Smart Parking Management System using IoT

M. Gopi Krishna, Goli Narendhar

Abstract: Today's world is of Technology, technology is a kind of boon to enabling human lives comfortable as well as swift. The utilization of sensible phones has enormous applications. The IoT(Internet of Things) platform enables to attach physical modules with the net. In consequence, several applications can be carried out. This paper represents proposed system of one of them. There are parking problems in big urban and crowded cities because of unplanned parking, which becomes problem to find parking yards, more time-consuming to park a vehicle. Although ample quantity of analysis works on the event of good parking system exist in literature, but most of them have not addressed the problem of real-time detection of parking lot and automatically generation of hourly basis parking charges. This paper addresses proposed system to solve the problems and bring out better performance by using IOT, GPS (Global Positioning System) to locate nearest parking yard to reduce time consuming, camera for detection of the vehicle number in order to allow vehicle into parking lot, and mobile application to find vacant lot and for advance booking. Moreover, this system avails online payment link for parking charge for calculated amount of parked hours, sends notifications. These all interface with Raspberry pi. Eventually, this system reduces time-consuming and makes easy parking.

Keywords: Internet of Things (IoT), GPS, Mobile Application, Raspberry pi, LEDs, Sensor.

I. INTRODUCTION

Looking for available parking gap during important hours in areas like Hospitals, Hotels & Shopping Centers, Airports, Universities, and Exhibitions & Convention Center has always become frustration for many drivers. Surveys say that traffic anarchy generated by vehicles while looking for vacancies of Parking is up to 40% of the overall traffic anarchy.As increasing of more vehicles, led by swift population growth in urban areas, significantly the demand of parking areas for vehicles has been increased .As surveys points out, finding a secured parking space in urban areas especially during important hours has become more or less impossible, in many situations. Looking for available parking lot in a hectic city like in some Indian cities, at a top hour is a terrible to drivers. They have to look around for a parking spot, something that is reported, It causes increasing of traffic congestion. Cycling around with a vehicle during look for a vacant space not only make drivers anger but also increases

the usual utilization of gas and fuel. The heavy and above average consumption of fuel products cause pollution which affects the environment and global warming. It is also believed that, in searching of parking areas occurring accidents. Another big challenge is associated with paying for the parking, most of the time, the customer may not have liquid cash sufficient.

The system of Smart parking management is a motor vehicle parking system that assist drivers to make out available parking lots and get reserved or advance booking. The elegant parking system in addition manages calculated hours, parked hours spent by the vehicle and provide payment link for paying the charge of the time spent by vehicle in the parking lot. The idea following such arrangement is, that system allocates a parking gap and payment process for the parked hours, to make digital and vanish corruption in parking areas of government.

In this fast-growing economy, the number of vehicle users increases exponentially and seeking vacant parking space. Going forward in technology smart phone encourages users to prefer mobile application based solutions. Growth of IoT has paved way for integration of networking devices and it makes them communicate each other on the basis of requirement.

II. RELATED WORK

A. Previous proposed works

Actually there were many works had been done on the regarding parking system. The summery and drawbacks of them was discussed below.

In this paper [1] The authors Femilda Josephin J S.et.al made a"Parking made easy an embedded design" In this design they presented a specific design of a real time parking guidance system that used PIC 16F877A micro-controllers which is used for wireless communiqué to provide the user the remote accessing control of elements like lights, sensors, and appliances which are presented within their working range of the environment. This kind of system is designed to help the users by aiding them to park their vehicles in the parking lot. The system automatically provides all the details in the parking areas on the basis of processing all the sensors data. Though research done, that could not lead the better position in the parking system because of this system used the low end devices.   In [2] author Pampa Sadhukhan built up "An IoT-based E-Parking System for Smart Cities" Thus increasing the number of vehicles on the road side and with the unavailable parking space causes to the parking related problems as well as increased traffic congestion in busy cities. a prototype of internet-of-thing based E-parking system is developed by the author Pampa Sadhukhan.

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This E-parking system used an integrated component called parking meter to address the above-mentioned issues as well as to provide smart parking management in the busy city. Thus it is required to develop an automatic smart parking management system that would help the driver to find out some suitable parking space for his/her vehicle very quickly. Even though ample of research works on the development of smart parking system exist in literature, but most of them have not addressed the problem of real-time detection of proper parking and automatic collection of parking charges. The drawback of this system mainly there is no advance booking, location finding.

In [3] the authors Jiong shi, Liping jin, Jun li, and zhaoxi fang In recent years, developed a smart parking system to mitigate the parking problems of vehicles in urban areas. For the development of this system some components and nodes are used such as high power consumption of sensor node and high deployment costs of wireless network. In this kind of system, the data of the sensor node is transmitted by Narrowband Internet of Things (NB-IoT) module, which is a new cellular technology introduced for Low-Power Wide-Area (LPWA) applications. Basic information management, charge management, sensor node surveillance, task management and business intelligence modules are put on the cloud server. With added third-party payment policy and parking advice service, the mobile application is developed for drivers to easy and convenient to use. Though developed with many features than past existing systems some are left and complexity has been in this system.

In [4]   author Kianpisheh presented a smart parking system using ultrasonic sensors to know presence of the vehicle. For each individual parking lot, a sensor was fixed in the ceiling above each parking lot. Working of Ultrasonic sensors based on echolocation, emits a wave, which is reflected back to the sensor, and the driver is instructed by a LED display board. The presence of a vehicle changes the output of sensor. These are similar to general Informative Parking System (IPS). It has some weakness. Studied in more details for informative parking system from the papers.

In [5] The authors Y. Liu, D. Wei, N. Zhang and M. Zhao presented a system "Vehicle-license-plate recognition based on neural network," In a vehicle license plate detection method using neural network approaches are designed. This system is employed by a neural network chip that is CogniMem to detect vehicle license plate. The advantages of the system are high speed recognition and stability than other systems. The phenomenon of the system, first it must take vehicle license plate images into the data store. When video stream captures vehicle plate, it will train data with calculate minimum distance to the influence field. If the system does not have the data store, then it can be misplaced and detect the wrong license plate.

In [6] The authors Anderson Ar. Rubem Ka, Gustavo GI, Itamir Filho,and Kayo Goncalves developed the "Reliability Analysis of an IoT-Based Smart Parking Application for Smart Cities". System is reviewed based on sensor smart parking solution, described how it was dispensed and its detecting algorithm, and made a reliability analysis assessing how many errors produced by the system, the success and error rates and the most common kind of errors produced in the long term (around 10 days). Sensing process is powerful with a worst-case success rate above 96% and has worked in an open sky with tropical climate conditions. Efforts are require to deal with external influence in the environment (as people or animals presence in range) and incorrect measurements. They attempted to avoid increasing excessive amount of entries in the database by cloud does not store all readings (done at each 1 second) or status determinations (those which are done at each 5 seconds). the results of the system are used for avoiding increasing excessive data in the cloud database, ultrasonic sensors can detect other objects not just vehicle in range and the worst situation ultrasonic sensor can also detect object that out of range in updating status process of each parking space.

In paper [7] The authors D. Di Mauro, M. Moltisanti, G. Patane, S. Battiato, and G. M. Farinella, built up a system that is "Park Smart", The system consists Cameras (wide angle camera), AISEE IoT (to transfer data between system and user through cloud). Cameras used to find availability of parking lots, single camera can detect more than one parking lots. This system tried to measure reliability of analysis and detection of available parking lots by using three different CNN models. This experiment is suitable for open environment only. Then it can be misclassified images of vacant available parking lots from the camera position, blocked by trees or other objects. If the system wants to get add neural network technique (license plate recognition).dataset may be confused and lower accuracy result. In many parking areas in cities, it allows parking spaces stacked.

In paper [8] authors Junhuai Li, Yang An, Rong Fei and Huaijun Wang, designed a "Smartphone Based Car-Searching System for parking of vehicles. This system works on the comparing of car-searching methods and it determines easier method to implement in low cost. The system of car-searching is searched by QR code. Identification of the parking spots is integrated and smart phone built-in sensor to navigate the path to reach the parking area. The QR code consisted data that included about the parking lots, floor and parking location are written in QR codes. The key of a navigation system is the pedometer based on smart phone. The navigation system can be added after on if navigation feature is wanted. The pros of this method are that it is easy implementation, low cost. The cons of this method, is not flexible much it needs to add/edit a new parking lot or change the shape of the map. Integration of the navigation feature after on.

B. Handouts

In any system there are both pros and cons, and the proposed system helps to beat above mentioned such problems. For, this system to be implemented motivation and inspiration is from previous proposed deices, present availability of technology like internet of things and parking problems. This system assists management and improves a parking process. The user can see information about vacant the parking lot, number of parking lots and all other possible a parking area's information. Advance booking of lots is done on the mobile application and gets the notifications.

Online payment link is also provided to make online billing. Py-tessaract (optical character recognition) is used here to recognize the vehicle number plate.

The whole process is done on the internet of things. Storing of data and send notifications on time are happening form database. User gets notifications on smart phone mobile application only.

III. PROPOSED ARCHITECTURE

A. System Overview

The following diagram represents the simple overview of the system in the step by step manner.

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┌─────────────────────────────────────────────┐
│ (1) Driver open mobile application and       │
│     reserve the lot and locate the parking   │
│     place                                    │
└─────────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────────┐
│ (2) Driver drives the vehicle to the located │
│     parking area                             │
└─────────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────────┐
│ (3) Allow the vehicle to park and send       │
│     notification                             │
└─────────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────────┐
│ (4) Exit from the parking lot and send       │
│     notification                             │
└─────────────────────────────────────────────┘
```
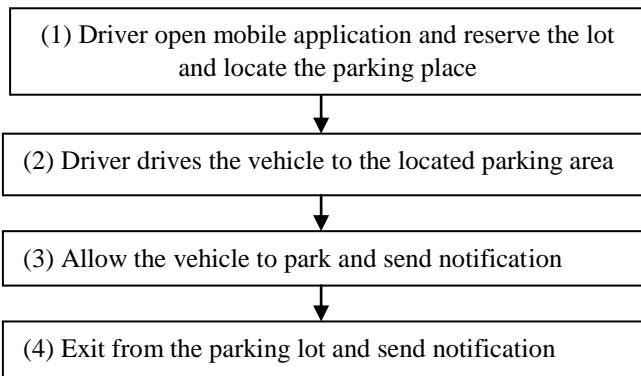
Fig.1: Flow of proposed system

From above Figure process from (1) to (4) are discussed below:

Process (1): Driver open mobile application and reserve the lot and locate the paring place:

- Mobile application gets the updates of parking lots to appear like "Full" or "Empty" through data base.
- Ultrasonic sensors are fixed in lots to update the lot status in the database via raspberry pi.
- Location of parking area is shown by the GPS to make known by the driver.

Process (2): Driver drives the vehicle to the located paring area:

- After reaching the location vehicle motion is detected by the IR sensor.
- Vehicle number is detected by the camera. and send the detected number to the database..
- In database reserved number and detected number are compared.

Process (3): Allow the vehicle to park and send notification:

- If comparison matches then allow the vehicle to park with indicating green LED glow.
- If comparison not matches then red LED glow means not allowing the vehicle to park and reservation not done.
- Notification is send while reservation, parked, and exited.

Process (4): Exit from the parking lot and send notification:

- Soon after Exit from the parking lot, when user wants to leave, the system sends the notification on to the mobile application of smart phone of user.

- In final notification there will be a payment link to pay the parking charge which is generated on hourly basis by the system since booking.

After exiting of vehicle from the lot the status is updated to the mobile application through database, by reading the values of sensor with raspberry pi.

B. Required software Technologies and Techniques

Python: Entire program of this project is developed and coded in python programming language since reliability user understandable.

Tesseract: It is a open source engine for optical character recognition. It will recognize and read the text that is in images.

Firebase: It is real time database and Store data. it Provides backend service and APIs that allow applications to synchronize clients and store on firebase's cloud.
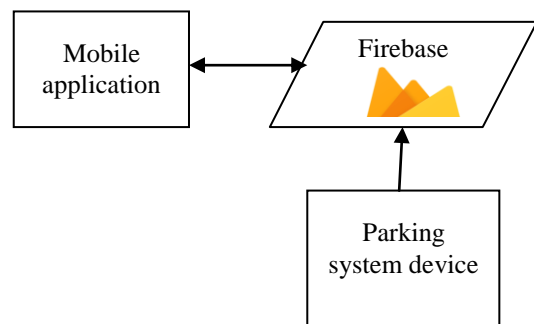

Fig .2: Diagram represents the how fire base as arbitrator

Mobile application: To create an application java is an official language but without coding there are many platforms like MIT app inventor and kodular these provide free drag and drop app creator without coding.

C. Required Hardware Components

Ultrasonic sensors: These are fixed to parking lots to know the status of lots and update it to the mobile application via data base. These sensors provide accuracy results.

Fig .3: ultrasonic sensors fixing

IR sensor: This sensor is fixed at the entrance of the parking yard to know the vehicle motion and arrive and to make run the further step of program.

Camera: camera recognizes the vehicle number plate to extract the vehicle number by Tesseract. To know whether arrived vehicle was reserved or not, through cross check of reserved numbers by detected number.

LED: There are two LEDs used to represent that if the arrived vehicle number is same as reserved then glow green otherwise glow red. The green glowing indicates allow the vehicle to park and red indicates not to allow.

GPS: global positioning system is used to locate the parking location of parking area on Google map to reach there without wasting of time to look for root.

Raspberry pi: It is a independent and credit card size board. Above mentioned components are connected to this and whole process is operated by Linux operating system since raspberry pi require own operating system.

IV. SYSTEM ALGORITHM

There are two parts mainly hardware part and application part. These two play pivotal role in this proposed project.

A. Hardware part

i. The below following diagram represents hardware part of the proposed system.
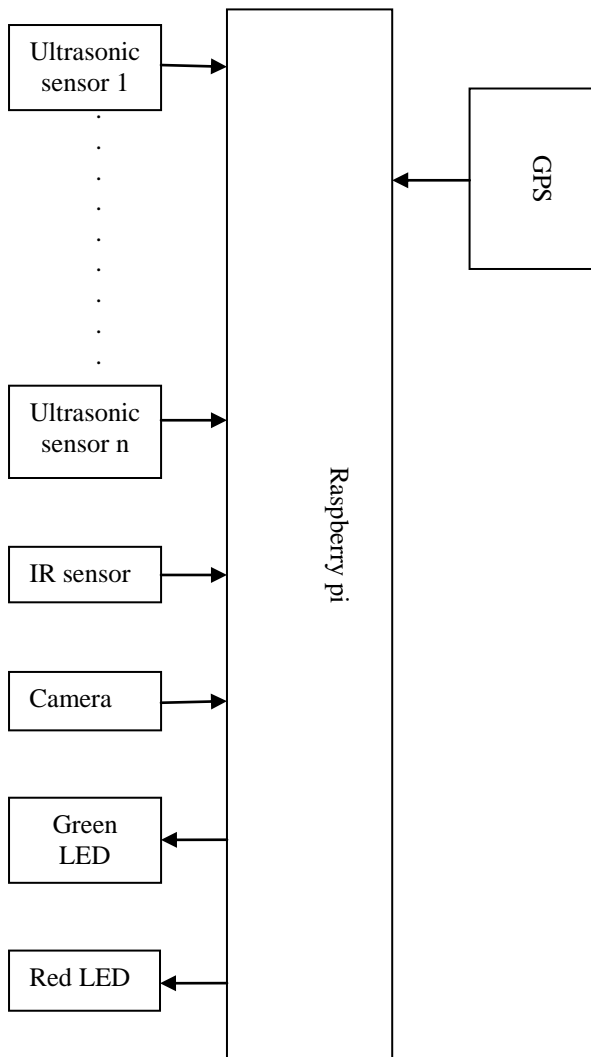
Fig .4: Hardware part block diagram of proposed system

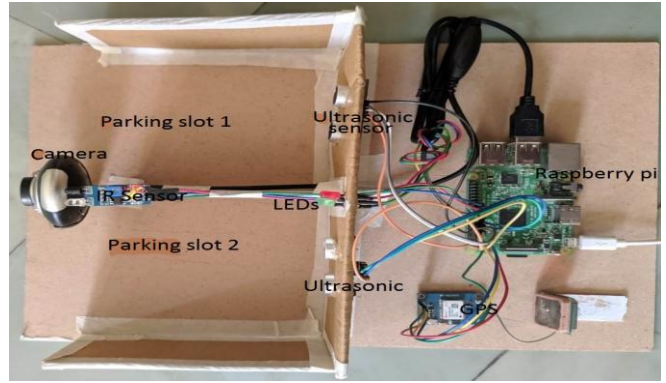ii. The below following diagram represents the proto type system

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Fig: 5 Prototype System

B. Application part

i. Mobile application for advance booking of parking slot window is shown below. First window of opening application.

Fig.6: Application of smart parking
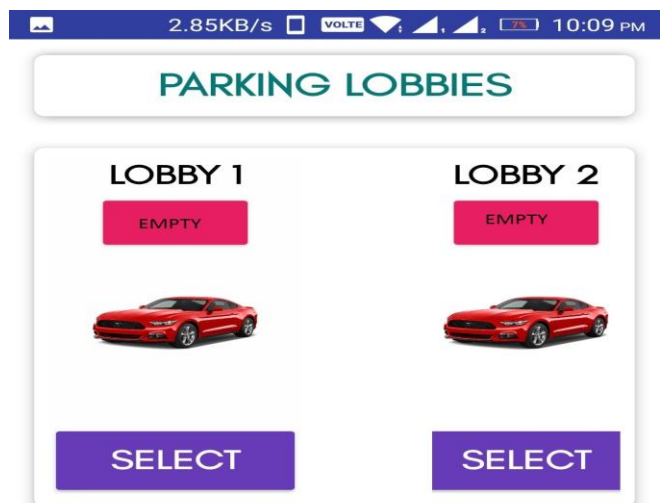
ii. Parking lobbies to proceed click on select.

Fig.7: Parking lobbies window

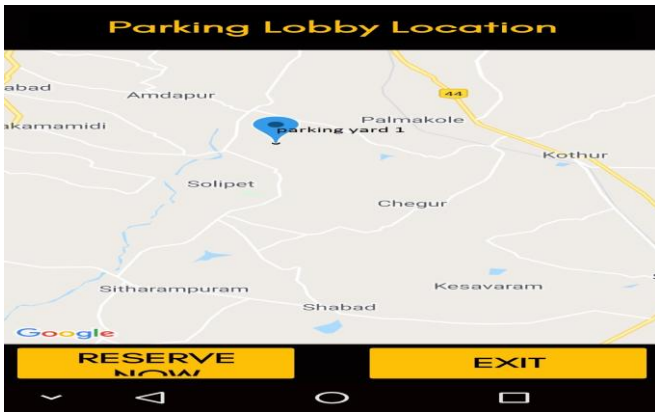iii. Location point of parking yard on google map to track root to reach there easily.

Fig .8: Parking location view on Google map

iv.   To reserve slot, have to enter require details asking.

Fig. 9: window for reserving slot

B. Flow chart

The following flow chart represents the steps of proposed parking system.
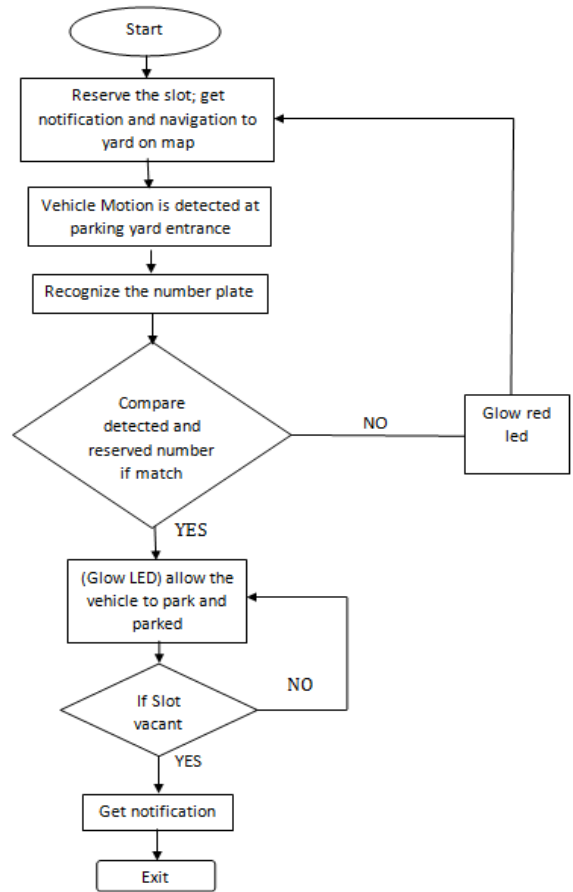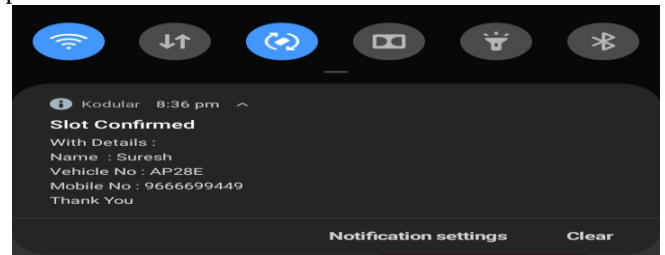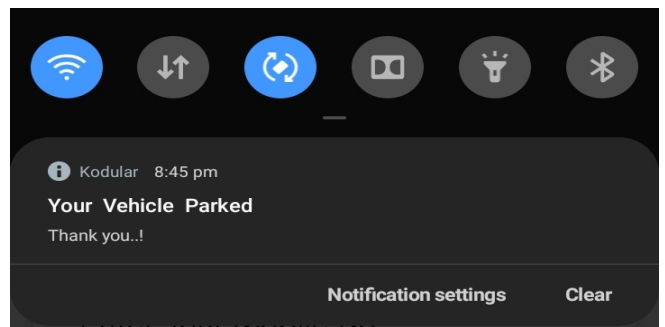

Fig. 9: Flow chart

V.   RESULT

The result of this prototype proposed system is considered as better than previous proposed systems. The result of this is represented in the form of notifications below.

i.   User gets confirmation notification on user android phone after user booking with details and internally at the system parking time starts.

ii. Now after reaching parking area and parked the vehicle user gets another notification.
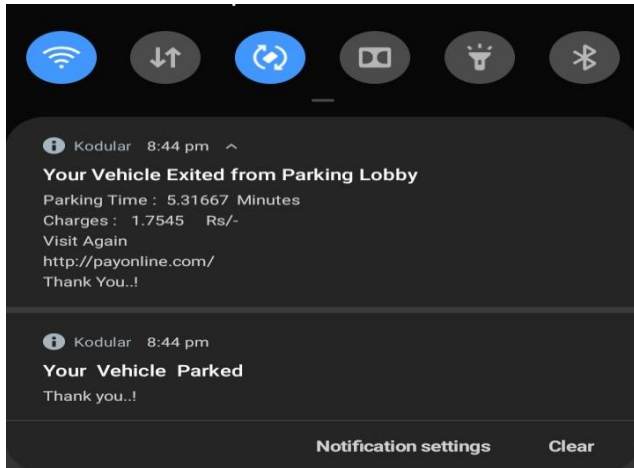
iii. While exiting parking area when vehicle vacates the slot user gets final notification with calculated amount of time, charge and with payment link.

VI. CONCLUSION

This paper proposed the smart parking management system using internet of things. Smart parking systems are very important present days to solve all the parking problems and Introducing new technology like internet of things to users. Making of online payment of parking charge ways bring into digital revolution and curbs to parking corruption by implementing this into real time.

ACKNOWLEDGE

The prototype proposed system is executed successfully and has given magnificent results. If it is brought into real time definitely produces the outstanding service. All the problems which are discussed initially will be gone and supports the development of the country. For implementation this prototype into real time may be low cost.

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