

A Secure Smart City Model using IoT Applications and Communication Networks

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Abstract— In this current era of technological advancement, everything needs to be equipped with the IT tools and the systems. So as is the case with the use of IoT applications as well as the communication networks. For the current research work, these applications are to provide with the secure smart city. If IoT concept is integrated into the modern cities, then things can get difficult in future. It is important to use technology so that infrastructure can be managed with better planning as well as control. There are various key factors, which drive the need for secure smart cities. One of the significant key factors is efficiency. One thing is obvious that IoT is going to be an indispensable element for future smart and secure cities, as technologies related to IoT have great potential to transform and change the daily life of people across the globe. Based on the findings, it is concluded that smart city development is need of the hour. Various issues are being faced by urban areas, in case the population kept on growing at the same pace, then smart city development is the only solution to deal with future problems. However, it was also found out that the implication of IoT applications, in terms of developing smart cities, is not yet common and only the developed world is focusing on it. It is important for big cities all around the world to consider using IoT based applications for smart and secure cities.

Keywords: IT tools, IoT applications, secure smart city, and communication networks

I. INTRODUCTION

The Internet of Things (IoT) is getting more and more space in the modern lifestyle across the globe. It is becoming common with the passage of time from emergency services to industrial applications, public safety, public transportation, as well as the lighting of the cities. There are multiple factors that are playing their role in enhancing the use of IoT in daily life especially in urban settings like urban cities are getting more populated so these cities need more space, smart management as well as better planning to cope with increasing demands. If IoT will not be integrated into the modern cities, then things can get difficult in the future because it is important to use technology so that infrastructure can be managed with better planning as well as control. The smart applications based on IoT will help in so many ways. The smart cities will not only be able to manage operations effectively, but it can also cut various costs by finding pertinent solutions to manage city operations (Hassanien, Elhoseny, Ahmed, & Singh, 2018). In this paper, the literature will be reviewed from different sources to get an idea of secure smart cities which can be developed with the help of IoT applications and communication networks.

II. REVIEW OF LITERATURE

It is important for the world to understand that a growing population is a huge problem, and if things are not managed accordingly, then it would be impossible to handle so much

population in the future. Big cities are getting populated with the passage of time and this growing number is not stopping anywhere. A prediction made by the UN is that the urban population of the world is going to be doubled until 2050. This stat is worrying in so many ways that how the world is going to cope with the double population in urban areas after 31 years from now on because the world is facing so many issues right now to handle the demands and needs of the current population.

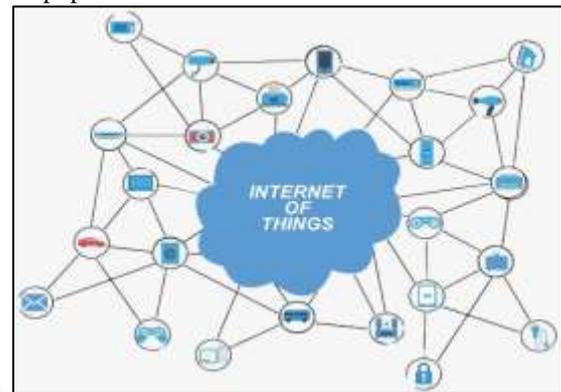


Fig. 1: Fundamental elements of IoT

The big cities around the world are dealing with various issues due to a growing number of people, and they are trying to find smart ways to manage things in an effective and efficient manner (Grizhnevich, 2018). It is vital to look at existing models being used in the different smart cities around the world so that future models can be developed with considerable points to be implemented for the secure smart city (Hassanien, Elhoseny, Ahmed, & Singh, 2018).

III. KEY FACTORS FOR APPLYING IOT IN SECURE SMART CITIES

With the development of smart city with a communication network based on IoT, it is important to find ways to integrate applications, devices, systems, operations with the lifestyle of people. A research study was conducted in 2014 by Goldman Sachs Equity Research Group, which revealed that workplace productivity, personal lifestyle, as well as consumption patterns, will be affected by IoT in so many ways. The group also revealed that internet users during the 90s were just 1 billion, and now it has been estimated that the number of things to be connected until 2020 will be around 28 billion. This shows the huge potential as well as the impact of IoT in daily life, and the way globalization is getting common, this boom in IoT is going to continue with rapid speed (Jankowski, Covelto, Bellini, Ritchie, & Costa, 2014). However, it is important to mention here that research on this topic has not been too extensive in number, rather limited research has been found so far, because this concept is relatively new, and grabbing the attention with the passage of time. However, one thing is obvious that IoT is going to be an indispensable element for future smart and secure cities, as technologies related to IoT have great potential to

transform and change the daily life of people across the globe (Hammi, Khatoun, Zeadally, & Fayad, 2017)

There are various key factors, which drive the need for secure smart cities. One of the key factors is efficiency. For example, taking wires communication systems into context. If there is any wired communication system, which has incurred any technical issue, then the technical team will have to physically visit the place to remove the issue, which means a lot of time, as well as cost, will be required. On the other hand, when a wireless communication system is installed, and it may have any issue, it can be rectified with

remote operations, rather than physically visiting the place. Looking at this aspect, it is evident that a lot of time will be saved, the costs will also be less, and more efficiency can also be achieved (Chakrabarty & Engels, 2016). One great example of a smart application based on IoT is the lighting system of Quebec City. This lighting system is integrated with IoT and the lighting pole is a smart one, which has various connected technologies such as LED lighting, Wi-Fi, Electronic billboards, and surveillance cameras (Locke, 2018).

IV. PROPOSED SECURITY ENABLED SYSTEM FOR IoT APPLICATION

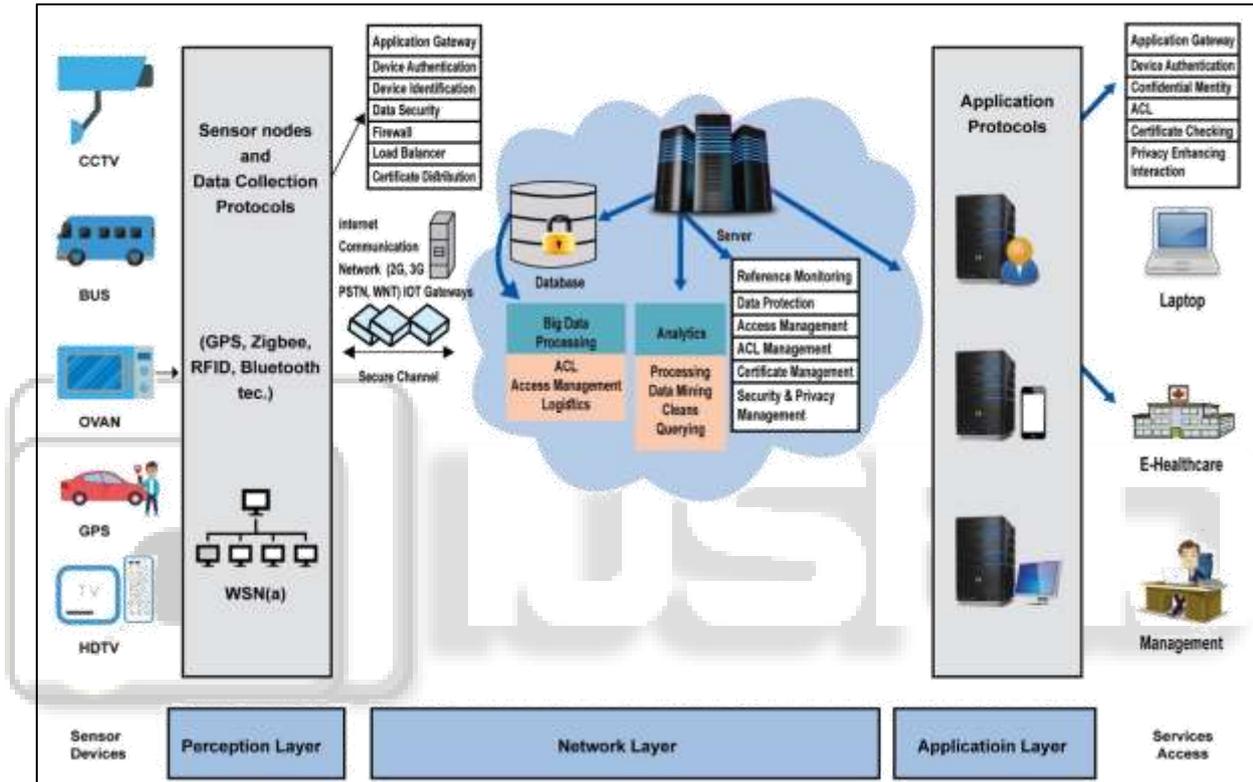


Fig. 2: Security enabled System IoT application

V. UNDERSTANDING THE USE OF IOT APPLICATIONS IN DEVELOPING SECURE SMART CITIES

It is vital to look at some of the examples from the real world of how IoT has been used by different smart cities all around the world. There are various smart cities all around the globe, which are integrating IoT based applications, and connection networks in their operations, and one of such cities are Barcelona (Spain), Songdo (South Korea), and Masdar (UAE). A research study was conducted to analyze IoT being applied in different smart cities. There are various opportunities as well as challenges associated with application of IoT in smart cities, but one has to deal with these challenges so that opportunities are grabbed, and new opportunities are explored. In UK, there is an example of the Bristol city, where city council is coming up with a city service named as SPHERE, and purpose of this project is to monitor the well-being as well as health of citizens. The agenda set by the Bristol city is encouraging even more smart projects and services in the future. One smart App based on IoT is used in the UK with the name “Love Clean Streets”.

The citizens can connect this App with the internet from their smartphones, and report any issue or crime from their neighborhood by using the camera. This is such a convenient and speedy way to report any issue to the concerned authorities (Boulos & Al-Shorbaji, 2014)

The research study to take an overview of the processes adopted by the smart cities looked at the smart initiatives taken by Barcelona city. The city has a joint venture with Cisco company so that both can work together to provide better services to the citizens. They have implemented a system based on IoT in the whole city. An underground fiber network is going to be built with a length of 500 Km, which is going to be great to reduce costs for the future. The bus stops in the city are connected with the fiber network and with the help of this fiber network, proper timetable of buses, digital advertising as well as information of tourists is shown with correct information (Mijac, Androcec, & Picek, 2017). This fiber network gives free Wi-Fi hotspots at the bus stations so that people can connect to the internet. The parking spots in the city are also connected with the Wi-Fi which means that if someone has to find

parking, he/she can use the internet to see available parking in a certain area of the city. A network is installed in the city based on sensors, which are useful in providing real-time information regarding environmental pollution, noise, citizens' flow as well as an influx of traffic. The weather conditions are also known with these sensors. Looking at these smart applications, one can see that if someone is going to any specific area, then he/she can see the flow of people as well as traffic, and if traffic is jammed, then a person can look for the alternative route (Boulos & Al-Shorbaji, 2014).

Another research study was conducted in 2019, where a theoretical overview of the smart city applications and architecture was taken in detail. The urban development is a difficult thing to handle in the most recent times, because the population is growing with the passage of time, and the increasing population is creating so many problems. The researchers analyzed the smart cities with different perspectives, which revealed that IoT is an essential part of the vision of smart cities, which means that smart cities cannot be developed without the essence of IoT. The smart homes are one example of it. Various devices at homes can be connected with IoT such as RFID, sensor devices, GPS, infrared sensors, CCTV cameras, and laser scanners. The sensors can be used through IoT to develop smart transportation in every urban city. The research concluded that there are four major aspects associated with the smart city; data processing, integration of systems, application domain, and technical infrastructure. There are four layers of smart city architecture such as domain application, data acquisition, common data, and data vitalization. These aspects are important to develop a smart city based on IoT applications and connection networks (Karim, Ahamed, Sakib, & Islam, 2019)

The research has identified one more thing that big data is also going to play a crucial role in developing smart cities in the future. The smart devices as well as use of internet are generating so much data on the daily basis, and if smart cities will be developed, then this data can be used to get great insights for a particular area or region. But research arena is very limited in this regard that how this big data will be used as well as integrated with the smart cities applications so that people are provided better services and facilities of life. In real world application of smart application based on IoT, there are various challenges to be faced and considerable strategy is needed to deal with each challenge accordingly. A research study concluded that ICT is going to be important in encouraging the use of IoT in smart cities. It was found out that more research is needed in this regard so that more empirical data is collected from the real world situations, otherwise things cannot be managed properly. The researchers should explore more aspects as much as possible (Lim, Kim, & Magli, 2018)

VI. CONCLUSION

After analyzing different factors as well as aspects through literature associated with IoT applications and connection networks, which are relevant to secure and smart cities; it is concluded that smart city development is need of the hour, because various issues are being faced by urban areas, and if population will grow in this manner, then smart city

development is the only solution to deal with future problems. However, it was also found out that the application of IoT applications in terms of developing smart cities is not yet common and only the developed world is focusing on it. It is important for big cities all around the world to consider using IoT based applications for smart and secure cities so that they can find new ways to manage city operations in an effective and efficient manner. Moreover, it was found out that research on this topic is still very limited so more research is needed to explore more challenges as well as opportunities.

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