iera, 2010]**. The IoT is a network of animal objects, such as cars, structures, and then even crucial electrical gadgets that we use every day, that are all connected to each other via the internet to gather and share data. These "Things" can self-organize and connect with other "Things" without requiring human interference. There are additional than six Internet-connected devices per person. The IoT concept has the potential to brand the Internet smooth more pervasive and immersive. In addition, by giving easy admittance to and communication with a wide range of campaigns, such as domestic appliances, monitoring, security cameras, sensors, displays, actuators, and cars.The IOT will facilitate the growth of a wide range of requests that take advantage of the massive volume and diversity of data generated by things to deliver extra services to corporations, individuals, and government organisations.

Only a few examples include home automation, mobile healthcare, geriatric support, automotive, smart grids and other IoT applications.Smart and self-configuring substances are merged into a worldwide network base in the IoT system. This will open up new possibilities for the ICT industry, paving the way for a diversity of facilities and applications that can take use of the interconnectedness of physical and virtual worlds.

The IoT is defined as "objects with virtual personalities and identifications in smart spaces that use intelligent interfaces to connect and interact in medical, social, environmental, and user contexts". The IoT's impact on consumers' lives might be regarded one of its most important features.

This difficulty has resulted in a growth in the number of distinct, and often incompatible, programmes aimed at knowingIoTschemes. In addition to technological hurdles, the adoption of the IoT model is hampered by the lack of a generally accepted commercial model that can attract coffers to expand the disposition of these technologies.

4. IOT FOR SMART CITIES

The IoT is at the heart of smart city projects; it is the empowering technology that has allowed for widespread digitalization, resulting in the concept of smart metropolises.

The IOT refers to the widespread connection of objects to the internet, allowing them to send and receive data as well as receive instructions for doing activities. By 2025, it is predicted that additional than 77 billion plans will be associated to the internet, stimulating even more submissiongrowth.

4.1 Smart City Working

In four steps, smart cities leverage a network of connected IoT devices and other technology to improve people's lives and spur economic growth.

The following are the steps to take:

- **Data collection**
- **Data analysis**
- **Communication**
- **Action**

To progress executive, ICT framework takescomposed real-time statistics from connected assets, substances, and machineries. Citizens can tooinvolve and interact by smart urbanbionetworks via mobile plans, connected vehicles, and associated buildings. It is practicable to reduce expenditures, increase sustainability, and rationalizesrudiments such as energy circulation and trash group, as well as decrease traffic mobbing and progresses air excellence, by unitingstrategies with statistics and city substructure. **[Ding, 2011]**

4.2IoT Architectures aimed at Smart Cities

Through the utilisation of cloud services, the Internet of Things integrates data sensing, transmission, besides storage functions.

A typical IoT design, based on technology, consists of five layers, each of which operates on the material from the preceding layer, as exposed in Fig. 1.

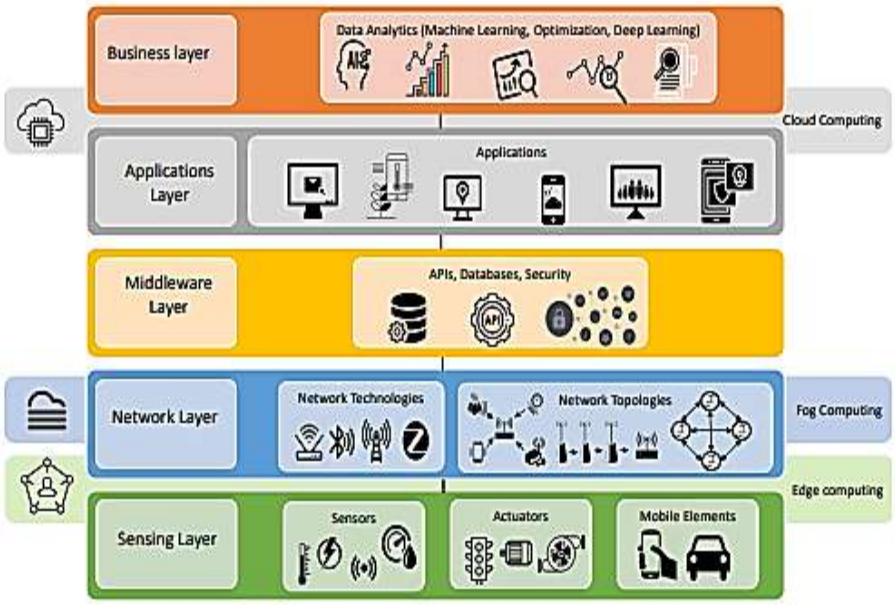

Fig.1: IoT ArchitectureCHALLENGES OF SMART CITY THROUGH IOT

A. Security

One of the most important and pressing concerns for IoT implementation is security. As the number of devices linked to the internet grows, so do the potential and incentives for exploiting vulnerabilities. Securing IoT devices is only possible if the entire IoTbionetwork is protected. To do this, IoT manufacturers must prioritise security as a need since the start of product expansion through deployment. Security testing, tamper-proof hardware, safe software, and safety testing are all part of this package.

The following are examples of mutualIoT security measures:

- **Adding security during the design phase:**IoT device creators should comprise security from the beginning of any IoTmanoeuvregrowth. Security ought to be allowed by default in such devices. It must also be a hard requirement for the creation of such devices to provide software security fixes and use safe hardware.

- **Never hardcode login credentials:** A recommended security solution for developers is to require users to update their credentialsbeforehandletting the device to work. Users must change their credentials on a regular basis using a strong password or biometrics. Most routers come with default login authorisations of "admin," which many users do not update, leaving them open to security breaches.

- **Hardware security:** Making gadgets impenetrable to tampering will be extremely beneficial. The same may be true about making equipment tamper-evident, so that tampering can be quickly discovered. This capability is particularly useful when devices are utilised in severe settings or at remote areas where they cannot be physically monitored.

- **Network security:** There are various ways to safeguard an IoT network, counting port security, no harbour forwarding, then not inaugural ports gratuitously.

- **Consumer education:** Informing customers on the risks associated with IoTorganizations and advising them on how to stay safe.

B. Privacy

When it comes to privacy, the IOT confronts some sole issues. A lot of it goes beyond the most pressing worry now, which is the privacy of user data. This is why consumer schooling is so critical for IoTrequests. When it derives to organized user plans, it becomes even more widespread. Vision and voice recognition features are increasingly included in smart TVs. Such capabilities can keep a constant focus on chats or watch doings while selectively transmitting statistics for post processing, raising privacy concerns. More contemporary examples of comparable technologies include Google Home and Amazon Echo.

C. Standards

In the IoT domain, there is a dearth of documentation and public standard repetitions. This has a significant impact on the IOT, limiting not only the growth of such plans but also it’s potential. The lack of a good standard allows IoT device makers to engage in inappropriate activity. There are no suitable rules and/or laws on manufacturers and their production processes. There are serious repercussions to having improperly arranged devices on a net and the capitals to which they are connected, and this, in turn, reduces people's faith in the internet.

D. Development and Regulation

There are various regulatory considerations regarding the IOT, similar to privacy concerns that require legal and serious deliberation from the public. Technology advances at a far earlier rate than controlling committees can save up with and develop policies for. As a result, governing and regulating committees are less likely to develop rules that persist longer than a few years.

5. BENEFITS OF IOT APPLICATIONS FOR CREATING SMART CITIES

The Internet is used by the IoT and any related material technology to connect numerous devices. In this context, all obtainableplans should be associated to the Internet to enhance accessibility. Figure 2

depicts the most important IoTsubmissions for smart metropolises. The following are the primary objectives:

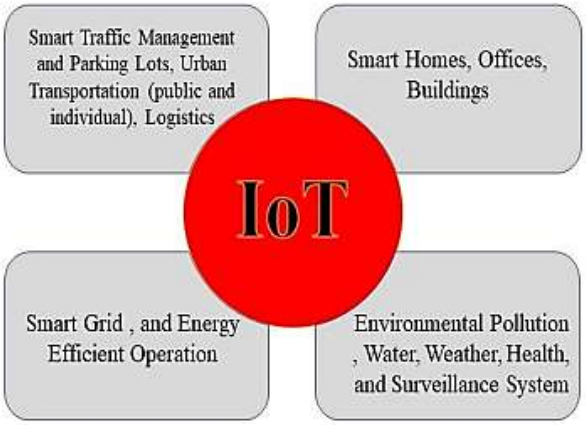

Figure 2: The Main Application of IoT for Smart City

A. **Smart Traffic Management and Parking Lots, Urban Transportation (public and private), Logistics:** Traffic Management data are one of the most important data sources in a typical smart city, and citizens and the government will benefit greatly from managing these data and applying proper analysis. Residents will be able to use traffic management data to plan their arrival time to a destination, and Smart parking lots will be able to track the arrival and departure of various cars for various parking lots throughout the city. As a result, the quantity of cars in each region should be considered in the planning process. Furthermore, where a larger expected number of vehicles is available, new parking lots should be constructed.

B. **Smart Homes, Offices, and Buildings:** Using modern IoT technology to instrument homes and buildings can help reduce resource consumption associated with buildings (electricity, water) while also increasing the happiness of the people who live there. Sensors could keep smart houses under surveillance and control thanks to the data they provide. Smart homes have a particular benefit in terms of applicability, as connected devices can control more functions, freeing up the citizen to conduct other duties.

C. **Smart Grid and Energy-Efficient Operation:** To create an automated and distributed advanced energy delivery network, the smart grid employs new technologies such as intelligent and independent controllers, advanced software for statistics management, and two-way communications amid power utilities and customers.

D. **Pollution, Water, Weather, and Surveillance Systems in the Environment:** We cannot regard a city to be clever if its residents are ill. To avoid this problem, a smart city should monitor

environmental pollution and communicate the results to inhabitants, particularly those with healthcare needs. Realizing the environment and noise data was reported in a different module. Water and weather systems can use a variety of sensors to offer relevant data such as temperature, humidity, wind, rain, speed, and pressure, which can help smart cities run more efficiently. Furthermore, from the perspective of people, security and safety are the most important aspects of a smart city.

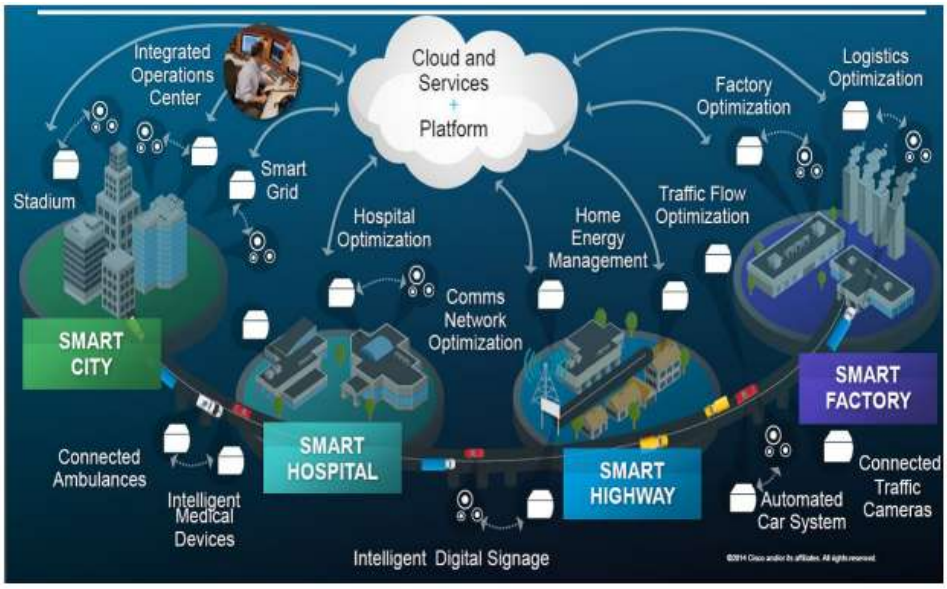

Figure 3: Development of smart cities

6.1 IOT attributes

❖ **A smart traffic-congestion solution**

Because of the expansion of civilisation, traffic congestion is inescapable and irritating in a bustling metropolis. The IoT offers a smart answer to this issue. In this aspect, smart traffic signals are crucial. Sensors will be installed in these smart traffic systems, which will use artificial intelligence structures to make judgments depending on traffic circumstances in real time.

❖ **System for smart Waste Management**

Trash management is a major issue in many modern cities, owing to the high costs of garbage disposal and the difficulty of dumping rubbish in landfills due to the fact that most of the land in the metropolitan zone would be filled by structures. Smart solutions to this problem will have a significant impact on the environment, providing consumers with a cleaner environment in which to live. It's also cost-effective. In order to avoid overflow, the control centre will schedule truck pickups properly. IoT technology can also be used to determine the best route for transporting waste containers in order to save money on garbage transportation.

❖ **Air Quality Monitoring using Artificial smart**

Due to the growth of civilization and increased gas emissions from industry and all types of vehicles, atmospheric conditions continue to deteriorate year after year. According to a recent WHO estimate, 90 percent of the world's population currently breathes filthy air both indoors and outdoors. Because of the constant breathing of filthy air, the majority of people living in metropolitan areas have respiratory ailments. It provides appropriate methods for monitoring air quality in congested regions, parks, and other public spaces.

❖ **System of smart Lighting**

Traditional lighting uses more energy and is more power hungry. Manual lighting is both costly and wasteful. IoT technology can be used in conjunction with sensor-enabled automated processes to reduce power consumption by over 30%. This IoT-enabled automated solution could be a better replacement to traditional street lighting systems. It's the ideal tool for gathering information on what's going on in the facility at any given moment. The luminaire contains sensors that will serve as a network data node.

❖ **Smart Water Management and Supply System**

Water, a valuable resource, is rapidly running out. By 2030, over half of the metropolitan population will be living in water-scarce locations, according to estimates. In order to avoid a predicted water catastrophe, IoT based smart water management digital technologies are necessary. Water flow across several distribution lines is managed by a smart IoT water flow metre. It detects the flow of water via a specific line and adjusts the water supply appropriately, lowering the operational costs of a standard water management system. Municipalities may save money on construction, maintenance, and other expenses by using an IoT smart water management system.

6. IOT ACTUAL APPLICATIONS FOR SMART CITIES

The Internet of Things (IoT) connects disparate devices through the Internet. Every available device should be connected to the Internet in this manner and with the particular objective of encouraging openness. With the goal of achieving this goal in mind, sensors can be installed in various locations to collect and break down data to improve usage.

- ✓ **Smart homes:-**For instance, inventive request reaction (DR) capacities might be improved, or it will be possible to prepare clients if the contamination exceeds its minimal point of confinement by examining the contamination.
- ✓ **Smart parking lots** - The landing and flying of numerous automobiles can be watched for distinct parking places dispersed throughout the city by authorising shrewd stopping. Similarly, in a

bustling metropolis, knowledge about fantastic parking facilities might provide points of interest for both vehicle owners and retailers.

- ✓ **Weather and water systems** - Climate and water frameworks can employ a few sensors to provide relevant data such as temperature, rain, wind speed, and weight, which can help to boost the productivity of metropolitan populations.

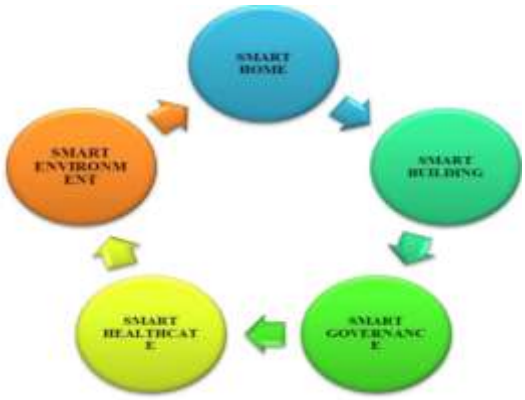

Figure 4: Smart City and its applications

- ✓ **Vehicular movement** - Vehicle movement data are a standout amongst the most vital information sources in a typical intelligent city, where residents and administration can benefit enormously by utilising this data. Residents may also be able to use vehicular mobility data to determine the best time to arrive at a destination.

- ✓ **Natural contamination** - If the citizens of a city are unlikable, it cannot be regarded a brilliant city. A separate programme to handle commotion and ecological data was also described in Reference.

- ✓ **Observation frameworks** -From the standpoint of the locals, security is the most important variable in a smart city. As a result, the entire smart city should be reviewed on a regular basis. Nonetheless, examining the data and discovering infractions is quite difficult.

7. CONCLUSION

With future-enabled internet services, Smart City has increased the quality of urban life. Information and communication technology, which play a vital role in providing numerous services, enable smart cities. In this study, the different uses and obstacles in the implementation of the smart city are examined.We have shed light on intelligent IoT applications that can be implemented in urban areas. Finally, the assumption is that smart city is a bizarreidea that focuses on all of the indispensable services and, if applied carefully, can undoubtedly assist us in finding wiser answers to urban region problems.**[Masud, 2013]**

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