# GEO-BASED SMART PARKING AUTOMATION SYSTEM

## Dr. B.Muthusenthil[1], M. Santhosh[2], G. Srinath[3], B. Yuvaraj[4]

[1]Asso. Prof, Dept. of Computer Science and Engineering, Valliammai Engineering College, Chennai, Tamil Nadu
[2,3,4]B.E, Dept. of Computer Science and Engineering, Valliammai Engineering College, Chennai, Tamil Nadu

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**Abstract -** *In recent days, the scale of vehicles has been greatly increased which is challenging for organizations to schedule the parking lots. This results in dynamic scheduling and updating the information to both the local organization and the server. To overcome this problem, an application is created through which the user can choose a parking area to park his vehicle. The available parking areas are being given as the input in the application. Also, the available parking slots in each parking area are also being displayed to the user. The cost for each parking area is also shown while booking and the user can make the payment through online payment merchants. For authentication of that particular vehicle in the parking area, each user is given a unique RFID tag which contains a driver's name, vehicle license plate number, and vehicle model. For authenticating the RFID tag, an RFID reader in every parking area is being used. The details of the RFID tag are being entered after the booking is confirmed by the user. Those entered details are being sent to the vehicle detection module of the particular parking area which is booked by the user. When the vehicle enters the particular parking area, the RFID tag is read by the RFID reader. If the read details are matched with the received details, the barricade of the parking area will open, providing authentication for the vehicle.*

***Key Words*: Vehicle detection, RFID (Radio Frequency Identification), Authentication, Payment and Security.**

## 1. INTRODUCTION

Everyday people face a big challenge in parking their vehicle in common parking areas like a mall, theatres, working areas, etc.., An additional manpower is being required by the parking area to guide every vehicle to park their vehicle. Also, many users park their vehicle against other vehicles and creating a problem for the other users while taking their vehicle back. To overcome this problem we have created a web application through which the users can book a parking slot in a parking area to park their vehicle. By doing this so we can overcome traffic congestion besides reducing the manpower. The users can also do the payment through the third party online payment applications. In addition to that, the shortest route path between the user's source and the booked destination area will be shown by using the A* algorithm. To authenticate the vehicle in the parking area, we are using RFID readers to scan the RFID tag in the vehicle. The details such as the driver's name, vehicle license plate number and vehicle model are being entered after the booking is confirmed. Then they are sent to the RFID reader to look for the RFID tag to authenticate.

## 2. OBJECTIVES

- To create an easy user interface among client, server and the local organization.

- To dynamically update the user's decided area and the parking slots in it.

- Establishing the shortest route between the client's source and the destination locations.

- To adjust the timing settings and cancellation of a slot.

- Providing reliable data security for the user.

- To obtain reviews and feedback from the client and provide appropriate support services.

## 3. SYSTEM REQUIREMENTS AND ANALYSIS

### 3.1 Software Requirements

**Web Application**

At first, a web application is to be developed for users to book a slot in a parking area to book their vehicle. By using the web application, the parking authorities can give their parking areas as input and they will display as available parking areas to the users. The web application can be developed by using the netbeans software with coding languages such as HTML, CSS, JSP, Java, etc.

**Database**

A database is to be created to store the details of the user account, parking authority account, details regarding to the booking, etc. The database can be created using SQL query language.

### 3.2 Hardware

**Arduino UNO**

Arduino is an open-source computer hardware which can be used as a microcontroller board. There are many types of Arduino board with multiple specifications. Here we are using Arduino UNO. It provide sets of digital and analog I/O pins which can be interfaced to various extension boards. The boards feature serial communication interfaces,

including USB on some models, for loading programs by using a dumper to dump programs into the Arduino.

### RFID reader

The RFID reader is used to read the RFID readers for authenticating the corresponding vehicle and allowing it into the parking area. The RFID reader is being connected to the Arduino board for processing the authentication process. The RFID reader is connected to a copper rounded wire which is mainly reading the RFID tags if they are placed over that coil.

### RFID tags

The RFID tags are used to store details of the user such as driver's name, vehicle license plate number and vehicle model. When the RFID tags are placed over the coil and the details inside the tag is being fetched for matching with the details that are being entered by the user in the application.

### LED display

The LED display is used to show the details in the display area to mention that the user has been authenticated.

### Barricade

The barricade is used only to allow the users who are authenticated. When the RFID tag is being scanned and the details in the tags and the received details are same then the barricade will be opened allowing the authenticated user to enter into the parking area.

## 4. RELATED WORK

Development in vehicles has been improved day by day and parking is a necessary thing for a user who owns a vehicle. Vehicles are used to reduce the time complexity (i.e.,) the time which takes for a person to move from one place to another vehicle can be reduced with the help of a vehicle. In working place the user needs to park his vehicle for a period of time until his work gets completed. In the parking area, there arise many difficulties since there is no discipline that is being followed in the parking area. To overcome those difficulties we have created an online smart parking application. In that application, the areas that use parking can give their parking area as an input. Users can use the application to book a parking slot in the parking area where they want to park their vehicle. For authentication of that particular vehicle, we are using RFID vehicle detection technique where every vehicle needs to buy an RFID tag. Details such as driver's name, vehicle license plate number and vehicle model are being stored in the RFID tag. The details of the RFID tag are being entered in the application after booking is done. Those entered details are being sent to the RFID scanners which are placed in the parking area. When the user shows his RFID tag in front of the RFID scanner, it will check whether the details received and the

details in the RFID tag are the same. If authentication is a success then the barricade for the parking area will be opened. Thus our project provides a solution to reduce the problems that arise in parking areas.

In [1], the creation of an application which can be used by the users to book a parking slot in the parking area is clearly explained in this system. The database is used to store the user details, booked details, parking area details, etc. The applications are being developed by using the C# and JavaScript programming languages. The database is being developed by using the SQL query language.

In [2], the detailed working of an RFID system to authenticate the vehicles are being explained in this paper. At first, every parking area is preinstalled with an RFID reader to scan the RFID tags. In addition to that, there is an administrator who is present for issuing new RFID tags to the customers. The central area of the project consists of raspberry pi which acts as a server for the database.

In [3], a simple technique to park a car in a parking area by providing an individual ticket to each car is being explained in a detailed manner in this system. Here the system start by reading the car plate and then allows the car to enter the parking area if parking is available. This system uses Cronbach's alpha to measure the validity and stability of the study questionnaire items and it also uses Spearman correlation for determining some factors such as city, age, gender, car type, job etc.

In [4], an automated system for parking management using RFID and OCR is being developed. The important process of this system is that for the identification, an RFID tag is required. By using this system we can save time and reduce the manpower in the existing system. Also, runtime updating of parking places allotment or re-allotment is made easy in this system to manage to park.

In [5], an integrated parking guidance system using RFID wireless technology and automatic gates with PLC control is being explained in a detailed manner. In this system, the vehicle which enters the parking area is being automatically detected by using the RFID reader. This concept is based on indoor positioning approaches which utilize Received Signal Strength Information (RSSI) and Kalman Filter method. Also, a model to analyze graphics display using adjacency lists is being added. The dynamic programming concepts to map the tag information of all the vehicles to the system model at the same time to define a dynamic tracing algorithm is being added.

In [6], a web application to analyze the airport parking system is being proposed using IoT. The Arduino board is connected with Ethernet shield and a pc configuration of IP address, MAC is mandatory. The user views his parking location and the status of his parked vehicle in the airport area. The total system is being accessed by the

administrator. The system is being mainly designed using ATmega328 microcontroller in the Arduino environment. Arduino UNO is interfaced with the ENC28j60 shield and connected to PC via RJ-45 cable.

In [7], a smart parking management system is being developed by integration of RFID, ALPR, and WSN technologies. Using ALPR and WSN, the system is able to collect information about the status of the available parking spaces and transmits them to a database server. This can be accessed by the user through a mobile application and the user can book a required parking area. Also, the application encourages an NFC-based user identification.

In [8], the system presents a design and implementation method of a smart car parking technique using a mobile application. It also identifies the empty slots in the parking areas automatically by using proximity sensor and the parking of the car at the corresponding slot for a particular time period is being designed using RFID, GSM, and ATMEGA controller.

In [9], the system is developed to automatically detect the presence of vehicles in the parking spaces. For considering the empty parking area, we are using Battery Assisted Passive (BAP) tags. The batteries in the BAP tags are replaced by a solar cell. When the light level is below some thresholds, the tag stops transmitting the data, and the system recognizes the slot as occupied.

In [10], a solution is provided for preventing theft of a vehicle from a parking area using RFID and GSM technology. This system uses multiple components like GSM kit, RFID readers, RFID tags, barrier gates, computers, software and LED lights. This system is used for controlling the GSM kit, operating barriers and glowing LED's in different cases. This system can be used to prevent theft of the vehicle in an organization. Check-in and check-outs of vehicles can e controlled by the software on the basis of smart card and RFID vehicle tag.

## 5. PROPOSED SYSTEM

This project is mainly focused on creating a web application for online parking system and RFID authentication process. Through the web application, users can book an area to park their vehicle in the required parking area. By this process, we can avoid the traffic that is created in the existing parking area. The RFID system is used for authentication of that particular user. Each user has a separate RFID tag which contains a driver's name, vehicle license plate number, and vehicle model. The user enters those details in the application after booking a parking area. Those details are sent to the vehicle detection module of that particular parking area which is selected by the user. When the user enters the parking area, the RFID reader in the vehicle detection area will scan the RFID tag of that user's vehicle. If

the user entered details and the scanned details are same then the barricade for the particular parking area opens.
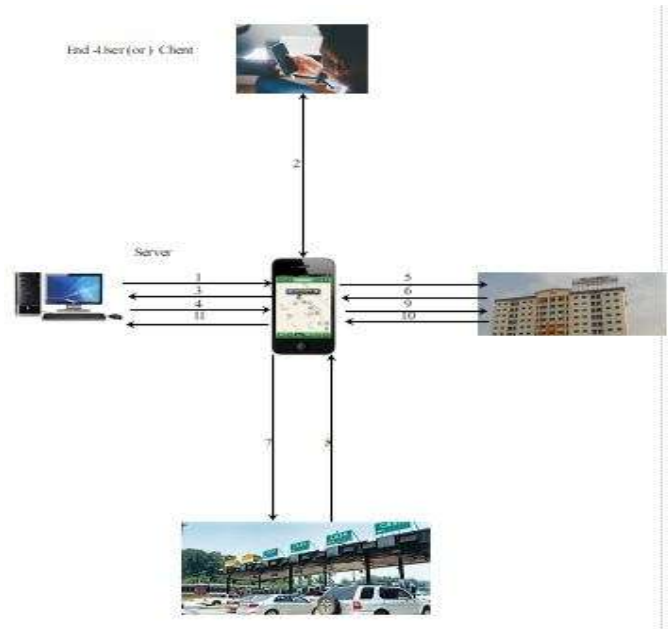
## 6. SYSTEM ARCHITECTURE



Fig – 1: System Architecture

The above diagram clearly explains the processes which are involved in the booking of a parking slot in a parking area by a user. At first the parking authorities logins in the system by creating an individual account. The details of the parking area are being given as input to the system. Those details of the parking authorities and the particular parking area are stored in the server which acts as a database. The user who wants to book a parking slot in a parking area should login inside the system by creating an individual account. Then he can enter his location and book a parking slot in the parking area wherever he wants to park his vehicle. For authentication, the RFID details of each vehicle area being entered by the user in the application. Those details are sent to the RFID reader that is present in the parking area that is booked by the user. When the user enters the parking area the RFID tag is being read by the RFID reader. If the details received from the application and the details present in the RFID tags are being same then the barricade for the parking area will open allowing the driver to park his vehicle in the booked parking slot in that parking area.

The client model involves booking of the parking area where the user needs to park the vehicle. The model also obtains parking details stored in the RFID tags of that particular vehicle. Then the payment is done only by the user through the online payment merchant of the user than the server of the payment itself. Besides the model involves viewing the history of the parking and allotment done by the user.

## 7. METHODOLOGY

The entire system has been divided into separate modules and they have been listed and explained below:

- Client module

- Server module

- Local organization module

- Vehicle detection module

### 7.1 Client Module

In the client module side, the web application for the user has been developed. The processes that can be done by the users in this module for booking a parking slot in the required parking area are explained below in a separate manner.

### Login process

At first, the users can need to login into the system for viewing the available parking areas. The users can create a new account if they want to login into the system or they can directly login into the system if they are an existing user.
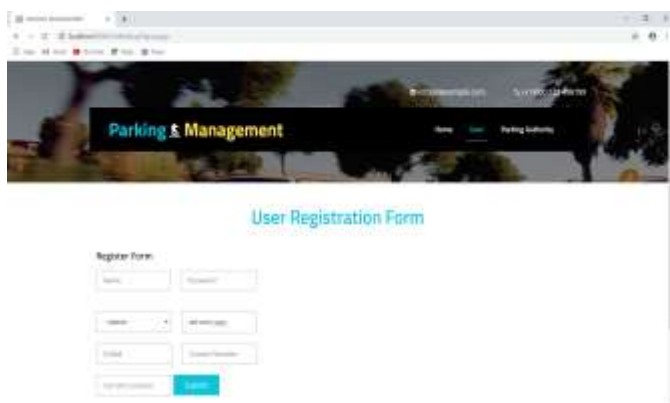


Fig – 2: User Login Form



Fig – 3: User Registration Form

### Entering the location

After logging into the system, the user needs to enter the location where they want to park their vehicle. After the location is entered by the user, the parking areas that are being available in that particular location are being displayed with the representation of that particular area in the map.
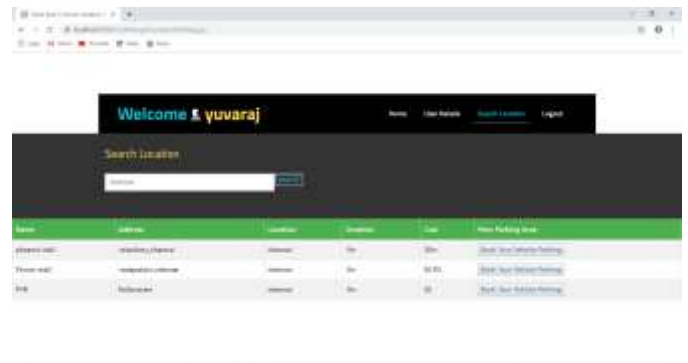


Fig – 4: User entering the Location
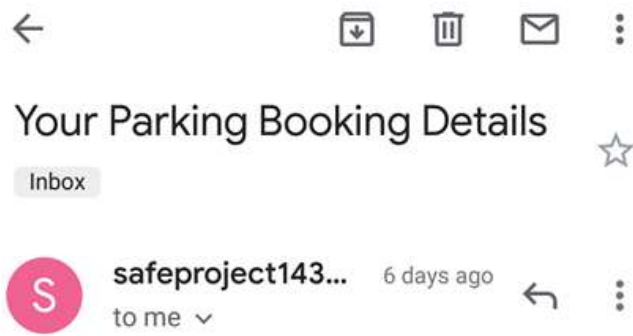
### Booking of a parking slot

When the parking areas are displayed, the user selects a parking area where he wants to park his vehicle. After a parking area is selected, the available parking slots will be shown. The user can select a parking slot which will be convenient for him. The user can make the payment via online payment merchants. After the booking is being confirmed and the payment is being done by the user, the system will redirect the user to a page which asks the details present in the RFID scanner present in the particular vehicle. After those details are being entered by the user, they are being sent to the local organization module where it again sends those details to the vehicle detection module for authentication.



Fig – 5: View of the parking slot in a parking area

### E-Mail process

After these processes are being completed by the user, an E-Mail regarding the confirmation of the booking will be sent to the user registered E-Mail ID.

## Your Parking Booking Details

Inbox

S   safeproject143...   6 days ago

to me

User Name is : yuvaraj   Booking ID is :
yuvaraj41204086   Your One Hour Cost is : 20
Allocated Place : A1,A2

Fig – 6: Confirmation mail after Booking

### 7.2 SERVER MODULE

The server module is the database where the user's details, parking areas details, booking history details of every user, etc. are stored. The database is built by using the SQL query language in the MySQL software.

### 7.3 LOCAL ORGANIZATION MODULE

This module is used by each and every parking authorities who needs to enter their parking area as an input in the system. Here the parking authorities are the local organization who can enter their parking areas as input into the system. The parking authorities can create a new account or they can login directly if they are an existing user.

If any parking authority wants to add their parking area as input into the system, they need to login into the system and enter their parking area details in the "parking authority details" area. After entering the details an individual account will be created for that particular parking area and it will displayed as a parking area to the user in the particular location that is entered by the parking authority.
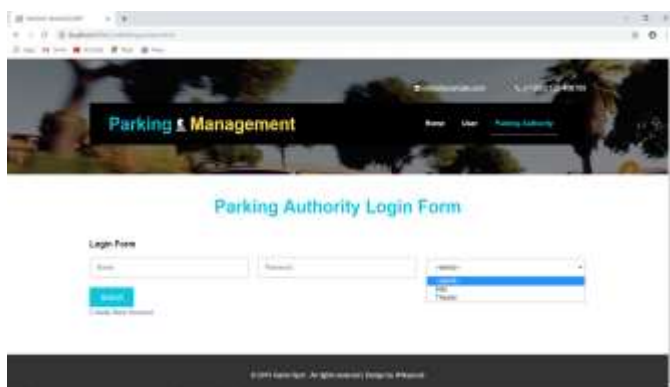


Fig – 7: Parking Authority Login Form



Fig – 8: Parking Authority Registration Form



Fig – 9: Uploading the details of the parking area

### 7.4 VEHICLE DETECTION MODULE

The vehicle detection module is responsible for the authentication of the vehicle that has booked a slot in that particular parking area. Initially, all the parking areas are preinstalled with an individual RFID reader in their parking area. Individual RFID tags for each vehicle are being provided. Those RFID tags contain the driver's name, vehicle license plate number, and vehicle model. The RFID details inside the RFID tag are entered by the user in the application after booking are being received by the RFID readers. When the vehicle enters inside the particular parking area, the user needs to show his RFID tag in front of the RFID reader. The RFID reader will read the details and those details will be matched with the details which are received from the application. If those details are same then the barricade for the parking area will be opened allowing the driver to park his vehicle in the booked slot.

### 8. FUTURE ENHANCEMENT

### 8.1 IN APPLICATION

At present we have created only a web application for booking a slot in a parking area through online. In the future, we can create a mobile application through which each and every user can book a parking slot through that mobile application. The advantage in creating a mobile application is that the traffic that is created in a web application due to multiple user access can be reduced. Another concern is that

we can also develop reserved slots for reducing the problem that is arisen due to the time constraint that can be created between two users.

## 8.2 FOR AUTHENTICATION

The authentication can be made simple by using automatic license plate recognition using image processing. The challenge that arises in this system is that it is difficult to detect the license plate of a vehicle during movement. Another challenge is that the system may take some wrong decisions by identifying numbers as alphabets. But if these problems are solved, this system might be a great improvement for authentication.

## 9. CONCLUSION

The difficulties in the parking system may become a more challenging problem in the future since there is an enormous increase in technology in the vehicle production system. Our proposed system gives a better solution for avoiding those problems in a smart manner. By using our application, users can book a parking slot in the required parking area. Also, the shortest path between the user source and the destination is being shown in the application. The authentication process for the vehicle is also provided by the RFID system. There can be an improvement that can be processed in the authentication system if the vehicles are produced with a default RFID tag installed in it. Thus the proposed system provides a smart way of parking and also the proper authentication system for authentication of the vehicle has also been built.

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