Smart Parking System Using IOT

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Abstract – A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies. This cost will be used to offer a solution of finding an available parking space upon a request by the user and a solution of suggesting a new car park if the current car park is full. Finding a parking space during the rush hours in a crowded city can be a time consuming and frustrating. Furthermore, drivers blindly search for a parking spaces and create an additional traffic congestion. The smart parking system make the search for a paring slot easier and convenient for drivers. Smart parking designs and develops and produces an outstanding leading-edge technology that enables clients to manage on-street and off-street parking efficiently and cost effectively. Smart parking system will maintain your system to the highest standard, to create a stress-free parking experience for drivers. In this paper, we present an IoT based cloud integrated smart parking system.

Index Terms – Sensors, parking detection, cloud.

1. INTRODUCTION

In the development of traffic management systems, an intelligent parking system was created to reduce the cost of hiring people and for optimal use of resources for car-park owners. Currently, the common method of finding a parking space is manual where the driver usually finds a space in the street through luck and experience. This process takes time and effort and may lead to the worst case of failing to findany parking space if the driver is driving in a city with high vehicle density. The alternative is to find a predefined car park with high capacity. Smart parking system are powered by IoT systems that detect the number of empty parking slots and sends the information over the internet to smart parking application [1]. These applications can be accessed by the drivers from smart phones, tablets or car navigation systems.

In smart parking system the sensors are used for each parking system whether to check if the parking slot is empty or occupied. The device that you build as part of this project is an application of Internet of Things (IOT). The electronic device that you build can assist the drivers in selecting the suitable parking spot for them. The data that the system collects will be sent to the cloud and anyone across the globe can access the data to do some analysis. The smart parking system that we propose is implemented using a mobile application that is connected to the cloud. The system helps a user know the availability of parking spaces on a real time basis.

However, this is not an optimal solution because the car park could usually be far away from the user destination. In recent years, research has used vehicle-to-vehicle and vehicle-to-infrastructure interaction with the support of various wireless network technologies such as radio frequency identification (RFID), Zigbee and the Internet. In this smart parking system, the wireless technology Zigbee is used for the data transmission of the information [2]. However, the current intelligent parking system does not provide an overall optimal solution in finding an available parking space, does not solve the problem of load balancing, does not provide economic benefit, and does not plan for vehicle-refusal service.

This research also implements a system prototype with wireless access in an open-source physical computing platform based on Arduino with RFID technology using a smartphone that provides the communication and user interface for both the control system and the vehicles to verify the feasibility of the proposed system. The device that you build will get the data of the parking slot status (whether it is occupied or not) from the digital IR sensors or the pi cams that are present over there. These sensors send the data to the microcontroller and in turn the data will be processed and the status of parking slots will be displayed to the user. If you are using Pi cam, then the image captured will have the data about the availability of parking slots. The data will also be sent to the cloud which can be integrated onto an Android App, so that the user can see the slots available directly from their mobile phones. The sensor nodes are equipped with different sensors, computation units, and storage parts to collect cooperatively, process and provide sensory data for [4] localization and surveillance. The system will allow parking administrators and managers to get real-time information about the parking field thereby promoting easy and enhanced parking management.

In this the IOT sub system includes sensor layer, communication layer and application layer. The primary goal of the intelligent car parking system is to find, allocate and reserve the best available car parking lot for a user who is

driving a car in a particular area and to provide instructions for reaching this lot. Sensor layer detecting the car lot occupancy. A car parking lot detection method is proposed based on carmatic threshold algorithm. An infostation based multi-agent system facilitating a car parking locator service is proposed. An access control system for reducing the waiting time proposed. At the application layer, an information centre provides cloud based service. An IOT management centre administrates the smart city via an IOT integrated service portal. A number of business services explore interfaces to the sensor layer. These includes a car parking locator service, car parking supervision service, car parking information service, GIS and GPS services, vehicle license patrolling, vehicle tracking service.

A. Proposed system

The smart parking system that we propose is implemented using a mobile application that is connected to the cloud. The system helps a user know the availability of parking spaces on a real time basis. A recent survey performed by the International Parking Institute reflects an increase in number of innovative ideas related to parking systems. At present there are certain parking systems that claim to citizens of delivering real time information about available parking spaces. Such systems require efficient sensors to be deployed in the parking areas for monitoring the occupancy as well as quick data processing units in order to gain practical insights from data collected over various sources.

2. LITERATURE SURVEY

Thus, congestion occurs in the traffic it leads to a hectic 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. Our system is a Raspberry pi-based parking sensor which contains pi-camera to detect the empty parking spaces and sends this data to server, this stored data is accessed by users [5], [6]. This enhances the user to check the status/availability of parking spaces before setting their journey. Here the challenge is to use the existing resources in optimum level to reduce the searching time, traffic congestion in the city. Some embedded systems such as Arduino, raspberry pi, etc. are used to develop internet of things applications. A few existing parking systems which uses sensors to collect the information but using sensors like video sensors in a parking system are expensive so our aim is to develop a system with less cost with more performance. Design and implementation of a prototype smart parking system based on wireless sensor network technology with features like remote parking monitoring, automated guidance and parking reservation mechanism is described on a smart parking system. This information is aggregated by a local controller and then sent over the internet then to server. The aim of this study to prove the smart parking systems uses the different types sensors, applications and used the different types of modules. In this smart parking system, we design an algorithm and the flow of the diagram.

Each parking slot has an ultrasonic sensor fixed above which can detect the presence of a vehicle in the slot. When the ultrasonic sensor received the signal from the from Arduino Uno module, it emitted sonic waves which were then reflected by the object and sensed by the sensor. The time between transmitting and receiving sonic waves was proportional to the distance between the object and the sensor, whereby longer time was taken when the distance between the sensor and the object were larger. The Ultrasonic sensor then sends a timing pulse to the Arduino Uno module which would be equivalent to the distance and the program uploaded in the module processes the time received from the sensor. If the data showed that the distance between both sensors is greater than 150 centimeters, the conditions satisfied the car parking condition; then the module sends the signal to the server specifying that the parking lot is empty, and makes the red LED OFF and the green LED ON. If the distances received from the both sensors are below 150 cm, modules send signal to the server which specifies that parking lot is occupied, and it makes the red LED ON and the green LED OFF, as shown in figure 1.1

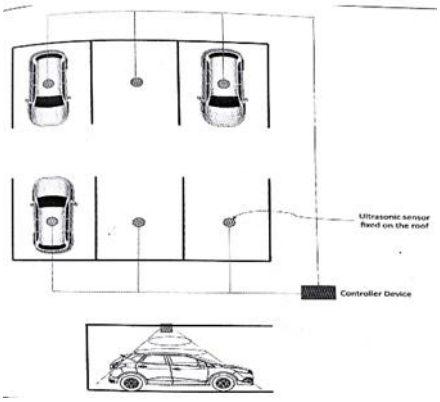


Fig 1.1

3. RELATED WORK

The Smart Parking System is designed by making use of some IOT supportable hardware's such as raspberry pi, Arduino boards etc. here we focusing on less power consumption and more performance device so raspberry pi is the suitable microcontroller for our implementation. And NOOBS installer is loaded into the storage device of microcontroller. This installer which consists of various hardware supportable operating systems such as mac os, tiny os, Raspbian os etc. where these operating systems which basically consumes less power. Our smart car parking system was developed to allow the detection of a car when parked in the parking lot and communicate the same to the server for the purpose of delivery. There have been different projects working on smart parking systems.

3.1. PROBLEM STATEMENT

The problem given in this paper is the cloud-based parking system where we have to implement the parking slot for every vehicle and each car park. The parking system is application-oriented technology which is used in the inter net of thing technology. This process takes time and effort and may lead to the worst case of failing to find any parking space if the driver is driving in a city with high vehicle density. The alternative is to find the predefined car park with high capacity, however this is not an optimal solution because the car park usually will be far away from the user destination. This system supports various wireless technologies such as sensors, Radio frequency identification and internet. The wireless technology which is used for the transmission of data is the Zigbee protocol. The data that includes the vehicle GPS location and distance between car parks and the number of free parking space in car park will be sent to the data Centre.

When the availability of parking slots changes, immediately the information is updated to the central server. Then user can access this stored information using internet from any location. And this information is used by parking operators to determine free parking areas and statistics can be measured at different times in a day on each parking space. The fig.3 shows the communication between two or more clients and SPS with server. Such that single client can access the information of many parking areas in the city. So, by observing the availability of parking slots the user can choose their convenient parking area. Thus, particular parking area is navigated from client's current position. You can either do this project using an Arduino microcontroller or a Raspberry Pi. If you are using an Arduino Uno then you should also embed a WiFi module on it to establish the connection to internet and send the data live. The raspberry pi will be already embedded with a WiFi module, so you don't require an extra one to establish the internet connection.

B. IMPLEMENTATION

The automated parking system using IoT that you develop can be implemented in covered parks, open parks and also street side parking. The smart parking system will have a cloud service provider that provides cloud storage to store information about the parking status in the slots. There will be a centralized server which stores the information about the number of parking slots, availability status and also the parking time. The parking system is designed in such a way that it is applicable for covered parks, open parks and street side parking.

The functionalities of the components of automated parking system project are as follows:

1. Centralized server: This maintains the information about the parking slots and its availability maintains databases which contain information about parking spaces present in the city.
2. Raspberry Pi: This will act as the microcontroller for the project and all the other sensors will connected to it.
3. Camera: The Pi camera will be connected to the microcontroller and will be used to validate the parking slots as either empty or occupied.
4. IR sensors: It will be used to sense the presence of vehicle in the parking slots by sending out IR radiations.
5. Navigation system: This will give the signals that will guide the users to navigate and go to the nearest available parking slot.
6. Display device: This will be the screen that displays the status of the parking slots and change real-time.
7. User device: This can either be the mobile phone or a website which can be used by the user to get the availability of parking slots directly through the user.

However, a smart car park system should provide more convenience and automation to both the business and customers. It should also satisfy the following requirements:

(1) The system should provide plenty of informative instructions or guidelines to help drivers to find an available parking lot.

(2) The system should provide powerful functions to facilitate administrators and managers to manage a car park.

In accordance with the above requirements, a smart car park system should minimize human operations and supervisions, so as to reduce the cost of manpower and the lost from human mistake and to enhance efficiency. Also, the car park system is required to provide higher accuracy, robustness, and flexibility in operations, more convenience to customers, lower cost of operating and maintaining overall system.

4. MODULES DESCRIPTION

RASPBERRY PI: The Raspberry Pi was released on 29 February 2012; 6 years ago. The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards and mice) and cases. However, some accessories have been included in several official and unofficial bundles. Processor speed ranges from 700 MHz to 1.4 GHz for the Pi 3 Model B+; on-board memory ranges from 256 MB to 1 GB

RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either SDHC or Micro SDHC sizes.

The boards have one to four USB ports. For video output, HDMI and composite video are supported, with a standard 3.5 mm phono jack for audio output. Lower-level output is provided by a number of GPIO pins, which support common protocols like I²C. The B-models have an 8P8C Ethernet port and the Pi 3 and Pi Zero W have on-board Wi-Fi 802.11n and Bluetooth is as shown in figure 2.1.

The first generation (Raspberry Pi 1 Model B) was released in February 2012, followed by the simpler and cheaper Model A. In 2014, the Foundation released a board with an improved design, Raspberry Pi 1 Model B+. These boards are approximately credit-card sized and represent the standard *mainline* form-factor. Improved A+ and B+ models were released a year later. A "Compute Module" was released in April 2014 for embedded applications. The Raspberry Pi 2, which added more RAM, was released in February 2015.

Fig 2.1

ARDUINO: Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming.

As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

The Arduino Uno is a microcontroller board based on the ATmega328. Arduino is an open-source, prototyping platform and its simplicity makes it ideal for hobbyists to use as well as professionals. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started which is as shown in figure 2.2.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal serial bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an Integrated development environment (IDE) based on the processing language project.

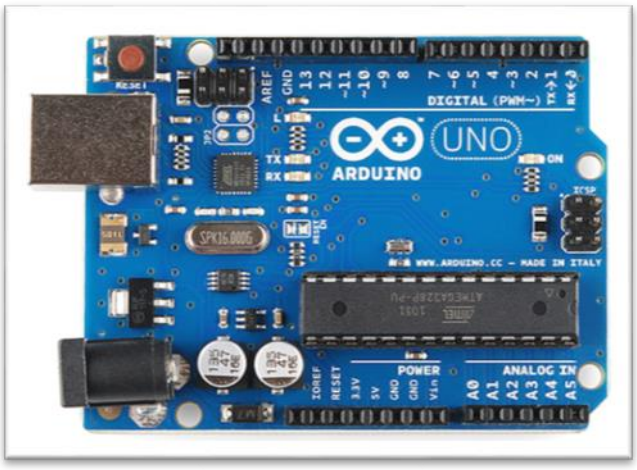


Fig 2.2

IR SENSOR: An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor.

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time which is as shown in figure 2.3.

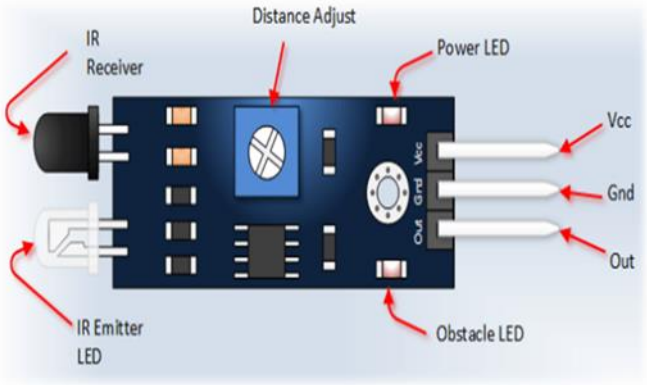


Fig 2.3

ULTRASONIC SENSOR: The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet. The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module. As shown below in the figure 2.4 the HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver.

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below.

HC-SR04 distance sensor is commonly used with both microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc. The following guide is universally since it has to be followed irrespective of the type of computational device used. Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off.

This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor. The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information the distance is measured as explained in the above heading.

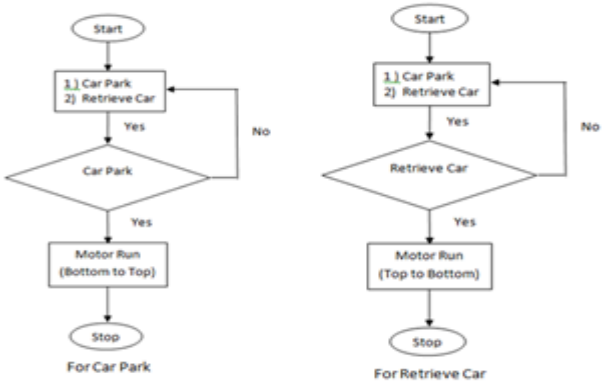
Fig 2.4

5. SYSTEM ARCHITECTURE

The ideal of creating a Smart City is now becoming possible with the emergence of the Internet of Things. One of the key issues that smart cities relate to are car parking facilities and traffic management systems. In present day cities finding an available parking spot is always difficult for drivers, and it tends to become harder with ever increasing number of private car users. This situation can be seen as an opportunity for smart cities to undertake actions in order enhance the efficiency their parking resources thus leading to reduction in searching times, traffic congestion and road accidents. Problems pertaining to parking and traffic congestion can be solved if the drivers can be informed in advance about the availability of parking spaces at and around their intended destination. Recent advances in creating low-cost, low-power embedded systems are helping developers to build new applications for Internet of Things. Followed by the developments in sensor technology, many modern cities have opted for deploying various IoT based systems in and around the cities for the purpose of monitoring. A recent survey performed by the International Parking Institute reflects an increase in number of innovative ideas related to parking systems. At present there are certain parking systems that claim to citizens of delivering real time information about available parking spaces which is as shown in figure 3.1. Such systems require efficient sensors to be deployed in the parking areas for monitoring the occupancy as well as quick data processing units in order to gain practical insights from data collected over various sources.

When a car arrives in parking lot, it is sensed by ultrasonic sensor which is one of the components of the sensor level. After getting data from the ultrasonic sensor, Arduino Uno Module processes the data and sends it to Programming level Data contains information about parking lot status. Once

Programming level circuit receives parking lot status, it carries out corresponding changes in web page, mobile, section LEDs and respective parking lot LED.



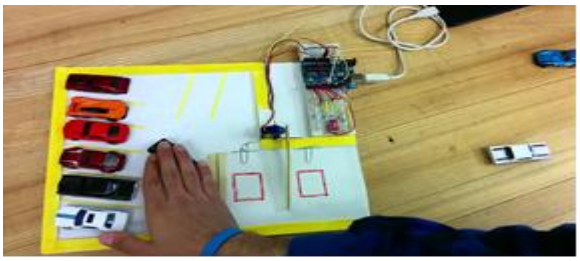


Fig 3.1

6. RESULT

These ssensors detect if a car is parked there or not and send that data to a central service. Drives use the companies mobile app to find the nearest unoccupied spaces. The result is to evaluate the performance of the proposed system, we determined the parameter for system performance as the cost in terms of user time in the system. The cost to the user is the time that the user spends in the parking system for service. the time in this study is the average waiting time for ther service to the user and average total time of the user in the system, including the waiting, travel amd service times a smaller cost value beds to better system perforamce.

7. FUTURE WORK

The future work in this paper is that the smart parking system is to improve the parking slot and vehicle to vehicle infrastructure. To improve this we have to implement the smart parking system by using sensors and wireless communication protocols. Therefore, the proposed system is improved by sending the notification to smart phone ,tablet where the parking slot is empty. This is how the future work is based on the cloud based parking system using IOT which is going to be implemented in the future. In future, this capability can be built into cars so that you can have your car navigate to the best available parking with the press of a button or voice command. Once the driver has parked its car in the selected slot it needs to confirm its occupancy. This the scenario in which the driver has to specify its presence. This feature is added so that only a genuine driver can park its car in a particular parking slot. If a driver fails to confirm his occupancy in the next 30 seconds of parking its car, an alarm would start ringing causing the authorities to know that a car has been parked in the wrong place. If by any chance a genuine driver fails do so he can stop the alarm any time by confirming his occupancy. In case the driver over shoots its parking time, a notification stating this scenario would be sent to the driver as well as to the parking attendant. The driver would then have an option of extending its parking time and pay accordingly for the extra time. In case the driver fails to do so, the parking attendant would make a note of this and charge money for the extra time in form of a fine. This fine would be collected from the driver at the time when the car would be leaving from the parking area.

8. CONCLUSION

In this paper, the implementation of cloud based smart parking system using Internet of Things is discussed. This system includes RFID technology with Android application which provides user interface for control system and vehicles. The average waiting time of users for parking their vehicles is effectively reduced in this system. The optimal solution is provided by the proposed system, where most of the vehicles find a free parking space successfully. This smart parking system provides better performance, low cost and efficient large scale parking system. Security measure to ensure that the users do not misuse the parking system can be implemented. The growth of Internet of Things and Cloud technologies have give 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 Cloud integrated smart parking system. The system that we propose provides real time information regarding availability of parking slots in a parking area. Users from remote locations could book a parking slot for them by the use of our mobile 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.

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