Research Article

An Intelligent Car Parking Using IoT with Node MCU Module

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ABSTRACT

Car Parking is the major issues in congested cities of today. There are too many vehicles on the road and not enough parking spaces. This led to the need for efficient parking management systems. Thus needs the use of Internet of Things (IOT) based parking management system using Arduino, Nodemcu ESP8266 wifi module, and Blynk application. With the help of Node MCU esp8266 wifi module and Blynk application, the parking slots can be monitored from anywhere around the world. The Parking Area has any number of slots based on our requirements. Every slot has one IR (Infrared) Sensor. Each Sensor is used to detect the presence of car in the slot. These IR Sensors are connected with Arduino. So when a car is parked in the slot, the arduino sends a command to the Nodemcu esp8266 wifi module, the Nodemcu then sends the command to the Blynk application. Thus the system solves the Parking issue and get users an efficient IOT based parking management system.

Keywords: Car Parking, Internet of Things (IOT), IR (Infrared) Sensor, Arduino, Blynk application.

Introduction

In this very age of modernization and improved lifestyle smart cities help in taking the lifestyle to a better level. There are various aspects that make a city "smart" and one of them is the parking system of the city. We can notice the early attempts in making the parking systems better which takes us to the early 1900's into the history [1]. The automated parking system was first introduced in 1905 in Paris and in 1920 a system called "Paternoster System" was built to park cars. With the advancements in technology gradually the systems have changed and in the present-day scenario "IOT" is used to achieve smart parking. IOT is an acronym for Internet of Things and the "things" in IOT are the devices which have unique identities that perform sensing, actuating and monitoring. These devices send data with other devices that are connected to it [2]. So simply, IOT accounts for things that have unique identity and which are connected to the Internet. Smart parking systems are powered by IOT systems which detect the number of available parking slots and send the information to the user by smart parking application over the internet. This application can be accessed through mobile phones and tablets [3]. The information is collected by using sensors that are put in each parking slot. This information is collected and sent to the cloud-based database. Users can book the parking slots in advance through the application provided. This application generates a unique QR code which is to be scanned with the camera that is available in the parking area. After the scanning of the code the gate is opened and the parking of the vehicle can be done.

With the growth of technology, the concept of the Internet of Things (IoT) and deep learning can be used in the planning of Smart cities which can gradually tackle urban mobility problems and can also help to provide a sustainable infrastructure economically, ecologically, and socially to the citizen [4]. At present, many intelligent systems mostly in the form of mobile applications help drivers by reporting traffic jams, road conditions, accidents, and alternative routes. However, due to a large number of vehicles active on roads, parking is still a tedious task. As indicated by drivers waste liters of gas simply trying to find parking. Normally, 30% of traffic congestion is caused while searching for an available parking space. As conferred on average drivers waste 3.5 to 14 min to find a free parking spot. Besides, it also causes driver frustration, traffic congestion, fuel consumption, and air pollution, and all these factors act as challenges for sustainable development. In this specific circumstance, knowing ahead of time about the available parking spots can mitigate this issue [5]. The use of deep learning techniques with the integration of IoT can ameliorate this problem by predicting the parking occupancy and availability with great precision.

In Internet of things (IOTs) is a vital technology, it is playing crucial role Sin day to day life of human beings. With the help of this technology now a day's humans are getting effective output with a very less efforts. It reduces the man made errors made by the humans due to negligence [6]. As technology advances smart phones are inevitability for every human being. The proposed parking system effectively manages the parking space and it will manage collision among the vehicles at the same time. IOT based smart parking organized the parking lot very efficiently. It helps user to find a free space in parking slot within no time. It ultimately leads to save time and fuel of the user's. It is observed that many people waste there fuel for searching free space in parking [7]. An infrared sensor detects the vehicles in the parking and will give the information about the free space. With the help of IOT The required information about the free or used slot send to the website.

Literature Survey

Recent developments in sensor devices, communication technology, ubiquitous computing, artificial intelligence, and wireless sensor network (WSN) gained momentum to the adoption of IoT based applications. Internet of things combined with cloud computing and big data analytics is speeding up the advancement of solutions to monitor the mobility of traffic in smart cities [8]. Numerous solutions have been developed aimed at finding the availability of parking spaces to increase the quality of life in overpopulated cities. In essence, the smart car parking systems deliver information to drivers about the availability of free parking lots while considering the distance and number of free spaces [9].

The main objective is to avoid the cramming in the car parking area by implementing an efficient car parking system along with a user-friendly application for an ease of use. Normally at public places such as multiplex theatres, market areas, hospitals, function-halls, offices and shopping malls, one experiences the discomfort in looking out for a vacant parking slot, though it's a paid facility with an attendant/ security guard. The parking management system is proposed to demonstrate hazel free parking [10]. The proposed system uses infrared transmitter-receiver pairs that remotely communicate the status of parking occupancy to the raspberry pi and displays the vacant slots on the display at the entrance of the parking so that the user gets to know the availability /unavailability of parking space prior to his/her entry into the parking place. Implementation involves minimal human interaction and provides a seamless parking experience thereby reducing a lot of time wasted by the user in parking his/her vehicle [11].

The project is about an automatic underground car parking system for residents. The aim of this research is to develop & implement an automatic parking system that will increase convenience & security of residential parking system [12]. The automatic parking system will be able to have less interaction of humans. The economy analysis technique will help in analyzing the project feasibility. Thus an efficient, reliable & safe automatic underground parking system will increase availability of space for car parking [13-15]. In metropolitan cities, vehicle parking has become a major concern in all busy areas and a good traffic system needs a good parking system. Different types of vehicle parking are applied worldwide namely Multilevel Automated Car Parking, Automated Car Parking System, Volkswagen Car Parking, etc. The present project work is aimed to develop a reduced working model of a car parking system for parking 6 to 24 cars within a parking area of 32.17 m². The chain and sprocket mechanism is used for driving the parking platform. This model will be further useful for different branches of engineering in order to develop different types of automations like PLC, Micro controller and computerization etc.

Table 1

S. No	Title	Author Name	Technology Used
1.	AN IOT based smart parking system	Y.Abdu lWahab	Using IOT Technology
2.	Evaluation of smart parking system	1.tayo fabusuyi 2. Rober hemisphire	Using Arduino
3.	Reservation based smart parking system	Wembo	Using IOT Technology

Contribution

The following contribution is as follows:

- To find the parking spaces from anywhere by using the mobile applications.

- Hence this reduces time as well as fuel consumption.
- IOT is used to display real time value of all the sensors.

- Used for detecting system status accordingly.
- Used to display the values at console screen.

Existing System

- The problem in the existing system is whether parking slot is available or not doesn't know before reach the parking area.
- There is waste of time as well as fuel consumption.
- Parking management influences drivers search time and cost for parking spaces.
- It may also causes traffic congestion.
- Finding a parking space in most metropolitan areas, especially during the rush hours, is difficult for drivers.
- Difficulty arises from not knowing where the available spaces may be at that time traffic congestion may occur.

Proposed system

Traffic on roads has become the obvious thing to deal with in our cities. Looking for a parking spot creates furthermore traffic on our roads leading to the wastage of fuel and most importantly time. Therefore, there is a necessity to know the empty parking spots around a particular area beforehand to the public. Hence there is a need for developing a system for the users to find out the empty parking spots. We propose the angle parking system to use the available parking space efficiently by arranging the parking spots in a certain angle to fit more vehicles. For every parking spot, the deployed IR sensors would detect whether a parking spot is empty or occupied through the mobile application. This information is first sent to the raspberry pi and is transmitted over the server and is then communicated through the mobile application to the user. The user can reserve a free parking slot by providing basic details such as vehicle number, time in, time out and then a QR code will be generated. On scanning the QR code within the time, the system will detect the slot and open the gate accordingly. The parking fee is displayed in the application on the basis of number of hours a vehicle is parked in that slot.

Fig 1: Proposed system architecture

Hardware

The three main hardware components used are GMS module, RFID card, IR sensors. A user is allowed inside a parking space only if the user has a RFID card. RFID card contains the information of the registered user. As the car enters the parking slot reader module scans the registered user's RFID tag. The data is sent to the ardunio for checking the availability of the car parking and simultaneously, the user is notified through SMS about the status of the parking area. The GSM module sends the message according to the availability. IR sensor sends the signals according to the presence of the vehicle.

Software

The cloud server acts as a mediator between the modules. The cloud server is connected to the Wi-Fi module. The user receives messages through the SMS module while the car enters and exits the parking area using RFID card. The messages sent by the SMS module are managed by the cloud. As soon as the IR sensor detects the car, the status of the cloud will be updated from 0 to 1 and when the car leaves the parking area the status of the car will be updated from 0 to 1.

Infra-Red Sensor

An infrared sensor is an electronic device that emits infrared rays so as to detect a few parts of the environment. An IR sensor can gauge the warmth of an object as well as detects the motion. These sorts of sensors measure just the infrared light that falls on them, as opposed to transmitting it that is called as a passive IR sensor. Most of the objects radiate some type of warm radiations. These sorts of radiations are imperceptible to our eyes. It can only be identified by

an infrared sensor. The emitter is just an IR LED (Light Emitting Diode) and the detector is basically an IR photodiode which is delicate to the IR light of a similar wavelength as that discharged by an IR LED. When the imperceptible light falls on the photodiode, the resistance and the output voltages change in relation to the size and intensity of the IR light. They require very low power and do not require any kind of contact for detection, they are not affected by oxidation or corrosion. IR sensor is used in this project by considering all these advantages.

Fig 2: IR sensor

The smart car parking system works on the simple principle of detecting obstacle and sending a visual feedback. The proximity sensor is mounted on the ceiling of the parking lot which consists of an Infra-Red emitter and a receiver. The IR emitter emits infra-red rays and these rays generally bounce off objects. The IR receiver receives these rays and converts them into an electrical signal creating a potential difference. The resulting potential difference helps complete the circuit. The LEDs are placed along the driveway and switch on based on the input received by the sensor. A threshold distance is calibrated using the potentiometer to fix a particular distance based on the average height of vehicles for sending and receiving the radiations. Resistors are provided to ensure the safe working of LEDs and IR sensors. For this project based on size a 12V battery is used to power all the components.
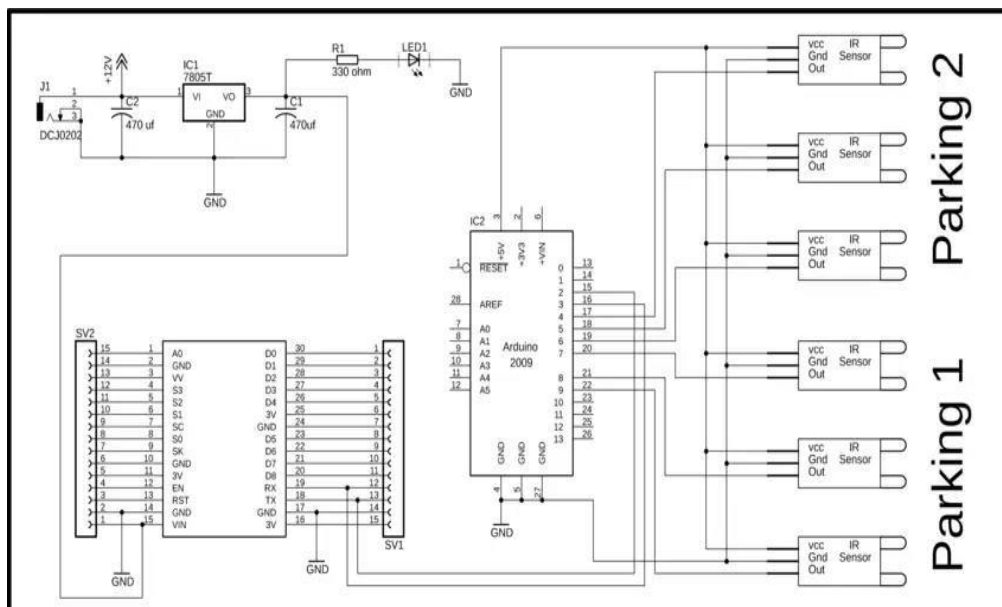

Fig 3: Block diagram of Smart car parking system

Case 1
When the parking space is empty, the IR emitter emitting the rays will not bounce back an object (vehicle) is not detected. The rays will not strike the IR receiver and hence there will be no rise in potential difference. The feedback of this result makes the Yellow LED switch on indicating the availability of a parking space.

Case 2
When the parking space is occupied, the IR rays emitted by the emitter is bounced back as the vehicle

height is within the threshold distance and the rays strike the receiver and these waves are converted into an electrical signal creating a potential difference. The feedback of this result is indicated by the Red LED turning on and thus specifying the driver that the particular parking space is filled. There is continuous emission of IR waves so the feedback is instantaneous. As soon as the vehicle exits the parking space, the rays don't return back and the Yellow LED switches back on.

Conclusion

The demand of smart parking system is increasing significantly. This allows user to involve real time access of the availability of the parking space. The existing system in today's world doesn't contain the facilities of parking reservation and parking slot availability checker. The existing system was vision-based monitoring system which estimates the number of the parking slots available in the area by counting the number of incoming and outing cars which consumes lot of time and efforts. The next existing system was sensor-based system which uses ultrasonic sound waves for detecting the presence of vehicles and then two-tier parking came into existence which used the concept of parking cars one above another. The result of the paper is to make the parking area connected with the world as well as reduces time and can be cost effective for the user. The result of this paper is to reduce car theft. This paper reduces overall fuel energy of the vehicle which is consumed in the search of the car.

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