Android Application for Smart Parking using IoT

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Abstract— **IoT or Internet of Things plays an important role in our day-to-day life. It is used to interconnect one device to another through internet. In the proposed system, we develop a user-friendly application for IoT based Smart Parking system. The main objective of this smart parking system is that users can book their slots and park the vehicle. Parking assistance is provided to find the user's parked vehicle from the parking slot through the application. At each parking slot, LED indications are used to identify the occupied and unoccupied spaces. Users can do the payment using two methods: online transaction and RFID technology. IR Proximity sensor is used to detect whether parking slot is occupied or not.**

Keywords—IoT; IR Proximity Sensor; Bluetooth Beacon; RFID

I. INTRODUCTION

Nowadays every park, malls, hospitals, multi-stored buildings have parking spaces. These parking spaces provide a convenient way to park the customers vehicle. But due to the rapid growth in population, the usage of vehicles are also increasing. Thereby a better solution is needed to park the vehicles because the existing systems are time consuming and also less secure.

The existing parking systems do not provide real time parking facilities. Customers waste time for searching available parking slots. This leads to wastage of time, congestion and also causes traffic. Another issue is people coming from faraway places have to waste time to find a vacant space and also sometimes they may not even get a parking space. Finally, users have to spend a lot of time for payment processing and there are chances for people to leave the parking space without doing the payment.

The Internet of Things or IoT is a system of interrelated devices connected to internet to transfer and receive data from one another. IoT has a great influence in our lifestyles from the way we react to the way we behave. Smart home is the best example of IoT technology.

In this paper an IoT based smart parking system is implemented for users. An android application is implemented which provides security and flexibility where users can book their slots and park their vehicles. This system helps to reduce manpower and also reduce time consumption. This is an eco-friendly system which enables the users to book their own parking slot through application. The proposed system ensures security and confidentiality of the user information. The application includes features like slot booking, online payment and also provide parking assistance. Users can view the parking slots through the application. They can book their own slot after a registration process. The data of the users are securely stored in a database. The application provides two methods of payment: online transaction and using RFID technology.

The main purpose of this methodology is to provide an application that enables RFID technology for parking system. By using RFID readers and labels in a centralized parking system, all the parking spaces can be operated in a faster and easy way. RFID readers are used at the entry check-in and exit checkout areas so that user does not need to wait for the payment processing. This system uses a Bluetooth beacon for locating the vehicle. IR Proximity sensor is used to detect whether parking slot is occupied or not. Number plate detection is done to using OpenCV.

The major contributions of this study:

• We implement a smart parking system with Bluetooth beacon for providing navigation to the users. The Bluetooth module provides a parking assistance.

• We design and implement an Android application for the system. This application provides slot booking, online payment and also provides parking assistance for the users.

- We implement this system using RFID technology for the providing a better payment procedure. Helps the users to pay the amount effortlessly.
- This system uses number plate detection for ensuring the security of the user. It also validates the booked user.

II. RELATED WORK

A. Smart Parking System using IoT Technology

In the existing system IoT technology is combined with advanced Honeywell sensors and controllers to obtain a systematic parking system [1] for users. IoT enabled smart parking system not only describes the architecture and connectivity of parking system but also improves the parking management. This system reduces the challenges which are faced in conventional smart parking system such as real state space, time consuming, labour cost and productivity.

B. IoT Based Airport Parking System

IoT Based Airport Parking System [2] is an efficient parking service. It displays all user details only to the administrator. Every passenger can view the parking location details in the smartphone via cloud server in the airport. This ensures security to the vehicles in the parking lots.

III. PROPOSED SYSTEM

The proposed system provides a software in which a user can book a parking slot without any human assistance. In this android application the users can navigate and book the slots for parking. Initially the user has to login and register in the application. The users will be shown some preset slots and can select the slots according to the users wish. The already booked slots will not be shown. Voice based navigation is also provided.
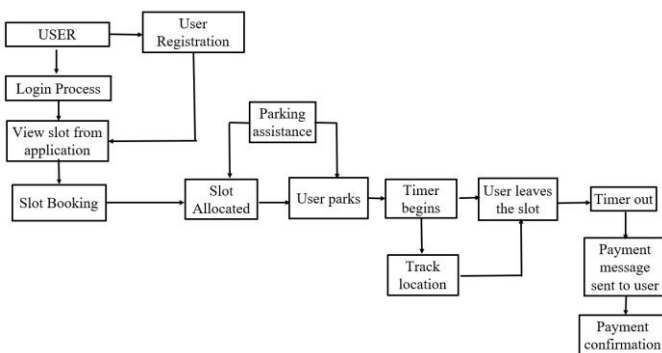
A. System Architecture

Figure 1: Flowchart of smart parking system

Here the user views the parking slot through the android application. User can book the slot after a user registration process. The user credentials will be stored to a database. Payment details and slot number will be sent to user after slot booking. User can use parking assistance if needed and park the vehicle. Once the user parks the vehicle, the timer starts. User can also locate the position of his/her parked vehicle through the application. The timer ends when the vehicle is

removed from the parking slot. Payment message is sent to the user and user can pay the amount using two methods: online transaction or by RFID tags. Payment confirmation is sent to the user.

B. Hardware Requirements

1) Sensor Interfacing

- IR Proximity sensor interfacing to GPIO of NodeMCU.
- RFID reader module interfacing using UART protocol.

2) MQTT client implementation in NodeMCU

- Running NodeMCU as MQTT client. And sending data to MQTT server.

3) Setup Bluetooth module as BLE

- Setting up Bluetooth module as BLE beacon.

C. Software Requirements

The tool used for developing the code is Android Studio. The program runs on java code. It runs on operating system such as windows 7 or later version. Front end of the application is done on android and the backend is done on SQLite.

IV. IMPLEMENTATION

The implementation of the proposed system contains two different stages.
A. Software Implementation
B. Hardware Implementation

A. Software Implementation

We have designed a simple mobile application where user can register their details and search for vehicle parking.

A. Login and Register: Users can input their details and register in the system. Users can use their username and password to login to the system.
B. Slot Booking: Dummy slots will be shown to the user. The user will select one and book the slot. The slot booked will be saved in the database.
C. Navigation: An image will be used for the visualization of route to the slot booked. Default route will be set on the basis of Bluetooth beacon. An audio will be played for the navigation.
D. Payment: Dummy payment will be done. Database will be used for the dummy payment. The RFID tags can read the start time and end time. This time period is taken for the price calculation. Then the amount will be automatically deducted.
E. Number Plate detection: Haar Cascade File is used by OpenCV for number plate detection. Frames are passed to the Haar cascade classifier. The classified frame areas are passed to extract the number plate. OCR is imported with the help of Pytesseract module. This package is used to detect the text given in the area passed.

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B. Hardware Implementation

The Node MCU collects the sensor data and uploads to the server using API (application program interface). The server receives the data using the API and stores it in the data base. Whenever any user searches for the parking slot the mobile application provides the available parking slots.

A. SMPS – SMPS (switch mode power supply) is the power source of the whole IoT device.

B. Wi-Fi Module: - In this project, we have used Node MCU(Micro Controller Unit) ESP8266-12E. The Node MCU contains Wi-Fi module. Node Microcontroller has ROM which can be used to upload a program.

C. IR Proximity Sensor: IR or Infrared Obstacle Sensor Module has two part IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of any obstacle in front of the sensor module. The sensor has very good and stable response even in ambient light or in complete darkness. An IR sensor consists of an IR LED and an IR Photodiode. Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

D. Bluetooth Beacon: HM-10 Bluetooth is used as BLE beacon for navigation. Beacons are small, wireless transmitters that use low-energy Bluetooth technology to send signals to other smart devices nearby. They are one of the latest developments in location technology and proximity marketing. They connect and transmit information to smart devices making location-based searching and interaction easier and more accurate. Setting up Bluetooth module as BLE beacon to navigate the location.

E. RFID- Radio Frequency Identification or RFID comprises of two components: reader and tag. Reader is a device which emits radio waves and accepts the signal from tags. Tags are used to store information of data. There are two types of tags: Passive and Active tags. EM-18 RFID reader and 125KHz RFID tags are used for payment.

C. Steps For Working Application

STEP 1: User has to do one time registration in the mobile application. Registration requires the following details name, mobile number, number plate text. Username and password is also required.
STEP 2: The Users can view the parking slot and book the slots for parking.
STEP 3: Users can set the time for the slot while booking.
STEP 4: The slot will be reserved until the user parks the vehicle. If the user fails to park the vehicle in the allotted time then the park will be marked vacant.

STEP 5: Once the user parks the vehicle timer starts and timer ends when he/she leaves the slot.
STEP 6: Payment will be on the basis of the parked time period.
STEP 7: Payment can be done by online transaction or using RFID tags.

V. CONCLUSION

This paper implements an approach to IoT based car parking and reservation system. In this proposed system, the user can park their vehicle without any human interference. This system also helps user to save time and improve the efficiency of their time. In this paper, we propose an android application for smart parking system based on IoT technology. The system uses RFID technology for providing payment. Security of the user is provided by number plate detection. The aim of this approach is to reduce the time taken for searching available parking space and also provides a handsfree payment. This smart parking system can be implemented into parks, malls, hospitals. This application provides a pre-booking facility of parking slots for the users. This android application is available in smart phones so that the user can access it easily. Navigation is also provided for further assistance.

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