

Smart Parking System Based on Internet-Of-Things

Sushmita Bore¹, Abhipsa Chand², Alisha Dhuri³, Akshada Jadhav⁴, Prof.M.Darokar⁵

^{1,2,3,4,5} Department of Computer Engineering

^{1,2,3,4,5} JSPM's Imperial College of Engineering & Research Wagholi, Pune,India

Abstract- Recently the upcoming technology of cloud is being used to solve many common problems we take this cloud based system and use it for the effective deployment of the smart parking system. The smart parking system is relatively new system which creates a platform for easy booking of parking slots and effectively manages the parking in a mall. The basic feature of the parking system is to make it easier for the customer to select the slot, and for the incharge in a quick manner. Using the technology of QR code we authenticate the users who are or will be parking and make the identification of the user efficient. Thereby, we implement this technology and make the life easier for the user and create a benchmark for future development.

Keywords- Smart Parking System, IOT, QR code

I. INTRODUCTION

In the development of intelligent parking system was created to reduce the cost of hiring people better use of technology to get better and optimised results. In the current scenario the parking is done in any space which the driver finds through luck and experience. This process takes much time and effort and may lead to the worst case of failing to find any parking space. In our research we found this problem of at most importance for drivers and many citizens, the alternative is to find a predefined car parking space with high capacity. Multiple vehicles need multiple car spaces, so from hummer to a basic nano there is a variety of requirement in terms of space. Small cars can easily park a while huge cars might not get the required space.

This study is aimed to provide information of parking spaces for the driver and make reservation using smart devices such as tablets, phones and many more. To create a well defined solution we need to take advantage of the significant developmental technology that is information of things technology. The system created will not only ease the citizen but also provide a defined parking space for the user.

Using technologies such as Ultrasonic sensors, car parking can be revolutionised. Using hardware based structures like Arduino one can create an IoT based network to efficiently program the hardware and use it for effective deployment and give the client a better service. The human

resource costing is also a primary source of nonincome the human resource can be minimised and thereby creating these system essential. In smart cities all the system will work together to create dynamic software based which will be unique for every user. In our survey we found that these systems are very much essential and a primary requirement from every citizen.

II. REVIEW OF RELATED LITERATURE

A. Smart parking system

Smart parking systems are very popular in many countries these systems create a nexus of multiple systems together the system help to create better services optimised the space usage, improve the efficiency of parking system and help the traffic in the city move more freely. Currently there are multiple companies who have expressed interest in creating such system smart parking adds to the better customer experience and also create scenarios where visitors spend less time looking for space to park. The smart parking system creates advantages with its cost efficiency and economical space requirements. It serves as better source of revenue generating up to 250% in rent over the span of 10 years.

We surveyed multiple owner of such parking space, the benefit shared were seemed to be most welcoming to the new owner of such parking spaces, in our talks with Bryan Peering from the base town centre he shared that the technology, aligned with excellent support and inside will be a very good investment it will add to the customer experience where visitors will spend more time in the shops instead of looking space to park. Smart parking will actually help in accurately predicting in sensing spot occupancy in real time. It will simplify the parking experience and will add value for parking stakeholder like drivers. The system will play the major role in creating better urban environment by reducing the emission of CO₂ and other pollutants.

B. Conceptual Framework

The rapid growth in the number of vehicle worldwide is intensifying the problem of the scarcity of parking space. Again according to industrial data 30% traffic congestion occur due to vehicle drivers struggling to find the parking

spaces, these in turn are magnifying the necessity of smart parking system. Today's intelligent parking management system is capable of providing extreme level of convenience to driver as well as simplifying and automating the business operation and administrative function of the parking site owners. The higher growth rate in the registration of new cars worldwide the major boom from regional economies such as Asia pacific will open the window of opportunity for parking management system. The global parking management industries are expected to grow at a compound annual growth rate of 11.4% from 2014 to 2019. the parking management market is estimated to be at 5025.9 million dollars in 2016. the market is expected to grow in tandem with the growth in vehicle ownership and parking facility development. Need for smooth traffic flow, business benefits to the parking site operators and decreasing hardware and connectivity cost are the key driver for the parking management industries.

III. RESEARCH METHODOLOGY

Raspberry Pi

Raspberry Pi is a mini computer. It contains lots of accessories which are embedded on a single circuit board. The following accessories are given below:

1. USB 2.0 port
2. HDMI
3. Power
4. Audio and video
5. Display
6. SD card
7. Internet

This minicomputer works on open-source software. Raspberry Pi, is a quad-core Cortex-A53 processor, which is described as 10 times the performance of a earlier Raspberry Pi. It was suggested that this is highly dependent upon task like threading and instruction set use. This shows that latest Raspberry Pi 3 is This shows that latest Raspberry Pi 3 is approximately 80% faster than the Raspberry Pi 2 in parallelized tasks.



Figure 1. Raspberry Pi

IV. SYSTEM ARCHITECTURE

System architecture shows that user will open the app and click on register button, if he/she is a new user. Then he/she will fill all the required information that is Name, Address, Mobile number, Car number, Number of cars, email id etc. These details are stored in hardware memory.

Then the user will log in using its user id and password. After log in, layout of parking space will be displayed to the user and the user will choose the slot.

All the slots that are available will appear in green, and the slots that are booked will be in red. Then the user will book the slot and he/she will get a QR code and the same QR code will be sent to hardware when the user will enter the parking space. QR code will be verified, if user is authorized then only he/she is allowed to enter and park the car.

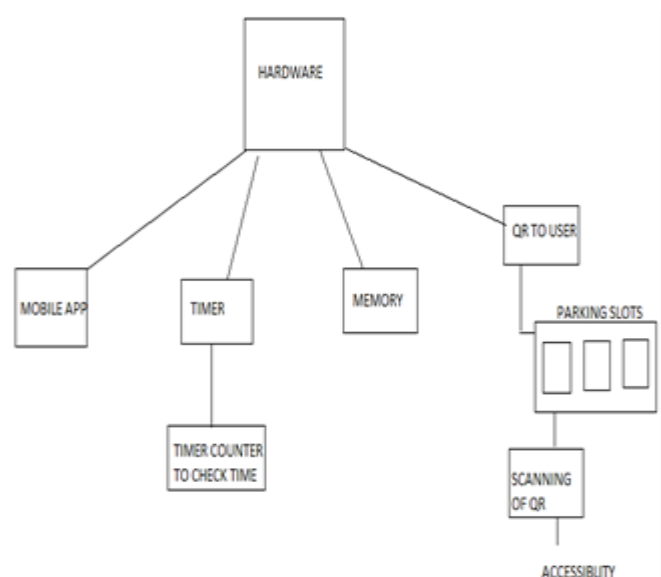


Figure 2. System Architecture of System

Hardware:

In our system hardware consist of raspberry pi, DC motor, motor driver, USB port, Ethernet port, memory etc.

Timer:

Timer periodically sends the information collected by ultrasonic sensor.

Timer Counter:

It helps to check the status of the parking slots. After booking the slot when user enter the parking slot , counter become i.e. counter=1 and when car left the parking slot then counter becomes 0 i.e. counter=0.

V. HARDWARE ARCHITECTURE

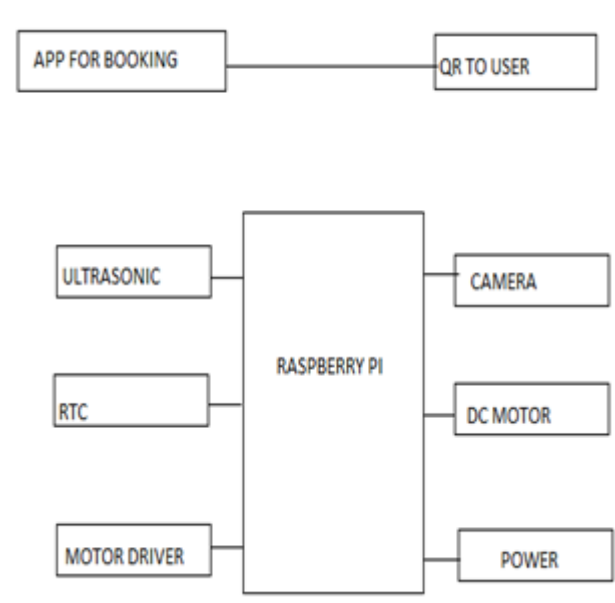


Figure 3. Hardware Architecture

The software system explained above is connected to the hardware and the further functionalities are as follows-

1. Raspberry pi-

In this system raspberry pi acts as a microcontroller and helps to store the data (performance of ultrasonic sensors) ,process the data , compare the QR codes, establish the connection between the user system and server.

2. Ultrasonic Sensor-

Ultrasonic sensors are the sound waves with frequency higher than the upper audible limit human hearing .They are used to detect object (car) and measures distance.

In this system it measures the distance,if the distance is high then there is no obstacle that implies the parking slot is available and if the distance is less that means the car is parked at that slot and hence it is booked.

3. Camera-

It helps to scan the QR code which is given to the user while booking as well as to the hardware.

4. DC motor-

A DC motor is type of a rotary electric machine that converts direct current electric energy into mechanical energy.In this system DC motor is used to open the gate after scanning the QR code by using camera. Then it allows entering in the parking space.

5. Motor driver-

A motor driver is a little current amplifier , the function of motor driver is to take a low current control signal and then turn it into a higher current signal that can drive a motor.

6. QR code-

It stands for quick response code. A barcode is a machine readable optical label that contains information about the item to which it is attached.



Figure 4.

VI. DISSCUSSION

Traffic congestion caused by a vehicle is an alarming problem at a global space and it has been growing exponentially . Car parking problem is a major contributor and has been still a major problem with increasing vehicle size with luxurious segment and confined parking spaces in urban cities. Searching for a parking space is a routine and often frustrating activity for many people in cities around the world this search burns about one billion barrels in worlds oil every day . As the global population continues to urbanize without a well planned convenience driven retreat from the car these problem will worsen. According to a report smart parking could result in 22000 gallons of fuels of saving till 2030 and approx 300000 gallons of fuel saved by 2050 if implemented successfully.

Smart parking systems typically obtains information about available parking spaces in a particular geographic area and process is real time to place vehicles at available positions it using using low cost sensors, real time data collection and mobile phone enabled selection that allow people to reserve parking in advance or predict where they will likely find the spot. When deployed the system smart parking thus reduces car emissions in urban centers by reducing the need for people to needlessly circle sitting blocks searching for parking, it also permits cities to carefully manage their parking supplies. The smart parking helps solve one of the biggest problems on driving in an urban areas ;finding empty parking spaces and controlling illegal parking.

VII. RELEVANT MATHEMATICS ASSOCIATED WITH THE PROJECT

System Description:

Input: User Information, authentication
 Output: Booking Confirmation, Slot allocation Set

Theory Analysis:

Power set, $P = A; P; I; O; SUCCESS; FAILURE$ $A = \text{Set of all admins present in the mall}$ $A = a_i a_i^i = [0-9]^* P$
 $P = \text{Set of users registered to the product}$ $P = p_i p_i^i = [0-9]^* I$
 $I = \text{Set of inputs where I contains multiple variants}$ $I = \text{Booking, cancelling}$
 $O = \text{Set of outputs where user gets confirmation about the booking}$
 $O = \text{Booking confirmation, unique space name}$
 $SUCCESS = \text{Account creation for a particular user successful , booking confirmation desired output generated}$
 $FAILURE = \text{Account not created desired output not generated}$

Desired output not generated -blank entries -wrong entries

A. User Interface Data

- Android Application Layout make in XML.
- Admin panel design in JSP.
- Communication Protocol:
- Web service.
- Usage of plug-ins, APIs ,extensions:
- Google play Service



Figure 5.



Figure 6.

VIII. RESULTS AND FINDINGS

A. Input

1. Register info.
2. Login info.
3. Booking information.
4. In Time and Out Time.
5. OTP.

B. Expected Output

1. Book Parking Slot.
2. Manage Booking Slots.
3. Maintaining time limit

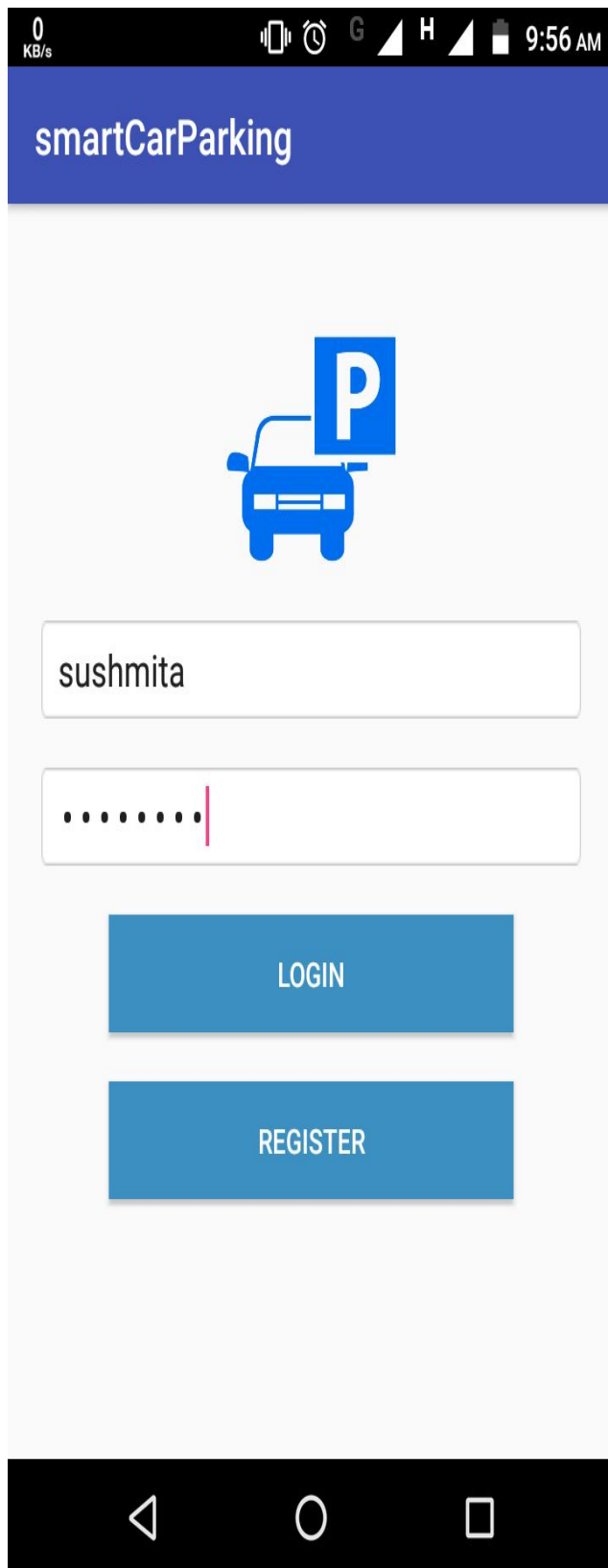


Figure 6. Login page

IX. CONCLUSION

The major enabler or driver for smart parking are the problem for urban livability, transportation mobility and environment sustainability primarily is about enhancing the productivity level and the service level in operation, some of the underling benefits could be lowering of operating cost while building value for customer to drive occupancy, revenue and facility value. We have evolved from traditional servicing channel like toll booth and parking attendance to incorporate pay station, meters and gates.

User register on application with information. Then user want to book parking slot with info like how many time. When user reach to parking gate then user give one booking key to Security guard then for verification OTP send on register mobile number and In Time is assign to this CAR.

X. ACKNOWLEDGEMENT

We thank our colleague inside and expertise that greatly assisted the research. We thank our mentor Akash Bhojraj for guiding us for this project. We thank our professor Madhavi Darokar for inspiring us to do this project and her comment on the manuscript.

REFERENCES

- [1] 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," Sept 23, 2015.
- [2] Y. Geng and C. G. Cassandras, "A new 'smart parking' system based on optimal resource allocation and reservations," in Proc. 14th Int. IEEE Conf. Intell. Transp. Syst. (ITSC), Oct. 2011
- [3] C. Rhodes, W. Blewitt, C. Sharp, G. Ushaw, and G. Morgan, "Smart routing: A novel application of collaborative path-nding to smart parking systems," in Proc. IEEE 16th Conf. Bus. Infom., Jul. 2014
- [4] L. Lambrinos and L. Dosis, "DisAssist: An Internet of Things and mobile communications platform for disabled parking space management," in Proc. IEEE Global Commun. Conf. (GLOBECOM), Dec. 2013
- [5] Cui Shiyao, Wu Ming, Liu Chen, Rong Na, "The Research and Implement of the Intelligent Parking Reservation Management System Based on ZigBee Technology," 2014.

- [6] Xuejian Zhao, Kui Zhao, and Feng Hai , “An Algorithm of Parking Planning for Smart Parking System,” July 4,2014

- [7] <http://www.mobility.siemens.com/mobility/global/en/urbanmobility/road-solutions/integrated-smart-parkingsolution/pages/integrated-smart-parking-solution.aspx>

- [8] <http://www.mobility.siemens.com/mobility/global/SiteCollectionDocuments/en/road-solutions/urban/smart-parking/siemens-smartparking-infographic-en.pdf>

- [9] <http://www.happiestminds.com/whitepapers/smart-parking.pdf>