Application software using IoT sensors for vehicles parking

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***Abstract :** In the modern scenario parking and traffic jams in metropolitan cities have become a common problem, the number of vehicles being seen on city roads have increased to a large extent and because of this it has become more problematic for the vehicle users as they are not able to park their vehicles due to the limited spaces. The cost for parking expansion is usually prohibitive or extremely high. There is a need of an application based solution that uses IOT sensors, IOT data integration and GPS to guide the people for the best available parking spot. At the same time the application should flag an alarm to security personals when there is disobedience of parking rules in the metropolitan cities. In this paper we propose the system of technologies which can be used to solve the above stated problem by making the application system automated, easier and faster in the coming future. Use of RFID technology, Ultrasound sensors, Raspberry Pi, CoAP, NFC can be done avoid the human interaction which minimizes the cost.*

Keywords - *Internet of Things, Near Field Communication (NFC), RFID, Smart Parking, Wireless sensors.*

I. INTRODUCTION

Internet of Things is a technology which connects variety of things that has the ability to communicate. It refers to wireless network among the objects. It is usually the network which will be wireless and self configuring in nature, such as household appliances. It provide the way to connect huge number of electrical, electronic and digital devices together using specific IoT sensors which can perform certain actions with the help of actuators which in turn are connected to the cloud.

Internet of Things (IoT) is presently a hot technology worldwide. People from different aspects of research, implementation, and business are involved in IoT. It cuts across different application domain verticals ranging from civilian to defense sectors. In the twenty first century it is possible to visualize eloquent connectivity, storage, and computation which in turn give rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring, emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Thus, it is significant to learn the basics and fundamentals of this growing technology [5].
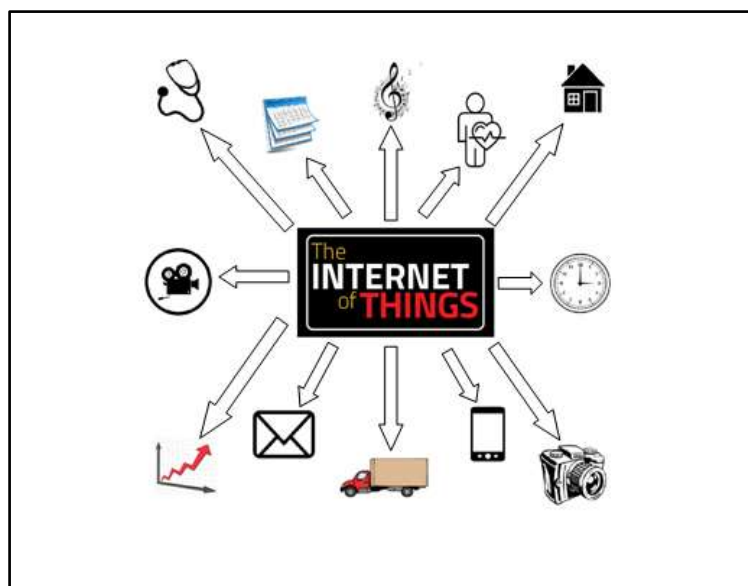

Fig.1. IoT, a mode of connecting things[9].

II. ISSUES RELATED TO PARKING

We are in world of growing population where people migrate from the rural to urban areas which leads to increase in the number of vehicles used by them. Therefore there is a need to manage available parking space

efficiently. Basically parking is problem of space. Shopping malls, cinemas, stadiums, factories, and office complexes are surrounded by vehicles. Following are the reasons which lead to parking problems:
● Weak implementation of parking regulations
● The footpaths are not properly constructed so walking environment is not comfortable. Hence wealthy vehicle owners do not feel like parking their vehicles three or four meters away from them.
● Very often owners park their car on street just to save parking amount this leads to wastage of parking space of society [1].
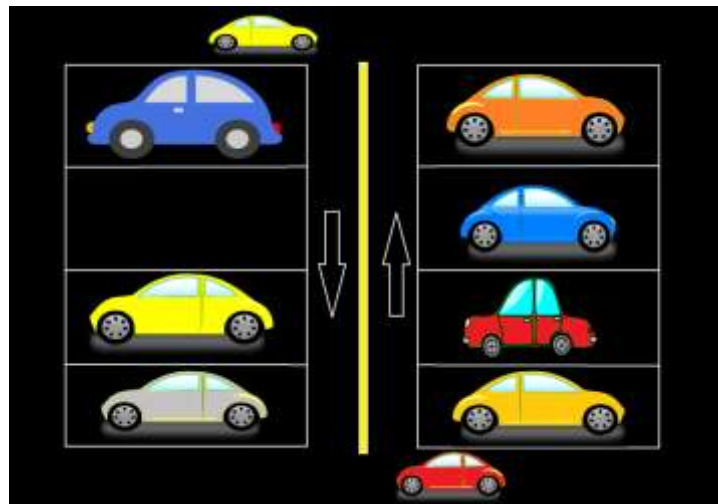

Fig.2 Parking scenarios[10].

● Due to lack of information about the available parking slots in cities drivers need to spend their time in searching one.
● In most of the places the parking space is their but other than specific people can't park over there.
● Unnecessary use of automobiles by people even for travelling small distance.
● Parking spaces those are disturbance to nearby businesses and residents.
● Businesses may feel difficulty in keeping hold of customers and residences may have difficulty in finding parking area closer to their homes.
● Need of handicapped parking spaces.
● When parking demand is generated by certain type of work but not being accommodated on the site of those works.
● Most of the time the vehicles parked are from outside of the neighborhood [7].

III. RELATED WORK
3.1 IoT BASED SMART PARKING SYSTEM.
In this paper a system is presented which is based on cloud and iot which is fully automated with specific technology used for booking the parking slot. It help the user of the system to find the free parking spaces for their vehicles and provide advance booking for the same. The system in this paper implemented using open source hardware computing based on arduino with RFID technology. It uses smartphone as the intermediate between the cloud and vehicle to check the feasibility of the system[2].
3.1.1 Disadvantage:
1. The system does not help in maintaining the parking rules and regulations.
2. It does not support quick payment service like NFC payment,etc.
3. The system uses MQTT protocol which is less lightweighted than CoAP.
4. The payment policy is inappropriate.
3.2   SMART ROUTING: A NOVEL APPLICATION OF COLLABORATIVE PATHFINDING TO SMART   PARKING SYSTEMS
In this paper an algorithm is implemented which helps to direct the vehicle driver to appropriate free(i.e. available) parking spaces which will help to manage the traffic congestion efficiently. It provides the driver appropriate information about the parking and direct them. GPS tracking system is used for directing the driver to the destination location. But this may result in traffic congestion as multiple users are directed at same place at the same time[3].
3.2.1 Disadvantage:
1. This is a complex protocol for commercial interest.

2. No advance booking facility.
3. Parking rules can't be maintained using this system.
4. Provide only direction to the parking therefore many time leads to traffic congestion.

3.3 THE RESEARCH AND IMPLEMENT OF THE INTELLIGENT PARKING RESERVATION MANAGEMENT SYSTEM BASED ON ZigBee Technology.

In this a system is proposed which uses ZigBee Network which is used to send the information required by the user to the PC with the help of coordinator and database is updated. Taking the help of internet the information is provided to the application layer to help people looking for parking spaces using web services. The system is made up of mobile client and server side parking lot. Using the web service interface the client asks server for parking information. Then server search the database for asked information and give the information to client using the interface[3].

3.3.1 Disadvantage:
1. Expensive system choice.
2. Parking rules are difficult to maintain.
3. Require proper monitoring.
4. Takes time to fetch the required parking information.

IV. AN EFFECTIVE APPROACH FOR SMART PARKING

We can approach, to solve the problem of insufficient parking spaces for the vehicle users by designing and building a system with open hardware components like Radio-Frequency Identification (RFID) technology, Ultrasound sensors, Raspberry Pi, Constrained Application Protocol (CoAP), Near Field Communication (NFC)[6].

Implementation Overview:

For deploying the system by making use of above mentioned components we need to make an software application for smartphone users. Using this application the user can book the parking slot for his/her vehicle by providing the necessary details like vehicle number, date, timing (approx. time interval for how long the vehicle will occupy the parking slot) and can select the mode of payment (cash, wallet, cards, NFC payments, etc.). After all these he/she can confirm by processing further and making payment. User can also cancel the booking with some cancellation charges for advanced booking. The application will keep track of the entire slot whether vacant or occupied and also with the help of various parking sensors like RFID, Raspberry Pi and ultrasound sensors. The application will also keep track whether the user of the system are obeying the parking rules or not using the GPS tracking system. The offenders of the parking rules will be caught by this application as the plate number of the vehicle will be reported to the security or responsible authorities.
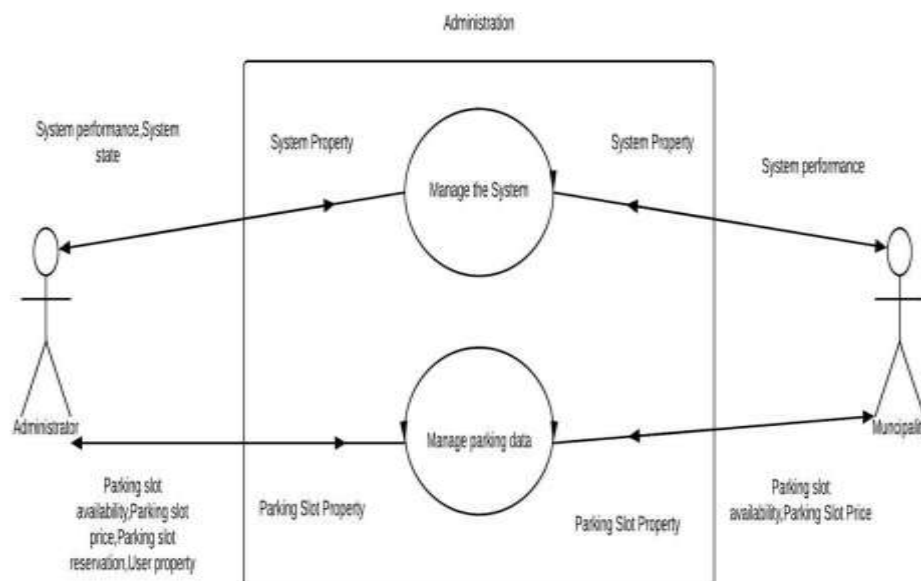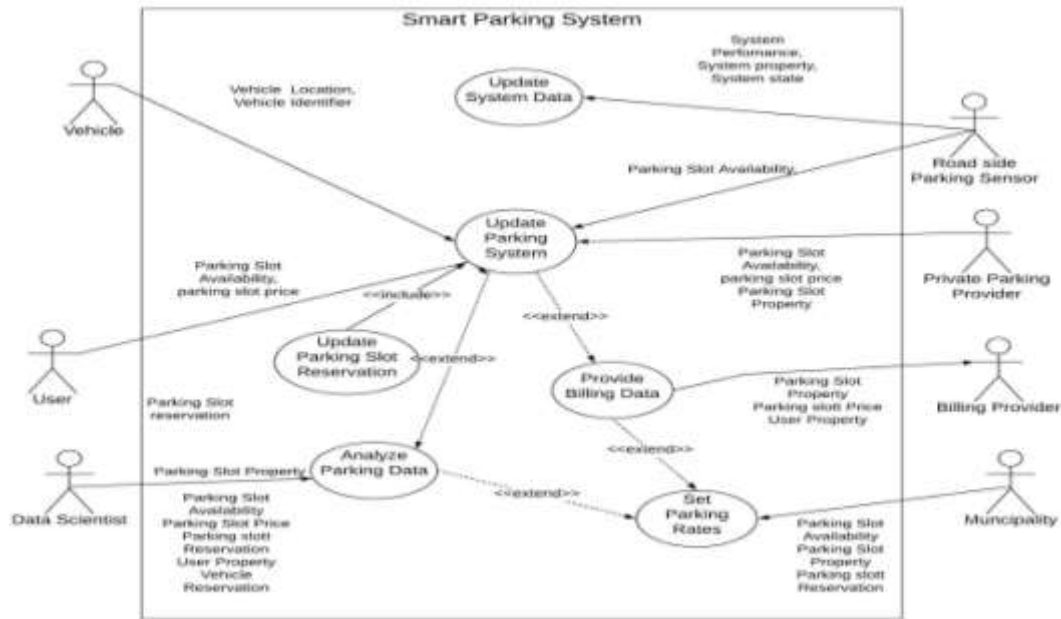
Fig.9. Use case Diagram of Parking System[4]

Following are the steps that need to be followed in order to park the vehicle using the parking application:
Step 1: Install the smart parking application on your mobile device.
Step 2: With the assistance of the mobile application search for a parking area on and around your destination.
Step 3: Select a particular parking area.
Step 4: Search through the various parking slots available in that parking space.
Step 5: Select a particular parking slot.
Step 6: Select the amount of time (in hours) for which you would like to park your vehicle for.
Step 7: Pay the parking charges either with your e-wallet or your credit card or NFC payment.
Step 8: Once the confirmation of payment is sent to the vehicle user then the application will guide the vehicle driver to allotted vacant spot for parking[8].
Step 9: It will notify the vehicle user 10 minutes before the time limit expires, to extend the parking time or to release the parking spot within 10 min.
Step 10: On disobeying the parking rules the application will notify the parking authority and fine would be charged as per the penalty rules.
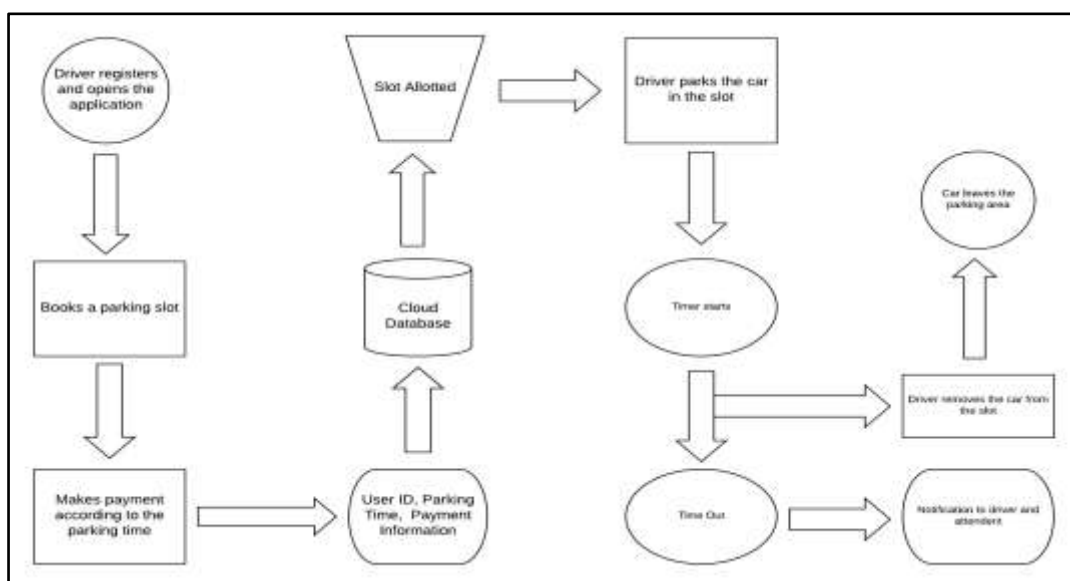

Fig.10. Flowchart for Parking System[2].

V. CONCLUSION

In order to achieve the objective of smart city the smart parking throughout the city can be a great step towards the same. This system will help to remove parking problem in the city and provide more facility to the public of the society. The system will provide the real time information about the availability of parking slot in a parking area. Using the application user can book the parking slot for them from remote location. The average waiting time of user for parking their vehicle is reduced in this system. This parking system provides better performance, low cost and efficient large scale parking system. Security measures can be implemented in this system if the user disobey the rules and regulations.

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