Smart Cities – The Future of World

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Abstract: With the flourishing and advancing part of IoT and Cloud Computing, smart cities are becoming an emerging standard, having ubiquitous sensing, high level wireless network infrastructure, consisting of intelligent information processing and control systems. Smart city systems can monitor the real world and real time, and are able to provide smart services and solutions to local residents and travellers in terms of entertainment, healthcare, energy and transportation. But security and privacy concerns are still there as Smart city systems collect a wide range of sensitive data which is directly proportional to the privacy of people. Here in this paper, we have firstly introduced about the key ideas for upcoming enhancements for smart cities and their data management strategies. After that we have discussed many security and privacy challenges while applying for these applications in real world. Mainly, here in we have pointed out some technologies and key ideas which can be researched and implemented in the coming future.

Keywords: M2M (Machine-to-Machine), H2M (Human-to-Machine), D2D (Device-to-Device), GPS (Global Positioning System), Raspberry PI, DOS attack, Mobility, Smartness, DDoS (Distributed Denial-of-Service)

I. INTRODUCTION

There is no universally accepted definition of 'Smart City'. This concept has different perspective and though for every person, city and country. It depends on people of a specific area, their willingness to have and digest a change, level of development possible there. From this we can simply say that level of smart cities in India can't be same as Europe. [1]

But still some definition boundaries are required to define the goals of a project. Following the same approach of Smart City Mission, the objective is to construct such cities which can provide good and easy life to citizens, 'Smart Solutions' to their complex problems. Goal is to implement 'Smartness' in (Economy, People, Mobility, Governance, Living and Environment). [2]

The expected smart cities of future will give its citizens a more convenient and easy life. All of this is because of M2M (Machine-to-Machine) technology. Here in this paper we will discuss the basic key ideas which can be implemented for the smart city project going on. We will also discuss one of the major challenge in the implementation of Smart Cities Project in various countries that is "Security". Along with this, certain

solutions related to security would also be discussed in this paper.

II. KEY IDEAS

A. Smart Tele-Care

Internet-Of-Things (IoT) is a latest computation platform in which things play a fundamental role in the form of digital-based capabilities and gets embedded with other technologies and connects to internet using some particular protocols. This technology will help to promote and innovate technologies to control the real-time medical activities of the under observation patient. [3] This new technology is said to be as IoMT (Internet of Medical Things). This is basically a collection of devices, hardware and software to connect healthcare IT with internet to carry out the required report and other analysis about the patient. These upcoming Medical devices will be equipped with Wi-Fi and will support the M2M communication. [4]

Telecare is basically referred to providing remote care of PWD (Persons with Disabilities) or elderly people; it's like assuring and providing proper care to them for living in their own homes. This Telecare smart city system will provide easy access to worldwide network of Telecare professionals. There won't be any individual need of Medical consultants as there will be automatic monitorization systems that will be monitoring the patients and keeps their Doctor up-to-date with their patient's changing conditions. These systems will give doctor an alert notification in case of any critical change in patient's health such as drastic rise of fall in blood sugar. [5]

B. Smart Traffic management System

The project of Smart cities must implement this idea of traffic management so as to make the travelling and roaming easier. Nowadays, we see traffic as a great issue in most of Metropolitan cities of the world. So there can be a decent way out to avoid the traffic congestion and implement a smart traffic management system. This can have a couple of Motion Sensor so as predict the traffic and control it efficiently. In following point we have explained how traffic management system can be implemented. This system of traffic management and control will coordinate the individual vehicles to get rid of Traffic congestion problems. The motive will be to create an IoT network among the physical vehicles

and exchange their basic status and location data to provide the specific results to prevent the traffic problems. This can be done with the help of electronics, sensors, network and software. All of this technical will change the unpredictable to predictable and under control situation. When everything will be under cyber-physical systems then technologies such as smart grids, smart homes and smart cities will be uniquely identifiable through their embedded computing systems and can be able to interoperate between the internet infrastructures.

For the implementation of these, traffic monitoring Raspberry pi camera systems are preferable for high-end video and still photography for image processing. These systems are easy to be used by the beginners and have plenty of features for advanced and professional level people too.

1) Real Time Scenario

Talking about India, it is second most populous country and World's fastest growing economy. Here in India infrastructure growth of technology is less as compared to the growth of vehicles due to cost and space constraints. The conventional traffic light system of India is based on fixed time allotment of signal but not as varying traffic density of traffic. Most of the time, this approach is not favourable as of increasing vehicles in India. Because of this, people need to wait in front of Traffic Signals more and more resulting in more wastage of fuel and time and increase of stress on people. Here we will propose a system which will be based on Image processing approach. This system can detect the traffic density on each side of square road. The proposed system can detect the vehicles using image processing only, so there won't be any need of sensors for this task required. Thus then image sequence will be analysed using digital image process for vehicle detection and as per norms of traffic conditions, traffic light will be changed.

2) Raspberry Pi 2

On the other hand, another approach for detecting the intensity of traffic Ultrasonic sensors can also be used. The y will send the signals to Raspberry PI 2 according to real-time scenarios to calculate and adjust the time for each side of road. There will be totally different approaches for each type of roads; here road can be a three, four or five sided also. Then according to signals received by Raspberry Pi 2 traffic light changes will be executed.

C. Smart Public Transport System

This system includes the feature of coordinating the public transports although it's already there in case of trains but still has to be implemented for buses also. This can be implemented by interoperatabilty of vehicles using Cloud Technology.

D. Smart Parking

This technology of smart parking can help the drivers to park their respective vehicles without hassles. This can also help in reducing pollution in our environment and can help in less emission of CO_2. According to report CO_2 emission can be decreased to even 400 tons while not wasting time to find a parking area. This is proved to be effective in Metropolitan cities like Barcelona, Birmingham, Braunschweig and Manchester. [6]

E. Smart Street Lights

For the sake of electricity in street lights which is being wasted in high amount daily can be deducted with simple implementations of Smart Street Light systems. These lights will be solely sensor based and gives only according to the requirement of people around it. Means if it has more people around then more intensity will be there. Ambient light sensors can be used to judge the amount of light required and that sensor will also detect that light is even required or not. No need to waste energy if there is nobody on street.

F. Smart Taxi

A Taxi fleet will be connected and customers will be able to book a taxi with an application. The localization system will notify and book the nearest taxi without any personal interaction with the driver. Nowadays, there are some mobile applications already, like "Ola Cabs and Uber". [7] With this smartness of application in smart phones people will also be able to track the booked taxi anytime.

G. Smart CCTV systems

CCTV surveillance systems and panic buttons in public transport like buses and trains should be there. Street lights also need CCTVs after a particular distance on road.

H. Smart Domestic LPG

According to this idea LPG pipes will directly go to houses directly from LPG Companies and people will be charged according to their use on monthly basis. A calculating device will always be there to count the units of gas used by customers just like electricity. This key feature will exclude the people from hassle of picking and plugging cylinders and also will save lots of effort of exporting and importing the cylinder.

I. Smart Energy

This will be really helpful and will act as next step for development of smart cities because for the use of smart sensors and monitoring purpose required energy generation is basic requirement. So this will exploit the deployed sensors, electric vehicle, energy consumption in all aspects, smart grids and so on. This smart energy not only will reduce the power consumption but also it will help in reducing the blackout in the respective areas.

J. Smart Environment

Smart Environment is a thinking and future aspect of smart cities which are thought to provide an ideal environment which can make people's life peaceful and easy. For accomplishment of this many environment monitoring systems are need to set up so as to have proper surveillance on changing climate, gases in environment, noise in city, greenhouse gases, water pollution and forest conditions.[8]

K. Smart Living

Making the city smart tends to create smart, safe and likely smart homes also so as to provide smart living. For this purpose, smart living will offer the intelligent handling, usage, accessibility, security, entertainment, energy saving, education

and climate adjustment within the smart homes. In community or building based smartness, smart applications of parking, waste management, sustainable environment and energy will be there so as make the smart life more reliable and eco-friendly.

III. DATA MANAGEMENT FOR SMART CITIES

Being smart is going to churn out tons of gigabytes of data/ information every day. Nowadays 3G and even LTE are almost gone as upcoming scenario is looking forward for more about Fiber and 5G. Also on the top of that, IoT apps, M2M Technologies- all are increasing and rising at a good rate. From these we can estimate that how rapidly and bulk traffic these things are going to produce. This is big data, which really needs attention. Attention in terms of management, maintenance and security. We have to take H2M, M2M, D2D, low power usage, high output and reliability as granted for these services. Therefore, the smart city data infrastructure needs to be prepared for all these challenges. So, let's discuss what the implementer has to think and do before all this.

Fig. 1. Data generation from different sources in Smart Cities

As a first step, the implementer ("Government") must need to define and make a format of rules and data to set proper standards for the implementation of task. Once the definition of this task is defined then guidelines for standard processes for database need to be set as a mandatory thing to be followed as:

A. Acquiring data

Data is acquired from different resources such as houses, traffic management systems, smart vehicles, smart energy producers etc. in different forms.

B. Validating data

After data acquisition, next step is to validate the data. Data validation is very important task. Validation of data can be done based upon so many factors such as sources of data, trusted network etc.

C. Storing data

After the validation of data next step is to store data at central repository so that Smart Cities project can generate efficient data.

D. Protection

Protection of data stored at a central place is required so that data cannot be breached and it should not be leaked.

E. Processing of this Big Data

Data generated in Smart Cities is considered to be a part of Big Data as it is generated on real time basis and it is huge in volume also. This data needs to be processed by using new technologies such as Hadoop.

F. Deleting

Once data is successfully generated and analyzed for generating results, it now requires to be deleted.

After these primarily rules of database, following things are also need to be considered as basic requirements:

* Taking Backups

* Rules, authority and standards for the user end

* ID and addresses assignment on network layer and on application layer to ensure security

* Requirements of Data-Centre

In addition, some data utilities for managing big data can be provided to integrate big data as the resolution of this big-data can be very helpful for the going and upcoming urban issues and problems. For this primary purpose of integration of this big data some special data integration tools are also required. Alternatively, we can say that the tools which can integrate the different data in one single format so as to perform same kind operations on whole data at the same time.

However, increasing the techniques for big data acts as a challenge also; as the process of implementing the environment to support large volumes of data. One of the possible solution is to design a customized environment for the management of this big data which is capable of letting the developer know that what are the necessary tools required to join different data.[9]

IV. SECURITY AS MAJOR CHALLENGE FOR SMART CITY

As we get advanced in communication technologies this primarily results in low cost of devices, services given by them and their computing power. These things has basically set the stage for the IoT to transform today's urban cities to smart cities which can harness the power of technology to create an efficient and improved quality of life.

Still there are some concerns that need to be addressed at the first place to ensure the harmony of future technology as smart city is deployed. These concerned things are: Cost of Device, life span of devices and the biggest one is interoperatability. In an interview, Petros Mouchtaris, head of Vencore Labs, explained about this thing. He explained that in most of the cases a low cost device of having a small memory has the rudimentary features of security in it only, which are easily patchable at once. But still things are not that hopeless as with the standardization of protocols for each module of smart cities required goal can be achieved.

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A. Insecure Products and Insufficient Testing

While using the products for smart cities, biggest concern of people and government is regarding the products used for these smart projects. There are high chances of this smart equipment to be hacked or even fed fake data by some attacker to use for his personal benefit. This data or control over these public devices may lead to disturbance in the cities instead of making the environment peaceful. These smart city devices used in public and industrial areas become highly attractive targets for the criminals, attackers. Attacks like spoofing, malicious data injection, DDoS (Distributed Denial-of-Service), and many more can come as a complication for proper management, operation and control for smart city. By this data attacker can easily fool the security of cities to execute their mischievous tasks with ease.

There are high chances of happening misuse of these smart sensors because most of the software and hardware product companies basically concentrate on making and executing the desired product and supportive software for controlling that product with mentality of giving service to client. They don't give much attention for the security of that product. That product can be a CCTV camera, Motion sensor or anything. Most of them don't try to explore the vulnerabilities of their system. [10]

B. Privacy Breach of Leaks in Data Sensing

Data of smart city is way more vulnerable than normal data, since private information here is collected, processed and then transferred. This data can be related to user's health, location, home and even from their internal privacy-sensitive lifestyle also. This would be a major drawback of smart city if anyone gets unauthorized access to all these data. For the sake of privacy of these things some layers of security can be applied to the sensing systems. These layers can be of encryption, anonymity and even access control. To handle privacy of user there would be some basic ideas to resolve the privacy of identity, location, footprint and query by user. [11]

C. Privacy in Data Storage and Processing

Along with advantage of effective data storage and processing on cloud servers, smart city faces the threat of data breach at cloud servers at the same time. These things come in picture when data is stored at untrusted servers. From this thing we can conclude that if we keep that data in clear form means without security measure then it can be accessed easily by attackers. One of the alternative ways is to encrypt that data and upload data in encrypted form to the servers. This way the cloud servers can have access of data but that is useless in case if it's encrypted. [12]

Other challenge to this smart city is in Traffic Management System. Let us take that at traffic signal and while going on road also data will be collected with the help of GPS systems or the cameras deployed at traffic signals. This location based data is difficult to preserve. Nowadays also it's a difficult and time taking task to define the access policies for this kind of data for the respective sharing among the collaborators.

V. SOLUTIONS TO SECURITY PROBLEMS

A. Soft Security Layer

Another approach which can be implemented is the concept of using a security functionality which is outside of IoT devices which can have a separate soft layer of devices. This can be firewall, encryption like thing. There can be a separate infrastructure which is connected to all IoT devices which can provide them this security layer feature. Data at IoT device will be collected and stored in encrypted form. Then data from IoT device will be firstly sent to this security layer where it will be decrypted for use.

Benefit of using this separate security layer is that even if in case the IoT device is compromised data won't be breached or accessed by the attacker since data in IoT device will be present in device as encrypted or raw form only. This will not only help in saving data only this will keep the security of smart city a secret also because if the IoT device gets compromised and security measures are running on that device itself, then all the security measures are going to be compromised as the attacker will get to know the whole security module which is being implemented in all the devices. [13]

B. Increased Reliability Standards

In a smart city, data flows in form of two-way control systems and sensors which act smartly (actuators). The feedback and control systems in the physical world, especially related to industrialization and public data is highly attractive target for criminals and terrorists [14].

Some serious kinds of attacks like DDoS(Distributed Denial of Service), Sniffing, spoofing, data injections, and so on attacks can easily crash and disrupt the management, control, and operations of smart city. But most of these high level attacks can be easily detected by the third party inspections and scans.

For the removal of demerits of above attacks smart city contractor can join hands with third party security solution organizations which can provide solutions like digital signatures, access control, and data integrity and so on [15]. At the same time, trusted computing is a state of art to resist unwanted and out of access changes in the given Operating System and software frameworks. However, dependability of control is considered to be the highest priority for the smart cities. At the same time detecting the misbehaviour of system and malicious attacks over the systems make it challenging to maintain everything, which requires collaboration of the multiple firms to achieve the goal of better smart cities.

VI. CONCLUSION

In this research paper, we have explored some key ideas which can be implemented to make Smart Cities in order to ease the life of local residents and travellers in terms of Health Care, Transportation, Communication and Networking. In addition, we have also discussed Data Management steps and points which need to be followed to maintain the Big Data of this smart city. Hereby we have also discussed about the security and privacy concerns of the people using this smart architecture. Basic solutions for the problems of security are

discussed here. Several open research directions are also discussed.

VII. ACKNOWLEDGEMENT

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