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Smart Parking Slot Detection System using Internet of Things (IoT)

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ABSTRACT: Nowadays in an urban area, looking for available parking slots, is not only a waste of time and energy but also it causes more traffic and air pollution. Therefore finding available parking spots is becoming more challenging on daily life. This project proposes a solution by providing motorists with real-time information about the availability of slots in parking spaces through internet. Sensors and raspberry pi were used in parking zones to detect vehicles and calculate the number of available parking slots. Drivers can see available parking slots in real time on a map and web page.

KEYWORDS: Smart Parking System, Parking Slot, Sensor, PIC, Raspberry Pi, Internet.

I. INTRODUCTION

In large cities with heavy traffic, looking for parking with available slots is not only a waste of time and energy; the worst is, causes more traffic. People waste away litres of gas just trying to park, on average 30% of traffic is looking for an available parking spot [1]. Today there are numerous navigation solutions based on GPS-capable devices that can find a parking spot, but finding available parking spot requires additional information and dynamic updates as parking spots become available or occupied.

In an endeavour to solve the parking management issue, different technologies have been developed in various parts of the world and research was conducted to develop efficient parking technologies. While some parking solutions are deployed as stand-alone technologies in some situations, in other situations, multiple technologies are combined to achieve the given goal [3]. These technologies include Digital Image processing systems, Ultrasonic sensor's technology, and others. The main drawbacks of parking space detection systems with Image processing is low accuracy and high dependency to the light (time of a day) and weather condition [4]. Ultrasonic sensor technology is more accurate but so expensive for a large number of parking lots.

Depending on location, time of the day, and price, some parking spots are more popular than others which are more likely to be accessible. Drivers cruising around looking for parking spots are wasting their time and money; at the same time, tons of unnecessary carbon dioxide is generated. Furthermore, as drivers became more and more frustrated, they tend to bend the parking rules more. These days, a Smartphone is a part of people's life and serves the reasons not only as a phone but also as a device with facilities that can make lives easier.

In this paper a smart parking slot detection system has been designed and developed to monitor real time information about parking zones. The following objectives have been developed:

(1) A webpage for a Smartphone which finds available parking slots.
(2) A parking monitoring system which includes sensors and a local server to determine available parking slots.

In this study, a driver, who is using the internet, can access the webpage and gets the information about the available parking slots within the area of his destination by using the webpage and Google Map.

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II. SYSTEM OVERVIEW

In Figure 1, the block diagram of the whole system is shown. Each parking Zone has its own Raspberry Pi and PIC microcontroller. The Raspberry Pi act as a local server, which can receive data from sensors through PIC microcontroller; after each car transaction, the local server will update the webpage with the information about availability of parking slots. The number of available parking slots in each parking area would be seen on the webpage with the help of internet. This would help the driver to easily search the place of destination and decide where to park the vehicle.

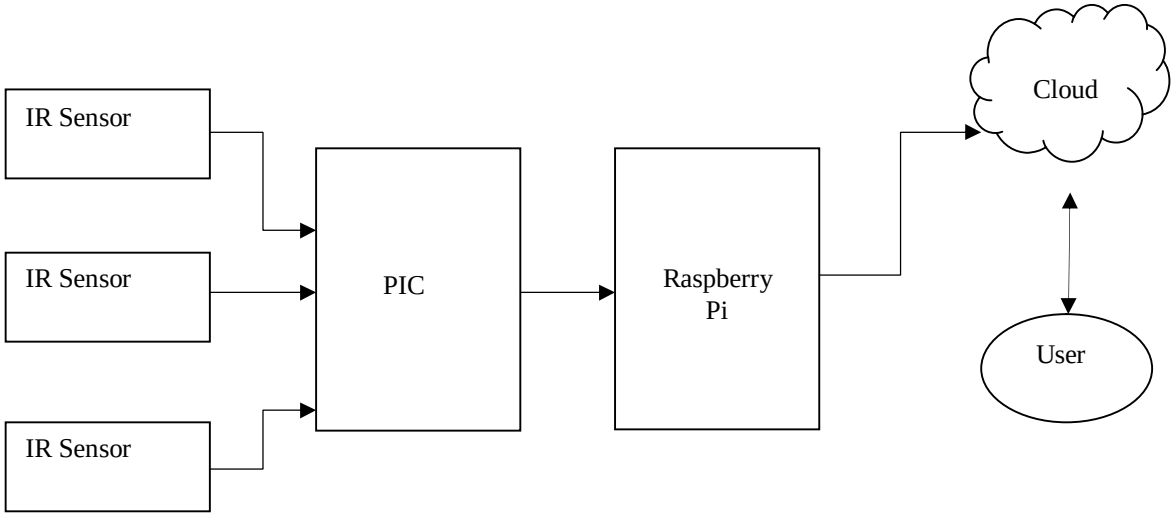

Fig.1 Block Diagram of Smart Parking Slot Detection System

Parking Components

Each parking zone consists of three IR Sensors, PIC Microcontroller, two RF data modem and Raspberry Pi. The sensors will detect the availability of parking slots. When a vehicle comes in the slot, the sensors send a signal to the local server. After each alteration, the local server sends the data to the webpage.

Raspberry Pi board is used for the local server. Raspberry Pi is single board computer which is affordable, inexpensive, high speed, low power consumption (5V), and quite small [2]. It receives the data from sensors and sends them to the Cloud Base Web Server. The PIC used for the programming section and RF data modem used to connect PIC and Raspberry Pi. It provides communication between them.

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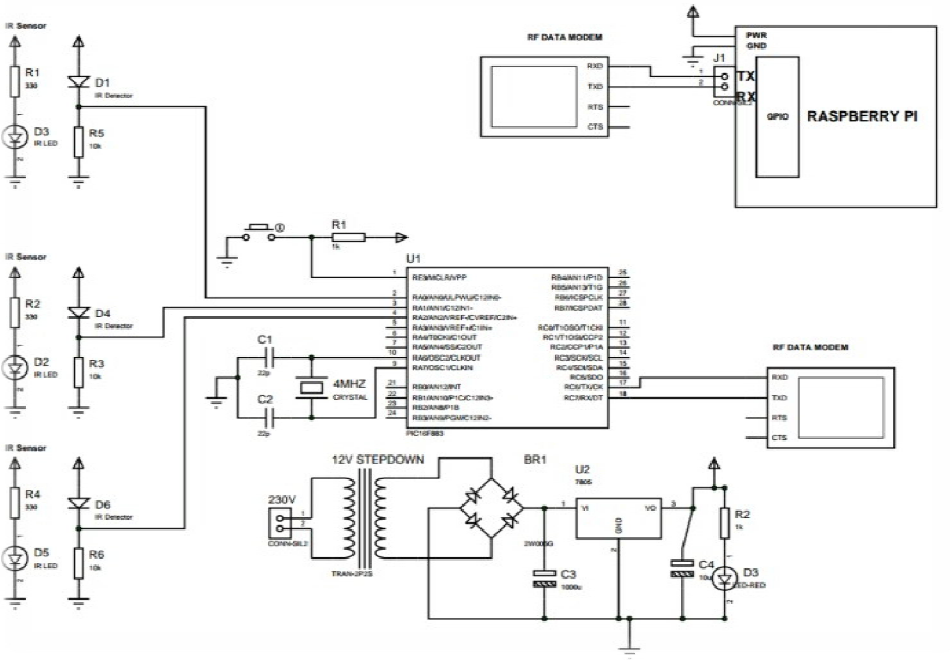

Fig.2 Circuit diagram of the system

In the circuit diagram there are three IR Sensors connected to the PIC Microcontroller. This section will sense the availability of parking slot. The PIC is connected to RF data modem for the serial communication with Raspberry Pi. The Raspberry Pi will act as a server which will store the data and load it into the webpage for the smart parking slot detection system. The power supply used for the entire system.

III. RESULT AND DISCUSSION

A prototype for the proposed smart parking slots detection system has been prepared as a proof of concept to meet the real-time requirements of parking monitoring services. Since access to the real and operational parking area is restricted the implementation is a model of open space parking, see figure 4. A testing activity was carried out to verify the functionality and reliability. The reliability of the system is determined by a success rate. The success rate has been calculated by dividing the total number of successful attempts "1" over the total number of trials multiplied by 100 percent. In the fig3 we can see the screenshot of webpage. The fig3 (a) give the availability of parking slot and fig3 (b) give the map of the corresponding parking zone.

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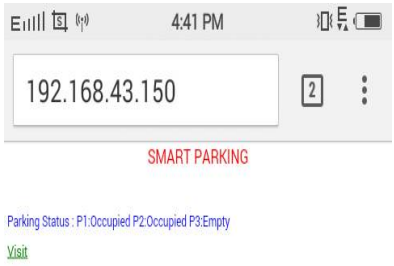

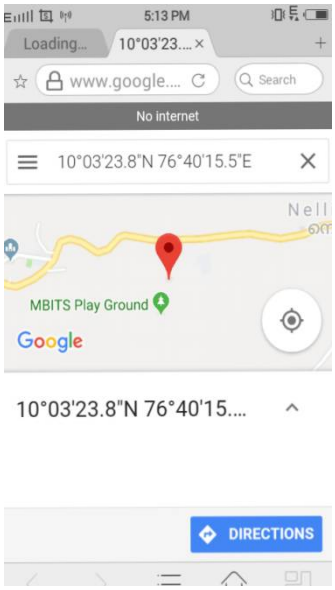

Fig.3 (a) Screenshot of webpage (b) Google map

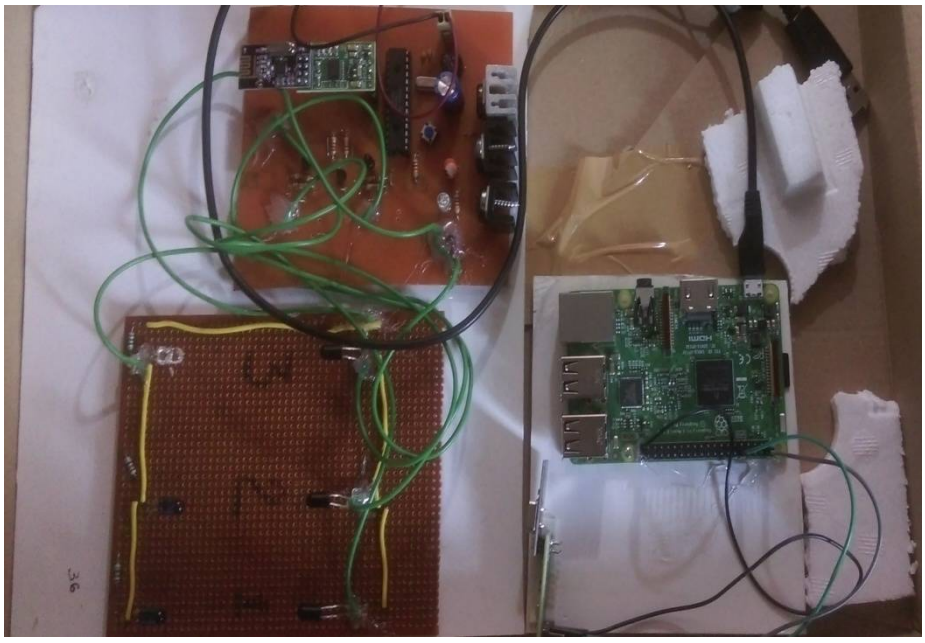

Fig.4 Implementation of working model

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IV. CONCLUSION

Frustration grows when no available slot is found, leading to an increased disregard for traffic rules. It is assumed that these problems can be alleviated if motorists could get access to real-time information about where there are available spots. In order to provide users with this information the following necessary components were implemented; (1) A Webpage for a Smartphone that is using Google Map for helping drivers to park their car easily. (2) A local server for parking zone which is using Raspberry Pi and IR sensors to keep track availability parking slots. (3) Client web server program for integrating sending and handling real-time data from parking monitoring system to the Smartphone application. The python language is used for Raspberry Pi for reading the received signal from sensors and HTML language is used for client web server side which is the best choice for server programming. An android application has been developed for achieving the best result. A flexible design that is independent of whatever conditions might exist at different parking spaces was developed and successfully implemented. To enable testing of the parking component, android application, client web server and prototype of parking zone were also implemented.

The parking monitoring system is low consumption, easy to implement, and inexpensive. It is good for any type of car parking zone and it can be implemented without affecting its operation routine. The benefit of Smart Parking Slot Detection is for drivers who do not know where to park their cars and with limited time to look for the available parking spot; eventually, the system is expected to reduce the city traffic. In addition, with people driving around less more gas will be saved so it will be a better environment and atmosphere. This study leads into an efficient, cheap, real-time and smart system.

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