

Smart Car Parking: A Novel Approach

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Abstract— The concept of smart cities has become very popular recently. Due to increasing number of vehicles in urban areas, we are facing problems of traffic congestion. It is essential to develop an automated smart parking management. It will help people to find out parking space quickly. This system will be implemented with the help of IOT (Internet of Things). It refers to physical things which is connected to internet or exchange information or data between internet and physical device with the help of automated parking system music and safe time for searching available parking space IR sensor has been used to check particular slot is available or not user can book advance parking slot and update information to the server every user has unique ID and password.

Keywords— Internet of things, Smart City, Infrared Sensor, Wi-Fi, Smart Car Parking

1. INTRODUCTION

Internet of things plays a significant role in our daily lives. With the help of modern technology, smartphone has become a necessity for every person. People prefer personal vehicles rather than depending on public transport. Finding a parking space in most metropolitan areas, is difficult for drivers Every person who had frustrated driving ever wished to have solution that could lead them to particular slot. It has been found that driver spend at least 8 minutes to search for parking slot that leads to 30-40% congestion. It is a laborious task for driver to search for slot. In Conventional Parking System No optimum use of available slot. Traffic jam in front of the parking can be seen in many shopping malls, hospitals. It causes economical loss to commercial places as people avoid visiting these places due to parking problem. Guard stop every vehicle and give slip which causes traffic jam.

It is time consuming to find out the parking slot which costs extra fuel. . Security problem is one another issue in manual car parking Due to increasing population there is high vehicles density on roads which leads to difficulty to find a parking slot [5]. The rapid growth of vehicle along with mismanagement of parking space has created many problems. Due to unplanned and lack of discipline people can park their cars anywhere which creates a mess as people . As a result of this, a huge traffic jam takes place. Due to mismanagement parking, car get dent by bumping with each other as there is lack of sufficient space.It leads to fight, argument among people that cause traffic congestion [6]. It causes road accidents. Traffic congestion is an alarming problem. Searching for parking slot is a daily routine. This causes burn of one million barrels of the world's oil every day People waste money and fuel search for parking slot [10]. The driver usually ends a space through luck and experience. Solution for this problem is to do advance booking. But it can't be optimal solution as the car park usually be far away from the user destination. Parking is an high-priced in terms of money, time and effort. Finding a parking slot is difficult for drivers which give chance for smart city to take action to reduce traffic congestion. Smart

Car parking system helps to find available slot and do advance booking. It will save user's time, effort,

and fuel. It will help user to find, allocate, reserve the best available car parking slot [7]. An Infrared sensor is used to check the available space [1]. If Slot is empty, you can book the parking with the help of mobile application [3]. WIFI module has been use to enable internet on hardware. IR sensor would sense the empty slot and notify to controller .Controller activates LED as per notification. If the car is parked LED would glow RED. If car is neither booked nor parked, LED would glow as GREEN .If car is booked but not parked, LED would glow YELLOW. For the purpose of car safety, User will get One Time Password [8]. User would decide which slot is convenient according to availability. Smart Parking use low cost sensors, real-time data and applications that allow users to monitor available and unavailable parking slots. The objective is to decrease time spent manually searching for the optimal parking slot. Problems with the Traditional car parking system:

- Huge traffic jam in front of the parking in many shopping malls, hospitals ,creates traffic jam.
- Time consuming to find out the parking slot which costs extra fuel and wastes time.
- Security problem is one another problem in manual car parking
- Guard needs to be appointed for the whole job, it is costly enough

The main objective is to design a Smart Parking System (SPS) to enables the user to check availability of parking slots in that respective parking area. Users find the best spot available, saving time, resources and effort. User can book his slot before reaching to desired destination through mobile application provided that allows an end user to check the availability of parking space and then book a parking slot accordingly This study provides real time information about nearby parking slot for the driver and reserve slot earlier using mobile application. The benefits of smart car parking are : i)Reduce Traffic ii) Reduction in pollution iii)Increase in Safety iv) No need to pay to guards v)Time Saving vi) Fuel Saving.

2. RELATED WORK

Our country has been developing radically; we have connected roads, commercial building and automobile. Transportation is becoming backbone of economy. Today also, we are using manual procedure of parking which are

maintained in unplanned manner. Over the years parking system related technologies has increased smart cities related to car parking facility and traffic control management has become the major issue. Parking expensive process in terms of money time and effort made for searching free spot [4]. Due to mismanagement of parking it leads to road accident, traffic jam. People get delayed to reach their destination. It causes to reach in meeting later. Car Parking consumes lot of fuel. The authors [13] proposed a algorithm for real-time parking. First, they used an algorithm to convert the online problem of a parking system into an offline problem. They layout a mathematical model to describe the offline problem as a linear problem. . they made an algorithm to explain this linear problem. Finally, they evaluated they form idea of using algorithm using experimental simulations of the system. It indicated timely and efficient performance. They did not mention the resource reservation the mechanism for assessing the resources system, the mechanism to guide vehicles to the parking slot , the mechanism for handling problems when the request for service is denied .They do not calculate the average waiting time and average total time that each vehicle spends on the system.

In another study Mainetti et al. [13] made an Smart Parking System based on the integration of UHF frequency, RFID and IEEE 802.15.4 Wireless Sensor Network technologies. It can collect information about the state of availability of the car slot , and can route drivers to the nearest vacant parking spot by using application. the authors does not proposed any mathematical equations for the system architecture and It is not applicable for large-scale parking system. They only implement the proposed architecture. They do not clarify the performance of the parking system.

In Geng & Cassandras [12] an approach is used for reservation of parking slots depending on the driver's costs. The data which is gathered by cars and parking slots cannot be fused with parking reservation requests and statuses.

This opportunity can lead to propose an Internet of Things solution to connect every parking slot to every cars efficiently Till now there is no proposed IoT-based scheme for traffic-correlated parking reservation service. Without considering the estimated time of car arrivals and reservation Parking reservation scheme cannot lead to an efficient solution.

Funck et al. [11] proposed system that used CCTV cameras in parking to detect available car slot.They have low degree of accuracy

The authors [13] proposed Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition. It has less interaction with humans. They used magnetic card and devices but number plate number will be vary from country to country. To solve this problem different algorithm has to be used.

Smart Parking System Based on Optimal Resource Allocation and Reservations[14] solves a Mixed Integer Linear Program (MILP) problem. For every MILP there is a solution which gives an optimal allocation based on user's current state . It supports new user requests and

current parking status so . there is no parking slot reservation issue . No driver would get parking slot with higher than the current cost function value. A vehicular ad hoc network (VANET) [13] based smart parking system is proposed .It provides the drivers real-time parking navigation, intelligent anti-theft protection and dissemination of friendly parking information. It used 802.15.4 low power wireless technology, Bluetooth and Wi-Fi to help the driver to search and book the vacant parking spaces. It used webcam to detect free parking slot .It provides SMS based reservation service .

In Car parking system using cloud server, data is stored on remote servers accessed from the internet, or "cloud".Some people stored in hard drive,some in compact disks.Some owners have to delete old data for making space for new data.

Hsu et al. [13] proposed an system including the parking guidance service. With help of application, slot can be reserved. The reserved parking slot would be displayed on a small map using wireless transmission for vehicles under short-range communication protocol DSRC. An inertial navigation system (INS) is implemented to guide the vehicle to the reserved slot. The system will timely update the status of the parking space .The authors had not evaluated the performance of the parking; they do not provide any mathematical model of the system. They do not consider the waiting time of each vehicle.

3. SYSTEM ARCHITECTURE



Fig 1:Top View of the System Architecture

1. **IR sensor:** IR sensor consists of IR transmitter and IR receiver which is used to detect the objects and obstacle in between transmitter and receiver, when the car comes on the parking slot, sensors read and detects the vehicle.
2. **Power Supply:** 7805 Voltage Regulator is used.Home supply voltage is of 220V. Since microcontroller works on 5V DC. With the help of adapter, AC is connected into 12V DC. By using 7805 Voltage Regulator, 12V is converted into 5V.
3. **Capacitor:** It act as a filter. It removes noisy data.
4. **Resistor:** Resistor will determine the quantity of current.
5. **Microcontroller ATmega328** -Microcontroller gives the state of parking slot from IR sensor

signal and send information through the computer via serial communication.

6. **Wi-Fi module:** The ESP8266 Wi-Fi Module is used to enable internet on hardware. .
7. **LED:** Red light indicates space booked, green light indicates vacant and yellow light indicates prepaid booking.
8. **Buzzer:** If the vehicle is improperly parked, it will create warning sound through buzzer.

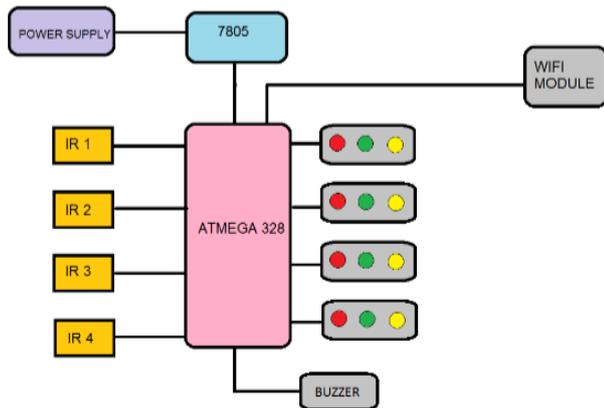


Fig 2: Block diagram

Figure 2 depicts sensors which are connected with ATMEGA 328 which gives current status from IR sensor to server. LED has been used. Red light indicates space booked, green light indicates vacant and yellow light indicates prepaid booking. WIFI module is used to enable internet on hardware.

Software Requirement:

1. Ionic Framework: Ionic is open source framework used for developing mobile applications. Updating in IOS gets expensive. It has high cost of maintenance and high cost of development. Due to this Ionic framework has been chosen.

4. RESEARCH METHODOLOGY

Each parking lot has to be equipped with a control system that enables monitoring of the number of free and occupied parking places and informing potential parking lot users about the parking slot status locally and in a wider area. If the car is parked LED would glow RED. If car is neither booked nor parked, LED would glow as GREEN. If the car is booked but not parked LED will glow YELLOW.

STEPS

The steps that a driver needs to follow in order to park its car using our parking system are:

- Step 1: Install the smart parking application on mobile device.
- Step 2: Sign Up and login.
- Step 3: Browse through the various parking slots available in that parking area.
- Step 4: Select a particular parking slot.

Step 5: Once you have successfully parked your car in the selected parking slot, confirm your occupancy using One Time Password

Step 6: Pay the parking charges either with your e-wallet or your credit card

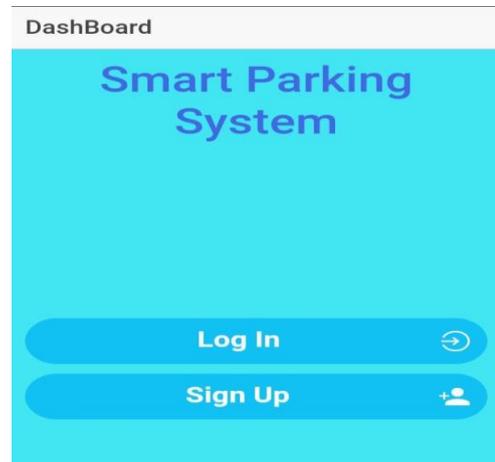


Fig 3: Smart Car Parking Dashboard

Figure 3 depicts whether user is already registered or not. If he is registered he would opt Log In otherwise Sign Up.

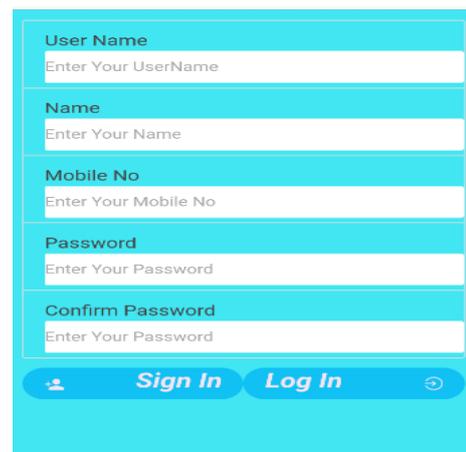


Fig 4: Sign Up

User will do registration

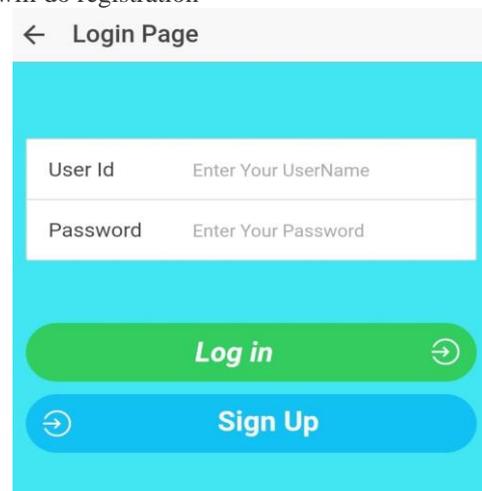


Fig 5: Login Page

User would do login with the help of credentials(User Id and Password)

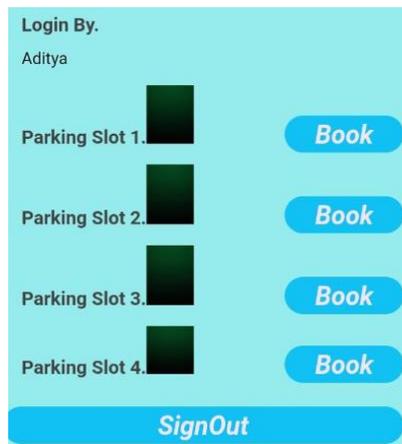


Fig 6: Book your slot

Book your slot according to availability. The Black color means the slot is available and the red light means the slot is already vacant.

Hii Aditya, you Have Booked a Parking.

Hii Aditya, you Have Parked a Vehicle. your OTP is 70663. Thanks for Using Our parking

Fig 7: Generation of OTP

In figure 7 user would get OTP on his mobile for security purpose so his car can't be robbed

5. CONCLUSIONS AND FUTURE SCOPE

A successful implementation of this project would result in less fuel consumption and less traffic. The system provides real time information about current availability of slot in the parking area. If it is entertainment centre, market place or mall, the first and foremost question is about the parking slot. From the proposed IoT based car parking a user can login with appropriate ID and password, can check available parking slot and book his/her slot. User will get one time password after booking for security purpose. The system is user friendly, save time for checking empty space, save fuel and reduces traffic congestion. In the paper, we address the issue of parking and present an IoT based smart Car Parking system. The future scope would be if user phone gets stolen or any problem which makes him unable to use OTP, so we can implement this project with fingerprint to confirm booking instead of OTP.

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