

A Smart Parking System Using IoT: A Need of Time for Smart City

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Abstract: The idea of a smart city has gained popularity recently. The Smart Parking facility is one of the crucial aspects of having a smart city. Finding a specific spot to park our car becomes a bothersome problem. Additionally, the number of automobiles continues to increase quickly every day. It has been observed that drivers struggle to find a safe stopping distance without considering where available parking spaces are. The demand for parking spaces causes traffic congestion and excessive fuel usage to grow. Numerous technologies were developed to help with the problem, but they weren't all successful due to differences in cost, effectiveness, power, precision, and other aspects. In this study, we used a Raspberry Pi to construct a prototype of a unique smart parking framework for an urban area based on reservations using the Internet of Things (IoT). The technology notifies users in real-time of the closest parking area and provides information on the availability of parking spaces there. It primarily focuses on reducing the amount of time spent looking for a parking space and allowing users to avoid spaces that are already occupied. For real-time parking spot monitoring, an ultrasonic sensor or an infrared sensor is used. The data collected by the sensor is sent to the NODEMCU ESP8266, which then sends it to a web page over the internet. By showing the open spots, the website will assist users in finding parking spaces. As a result, it minimizes fuel usage, which in turn lowers environmental carbon footprints.

Keywords: Smart Parking, IoT, Parking slot, Node MCU (ESP8266).

1. Introduction

Parking is currently a major issue at malls, event venues, and other places. It's because there aren't enough parking spaces. The number of automobiles per family now is more than the number of family members, and as a result, the number of vehicles in the nation has increased as well. This results in a parking situation that, regrettably, does not meet the country's present needs. This makes parking challenging and increases the time required to park the car as well as the fuel consumption of the car. Additionally, businesses and offices in metropolitan locations struggle with parking during working hours. Modern cars, especially those that are autos, take up a lot of room and are most affordable for low-income households. Of these crowded cities, there is a lack of parking due to the increase in vehicles. Parking issues are a major concern everywhere, including in malls, railways, and airports. People spend the majority of their time looking for parking spots to leave their cars. As a result, there is a great deal of traffic congestion, making it difficult for drivers to obtain parking spaces for their vehicles. The main cause of traffic in urban areas is car congestion, which causes individuals to waste time looking for parking spaces in unusual ways. The pollution that results from this rise in vehicles is a further problem that is added to this.

The use of information, communication, and technology by smart cities to increase operational effectiveness for the general public and hasten improvements in citizen quality of life. The adoption of smart cities is being driven by three rising trends: Internet of Things (IOT), automation, and machine learning. By implementing systems like smart parking, which uses a smartphone app to help cars find parking spaces, and smart traffic management, which tracks and analyses traffic patterns, any city can be considered for the "smart city" programme.

The main goal of a smart parking system is to make it quicker to find parking spaces, which also cuts down on fuel usage. The parking lot would have sensors installed, and users could reserve a spot and make payments online using a mobile app. The management of vast free parking spaces is a concern in developing nations like India. The employment of sensors and other communication modules by conventional parking management systems does not address a solution for both open and closed parking spaces. The position of a free parking space is determined by mobile applications using GPS connections through the Google map API, however they do not always pinpoint the exact location. Low precision, light, and weather conditions are the main limitations of parking spot detection devices. The technology used in this study to create a mobile application to discover parking uses an IR sensor to find open spaces.

2. Internet of Things

Things and identity communication devices served as the foundation for the Internet of Things (IoT) idea. Through the use of remote computers connected to the Internet, the devices might be tracked, managed, or watched over.

There are various meanings of the internet of things. In a nutshell, it is described as anything that is a part of the physical world or an environment that has been connected to a network via wired or wireless connections and has sensors or other embedded systems attached to it. Smart gadgets or smart objects are the terms used to describe these connected items. Additionally, it consists of intelligent machines that can interact with one another, the environment, and various other items. And these can be processed using a variety of processors, including network processors, hybrid MCU/MPU processors, etc. Additionally, the devices are linked together utilising various technologies as RFID, BT/BTLE, GPS, and Wi-Fi.

Kevin Ashton used the internet of things for the first time when it was originally introduced in 1999 at the auto-ID centre. The

newest technology promises to connect everything in our environment to a network and allow them to communicate with one another without the need for human interaction. There is currently no uniform architecture for the internet of things because it is still in its early stages.

3. Literature Survey

Chi-Hung Chuang, Luo-Wei Tsai [1], “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 [2] “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”.

Vanessa W.S. Tang [3] “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 [4], “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”.

4. Proposed System

Parking issues are critical and have even gotten worse in several places recently due to the exponential growth of automobiles in urban areas.

The project's goal is to create and offer:

- A straightforward online application for parking cars.
- Reserving a parking space online.
- You can use Google Map to look up local places.
- Convenient payment system.
- Parking space owners may include their prized parking palaces.
- Make it simple for parking consumers and owners to automate.

The user can look for nearby parking spaces using the proposed Smart Parking system. The difficulty of finding a suitable parking spot has become a major issue in the modern world, which is where the idea for this project originated. Drivers can use the smart parking system to find the best spot to leave their cars. Drivers can avoid wasting gasoline and time looking for parking spots by doing this. Additionally, less fuel will be burned when looking for parking. Once the user locates the ideal parking space, he can reserve it for a specific amount of time, at which point the website's availability count will be reduced.

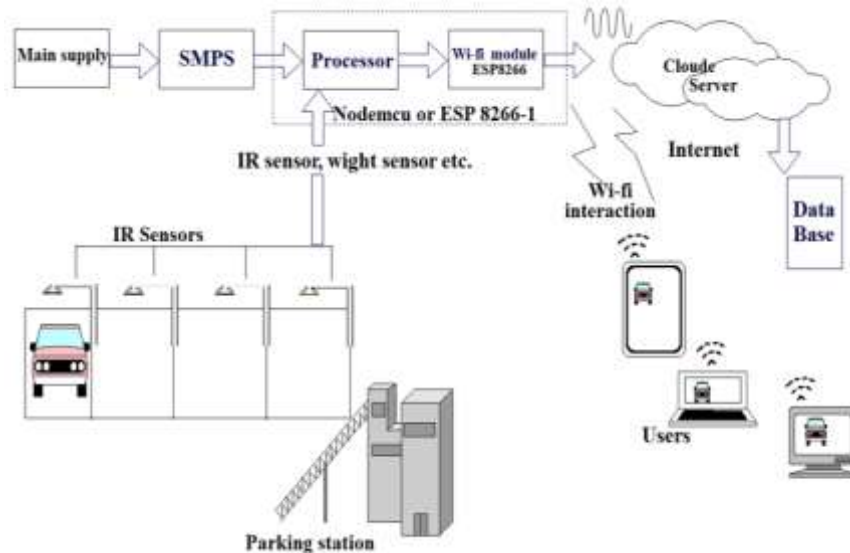


Fig. 1: Basic Architecture of the Proposed System

Server computers are essentially centralized computers with static IP addresses that are mapped by a DNS server. The server machine has a static IP and a high-speed internet connection. Anytime a client device uses a URL and web browser to access a webpage, the server machine is in charge of handling the request and providing the necessary information.

Databases on server computers are used to store user data as well as to locate accurate user information. For testing purposes in this project, we used a server from 000webhostapp.com, but we could build up our own server or rent whatever server we wanted, depending on the situation.

A self-contained SOC with an integrated TCP/IP protocol stack, the ESP8266 Wi-Fi Module enables any microcontroller to connect to your Wi-Fi network. The ESP8266 is capable of offloading all Wi-Fi networking tasks from another application processor or hosting an application. Each ESP8266 module is pre-programmed with an AT command set firmware, so all you have to do is connect it to your Arduino project to receive nearly the same amount of Wi-Fi functionality as a Wi-Fi Shield (and that's just out of

the box)! The ESP8266 module is a very affordable board with a sizable and expanding community.

Through its GPIOs, this module may be coupled with sensors and other application-specific devices with a minimum of upfront development and runtime loading thanks to its robust on-board processing and storage capabilities. Because of its high level of on-chip integration, it only requires a small amount of external circuitry, and even the front-end module is made to take up little space on the PCB.

The two-part Infrared Obstacle Sensor Module emits IR energy and scans for reflected energy to detect the existence of any obstacle in front of the sensor module. A potentiometer built into the module allows users to alter the detecting range. Even in low light or total darkness, the sensor responds with a very good and consistent quality.

A photo-coupler, also known as an opt-coupler, or photo-diode, is what makes up an infrared sensor. The Infrared Obstacle Sensor contains an integrated IR transmitter and receiver, as was previously stated. A light-emitting diode (LED) known as an infrared transmitter produces infrared radiation. As a result, they are known as IR LEDs. Although an IR LED appears to be a regular LED, the radiation it emits cannot be seen by the human eye. As they detect the radiation from an IR transmitter, infrared receivers are sometimes referred to as infrared sensors. Photodiodes and phototransistors are used as IR receivers. As opposed to regular photo diodes, infrared photodiodes only pick up on infrared radiation. When the IR transmitter sends out radiation, some of it reaches the target and is reflected back to the IR receiver. The output of the sensor is determined by the IR receiver's reception intensity.

5. Conclusion

The world's rising urbanization has given the idea of "smart cities" a boost on the global agenda. The conversion of cities into "smart cities" presents a fantastic opportunity for enhancing citizen wellbeing and promoting economic development. All urban cities have long entertained the idea of becoming "smart cities." Since a few years ago, initiatives have been taken and concepts have been put to use in numerous nations to make them a reality. The Internet of Things is clearly the essential technology used in conjunction with cloud computing. A smart parking facility is a necessary service for a smart city. Previous technologies were used, but they turned out to be either ineffective or expensive. The crucial elements are the sensors that are utilised to identify the vehicle.

Our approach reduces the amount of time that drivers must wait to park in a large parking lot. The owners of parking facilities benefit by increasing their venue generating. Additionally, it would lessen the need for staff at the parking lot, which would significantly cut down on costs and mistakes.

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