

Smart Parking Allotment System

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Abstract: In metropolitan areas, parking management influences drivers search time and cost for parking spaces, parking revenue and traffic congestion. In order to address problems associated with parking, various smart parking systems aiming to satisfy the drivers and parking providers needs have been developed. Based on the observation that parking space reservation can help drivers to reduce the search time dramatically, we are going to design and implement a prototype of Reservation-based Smart Parking System that allows drivers to effectively find and reserve the vacant parking spaces by generating 'Unique Code'. With the real time tracking of parking status via various sensing technologies and android communication, a smart parking system will dynamically update the parking price according to the physical parking status, and the parking price will affect driver's decision on parking slot selection, therefore, affect the status of parking. With the motivation to alleviate the parking contention, balance the benefits between parking service providers and drivers, coordinate among service providers, differentiate the needs of individual drivers, and reduce the amount of traffic searching for parking.

Keywords: Android, IoT, Android Auto, Smart City.

I. INTRODUCTION

According to the most recent reports of the United Nations (UN), 54% of the world's population live in urban areas, and this proportion is expected to raise to 66% by 2050 [1]. A direct implication is the increase of traffic congestion, which brings other issues with it, such as air pollution and parking problems. Finding a vacant parking space in a congested area or in big cities, specially, in peak hours, is always time consuming and frustrating to drivers. To minimize hassle and inconvenience to the drivers, we are going to develop a system, where the system provides accurate, real-time car park space availability to the drivers looking for parking spaces and then guides them to the available spaces by dynamically updated guide signs. The system will obtain the availability of parking spaces using the GPS enabled network using Android application after getting the users request. The user will have the application through which he can send request to server main application. After that he can see the available spaces for parking his vehicle. If user wants any space he can select that space and reserve it for limited time. If he cannot make there in that time then that space will be available to others. He can again request for same place by sending message then time will be extended. The proposed system uses GPS network and Google maps for finding the available space. If the driver have the up-to-date knowledge about the traffic situation like information about the free parking place near the destination area it would be then great benefit.

We want to develop a system where Car itself will show the near-by parking to driver. Show all nearby parking areas and internal parking slots, User can book parking slot from remote location, System will maintain 'Unique Code' to authenticate user, booked parking slot, etc. System will also show expected time to get free parking lot in case of full parking. After allocating the space user will get notification about leaving the parking space in some time interval if user says yes then the parking space status will be set to vacant and then that space will be visible to other users.

When user will come for actual parking, then he has to enter the 'Unique Code' which has already assigned to him. Then that code will be checked by the server and if that matches then only the gate of the parking will open.

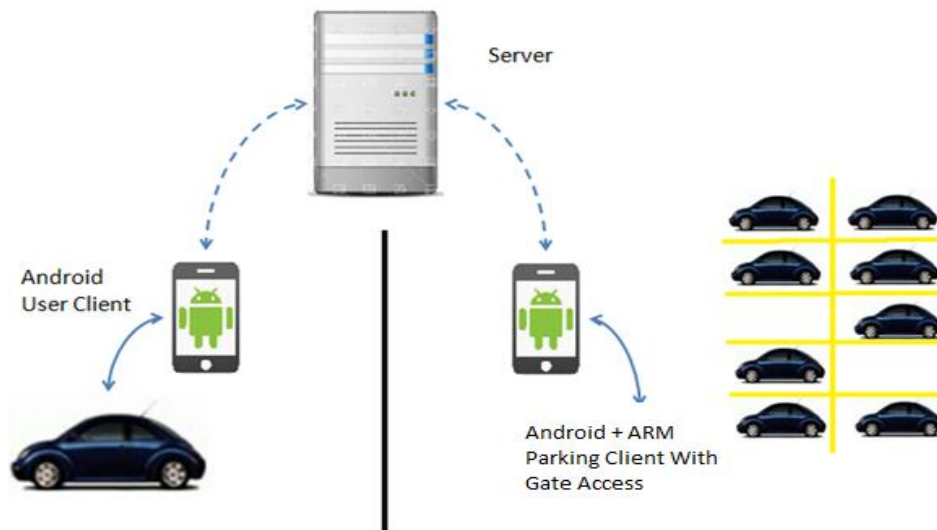


Fig1. System description

II. MOTIVATION

- A. A research has been going on to have Android device in-built in Cars.
- B. Android Auto is a smartphone projection standard developed by Google to be operated in automobiles through the dashboard's head unit.
- C. The following models are available with Android Auto:
 - Hyundai Sonata (May 2015)
 - Hyundai Elantra (Q1 2016)
 - Kia Optima (December 2015)
 - Kia Sportage (April 2016)
 - Kia Sorento (June 2016)
 - Skoda Fabia (June 2015)
 - Skoda Rapid (June 2015)
 - Skoda Octavia (June 2015)

III. LITERATURE SURVEY

A. Robin Grodi, Danda B. Rawat and Fernando Rios-Gutierrez(2016) Due to increasing of number of vehicles on the road so to find the parking space has become a problem for drivers, especially the places where events are organized it can be the frustrated experiences movement for drivers. So the solution for the above problem, some parking systems have sensors to detect when car enters and also while leaving, exception to that if the parking space is full, but this is the partial solution for the parking systems. The this paper proposes the parking system using the Wireless Sensor Networks(WSN) and Networks, using this the parking spot statuses are detected and transmitted to a database. The respected user can get this information through any website or mobile app which the real time updates. The system provides the instantaneous nearby parking lot for the demanding user. With the successful implementation of smart parking, the economical and time costs associated with traffic jams, cost associated with wasted gas fuel, and time looking for an empty parking space that are caused by inefficient parking will be significant reduced. [2]

B. Hongwei Wang and Wenbo He (2016) In this paper it is said that to find the parking space in the metropolitan area, especially in the rush hours. The difficulty arises from not knowing where the available spaces may be at that time; even if known, many vehicles may pursue very limited parking spaces to cause serious traffic congestion. . In this paper, we design and implement a prototype of Reservation-based Smart Parking System (RSPS) that allows drivers to effectively find and reserve the vacant parking spaces. It is much better to book the parking lot space online rather than manually. The drivers are allowed to access this cyber-physical system with their personal communication devices. The experiment results show that the proposed reservation-based parking policy has the potential to simplify the operations of parking systems, as well as alleviate traffic congestion caused by parking searching. [3]

C. Giuliano Benelli, Alessandro Pozzebon (2016) In this paper it is proposed the automatic parking car parks payment based on Near Field Communication technology. This system has been projected and developed as part of the SIESTA project, a research project financed by the Tuscany region in Italy, to study innovative services for tourists visiting cities of art. This system make the user to use their mobile phones to make an electronic ticket to enter and exit the parking and as an electronic wallet to pay automatically for it. To implement this system there are four applicative protocols have been developed: two protocols manage the entrance and the exit operations for close parks, while the other two manage the interaction of the user with the kiosk. It is also interacting directly with the NFC memory of the phone for the read/write tasks, and of a database collecting all the information concerning the presence and the payment of the users. [4]

D. Manuel Quiñones, Víctor González, Luis Quiñones, Carlos Valdiviesoy Willian Yaguana(2016)The design of a smart parking system, the base was the current system "Sistema integrado de Estacionamiento (SIMERT)" . To the feasibility of the project it was considered a technological platform that could be adapted to the city conditions and that be friendly with the environment, furthermore the suggested solution gives us connectivity with a Web application for integrated parking and usability of administrators and final users. [5]

IV. PROPOSED ARCHITECTURE

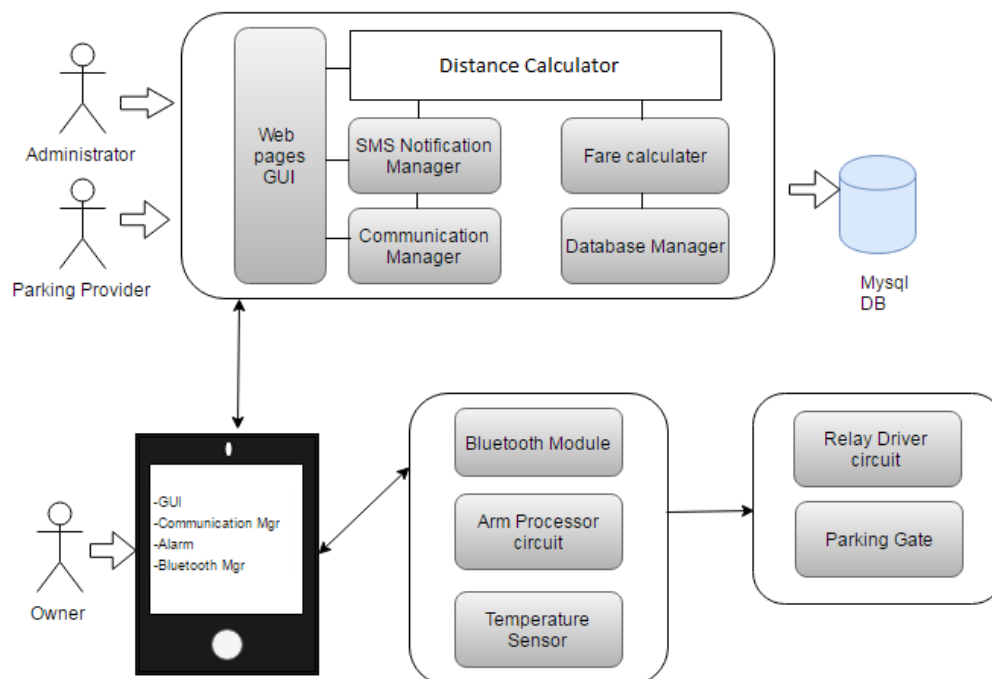


Fig 2. System Architecture

Administrator, Parking Provider and owner are the users.

GUI: Client is an Android based Architecture and This module will be Responsible to take input from user .The Gui developed in XML.In this System devices input will be taken through this GUI. The application requires minimum inputs and maximum features etc.

SMS Notification Manager: This module sends the SMS Notification to user and parking provider of every important Constitution.

Communication Manager: Communication Manager handles the client server communication we have used HTTP Standard communication technique for communication. It relies on a stateless, client-server, cacheable communications protocol -- and in virtually all cases, the HTTP protocol is used. The idea is that, rather than using complex mechanisms such as CORBA, RPC or SOAP to connect between machines, simple HTTP is used to make calls between machines.

Web Services: For every access of the data web services is needed .Connection between the App and server the HTTP protocol will be used.

Calculate Location: The GPS is integrated in the app which will calculate the exact location of your device which will be uploaded with the complaint. Also the user can manually provide the detailed address if he/she wills to.

Distance Calculation Algorithm: Calculate distance from current location for nearby Parking Slot.

The haversine formula is an equation important in navigation, giving great-circle distances between two points on a sphere from their longitudes and latitudes. It is a special case of a more general formula in spherical trigonometry, the law of haversines, relating the sides and angles of spherical triangles. 'haversine' formula to calculate the great-circle distance between two points – that is, the shortest distance over the earth's surface – giving an 'as-the-crow-flies' distance between the points.

$$a = \sin^2(\Delta\phi/2) + \cos \phi_1 \cdot \cos \phi_2 \cdot \sin^2(\Delta\lambda/2)$$

$$\text{Haversine formula: } c = 2 \cdot \text{atan2}(\sqrt{a}, \sqrt{1-a})$$

$$d = R \cdot c$$

where ϕ is latitude, λ is longitude, R is earth's radius (mean radius = 6,371km);
 note that angles need to be in radians to pass to trig functions!

The haversine formula 'remains particularly well-conditioned for numerical computation even at small distances' – unlike calculations based on the spherical law of cosines. The 'versed sine' is $1-\cos\theta$, and the 'half-versed-sine' is $(1-\cos\theta)/2 = \sin^2(\theta/2)$ as used above. Once widely used by navigators. For the curious, c is the angular distance in radians, and a is the square of half the chord length between the points. A (remarkably marginal) performance improvement may be obtained by factoring out the terms which get squared. If atan2 is not available, c could be calculated from $2 \cdot \text{asin}(\min(1, \sqrt{a}))$ (including protection against rounding errors).

Fare Calculator: Calculate and Generate charges based on real time at the time of checkout.

Database Manager: This module manages all the Request and Responses coming from the client and parking Provider and store into the Database.

Relay Driver Circuit: Relays are low-power circuit to control the signals.

Temperature Sensor: Temperature Sensor is used to detect the Temperature of Parking slot and alert the driver.

V. MATHEMATICAL MODEL

$S = \{I, O, F, \text{success}, \text{failure} / R1\}$

• $I = \text{Inputs} = \{I1, I2, I3\}$

$I1 = \text{Location}$

$I2 = \text{Profile Info}$

$I3 = \text{Parking info}$

• $O = \text{Outputs} = \{O1, O2, O3\}$

$Y1 = \text{Parking slot}$

$Y2 = \text{Notification}$

Y3= Billing

- F=Functions = {F1,F2,F3,F4}

F1= Registration

F2= Authentication

F3= Fetch Current Location

F4= Distance Calculation

- Success= User access system properly
- Failure= Unable to search parking space

R1=Constraint

- If Network is not present.

VI. FUTURE SCOPE

We can add more sensors at every park place, and assign separate id to sensor and each car. It will help us to check whether particular car is parked at particular place properly or not, and also it is beneficial to generate proper amount. If the car Id and the sensor id are not matched it will indicate through alarm. It is also very time effective for the user to avoid the headache of searching for the vacant place for the park in parking.

We can also avoid the vehicle theft by providing security out gate. We can use the finger print recognition at the out gate to check the particular user and the car id correctly.

We can use RFID application for debit the parking amount charges through the RFID tag.

VII. CONCLUSION

In big countries like India, where cities are growing faster day by day, applications like this are very useful to manage the allotment of parking spaces properly which will reduce the load of people to search for park space here and there. This system is simple and cost effective way to park vehicles with the help of android based and IoT approach which will help driver to book the parking slots within a single click and provide authentication at gate. Like the previous approaches our system does not need installation of sensors which will reduce the cost.

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