



## **Real Time Parking Availability and Management System.**

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### **ABSTRACT**

The idea of this project is related to a prototype of a parking system, an android application known as real-time parking availability system. This application will be used by the mall, colleges or any parking area. A real-time parking availability system is an application designed to address the ongoing challenge of finding parking spaces easily. This system leverages various technologies such as sensors, mobile applications, and data analytics, Machine Learning & IOT to provide up to date information on parking space availability in metro cities, commercial lots, or public parking areas. The system will help and monitor the parking slot availability and also allow drivers to pre-book for a parking slot before reaching the parking area. The booking will be for a specific period of time of which if the driver does not reach the parking area on time, their reservation will expire, and the booked area will be available for others. The android application will help people or drivers to book and see available parking slots nearby.

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### **1. INTRODUCTION**

The Real Time Parking Availability System is a technology application designed to solve the constant problem of efficiently finding parking spaces. This innovative system uses various technologies such as

[7] Cameras, mobile applications, machine learning algorithms, IOT and data analytics provide updated information on the available parking spaces in metro areas, commercial areas or public parking lots [4]. Using sensors installed in parking lots or on streets, this system continuously monitors and collects data on available parking spaces [8][9]. This information is then processed and made available to drivers in real time via dedicated mobile apps or electronic signage. Users can access this information before reaching their destination, saving time and reducing the frustration associated with finding parking spaces.

In addition, this app often includes features such as navigation to the nearest available parking spaces, reservation options and payment systems that streamline the entire parking experience [5]. In addition, data collected from these systems can be used by city planners to optimize traffic flow, reduce congestion and make informed decisions regarding urban infrastructure development [6]. Overall, the real-time parking availability system significantly increases driver convenience, reduces traffic congestion, and contributes to more efficient urban mobility by providing accurate and timely parking availability information.

In short, this application consists of all the solutions of packages like finding the nearest parking station to your location or related to any area or region where you want to park and then it gives you access to pre book the parking space. When you search for parking space then it will give numerous amount of parkings available in that area with the amount of fair they charge so that you can choose best possible parking for your vehicle. It will also provide rating of all the parking space for your better decision making and for your concerns related to safety and security provided by parking. Also, if you pre-book the parking lot then it can help you to reach there by providing the shortest possible path with the help of google maps, which is very easy to navigate by any user or driver. With the help of our application you also do not need to switch to other apps for location navigation . After you reach the parking station entry gate, our parking model scans your car number and does the entry part automatically without any human interaction which makes it fast and secure from any type of fraud like wrong entry and exit time issues.

In case you did not pre-book the parking lot and you directly went to any parking station then at the entry gate our model will scan your car number and compare to our database like, is there any extra space available to allow this car to park at our lot or not? and if there will be extra space then it will allow the car entry with fresh new booking of parking space to the car by itself . And if there is not any extra space and as you also didn't pre-book the parking lot so your entry will be denied.

At last when you take your car from the parking space then at the exit gate our model will automatically calculate the total duration of parking time of the vehicle and then it shows the total fare which can easily be paid by you with the help of UPI or other online medium . Lastly the data at cloud will automatically update itself and show empty space for further booking of area by another user.

This real time parking availability system is the best possible solution for finding the best and nearest parking station which gives you better experience of parking and also helps to decrease the unwanted traffic from cities which is caused due to irresponsible parking of vehicles. This system also helps to save fuel for vehicles and our environment.

## 2. Literature Review

In this paper [1] presented smart parking using IoT and Machine learning technology. For each and every parking lot, the sensor is present at every place for better possibilities and organisation of vehicles. Ultrasonic sensors are used for better communication between applications and the driver. If there is any vehicle present then it reflects the total duration and space availability status. It is the same as the previous Information parking model[1]. This system uses the best possible technology to produce the best outcome from the previous system. Here, the driver has the right to first check the available space and then go for it, if the driver gets the free parking available then he parked there. The driver uses mobile applications for most of his work like booking to park his or her car to take out of the parking zone.

Another paper [2] in which a different type of solution is provided based on intelligent parking system methods detection of available parking spaces using a camera. This paper shows how cameras can be used for better parking solutions. This paper has compared many previous already given solutions which is good but not the best possible solution to trust on. This paper also concludes that vision based sensors are more accurate than, normal sensors. With, the use of cameras the output like sensing and allocation of free parking spaces is easier also it increases reliability, scalability and efficiency. But with all the review from this paper we find out that may be CCTV is costly and not easy to install but still the best possible solution to use for better output.

[10] This paper gives us an overview related to how IOT is useful in making a better parking system. This sensor is used for finding if a lot is free or not for parking space. Also, in here the cloud is maintained for showing all the data related to parking to user application which is very good but it still has to work on a pre-book facility because it can play a major role in this. This paper also includes the facilities like automated gate opening and entry and exit at the gate.

[3] This paper represented everything perfect but still we thought there might be some changes which can help to provide perfect the parking experience because all the above paper are not perfect and all solution are more technical which is good for the admin side but still, we have to work on user experience so our idea is more focused on application side like UI and function available like google map and payment system. Apart from that, we also checked other papers. But according to us, each and every paper has completed some specific part only and for our point of view there is a gap and for that we are going to present our paper which discusses each and every aspect of the parking problem and from our knowledge it is the best possible solution till date.

## 3. Proposed Methodology

Our Proposed Model of Smart Parking Availability System is consists of 3 things:

- **IOT:** The IoT part of this model contains a hardware embedded controller (Arduino), LED Lights. It supplies the power, connectivity facility (WiFi, cellular networks: 3G, 4G) which is used to perform CRUD operations on the cloud Database.
- **Machine Learning:** The ML part of this model contains a camera application program. It is used to fetch the number plates of the vehicle from the recording captured by camera and performing CRUD operations in the cloud database and checks whether the any slot is already booked or not for the vehicles which is facing the camera of the parking space and sends the signal to the IoT devices to allow/ not allow the vehicles in the parking space.
- **User-Interface (Mobile Application):** It contains the mobile application which shows the real time availability of the slots, time & distance to reach, price, navigation map, all the records of the previous parking experiences.

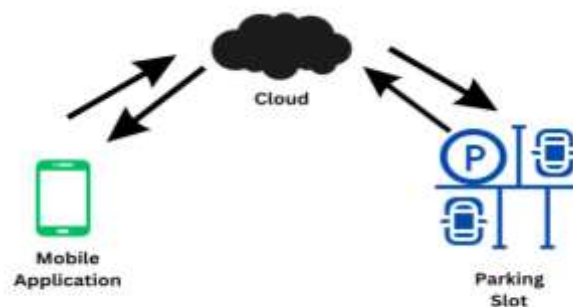


Fig 1. Architecture of Smart Parking System.

### How IoT play a role in our model

The microcontroller plays a significant role in our model, there are various controllers available like : Arduino, Raspberry Pi, etc.

However, we are using a Raspberry Pi controller in our model. This controller is most suitable according to our requirements as it supports Python based application code and has more processing power to process.

A application code is feed into controller which sends the car number in cloud to check whether the slot is available or not related to that no. and perform action based on given criteria:

- If any slot is reserved corresponding to the car number. So the controller gave signal 1 to the motor (to open the gate) and LED light (showed green colour).
- If any slot is not reserved corresponding to the car number So the controller gave signal 0 to the motor (to Not open the gate) and LED light (showed red colour).

### How ML play a role in our model

The [3] YOLO which is a short name for a model of machine learning, It works mainly on real-time object detection like car number plate. The use of this model is for the detection of the number plate of the car from the stream video of the camera.

Here [3] YOLO stands for 'You Only Look Once', which helps us to perform operations based on some predefined algorithms on which this model works . Here we have used 'YOLO-v4- tiny-3l' which is also a model but like a subset of the YOLO model, and this model mainly works for real time detection of car number plates. OpenCV is also used by us in this, it is an open source computer vision library so free to use. It is easy and free to use so best for computer vision projects. In this project, We have used some special libraries particularly beneficial for our project in computer vision.

### Process Flow

This section describes the process flow of follows:

- **The System:** It shows the overall flow of the information of the system that is installed in parking space.

First, car no. plate is scanned through camera and sends to cloud, if any slot is reserved prior so gate will open and green light shown and user entry time is updated in cloud database.

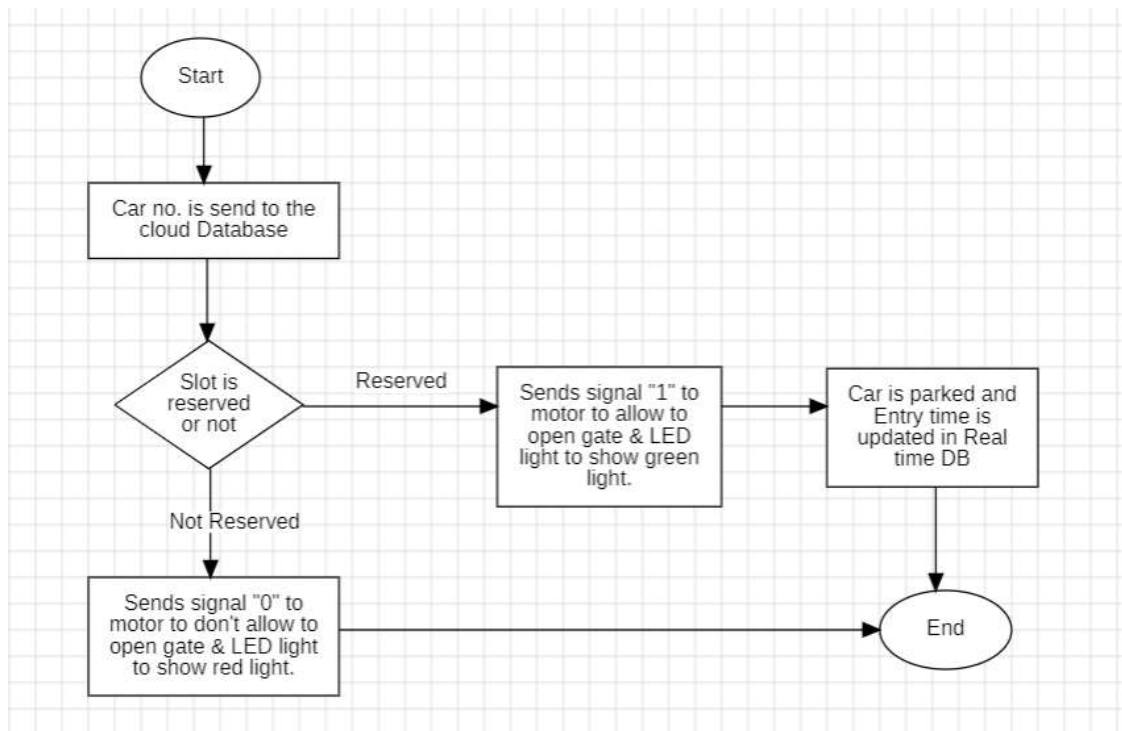


Fig:2. Process flow of the system.

- **The Application:** It shows the flow of information of the application / user-interface which is used by the user.

First, user login then the available parking is shown to them either nearby location or based on any specific city parkings.

- a. If a user wants to book then one slot is reserved for them corresponding to their vehicle no. in the cloud Database then after reaching the parking space the entry time is updated when their car is entered into the parking space.
- b. If the user wants to reach the location first to book the prior slot. So in that case after reaching the location, users book their slot from the application and then entry time is updated when their vehicle is entered into the parking space.

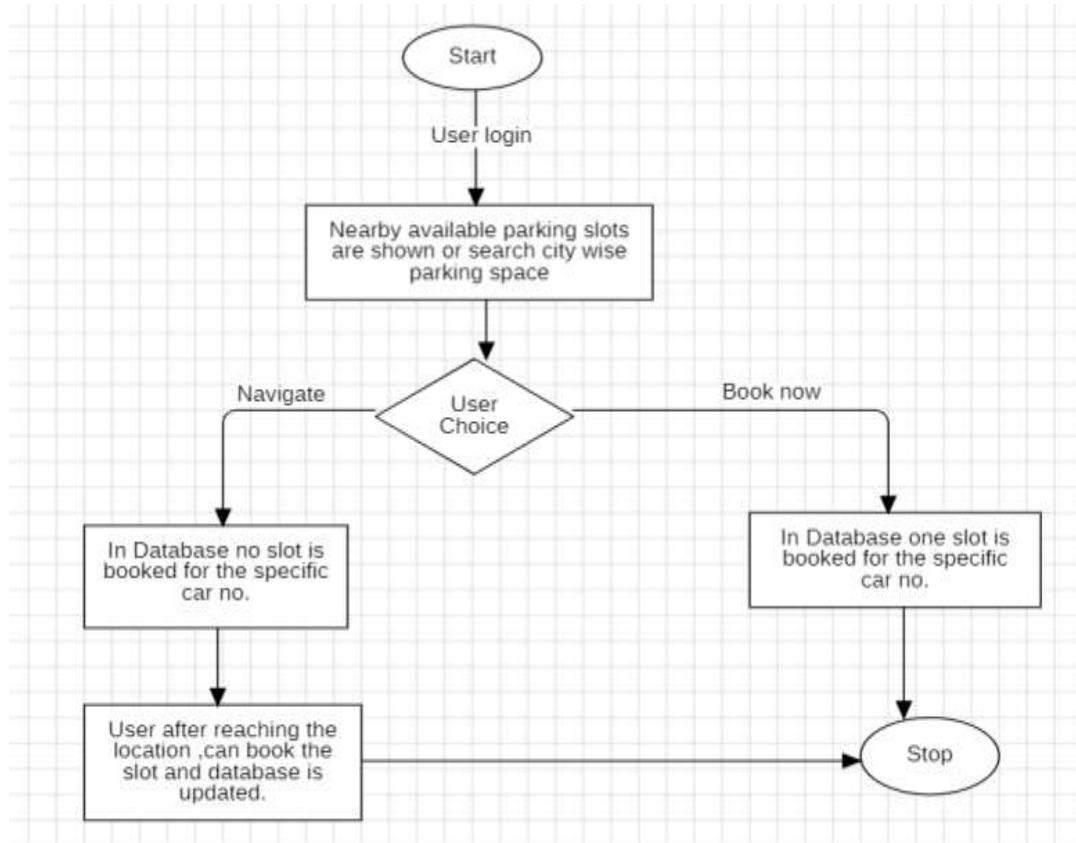
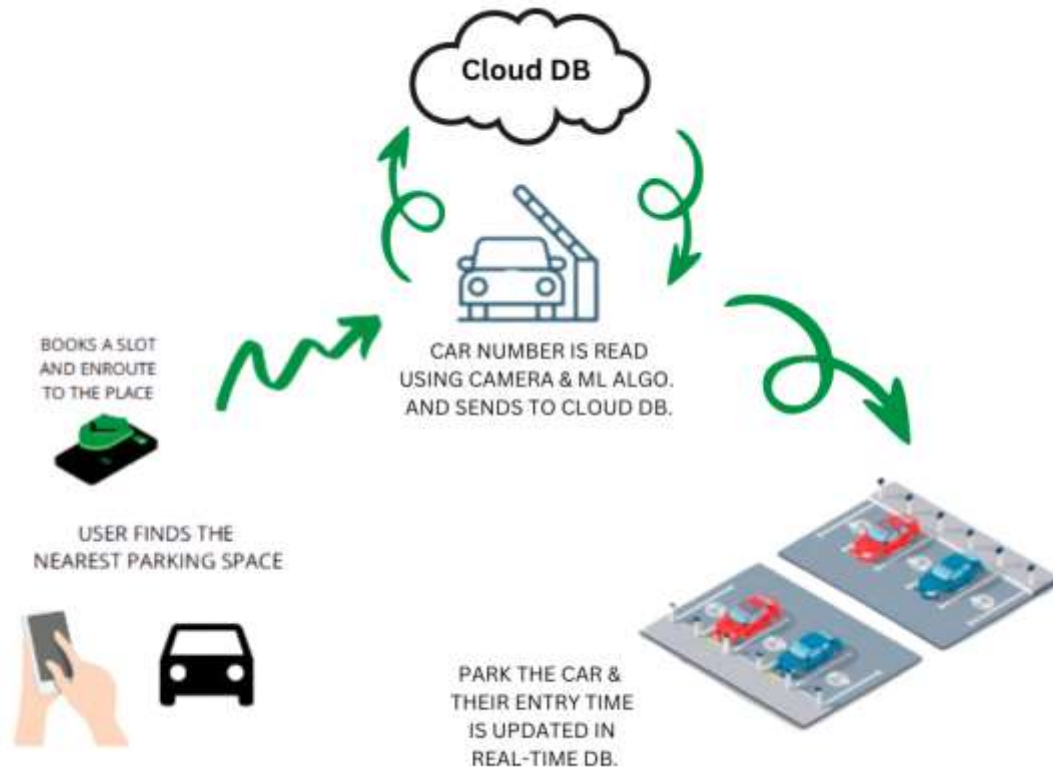


Fig.3. Process flow of the app.

#### 4. Implementation

Now, Let's discuss how our smart parking model works. We divide the implementation part into 2 parts:

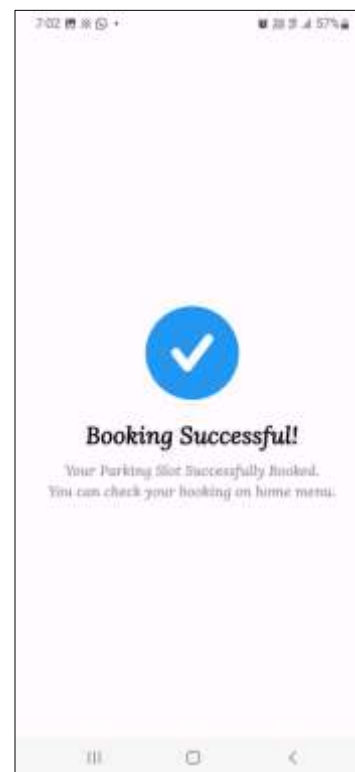
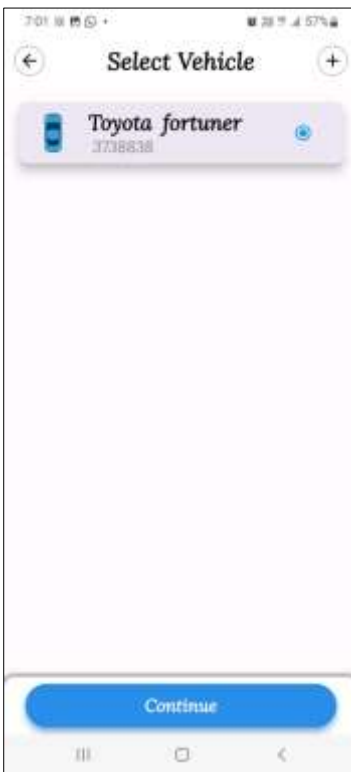
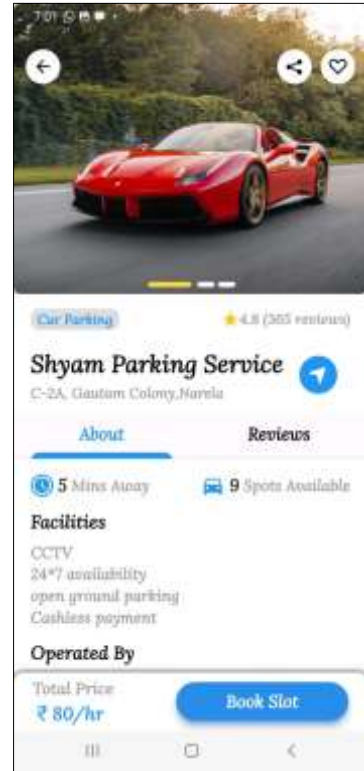
1. **Parking System:** It describes how the things work in the parking space to ensure the smoothness in the process of Smart Parking System. There are various steps involved in this process are: (Refer Fig:4)
  - a) First, the user finds the more suitable parking space based on their requirements either nearby or specific city wise.
  - b) When they reach the parking space, their vehicle is standing in front of the parking gate.
  - c) Then, the camera installed at the entrance captures the video recording and sends it to the "YOLO model" which extracts the number plate from all frames and sends them into a cloud database to check whether that vehicle number is stored against any parking slot reservation.
  - d) If it is found in the database then only the "Entry Gate" is open and after that, entry time is updated in the database which is further considered in calculating the parking fees/ fare.
  - e) When the payment is done by the user either through app or cash then the status of that slot is updated (Active again) in cloud firebase which ensures the "Real time availability of parking space".



**Fig. 4 Project Implementation**

2. **Mobile App (User-Interface) :** The below given images shows the application view:

- a) First the **"login page"** is shown to authenticate the user.
- b) Then, **"Home Screen "** is showing which displays the nearby parkings of the user location and the specific parkings based on their query.
- c) Then, **"Detail Page"** of the parking space is shown to the user before booking the slots.
- d) After that **"Vehicle Screen"** is shown which displays all data of all their vehicles and the user selects one of them to book the slot.
- e) Then finally the **"Successfully Booking Screen"** is shown to the user which ensures that the user's slot is booked in that parking.
- f) Users can also manage all their **"Ongoing, Completed, and Cancelled"** parking slots.



### 5. Conclusion & Future Scope

The proposed Smart Parking System model consists of ML Algorithm (YOLO model) , IoT framework (Raspberry Pi) that helps in sending the data to cloud database (firebase) to facilitate the real-time availability of parking space and helps in prior booking of the slots in parking. This smart system also consists of a Mobile Application which shows the real-time slots, time, distance , navigation map, current status, payment status, timer of occupied slot,.etc. It helps the user to avail the parking facilities without any hassles.

The Future scope of this research paper is consisting some features like:

- Automatic payment options while exiting the parking space without any human interference.
- Real time camera view of that slot shown to the user where their vehicle is parked till the space is occupied by that user.
- Security/ warning message will be sent to the user when there may be any possibility of any security concerns like: unlock the vehicle, engine on/off without vehicle owner permissions.

## 6. References

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