SPARK – An Android Application for Parking Reservation System.

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Abstract— **The parking problem in big cities, especially the metro-cities, has become one of the key reasons of causing traffic in the city. Finding a parking spot is a very hectic and time-consuming job. Even after finding a parking lot there is no guarantee that drivers will get an empty parking space to park. To solve this issue, we have proposed a system that will allow users to reserve a parking spot beforehand. This paper offers an android based reservation system where users will be able to view the various parking lots in user's proximity or in proximity of the destination, the user is travelling to and see whether any parking space is available or not, along with the pricing model for the parking slot.**

Keywords— Android, Parking Space, Parking Guidance System, Parking Space Reservation, Resource allocation, Reservation.

I. INTRODUCTION

The number of vehicles is increasing day by day whereas the parking spaces are still limited. Due to which in metro cities, Parking is a big challenging problem. Daily, it is estimated that 30% of vehicles in the central area of cities travel around for finding parking slots, which takes an average of 7.8 minutes to find parking slots [1]. Travelling around on streets for parking does not only waste time and fuel for drivers but also contributes to additional traffic congestion, gas emissions, and traffic accidents [2]. Not only the scarcity of parking area but also the lack of well-designed reservation system for parking services is another parking problem. Since past few years, on-street and garage parking management problems attract attention from transportation science, operational management and computer science fields [3]-[6]. Some researchers design and implement various smart parking systems [7]-[8]. The automatic allocation or reservation approach is a key element in parking management systems. Geng & Cassandras [9] propose a smart parking system to optimally allocate parking slots to drivers with considering drivers' travel and parking cost. Kotb et al. [10] combine parking reservation and pricing models to minimize the drivers' costs and maximize the resource utilization. In their studies, static resource scheduling, dynamic resource allocation, and pricing models are established. The reservation systems designed in above literature immediately respond to reservations by allocating parking slots to drivers as long as there are available parking slots. It implies that all available parking slots are supplied (open) to drivers at the beginning of a daily operational time. Hence it is helpful to the drivers as well as the environment if we reserve a parking spot ahead of time before arrival to the destination.

This paper presents an android application which will help the driver to reserve a parking spot ahead of time and the application will dynamically allocate a parking spot to the driver before its arrival to the parking spot.

The rest of the paper is organized as follows. In section II, we describe the traditional system & parking reservation problem and establish an approach for parking reservation system. Section III gives an overview of the system. In Section IV, the proposed system is explained. Methodology is described in Section V while conclusion is presented in Section VI.

II. TRADITIONAL SYSTEM

According to the traditional approach, Drivers have to waste time for finding a parking spot in a new area or a crowded area and finding an empty parking space in that selected parking slot is a tedious job. Not finding a parking space sometimes is indeed a critical issue and can cause congestion on streets. The number of vehicles is also increasing each day, adding to the parking issues faced at public places. Drivers in metro cities face difficulties on a daily basis to find a parking space especially during peak hours, the difficulty roots from lack of knowledge of where the parking spaces are available at the given time. Even if it is known, many vehicles may pursue a small number of parking spaces which in turn leads to traffic congestion. The traffic on roads and parking space has been an area of concern in majority of the cities. To avoid these problems, recently many new technologies have been developed that help in solving the parking problems to a great extent.

Availability of a parking spot is unknown to the drivers, hence after finding a parking lot it is uncertain whether the driver will get a parking spot or not, due to unavailability of parking spaces. This could result in wastage of time, money and fuel since travelling to such a parking lot will be useless. Sometimes while paying for the parking there is a shortage of exact change available at both the sides i.e. at the customer side and as well the parking manager side. So it is a hectic job to find the exact amount or change required.

III. OVERVIEW

To overcome all the problems of the traditional system discussed above, we have suggested a system which will be helpful in dealing with these problems.

To solve the problem of finding a parking lot in an unknown locality, we would provide the user with a map which will show him the list of parking lots in his vicinity available to him.

For solving the problem of finding a guaranteed empty spot in a parking lot, we provide the user with the status of available parking spots in the parking lot. If no parking spot

is available, then it can suggest the user to go to the next available nearest parking lot where parking spots are available.

Navigation to the parking spot shows the shortest and optimal path from user's current location to the parking lot which helps in saving time as well as fuel and makes the job of the driver easier.

The shortage of cash or change can be handled by implementing an online payment portal. This will turn out to be a hassle-free approach and can help the user to pay the required amount easily without worrying about doing a payment in cash.

IV. PROPOSED SYSTEM

The proposed system is a parking reservation system that provides customers an easy way of reserving a parking space online. It overcomes the problem of finding a parking space in commercial areas that unnecessarily consumes time.

The system is divided into two subsystems based on role of the user- an admin sub-system for management of the parking lot by the admin (or parking lot manager) and a customer subsystem where actual user (i.e. Drivers, Car owners, etc.) will use the application to reserve the parking spot.

An admin will register their parking spot with mandatory details related to the parking spaces available along with the exact location of the parking lot. This details will be then used by the system to display availability of the parking spaces and the location of the parking spot to the users. Users would register with their basic information and contact details along with the their vehicle information in detail whether they have a two/four wheeler, if it's a four wheeler does it belong to the micro/mini/sedan segment to determine the empty space going to be required for its parking. Users will get a list of nearby parking lots available to them (or near the destination they are visiting), they can select one parking lot and the availability status of the parking spaces would be displayed to the users. Then according to their preference and vehicle type they can reserve a spot for the specific time. Users would be shown the estimated amount to be paid during checkout, users have to pay a small amount of money in advance to reserve a spot and the rest of the amount can be paid during their vacating of the parking spot allotted to them according to the time of usage of the parking spot. A QR code will be generated and sent to the user which will be scanned by the admin (or manager) at the parking lot for authentication of the user and spot can be accommodated by the user after verification. Verification is done by the admin system which will be used by the admin (or manager) and it will update the status of the given parking spot as 'occupied'.

When the user has to exit the parking lot he has to pay the amount excluding the amount paid during reservation of parking spot and including the penalty (if applicable, i.e. user will be penalized if he occupies the parking space above the specified time) after successful transaction user will get a new QR code which will be used to scan and exit at the checkout. User can pay the amount using cash or else he can pay using the online payment portal of the application. After successful scan of QR code, the status of the parking spot will be updated to 'available' again.
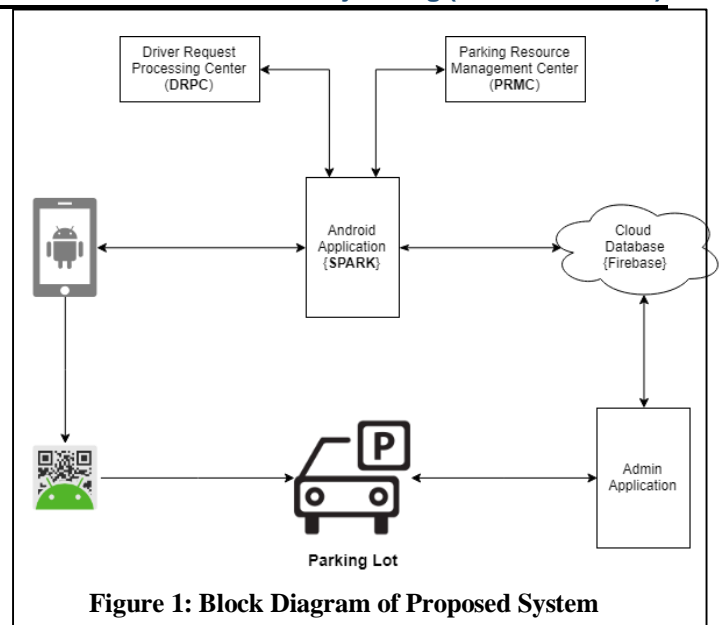

Figure 1: Block Diagram of Proposed System

V. METHODOLOGY

Since the proposed system is divided into two subsystems based on the role of the user which are:

1. Admin Subsystem (Used and Managed by Parking Lot manager / worker)

2. Customer Subsystem (Used by End-Users which are Drivers / Vehicle Owners who actually want to reserve a parking spot)

The Admin sub-system contains various modules as follows:

- Admin Registration / Login

It is an android base application, in this application the parking lot manager registers and enters various essential details related to parking lot. The managers will get their respective user id and password for accessing the module.

- Updating Status of Parking Lot

When a vehicle enters into the parking and is being allocated a parking spot, the status of that parking spot is updated by the manager using the application so as to keep real-time status of the parking spot.

- Scanning the QR code

When the customer (i.e. User using the Customer module) enters the parking lot, the manager scans the QR code for authenticating the user.

Another QR code scan is done while the user exits the parking lot for confirmation of payment.

The Customer sub-system contains various modules as follows:

- User Registration / Login

It is an android base application, in this application user need to register with user details like username, password, email Id, mobile number. After registration, user can be logging in the application by our registered mobile number and password.

- User profile:

The profile of the user will be displayed such as Name, username, email, contact no, etc. with an option to make any changes if required.

- Vehicle details:

    Vehicle details such as type of vehicle i.e. Two wheeler or four wheelers, along with the vehicle registration plate number, will be stored into the user profile which then will be used to book a parking spot based on the type of vehicle.

- Parking availability check:

    User can click on the parking lot to view the availability. If a spot is available for the specified time slot given by the user then, user can be able to reserve a spot. Otherwise, another parking lot near the current parking lot would be suggested to the user.

- Book the parking spot

    The user can select any empty spot from available parking spots. Users will be given a list of parking lots available nearby current location or the location where the user is visiting. The reservations are done on the basis of time of arrival & time of departure (No. of hours parking lot is to be reserved for).

- Automated pricing model:

    Based on the time for which the user reserved the spot for is used to calculate the total cost incurred for parking.

- Reservation status:

    After successful reservation of a parking spot the status and details of the reserved spot are displayed to the user.

- Navigation:

    This provides a guidance for user to navigate to the parking lot.

- QR Code Generation:

    After successful payment of advance amount, user will get a confirmation for their reserved parking spot and a QR code will be sent to user which will be used for authentication.

- QR Code Scan:

    User has to scan the QR code at parking lot to authenticate and accommodate the reserved spot as well as while exiting the parking lot.

- Penalty for delayed departure:

    If a user surpasses the time specified during reservation of parking spot he/she will have to pay penalty for it. The amount to be paid for penalty is depended upon the current demand and allocation status of all other parking spots (If a user exceeds the time limit during peak time he will have to pay more penalty than the ones at non-peak time).

- Feedback:

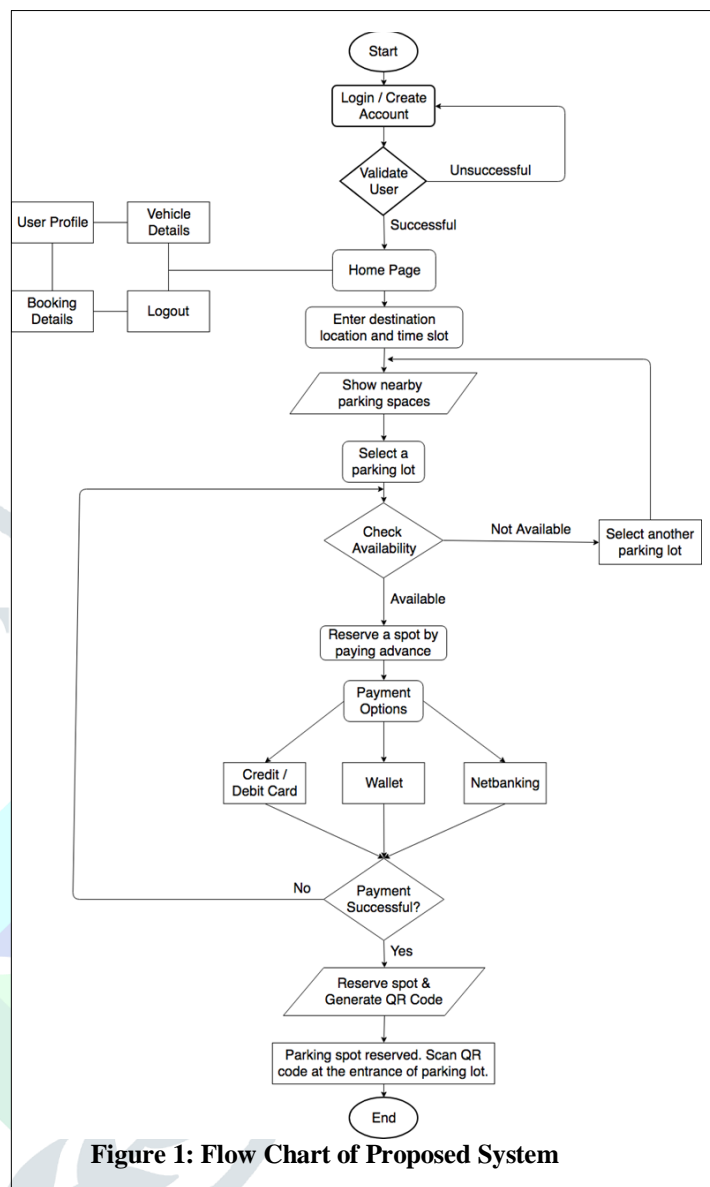   The system has a feedback form, where user can provide feedback into the system.

Figure 1: Flow Chart of Proposed System

VI. CONCLUSION

The paper addresses a solution to overcome the problem of finding a parking space. The system implements a dynamic allocation of parking slots to the users as well as gives a pricing model based on the time slot required for parking. User authentication and payment authentication can be formulated using QR code present in the system. Due to real-time nature of database and use of cloud functions, the system has a real-time and updated status of parking lots. This system helps user to not only find and reserve a parking space but also to save time, fuel and energy.

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