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Internet of Things for Innovative, Improved and Effective Smart Transport Management System in Smart City

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ABSTRACT: With advancement of automation technology, life is getting simpler and easier in all aspects. In today's world automatic systems are being preferred over manual system. With the rapid increase in the number of users of internet over the past decade has made internet a part and parcel of life, and Internet of Things is the latest and emerging internet technology. The Internet of Things is defined as a pattern in which objects equipped with sensors, actuators, and processors communicate with each other to serve a meaningful purpose. Last few decades the traffic management is the vital issues in big cities. With the help of Internet of Things we can improve the traffic efficiency. In this paper we have discussed Internet of Things and its domain particularly being used in parking, traffic, highways and in emergency services. We can use them collaboratively to achieve complex tasks that require a high degree of intelligence.

KEYWORDS: Internet of Things, Smart Transport, Connected Highways, Traffic, Parking, Emergency Services.

I. INTRODUCTION

The term "The Internet of Things" was coined by Kevin Ashton in a presentation to Proctor & Gamble in 1999. Internet of Things (IoT) is an interaction between the physical and digital worlds. The digital world interacts with the physical world using a plethora of sensors and actuators. We can also understand Internet of Things as a paradigm in which computing and networking capabilities are embedded in any kind of conceivable object. We use these capabilities to query the state of the object and to change its state if possible. In common parlance, the Internet of Things refers to a new kind of world where almost all the devices and appliances that we use are connected to a network. We can use them collaboratively to achieve complex tasks that require a high degree of intelligence.

The goal of Internet of Things is to create a better world for the human beings. The major objectives for Internet of Things are the creation of smart environment based on self-aware thing for new and innovative things.

II. IoT APPLICATION DOMAINS

A number of application domains are particularly amenable to improved productivity through the deployment of IoT technology. This includes many different systems, like, Internet connected cars, wearable devices including health and fitness monitoring devices, watches, and even human implanted devices, smart meters and smart objects, home automation systems and lighting controls, smart phones that are increasingly being used to measure the world around them and wireless sensor networks that measure weather, flood defenses, tides and many more.

The below diagram gives the overview of major application domains of IoT. Some of the domain includes Healthcare, Transportation, Industry, School, Market, Agriculture, Vehicles and Smart Homes.

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Figure 1: Application Domains of IoT

Factory and plant automation applications are often grouped under the heading of Industrial Internet of Things. The networking of biomedical instruments and databases in hospitals has the potential to dramatically improve the quantity and availability of diagnostic and treatment decisions. It also has substantial implications for rural and remote clinics, providing ready access to specialist opinions. Extending medical instrumentation to the home has improved quality of life and reduced hospital readmissions. The last two decades have seen a surge in the use of electronics in automobiles, based on dozens of networked microprocessors. There also exists communication between vehicles, and between vehicles and infrastructure. Transport and Logistics are already heavy users of RFID tags for the tracking of shipments, pallets and even individual items. Here the key driver is low cost, as well as orderly communication to hundreds or thousands of tags simultaneously. IoT technology is having major impacts on a very broad range of industries including entertainment, dining, public transport, sport and fitness, telecommunications, manufacturing, hotels, education, environmental science, robotics, and retail. In many of these industries, IoT is becoming a key enabler of innovation and success, and industries are willing to invest in new technologies.

III. ARCHITECTURE OF IOT

The technology architecture must be capable of handling millions of devices and sensors; thousands of servers; multidimensional transmission, processing, and streaming of Big Data and more. More important, the infrastructure needs to process the data, capture the insights, and take a decision at the edge of the network without the need to transport a large amount of data to a data center and then bring the decision back to the edge.

Below diagram represents the Simplified IoT architecture with software component, hardware component and a middleware which acts as an interface between the two components. Software component consists of Applications, Decision Support Tools and Big Data Stores. Hardware component consist of Network and Telecommunications Equipment and Connected Devices.

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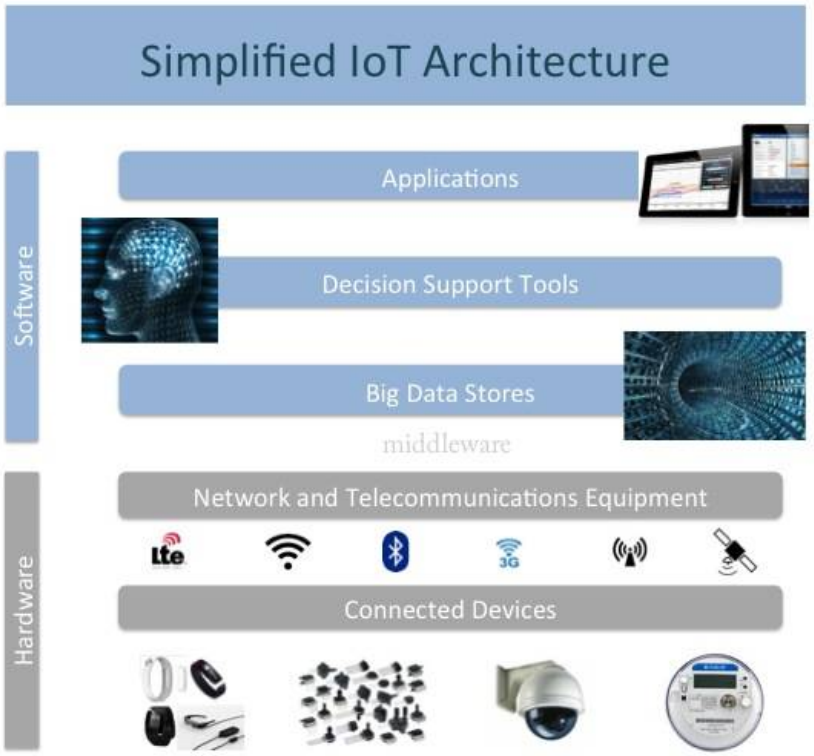

Figure 2: IoT Architecture

The efficiency of a technical architecture will be determined by how well it:
• Interconnects people, machines, and sensors
• Securely collects real-time and context-aware data from multiple sources
• Stores data from devices, people, and applications so that it can scale to accommodate growing volume
• Organizes data by using semantic links to identify and send it to relevant users according to individual access rights
• Analyzes data by interpreting and correlating patterns of use, such as sales trends, that may allow for monetization opportunities in the future.
• Shares information with end users and publishes linked data based on semantics.
• Enables an open ecosystem for innovation to develop new services

An IoT application if built considering these architectural details will be an effective one.

IV. IoT And Smart Transport

A. *The IoT and connected highways*

Vehicles are getting more "intelligent" technology every year. This technology will let vehicles communicate interactively and share critical information.. When the traffic ahead slows dramatically, the vehicles in front will signal and alert for the dramatic change in speed. Vehicles may soon alert us to approaching fire trucks, traffic congestion or even potholes. Through smart phones, IoT-connected vehicles may communicate maintenance issues like tire pressure, fuel level or the need for new antifreeze, before these become serious problems.

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Vehicles in the IoT just not only connect to other vehicles but traffic lights, cross walks and even the road itself could provide real-time information to make our trip safer and more efficient. There are benefits besides safety. With the IoT in place, in-vehicle navigation data would be more accurate with near real-time updates. Connected vehicles could share fuel efficiency data so drivers could get more miles per gallon by selecting the right routes This kind of connectivity also enables Internet browsing; passengers can start shopping before they hit the store or entertain themselves during a longer ride. Automotive manufacturers and technology companies are now testing this type of connectivity. The prediction is that by 2020 about one in five vehicles worldwide are connected vehicles on the road.

A connected highway could also keep in touch with local governments. Maintenance crews could be alerted to potholes or icy patches when a connected vehicle detects them. One result of such a connected highway with connected vehicles is fewer fender-benders.

B. *IoT AND TRAFFIC*

Last few decades number of vehicles are increasing in the same manner as growth of population. This causes major traffic congestion, noise, pollution and increased travelling time. With the help of IoT we can improve the traffic issues and manage traffic smartly.

Traffic can be managed smartly by collecting and verifying the vehicle at the traffic junction, for eg. amount of vehicle on the road. Then, it transmits the data to the adjacent traffic lights to support traffic control decision and can even trace criminal or illegal vehicles such as stolen cars or vehicles lying at the accident site etc. in a more efficient way. Continuous data with respect to the toll naka can be received and one can pick paying it online instead of waiting in the queue for their turn.

C. *IoT AND PARKING*

Parking lots have largely been ignored when it comes to technological innovations and ideas. Normal parking is inefficient, frustrating and time-consuming. Driving around after arriving at a mall or a multiplex is annoying, while searching for a spot in a hospital lot is nerve-wracking. However, with the increasing number of cars on the street, along with the time taken to park them, the problem can be effectively addressed with smart parking.

By enabling smart parking, arriving and departing times of different cars are traced all over the city. Thus, these parking lots have to be planned in such a way to take a number of vehicles in every region into account. Further, new parking lots have to be set up where there are more cars. Accordingly, the data of smart parking lots are able to provide profits for both customers and merchants' daily lives in the smart cities. Based on the road sensors and intelligent displays, the drivers are directed to the best path for parking in the city. Some benefits of these kinds of service are finding a parking lot faster, which means fewer CO emissions from the cars, lesser traffic congestion, and happier citizens. This service can be integrated into urban IoT infrastructures. Moreover, by short-range communication technologies like RFID and NFC, it is possible to realize an electronic verification of parking permits and allow for offering better services to citizens.

D. *IOT AND EMERGENCY SERVICES*

In the public safety industry, the concepts of digital transformation have the potential to become very beneficial in terms of crisis and emergency incident management. On the other hand, public safety and emergency service were much focused on reliability, stability and availability of the services they provide to protect the citizens.

We can see clear benefits of smart technology in Emergency Services. IoT enables access to data from building, real-time temperatures in a fire or even indoor location of teams. We can even monitor the environment to mitigate the impact of disasters such as floods or earthquakes. We have better situation awareness, or improve our leadership when coordinating teams in incidents. IoT will give us the ability to achieve it in a greater way than before. The most crucial thing in emergency services is to get the agencies connected, working connected and saving lives connected. IoT technologies play an important role in supporting police, fire and ambulance first responders and their associated back office operations.

In medical and paramedic situations, there are many uses of telemetry techniques to monitor a patient's life signs and use these to provide remote specialist advice and inform the accident and emergency teams before the patient's arrival, controlling traffic lights to get emergency services to an incident fast. Some additional situational information

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such as on-site photographs is also sent so that the first responders know about the whole scenario and the degree of medical help that is required.

V. CHALLENGES FACED IN IMPLEMENTATION

With the ever increasing vehicles on road, the transportation industry faces the unprecedented challenges. Transportation industry can't meet the rapid growth of data both in volume and variety. The data have rich sources, diverse types, and new sets of data are produced continually. Dynamic data generated by various sensors are of huge volumes. The data are generated by GPS vehicle location tracking system and other search equipments yearly have raised over the threshold level. The amount of data generated by a city per month has exceeded TB (terabyte) level, are developing from PB (Petabyte) to EB (Exabyte) levels. A massive data storage space and equipment is required and it must have fault tolerance and stability. The conventional data processing systems are faced with the lack of efficiency and accuracy. The information management system using traditional data processing technology can't meet the rapid growth of data and hence collapses and failures may occur.

Data acquisition is at different depths in different areas, and without uniform standards. The data in most information system is scattered in grassroots enterprises, the functional department just collects the report and ledger on a fixed time period and they do not achieve connections and data synchronization between systems.

VI. CONCLUSION

Smart parking facilities and traffic management systems have always been at the core of constructing smart cities. Smart city by urban IoT require more powerful communication infrastructure to provide more information. The vehicular traffic information is a substantial source of data in smart cities whereby utilizing the data and employing a proper analysis, residents and the government will profit significantly. Residents can utilize the vehicular traffic information to define the arrival times at their destinations and plan accordingly. Traffic monitoring is conducted by sensing capabilities, GPS installed on modern vehicles and a mixture of air quality sensor and acoustic sensors along the given road. This information is essential for authorities and citizens to discipline traffic. EPC, RFID, GPS, GPRS, Internet, WSN etc. are useful technologies for the smart traffic management system and is used to resolve complex errands which require a high degree of intelligence.

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