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Automated Parking System (V-PARK)

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Abstract - *In fast times like today, automation is being used in every small operation. Automating a process not only makes it fast but also increases accuracy. We proposed a parking facility with full automation using an RFID tag which allows patron in the vehicle to IN and OUT. The main objective is to provide the authenticity of bikers and car drivers in the college and avoid cramming in the parking area by implementing RFID Tag/ Smart Parking System using RFID technology. The user will upload scanned documents into the web portal and these documents will be verified. After the verification is done successfully, the user will be provided with the RFID tag. This project includes components such as RFID readers, RFID tags, Computers, Software, and microcontrollers. This system can also prevent theft of the vehicle in the college as there is restricted and monitored access to vehicles. The Check-ins, Check-outs of the vehicle will be recorded in the database based on the RFID vehicle tag and ID card. When there are parking spaces available on the campus, the user can check the availability/unavailability of spots using a webpage or telegram bot. A backup TOTP* [6] *based QR code authentication is used to make sure that in case of the RFID tag failure, the authorized vehicle is still able to get access to the campus.*

Keywords— RFID, QR code, TOTP, Web Portal, RFID

1.INTRODUCTION

With the increase of vehicles, parking is a major concern at the institute. With the growing number of students entering the campus along with other visitors, it is difficult to maintain the security of these vehicles parked inside the campus. The problem is getting more severe nowadays since a huge percentage of students have their vehicles with a finite number of parking lots available on the campus. The security guards near the parking gate are inadequate to verify all the vehicles entering the campus because of the manual monitoring that simply checks the identity card without verification (assign parking privilege to students) which can lead to unauthorized vehicles entering the campus. Nobody will help with this concern because there is an improper monitoring system that cannot keep a record of the IN and OUT information of the vehicles and availability details. To overcome the precedent problems encountered, we come up with an idea or proposal for an automated parking management system called **"V-PARK"**. Our system is an embedded system with hardware and software requirements. Here, members of an institute request an RFID tag through an application by uploading their documents (RC book, DL) and are stored over the cloud. On the other hand, the admin verifies the documents with the help of the government portal and provides an RFID tag to the member. The tags are stuck over the vehicles and scanned by the RFID reader to keep a record of IN and OUT information. While entering the campus, a monitor will show the number of parking lots available which gets updated continuously. To check the availability/unavailability of parking spots can be done by users with the help of a web page or telegram bot. In case, if RFID tag gets damaged, then there is an alternative like a QR code which will do the same work as RFID tags do. A survey was conducted by us to investigate the problems confronted by the students, faculty members. From the survey's results, we confirm the previously mentioned problems that the students, faculty members are facing, and providing suitable solutions to these problems our proposed system fulfills all the requirements that need to be addressed by us.

2.EXISTING SYSTEM

Existing parking management at the campus is completely manual and allows the students/faculty to enter the premises after showing the security their respective identity cards. Handling the parking lot manually is difficult as the manual process also allows the students that are not eligible, to park inside the campus. Due to this, there is an increase in the crowd and the campus may face a lack of space availability problem for eligible students.

3.LITERATURE REVIEW

The proposed parking management system with a full automation process for parking vehicles is described in this section expressly. Our system includes a registration unit, a verification unit, an RFID unit, a 2-wheeler unit, a 4-wheeler unit, and a QR code generator unit.

Registration unit: In this, members of the institute who want to use the parking facility will have to register themselves through the mobile application. After successful registration and email verification, log in with your credentials and go further by filling up the form and uploading the documents related to your vehicle (RC book /Driving license/Insurance). Students who belong to final year diploma, SE, TE, BE from VIT and all VSIT students are eligible to use it. The form will automatically validate by checking eligibility criteria assigned to the students. There are no eligibility criteria assigned to faculty members so they can easily use it. After submitting the form, it will go to the verification unit and members will wait for an acknowledgment.

Verification unit: In this, the issuer request comes to admin and whatever documents are uploaded by the members are stored over the cloud. Here, the admin is responsible for the verification of documents which is done with the help of the government portal (www.parivahan.gov.in). It is an extra security measure to ensure validity. After the verification, the admin will know the member's RC status and license status. So, based on this admin will send an acknowledgment to the issuer and accordingly issue the RFID tag.

RFID unit: This is the authentication and main unit of our system. As from the previous process when a valid member will issue an RFID tag [2], it will be stick on his/her vehicle. Whenever a member tries to enter the campus, an RFID reader placed on the entry gate will scan the RFID tag. If it is a valid tag, then the vehicle will allow parking on the campus.

2-wheeler unit: This unit comprises of the previous unit, LCD, Arduino microcontroller, Pushbutton, Sensor, and Servo motors. Whenever the tag gets verified by the reader, if it is valid entry gate will open and allow the member to park their vehicle. Based on this, updating of values takes place on an LCD. And at the time of the exit gate sensor will sense the movements of vehicles and accordingly opens the exit gate and updates the value on the display.

4-wheeler unit: This unit comprises Raspberry pi, webcam, and web page. This authentication process will be the same as mentioned in the RFID unit. After entering the campus, raspberry pi gets a signal and further allows the webcam to capture an image of the parking lot. After that raspberry pi process that image and accordingly display the availability/unavailability of lots on the web page, from where member can refer to it while parking.

QR code generator unit: It is an alternative option for the RFID unit. For the QR code, a secret key is generated after submitting the form by each member. This QR code can be used in case if the member's RFID tag is damaged or may have a technical issue. If a member's RFID tag is not detected, then ask for a QR code through a mobile application. QR code is generated using TOTP [6] (time-based one-time password) which gets updated every 30 seconds. The guard who will scan the QR code will have the same secret key as that of the member. If the QR code is scanned successfully, the member is granted access to the parking lot else access will be denied.

4.PROPOSED SYSTEM

Here, we describe our parking system with fully automated called **"V-PARK"** that will accommodate the goals and provide a smart solution for the institute. Our proposed system includes both hardware and software components.

The hardware components include cameras or sensors, microcontrollers, and RFID readers which will be mounted on the entrance and exit gate. The software components will include a mobile application, cloud storage/MySQL, and an admin panel. The mobile application is developed using React native because it can be used on android as well as the iOS platform. Admin panel will be developed using HTML/CSS and PHP where it will show the registered user's feed data. One web page is created where it will show the vacant parking spaces in case of a 4-wheeler. From where admin can verify it from government portal. The cloud service Firebase will act as a mediator for user and admin which will be used to store the documents of users like driving license, RC book and access it from the cloud by admin and provide RFID tags accordingly.

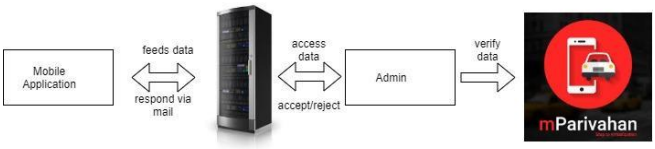


Fig 4.1

The main hardware components of our system are Arduino Uno, Raspberry pi, Webcam, LCD, Ultrasonic sensor, RFID module, Servo motors, etc. A user can park his/her vehicle only if the user has an RFID tag. As soon as the vehicle enters the parking lot, the RFID reader scans the inscribe user's RFID tag details. That data will be received by Arduino and Raspberry pi. In the case of Arduino, the entry gate will open with help of a servo motor and accordingly update values on the LCD. In the case of Raspberry pi, it allows the webcam to capture an image of the parking lot and process further to display the availability of parking space on the telegram bot [8].

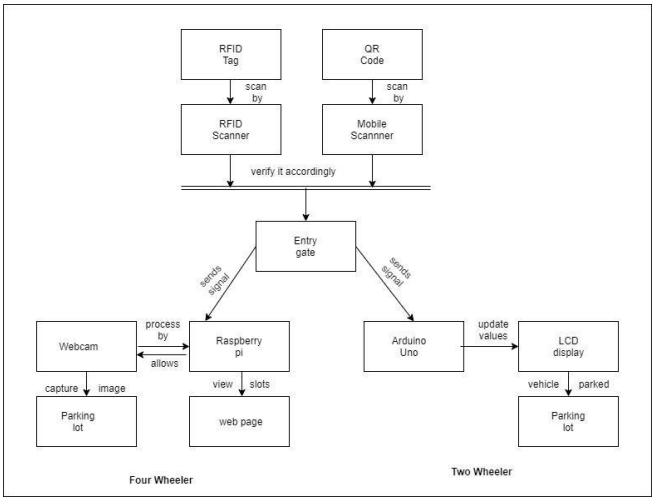
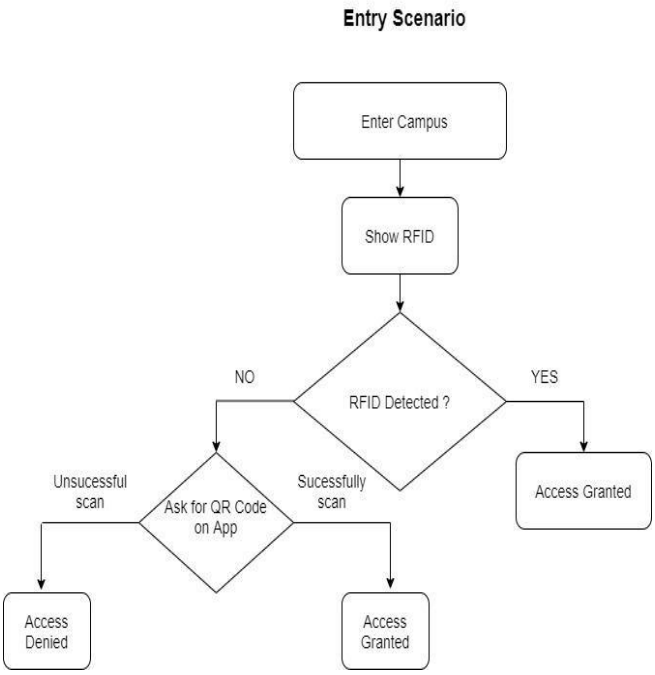
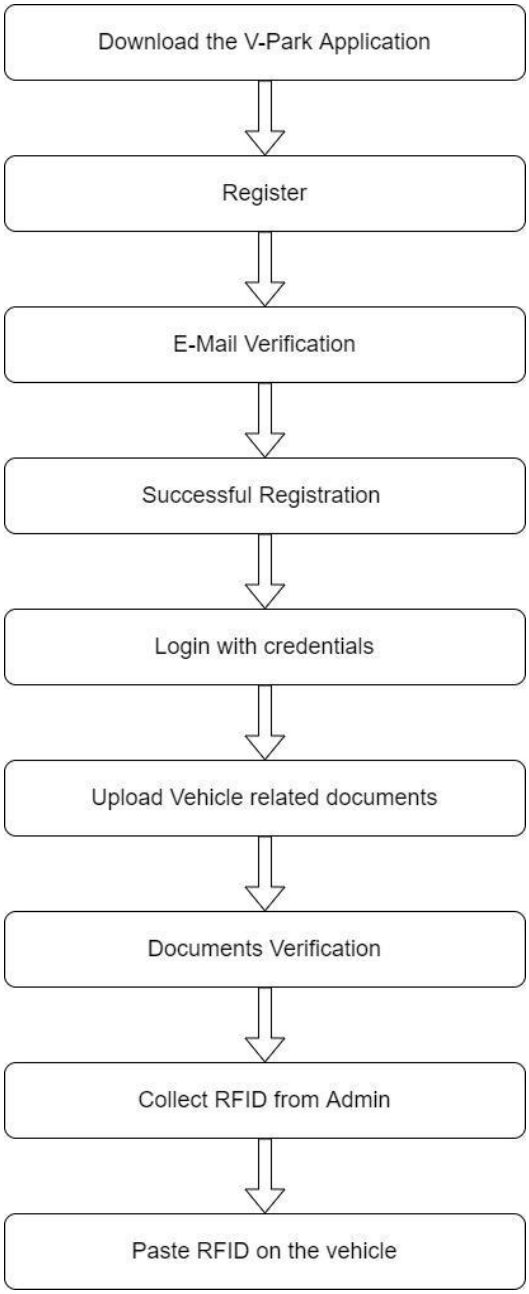


Fig 4.2

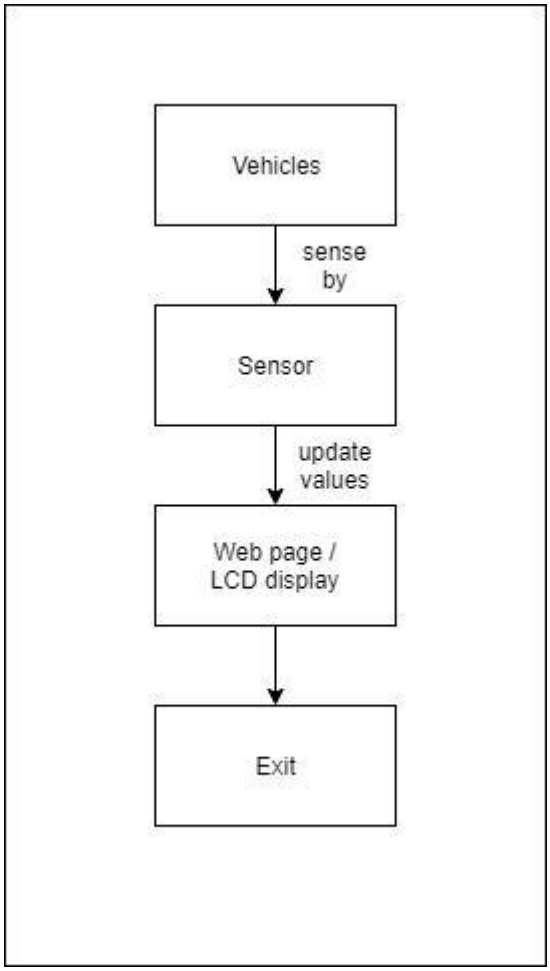
4.1 ACTIVITY DIAGRAM



Flowchart 1 - This represents the entry scenario i.e., the moment a vehicle enters the campus.



Flowchart 2 - This represents the overall flow of registration of the user in the proposed application and the issue of the RFID tag.



Flowchart 3 - This represents the exit scenario for vehicles.

5. FUTURE SCOPE

Smart and automated parking systems are in demand nowadays, which involves real-time access for parking availability to users. The current manual system of our institute does not contain facilities of authentication/authorization of vehicle/members neither there is a parking slot availability checker nor has the count for vehicles. The proposed system will be an automated parking management system. There will be automated authentication and verification process for entering the campus, where only vehicles with valid RFID tags can enter and park. We can further improve it, by using image processing where the vehicle number plate will be scanned at the entry gate and processed accordingly. If that vehicle is registered, only then it will be allowed to enter thus eliminating the use of RFID tags suggested in the current project.

6. ACKNOWLEDGMENT

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