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ANDROID BASED SMART PARKING SYSTEM USING SLOT ALLOCATION & RESERVATIONS

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ABSTRACT

Among the challenges that we face in our day to day life one of most unavoidable challenge is parking the car wherever we go. As our need increases our travelling increases but due to drastic increase in usage of vehicles and increase in population we face the tough task of parking our car particularly during busiest hours of the day. During peak hours most of the reserved parking area gets full and this leaves the user to search for their parking among other parking area which creates more traffic and leaves them with no indication on availability of parking space. To overcome this problem there is definitely a need for designed parking in commercial environment. To design such parking slot we need to take into the account of reservation of parking slot with optimal parking space which depends on cost and time. Cost function should also combine with the parking cost and proximity to the destination. However here we have designed the time driven sequence method which solves the problem of parking using slot allocation method. This paper proposes an android application, which is used to implement a prototype of Smart Parking System based on Reservation (SPSR) that allows drivers to effectively find and reserve the vacant parking spaces with the help of IoT (Internet of Things) with slot allocation method and performs automatic billing process.

Keywords: smart parking, slot allocation, parking area control unit (PACU), smart parking allocation centre (SPAC), Android application, RFID (Radio Frequency Identification).

1. INTRODUCTION

As the population increased in the metropolitan cities, the usage of vehicles got increased. It causes problem for parking which leads to traffic congestion, driver frustration, and air pollution.When we visit the various public places like Shopping malls, multiplex cinema hall & hotels during the festival time or weekends it creates more parking problem. In the recent research found that a driver takes nearly 8 minutes to park his vehicle because he spend more time in searching the parking lot. This searching leads to 30 to 40% of traffic congestion. Here we going to see how to reduce the parking problem and to do secured parking using the smart parking under Slot Allocation method with the help of Android application. RFID application is used for debit the amount for parking charges through the RFID tag. The main contribution of our proposed systems is to find out status of the parking area and provide secured parking.

a) Motivation of the paper

The main motivation of this project is to reduce the traffic congestion that occurs in and around the urban areas which is caused by vehicles searching for parking. In the newspapers, we can able to see many articles regarding the parking problem all over India like Delhi, Mumbai, Chennai, Bangalore and many metropolitan cities. Growing population has created many problems; parking problem is one of the big problems in our day to day life. In a recent survey, researchers have found that for one year, car cruising for parking created the equivalent of 38 times trips around the world, burning 177914.8 litres of fuel and producing 730 tons of CO_2. To reduce all these factors we go for the smart parking system.

2. SMART PARKING

In earlier days, different models like CLAMP, PARKISM, PARAGENT, MULTILAYERS were used for parking.

Over the past 20 years, traffic authorities in many cities have developed a model called Parking Guidance and Information (PGI) system for good parking management. PGI systems, tells about the dynamic information of parking in the controlled area and guides the users to the vacant parking slots. Parking information will be displayed in the VMS (Variable-message sign) board at major roads, streets and at the intersections. The parking guidance system has several shortcomings, hence to overcome all these problems we go for smart parking.

Designing, developing and producing a leading-edge parking technology is called as Smart parking. It is a vehicle parking system that helps drivers find a vacant spot. Using the IR sensors in each parking slot, it detects the presence or absence of a vehicle, and sends messages to user. Smart Parking system is proven as an exact, robust and cost efficient way to ensure that road users know exactly where unoccupied car parking spaces are. The features of the proposed system are;

- Guides drivers find available parking spaces near them
- Less number of drivers searching to park, thus reduces the traffic congestion
- Avoids air pollution & global warming.
- Scalable, robust and reliable.
- Reduces the driver stress and improves the urban area.
- Provides tools to optimize the parking space management
- Accurately find out the vehicle occupancy in real time.

This system explicitly reserves and allocates optimal parking space to drivers, as opposed to simply guiding them to a space that may not be available by the time it is reached. The reservation in our "smart parking" system is different from that in the e-parking platform and others mentioned earlier. In the "smart parking" system parking slots will be reserved for the user and by the user which are selected to be optimal based on a well-defined objective function structure.

a) Overview of smart parking

This proposed system, uses the "Smart Parking" which takes the basic structure of PGI systems as one component. It includes Driver request processing centre (DRPC), smart parking allocation centre (SPAC) and Parking resource management centre (PRMC)

b) Driver request processing center (DRPC)

It is the first stage in the allocation process; drivers who are looking for parking spots will send requests to the DRPC. The request consists of two constraints: parking cost and the walking distance between a parking spot and the driver's actual destination. It also contains the user's information, such as current location, license number, car size, etc.

c) Smart parking allocation center (SPAC)

The SPAC collects all the driver's requests from the DRPC over a certain time and makes an overall allocation at decision points in time. An assigned parking space is sent back to each driver via the DRPC. If a driver is satisfied with the assignment, he/she has the choice to reserve that spot. The allocated parking space is updated in the PRMC.
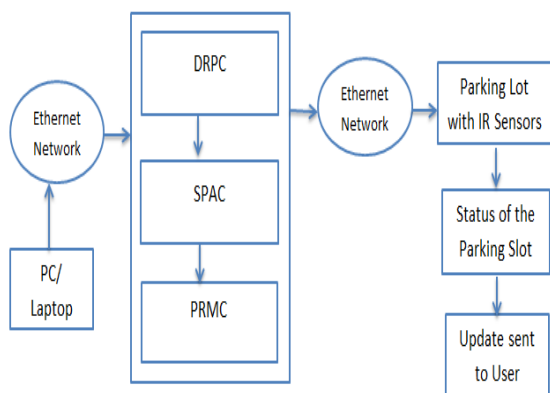

Figure-1. Smart parking frame work.

d) Parking resource management center (PRMC)

The PRMC updates the corresponding parking spot from vacant to reserve state and makes sure that other drivers have no permission to take that spot. If a driver is not satisfied with the assignment or fails to accept the slot, he has to wait till the next allocation decisions are made by the SPAC. Drivers with no parking assignment have the

opportunity to change their cost or walking-distance. The status of the parking space is updated in the VMS (variable message sign) such as the number of parking spot occupied, reserved and also that are open to reserve.

3. PROPOSED SYSTEM

The proposed system is the combination of smart parking and the Slot allocation with the Android application. In the existing system, a dynamic algorithm is carried out, which is a random allocation method. It randomly allocates parking lot to the users.

3.1 SLOT allocation algorithm

The slot allocation method follows a sequence as discussed above. It has the Parking Area Control Unit and the Smart Parking Area control Unit (SPAC). The functions are as follows:

- Initially the slot selection is made from the mobile phone
- Transforming request for parking slot from the mobile using Android application
- The Parking Allocation Control Unit (PACU) gets the request slot number from the mobile
- Checks for the parking slot for availability. If it is free go to the next stage. If the slot is not free goes to the initial state.
- If the parking slot is free, the requested slot is reserved in the parking area
- After reserving the parking slot in the parking area, it checks for a condition if it is available. (i.e. Whether GREEN led is on)
- If the parking slot is not free then it will go to the initial stage.
- After reserving the parking slot in the parking area then the status of the led will be RED=ON && GREEN=OFF.
- If car gets entered into the parking slot, the timer gets ON and measures the total time. If not, the timer waits till car to get in.
- Once the car is to move out of the parking slot, the timer gets OFF and displays the total cost.
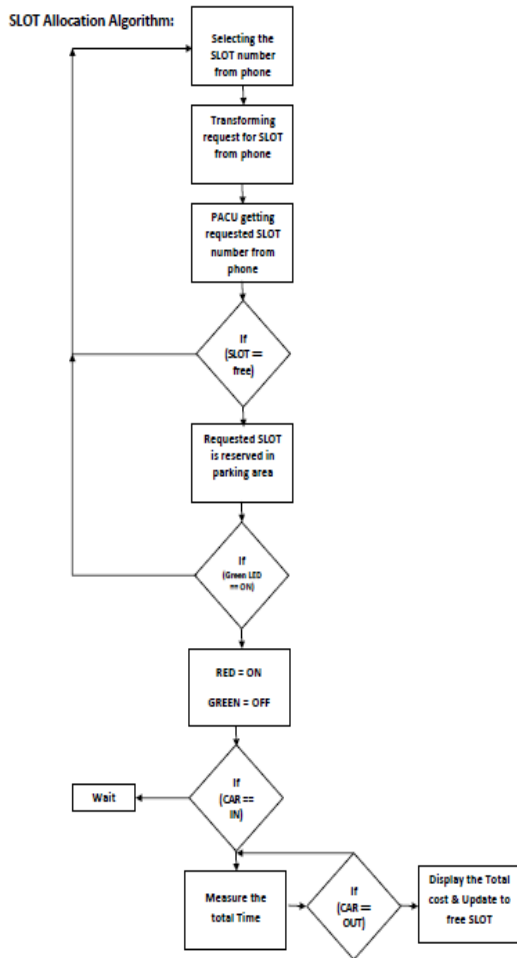- Displays the total cost finally and updates the free slot information.

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Figure-2. Slot allocation.

Figure-3. Block diagram**.**

The above steps conclude the slot allocation algorithm. Initially the driver sends request via mobile phone using Android application and do reservation as mentioned in the smart parking overview. They have the database of all drivers request and according to the requests with the slot allocation method; the parking slot is allocated to the drivers in the parking area. And finally updates the information to the mobile phone users. Here we can reserve our own parking slot. It is user friendly. Driver can choose the parking slot which is comfortable for them. It overcomes the process of time saving compared to the dynamic resource allocation method and also cheaper than that. Using the FCFS scheduling method the priority will be scheduled.

3.2 Block diagram
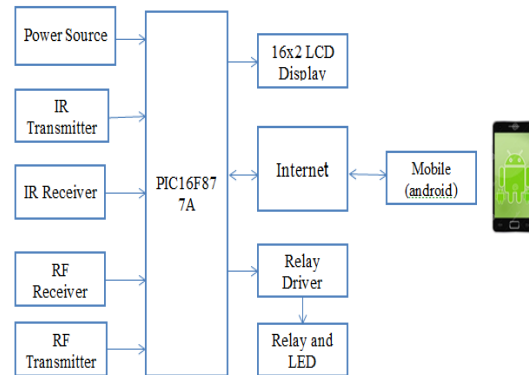   The block diagram consists of PIC16F877A controller, IR sensor, RFID tag, Relay, LED and Android Mobile device.

IR sensor
        An infrared sensor is an electronic device which is used to sense light wavelength of its surroundings by either emitting or detecting infrared spectrum. It will also capable of measuring the heat being emitted by an object and detecting motion. LED will be glow with respect to the IR sensor detection. Green LED will be glow if no object is detected and Red LED will be glow if object is detected.

RFID
        A Radio Frequency Identification Tag (RFID) tag is an electronic tag that exchanges data with a RFID reader. Here we are going to use Active tag of RFID. While RFID's original uses were primarily for inventory tracking in retail environment, this technology has quickly created a presence in an extremely diverse number of fields including easy gas payment, credit card replacement. RFID tag has chip, memory and an antenna.

ANDROID
        An android application is created using Android studio. The android applications are developed using the JAVA code. Using the JAVA compiler the source files are converted to JAVA class files. The Android SDK contains a tool, which converts JAVA class files into a *.dex* (Dalvik Executable) file. The *.dex* file and the resources of an android application are packed into an *.apk* (Android Package) file. The resulting .apk file contains all data to run the Android application and can be deployed to an Android device using *adb* tool. The Android system is more secured. The Android system installs each and every Android application with the unique user and group ID. Android contains a permission system, declares required permission in the *AndroidManifest.xml* configuration file. Using the slot allocation method the Android application is developed for the Smart parking. Slot reservation can be done using the slot allocation method. The request is updated in the server and forwards it toparking area.

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4. RESULTS AND DISCUSSIONS

Slot allocation is implemented using Android application for the smart parking, which are as follows,

Figure-4. Outlook of an application for smart parking.

Here we have created two slots using Android application [4] in my mobile and updated to the embedded kit using the internet [6]. Initially both slots are free it is indicated in the embedded kit, green LED glow [5] as denoting the parking status free initially. The slot S1 is booked so it is changed as red colour in mobile [7] and in the embedded kit particular kit the corresponding LED is changes to red from green [8].
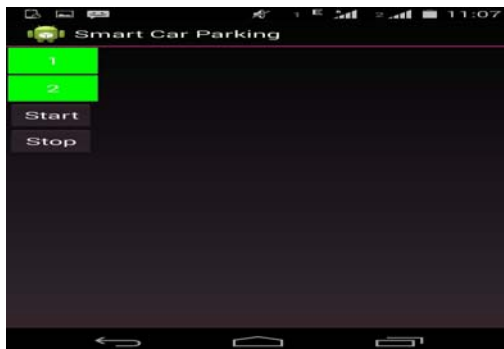

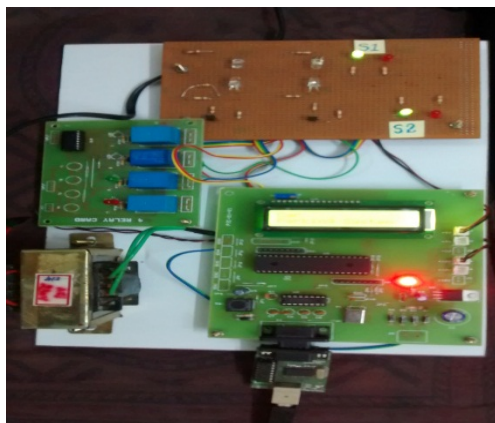**Figure-5.** Status for parking slots.

Figure-6. Indication of led showing the availability of slots.
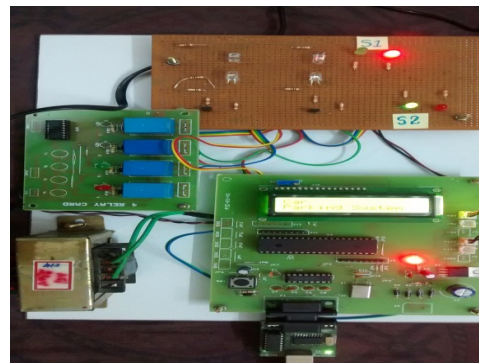

Figure-7. Slot allocation.

Figure-8. Led glows with respect to slots allotted.

Figure-9. Cost estimated for slot.

The cost is estimated and automatic billing process is carried out using RFID tag [9].

5. CONCLUSIONS

The Smart parking system based on Slot booking is implemented, using the Android application. Using the slot allocation method we can book and block our own cheapest and shortest distant parking slot. It is an efficient one for solving parking problems, which overcomes the traffic congestion and provides automated billing process using the RFID tag.

This work is further extended as a fully automated system using multilayer parking method. Safety measures such as tracing the vehicle number face

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recognition of the drivers so as to avoid theft & automatic billing process can also be designed. We plan to expand the tests on the real time environment where the users can have the "Smart Parking" system in their handheld devices.

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