

The Smart Car Parking System Based on Internet of Things

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ABSTRACT

The challenges that we are facing in our day to day life is parking of the car. When we visit various public places such as office, shopping mall, multiplex cinema halls etc it is very hard to search the availability of parking area. This situation calls for the need for a smart car parking system which is equipped with sensors (Infrared) and microcontrollers (arduino-uno) to automatically count the cars parked in the lot. In this paper we are going to design and implement a prototype of Smart Car Parking System which is based on Internet of Things. This paper proposes a system that helps users to automatically find the vacant available space in the parking area through the infrared sensors which are located in each parking space and the user can find the vacant parking slot through an android application of mobile device via server. In other words we can say that it's a new way of communication between the humans and the things. These all things are done with the help of latest technology based on IoT.

Keywords: Internet of Things (IOT), Sensors, Microcontroller, Android Application, Smart Car Parking System

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I. INTRODUCTION

In this paper we are going to implement how to reduce the traffic congestion that occurs in and around various urban areas which is caused by vehicles during parking. When we visit various public places like Shopping malls, multiplex, cinema hall & hotels during the festival time or weekends it creates more complex parking problems. The difference between our proposed system and the existing system is that we aim to make our system as less human dependent. The present scenario of our proposed system uses the concept of IoT (Internet of Things). The IoT is a network of objects and sensors that are connected to each other to share and to collect the data and information between the devices. The IoT network makes parking facilities more easy and convenient to upload the field data to the server with minimum cost and also helps to reduce burden. In our system, we design and implement a prototype of Smart Car Parking System (SCPS) that allows drivers to effectively find the vacant parking spaces through a mobile application via server by periodically learning the parking

status from the Infrared sensor networks deployed in parking lots. The infrared sensors consist of IR transmitter and receiver part. For detecting the reflected IR light we are going to use IR receiver to detect the IR light that was emitted from IR transmitter. The protocol used in our proposed system is MQTT (Message Queuing Telemetry Transport) which is the latest protocol. It is light weight and more data can be sent as compared with the other protocols such as HTTP, SMTP, FTP etc.

II. LITERATURE SURVEY

2.1. Hilal Al-Kharusi Ibrahim Al-Bahadly (April 2010) "Intelligent car parking system based on image processing."

- This paper aims to present an intelligent parking space detection system based on image processing technique. The proposed system captures and

processes the image drawn at the parking lot for this purpose camera is used as a sensor to take photos and to show the occupancy of car parks.

2.2. Hongwei Wang and WenboHe(Jan 2011) “A reservation based car parking system”

- This paper proposes a system based on the design and implementation of a prototype of reservation based car parking system that allows driver to find the vacant parking spaces. We implement parking reservation system to balance the benefit of service provider and requirements from the user.

2.3. Amin Kianpisheh, NorliaMustaffa(July 2012) “Car Parking System (CPS) architecture using ultrasonic sensors.”

- This paper proposes CPS detection system which is based on ultrasonic sensors. The work of ultrasonic sensor is based on echo location.
- In this paper we have studied that the sensor transmit the sound which hits a solid object and is reflected back to sensor. The time between the samples and return echo is used to calculate the distance.

3. Problem statement

To propose an IoT based smart-parking system using Infrared Sensors that helps user to automatically find free parking space based on some performance parameters that makes our system time and cost effective. Available parking slots should be sensed and updated in an IoT database so that anybody connected to the database can efficiently identify free parking slots in a specific location.

4. Proposed system

The proposed system overcomes the drawbacks of the existing system. The system makes it more user-friendly because in our proposed system we are using the latest technology such as IoT. In the proposed concept, we are going to make a prototype of smart car parking system based on IoT (Internet of Things) in which Infrared sensors will be deployed to each and every parking slots, whenever any vehicle occupy the parking slot, the sensor will get actuated and it will send this information (presence or absence of vehicles) to the IoT gateway i.e. (Arduino UNO) and then this information will be uploaded onto the server via [Ethernet or WiFi shield (W5100 or esp8266)] which is called capillary communication instead of cellular communication [GSM based]. The communication involving the router and the android application through server can be done easily by using IoT stack. The application layer of the IoT stack consists of MQTT (Message Queue Telemetry Transport) protocol. MQTT is a publisher/subscriber protocol which is used instead of HTTP (Hyper Text Transfer Protocol), SMTP (Simple Mail Transfer Protocol) etc.

III. SYSTEM ARCHITECTURE

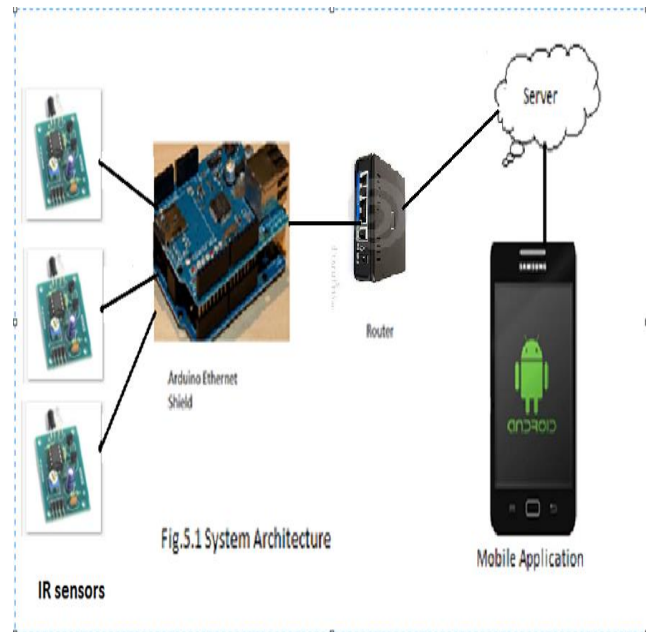


Fig 1: System Architecture

In our architecture we use infrared sensors, Arduino-uno (microcontroller), Ethernet shield etc. The user client is connected with the server by using Android mobile application. The android application links with the sensors and the devices. The sensors are used to sense the data through the Ethernet shield which is connected to the server. When the system starts working the IRs sensor continuously sense the presence of vehicles. Whenever any vehicle is detected at that time the IR sensors sense the output is red and when there is no vehicle at that time its output is green. This data of IR sensors is given to the arduino-uno then this data is published by arduino-uno to the server where broker (mqtt) is available. Now in order to monitor this data the mobile phone consists of android application. This android application subscribes to the server and the data can be observed on the application (mobile app).

6. System requirement and specification

For designing such systems we have some requirements such as required hardware and software some safety precautions to be taken mentioned below

6.1 Hardware Requirement

In Hardware requirement we want client mobile application and many primary devices that are explained below

6.1.1 Infrared Sensors

The infrared sensors are used to detect the object or any obstacle. These sensors work on a simple logic and principle in order to detect the obstacle. These sensors are very cheap and easily available in market. It uses 555 comparator IC which has a voltage of about 0.5 volts-0.25 volts. It reduces

program complexity and can be used. Whenever any vehicle is detected at that time the IR sensors sense the output is red and when there is no vehicle at that time its output is green.

6.1.2 ArduinoUNO :

The Arduino Uno is the microcontroller. It can be considered the heart of the system. The microcontroller is also known as the processing node. The main job of this node is to process the data and information received from IR sensors and transmit to further link for action which can be monitored on android application. It also sends the information received from application to the IR sensors.

- Arduino is an open-source electronics prototyping platform based on flexible, user-friendly hardware and software.
- In-Expensive (Less than Rs. 1000/-)
- Simple and easy to learn programming.
- Controller independent programming language.

6.1.3 Ethernet Shield:

The **Ethernet Shield** allows an Arduino board to hook up to the internet. It is based on the Wiznet W5100 ethernet chip. The ethernet shield connects to an Arduino board with long wire-wrap headers which extends through the shield. This keeps the pin layout intact and allows another shield to be stacked on top.

6.1.4 Router:

The main aim of router is to forward data packets along networks from the IR sensors to the mobile phone (android application). The data and the information from the sensors is sent to the server through router.

6.1.5 Mobile Application(Android):

The android operating system is based on the open Linux kernel. An android application is created using Android Studio. The IONIC Framework is used in the NODE.JS. JAVA is used to develop android application. Using the JAVA compiler the source files are converted to JAVA class files. The Android SDK contains a tool, which converts JAVA class files into a Dalvik Executable file. The Dalvik Executable file and the resources of an android application are packed into an Android Package file. The resulting Android Package file has all data to run the application and can be deployed to an Android device using *adbtool*. The Android system installs each and every Android application with the unique user and group ID. The Android application is developed using slot allocation method for the Smart parking.

7. System Implementation

7.1 Hardware Implementation



Fig 2: The prototype of our architecture.

The client is connected with the server by using Android mobile application. The android application links with the IR sensors and the devices. The sensors are used to sense the data through the Ethernet shield which is connected to the server. When the system starts working the IRs sensor continuously sense the presence of vehicles. Whenever any vehicle is detected at that time the IR sensors sense the output is red and when there is no vehicle at that time its output is green. This data of IR sensors is given to the arduino-uno then this data is published by arduino-uno to the server where broker(mqtt) is available.

7.2 Software Implementation

To monitor the data the mobile phone consists of android application. The application (android) subscribes to the server and data can be observed on the application (mobile app). The IONIC Framework is used in the NODE.JS. The android applications are developed using the JAVA code. Using the JAVA compiler the source files are converted to JAVA class files. The Android SDK contains a tool, which converts JAVA class files into an Executable file. The Executable file and the resources of an android application are packed into an Android Package file.

IV. CONCLUSION

We have proposed a parking system that improves performance and efficiency in order to find a parking slot and minimize the costs of moving to the parking space. The proposed system makes use of Android application to facilitate the parking and retrieval of the vehicle, for the user. We hereby aim to reduce the human efforts required for parking of vehicle at public places like shopping malls, public parking, 5-star hotels etc. Thus, the proposed design would provide an efficient car parking system based on internet of things method. A favourable IoT solution must make parking facility easy to upload field data to the Internet and reduce maintenance, burden and cost. Using an

Internet of Things (IoT) gateway to connect with the arduino-uno microcontroller, however, sensors and other edge devices, field data can be retrieved, analyzed and stored to the Internet.

V. FUTURE SCOPE

In future, we will implement Hybrid or Generic App for Android, Windows and IOS platform for the same context and with regards to IoT implementation we will make it two way communication like any user from App itself will be able to book parking slot depending on the slot availability and all the data will be stored in MongoDB database to make further analysis of particular parking area which may convert valuable data into good business.

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