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SMART PARKING SYSTEM USING IOT

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ABSTRACT

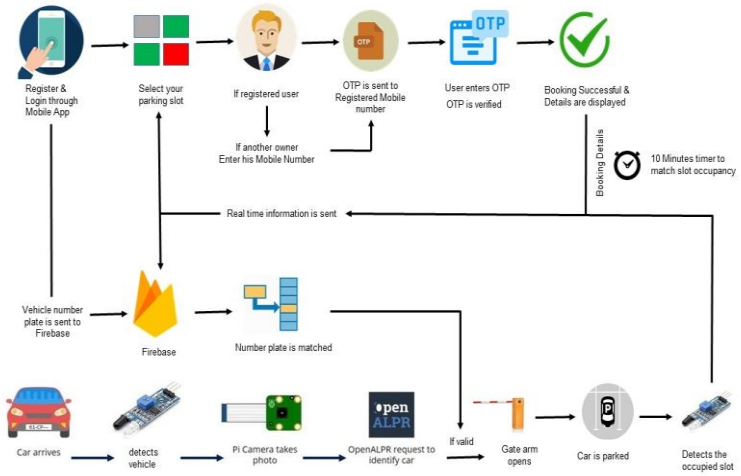
Smart Parking System is a giant stride towards smart cities. It is an intelligent system that takes care of finding a free parking slot for the user and reserving the chosen slot. It frees the user up from the task of locating a free parking slot, thus saving up a considerable amount of time for the user. Along with helping the users out, it also helps achieve the objectives of the smart city by reducing traffic congestion, fuel expenditure and the release of pollutants into the atmosphere. It increases traffic management. This system walks hand in hand with digitalization by maintaining transparency with users. A smart parking system delivers enriched and hassle-free parking experience to users.

Keywords—smart parking system; internet of things; android application; parking sensor; OpenALPR; firebase; node-red

INTRODUCTION

Smart Cities are not the future anymore they are the present. With the evolution of smart cities come responsibilities to manage things more smartly. Smart Parking System is an automated way of searching for a free parking slot and reserving it for your car. This system is a step towards better traffic management and making the process of parking cars easy. The Smart Parking System involves parking your car through a mobile application, thereby reducing a considerable amount of searching time. The Internet of Things (IoT) may be a novel paradigm that's 39 rapidly gaining ground within the scenario of recent wireless 40 telecommunications. It involves sensing through various objects and creating wireless connectivity amongst them to realize a standard goal. Internet of things may be a novel paradigm that has shifted the entire curve of technological advancement many new technologies are often incorporated with the internet of things to return up with more creative solutions. These technologies involve cloud co mputing, machine learning, AI and lots of more. The usage of a combination of these technologies has truly sprung a replacement technological era. Cloud computing is on-demand availability of resources. These resources can range from infrastructure to network to software. Any technological resource you name it, and it's available on the cloud. Cloud computing has given certain advantages that create it hard to ignore. This system is developed by integratingthe three modules 1) Android Application for booking parking slots, 2) Parking Sensor node, 3) License Plate Detection at the parking lot entry. The basic flow of this system is shown in the Fig. 1.

Fig. 1. Flow Diagram of Smart Parking System



ANDROID APPLICATION

From the user's point of view, we have developed an android application that is capable of showing the real-time status of parking slots to the user. This application allows users to select an available slot and proceed further with booking. For the authenticity of the user, we have provided an option to select who's driving the car. If the car is being driven by other than the user then, the application will ask for another person's mobile number and it will send an OTP to it. After verifying OTP the booking confirmation will appear. The booking receipt can be downloaded in PDF file format, which carries booked slot number, name of the user, vehicle number.

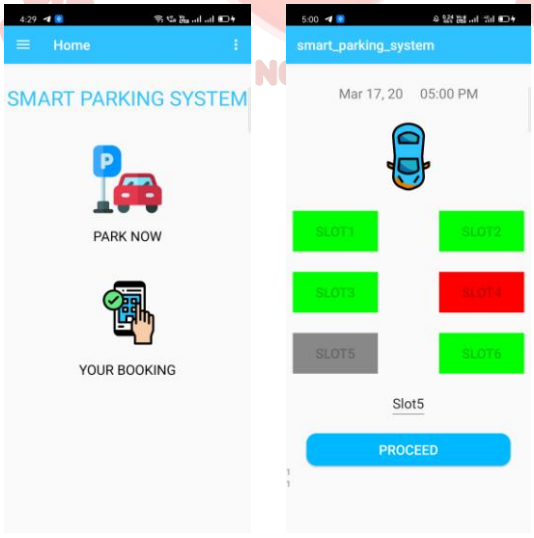


Fig. 2. Smart Parking System Android Application

PARKING SENSOR

In the literature review we analyzed that many proposed Parking System[4][5] included the concept of having many sensors connected to one micro-controller unit, i.e. individual sensors for slots but only one micro-

controller. This reduces the portability and flexibility of the system. Thus, the Parking Sensor is an end device that will be installed in each parking slot.

It comprises of three devices which are:

1) Microcontroller Unit (MCU)

2) IR sensor (for detection)

3) Power Supply Unit

The micro-controller unit we have used for implementation is Node-MCU v1.0. Node-MCU will continuously read IR sensor value and also it will be updating values to Firebase in a real-time fashion. Then these values will be used to show the real-time status of parking slots via android application.

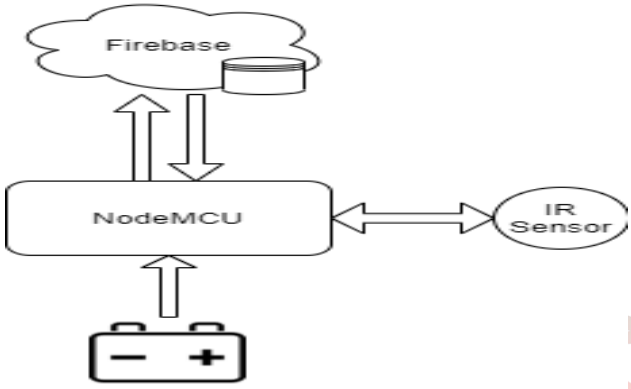


Fig. 3.Parking Sensor Architecture

LICENSE PLATE RECOGNITION

The third module of this project is the detection of the license plate number. For this we are using Raspberry Pi 4, Rpi Camera, Node-Red[2] and Open-ALPR[3] API. The process of detecting a car license plate is automated by a Node-Red flow which will open the entrance gate for cars having a license plate that is used while registering in our application. We have incorporated an IR sensor which will trigger Rpi Camera when a car is detected at the parking lot entrance. The purpose of using License plate detection is to allow valid cars into the parking lot. The Open-ALPR API will be called via a curl request, in response Open-ALPR will send a JSON object which will contain detected number plates with corresponding confidence. Then the msg.payload.plate (contains OpenALPR detected license plate number string) will be mapped with the registered number plates in firebase which is connected to our Android Application. Upon receiving the valid conditional mapping the entrance gate will be opened for 10 seconds to allow the car to enter into the parking lot.

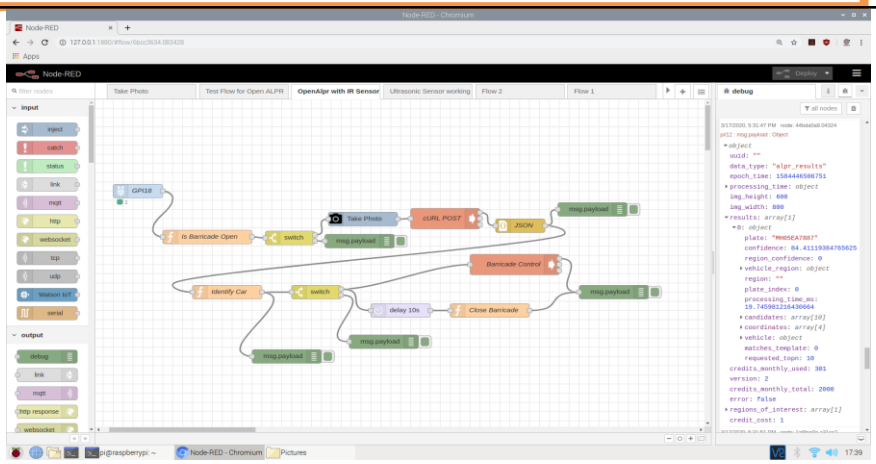


Fig. 4. Node-Red flow for Automation of License Plate Recognition

IMPLEMENTATION

We now have implemented the Smart Parking System by combining these three modules and now it is a workable demonstration of how current parking lots can be transformed into Smart Parking System. Fig. 5 shows the hardware setup of the system

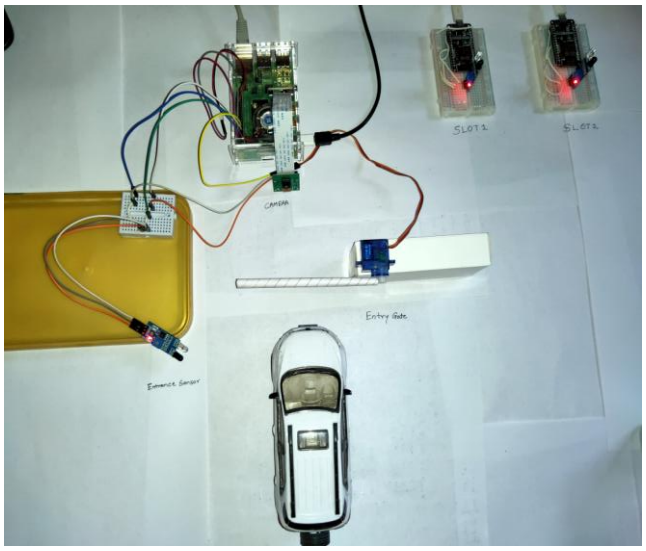


Fig. 5. Hardware Setup of Smart Parking System

FEATURES OF SMART PARKING SYSTEM

o Accurate Detection – the use of IR and camera module leaves no chance for blunder in detection of the slot.

o Probability – the expectant time entered by the user can be used to predict when the slot will free up for other users.

o Security – the camera module provides reliability and security to the vehicles.

o Transparency – the whole system is quite transparent. This is because the whole system is digital with very less or no human intervention leaving no scope for mistakes. The transparency is maintained in every aspect with the user including payment.

o Utility – the user has to pay only for the amount of time he/she is parking his/her vehicle. This helps in keeping the charges to minimum, leading to a pocket-friendly system.

o User authentication – the camera module responsible for authentication is quite efficient. The users will be authenticated based on their booking and license plate recognition.

CONCLUSION

After the implementation of this Parking System, traditional car parking can be transformed into smart parking systems. This helps to reduce traffic congestion and saves time searching for free parking space. With the real-time status of available parking slots users can stay relaxed about available parking wherever they go. The OpenALPR platform helps in authenticating valid license plates which increases security measures of this system. Thus Smart Parking System will reduce parking-related problems[1], time consumption and fuel wastage.

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