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Hospital Parking Management System using Internet of Things

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ABSTRACT

As the number of automobiles in urban cities are increasing day by day, traffic volume and parking slots are the major problems. Efficient hospital parking management is always crucial for vulnerable patients despite the fact that many cities move away from vehicle dependence. Utilizing Internet of Things technology is an effective and efficient manner to automate the administration of the parking system that assigns an effective parking spot. The Internet of Things provides wireless access to the system, and the user can keep track of the parking area's availability in the hospital. Often, the user invests time and energy looking for parking spots in hospital parking area. This is sometimes life threatening for serious patients. This paper's major goal is to find a solution to this issue. The user can view the parking information on the Thing Speak website or mobile application. As a result, the user's waiting time while looking for a parking spot is minimal. As per the information in the web site the free parking area can be accessible to authorised persons through RFID technology.

Keywords: *IoT, RFID, Smart parking, cloud*

INTRODUCTION

One of the biggest problems in today's modern, congested cities is parking. There are simply too many automobiles driving around with insufficient places to park them. Many patients face parking issues in hospitals. Effective parking management systems are now required. Thus, we show how to implement an IOT-based parking management system that enables effective parking spot usage.

This issue is resolved with the aid of cutting-edge smart parking technologies and IoT connectivity. Parking spaces that are vacant are located using installed IoT sensors. To reach a cloud server, this IoT data is wirelessly transferred. To provide individuals looking for a place with a map of available spaces, all the parking lot data is gathered and processed in real-time. While an authorised person monitors [1] environmental factors like temperature and light, the end user is responsible for keeping an eye on vacant space. When indoor parking is available, infrared sensors are employed, and when outdoor parking is available, ultrasonic sensors are used. According to the actions of light and heat, respectively, light and heat are obtained by binding. Although an Android application [2] is used to help drivers recall their parking place and

an automatic number plate camera is utilised to manage, monitor, and secure parking spaces, there are no private parking detection facilities or information for arriving drivers regarding the availability of parking places. The issue of parking availability in the real world is addressed in [3] with a time-saving, practical solution. In this case, local data-filtering devices deliver the data. This signal is transferred through the cloud for the procedure as well as for evaluation utilising machine learning algorithms. This study takes use of a mobile phone application that gives users access to real-time traffic data by utilising the Google API decreasing the amount of traffic congestion. This solution does not permit parking space reservations. The smart parking solution that utilises reservations [4] makes it possible to reserve an available space (SPSR). This involves overseeing the host parking database, which collects and stores data on the driver's identity and the precise position of the parking place. When the parking reservation time is about to expire, a notification will be issued to the user via the web service that has been provided to them by the admin. The major drawback is that another user might occupy a space that has been reserved; this is avoided by using QR scanners to identify the user. Using zigbee concept a new solution [5] describes the setup of wireless sensor networks (WSN) used in a car parking system where the server will makes use of xbeezigbee. The vehicle parking system can recognise the car that is parked in the allotted spot. Its objective is to make this project both user-friendly and cheap. This parking system assists the user in retaining data that is 90% accurate. Other proposed works [6] [7] even though shows better results are expensive. The methodology used in the work is described in section 2 and hardware modules used are given in section 3. Section 4 and 5 gives the cloud and hardware description respectively. Last two sections discuss the results and conclusion.

METHODOLOGY

The four main pieces of hardware used are the EM-18 RFID reader and card, the NodeMCU ESP8266 (NODEMCU version 1.0) module, the IR sensors, and the servo motor. The ThingSpeak app must first be used by users to check whether or not the parking place is available. ThingSpeak pulls information from the NodeMCU module. The only people who can enter a parking space are those who have an RFID card. The RFID card contains the details of the registered user.

As soon as a car pulls into a parking spot utilising a server motor opining entrance gate, the reader module recognises the RFID tag of the registered user. While the information is being sent to the NodeMCU to use in determining whether there is parking slot is available or not, Thing speak keeps the user informed about the parking area's condition. The IR sensor sends signals based on whether a vehicle is present or not. Below Figure 1 shows the basic block diagram of the proposed system.

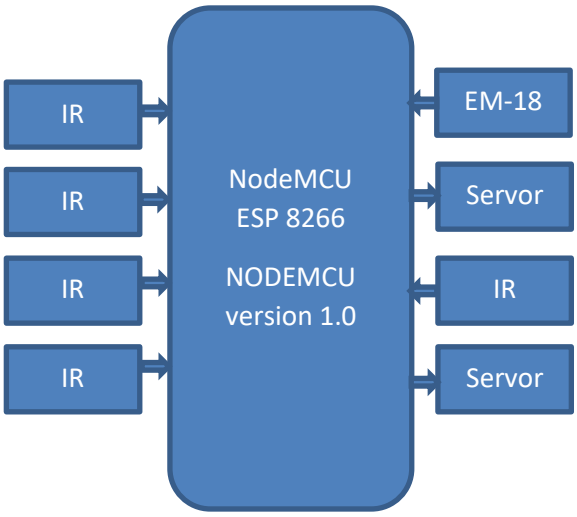

FIG 1: Block diagram of Smart parking system

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Hardware modules

NodeMCU

The open source IoT framework NodeMCU is economical. It originally included hardware based on the ESP-12 module and firmware that works on Espressif Systems' ESP8266 Wi-Fi SoC. Support for the 32-bit ESP32 MCU was later introduced. Figure 2 shows the NodeMCU.

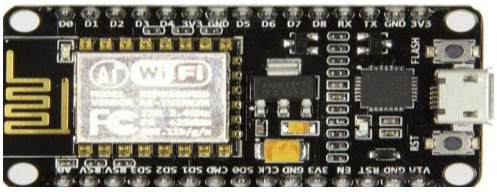

FIGURE 2: NodeMCU module

IR Sensor

An IR sensor shown in Figure 3 is a technological innovation that produces light to detect nearby objects. An IR sensor can gauge an object's heat while also spotting movement. Typically, all things emit some kind of thermal radiation in the infrared spectrum. Our eyes cannot see these kinds of radiations, but an infrared sensor can detect these radiations

FIGURE 3: IR sensor module

EM18 RFID module (reader and card)

A 125 kHz RFID reader called the EM18 shown in Figure 4 is used to detect RFID tags. After reading tags, it sends unique ID serially to the PC or microcontroller using UART communication or Wiegand format on respective pins. EM18 RFID reader reads the data from RFID tags which includes stored ID which is of 12 bytes.

FIGURE 4: EM-18 RFID reader

FIGURE 5: RFID cards

Servo motor 9G

It is a rotator that allows for the management of both angular and linear motion. A servo motor is used to raise and shut the gate. Servo drive transmits electrical impulses to the servo motor to create motion. Below Figure 6 shows the Servo motor.

FIGURE 6: Motor

Thing Speak Cloud

Assembling, visualising, and analysing real-time data streams in the cloud is possible with the help of the IoT analytics platform service like ThingSpeak. Data posted by your devices to ThingSpeak is instantly visualised by ThingSpeak. You can collect, visualise, and analyse real-time data streams in the cloud with ThingSpeak. Some of the key features of ThingSpeak include the ability to Visualize your sensor data in real-time, Aggregate data on-demand from third-party sources, and Use the power of MATLAB to make sense of your IoT

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data. Devices can easily be configured to send data to ThingSpeak using popular IoT protocols.

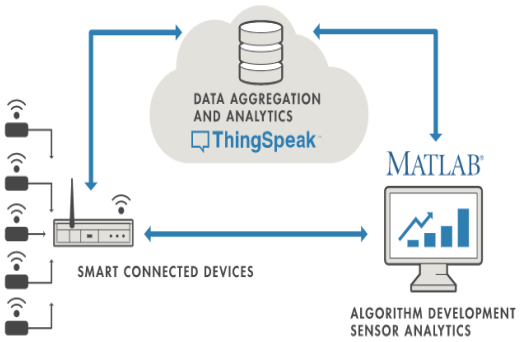

FIGURE 7: Thing Speak

Hardware Implementation

This section describes the implementation of the proposed system. Each parking spot occupant has an RFID card with their personal information on it. When the RFID card is scanned by the reader module, information about the user is transmitted to the NodeMCU module. The entrance gate will only open if the NodeMCU module decides that the user is permitted; otherwise, it won't. All users can use mobile applications to check whether a parking place is open or occupied after the IR sensor has assessed whether it is unoccupied or occupied. This information is then sent to the ThingSpeak cloud. The Node MCU module, which houses all of the data in the ThingSpeak cloud, supports the system. The Thing Speak cloud is accessed by the mobile application to retrieve all data. Top view and front view of the developed system is shown in Figures 8 and 9 respectively.

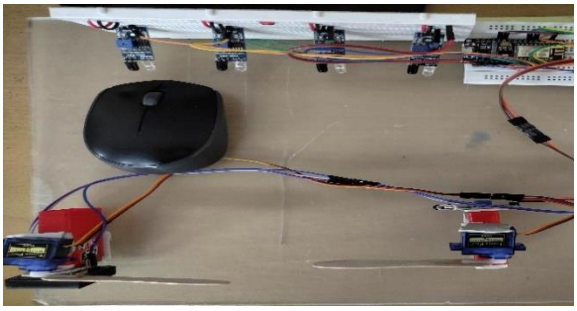

FIGURE 8: Top view of the hardware implementation.

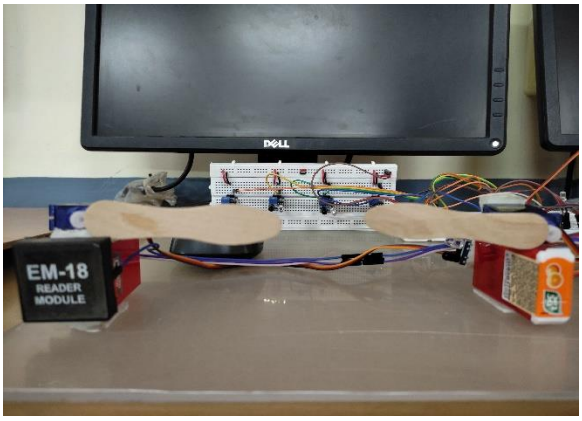

FIGURE 9: Front view of the hardware implementation

RESULTS

The graphical and symbolic representation of the slots are shown in below Figure 10

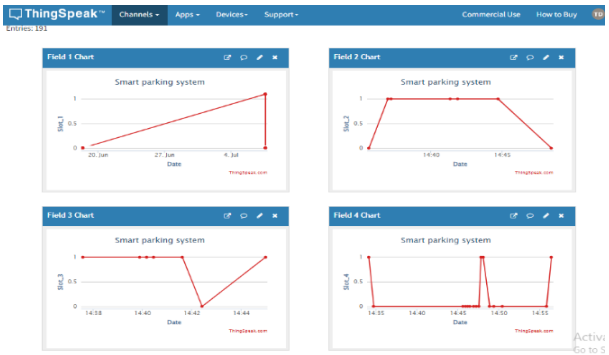

FIGURE 10: Graphical representation of parking slots

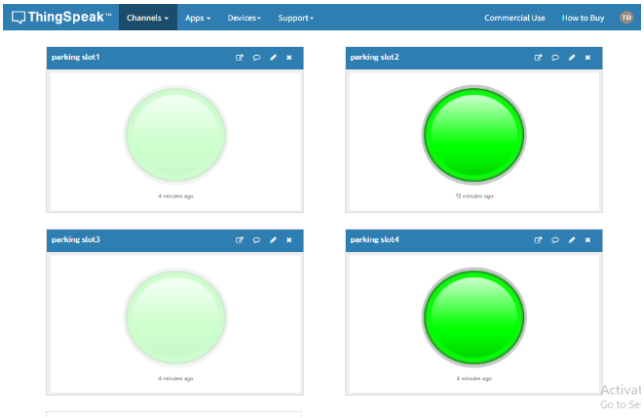

FIGURE 11: Symbolic representation of parking slots

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The aforementioned graphic illustrates how useful collected data is for further data visualisation and analysis. Here, the parking spaces are used effectively. The user can determine if a parking space is full or empty from the above graphic representation on the screen. In the picture above, slots 1 and 3 are occupied and slots 2 and 4 are unfilled.

CONCLUSION

The model seeks to improve parking problem in hospitals and in city markets. This device streamlines the parking process and reduces the need for human interaction. The mobile application, which collects data directly from the ThingSpeak cloud and displays real-time parking spot availability, facilitates the work. Only authorised users can successfully utilise the parking slots as shown above. This kind of model is well suited for tier 3 cities in India where the space and cost are the main concerns.

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