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Parking Slot Allocation System

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Abstract: *Increased vehicle numbers and poor management of parking spaces lead to parking-related problems as well as increased traffic congestion in urbanareas. Hence, it is highly necessary to develop an SPS that will help the driver find suitable parking spaces for their vehicle quite quickly. The proposed system provides facilities, including searching for parking slots, and reservations.It applies the concepts of the Internet of Things (IoT) by utilizing bearable hardware and sensors to detect parking availability and recognition to control.This approach should reduce costs and efforts over the long term and improve the standard of living for the citizens of a city.*
Key Word: *Internet-of-thing(IoT), Smart parking system (SPS)*

I. INTRODUCTION

The growth of the Internet of Things concepts allows the rise of many possibilities for smart cities. Searching for free parking slots wastes significant amounts of time and effort and leads to substantial financial costs. This is the case for people who are always pressured to be on time. This is why we need a smart parking management system (SPMS) as a modern solution to manage to park and save users time, effort and cost. In the context of modern life, it has become necessary to improve search methods for available parking slots and minimize the congestion that occurs in the parking area. Parking problem that aims to reserve, find and provide the best location for each driver is important in the city, because of energy consumption and time spent searching for car parking slots. Here system uses IR sensors which is used to monitor real-time parking status and a web application provides the users to find a vacant parking location

Two modules are used in this proposed system. One module is hardware while the other is software. The hardware module acquires the condition of the parking slots and sends this data to the internet. The software module consists of the software part showing the car driver the empty slots. This technology can be easily implemented and is very cost-effective.

II. RELATED WORK

Now many different kinds of parking technologies have been implemented based on different technologies like radio frequency identification (RFID), Bluetooth, wireless sensor network (WSN), Wi-Fi, ZigBee, etc. as well as AI-based technology projects have also been implemented. Different applications provide different kinds of applications. They can be functionalities such as adding maps to show navigation to the parking slot or showing the price based on the time the car has been parked in the parking slot.

ANPR camera used to capture the number plate of the vehicle of the user when parked at the slot was proposed by Norah Farooqi[1]. An ANPR camera is a mass surveillance device that does optical character recognition on images to read license plates,inform the police, and prevent criminal activities. The system checks whether the database contains the captured number plate. Themotion is detected using a TCRT5000 sensor which modifies the state of the slot.

Ultrasonic sensor node was used in the parking lot to detect the presence of the vehicle and led for indicating the status of the parking lot [2]. In this system, Wi-Fi access points (APs) are deployed within each parking facility and a central server is used to provide parking availability information throughout the city, and to receive parking lot reservation requests from drivers.

Ivan Ganchev and Mairtin O' Droma presented "A cloud-based, intelligent parking service for smart cities." The IoT subsystem includes the sensor layer, communication layer, and application layer. A primary objective of the intelligent parking system is to locate, allocate, and reserve the best parking spot for a given user, based on their location, and to provide directions to this lot. A

sensor layer detects whether the lot is occupied. The car parking lot detection method is based on an automatic threshold algorithm.The cloud tier, mobile apps tier, and OSGI web servers tier provide data storage and computing resources[3].

Manjusha Patil and Vasant N Bhonge have proposed RFID and a wireless sensor network for smart parking systems. It provides information about available slots and guides the driver to the right place. There is no need to modify the existing

parking system and it is compatible with the existing wired network. Although this system has some drawbacks. There are no rules for reserving available slots. The use of RFID will increase expenses. It takes more time to implement between nodes. [10]

Ahteshamulhuqosmani, Ashwini Gawade, MinalNikam, and SwatiWavare suggested an IoT-based smart parking system [4]. They provided an android app for booking purposes. IR sensors were used to sense the car's position. Regular users were offered e-valet services as well. RFID tags are given to users to check their authorization and charges. The main disadvantage is that RFID increases the project cost.

Some of the related work developed either application or were web-based to support their system [5, 6]. Both [10,11] implemented mobile applications run on iOS and Android. The Java language is also used in [7] to develop different mobile applications on the Android platform. In contrast, the application developed in [8] supports the Windows platform. The study in [9] focuses on writingan algorithm for smart parking without applying an application.

III. EXISTING METHODS

A. AN IoT-BASED E-PARKING SYSTEM FOR SMART CITIES

In this method, improper parking within the parking lot and the duration of the parking slot can be determined using a parkingmeter. At the middle back end of the parking lot each parking lot is equipped with a PM, which consists of an ultrasonic sensor to detect the presence of a vehicle within the parking lot, a led to indicate the status of the parking slot, a microcontroller Arduino MEGA 2560, an alarm IC module to create warning sound in case of improper parking, a camera module for taking snapshot of thevehicle's license plate and IEEE 802.11 b/g/n compatible wireless module for communicating with the local parking management server. PLMS, software module is deployed on microcontroller Arduino MEGA 2560 to detect the presence or absence of a vehiclewithin the parking lot. LPMS maintains the record for each parking lot to keep track of its status which can be empty, reserved, or occupied.CPMS is a high-end server with a global IP to make CPMS available on the Internet. The PM also consists of two smallersolar cells to recharge the batteries. This system also enables the automatic collection of parking charges by providing smart payment options For sending SMSs to the site officer as well as the driver, a GSM module is attached to the local parking management server via some serial port.

B. UPARKING: DEVELOPING A SMART PARKING MANAGEMENT SYSTEM USING THE IoT

In this method, parking will be handled by the UParking system by searching, booking, and paying for parking. The monitoringmodule uses an ANPR camera to monitor the parking entrance and deter entry by capturing the car plate number; the system then checks the Uparking database to determine whether the plate number is in the database. In this, the user can edit personal information and display statistical reports, as can an administrator. In the management module, bookings, users, parking information, and other information is managed and stored in the UParking database. Users can interact with the system through the mobile application's user interfaces. In terms of hardware, an Android smartphone, an ANPR camera, a TCRT5000 sensor, a servo motor, and a microchip are used. As far as software is concerned, the application runs on the Android operating system.UParking uses the platforms Android Studio, MySQL, Arduino, XAMPP (a local webserver), and Notepad++ (a source-code editor). The UParking system provides a monitoring service that shows the state of each slot in the parking lot by using TCRT5000 sensors, an Arduino mega board, and a Nodemcu chip. Later, performs various tests to verify that the system is against functional requirements. The TCRT5000 sensor was tested to determine whether it modified the occupancy state or not. Also, the camera wastested to see if it sensed the car’s presence and allowed registered users to access it.UParking reuses existing software components and integrates their services into the system, such as Google Maps API, PayPal API, and the ANPR Camera system.

C. CROSS-PLATFORM SMART RESERVATION BASED PARKING SYSTEM

This system relies on real-time parking information to monitor parking space reservations and allocations. UltraSonic HCSR04range sensor for real-time parking monitoring. A Node MCU running on the ESP8266 WiFi SoC is used as a microcontroller. There is a centralized server for monitoring and updating the system according to real-time scenarios. There are several payment options available.

Users of offline payments (cash), Paytm, credit cards, debit cards, etc. The parking space closest to the user will be randomly assigned. To display the number of free parking spaces in these parking lots, use the LCD to show the exact number.

IV. PROPOSED METHOD

The proposed parking system using IoT technology and the system involves the user who is driving vehicle into the parking lot. The IR sensor detects the presence of the vehicle when it enters the parking slot. The IR sensor connected to NodeMCU as a microcontroller. After IR sensor has detected the presence of the vehicle, the website displays the available vacant parking space for the other user to park the car.

The process also involved the database to store the availability of parkingspace data received from the IR sensor. All data in the database can be seen via the Smart parking system website. Meanwhile, NodeMCU is connected to the Internet by using an access point. This is important to ensure that the NodeMCU can send data tothe database when the IR sensor detecting the presence or absence of a car in a parking slot. The data that will be sent to the database will involve the availability status of a parking slot. The data can be viewed by the user by opening the website.

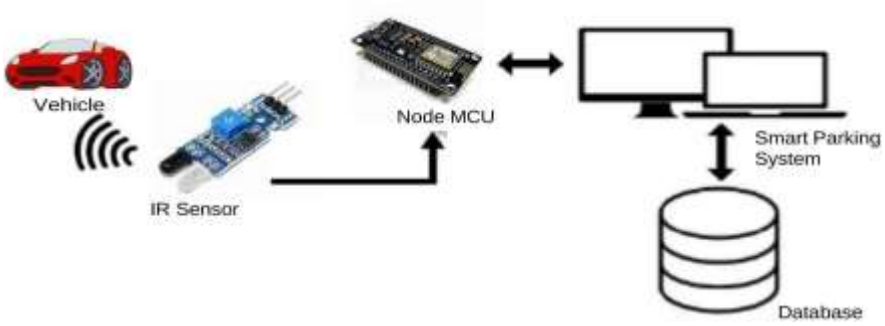

Figure 1 : *Block diagram of the proposed system*

A. SOFTWARE USER INTERFACE

A smart parking system has three sections. Firstly, there is the developer side, where developers can manage and monitor the parking system model. Secondly, on the user side where the user can search for parking spots on the web app and move to the vacant slot. Thirdly, the database where all storage and communication data link between the parking space and the user.

Figure 2 : *UI of Smart Parking System*

Figure 3 : *Usecase diagram of proposed system*

B. HARDWARE FOR SMART PARKING SYSTEM

The hardware side consists of mainly 2 components, an IR sensor, and nodeMCU

1. NodeMCU

Node MCU is an LUA-based open-source firmware for the ESP8266 Wi-Fi module, as well as an open-source IoT technology. Because it features a built-in capability for Wi-Fi to connect to the internet, the ESP8266 is the most popular controller for IoT applications.

In this project, the ESP8266 Node MCU serves as the main controller, controlling all of the peripherals connected to it. Raspberry Pi Zero and NodeMCU are more advanced functions micro-controllers than Arduino, due to improvements in microcontrollers. In comparison to Arduino's 8 bit ATMEGA clocked at 16 MHz, NodeMCU has an embedded Wi-Fi module ESP8266 as well as a 32bit TensilicaXtensa lX106 core clocked at 80MHz. 4 Megabytes of storage, 20 Kilobytes of RAM, and 10 pins of GPIO (General Purpose Input Output) allow users to connect to components such as motors, sensors, and servos. NodeMCU is a microcontroller that allows you to write and send code straight to it. The following is how microcontrollers are typically used. The program is loaded while the microcontroller is turned off.

2. IR Sensor

The parking app uses aggregated data from connected vehicles. IR data is an important part of such data. Sensors, which are already common in connected vehicles, eliminate the need for expensive infrastructure that is often used to assess the availability of parking spaces. The IRsensor of the networked vehicle recognizes the empty parking space in the immediate vicinity. This parking space information, combined with information from millions of vehicles, provides a comprehensive and accurate picture of parking space availability. This data will be shared with other information from the connected car. Location data is used by the mobile parking website to guide the driver to the nearest available parking space.

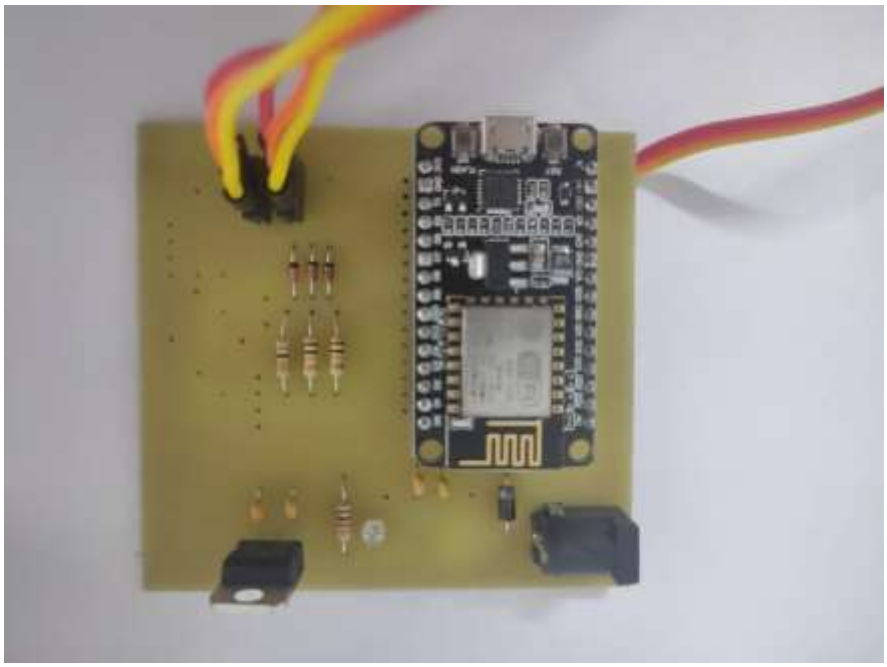

Figure 4 : *Hardware assembled on PCB Board*

V. CONCLUSION

This paper presented a developed smart parking management system based on IoT technology. The smart parking system combinesa web application that offers features and services to serve users and a website to manage to park. The system provides an integrated solution to effectively improve the parking management process based on defined requirements and analysis. The system will also be enhanced with additional new features. It has been tested in a variety of situations and can be integrated with other systems.

VI. Future Work

The future of smart parking is expected to be significantly impacted by the advent of automated vehicles (AV). Testing of mechanical parking, private AV parking, and robot parking staff has already begun in several cities around the world.

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