

IoT Based Smart Parking Reservation System

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Abstract : The main aim of this paper is to present an innovative parking system that can register the vehicle and owner details to book a slot for parking in the targeted areas such as malls, events, hospital employee parking, etc. In current systems, while entering the parking places, there are long queues due to the slow processing of manual payments. Proposed system overcomes the problem of finding an empty parking slot in commercial areas. Along with that it reduces the disadvantages in the current parking management, and will help to minimize the involvement of humans in the overall process. The project aims to automate the tasks at the parking system with great efficiency and fast operations which will help the user to park their vehicle on the desired spot as per their time schedule.

IndexTerms – IoT, Image Processing, Android, RESTful API, OCR, Smart Parking.

I. INTRODUCTION

Parking is one of the most common problems that everyone faces almost every day in day to day lives. Due to the ever-increasing population and ever-increasing demand for transportation, there has always been a huge gap between the number of vehicles and the parking spaces available. In countries like India, this problem is even severe leading to many traffic management issues like finding a parking slot at a particular time. In public places like shopping malls, hospitals, Movie Theater etc., parking spaces are readily available but people tend to waste a lot of time finding the free parking slots. Moreover, the payments at such public parking places are manual. Hence, it takes a lot of time for a human to collect the payment manually from each vehicle owner that enters the premises. Many slots remain vacant or are not used efficiently. To overcome these common problems with an increase in the need for parking slots at public places effective and efficient parking management system is proposed in this paper which will automate the whole process of Parking Management.

II. RELATED WORK

The conventional parking systems are simple but require considerable manpower, cost, and management. Many times people park their vehicles on the road because parking slots are either already full or at the crowded places like malls, movie theaters having the dedicated parking slots for their customers, due to the peak hour's people are forced to wait in line to get slot vacant. For efficient management of vehicles, parking stations must have an intelligent solution that will automate the work. This vehicle safety is achieved, and overall wastage of time and money is reduced. As proposed by H. K. Khanuja et al. [1] they have used RFID tags for identification of each individual vehicle and REST API for integrating IoT and Android. [2]Rakesh Kumar Lenka and team proposed a Real-time navigation service to the parking space along with a probabilistic emptiness value based on your Estimated Time of Arrival (ETA) to the location and can be accessed from your personal devices. This intelligent system reroutes you to the next nearest parking space if the desired one gets filled midway of your journey. [3]As proposed by Ibai Lana, Javier Del Ser, Manuel Velez, Eleni I. Vlahogianni, the design of a smart parking system is introduced Using Image Processing and Artificial Intelligence. Cameras and ultrasonic sensor were deployed in locations to recognize the license plate numbers, ensuring ticket-less parking. Big data analysis and neural network will be included in the algorithm to provide related parking information and user recommendations. [4]S. Sunmathi et al. has implemented system using a mobile application that is connected to the cloud. The system helps a user know the availability of parking spaces on a real time basis. [5]The System proposed and developed by Jiang Ruili, Wang Haocong, Wang Han, Eoin O'Connell, Sean McGrath is an effective cloud-based smart parking system solution based on the Internet of Things. It constructs each car park as an IoT network, and the data that include the vehicle GPS location, distance between car parking areas and number of free slots in car park areas will be transferred to the data center. The data center serves as a cloud server to calculate the costs of a parking request, and these costs are frequently updated and are accessible any time by the vehicles in the network.

III. PROPOSED SYSTEM

We are proposing a system that would give users the capability to pre-book the parking slot using a mobile and web application. This application would be integrated with a payment gateway in order to reduce the manual intervention required to collect the payments.

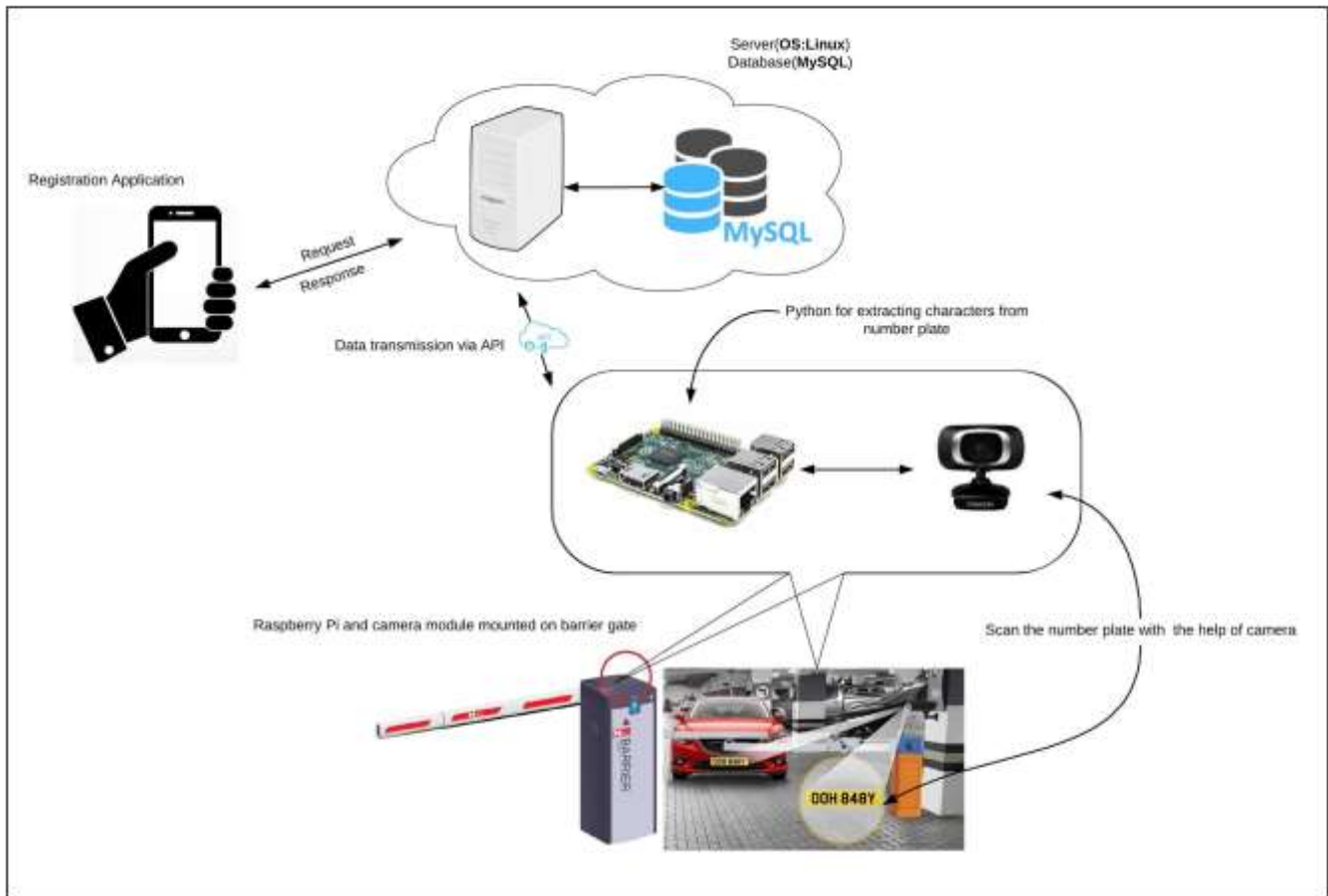


Fig-1-System Architecture

The user will register on the application with correct credentials and then he/she will be able to book a slot for parking the vehicle. Camera and Raspberry Pi module placed at the barrier gate will capture the image of the number plate of the vehicle, the image processing algorithm will extract the characters from the number plate, and it will check in the database if a slot has booked with the same information. If the vehicle number is present in the database, then only the barrier will be opened.

In order to ensure that the same vehicle gets the parking space who has booked it, we can make use of character recognition algorithm(Optical Character Recognition) to verify and authenticate number plates. When a request is sent to REST API , the server transfers the client to the state of the requested resource. REST is a good model for IoT because each device can easily transfer its state information and can standardize a way CRUD operations. For image processing purposes, Raspberry Pi can be used to act as the main processing unit. Along with raspberry pi, we use a camera to capture the image and send it to raspberry pi for further processing using image processing algorithm. Both, raspberry pi along with the camera will be placed on the barrier of the gate. Once the OCR algorithm recognizes the number plate and system validates it, the barrier will be opened if the booking is done for the vehicle with the same number plate. The mobile application intelligently scans for the available parking slots and guides the user about the same. Further, the user would get a notification on their mobile app for the payment of the parking fees. All the user details and corresponding vehicle details are stored in the database and are accessible through API. Thus the proposed system will help improve to use the available public parking spaces efficiently by reducing time in booking and payment for parking slots.

Figure 1 shows overall architecture and the workflow of the system. First user Registration will be done through mobile application or website. Then the data will be stored in our database servers. User will book a free slot and at the time of check-in that is at entrance gate of parking his vehicle number plate will be verified with use of Camera and OCR algorithm. If it Matches with database then the gate will open and user can park his vehicle. Fee will be calculated based on time difference between entry and exit of a vehicle from the parking slot and notification will be sent to the user for paying the generated amount via payment gateway provided in the android and web application.

IV. CONCLUSION

In this paper we have proposed a system which tries to overcome the problems which are observed in current parking systems by providing an effective and efficient solution using IoT and image processing. Proposed system allows only authorized vehicle to enter and park which guarantees security. User will be able to get notifications for tracking his vehicle on application. Parking management system will maintain the information regarding free slots, occupied slots, fee payments and related operations. Therefore by using IoT based Smart Parking Reservation System user can book a parking slot prior to reaching the place with all the real-time payment options available for hassle-free parking slot booking.

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