

IoT BASED SMART CAR PARKING SOLUTION

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Abstract

The increasing number of vehicles on the road along with the mismanagement of available parking space leads to the parking related problems. It causes the problem for parking which leads to traffic congestion, driver frustration, and air pollution. A driver doesn't know where the exact place for parking, it not only takes time but can also fail to find free parking space. Thus it is highly required to develop an automated smart parking management system that would help the driver to find out some suitable parking space for his/her vehicle very quickly. It propose an automatic and real-time system for automated car parking. This system would be implemented by the use of internet of things (IOTs). IOT refers as any physical thing that is connected to internet or exchanging information or data between internet and physical device. Arduino MEGA is a microcontroller used in IOT. It is used for building digital devices and interactive objects that can sense and control physical devices. Our smart parking will be implementing using Arduino MEGA board for car parking and Ethernet shield to connect parking area with internet. By using our IOT based smart car parking system, a user can save much time for searching free parking space

Keywords—IOT, adreno kit, smart car parking.

I. INTRODUCTION

Internet of things (IOTs) is a recent topic that plays an important role in our daily lives. IOT reduces human labor, effort, time and errors due to human negligence. With the development of modern technology, smartphones have become a necessity for every person on this planet. A smart parking system helps to monitor vehicle parking. It helps to manage parking collision among vehicles when they are parking at the same time that means it helps in synchronized parking. In IOT objects are connected to each other and exchange information from internet. Our IOT based smart parking organized the parking lot. It helps user to find a free space in parking slot. It saves user's time as well as their fuel. It helps nowadays to obtain parking spaces in metropolitan area which is very crucial. People waste money and fuel in searching for parking slot. IoT Based Smart Car Parking system gives information about parking spaces. An ultrasonic sensor is used at each slot in parking; it tells the space availability. The information about the free or used slot sends over server through IOT. For exchanging the information of availability of spaces It is using internet connecting devices such as Ethernet shield and Node MCU devices, these devices helps to connection between parking area and server. All the real-time sensor status information is stored on to the web server. It are developed the android application "Park Me" for the user to find the available parking slot and reserve that parking slot. This application is very user-friendly and easy to use. With this application user can reserve the available parking slot from anywhere anytime. Looking for a vacant parking slot in a busy city is a nightmare for drivers. They have to drive around looking for a free parking spot. This leads to the driver frustration and fuel wastage. The common method of finding a parking space is manually going at each parking area where the driver usually gets finds a space. 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 purpose of this system is to reduce the time to find the vacant parking space. This system detects and reserves the vacant parking slot using Android application.

II. RELATED WORK

[1] Thanh Nam Pham, Ming-Fong Tsai, DucBinh Nguyen, Chyi-Ren Dow And Der-Jiunn Deng, Sep 2015, IEEE Access, proposed a Cloud Based Smart parking system Based on Internet of Things technologies. The system is derived from the idea of IoT. The system uses the WSN consisting of RFID technology to monitor car parks. An RFID reader counts the percentage of free parking spaces in each car park. The use of RFID facilitates implementation of a large- scale system at low cost. The system provides a mechanism to prevent disputes in the car park and helps minimize wasted time in looking for a parking space. After logging into the system, the user can choose a suitable parking space. Information on the selected parking location will be confirmed to the user via notification. Then, the system updates the status of the parking space to “pending” during which time the system will not allow other users to reserve it. If after a certain period of pending time the system determines that no car is parked in that space, then it changes the status to “available.” The system will update the status from the WSN node (the status of car park spaces) when a new car joins in the system. Therefore, the status of the overall parking system is always updated in real time. The system will help plot the parking time for each parking space in real time and can support the business with hourly parking charges. [2] Mohammed Raheel Ahmed, T C Jermin Jeajunita, Nov 2016, IJAREEIE, proposed a IoT Based Cost Efficient Smart e-Parking System. The entire framework incorporates three modules: Cloud, Parking Area and User as illustrated in figure 1. User must register in any of enrolled parking area and a unique RFID tag/ smart card will be assigned. To book a parking slot, user selects parking area location and send request to cloud via smart phone, and also can view the respective parking area details. Cloud will calculate shortest distance between user & nearest parking area in requested location, and free slot available in parking area. If user’s nearest parking area is not available for any slot then search for next nearest neighbour parking area. Cloud sends a response message to user that entails allocated parking slot in particular parking area and respective parking area will receive user’s detail and slot. Once user enter into a parking area, RFID tag will be verified by check-point, allow to park and parking area details will be updated in a cloud. When user exits, again RFID tag will be verified by check-point, and a bill generated from cloud is sent to both user and respective parking area. Once payment done user is allowed to exit, parking area updates its status in cloud and cloud sends new updated status of parking area to its neighbour parking area.

III. METHODOLOGY

The method is to build an IoT based smart car parking system which helps users to find automatically vacant space in the parking area using android application. User identification can be check through RFID. This system provides an effective solution to reduce carbon footprints in the atmosphere. It reduces the risk of finding the parking slots in any parking area and also it eliminates unnecessary traveling of vehicles across the filled parking slots in a city. So it reduces the time and it is cost effective also. This can be used for any parking area like private parking areas, shopping centres, cinema theatres.

IV. RESULTS AND DISCUSSION

If a number of parking slots increases then the initial cost of wiring is increased. It is easy to handle logical structure but not easy for the physical installation of components. A user should be registered into the IoT based Smart Car Parking System for satisfies with provided services. If the user has not registered into the system then, a user is unable to get provided services. Internet connection should be required to use this system services or facilities.

V. CONCLUSION AND FUTURE SCOPE

The systems scope is to build an iot based smart car parking system which helps users to find automatically vacant space in the parking area using android application. this system provides an effective solution to reduce the risk of finding the parking slots in any parking area and also it eliminates unnecessary traveling of vehicles across the filled parking slots in a city. so it reduces the time and it is cost effective and reduces carbon footprints in the atmosphere. this can be used for any parking area like private parking areas, shopping centres, cinema theatres, hospitals, malls.

VI. EXTERNAL INTERFACE

Sensors: The system uses ultrasonic sensor to detect a presence of a vehicle (Whether the parking slot is occupied or not).Based on the parking slot occupancy, the status (occupied/ unoccupied) is displayed on the web application dashboard. **RFID sensor** is used to verifying users. Payment can be done by using RFID tag. **Arduino Board:** This will act as the controller, it controls physical devices, process on data comes from sensor devices and produce output. Data will be taken in analog form and will be converted into digital form. **Ethernet Shield:** It provides the internet connectivity to Arduino board for connecting to the server. **NodeMCU:** It provides the internet connectivity to Arduino board for connecting to the server. **Server:** The server is the central storage used to store data of parking area and user information. **Mobile application-:** Mobile application is used to interact with the system. **Jumper wires:** Wires are used to connect sensor, Arduino MEGA and other devices. **Servo Motor:** Servo motor is used to opening and closing of entrance gate

VII. FUNCTIONAL REQUIREMENTS

- The modules and functional requirement of system are mentioned below:
 - 1. **Registration:** The Registration function is used to register the new user, new parking area and new parking slot into the system. The registration process requires the more information. For example, if a new user wants to register into the system, user needs to enter Name, username, password, mobile number, car number etc. information required. If all entered information is correct then registration function gives “Registration successful” message.
 - 2. **Login User:** The login user function is used to authenticate the valid user. Every user has a user name and password, with the help of that user can login into the system and complete the car parking process. Every user has the unique user name. If a user want to login into system, a user needs to enter correct user name and password. If user name and password is correct then system allow to user to access into the system, otherwise gives error message as “Invalid user name or password”.
 - 3. **Finding vacant slot:** The finding vacant slot function used to find the vacant parking slot with help of ultrasonic sensor status. This status stored in the database. This function checks the sensor status and decides the parking slot is vacant or not. If the slot is vacant then a user can see a green square box in a mobile application. Then a user can select this slot for reservation.
 - 4. **Vacant slot Reservation:** This function is used to reserve the user selected parking slot. Before the reservation of a slot, the system checks the slot status. If the slot is vacant then the allocation of parking slot function allocates a slot to the user. For this module, the input is the status of parking slot and user selected parking slot. The output of this module is slot “Reservation successful”.
 - 5. **Allocation parking slot:** The allocation parking slot function is used to allocate the vacant parking slot to a user. This function takes input as a vacant slot and gives the allocation that selected slot to the user. After allocation, it gives “Reservation successful” message to the user.
- Performance Requirements** The performance requirements of system are mentioned below:
- The reservation of parking slot depends on how many parking slots are available that many users can reserve a parking slot.
 - The reservation of parking slot capacity is depending on the size of area and number of ultrasonic sensor available.
 - The RFID sensor gives the user identification; therefore, payment is successfully done.
 - If one user reserves anyone of parking slot then another user can’t able to reserve the same slot.
 - The software is such that as the time goes by the need of the parking management, an employee may keep on changing thus it is made to change from time to time.

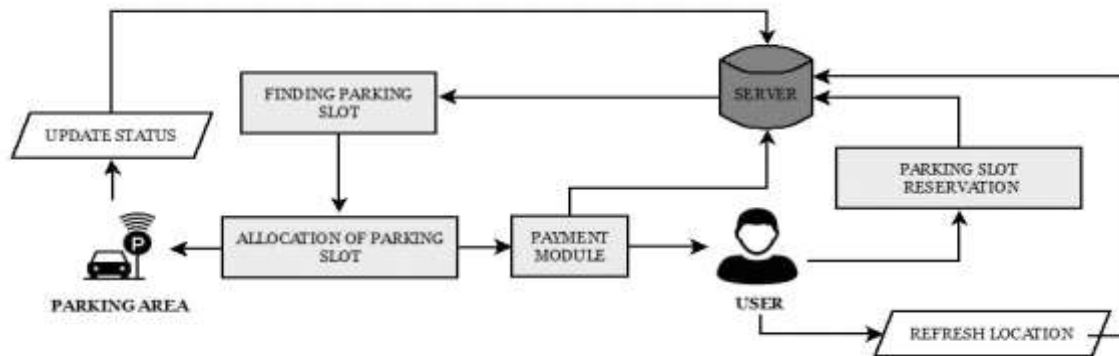


Figure 1: Architecture of system.

VIII. ALGORITHMIC DESCRIPTION OF EACH MODULES

1. Login module

a. Authorization

Step 1: Start

Step 2: If user is already authenticated, go to step 4

Else If User is registered but not yet to be authenticated by admin

Go to step 3

Else

i. Redirect to registration page

ii. Enter valid registration page

iii. Send the user registration data to admin

Step 3: Admin checks authenticity of user

Step 4: If user is authenticated, allow user to login

Else

Deny login

Step 5: Stop

b. Authentication

Step 1: Start

Step 2: If user is not registered, go to step 3

Else

If user is authenticated

If username and password are correct

i. Allow Login

ii. Allocate session to user

iii. Redirect to home page (Profile)

Else

Show message "Invalid Login details"

Else

Show message "User is not authorized by admin"

Step 3: Stop

c. Display Available and Reserved Slots Algorithm

Step 1: Start

Step 2: Select the parking area to view available / reserved slots and click on it.

Step 3: Get the data about selected parking area's slots and display it in grid view format.

Step 4: If slot status is vacant then allow user to reserve the slot

i. Select appropriate vacant slot from list

ii. Click on it to reserve

iii. Display details about reserved slot

a. Show parking area name

b. Show slot which is allocated

Else

Disable the button such that user cannot reserve the same slot.

Step 5: Stop

d. Finding Path between Current Location and Parking Area

Step 1: Start

Step 2: Get current location

Click on current location icon on map to get accurate current location.

Step 3: Get the appropriate parking area location

Click on the appropriate marker showing parking area location to get parking area location

Step 4: If both current location and parking area location is available

i. Generate URL by using both the locations

ii. Download the all necessary data (distance from two locations, travel time between two locations, coordinates of all locations which are between these two places for drawing path) using above generated URL

iii. Decode the downloaded information e.g. Distance, Time and intermediate coordinates

iv. Display the Distance and Travel Time.

v. Decode the all intermediate coordinates and draw the path between current location and parking area.

Else

Try again to get both locations accurately by clicking on current location icon and marker both are available on map.

Step 5: Stop

IX. ENVIRONMENTAL SETTING FOR RUNNING THE SYSTEM

Software required for implementing the system are Arduino IDE and Android Studio.

High speed internet connectivity should be available for fetching the data in less time.

X. DETAILED DESCRIPTION OF MODULES

1. Arduino

a. void setup()

- The function execute-only once in the program.
- The function mainly used to set baud rate and reset wifi module.
- It need to Initiate SPI bus in this function.

- the servo set on default angle.
- Wifi module connected to the specified network.
- Ethernet shield initialize with respected mac and IP.
- Function initialize the input pin and output in of ultrasonic sensor and output pin of led.

b.void loop()

- digitalWrite() function is called here to high and low pins.
- client.connect() function is used to send data to mysql.
- client.readStringUntil() function is used to get data from serial monitor.
- servo.write() method rotate the servo on given angle.

c. SonarSensor()

- digitalWrite() function is used here for low and high trigpin of an ultrasonic sensor.
- pulseIn() method is used here for calculating the duration in seconds.

2.Web Server

All the sensed data by the sensors is stored on the online database. This data is accessed by user using android application.

3.Mobile Application

- Details of all users and parking area details is stored on the web server which is further used to user login, showing parking areas, parking slots and its status subsequently.
- When user logged in data from server is fetched after authentication of user.
- When user click on map tab, map is loaded on the page using mapFargment(). The map is initialized by calling onMapReady() method. At the same time current location and parking area location is loaded on map.
- The distance and travel time between two locations (current location and parking area location) is displayed after user clicks on the parking area location marker. At the same time all information (distance, travel time, intermediate coordinates) is fetched from Google server and displays it on the map.
- The parking area slots status is displayed after user selects the parking area then he/she can see a button to that displays the slot status. The status data is fetched from server, which is periodically updated by ultrasonic sensors.
- Side navigation menu is displayed at left side of screen. If user slides from left to right it will open. On side menu user can see various options like all parking areas, editing of profile, reservation status by user, etc.
- If user selects the balance tab he can see the available balance.

AKNOWLEDGMENT

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