Smart Parking System

Harish Umasankar
2020102067
ECE
International Institute of Information Technology, Hyderabad
Hyderabad, India
harish.umasankar@students.iiit.ac.in

Tanniru Abhinav Siddharth
2020112007
ECD
International Institute of Information Technology, Hyderabad
Hyderabad, India
abhinav.tanniru@research.iiit.ac.in

***Abstract*— A critical challenge in parking vehicles is the lack of information and inefficient use of available parking capacity. This paper focusses on how to optimize parking space so that users can find and navigate to the parking slot comfortably. We propose a Smart Parking System that displays the number of available parking slots and displays the location of the available slot through Bluetooth.**

Keywords*— *Parking System; Smart City; Sensors; Bluetooth; Parking Management

I. Introduction

Finding an empty parking spot is always difficult for drivers and the issue gets harder as the number of cars searching for parking increases.

We are going to tackle this problem by informing the drivers about the availability of at and around their destination. We will set up LEDs over each spot which glows green when it is empty and red when it is used. So, if you have hundreds of parking spots in a row, it is very easy to detect if there is an empty space. We display a counter to show the number of empty parking spots on each floor.

The smart parking system that we propose is implemented with the help of a mobile application which helps the user know the availability of empty parking spaces on a real time basis.

II. Background and Issues

Searching for parking is a routine activity in urban areas and it is estimated that nearly 30% of urban congestion is created by drivers cruising for parking space. It was estimated that the average time to find a parking space was about 8 minutes.[2]

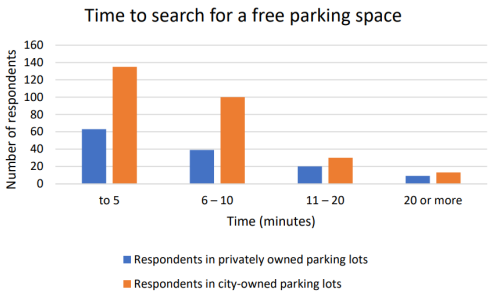

Figure 1: Time to search for a parking spot[1]

The International Handbook for On-Street Parking Management mentions that when the parking is close to saturation (the occupancy rate is above 85%[3]), it is difficult for the driver to find the parking space for parking, thereby increasing the traffic burden of the congested area. This obviously congests traffic, pollutes the air, and creates CO2 emissions.

Our smart parking system aims to reduce or solve these issues by supplying the user information about parking availability in an efficient manner.

III. Approach

1. Install the smart parking application on your mobile phone.
2. Connect to the Bluetooth network.
3. Check for empty parking spot on the mobile application.
4. 7-segment display shows the number of empty spots available on the current floor.
5. Find an empty parking spot with the help of red and green LEDs in every parking slot

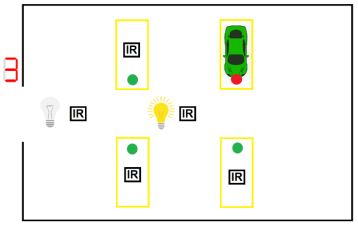

Figure 2: Layout diagram

IV. Block Diagram and Functional Entities

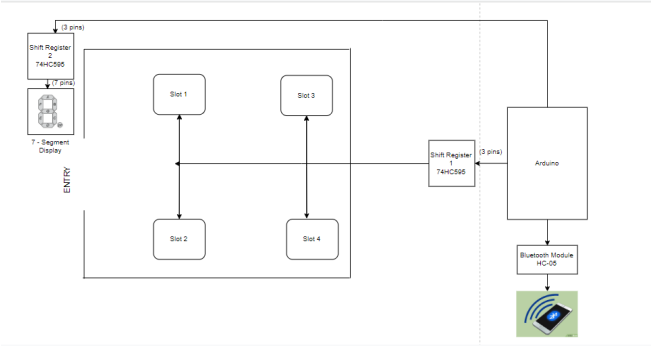

Figure 3: Block diagram of circuit

The parking system consists of 4 parking slots.

- Parking Slot: Each slot comprises of an InfraRed Sensor and a RGB LED. The IR Sensor is used to detect whether a vehicles is parked in that spot or not. The colour of the RGB LED denotes the availability of that parking slot. If the RGB LED glows green, the parking slot is available. If the RGB LED glows red, then the parking slot is not available.
- Counter Display: The number of available slots is displayed by the 7-Segment Display. If the IR Sensor in one slot detects a vehicle, and the other three IR Sensors do not detect any vehicle, then the counter displays 3 as there are 3 unoccupied slots. We can optimize the number of pins to control the 7 Segment Display by using a Shift Register. Without a shift register, the 7 Segment Display needs 8 pins to control the LEDs. After using a Shift Register, we control the 7 Segment display by using 3 pins.
- Arduino Microcontroller: The Arduino microcontroller acts as the mediator between the InfraRed Sensors, Bluetooth Module, and the Android Application. The program to control the Arduino Microcontroller is written in C language in Arduino IDE and uploaded to the microcontroller. The microcontroller transfers the data through the Bluetooth Module to the Android Application by printing the data in the Serial Monitor. The data is encoded in the given format – XY, where X denotes the parking slot number and Y denotes the availability, that is, 1 if slot is available and 2 if slot is occupied.
- Android Application: The Android Application uses the Bluetooth module (HC05) to receive the data from the Arduino. The Android Application is developed using MIT App Inventor 2. The role of the application is to display the availability of the slots in the parking system. The MIT App Inventor decodes the received message which is 2 digits to display the availability of the parking slots.

V. ADVANTAGES

- Very Accessible: Since Bluetooth is available in all devices, it is easy to connect to the system from the user's device.
- Environment Friendly: By efficiently allocating the parking space we can avoid traffic congestion, thereby reducing the pollution so caused by it.
- Cost Effective: Since InfraRed Sensors are cheap and easily available, Smart Parking System can be implemented easily and economically.

VI. APPLICATIONS

Smart Parking Systems can be implemented in offices and shopping malls. It can also be implemented in housing societeis and other places that generally have a high congestion of traffic.

VII. CONCLUSION

In this paper, we look at the parking space issue and provide a solution that is implemented by using Infra-Red Sensors and Bluetooth. This system will help users find and navigate to parking slots easily. By implementing this parking system, we can improve the lives of the users and also reduce pollution caused due to traffic congestion.

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