

Smart Parking System Based on Internet of Things

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Abstract

Recently parking has become a serious issue and even worsen, because of the increasing number of automobiles everywhere. In this paper we propose an IoT based guidance for user to monitor and book the parking space for the vehicle and for managing and monitoring free parking space, it provides an intelligent solution. It aims at implementing smarter and better parking guidance mechanism which significantly reduces difficulty in conventional parking system. The system can monitor the state of every parking slot by deploying a sensor node on the slot. Accordingly sensor senses the status of parking slot and send status to central node server controller. The Node MCU collect the data from all sensor node and upload to the server where user can check the parking status from anywhere using internet and any browser. User can also book a parking slot in by crating there profile on the server.

Keywords: Ethernet Modem, Node MCU, Sensor node.

INTRODUCTION

Now a days, main problem in malls, function halls and etc., is parking. It is due to the lack of sufficient parking space. Now a days the vehicles in a family are greater than the head count of the family members, and due to this the vehicles are also increased in the country, which leads to the parking scenario which is unhappily falling short to the current requirements in the country. Due to this parking is difficult and it also increases the time needed to park the vehicle with increase in the fuel consumption of the vehicle. And during the working days the companies and offices are facing the problem of the parking in urban areas. Now a days vehicles are most affordable to the low income group families also and the vehicles especially the cars are taking lot of space. Due to the increase in vehicles the parking space is also not sufficient in this congested cities. Whether at a shopping malls, stations and airport, problems with parking is a big issue. Most of the time people spend their time on searching parking, to park their vehicles. Thus, lot of congestion occurs in the traffic which leads to a tedious job to find the parking space to park their vehicle. The most traffic occurs only because of vehicle congestion in the urban areas thus people are wasting time in searching the parking area abnormally to park their vehicles. And one more issue is also added to this is pollution, which effects the entire environment due to this increase in vehicles.

POSSIBLE SOLUTIONS TO OPT TYPE OF VEHICLE

In our Proposed System user can view parking space availability and accordingly select the type of vehicle.

If user has to go in a mega mall. First of all user has to login on website and search for particular mall than view the status of parking areas of that mall .If parking space is available ,then user can book the parking space happily. Otherwise user can view two-wheeler parking area. In case, if two-wheeler parking area is also occupied, user has option to use public transport.

The user after looking the status of parking can really decide the type of vehicle to choose for his convenience.

Benefits of Implementing Online Parking system

1. No need to waste time on looking for parking.
2. Reduction in time and fuel spent by road user searching for parking.
3. Less queues as motorists will be guided to parking areas.
4. Proper selection of vehicle according to the availability of parking space.
5. Online parking results in higher revenues and profitability for parking facilities.

Internet of Things

The concept of Internet of Things (IoT) started with things and identity communication devices. The devices could be tracked, controlled or monitored using remote computers connected through Internet.

The internet of things has different definitions. In Short it is defined as the things present in the physical world or in an environment are attached with sensors or with any embedded systems and made connected to network via wired or wireless connections. These connected devices are called as smart devices or smart objects. And it consists of smart machines, which communicate, interact with other machines, environment, objects etc. And these can be processing by using some processors such as network processor, hybrid processor MCU/MPU etc. And the devices are connected by using some technologies called GPS, Wi-Fi, BT/BTLE, RFID etc.

Internet of things was first introduced in 1999 at auto-ID centre and first used by Kevin Ashton. This latest technology promises to connect all our surrounding things to a network and communicating with each other with less human involvement. Still internet of things is in beginning stage and there is no common architecture exist still today.

RELATED WORK

Some of the recent studies shows about the parking management and the slot management. And also gives the information about reservation based parking management.

Chi-Hung Chuang, Luo-Wei Tsai [2], developed a monitoring system for parking lot management system and the result of access management is reduced human resource, through the recognition car license. The constraint of this project is the recognition process takes more time to compare.

Mingkai Chen [3] developed a parking guidance and information system based on wireless sensor system and the information is transmitted between the nodes and processing the data, and the information passes to the display drivers. In this the constraint is, if the main node of the sensor system fails means the total block is failed.

Huang Cai-mei. [5] Presented an idea for reserving the parking slots and reversed cars look for the intelligent terminals to achieve the parked position of vehicles and get the guide route, so that user can quickly find the parking area.

BhosaleSwapnali [6] developed an idea for generating the multiple images using a fixed camera capture under different variations. Multiple images detection & recognition is important in the analysis of video data and higher level security system.

Vanessa W.S. Tang [8] presented an idea on WSN-based intelligent car parking system and the sensors are deployed into a car park field, with each parking lot equipped with one sensor node, which detects and monitors the occupation of the parking lot. The constraint of the project is that they deploy only sensor node if it fails means total lot information is lose.

Giuliano Benelli [9], develops an idea that the users use their own mobile phone for allows an electronic ticket to enter and exit the parking and as an electronic wallet to pay automatically for it.

PROPOSED WORK

Recently, with the explosive increase of automobiles in cities, parking problems are serious and even worsen in many cities.

The aim of the project is to design and provide:-

- A simple web application for parking vehicles.
- Booking parking slot from home.
- Can search nearby places using google map.
- Easy payment system.
- Parking owners can add their won parking palaces.
- Make easy to automate parking owners and customers.

User can search their destination parking facilities and according the availablity they can choose vehicle either 4-wheeler, 2-wheeler or public transport to reach their destination.

We have designed a simple web application. Where user can register their self and search for vehicle parking.

User can also change their profile information's like name contact info. User can also add their identity card as driving licence. User can also change their login password.

On the other hand any vehicle parking owner can create their profile and add their parking facilities.

Like parking areas available and vehicle allow for parking also owner can add their parking charges according to hour basis or day basis.

Owner has to add their parking location parking area name and name of building.

Parking owners has to also add parking architecture.

After than a team of parking installation goes to their parking location and install the parking devises and sensors to their parking areas.

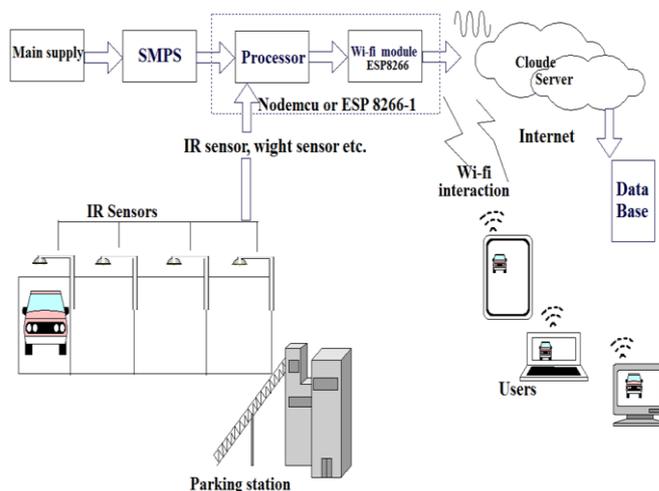


Figure 1: Proposed block diagram

Implementation and Simulation

The implementation of the proposed system contains two different stages

1. Software Implementation
2. Hardware Implementation

1. Software Implementation

In the software implementation, we have designed a simple web application. Where user can register their self and search for vehicle parking.

Required thins to deploy Web application.

Domain name:

Domain name is the most essential components for web application development.

“A **domain name** is an identification string that defines a realm of administrative autonomy, authority or control within the Internet”. Domain names are formed by the rules and procedures of the Domain Name System (DNS). Any name registered in the DNS is a domain name.

Here we have used a free domain name along with the name of free domain name provider URL which is provided by 000webhostapp.com

Server

“A computer or computer program which manages access to a centralized resource or service in a network”.

Basically server computer is a centralised computer which has static IP that is mapped with the DNS server. The server computer always connected with high speed internet connection with static IP. Whenever any client device is request for any webpage using URL and web browser the server computer is responsible to manage the request and provide the related data.

Server computer also contain data base which is used to store the data of the user and also used to identify the valid user info.

In this project we have used server from 000webhostapp.com for testing purpose but according to the requirement we can take any server from any places on lease or we can setup own server.

We have used following web development languages to develop our web application.

- HTML
- CSS
- Java Script
- PHP
- AJAX
- BOOTSTRAP
- SQL
-

2. Hardware Implementation

Every parking place has to install an IoT hardware kit. So that the iot device update the status of that particular slot that is vacant of parked any car.

The controller collect the sensor data and upload to the server using API (application programming interface). The API is created on web server using PHP. Server receive the data using API and store it in data base. Whenever any user search for the parking places the web application used that data to display the real result of the parking place.

Components required.

A. SMPS – SMPS (switch mode power supply) is the power source of the whole iot device.

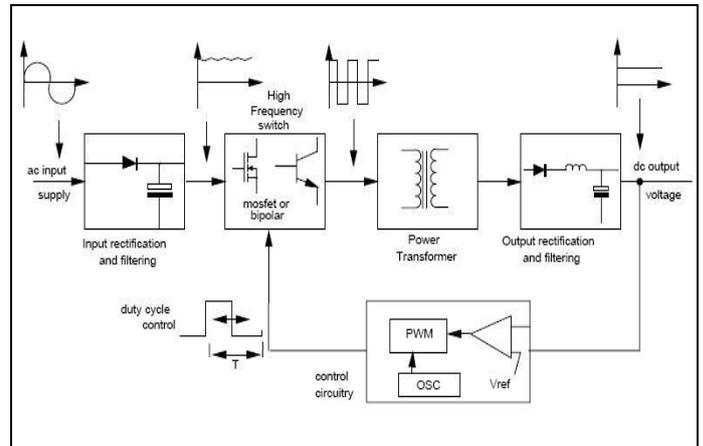


Figure 2: circuit diagram of switch mode power supply

SMPS convert the 220V AC power to 5V DC.

Because our whole system run on 5V DC we need the SMPS to supply the required power.

B. Wi-Fi Module: - in this project we have used Node MCU (Micro Controller Unit). The Node MCU contains Wi-Fi as well as a Node microcontroller. Node Microcontroller has 3Mb of ROM which can be used to upload a program.

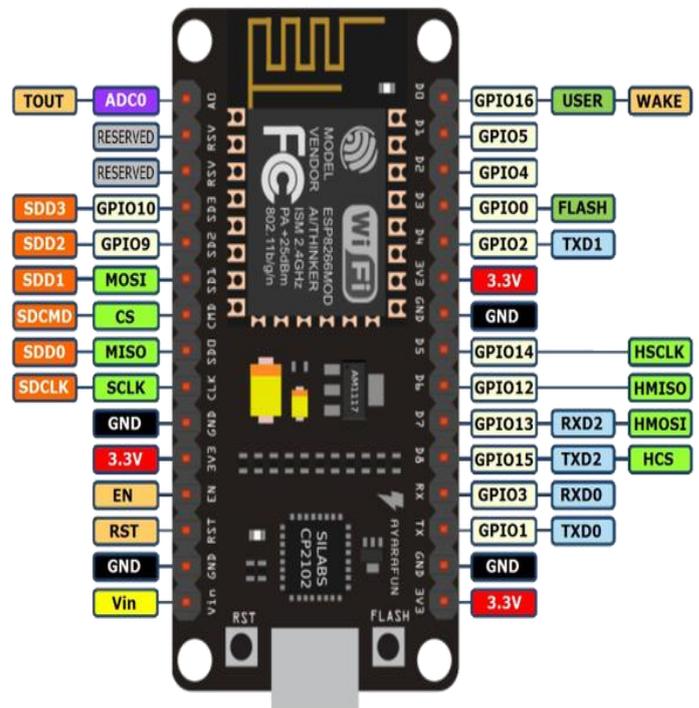


Figure 3: Pin Diagram of Node MCU

ESP8266 is an impressive, low cost Wi-Fi module suitable for adding Wi-Fi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone Wi-Fi connected device—just add power!

The feature list is impressive and includes:

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area.

C. IR Sensor: Infrared Obstacle Sensor Module has two part IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of any obstacle in front of the sensor module. The module has on board potentiometer that lets user adjust detection range. The sensor has very good and stable response even in ambient light or in complete darkness.

An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo-Coupler or Opt-Coupler. As said before, the Infrared Obstacle Sensor has built-in IR transmitter and IR receiver. **Infrared Transmitter** is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye. **Infrared receivers** are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

PCB Layout

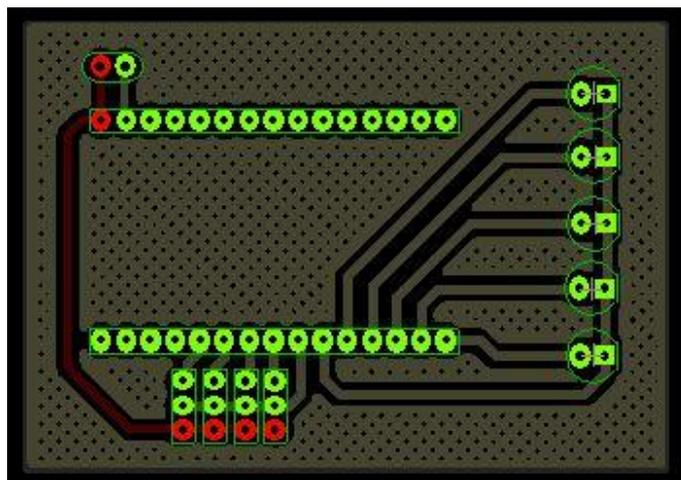


Figure 2: PCB Layout.

CONCLUSION

The growth of Internet of Things have given rise to New possibilities in terms of smart cities. Smart parking facilities and traffic management systems have always been at the core of constructing smart cities. In this paper, we address the issue of parking and present an IoT based web application smart parking system. The system that we propose provides real time information regarding availability of parking slots in a parking area. Users from any locations could book a parking slot for them by the use of our web application. The efforts made in this paper are indented to improve the parking facilities of a city and thereby aiming to enhance the quality of life of its people.

In our system user can view the real view of parking slot of nay register buildings, mall, hospitals, colleges and may more public parking areas. Due to this user has a choice that in what transport system he should use to visit that place.

REFERENCES

- [1] I.V.VAIBHAV, A.Ramya, A Review on Smart Parking Management System Using Vehicle Authentication, IJAREEIE 2016
- [2] Chi-Hung Chuang, Luo-Wei Tsai, "Vehicle License plate recognition using super resolution technique", 2014 11th IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS).
- [3] Mingkai Chen, "A Parking Guidance and Information System based on Wireless Sensor Network", IEEE International Conference on Information and Automation Shenzhen, China June 2011.
- [4] Pahang, "Development of an Automatic Parallel Parking System for Nonholonomic Mobile Robot", International Conference on Electrical, Control and Computer Engineering Pahang, Malaysia, June 21-22, 2011.

- [5] Huang Cai-mei, He Zhi-kun, “Design of Reverse Search Car System for Large Parking Lot Based on NFC Technology”, 2014 IEEE.
- [6] BhosaleSwapnali B, Kayastha Vijay S, “Feature extraction using surf algorithm for object recognition”, International Journal of Technical Research and Applications.
- [7] Face recognition using principal component analysis and neural networks, at: <http://www.researchgate.net/publication/23595016>.
- [8] W.S. Tang, Yuan Zheng, “An Intelligent Car Park Management System based on Wireless Sensor Networks”, 2009 IEEE.
- [9] Giuliano Benelli, Alessandro Pozzebon, “An Automated Payment System for Car Parks Based on Near Field Communication Technology”, University of Siena, Italy be nelli, alessandro.pozzebon { @unisi.it}.
- [10] Abhirup Khanna “IoT based Smart Parking System” University of Petroleum and Energy Studies (UPES) Dehradun, Uttarakhand, 2016