

## IOT Based Smart Parking System

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**Abstract**— There are billions of motorized vehicles on the globe. As a result, it creates the need for an efficient parking system which manages the vehicle parking. But the present parking system has many problems such as high operation cost, heavy labor support, inefficient management of vehicles, time consuming process of issuing tokens, collecting money, inappropriate management of the parking slots etc. Thus we are trying to resolve the above stated issues by RFID based automatic parking system. It uses a microcontroller such as Raspberry Pi along with sensing circuits monitoring entry and exit of vehicles. The vehicles are allowed entry only when the reader senses a valid RFID tag at the gate. An account in central database is maintained corresponding to every valid RFID tag. It enables us to monitor and store the time of entry and exit of vehicle. Also an Android application is provided for user guidance. This database can also be analyzed to find patterns of days in which the need for parking was in demand. This system allows automatic authorization of vehicles with the help of RFID tags and RFID readers and provides a statistical representation of traffic prediction for a particular place. Security check is handled with minimum delay time so that traffic jam problem will be avoided during these processes. The user application provides timely notifications about the activities. These processes allow parking system to work efficiently and require less man power to manage the parking. Thus the cost of operating the parking system is significantly reduced.

**Keywords**— IOT, RFID, regression, Raspberry Pi

### I. INTRODUCTION

The aim of this project is to develop RFID based automatic parking system. The objective of this system is increasing the efficiency of existing manual parking systems and reducing their operation cost by reducing man power requirement, cost of operation, processing speeds at check-ins and check-outs, queue length, etc. also providing the customer with facilities which will help them to pre-book the parking slot according to the availability and time schedule. This would help in tackling the increasing demand for parking facilities by decreasing capital requirement per car slot. The users go through a onetime registration process where there are asked to fill in their personal details and an account is created for them, this account has information about them. In this system, the user pre books the parking slot according to his time and other requirements. The user's car is provided with a unique tag which he gets on registration so that each car will have a unique tag Id, this tag is linked with his account and includes his personal information, and this tag uses Radio Frequency

identification (RFID) technology and is placed on the top of the user's windshield. The parking entry gate automatically authorizes the car at the entry gate and records the time till the car passes from the exit gate. It will also provide a platform for monitoring parking demand at different times of the day. The RFID based automatic parking system is an independent system in itself and does not depend on any service from any external system. All the functions needed is performed by one or other component of the system itself and all the inputs and outputs concerned with our system is handled by various components of the system itself like display, processor, RFID reader, RFID tags etc. Thus the RFID based automatic parking system is totally self-contained.

Rest of the paper is organized as follows; section II contains motivation that leads us to find a solution to address this problem, section III contains precise problem definition, section IV explains the working of our model, section V contains applications related to our model, section VI

discusses limitations of our model, section VII concludes the discussion with future directions.

## II. MOTIVATION

The number of cars is increasing day by day exponentially. According to a survey, there are on an average two cars per person in a family. Due to the increasing demand for purchase of cars, there is a need for management of parking efficiently. Many times the parking slots stay empty in many places due to which people park their vehicles on the roads thus increasing road traffic and congestion. Also many times people choose wrong time to visit places like malls, multiplexes, etc. which forces them wait till a parking slot becomes vacant. Conventional parking systems do not have any intelligent monitoring system and the parking lots are monitored by security guards. A lot of time is wasted in searching vacant slot for parking and many a times it creates jams. Conditions become worse when there are multiple parking lanes and each lane with multiple parking slots. Use of parking management system would reduce the human efforts and time with additional comfort. In the proposed system, the android application provides the user to pre-book the parking slot and also helps the user to decide where to park the car. The system would not only save time but the software and hardware would also manage the check-in and check-outs of the cars under the control of RFID readers and tags with additional features of entry and exit data logging. The main motivation for making Smart Parking Control System is the huge amount of time people take to park their cars in malls, multiplex systems, hospitals, offices and super markets. In the existing system, one has to spend ample time before they find out an empty parking spot. This project has the aim of creating an automated system which not only helps users to make parking much more efficient and faster but also helps to schedule their visit time according to the traffic situations in various places thus saving a lot of time for the user.

## III. PROBLEM DEFINITION

The model provides an android application for the user to manage his cars according to the RFID numbers along with the parking slot pre-booking facility. The application also provides traffic analysis which predicts traffic. The user can select the time to visit the place and pre-book the slot for parking accordingly based on a regression model. The regression model takes historical data to train itself and thus makes predictions for the next few hours. When the slot is booked the user will be first validated and then only he will be allowed to park the car. The user will get timely notifications about the car activities whether entered parked or exited which enhances the security of the car.

## Scope

The main Scope of the study may be presented in a short Conclusion Section. In this section, the author(s) should also briefly discuss the limitations of the research and Future Scope for improvement.

## IV. WORKING OF THE MODEL

The model spans multiple use cases, the most prominent of them are the office use case and the public places use case.

Starting with the office use case, there are three main components- the subscriber app, the RFID components, the parking management system. If a person wants to avail the services provided by our system, he has to first register (using the subscriber app). After successful registration the person gets an RFID tag which he sticks on his car's windshield. When his car enters the gates, his RFID tag gets scanned and the database is checked to see if he is an authorized user or not. If yes, the gates open and allow the user to enter. If the user is not an authorized person the gates remain closed. A message pops on the user's mobile app, showing the name of the parking lot and the time of the entry. Same applies while exiting the parking lot.

The second use case deals with public parking places like malls, theatres, public parking lots etc. The subscriber first checks the traffic density in the next few hours via our subscriber app. It is a prediction model based on time series analysis. The user can then book the slot. After booking a QR code is generated and the user has to show that code at the parking lot in order to avail the pre booking facility. Also the user cannot be very late; in that case the user cannot claim that parking slot. The parking fee is calculated and charged to the user during his exit time. The user can pay the fees via the payment gateway. Overstay can cause extra charges. Developing a system which suggests the subscriber another parking lot in case the desired parking lot gets filled up, makes the system more intelligent and a perfect parking companion.

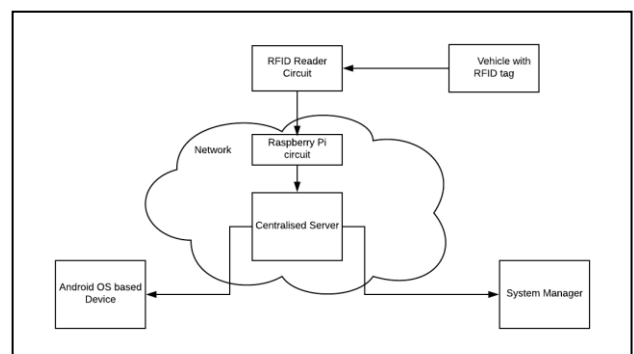


Figure- Architecture Diagram

## V. APPLICATIONS

There are multiple use cases of IOT based Smart Parking System. It can be used for better and efficient management

of parking spaces at offices, malls, theatres, public parking etc. It can even be adopted in residential societies where only authorized vehicles are allowed to enter. In an office a person can be given an RFID sticker which he puts on his car. When he enters the office his RFID sticker gets scanned by RFID reader and entries are made in databases accordingly. App notifications are provided on his phone so that the user also keeps track of his entries. On his exit his exit time is recorded and a message is sent to the user.

Considering the mall use case, parking management in a mall is very crucial especially during special occasions like public holidays, sale etc. A lot of manpower is required in order to efficiently manage parking. Our solution not only provides parking management facilities, but also pre booking of parking slots just like pre booking of movie tickets. A user can get a brief idea about the traffic condition at the mall in next few hours using our intelligent prediction system. It also provides suggestions whether to bring a two wheeler or a four wheeler. A user can book the slot and then a QR code is generated. When he arrives at the parking lot, the QR code gets scanned and then the user is validated. Based on his time in mall, parking fee is calculated. Overstay results in additional charges.

Same scenario like above can be implemented for theatres and public parking lots. For public parking we can also make a system which gives intelligent suggestions of the nearby parking lots in case the required parking lot is full. Payment gateway can be provided which helps in easy payment of parking fees. Nearby parking lot suggestion and payment gateway both are in the future scope of our project. In residential societies, residents can be provided with an RFID tag and the other frequent visitors like maid servants, milkman etc. can be provided with temporary tags where in the entire concept of making manual entries in log book can be avoided.

## VI. LIMITATIONS

There are few limitations to our project which can be solved. The first one is the number of slots. If the slots in the parking lot get occupied, then the entire capacity of our parking lot gets used. There is nothing much we can do rather than waiting for the slots to get vacant. This is an infrastructure issue. The second limitation is the prediction model which we are considering. Although that model is accurate, it is not hundred percent accurate. This may give rise to some approximate predictions. Every suggestion for the traffic for next few hours will not be hundred percent accurate. The third limitation is holidays. Suppose if we consider that we have a holiday on Thursday there is a great possibility that people take holiday on Friday as well. This leads to complete wrong predictions for our model as our model has considered Friday as weekday and is not expecting much traffic. The fourth limitation is that even if we are providing the facility of pre booking, this facility fails if the slots are full. The solution to this problem is suggesting nearby parking lots.

This is in the scope of our project. Nearby parking lots can be searched if a user finds a parking slot full, he can be suggested to park at a new parking lot. The fifth limitation is that if the RFID sticker gets tampered, it is difficult for the RFID reader to scan it. Either inconsistent entry will be made in database or no entry will be made.

## VII. CONCLUSION

The hypothesis of project was to implement an IOT based smart parking system which is efficient, secure and reduces human efforts. We have satisfied our hypothesis by implementing an IOT based parking system which allows only authorized vehicles to enter thus guaranteeing security. The subscriber receives time to time notifications on his mobile app and is able to track his vehicle. The parking management system keeps a track of free slots, occupied slots and hence keeps the track of vehicles parked in the parking lot and the vehicles which can further be occupied. This ensures that the vehicle is safe, monitored and also tells the exact number of vehicles that can be fitted. Hence the basic requirements of IOT based smart parking system have been satisfied.

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## REFERENCES

- [1] Li Liu , Mohammed Khalilia , Huachun Tan , Peng Zhuang , "Traffic pattern forecasting using time series analysis between spatially adjacent sensor clusters" In 2009 International Conference on Machine Learning and Cybernetics, Hebei, China, IEEE.
- [2] Rakesh Kumar Lenka, Rabindra K. Barik, Nihal Kumar Das, Kriti Agarwal, Debesh Mohanty, Swati Vipsita, "PSPS: An IoT based predictive smart parking system", 2017 4th IEEE Uttar Pradesh Section International Conference on Electrical, Computer and Electronics (UPCON), Mathura, India, IEEE.
- [3] Ibai Lana, Javier Del Ser, Manuel Velez ; Eleni I. Vlahogianni, "Road Traffic Forecasting: Recent Advances and New Challenges", IEEE Intelligent Transportation Systems Magazine ( Volume: 10 , Issue: 2 , Summer 2018 ), IEEE.