International Journal of Advance Research in Science and Engineering
Vol. No.6, Special Issue (01), September 2017, BVCNSCS 2017
www.ijarse.com
IJARSE
ISSN 2319 - 8354

SMART CITY – PARKING MANAGEMENT USING MOBILE APPLICATION

G.Naresh[1], Dr. B.Indira[2]

[1]Research Scholar, Faculty of Informatics,Department of CSE,Osmania University, Hyderabad, Telangana (India)
[2]Associate Professor,Department of CSE,Kasturba Gandhi Degree & PG College for Women, Secunderabad, Telangana (India)

ABSTRACT: *A Smart City is an urban development vision to integrate Information and Communication Technology (ICT) and Internet of Things (IoT) technology in a secure fashion to manage a city's assets.*
Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. We need to empower computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory. This is precisely what IoT Platforms does for us. It enables devices/objects to observe, identify and understand a situation or the surroundings without being dependent on human help.
Parking in the city has been a major problem these days. Traditional Parking System is not only expensive but also time consumption process. An efficient way to manage the parking system is using Internet of Things (IoT). Here a mobile application acts like an interface for the end users to interact with the system. The purpose of this mobile application is to provide information regarding availability of different parking slots (two wheeler, three/four wheeler and heavy vehicles) and allow the end users to book a slot with the online payment for number hours. It also direct the end users to parking slot by using online maps. If the vehicle is not parked in allotted slot, the information caught by sensors and alerts message will be sent to the mobile. Every time the availability of parking slots will be updated.

Keywords: Information and Communication Technology (ICT), Internet of Things (IoT), Smart City, Parking Management, Mobile Application, Sensors

I. Introduction:

Parking a vehicle in the big cities is major task. Immediately we can't find a space to park our vehicle. Manually we need to search for a parking space. This process will create air pollution, consumption of time, traffic jam, driver frustration and more fuel consumption.

An efficient way to manage the parking system is using Internet of Things (IoT). Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. It enables devices/objects to observe, identify and understand a situation or the surroundings without being dependent on human help.[1]

A Smart City is an urban development vision to integrate Information and Communication Technology (ICT) and Internet of Things (IoT) technology in a secure fashion to manage a city's assets. These assets include local department's information systems, schools, libraries, parking system, transportation systems, hospitals, power plants, water supply networks, waste management etc.

Here a mobile application acts like an interface for the end users to connect with the system. This mobile application will give information about the availability of parking slots. User can reserve the desired slot with the vehicle number by online payment option. The mobile application will guide to the parking place with the help of Global Positioning System (GPS).

II. Review of previous approaches

Atheshamul huq osmani, Ashwini Gawade, Minal Nikam, Swati Wavare and Kalpana Kadam [1], the authors propose android application for graphical view of available parking slots. IR sensor will give information of available parking slots. The authors propose RFID tag to regular user to take advantages of e-valet facility.

Abhirup Khanna and Rishi Anand [2], the authors propose the smart parking system is implemented using a mobile application. This system will help the driver with the information of availability parking slots by connecting to the cloud. Infrared, Passive Infrared (PIR) and Ultrasonic Sensors will sense availability of parking slots and send information to the cloud. Extra payment and penalty amount calculated and collected by attendants.

Prabhu Ramaswamy [3], the author propose a system in which each slot in the parking system will be controlled through ultrasonic distance sensors & raspberry pi camera connected through raspberry pi devices. IoT is the great enabler to create interconnected digital systems and greatly helps to reduce greenhouse emission to save environment as well saves fuel economy.

Devendra Singh Chundawat, Adarsh Sharma and Mohit Bajpai [4], this paper explained a design and implement the prototype of a Smart Parking System based on Reservation (SPSR) using android. It also provides reservation service as part of user-targeted service. Drivers can retrieve parking information and reserve their desired vacant spaces via Internet.

Basavaraju S R [5], the author proposes a parking system is designed in such a way that it is applicable for covered parks, open parks and street side parking. The smart parking system which contains cloud service provider which provides cloud storage to store information about status of parking slots in a parking area and etc. Parking slots and parking area information is accessed through website is built with basic JSON interface which can be work in any browsers

In the other study [6]-[10], helped and inspired to achieve the concept of our proposed system.
Omron vision sensors [11], this site provide information about the vision sensors. It also explains about working capability of vision sensor.

III. Proposed System

Here we need to get information about the parking places in smart city. These parking places will be categorized into different types (two wheeler, three/four wheeler and heavy vehicles). If two-wheeler parked in four-wheeler parking slot the space will be wasted. Similarly if three/ four wheeler parked in heavy vehicle parking slot the space will be wasted. We can't park four-wheeler vehicle in two wheeler parking slot. Similarly we can't park heavy vehicles either in two-wheeler or three/four wheeler parking slots. The information of different parking places will be stored in the cloud database. Mobile application will allow the users to access this parking management system with the type of vehicle they want to park. Every time the availability of parking slots will be updated.

The mobile application will guide the driver to the parking place with the help of GPS. GPS won't work in cellars. So we are using vision sensors here to detect vehicle with number. Based on vehicle number it will guide in the cellars. If driver will try to park their vehicle in un-allotted slot then our system will alert them with the message. Extra payment and payment will be collected through online only.

Mobile Application: The mobile application acts like an interface for the end users to interact with the system. The application is developed in Apache Cordova and Angular JS Framework using JavaScript as a programming language. The purpose of using Apache Cordova is to create applications that can run on both android and IOS platform with the same source code. The application is connected with the IBM MQTT server through a secure channel.[2] The purpose of this mobile application is to provide information regarding availability of parking spaces and allowing the end user to book a slot accordingly. Transfer of data takes place in JSON format between IBM MQTT server and the mobile application. In order to ensure proper communication both the Raspberry pi and mobile application must be subscribed to a particular channel on IBM MQTT server[5].

The Cloud: The IBM MQTT server is hosted on cloud. Cloud acts as a data base to store all the records related to parking slots of parking areas and end users that have access to the system. It keeps a track of every user connected to the system and maintains information such as time at which the car was parked, time duration for parking a car, amount paid by the user and mode of payment. It is due to the flexible nature of cloud which permits the system to add any number of users at any time of the day. Continues backup is made of the data stored on cloud in order to ensure easy and quick recovery of data in case of any kind of system failure.

Sensors: Here I am using vision sensors in the parking slots. The vision sensors have built the processor into camera unit. Sensors include high power lighting capable of evenly lighting across a wide field of view. The focus of the lens can be adjusted to take clear images for the specific field of view. In the vision sensors commands can be input from a PLC to control the FQ2, inspection results and measurement results can be output from the FQ2 to PLC. We can also transfer these images to a computer [11].

Vision sensors will maintain a data of the particular parking area such as vehicle number, mobile number, no of hours and allotted parking slot details etc. We will place one sensor at the entrance to detect parking slot is allotted or not. Each parking slot will also have vision sensors to detect the parked vehicle number and check whether this slot is allotted to the same vehicle or not.

IV. Implementation and Working

In the previous section we discussed about the technical stack related to the smart parking

system. In this section we talk about the implementation and working of the system in the real world scenario. The complete process of booking a parking slot, parking a car in that slot and leaving the parking area is explained with help of following flow chart.

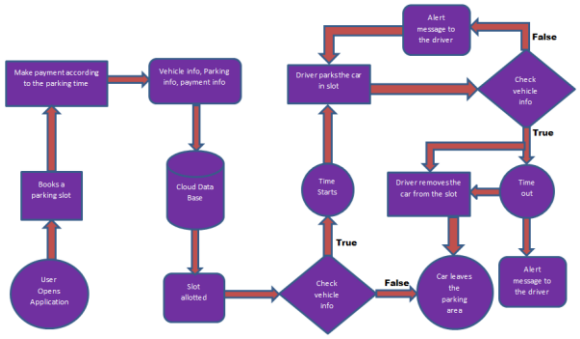

Figure 1: Flow Chart of the system

Our system will provide information about available parking slot based on a type of vehicle, near to the vehicle location or selected area. In each stage our system will availability of the parking slots. This is done by implementing our system in the parking area of smart city like shopping mall or cinema hall etc. Below are the steps that a driver needs to follow in order to park vehicle using our parking management system.

- Step 1: Install the parking management system application in your mobile.
- Step 2: Select a type of vehicle you are going to park.
- Step 3: with the help of parking management system search for a parking slot near to your current location or particular area.
- Step 4: Select a particular parking area.
- Step 5: Browse through the various parking slots available in parking area.
- Step 6: Select a particular available parking slot from the parking area.
- Step 7: Select no of hours you are going to park vehicle.
- Step 8: You have to pay the parking charges with online payment systems like mobile banking, internet banking, credit card, debit card etc.
- Step 9: You will direct to the allotted parking area with your mobile application.
- Step 10: We can only allow the vehicle after checking whether the vehicle is allotted a parking slot in this parking area or not.
- Step 11: After parking the vehicle occupancy will be confirmed by the user.
- Step 12: We can check with sensor of the parking slot that vehicle is parked or not. If not we will alert the user with a message to park their vehicle in allotted slot.
- Step 13: Once you have successfully parked your vehicle in allotted parking slot, confirm you're occupancy using the mobile application.
- Step 14: User can allow to extends parking time or extend with penalty charges.
- Step 15: Exit sensor will check vehicle payment is done or not.

The above mentioned procedure for booking a slot and parking a car in that slot is explained with the help of the following screen shots.

To use our parking management system first user has to install our mobile application in mobile. When we open a mobile application we will find below screen shot.

Figure 2: select a type of vehicle to park.

The above figure depicts the type of vehicle you are going to park. Here you can select two wheeler or three/four wheeler or heavy vehicle. After selecting one of these options you are allowed for the next step. In this scenario selected four-wheeler.

After this step it will show you available parking areas near to your current location based on type of vehicle you selected. Parking management system also allows you to availability of parking areas in a particular location. It will help you before reaching location you can reserve a parking slot. After selecting the parking area our system will show you no. of cellars available. Here you can select a cellar it will show you parking slots information in that cellar.

Figure 3: Select a parking slot.

The above figure depicts the availability of the parking slots. In this case SM1 and SM3 are parking slot available. SM2 parking slot already allotted to other vehicle. User selected SM1 parking slot.

Figure 4: Selecting no of hours.

The above figure depicts no of hours you want to park your vehicle. Here user selects 1 hour option.
After selecting the no of hours user has to provide his vehicle number and mobile number. Parking charges will be generated based on no of hours selected. User has to pay these parking charges through the online payment systems like internet banking, mobile banking, credit card and debit card etc. Our system will support above mentioned payment systems user has to use one of these payment system.
After completion of the payment process parking management system will be allotted the parking slot with vehicle number. Confirmation message will be sent to the mobile number. Our system will support online maps like Google maps user will be guided to the parking area with the help of GPS to parking area [1].

Figure 5: Vehicle checking with the entrance sensor.

The above figure depicts sensor will check whether the vehicle is allotted a parking slot in this parking area or not. The sensors will also detect the height and width of the vehicle [11]. It allow only when height and width of the vehicle will be matched with type of vehicle selected. The check will be done through the vehicle number provided by the time of booking. Here sensor will detect the vehicle number [5]. Using vehicle number it will search in the data base information related to parking area. If the vehicle number is found it will show you information about the allotted slot allows the user park the vehicle. The time will be counted from the time of entering the vehicle. Otherwise it shows you not allotted we can stop the vehicle allow the user to book a slot from the system. If slots are not available won't allow the vehicle to enter in parking area.
Cellars and Parking slots information pasted on the walls to guide the user to parking slot. After reaching the parking slot user can confirm occupancy of vehicle with the mobile application.

Figure 6: Occupancy check.

The above figure depicts to confirm the occupancy after parking the vehicle in allotted slot.

Figure 7: Vehicle checking with the parking slot sensor.

The above figure depicts parked vehicle is allotted to that parking slot or not. After confirming the occupancy we will check if the parked vehicle is allotted to this parking slot or not. Sensor will detect the vehicle number and it will check vehicle number is matching with the parking slot information in the data base. If not we will be sent alert message to the mobile of parked vehicle provided at the time of booking. If the parked slot is not allotted to any vehicle then slot will be allotted with penalty charges on user interest. After booking the parked slot previous slot will be cancelled and it shows in the availability. If parking slot is allotted to any other vehicle user need to park vehicle in allotted slot. This above process will be done until the vehicle will be park in the allotted slot or book parked slot.
After completion of the parking time system will sent alert message to the user. User can also facilitate to extend parking time. But user needs to pay extra amount for this extension of parking time. User not

extends parking time and still placing in the parking slot he will be penalized with one hour extension. This process will repeat until user leave the parking slot [2].

We will place other sensor at the exit to check the vehicle payment is done or not. The sensor will detect the vehicle number and calculate the amount. If any payment is pending allow the vehicle to leave parking area after payment is done. The parking area system will be updated it shows this parking slot in the availability.

Advantages of Proposed System:

1. User can book a parking slot from anywhere in the city
2. User can pay amount through online.
3. User will guide to the parking area with mobile application.
4. No need of manual check, sensor will check the parking details in the data base with the vehicle number.
5. No need of attendant to guide parking slot. Sensors will guide them.
6. Parking slot sensor will check this slot is allotted to parked vehicle or not.
7. User can extend his parking time.
8. Exit sensor will check vehicle payment details. If any amount is due allow the user to pay amount through online only.

V. Conclusion

Smart City is a dream of the people now it became true with the help Internet of Things and cloud technologies. Smart parking is one of key element in the growth of the smart city. User can also book a parking slot from other location by using mobile application. Smart city parking management system will provide better parking experience in the smart city. Smart city parking management system will avoid parking problem like traffic jam, more fuel consumption, more consumption of time, air pollution and driver frustration etc.

V. References:

[1] Ahteshamul huq osmani, Ashwini Gawade, Minal Nikam, Swati Wavare, Prof. Kalpana Kadam, Research paper on Smart City Parking System. Vol-2 Issue-3 2016, IJARIIE - ISSN (O)-2395-4396.

[2] Abhirup Khanna, Rishi Anand, IoT based Smart Parking System, 2016 IOTA, MIT, Pune, India 22 Jan-24 Jan, 2016.

[3] Prabhu Ramaswamy, IoT Smart Parking System for Reducing Green House Gas Emission, DOI 10.4010/2016.499, ISSN2321 3361 © 2016 IJESC.

[4] Devendra Singh Chundawat, Adarsh Sharma and Mohit Bajpai, A Review on Smart Parking System for Smart Cities. SSRG International Journal of Civil Engineering(SSRG-IJCE)-volume 3 Issue 5-May 2016.

[5] Basavaraju S, Automatic Smart Parking System using Internet of Things (IoT), International Journal of Scientific and Research Publications, Volume 5, Issue 12, December 2015, ISSN 2250-3153.

[6] Thanh Nam Pham, Ming-Fong Tsai, Duc Binh Nguyen, Chyi-Ren Dow and Der-Jiunn Deng, A Cloud Based Smart-Parking System Based on Internet –of –Things Technologies, volume 3, 2169-3536 © 2015 IEEE.

[7] Rico, J., Sancho, J., Cendon, B., & Camus, M. (2013, March). Parking easier by using context information of a smart city: Enabling fast search and management of parking resources. In Advanced Information, Networking and Applications Workshops (WAINA), 2013 27th International Conference on (pp. 1380-1385). IEEE.

[8] Zheng, Y., Rajasegarar, S., & Leckie, C. (2015, April). Parking availability prediction for sensor-enabled car parks in smart cities. In Intelligent Sensors, Sensor Networks and Information Processing, (ISSNIP), 2015 IEEE Tenth International Conference on (pp. 1-6). IEEE.

[9] Dash, S. K., Mohapatra, S., & Pattnaik, P. K. (2010). A survey on applications of wireless sensor network using cloud computing. International Journal of Computer science & Engineering Technologies (E-ISSN: 2044-6004), 1(4), 50-55.

[10] Fox, G. C., Kamburugamuve, S., & Hartman, R. D. (2012, May). Architecture and measured characteristics of a cloud based internet of things. InCollaboration Technologies and Systems (CTS), 2012, International Conference on (pp. 6-12). IEEE.

[11] Omron vision sensors website, http://www.ia.omron.com