

# SMART QR BASED PARKING SYSTEM

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**Abstract:** SMART QR BASED PARKING SYSTEM would be mainly focused on assisting driver to easily find vacant parking spaces in a specific parking region with the help of QR code based Smart Parking System and to reduce traffic and energy consumption and air pollution. Thus this project has come up with an optimal solution that gives liberty to the people to book their own parking space as per their need and specification of the vehicle. The purpose of this project is to make people more convenient to park their vehicle, which in this case is Reservation Based Smart Parking System, The question to be addressed here in this module is, how to give parking slots to the drivers?

The project is to mainly answer this particular question addressed by providing a Web Application and an Android application to reserve parking slot as per drivers need. The drivers need to visit the Web Application with the details of their journey and then system also suggests the available parking slots in that area and they can immediately reserve the space by make the payment for allotted time. Then a QR Code has been generated and then users can scan that through the Android Application and then immediately it shows the directions to that parking slot. When driver reach the spot then he has to show the QR to the security guard then security guard scan the QR then immediately the parking time will be started in the server.

Then the server will check the time and when allotted time is exceeded then security guard and the driver will get the notification Alerts in their mobile through android application and then automatically bill the amount for the time. Whenever the driver is going to leaves the parking slot then he has to show the QR gain to the guard and then he has to pay the extra amount if charged. After the clearance of the payment the guard and driver gets the notification of the GATEPASS .This system it may be very useful to reduce the load on the driver as well as to reduce traffic on road and can be helpful to park the vehicle in the peak hour. The Quick Response QR code is affixed at every parking space. The user can thus select the parking space from the visual display. The users have to scan the QR Code whenever he park and unpark the vehicle.

The action of the user is then reflected in the database. The android application was thus developed that can incur the parking information which was uploaded on the web map server. This system reduces the time which is involved in searching the parking space thus reducing the fuel consumption, user's frustration. It reduces vehicle travel time and parking time.

**Keywords:** GPS, Global Service for Mobile, Java Virtual Machine, Java Development Kit, Integrated Development Environment

## 1. INTRODUCTION

Use of automobiles is increasing day by day which leads to various parking issues. Vehicular population is shooting out the roof, no amount of space is sufficient to accommodate stationary vehicles. Management of parking has grown to large extent.

The main problem is to manage parking in congested areas. One of the congested area is college campus .However improving parking on campus is important. The problem is parking spaces are either insufficient according to the demands of students or these spaces are poorly allocated. Colleges have to try almost every possible way to deal with problem of campus parking. Parking on campus needs improvement.

Users entering the university are allowed to have a car on campus. With every new freshmen entering parking possess a problem in campus. Problems in parking campus results in users inconvenience, which results in frustration.

Parking the car today need parking policies for safety and security reasons. There is always competition for the parking space. A good solution to overcome parking crises would be by increasing the number of parking spaces or else enlarge the parking lots, but this will lead to huge investment. However better management of existing parking spaces will be wise method. The availability of parking spaces should be improved.

Another approach for managing parking in campus is by improving the efficiency of the use of existing parking spaces, by informing user about available parking space and guiding him accordingly. Now a day there is growing popularity and affordability of internet –enabled smartphones and because of data available online we can step to solve parking problem. Android smartphone enables user to virtually carry the internet with him.

### 1.1 Mobile web Map

It is a service application providing maps. By using map user can find spaces on his phone. Maps act as communication language of distinct information for viewing whether parking space is engaged or not. It will inform user about current status of parking lot.

### 1.2 Quick Response(QR) code

It is 2-D barcode which encode numeric and alpha numeric value. QR code encodes binary information into a square matrix of black and white pixels. QR code scanner application is able to decode information encrypted in QR code . QR code is used for allocation and de-allocation of space. Hence this paper focuses on use of user interface including navigations for enhancing efficiency of parking system. The main goal of this paper is to maximize the occupancy of parking lots and develop a user-friendly mechanism that helps user find and reserve available parking in the campus, in advance . At times of peak parking in the parking lot, the only primitive way is to accurately provide users with available parking spots inside the parking lot.

**2. PROPOSED METHODOLOGY**

In this section, we are representing the architecture and design of proposed QR code based smart parking system, which implements a reservation service and gives the details and information of generation of the QR code algorithm.

**2.1 System Architecture and Design**

Fig.2.1. Block diagram of proposed system ,the Fig. shows three components in the smart parking model, including admin, user and the zoner. The app will show the parking slot as per the region selected with is price, type and time .The user will receive the information as per the selection of the parking slot and region for a selected period of time. As per the user information unique QR codes is generated by SPS in which the identity of the user is encrypted which can be used for authentication process and send it to the user.

After each user booking the database is updated which shows which slots are occupied and which are empty. The zoner identifies each user by the randomly generated unique QR code, zoner directly scan the QR code by QR code scanner and verify the details and authenticated user. Due to this the time consumption is less and there is no need of communication between the user and zoner making authentication fast and convenient.

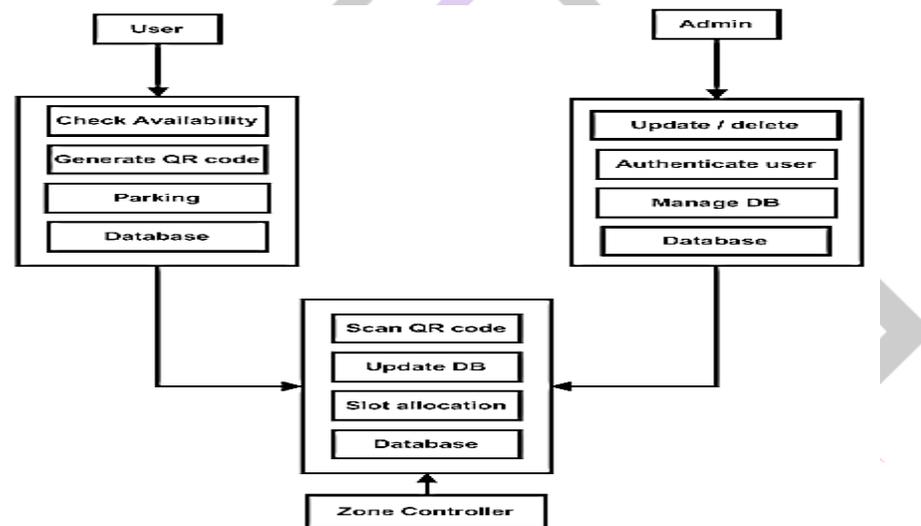


Fig. 2.1. Block diagram of proposed system

**2.2 QR CODE(Quick Response Code)**



Fig 2.2 QR CODE

QR Code (Quick Response Code) is developed by Denso Corporation in 1994. There are 40 versions in QR Code, four levels of error correction, and the maximum time update is fast due to WI-FI usage at web server. Disadvantages are Wireless

sensor is used to update the status of parking slot which is expensive, Web page is use to know the information of the parking place and slot, Reservation cannot be done through web page, Sever failure can be happen due to load on server.

In it a show the design and implementation of an android application, which is parking system, based on Reservation that allows drivers to easily find and reserve the vacant parking slots in the specific zone with the help of Internet with slot allocation method and performs automated billing process. In this system the billing process is also done using the RFID technology which has the details of the user bank account. RFID's mainly use is primarily for tracking, this technology has quickly created an extremely number of areas including easy gas payment and credit card. Advantages of the system are Using slot allocation we can book and block our own reservation, IR sensors and RFID are used for accuracy, RFID tags are used for automated billing process. Disadvantages are Hardware failure may occur, Expensive due to RFID and IR sensor, Complex circuit.

### 3. PROBLEM STATEMENT

Some of the existing system used RFID technology. The every car has to be provided RFID tags and RFID reader at parking space and other existing system uses GSM and INFRARED technology. All this appliances becomes very much expensive, hence our paper overcomes this problem as it uses android application. Moreover our system depends on the QR code which is an alternative for the existing system which is based on RFID tags. QR code reduces the data space in database; it also reduces the cost of as compared to other existing system.

The Fig. shows three components in the smart parking Model, including admin, user and the zoner. The app will show the parking slot as per the region selected with its price, type and time .The user will receive the information as per the selection of the parking slot and region for a selected period of time. As per the user information unique QR codes is generated by SPS in which the identity of the user is encrypted which can be used for authentication process and send it to the user. After each user booking the database is updated which shows which slots are occupied and which are empty. The zoner identifies each user by the randomly generated unique QR code, zoner directly scan the QR code by QR code scanner and verify the details and authenticated user. Due to this the time consumption is less and there is no need of communication between the user and zoner making authentication fast and convenient.

### 4. RELATED WORK

Now a day the common parking guidance approaches are adopted by drivers. Blind search is the most common approach which is adopted by every driver. Drivers search the parking spaces randomly. If the driver gets the vacant space he parks his vehicle else his search for the parking space goes on.

Parking Information sharing is another way which is adopted by the drivers. It represents the current state of the parking spaces .If the driver obtains the information regarding the parking lot which is near to his destination, then the driver will automatically know regarding the spaces available in the lot. So the drivers by their own make the decision of parking .If the parking spaces available in the lot are very few during the busy hours then more drivers struggle for the parking spaces. This phenomenon is called "multiple-car-chasing-single-space", which further causes severe congestion.

To alleviate the "multiple-car-chase-single-slot" phenomenon, some designers have devised a solution to use a buffer that publishes the live availability information.

The threshold of the buffer is determined. Therefore, if a parking lot has very few unoccupied spaces than a threshold, then the system will display that the parking lot is fully engaged. But it is not easy to determine the threshold for the buffer. If the buffer is too small, the problem of "multiple-car-chase-single-space" will not be eradicated. If it is too large, the usage of parking spaces will be low. So to overcome the disadvantages of the above parking approaches we have designed a system that can be used on Android Smartphone.

By using this system the user can determine the availability of parking spaces prior to entering the parking lot. The system provides a visual display to the user regarding the available parking spaces by which he can book or reserve a space whenever he needs. The system significantly reduces traffic snarl up and the resulting environmental pollution by decreasing the time required for users to locate parking space.

### 5. MOTIVATION

Use of automobiles has increased tremendously in today's world. The available parking slots are not utilized properly. The main reason for this is the insufficient information the user has regarding available parking spaces. The driver usually follows a guess based approach to find a parking space and most of the times get frustrated.

The driver finds himself in a great puzzle searching a parking space in his busy work schedule. Many a times he parks in undesired and inconvenient places. Lack of proper facility to help him park his vehicle leads to his migration to remote places for parking, thus causing wastage of fuel and user's time. Increasing the number of parking spaces is a solution to this problem but it is not a easily feasible solution because it requires huge investments and is a time consuming process. Additional parking spaces also impact area traffic and local residents.

Moreover, most of the parking management systems which are presently available are static and serve only on a small scale. There needs to be a system to solve all these discouraging issues of parking vehicles. . Use of internet would make the system more flexible as anyone can access and use such a system from anywhere. With the advent of technology geographic information systems help in getting information related to geology of the earth. So such systems contribute a lot in collecting information for developing a parking management system with a huge database of maps. Almost everyone today has an internet enabled smartphone, so making such a application available to the user on his smartphone is very efficient. Without wasting so much of user's time such application helps him to search the parking space.

## 6. METHODOLOGY

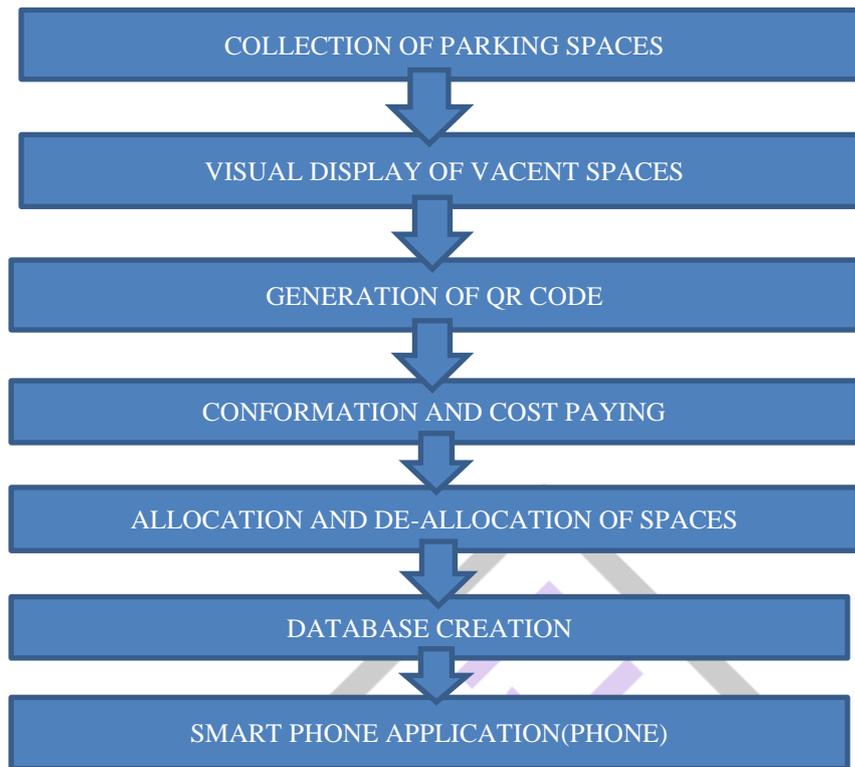


Fig 6.1: System Flow Chart

Figure 6.1 shows how the system is assembled. Initially parking spaces with their longitude and latitude in the college campus were registered on the web map server to make the system more dynamic by using internet. Each parking space is uniquely identified by QR Code. The QR code was generated using fields like space id, latitude and longitude of the space. The QR Code was printed and affixed at the corresponding parking spaces.

A database that shows all the mapped parking spaces with their attributes is created. A web server Application Programming Interface, API is established and published over the internet. The user can then access the API using the application. The user willing to use the application must be connected to the internet via his phone. The user has to download the application and install the application on his android smartphone. He has to register himself to the system by giving details like name, password, email id, phone number. He can then log in to the system whenever he needs to reserve a parking space or use the available space.

The system provides visual display of available parking spaces in a particular region. The user will have to select the desired parking space by just clicking on the space. After reaching on the space user scans the QR code which is affixed at the space by using the scanner in the application and parks his vehicle on the space.

While departure he rescans the QR Code and leaves the space. Here the internet acts as a communication medium that captures the activities of the user in the application. These activities are then reflected into the database that maintains the status of every parking space i.e. whether it is available or allocated.

## 7. EXPERIMENTAL RESULTS

### 7.1. Start the application:

The user needs to install the application on his Android based device. After installation, the icon of the app will feature on the Home Screen of the user's device. App welcome screen will be flashed to the user on opening the application.

### 7.2. Registration:

Initially, the user has to register his details with the application for the first time. This is a one-time registration. The user has to enter details like user name, gender, phone number and email- id. All this data will be stored on server. Booking for slots mandatory has to be done four hours prior to arrival. On server side the parking owner also needs to register the number of parking slots available and for what type of vehicles and the amount that needs to be paid.

### 7.3. Login:

Once the user registers, he can use his email id and phone number to login in future. This authenticates the user.

### 7.4. Selection of location for parking:

The user is provided with multiple parking locations. User has to select one of the locations provided where he desires to park the vehicle.

### 7.5. Select vehicle type:

After selecting the location, options for the vehicle type is provided i.e. 2-wheeler or 4-wheeler alongside the rate chart for parking charges is prompted.

### 7.6. Enter user's details for slot reservation and Money

### 7.6.1 Wallet:

In case the slot is available, the client can proceed further with the reservation process or else he can go back to change the location/vehicle type or else can terminate the entire process. Money wallet is a simple, useful and intuitive personal finance assistant with online synchronization, through this a user will pay for his reserve parking slot and the parking owner will receive his appropriate amount.

### 7.7. Confirmation to user:

On successful reservation, a confirmation page with user details is shown which is editable and Green is indicated to show user's reserved parking slot.

### 7.8. Parking Dashboard:

Parking dashboard provides more efficient distribution of parking slots and by using this dashboard the parking owner can manage their parking slots. The parking owner can allocate or de-allocate a parking slot. The dashboard also shows reserved slots which can be allocated when the corresponding user verifies his details and confirms the selected slot. A shortcut icon of the application appears in the main menu of the screen. Figure 7.1 shows the application shortcut icon which appears on the screen of the smartphone.

### 7.9 COST ESTIMATION

QR based android application need a mechanism for cost calculation. The cost is calculated on the basis of allotted time for parking and the type of vehicle. The payment is done in two ways:-Initial payment and Final payment. Initially the cost is set as 50Rs for all vehicles. When the time exceeds then security guard and user will get notification alert. At this time the initial payment is taken as the final payment.

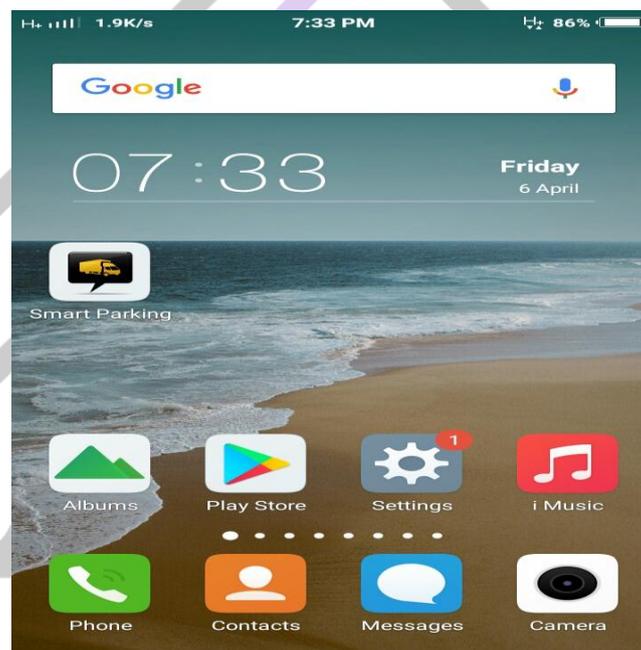


Fig. 7.1: Menu of a smart phone showing the smart phone application short cut icon marked

When clicked on the icon of the application the first page appears as shown in the figure 7.2 below which prompts the user to enter mobile number and password and then log in to the system if he is already registered else the user will have to click on registration button.



Fig. 7.2: Log in page of the application

After clicking on registration button the user will have to register himself by entering the appropriate details into the fields as shown in the Figure 7.3



Fig. 7.3: Registration page of the application

After submitting the details the login page will appear with fields mobile number and password. User will have to enter correct mobile number and password same as he entered while registration. After successful login next page which contains the menu including options that are map, list, QR Code scanner and logout as shown in the figure 7.4 will be displayed.

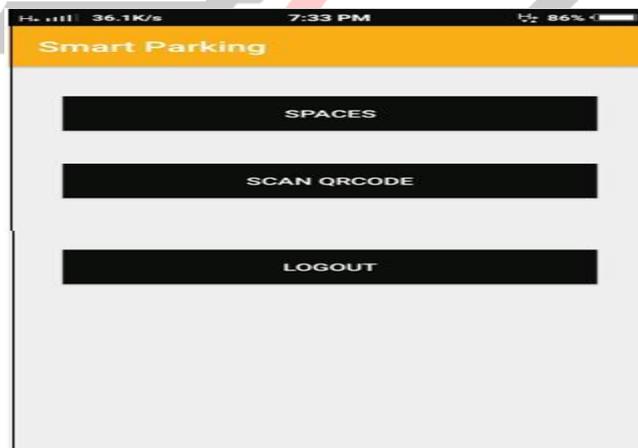


Fig. 7.4: Main menu of the application

The user is provided with multiple parking locations. User has to select one of the locations provided where he desires to park the vehicle. After selecting the location the remaining details including parking time(in time and out time),vehicle number, card expiry date, card holder name ,card number, and then vcc/cvv number and then the user has to do the payment and it is shown below in fig 7.5 :

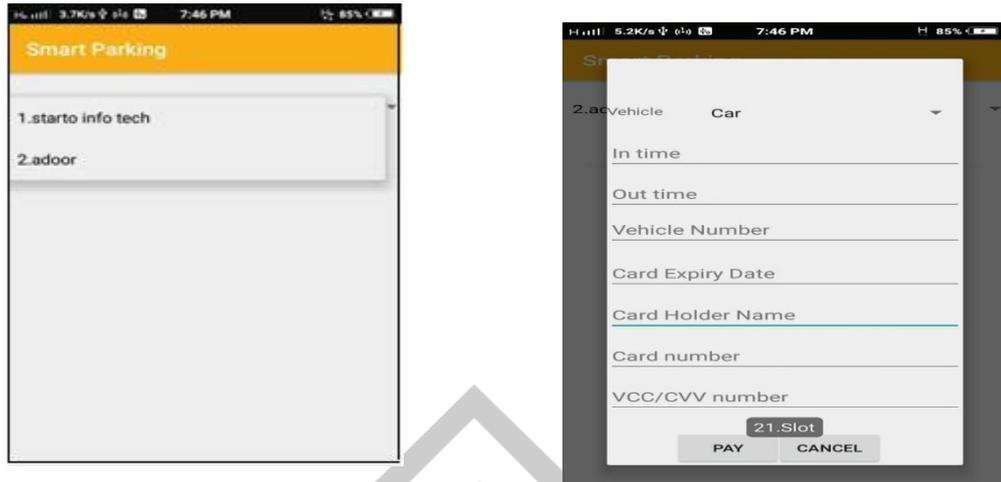


Fig 7.5: Selecting the space and entering the required details about vehicle

After payment a QR code is generated on both side of user as well as the server side as shown in the figure 7.6. The user has to confirm the QR code generated in his mobile. Once the user reached the spot the user can scan this QR code with the code generated in server side.

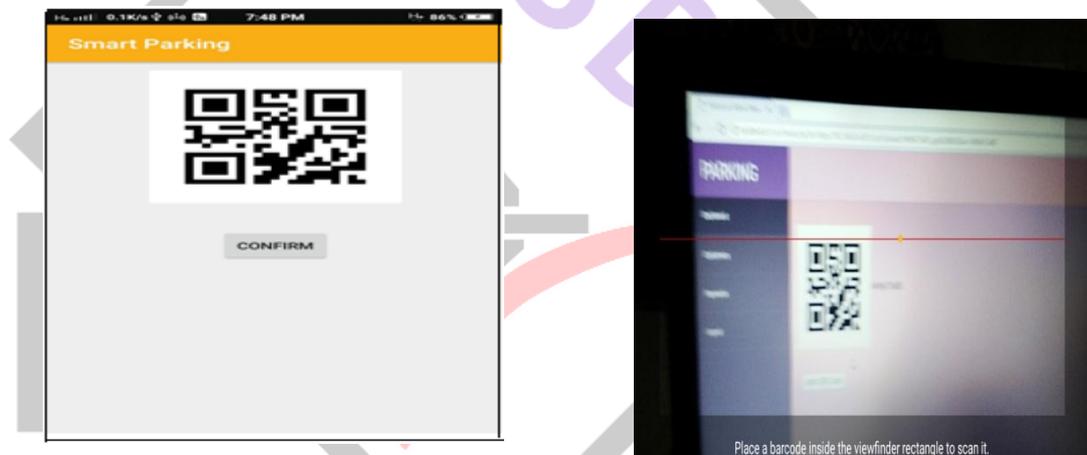


Fig 7.6: QR Code generated on user and server side

A web map page obtain after the QR code creation is shown in Figure7.7. This web map interface is connected to the database which stores the status of every parking space and accordingly reflects it on the web map. The changes in the parking situation are reflected on the web map via internet. This page allows the user to know the number of vacant parking spaces within the college.



Fig 7.7 Web Interface Map

After clicking on the red mark the parking slot will be displayed and the user can park their vehicle in the slot till the allocated time. Whenever the user parks or un-parks his vehicle he will have to scan the QR code affixed at the space by using the QR code scanner option .which is displayed in the main menu. The camera of phone is invoked to scan the QR code which is affixed at the parking space .

A parking dashboard provides more efficient distribution of parking slots and by using this dashboard the parking owner can manage their parking slots. The parking owner or the server can allocate or de-allocate a parking slot. The dashboard also shows reserved slots which can be allocated when the corresponding user verifies his details and confirms the selected slot.

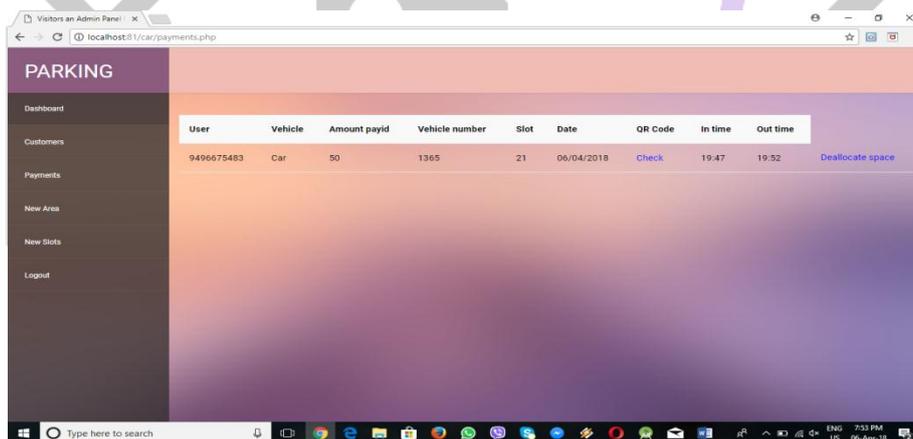


Fig 7.8: Parking dashboard showing the parking slot allocated details

**7.11SYSTEM IMPLEMENTATION**

This system is implemented in the user system, merchant system, and the third party system. Some programming language that used in this implementation is VB, C#, Java, and PHP. The mobile user application is built using the Android Studio, merchant application build using PHP and third party build using XAMPP, Apache, MySQL , PHP and Visual Studio (C# and VB).

**8. SYSTEM ARCHITECTURE**

System Architecture System architecture shows six components in the smart parking model, including parking owners, users, internet, application server, server database and the database of parking owner. The parking owner has the dashboard which has its own database of parked and un-parked slots. The user uses API on mobile phone to register for the app using internet. The application server keeps a track of GPS location and matches it to the nearest parking slots. The main sever database keeps the data of all parking owners in an area and their location on GPS.

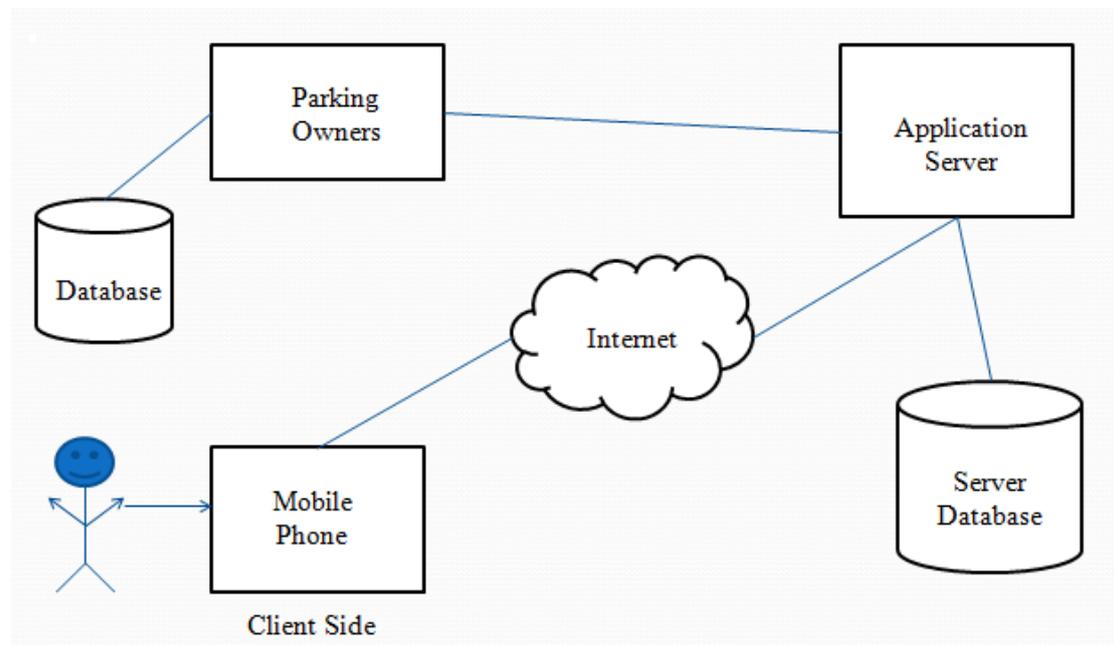


Fig.8.1 System Architecture

## 9. ADVANTAGES AND DISADVANTAGES

### 9.1 ADVANTAGES

- It helps the visitors in finding out the availability of a parking slot, get the availability confirmed.
- It helps the parking owner to monitor the vacant slot availability so it can be used by the next person.
- The proposed plan saves the time of visitors in searching and booking a parking slot.
- The tedious job of parking owner to allocate the vacant slot in a methodical and organized manner is simplified as visitor himself chooses the suitable parking place for his vehicle and the process is made more efficient.

### 9.2 DISADVANTAGE

- Continuous Internet connection – Android phones will require a continuous Internet connection alias active connection so that phone is prepared to accept GPRS packet that suits the needs.
- GPS location- GPS facility should be available in the phone so that location of the user can be traced and appropriate parking location can be prompted.

## 10. BENEFITS

Smart Parking is one of the most adopted and fastest growing Smart City Solutions across the world. Airports, universities, shopping centers and city garages are just a few entities that have begun to realize the significant benefits of automated parking technology. The ability to connect, analyze and automate data gathered from devices, powered by and described as the Internet of Things, is what makes smart parking possible.

Smart Parking involves the use of low cost sensors, real-time data and applications that allow users to monitor available and unavailable parking spots. The goal is to automate and decrease time spent manually searching for the optimal parking floor, spot and even lot. Some solutions will encompass a complete suite of services such as online payments, parking time notifications and even car searching functionalities for very large lots. A parking solution can greatly benefit both the user and the lot owner. Here are some of the top benefits:

- Optimized parking – Users find the best spot available, saving time, resources and effort. The parking lot fills up efficiently and space can be utilized properly by commercial and corporate entities.
- Reduced traffic – Traffic flow increases as fewer cars are required to drive around in search of an open parking space.
- Reduced pollution – Searching for parking burns around one million barrels of oil a day. An optimal parking solution will significantly decrease driving time, thus lowering the amount of daily vehicle emissions and ultimately reducing the global environmental footprint.
- Enhanced User Experience – A smart parking solution will integrate the entire user experience into a unified action. Driver's payment, spot identification, location search and time notifications all seamlessly become part of the destination arrival process.
- New Revenue Streams – Many new revenue streams are possible with smart parking technology. For example, lot owners can enable tiered payment options dependent on parking space location. Also, reward programs can be integrated into existing models to encourage repeat users.
- Integrated Payments and POS – Returning users can replace daily, manual cash payments with account invoicing and application payments from their phone. This could also enable customer loyalty programs and valuable user feedback.

- Increased Safety – Parking lot employees and security guards contain real-time lot data that can help prevent parking violations and suspicious activity. License plate recognition cameras can gather pertinent footage. Also, decreased spot-searching traffic on the streets can reduce accidents caused by the distraction of searching for parking.
- Real-Time Data and Trend Insight – Over time, a smart parking solution can produce data that uncovers correlations and trends of users and lots. These trends can prove to be invaluable to lot owners as to how to make adjustments and improvements to drivers.
- Decreased Management Costs – More automation and less manual activity saves on labor cost and resource exhaustion.
- Increased Service and Brand Image – A seamless experience can really skyrocket a corporate or commercial entities brand image to the user. Whether the destination is a retail store, an airport or a corporate business office, visitors will surely be impressed with the cutting edge technology and convenience factors.

## 11. FUTURE SCOPE

The system be further be enhanced by providing various options. In manual systems it is nearly impossible to collect the right amount from the user according to the amount of time for which he parked his vehicle.

In our project the cost is set by constant values but the cost calculation mechanism need a cost for type of the vehicle (2wheeler, 4 wheeler) and the time spend in the parking slot. Another future scope is the time extensions. The user can extend the allotted time before the time exceed. And also deallocates the parking slot before exceeding the time.

In our project if the user does not come in our parking slot for taking the vehicle after exceeding the time the server automatically exceeds to the time twice of the allotted time. But this process is not possible for all time. The system can be further enhanced by providing options for payment of bill by various modes such as credit card etc. Displaying maps with price tags on each parking space and distance in kilo-meters from the user's current location will make the system more user friendly.

## 12. CONCLUSION

The system gives a visual display to the user regarding the current parking scenario. The system reduces work of manual parking process by converting the entire parking process to automation. The system makes it easy for the user to book or reserve a space on the Smartphone. Thus Smartphone acts as a park finder .This ultimately reduces the time that every driver spends for searching a parking space which then reduces the fuel consumption, traffic volume and environmental pollution by increasing efficiency of transportation.

This paper summarizes an efficient way to park a vehicle using recent technology. This app allows the user to take control of the parking decision unlike traditional method of trying several parking spaces physically. Usage of this app at large scale would benefit user even if a user is in new place. The app is user friendly and handy so people of all age groups can use it easily.

If it is a dwelling, entertainment centre or a market place, the first and foremost question in the minds of everyone is about the parking slot. Compared to other developed countries, the problem of parking is disheartening in India as there is no well devised reach the place within the time slot allotted. It helps the administration to allocate the vacant slot to the next person in queue. A well thought parking plan saves the time of visitors in booking a parking slot in advance and the administration to allocate the vacant slot in a methodical and organized manner.

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