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IOT Based Smart Parking System

Apeksha P. Bari[1], Manali A. Parab[2], Amey U. Kokate[3],Nida Parkar[4]
[1](Student, Computer Engineering, Atharva College Of Engineering, India)
[2](Student, Computer Engineering, Atharva College Of Engineering, India)
[3] (Student, Computer Engineering, Atharva College Of Engineering, India)
[4](Assistant Professor, Computer Engineering, Atharva College Of Engineering, India)

Abstract: *Now a days the concept of smart cities have gained grate popularity. Thanks to the evolution of Internet of things the idea of smart city now seems to be achievable. Major efforts are being made in the field of IOT in order to maximize the productivity and reliability of urban areas. Problems such as, traffic congestion, limited car parking facilities and road safety are being addressed by IOT. In this paper, we present an IOT based Server integrated smart parking system. This system consists of an IOT module which check the state of availability of parking lot. A mobile application is also provided that allows an end user to check the availability of parking space and book a parking slot accordingly. The paper also describes a high-level view of the system architecture. Towards the end, the paper discusses the working of the system in form of a use case that proves the correctness of the proposed model*

Keywords –*Cloud of Things; Smart Parking; Smart City; Arduino*

I Introduction

The idea of creating a Smart City is now becoming possible with the emergence of the Internet of Things. One of the key issues that smart cities relate to are car parking facilities and traffic management systems[1]. In a recent research it has been found thatfinding an available parking spot is always difficult for drivers. Ittends to become harder with the increasing number of private car users. This concern attractedstrategic investments from dedicated industry sectors to boost parking revenues through technology-enabled solutions like reduction in searching times, traffic congestion and road accidents. Problems related to parking and traffic congestion can be solved if the drivers can be informed in advance about the availability of parking spaces before reaching to their intended destination. Researchers [2] show that more than 66% of drivers are willing to pay for car parking during working hours. This directly adds value to the car parking business. It is stimulus for the development of intelligent car parkingservices for smart cities. The system helps a user know the availability of parking spaces. The parking systems aims at providing facilities to users like find, allocate, and reserve the 'best' available car parking lot for a user in a particular area, providing navigation instructions for reaching this lot.

II Problem Statement

In recent research in metropolitan cities the parking management problem can be viewed from several angles. High vehicledensity on roads. This results in annoying issue for the drivers to park their vehicles as it is verydifficult to find a parking slot. The drivers usually waste time and effort in finding parking space and end up parking theirvehicles finding a space on streets. In worst case, people fail to find any parking spaceespecially during peak hours and festive seasons.

III System Architecture

The following figure gives complete view of the system.

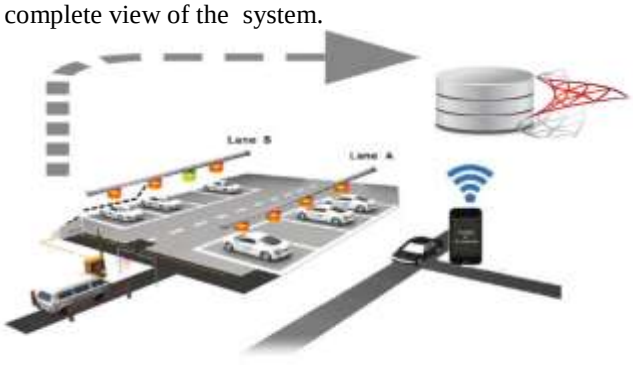

Figure 1: Smart Parking System

The above mentioned figure depicts a parking area. The parking system implementation shows that the communication happens between various actors. The primary actors that constitute the parking system are:

Parking Sensors:

For our parking system we have made use of sensors like Infrared, Passive Infrared(PIR) and Ultrasonic Sensors. The work of these sensors is to sense the parking area and determine whether a parking slot is vacant or not. In this case we are using ultrasonic sensors to detect the presence of a car. The ultrasonic sensors are wirelessly connected to raspberry pi using the ESP8266 chip. An WiFi chip consists of a self contained SOC and integrated TCP/IP protocol stack. The chip allows any microcontroller to access a WiFi network. The sensors are connected to a 5V supply either from raspberry pi or an external source. External source being more preferable.

Processing Unit:

A microcontroller device which is **Arduino** iscomputer hardware and software device. It designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects. The microcontrollers can sense and control objects in the physical world. The design of Arduino board is a combination of microprocessors and controllers. The boards are equipped with sets of digital and analog I/O pins. That pins may be interfaced to various expansion boards (*shields*) and other circuits.Thatpins may be interfaced to various expansion boards (*shields*) and other circuits. The programming of microcontrollers are typically perform using a dialect of features from the programming languages C and C++. Arduino project also provides an integrated development environment (IDE) based on the Processing language project.

Mobile application:

The mobile application acts like an interface for the end users to interact with the system. The application is developed in Android Studio and Java as a programming language. The application is connected with the SQL server through a secure channel and a 2 factor authorization. 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 SQL server and the mobile application. In order to ensure proper communication both the Arduino and mobile application must be subscribed to a particular channel on SQL server.

The Server :

The SQL server acts as a data base to store all the records related to 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 server which permits the system to add any number of users at any time of the day. Continuous 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.

On closely looking at the figure one gets to see that empty parking spaces are indicated by red light in Lane A whereas green light in Lane B. This is due to the fact that in case of Lane A although there is no car currently parked but there still is a red light because the slot has already been booked by some user. On the other hand, the parking slot in Lane B shows green light because it neither has a booking nor a car parked in it.

IV Implementation And Working

In this section we talk about the implementation and working of the system in a real world scenario.The complete process ofbooking a parking slot, parking a car in that slot and leaving the parking area is explained with the help of following Flow Diagram.We conducted an experiment in order to depict the working ofour system at every stage. We are checking the availability ofparking space to actually park a car in a vacant parking slot by implementing the smart parking system in theparking area.

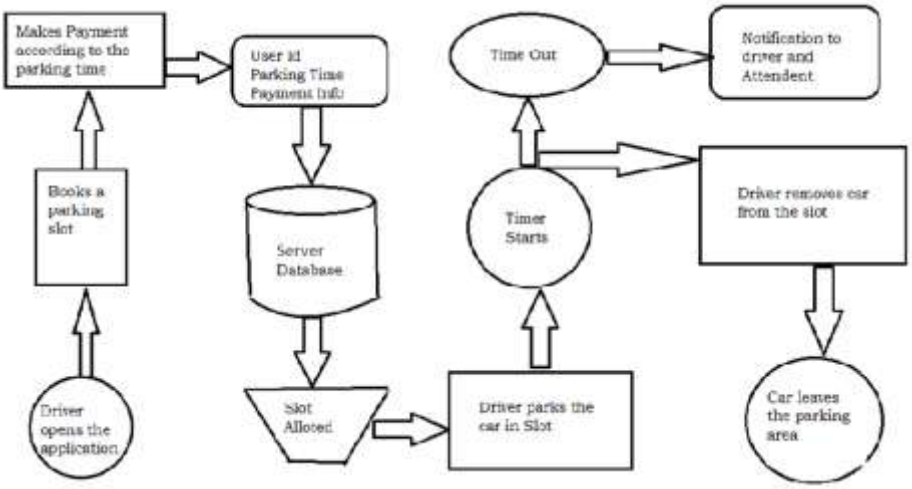

Figure 2: Control flow of the system

Below are the steps that a driver needs to follow in order to park its car using ourparking system.

- Step 1: Insall the smart parking application on yourmobile device.
- Step 2: Using the mobile app search for aparking area on and around your destination.
- Step 3: Select a particular parking area.
- Step 4: Browse through the various parking slotsavailable in that parking area.
- Step 5: Select a particular parking slot.
- Step 6: Select the amount of time (in hours) for whichyou would like to park your car for.
- Step 7: Pay the parking charges either with your e-wallet or your credit card.
- Step 8: After successfully parking your car inthe selected parking slot, confirm your occupancy using the mobile application..

The above procedure of booking a slot and parking a car in that slot is explained with the help of the following screenshot

Figure 3: Booking a parking slot

The above figure shows the presence of vacant and occupied parking slots. In this case parking slots A1 and A3 are vacant whereas slot A2 is occupies. The driver chooses the A1 parking slot.

Figure4 : Occupancy Check

Once the driver has parked its car in the selected parking slot the driver needs to confirm its occupancy. Figure 4 depicts this very scenario in which the driver has to specify its presence. This feature is added so that only a genuine driver can park its car in a particular parking slot. If a driver fails to confirm his occupancy in the next 30 seconds of parking its car, an alarm would start ringing causing the authorities to know that a car has been parked in the wrong place. If a genuine driver fails to do so he can stop the alarm any time by confirming his occupancy. In case the driver over shoots its parking time, a notification stating this scenario would be sent to the driver as well as to the parking attendant. The driver have an option of extending its parking time and pay accordingly for the extra time. In case the driver fails to do so, the parking attendant would make a note of this and charge money for the extra time in form of a fine. This fine would be collected from the driver at the time when the car would be leaving from the parking area.

V Conclusion

Smart parking systems gives rise to new solutions with the help of Internet of things . The system have always been at the core of constructing smart cities. In this paper, we address the issue of parking. It presents an IoT based Cloud integrated smart parking system. The system provides real time information regarding availability of parking slots in a particular parking area. With the help of this mobile application user can book a parking slot for them from remote location. The efforts made in this paper are indented to improve the parking facilities of a city and thereby aiming to enhance the quality This designed automatic smart parking system which is simple, economic and provides effective solution to reduce carbon footprints in the atmosphere. It is well integrated to access and map the status of parking slots from any remote location through web browser. Thus it reduces the crisis of car parking across a remote city and also it eliminates unnecessary travelling of vehicles across the filled parking slots in a city. So it reduces time and it is cost effectivealso.

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