Smart Car Parking System Using IoT

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Abstract

A simple and easy task such as parking is thought as a tedious and time-consuming process due to mismanagement of parking system. Current parking systems involve huge manpower for management and requires user to search for parking space floor by floor. Such conventional systems utilize more power, along with user's valuable time. This paper presents a Smart Parking & Energy Management solution for a structured environment such as a multi-storied office parking area. The system proposes implementation of state-of-the-art Internet of Things (IoT) technology to mold with advanced Honeywell sensors and controllers to obtain a systematic parking system for users. Unoccupied vehicle parking spaces are indicated using lamps and users are guided to an empty parking space, thus eliminating need for searching for a parking space. The occupied parking spaces are virtually stored to the cloud to be accessed by central system and direct the upcoming cars to empty spaces. The automatically controlled light illuminance helps reduce energy usage, along with lighting up the parking space to the user whilst in the parking space. The entire system being fully automatic leads to reduced manpower involved and improves illuminance aesthetics of the parking area. This paper aims at improving user's time value and convenience in a parking system.

Keywords: IoT, Arduino, Wireless sensor networks.

1. Introduction

Large commercial areas such as malls, hospitals, city centers and residential societies demand extensive parking areas due to increasing quantity of vehicles. A commonly imposed solution for such a system is multi-storied parking system. Users utilizing the multi-storied parking need to search for an empty parking space, thus unnecessarily spending time around the parking lot instead of spending it productively. Users that have come to work in offices or for shopping in malls have to begin their day in the parking lot getting annoyed by loud car honks and breathing in the polluted air. Repetition of such user inconvenience leads to reduced quality of life. During peak times, the entire entry area is crowded. The rate of vehicles entering and exiting keeps on fluctuating, causing few of the parking spots to be left entirely vacant. Multi-storied parking spaces require commodities such as illumination, air ventilation and manpower for handling the traffic at all times. This raises the overall cost of electricity, along with the wastage of energy. The cost of parking space expansion is very high and is thus followed with high power consumption. In a multi-level parking system, lighting system consumes the most energy since illumination is required during all working hours. The demand for an intelligent parking service is increasing rapidly due to space constraints and growth in vehicle quantity. The smart parking system is a green solution that provides user time saving and energy conservation. The user is instructively guided to the

empty parking space, without necessitating user to manually find for one. The smart parking & management system provides accurate positioning, monitoring and online control. This solution is highly cost effective and user convenient. Wireless sensor network (WSN) involves clubbing of large number of sensors in the area of interest in a cost-effective manner. Such an establishment has been proven more effective against those involving technologies such as camera monitoring systems, pneumatic tubes, etc. Existing WSN used in parking system focus mainly on parking space booking & allocation along with merging them with online payment portals using IoT based platforms. The method proposed in this paper provides a solution for a much larger parking space, taking into account all the possible aspects up to a level of its implementation. Security is also a main concern in parking spaces which is considered in an IoT systems by providing live feedback of state of the asset to be monitored; in this case, the user's vehicle. A similar system has been proposed for roadside parking where separate area has not been allocated for the same purpose. Several paid parking systems are known to be equipped with hardware - software integrated payment gateways. The distributed sensor network consists of Dual Technology Ultrasonic and PIR sensors for detecting the incoming vehicle and illuminates the aisle lights. The Parking Sensor detects human presence or vehicle presence in any given area. It operates on both Passive Infrared and Ultrasonic technology. It transmits the car/human occupancy data via an RJ25 interface to the Wireless Parking Controller. The Parking Sensor also has the capability to connect to an external dual-colour indicator light, through RJ25 interface, which can indicate parking slot vacancy status. The whole system is connected through a server by Zigbee . Zigbee is a wireless technology that provides secured data transfer between a controller & a gateway. It operates on 2.4GHz ISM band and has data rate up to 250kb/s in the range from 10 to 70m.

2.Literature Survey

1. Sameera Sulthana. H, Shambhavi. G, Sowmya. K. U, Nagesh Babu .The concept of Internet of Things (IoT) started the things with Identity communication devices. The devices could be tracked, monitored using remote computers connected through Internet.
2. Dipali Balmiki, Manas Singhal1,Anupama Singh, Divyangi Tyagi .The project entitles "Smart Parking System" present an automatic IoT based smart vehicle parking system. The concept of smart cities has always been a dream. Our future work is to create car parking system to work as an operational platform in a smart city
3. Denis Ashok, Akshat Tiwari, Vipul Jirge. Current parking systems involve huge manpower for management and requires user to search for parking space floor by floor.

3.Existing System

This section contains the implementation of the proposed system. Every user who enters the parking slot contains a RFID card which contains the details of the user. When the RFID card is scanned by the reader module, the details of the user are transferred into the module. Now the IR sensor checks whether the parking space if free. If, there is no space available the parking barrier gate will not open. A message is sent to the user with the help of a GSM module which sends a registered message depending upon the availability and unavailability of the parking space. The WIFI module supports the system by storing all the data in the cloud. It connects the devices with the cloud server. Here, the user scans the RFID card

provided to the user. If space is available, the user receives a message "Welcome username" the barrier gate will open and the user can park the car. When the user exits the parking space the user again has to scan the RFID and a message will be received by the user "thanks for using smart parking username". The database about the user's activity in the parking space will be stored in cloud database. The user will know that a particular space is available with the help of the cloud status. When the car is parked the IR sensor detects the presence of an object and updates the cloud status from 0 to 1 and when the car leaves, the cloud status is updated from 1 to 0. So, the user can park his car where the cloud status is 0. The cloud status is updated every 2 minutes.

4.Proposed System

It consists of three sections: first section is the parking area which includes Arduino devices along with IR sensor. The user interacts with the parking area with the help of these devices. The user cannot enter the parking area without the help of RFID card. The second section contains the cloud based web services which acts a mediator between the user and parking area. The cloud is updated depending upon the availability of the parking area. The admin administers the cloud services and it can also be viewed by the user for checking the availability. The third section is the user side. The user gets notification on the basis of the availability via SMS through GSM module.

4.1 Hardware
1.IR Sensor
An infrared sensor is basically an electronic device which is used to detect the presence of objects. Infrared light is emitted by this device. If this device don't detect any IR light reflected back that means there is no object present. If the light is detected by the sensor there is an object present. Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other board Arduino.

Fig 4.1:IR SENSOR

2. GSM Module
The GSM module is a circuit which is used to setup communication between mobile phones and microcontroller. It is used to send SMS, MMS and voice messages through mobile network. GPRS extension in GSM allows high data transmission. GSM uses time division multiple access approach for transmission.

3. Arduino UNO

It is a compact board which can be used in various devices and various field. It has overall 22 input/output pins out of which 14 pins are digital pins. It has a flash memory of about 32 kb. These pins can control the operations of digital pins as well as analogy pins. This module is a bread board friendly board which can be easily used anywhere.
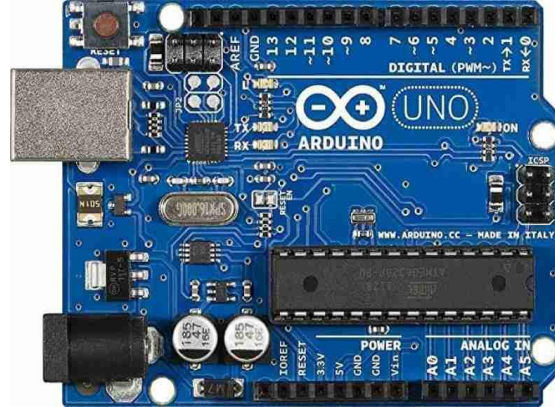

Fig 4.3: Arduino uno

Microcontroller used here is an Arduino UNO. The UNO is a Microcontroller board based on ATMEGA 328P.

The ATMEGA 328P has 32kB of flash memory for storing code. The board has 14 digital input and output pins, 6 analog inputs, 16 MHz quartz crystal, USB, an ICSP circuit and a reset button. The UNO can be programmed with the Arduino software.

4. WIFI Module

It is used to send data from embedded system to the internet using URL by HTTP POST method using TCP/IP protocol. It is developed by espressif systems. It is a32 bit microcontroller with 80kb user data. It contains 16 gpio pins.
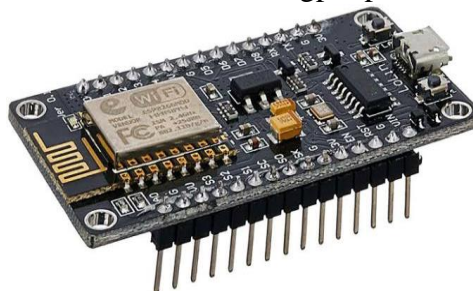

Fig4.4: Node MCU

4.2 Software Requirements

The cloud server acts as a mediator between the modules. The cloud server is connected to the WiFi 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.et

5.Result And Dicussion

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 contains 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.

6.Conclusion

The concepts of smart cities have always been a dream. There have been advancements made from the past couple of years to make smart city dream to reality. The advancement of internet of things and cloud technologies has given rise to the new possibilities in terms of smart cities. Smart parking facilities have always been the core of constructing smart cities. The system provides a real time process and information of the parking slots. This paper enhances the performance of saving users time to locate an appropriate parking space. It helps to resolve the growing problem of traffic congestion. As for the future work the users can book a parking space from a remote location. GPS, reservation facilities and license plate scanner can be included in the future.

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