

Android Application Based Smart Parking Using QR Code

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Abstract

In today's world, parking is an underrated problem and considered as an expensive facility in metropolitan cities during peak hours. This project concentrates on constructing an automatic parking system which is intended to reduce the road traffic in urban areas and decrease air pollution. QR (Quick Response) code can be read and scanned by Android compatible devices and provide plenty of information. This system removes the disadvantages of the existing approaches which use RFID, ZigBee, etc. The driver (user) checks for available parking spaces/slots and reserves the convenient one in that region as per the requirements of the user's vehicle. QR code is generated which encodes the distinctive information and aspects of the user and is used to improve the process of authentication. This system uses a novel algorithm, an android based application that gathers information about the occupancy state of parking slots and thus assists the drivers to nearest vacant parking slot.

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1. Introduction

A car parking is a key concern in the urban regions in both developed and underdeveloped countries. With the rapid increase of car ownership, many cities are suffering from imbalance between parking supply and demand [1]. Smart Parking System concentrates on assisting the driver or user to available vacant parking slots in a specific zone with the help of QR code and focuses on energy conservation and traffic reduction which further results in decrease of air pollution.

A QR (Quick Response) code comprises of black squares arranged in a square grid on a white background. QR code can be read by imaging devices such as a camera which is processed using Reed-Solomon error correction. The advantages of using QR code in the proposed system are:

1. Accurate information
2. Quick response
3. Two-dimensional code
4. Can be read in 360 degree from any direction.

Smart Parking system allows the users to control parking slots through an Android interface. Users also have the facility to keep track of the timings. The proposed system concentrates on two segments. One section is the user side where features and facilities for the user is provided. The second section is the developer side who has the authority to control and monitor the different sections of the system. A user-friendly application is created for the various user operations which includes finding a vacant available parking slot, booking the confirmed slot. The circuitry used in the system is cost-effective and easily built. Hence organizations can implement it [2]. The user details are stored and modified in the database. Using the user information from the database, a unique QR code is generated for each user, which is used to book an available parking slot in convenience of the user.

2. Literature Survey

Car parking is a huge issue in today's world, especially with huge open parking spaces that do not have distinguished parking slots. This requires a security personal to be present to coordinate and allot parking space for incoming cars into the parking space. During the peak hours more than one personal might be required.

On successful implementation of our project we will be able to save time in waiting for the security personal to instruct us and provide a systematic arrangement of cars in the said parking space.

This paper [3] uses the concept of RFID technology. It allows for a secure check-in and checkout of the already registered vehicle within a parking space in an organisation using RFID tags and RFID readers. The user initially registers with the organisation to get a smart card with an inbuilt RFID tag, then the vehicle is registered with a vehicle RFID tag and is linked to the respective smart card of the user. In this system when a car approaches for check in the RFID tag on the vehicle is read, if it is already registered the smart card of the driver is checked for in the database to verify if the vehicle RFID tag matches the user RFID tag. Then the barricade opens to let the car in. At the time of check out the vehicle tag and the smart card RFID tag is read using the RFID reader and is crosschecked with the database and the barricade opens to let the vehicle out. The drawback in this system is that it doesn't allot specific parking slots for a vehicle inside the parking space. It only checks if the user is permitted entry or not. RFID tags can be affected by liquid or metals and they are expensive. It's also a 'read-write' code.

In [4] smart parking is enabled through wireless communication. Here ultrasonic sensors, Arduino mega 2560 and Xbee-pro s2 are used. Ultrasonic sensors are present at every parking slots which are controlled by Arduino mega 2560. These node sensors can transfer information between each other. The information is processed by the control block and is sent to the monitor placed at the entrance. An ultrasonic sensor is present at the entrance of the parking area to detect the presence of the incoming vehicle. The mega 2561 present at the entrance receives data form the parking lots to show the driver available parking slots. Xbee-pro is used to connect the Arduino in the parking lot to the one at the parking space entrance. The drawback here is that the driver/user is unable to book a slot in the parking space ahead of their arrival. They can check for the availability of parking slots only after they reach the entrance of the parking space.

In [5] QR codes are used to find parking slots in an area. Here QR codes are set in each area and every parking spot has a unique QR code. The QR code for each spot is generated using the location (parking lot number, floor number, etc) of the parking spot. These QR codes are location specific. Hence once the driver scans the code it shows the location of the parking

spot along with directions. This also uses the Dijkstra algorithm (shortest path) for the driver to find the spot where they had parked their car using the sensors present in their smartphone and the pedometer principle. In our project we have adopted the use of QR codes since it is cheaper and it's a read only 2-dimensional code.

3. Problem Statement

The idea is to build an automated parking system based on QR code and android application to minimize the difficulty of parking and avoid time consumption in searching for parking slots.

4. Objectives

To avoid the time spent on searching for a parking spot after arriving at the location. In this system, we can reserve a slot of our preference while we are still commuting to the specified location.

The user can check for availability of parking slots, reservation of the same and the booking of a slot of the user's choice using the application. Consequently, resulting in a well organised system.

5. Proposed Architecture

The system that is proposed requires the users of the android application to login using their credentials on a smartphone. These login details will be sent to the database. The application is supported by the Firebase Realtime database. The main advantage of using this database is that it is a cloud-hosted database and provides support to multiple platforms like Android, iOS, and web.

After logging in, the app will display the availability of parking slots to the user. The user then goes on to select a desired slot based on the vacancy. A QR code is then generated by the application which has the encrypted information of each user based on their unique login details. This ensures authentication of each user. The next step is updating the database which consists of all the data related to occupancy and vacancy of the parking slots.

Once the user reaches the selected slot, the scanner installed at the slot can be used to scan the QR code to ensure the authenticity. Once this is checked for, the barricade guarding the entry to the specified slot opens and the car can be safely parked. The main leverage on implementing such a system is the drastic decrease in the time consumption and increase in security provided by the barricade and authenticated entry into the parking space.

The progression of the intended system is shown in The diagram below:

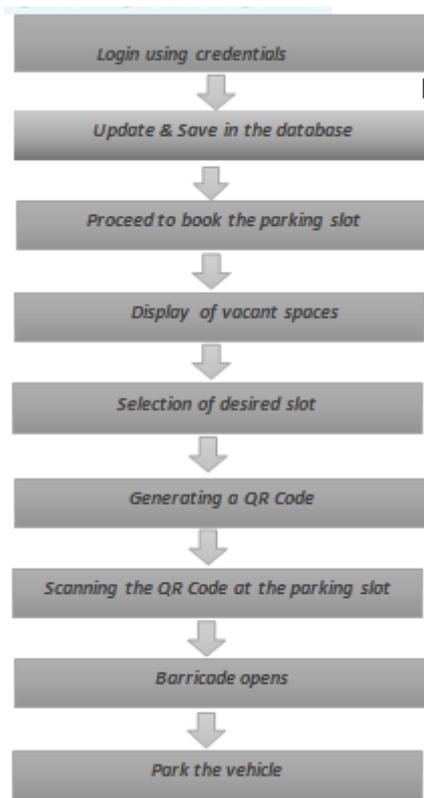


Figure 1: Flowchart representing the architecture of the system.

6. Algorithm

- A. User login- the user login using username and password. If they are a first-time user, sign up using name, username, password, etc
- B. Database update- personal information of the user is updated
- C. Booking
 - Display of vacant slots
 - Selection of a slot
- D. Generation of QR code- After booking a QR code is generated using the user information
- E. Scan QR code at the parking slot- On reaching the parking slot the user scans their QR code at the QR code scanner.
- F. Barricade opens- If the QR code matches the parking slot, the barricade opens.
- G. Vehicle parked.

7. Proposed Methodology

Fig2. shows the login page of our app for our smart car parking. The user enters the username or email id and their password to open the app. If the user is new, they must sign using personal details and choose a username and password for their account.

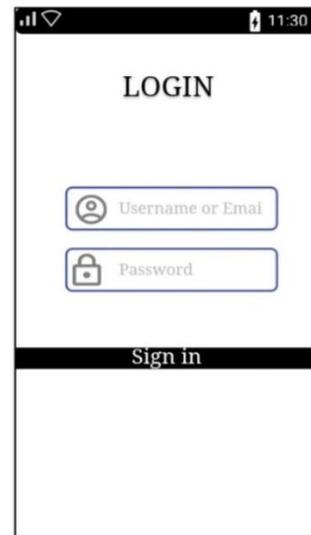


Figure 2: User login page

Fig.3 depicts the look of the parking space with available and booked parking slots. The user will be able to choose a slot based on their preference.



Figure 3: Parking slots in the parking space

Once the user books the slot, they will receive a QR code that is generated using the user's information.



Figure 4: Generated QR code after the booking

The user then uses this QR code shown in Fig.4 to scan at the QR code scanner in the parking slot. If the QR code is correct the barricade opens, and the user is able to park the car.

8. Components Involved

QR (Quick Response) Code



QR (Quick Response) code was first designed in the year 1994 initially for the automotive industry in Japan. They were used to track parts in vehicle manufacturing, but now can be used for various consumer purposes. They are typically used for storing personal information for use, as used in our application too.

Some advantages of using QR code in our application is as follows:

1. QR code is a matrix two-dimensional barcode, thus enabling a 360-degree readability.
2. A known fact is that QR code supports high capacity encoding of data; 7089 characters can be encoded by its maximum symbol.
3. The adapted CCD reading helps in recognizing more QR code symbol per second than PDF417.

Algorithm to generate QR Code

- A. Start
- B. Input the text or the source file (infile).
- C. Calling of GenSig (infile)
- D. Compress 'sig', 'infile' and 'suepk' into the file 'test.zip'.
- E. A string data that is empty is created
- F. Conversion of the 'test.zip' into a string and is stored in 'data'
- G. Input - Resolution of the QR Code and Image format to be generated
- H. Correction of input error level
- I. ZXing library method is used to convert 'data' into a BitMatrix object 'bitmatrix'
- J. BitMatrix is written to an image
- K. End
- L. BitMatrix represents a 2D matrix of bits.

Algorithm to decode QR code

- a. Start
- b. Input - image of QR Code
- c. Construction of a Binary Bitmap object called 'bitmap' from source image is done
- d. ZXing library method is used to decode the 'bitmap' and stored in the object called 'result'
- e. 'result' is converted into string and written into 'result.zip'.
- f. Extraction of result.zip
- g. If the user requests call VerSig ('sig', infile, 'suepk')
- h. End

9. Conclusion

The paper is based on a Smart Parking System connected with reservation of slots by using an Android Application. It is a well-managed, straight forward and financially sound solution to bring about a decrease in carbon footprints. User is able to book a slot without actually having to traverse to the spaces based on the available slots and uses features like QR code to ensure consistency.

It takes out the exorbitant wandering across filled parking spaces, thus decreasing time and being a lot more cost effective. It provides an ideal way for taking care of parking issues which eventually reduces traffic congestion. For future research, the proposed system can further be upgraded by including features like CCTV so that much more information regarding the status of the parking can be checked enhancing the statistical data. Another upgradation for the same would be adding navigation facilities so that the user will get a clear picture of the destination slot.

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