

# RFID BASED SMART CAR PARKING SYSTEM

<sup>1</sup>Akshay Sanjay Bendale, <sup>2</sup>Rutuja Mahesh Kawade, <sup>3</sup>Harshada Sanjay Bhagwat,  
<sup>4</sup>Prof.Veena C (Project Guide)

Department of Electronics and Telecommunication Engineering  
JSPM's Imperial college of engineering and research  
Pune, India

**Abstract-** As in increase in population the main objective is to avoid the slotted car parking area by implementing an efficient car parking system along with a user-friendly application which driver can access easily Normally at public places such as theaters, market area, hospitals, offices and shopping malls, one experiences the discomfort in looking out for a vacant parking slot, though it's a paid facility with an attendant security guard. The parking management system is proposed to demonstrate hazard free parking. This system aims at replacing the conventional parking system with an IoT-based smart parking system by using RFID (radio-frequency identification). The users will be provided an entry card for getting access to the parking slot. The users will also be provided with an android based mobile application, using which they can know about the availability of the parking slot on their mobile phones. The users will need to maintain a minimum amount of balance in their entry card for getting access through the parking system, otherwise, the system will deny the access if invalid card enter. In this way, this smart parking system will help reduce human effort and time by using automation technology.

**Keywords:** RFID, Servo motor, Sensors.

## INTRODUCTION

With growing popularity of Smart Cities, there is always a demand for smart solutions for every domain. The IoT has enabled the possibility of Smart Cities with its over the internet control feature. A person can control the devices installed in his home or office from anywhere in the world by just using a smartphone or any internet connected devices. There are multiple domains in a smart city and Smart Parking is one of the popular domain in the Smart City. The Smart Parking industry has seen a number of innovations such as Smart Parking Management System, Smart Gate Control, Smart Cameras which can detect types of vehicle, ANPR (Automatic Number Plate Recognition), Smart Payment System, Smart Entry System and many more. Today similar approach will be followed and a smart parking solution will be built which will use an ultrasonic sensor to detect vehicle presence and trigger the gate to open or close automatically. The ESP8266 NodeMCU will be used here as the main controller to control all the peripherals attached to it. 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 and also has money in it which they can recharge at kiosks present in the vicinity. In this system, the users are guided to the vacant slot for parking using Video Displays at the entrance of the parking floor, these displays show a visual representation of the parking lot with empty and occupied slots which are green and red respectively. The user is provided with a tag which he receives on registration, this tag is linked with his prepaid 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 charges are automatically deducted from the user's account based on the time spent inside the parking area who are unable to use traditional joystick controllers or other forms of assistive technology, gesture control offers a ground breaking solution that can drastically improve their quality of life.

This technology uses a combination of sensors and algorithms to detect and interpret hand gestures, allowing users to navigate their wheelchairs with ease and precision. The aim of this research paper is to explore the current state of gesture control wheelchair technology, its benefits and limitations, and the future directions for research and development in this field. By examining existing literature and conducting a review of available research studies, this paper will provide an in-depth analysis of the potential applications and impact of gesture control wheelchair technology on the lives of people with disabilities. The IR sensor at the entrance toll gate detects a coming car and will automatically open whenever there is a free slot in the parking lot but if the lot is full, then the gate will not open. A simple mobile app is designed using Blynk server to show the driver the occupied and empty slots in the parking lot where Esp8266 NodeMCU enables the communication between the sensors in the parking lot and any mobile device via a Mobile application. The code for this project is divided into two parts, one part for controlling the Arduino board and the other code is for controlling the ESP8266 NodeMCU connection with the Blynk server. However, both of these code snippets are written using Arduino IDE.

## LITERATURE SURVEY

Feng Yuan Wang and Yi Liu presented a paper in 2017 titled Mechanical Parking System that consisted of a rotary mechanism that allowed all the cars to travel in rotary motion. Cars were loaded and unloaded with the rotary motion of all cars. This system was preferable for 8 to 12 cars. Advantages were that it was easy to operate and easy parking of the vehicle was achieved. Limitations were that all cars need to be rotated to access one car, high initial cost and high maintenance and Complicated Structure. Robin Grodi, Danda B. Rawat and Fernando Rios- Gutierrez published a paper in 2017[2] titled Smart Parking Occupancy Monitoring and Visualization system for smart cities. Robin Grodi, Danda B. Rawat and Fernando Rios-Gutierrez had done work on how the vehicle will occupy in the particular allocated place. RFID sensors detected the presence of the car/vehicle or other

objects in the allocated slot. Once a vehicle was detected, the system needed a way to notify drivers or a parking spot being occupied. The disadvantage was that, the parking place would be detected only to the nearby places and there was no GPS sensor to search the parking slots from far.

## OBJECTIVE

Nowadays in many public places such as hospitals, multiplex systems, malls, offices, market areas there is a crucial problem of car parking. The car-parking area has many slots for car parking. So to park a car one has to look for all the lanes. Moreover, this contains a lot of manual labor and investment. So, there is a need to develop an automated parking system that indicates directly the availability of vacant parking slots in any lane right at the entrance. The vacant parking slot will be shown on LCD Display and Driver can access from Mobile Application also, It involves a system including infrared transmitter and receiver pair in each lane and a display outside the car parking gate. So the person/driver will easily get the vacant parking slot through the Mobile Application. Conventional parking systems do not having intelligent monitoring system and the parking lots are monitored by security guards. Use of parking management system would reduce the human efforts and time with additional comfort. In the proposed system, the display unit displays a visual representation of the parking and it shows the empty and occupied slots which help the user to decide where to park their car. Much time is wasted in searching for parking slots and many a times it creates jams. Conditions become worse when there are multiple parking lanes and each lane with multiple parking slots. 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/ tags with additional features of automatic billing, Entry exit data.

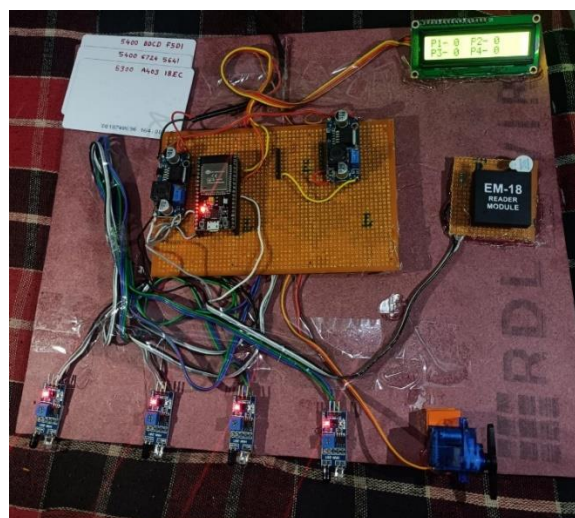
## MOTIVATION

The main motivation for making Car Parking System using NodeMCU is because of huge time people are searching for vacant place to park cars in malls, multiplex systems, hospitals, offices and super markets. In the existing system, one has to spend time before they find out an empty parking spot and also the conventional payment method requires the user to spend a lot of time to complete their transaction. Creating a Smart Parking automated system which not only helps users to make parking much more efficient and faster but also automates the payment gateway using RFID thus saving the user a lot of time.

## DESCRIPTION

There has been a tremendous growth in the number of vehicles on road in past few years. But unfortunately the road networks and road widths have not grown in proportion to vehicle numbers. This has created in huge parking crisis especially in urban areas. At such times smart online parking systems are the need of the hour. This system aims at replacing the conventional parking system with an IoT-based smart parking system by using RFID (radio-frequency identification). The users will be provided an entry card for getting access to the parking slot. The users will also be provided with an android based mobile application, using which they can know about the availability of the parking slot on their mobile phones. The users will need to maintain a minimum amount of balance in their entry card for getting access through the parking system, otherwise, the system will deny the access to enter. In this way, this smart parking system will help reduce human effort & time by using automation technology. In this system NodeMCU plays the important role. The car will having the RFID tag through this tag the car will be verified and the amount will be debited with the help of servomotor the gate will be open. IR Sensor will detect the car present or not on the parking slots. The Driver will also the get the status of the vacant slots on the Mobile Application.

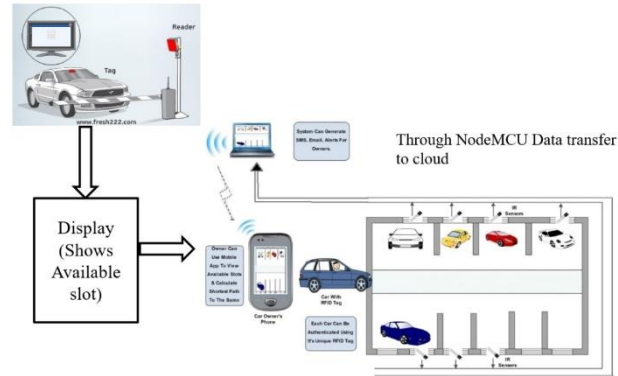
The hardware comprises of IR Sensors, NodeMCU and RFID Sensors which communicates with the Google App Engine and is rendered on various Applications such as the Website and the Mobile Application The rfid scanner is used to scan for user card and transmit the data to microcontroller, the microcontroller transmits the data over iot server to check if the card is valid and if it holds sufficient balance. If the card is invalid or doesn't hold sufficient balance, the entry to the vehicle is denied. If the card holds sufficient balance it is provided entry and then the sensor which is blocked by the car parking indicates which slot the car is parked in.



**Fig 1: HARDWARE DESIGN**

The NodeMCU (Node Micro Controller Unit) is an open-source software and hardware development environment built around an

inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds. However, as a chip, the ESP8266 is also hard to access and use. The IR sensors and the RFID readers send values to the NodeMCU which then is sent to the Google App engine where the database gets updated and these values are later interpreted by the App and the website which can be viewed by the end user. The hardware consists of two Raspberry Pi, 4 IR Sensors, one RFID Reader, Jumper wires and RFID Tags. The IR Sensor is primarily responsible for detecting any object within its range. The RFID Reader is used to read data from the RFID Tags.



**Fig: 2 Architecture**

The diagram above shows the design of an RFID based smart car parking system using Arduino Uno, in which only authorized personal with valid RFID card will have access to the Parking Lot. When the circuit is switched ON information about the availability of slots is displayed on the LCD display. If the card number is matched with saved number in the database, the Arduino will allow the car to park in the secured area. With the help of IR sensors placed in each slot the information about the occupancy of slots is displayed on the LCD display. A welcome message with the name of the card holder is also displayed on the LCD display. As the car enters, information about the free slots i.e., the free slot number is displayed on the LCD display. As the car exits the parking lot, there would be another RFID reader and the exit gate, to prevent multiple entries using a single card. This also prevents the entry of vehicles from the exit side. As the car leaves the parking lot through the exit, the number of available slots is updated and it displays the same on the LCD display.

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