

# Track Your Parking Lot with the help of Sensors

Parul Madan, Satya Prakash Upadhyay, Paravjot Singh, Rashmi Sharma, Gunjan Chhabra



**Abstract:** *The increasing number of vehicles around the globe increases the parking problem. Parking of vehicle in front of the house or in the basement of shopping mall, consumes a lot of time and energy of the driver. Additionally, the emission of extra CO<sub>2</sub> is adding to the environmental cause globally. So here, author has proposed a solution of mentioned problem. An Automated Parking Management System (APMS) is proposed here that dynamically detect the vacant parking slots. This interface will provide the facility of advance booking through which the user can book a parking slot in advance to avoid last moment rush. The user can also locate, view the nearest empty parking lot in advance and plan his/her journey accordingly. The proposed work is done with the help of sensors that will fetch the data dynamically from the parking slots (whether they are vacant, occupied or waiting) with the help of raspberry pie. The retrieved data is interfaced by an android application that will then show the status of the slots. Apart from mentioned advantages, this work also addresses the environmental concerns due to CO<sub>2</sub> emission. In short, through this application user will get a safe and secure vacant parking slot without any hustle and wastage of time.*

**Keywords:** *Automated parking system, Advance booking system, Android Application, Real time application.*

## I. INTRODUCTION

Someone rightly said that “Necessity is a mother of invention” but every invention is having some negative impact on society/environment/human life. For example, mobile phone usage affect brain or other body parts, usage of Air conditioner affect the respiratory system; similarly, many more issues are relevant to multiple inventions. Likewise, the invention of vehicles provide comfort to society but its emission affect human health, bad for environment and no doubt it need space for parking everywhere. Parking is a burning and emerging issue in almost every developed or developing city as well. One of the reasons is that the available parking space is limited; another reason could be that searching for parking availability waste a lot of precious time and fuel of the respective person. This ultimately results in a global issue of air pollution, traffic congestion and driver frustration. The reason why parking is a big question in metro

areas is because of the current transportation infrastructure developed is unable to cope up with a rush of vehicles on road. So, the focus of this paper is vehicle parking.

In parking lots with large areas and multiple levels, drivers often oversee the empty slots and move further. This may cost them an hour or more to just move inside the parking lot to find any vacant slot. Moreover, they are also not able to make out which parking slots have just been emptied at runtime. This can lead to a great level of frustration if after spending a lot of time, he/she is going to park his/her car and suddenly other driver reaches ahead of him/her at takes the slot. As per the increasing demand of parking, there is an urgent requirement of an innovative parking management system. In order to resolve above-mentioned problems following are the features of Parking Management Android Application.

- This application will handle the real time data with the help of sensors. Sensors will detect the vacant, occupied and waiting slots.
- Integration with Google map help user to navigate their desired parking lot.
- For optimization of the parking space, sensors will provide the data accordingly.
- It reduces the roaming and searching overhead of driver as he/she will park the vehicle in an already defined spot. Moreover, this will increase the value of the stakeholder.
- This parking management system will control the CO<sub>2</sub> emission of vehicles, which ultimately increases the air quality.

The overall structure of remaining paper is as follows: Section II will explain the relate work on parking issues. Section III elaborates the methodologies of proposed work along with some implemented portion in succeeding section. Further, conclusion and future work will be deliberated.

## II. BACKGROUND AND PRELIMINARIES

In today’s era, Internet of Things (IoT) is the main area of exploration. Day to day new fields or applications of IOT has been introduced. This section explain the groundwork of IOT and its application. Through this paper author has proposed one more application of IOT i.e. smart parking system for the hassle-free parking of vehicles. Before discussion of proposed work, let us understand what IOT exactly is?

Internet of Things (IOT) is a huge network of connected devices. These devices collect and share information about how they are used and the environment in which they are operated. All communications in-between physical devices done through sensors that are embedded in respective devices. Such devices a mobile phone, any electrical appliance, traffic lights, barcode sensors, and almost everything that we come across in our day-to-day life.

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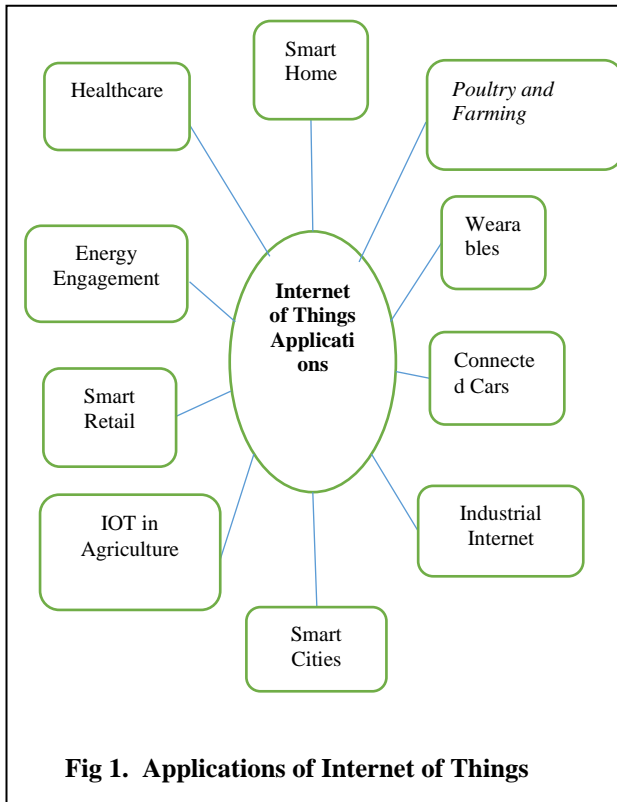
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These sensors continuously emit data about the working state of the devices [1 & 2].



Along with mentioned existing applications, one more application named smart parking system has been proposed in this paper.

Although, multiple researchers has worked on the same application but every work is having some limitation. In [3] author mentioned the ways of designing and developing a smart parking system with the use of Raspberry pi. The ways of integrating it with system also discussed in this paper. Although this paper almost covered all the areas of smart parking system but neither, consider the load of sensors nor about reduction of sensors load on Raspberry pi for smooth performance of system at run time.

In [4] authors discussed about the different ways of deployment of smart parking system in different cities. The limitations of current parking scenario due to which users face a lot of difficulties also explained. Along with solutions of few problems author had deployed a website as a user interactive mode but website is not so good in terms of maintenance and timely update of traffic areas.

Authors of [5] very precisely stated the number of vehicles on Indian roads and traffic populations. Some alternate technologies also discussed here before the introduction of smart parking system. Multilevel car parking system (MLCPS) is one such technology, which is implemented in India currently. This technology is used for optimum utilization of parking space by utilizing vertical spaces rather than horizontal spaces. This technique has made the condition little better as compared to earlier situation. Still improvement is required in terms of space availability and searching time in public places. Along with, MLCPS technique Rotary Type and D (Stacker) system techniques are discussed in mentioned paper. This paper also calculated the estimated income from smart parking system by 2020

worldwide that is nearly equal to \$356.5 million yearly. It had also mentioned implementation of smart parking application using RFID technology.

As technologies improved day by day, RFID [6 & 7] is a very efficient technology, which provides data transmission through wireless sensors. In [6] author crisply explained the benefits of RFID sensors. Some of those are:

- The RFID sensors at the entry point of parking lot helps in avoiding multi check-in thus avoiding traffic congestion in the parking lot.
- The RFID technology enable automatic parking fee collection thus saving time of the drivers.

Additionally, in [8 & 9] almost every technology that can be and being used in implementation of smart parking system but did not focused on the point of deployment of these technologies in real life scenarios.

Implementation of above-mentioned technologies in real life scenarios are very painful and very difficult to execute. Before proposing smart parking system, very carefully author did the market research and listed out the ways to deploy this proposed application smoothly and efficiently.

Currently many cities like Dehradun, Lucknow, Jabalpur, Indore, Pune and many more urban cities have pre-paid parking facilities which provide driver the ease of paying for parking in advance. In addition, through an automated parking ticket generator drivers save their time and hustle of getting parking tickets from parking managers. Although this proves out to be a little helpful but did not solve the problem to find a parking spot to get your vehicle parked. This method [7] can only be implemented where the parking traffic is low but proves out to be a real failure when comes to metropolitan cities like Bangalore, Delhi, Mumbai and Kolkata. These cities demands a far better alternative of handling parking traffic. Therefore, IOT is the only technology that can help in Smart parking system for these cities. With the help of sensors, parking traffic can be very handled.

In this research paper, solution of the parking problems are proposed that is entirely based on smart parking system. In this method, sensors and interfacing are used. Author has proposed an application to facilitate the user to handle the entire road load from home only by booking advance-parking slot at their desired destination. This application will be using raspberry pi based sensors for the detection and fetching of data.

Although multiple smart parking applications are already deployed on Google Play store but they are not working properly. These applications only cover a small area of a particular city, which is not mentioned in the app and does not respond smoothly to the location services. They are not user friendly either.

In short, following table contains the Problems that are identified from mentioned survey:

Table-I. : Problems Identified related to Parking System

S.No.	Problem Identified	Explanation
1.	Wastage of valuable time from inconvenient and unstructured parking lots	On an average, a person spends 4 to 12 minutes waiting and looking around for a spot in conventional parking lots
2.	Wastage of fuel while waiting for spots or driving around to find a spot, resulting in more CO2 being produced and thus effecting environment.	Average distance covered to look for a parking spot in conventional parking lots = 1,2km
		Average CO2 emitted by a car in a day = 0.14 kg.
		Therefore 14kilogram for 1000 cars in a single day and 5120 kilogram in a year just for 1000 cars.
3.	Potential accidents caused by abundance of moving vehicles in disorganized parking lots.	On an average 413 accidents occurred in public parking lots in Urban cities per year.
		On an average 788 parked car collisions occurs in a month.

Proposed android application will facilitate the user to view, navigate and book the nearest parking slot to their destination. These mentioned features of application will reduce the mentioned accidents due to parking system issue.

### III. PROPOSED WORK

In this paper, author has proposed a smart parking system using sensors of IOT. Following is the proposed model or working of smart parking system:

The overall flow of the application would start with opening the application, after which the user has to login for accessing the resources. If did not have account, then register by following simple steps. Then the current location of the user is fetched on basis of which the list of nearby parking lots will be displayed. Further, on click of any parking lot, corresponding vacant, occupied and waiting parking slots are shown. Here, the user can view as well book the respective slot. An option to navigate to the parking location is also being integrated with the help of google maps.

Fig. 2 depicts the first interaction of the user with the application. The user are required to login with email id and password before proceeding.

Complete application consists following modules:

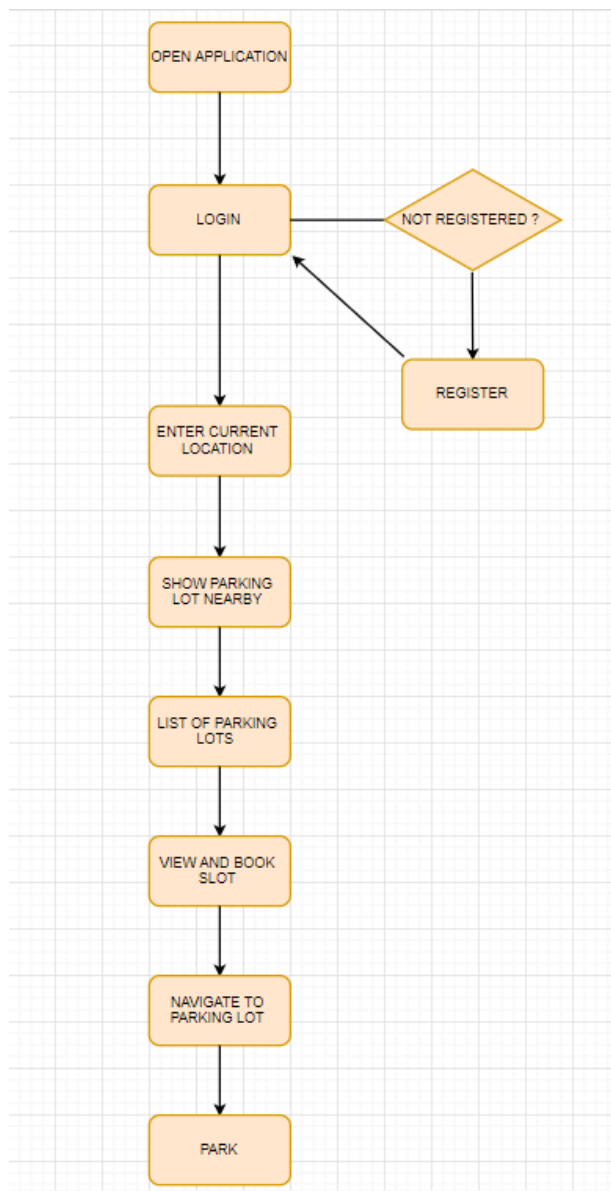


Fig 2. Overall Application working

- **Registration module:** The user are required to login with email id and password before proceeding. If did not have an account, then first register by following certain steps (Fig. 3) and then login into the app.
  - **Vacancy checking:** Here, vacant parking slots are being displayed. The user first login and enter certain details such as vehicle no, type and destination, then based on the chosen destination a list of parking lots will be available which will further display vacant, occupied and waiting slots (Fig. 4).
  - **Reservation module:** This module will reserve the parking slot on the basis of the entered destination, arrival time and expected departure time. (Fig. 5)
- The reserved slot will be visible as the waiting slot (yellow colour) to other users. It will automatically become vacant if no parking was detected after half hour of booking.

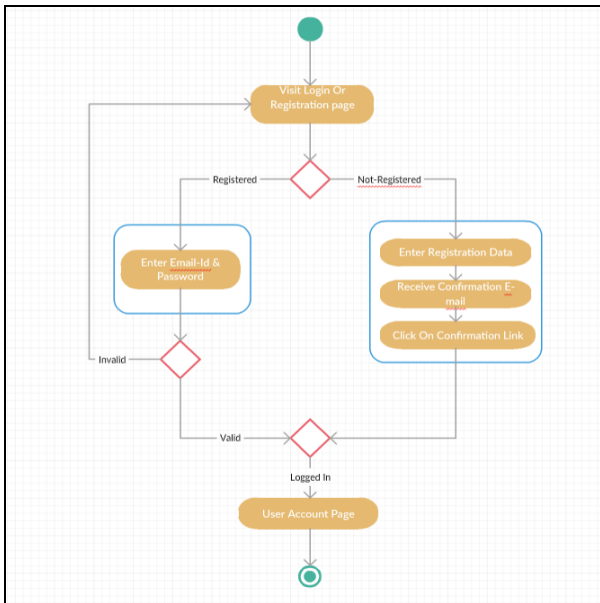


Fig 3. Registration module of parking application

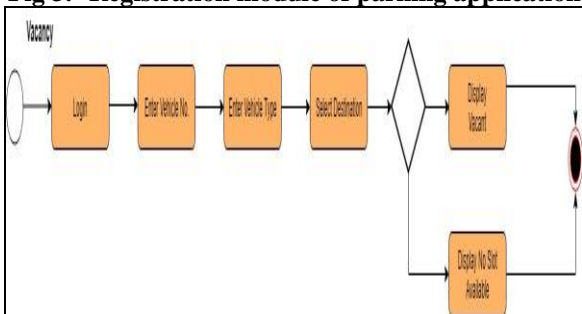


Fig 4. Vacancy checking module

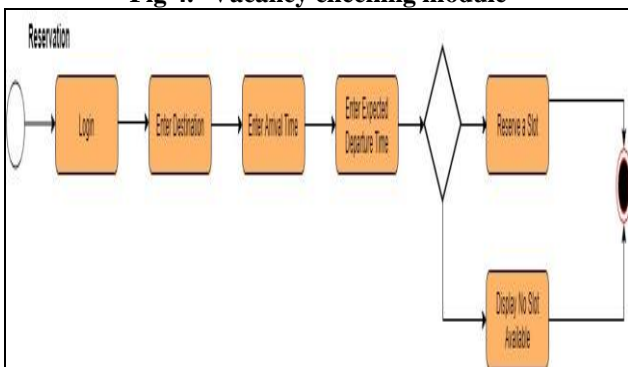


Fig 5. Reservation module

IV. METHODOLOGY

A. For creation of application layout

In order to create android application of smart parking system, following methodologies are used for above-mentioned modules execution (Fig 6.) :

- There will be one form where the user/parking manager will fill in the details to register to the application.
- Then there will be a login form through which user will be verified.
- A connection will be made to the SQLite database to store all the information.

B. For handling database of parking areas and registered users:

- For handling of database, SQLite database will be used to store user and parking lot details [3].

C. For searching of location:



Fig 6. Application Registration and Login layout

- API stands for application programming interface. Google maps service is splitted into multiple APIs. The API of google maps is used to integrate Google maps into web pages or android applications. This allow users to visualize or use the location for their local business with accurate real time
- data and dynamic imagery.
- Google maps uses Java script API to customize and use the map in your webpage it provides some extra geographical information like latitude and longitude.
- To use the Java Script API, you have to get the API key and then you can add it to your mobile application or webpage.

D. For Fetching of information from sensors Raspberry Pi is used:

- Raspberry is tiny credit card sized computer .An SD card can be inserted on board acts as the hard drive for raspberry .It is powered by USB, Raspbian is the official operating system of the Raspberry pi (Fig 7.) . It is a version of Linux built especially for the raspberry pi. It works as a normal computer to handle small traffic.
- To install SQLite on our raspberry pi we have to enter the command in the terminal:-
- **sudo apt-get install sqlite3**
- After the installation SQLite libraries are supplied with SQLite shell and we can use the command to invoker the database and use it [3] :
- **sqlite3 sensordata.db**
- **E. For deployment of sensors at respective sites.**
- In order to deploy sensors at several nodes of different parking slots one raspberry pi will be assigned for the particular area [10].
- Moreover, there will be many units like this to cover the whole area (Fig 8.).



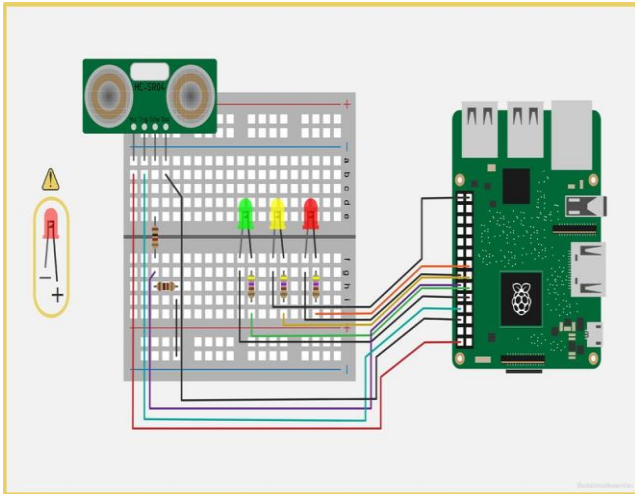


Fig 7. Raspberry Pi Circuit Diagram



Fig 8. Ultrasonic Sensor

IV. RESULTS AND DISCUSSIONS

Three of the four phases of the Smart Parking Application is completed.

In the First phase, basic functionality of an android application is ready and the application is able to fetch user registration and login details through an android activity that is stored on the local host.

In the second phase, sensors are deployed at the parking slots and data is retrieved dynamically at runtime.

The fetching of current location of the user, displaying nearest parking lots and available slots to the user is to be carried out in the third phase. The users will grant the access of their current location to the application when requested.

The parking manager will provide the structural details of the parking lot such as number of rows, number of columns, total number of slots and individual parking for two wheelers and four wheelers at the time of installation of proposed work. It will then be integrated to the database of the application.

Initially, in order to provide a view of available and occupied slots to the user developer will enter details and structure of the parking manually.

Current location of the user is fetched through a button click and is used to display the nearest parking slots to him.

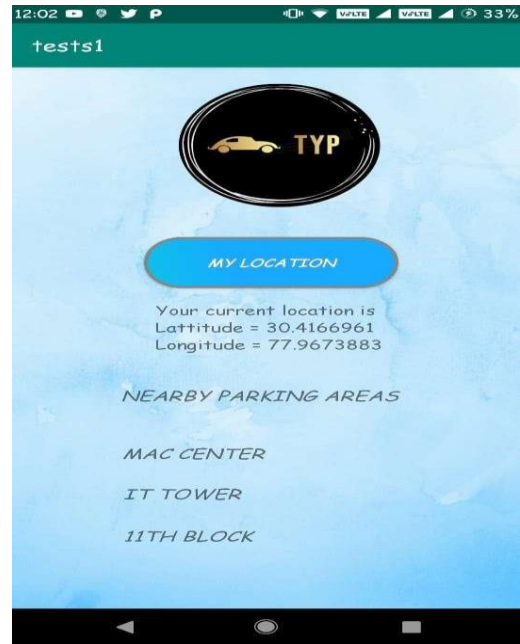


Fig 9. Fetching current location of the user



Fig 10. Available, occupied and waiting slots display

The application will show the Occupied, Waiting and Available slots to the user in Red, Yellow and Green colors respectively.

V. CONCLUSION AND FUTURE SCOPE

There is an urgent need to minimize the time, effort and energy wasted while parking vehicles. Also, keeping insight the environmental concerns, we have proposed a TYP : Track Your Parking lot android application with all functionalities through which user can locate the nearest parking lot, view particular slots and navigate to it through Google Maps. This will ultimately reduce the aforementioned problems.

