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IOT Based Car Parking System Using RFID

Prof Ramnika Jha [1*], Tejanshu Chakole [2*], Tanvi Shastri[3*],Shubhangi Ghogare[4*].

[1*]Associate Professor Faculty Electronics and Telecommunication of Engineering, D Y Patil College of Engineering, Savitribai Phule Pune University, Pune, Maharashtra, India

[2*3*4*]Student, of Electronics and Telecommunication Engineering, D Y Patil College of Engineering, Savitribai Phule Pune University, Pune, Maharashtra, India

ABSTRACT:

People that hand out printed parking tickets are typically present in car parking lots. This takes up a lot of time and creates heavy traffic. Outside the car parking places, there is a lot of paper trash that is both a traffic and commotion-causing hazard. Paid car parking systems that are based on RFID and IOT can be utilised to prevent all of these. This concept makes use of a rechargeable RFID that can be scanned at the door. A RFID card is part of RFID and IoT-based paid parking systems. The RFID card reader at the parking lot entry allows you to recharge and swipe this card. The microcontroller would get the card details from the card reader after reading them. The card's validity and balance would be checked by the microcontroller. The buzzer will turn ON and the gates won't open if the card is invalid, according to the microcontroller. The gates will open to allow the automobile into the parking area if the card is valid, and the microcontroller will then signal the motor driver.

Keywords: IoT, car parking, RFID, IR Sensors, Node MCU, WIFI, RFID Tag, Smart Parking

INTRODUCTION:

The Arduino Uno, an RFID card, an RFID reader, an IR led, an IR receiver, a motor for the gate, a motor drive, a keypad, an LCD buzzer, an IOT module, and an IOT website are all used in this project. Various objects play important roles in a project. For example, an RFID card is used for user authentication so they can sign in and out. An IR led and IR receiver are used to receive signals and send them to an Arduino Uno so it can control a motor. An IOT LCD panel is provided to display information about the number of parking spaces available, including the number of cars that can fit in each space and the spaces that are available for parking. In this project, the free spots are identified using two IR sensors. To provide a signal on the RFID card's authenticity, we employed Buzzer.

PROBLEM STATEMENT:

Inappropriate spaces created by improper parking can result in collisions between automobiles. There are not enough parking spaces, which causes traffic jams and aggravates drivers. When one car follows another vehicle blindly and without proper identification, this is referred to as tailgating. Most of the time, gates are left open, allowing all kinds of vehicles access to the area. Due to a poor identification system, security officers are powerless to admit only certain vehicles onto the property. The manual gate-opening method is reliant on the presence of the guard. Finding an open spot manually in a huge parking lot with hundreds of accessible spots is an extremely time-consuming operation. It takes a lot of time and is frustrating. The manual parking system entails a variety of duties, including the issuance of tokens, keeping track of arrival and departure times, calculating fees, and ultimately collecting the money. It is crucial that the parking solution uses the least amount of space and can hold the most vehicles possible because the price of land has increased tremendously in cities. In major cities, the average traveller spends 10 to 15 percent of his time trying to find a parking space.

WORKING APPROACH:

Step 1-

the user has to first register himself through the RFID Card which indeed stores his information on the server. This data is useful to track the user later if he tries to breach the system policies. After registering into the parking system his user has the privilege to go into the application and checkout for a free parking space available and then he can actually go and park his car there.

Step 2-

The application is updated each time when the vehicle is detected in the parking area with the help of IR sensors.

Step 3-

IR sensors are responsible to detect if a particular slot contains a bike or not. Vehicle identification is done with the help of RFID tags which are present on each vehicle which indeed help us in calculating the amount to be paid by each user separately.

Step 4-

RFID readers are present in the parking area which captures the RFID information of each user. Before generating the parking bill, IR sensors and RFID tags work together to know which vehicle is being parked, and depending on the time and the amount the corresponding bill is generated.

Step 5-

Node MCU is a processor which performs all of the above functions through the use of the Internet.

Payment of the parking bill is done through online banking. All of the data generated above is stored and retrieved from the database.

WORKING PRINCIPLE:

Entry into the system is made by the user swiping his card. This calls for the entity that checks the balance on the card. In case of enough balance, the car moves further and empty slots based on its size are checked for it. Otherwise, the user is asked to recharge the card.

There is a separate counter for topping up the card which is implemented with the use of a state machine. The options available for topping up are Rs. 50, Rs.100, Rs. 500, or the multiplies of the above.

In case there are no empty slots available, the car is made to exit. If not, the car is charged as per the time it occupied in the parking with the help of a background clock that starts to run as soon as the car enters the 10 | P a g e system and stops at the exit.

This procedure will exclude the unnecessary traffic problem faced in the parking areas. The sense of security will be expanded by using metal detectors, CCTV cameras (click pictures of the number plate and the driver)

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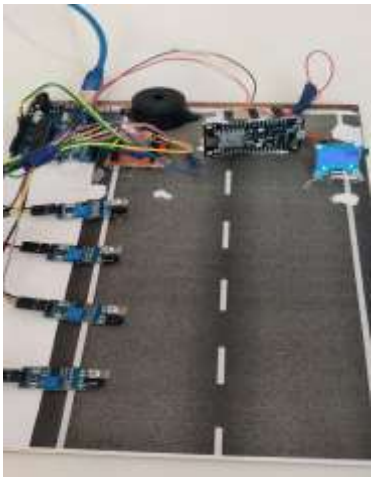
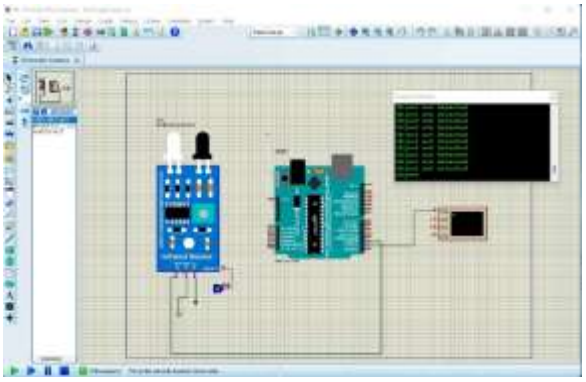




CODE:

```
//RFID
int count = 0;                          // count = 0
char input[12];                         // character array of size 12
boolean flag = 0;                       // flag =0
int UID_1 = 0;
char tag1[] = "3E004E007505"; // Replace with your own Tag ID
char tag2[] = "3E004DFDFF71"; // Replace with your own Tag ID
const int IRSensor = 7;
int buzzer = 6;

//Servo motor
```

```
#include <Servo.h>
Servo myservo;  // create servo object to control a servo
int potpin = 0;  // analog pin used to connect the potentiometer
int val;    // variable to read the value from the analog pin

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  pinMode(IRSensor, INPUT);
  myservo.attach(8);  // attaches the servo on pin 9 to the servo object
  myservo.write(0);
  pinMode(buzzer, OUTPUT);    //Buzzer
  digitalWrite(buzzer, LOW);

  delay(1000);

}

void loop() {
  String tag11 = tag1;
  String tag21 = tag2;
  int IR = digitalRead(IRSensor);
  Serial.println(IR);
  delay(1000);
  if (IR == 0) //Check the sensor output
  {
    Serial.println("Scan RFID Reader of Car.....");

    // put your main code here, to run repeatedly:
    if (Serial.available())
    {
      count = 0;
      while (Serial.available() && count < 12)         // Read 12 characters and store them in input array
      {
        input[count] = Serial.read();
        count++;
      }
      Serial.print("RFID ID:");
      input[strlen(input) - 1] = '\0';
```

```
    Serial.println(input);
    String input1 = input;
    Serial.println("Wait for verification.....");
    delay(2000);
    if (input1 == tag11)
    {
     Serial.println("Gate Open .....USER 1 Authenticated");                    // Print RFID tag number
     UID_1 = 1;
     myservo.write(90);
     delay(1000) ;
     myservo.write(0);
    }
    else if(input1 == tag21)
    {
     Serial.println("Gate Open .....USER 2 Authenticated");                    // Print RFID tag number
     UID_1 = 2;
     myservo.write(90);
     delay(1000) ;
     myservo.write(0);
    }

 else

    {
     Serial.println("Unauthenticated Car");                    // Print RFID tag number
     digitalWrite(buzzer, HIGH); // turn the LED on (HIGH is the voltage level)
     delay(2000); // wait for a second
     digitalWrite(buzzer, LOW); // turn the LED off by making the voltage LOW
    }
   }
  }

else
  { Serial.println("None");

   delay(2000);
  }
delay(1000);
  }
```

TESTING RESULTS AND DISCUSSIONS:

Testing:

1. RFID Reader Communication Test:

- Test Result: The RFID reader successfully detects and reads RFID tags within the specified range.

- Outcome: The RFID reader is functioning properly, and communication with the central parking system is established without any issues.

2. Entry and Exit Gate Testing:

- Test Result: The entry and exit gates open and close properly upon receiving signals from the central parking system.

- Outcome: The gate control mechanisms are working correctly, allowing vehicles to enter and exit the parking area smoothly.

3. Authorization and Access Control Test:

- Test Result: Authorized vehicles are granted access to the parking lot, while unauthorized vehicles are denied entry.

- Outcome: The access control mechanism is effective in allowing only authorized vehicles to park in designated spaces.

4. Occupancy Monitoring and Space Availability Test:

- Test Result: The system accurately tracks and updates the availability of parking spaces in real-time.

- Outcome: Users can easily identify available parking spaces, and the system efficiently manages the occupancy of the parking lot.

5. RFID Tag Readability and Reliability Test:

- Test Result: The RFID tags are properly encoded and consistently read by the RFID reader.

- Outcome: The RFID tags function reliably, ensuring accurate detection and identification of vehicles within the parking system.

6. Integration Testing:

- Test Result: The car parking system components, including the RFID reader, central parking system, user interface, and gate control mechanisms, communicate seamlessly.

- Outcome: All components integrate smoothly, allowing for a cohesive and functional car parking system.

7. Payment and Billing Test:

- Test Result: The payment processing functionality accurately calculates parking fees based on duration and generates valid payment receipts.

- Outcome: Users can make payments for their parking and receive appropriate receipts, ensuring a smooth and reliable payment process.

8. User Interface Testing:

- Test Result: The user interface components, such as LCDs, buttons, and touchscreens, function as intended and provide a user-friendly experience.

- Outcome: Users can easily interact with the system, receive relevant information, and complete parking-related tasks efficiently.

9. Error Handling and Exception Testing:

- Test Result: The system successfully handles and reports errors or exceptions, providing appropriate error messages and taking necessary actions.

- Outcome: Users are informed of any errors or issues, and the system takes corrective measures to ensure smooth operation.

10. Performance and Load Testing:

- Test Result: The system demonstrates satisfactory performance, response time, and scalability, and can handle the expected volume of vehicles and transactions.

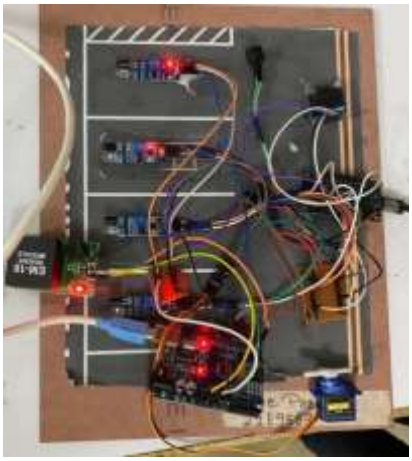
- Outcome: The car parking system performs optimally under various conditions, ensuring a smooth parking experience for users.

Discussion:

This project is designed in such a way that only authorized personnel with a valid RFID card have access to the park. The proposed car parking system uses an RFID reader at the entrance to sense the authorized vehicle and allocates the available parking slots to the vehicle. This system clearly displays the total parking slots available and indicates the occupied slots and non-occupied slots in the display board so that the user can check the slots before

entering the parking area and can park his car in that slot without wasting his/her time. The parking slots are continuously monitored and data is continuously updated in the display board. Unauthorized entry will be denied access to the parking system.

ACTUAL WORKING MODEL:



CONCLUSION:

RFID and IOT-based Paid Car Parking Systems include an RFID card. This card can be recharged and swiped at the RFID card reader at the entrance of the car parking. The card reader would read the card details and send them over to the microcontroller. This project provides more than just information about vacant spaces but also helps drivers to locate an available parking slot in order to reduce traffic problems in the parking area. The system will detect the vehicle plate number and use it to inform the driver where his/her car is parked and also for the purpose of security monitoring. We design this smart parking system using hardware and software based on the IoT concept, and mobile application. The driver can easily check parking information and use mobile payment to pay the parking fee.

The goal of our study is to improve the parking process by reducing the time that is required to park a car. To the best of our knowledge, we are the first to design this kind of device architecture to detect vehicle/registration plate objects and mobile applications.

RFID and VHDL-based Secure Car Parking System is actualized in this project and can be utilized to dispense with the bother of manual operation of parking framework. It is a secure customized parking solution that is cost-effective and which focuses on the main idea of saving space while parking. It is also very easy to maintain the network of cars incoming and outgoing as most of the procedure is software based. The idea also boosts fast parking Our system minimizes the parking waiting time in a large-sized parking facility. It also helps in maximizing their venue generation for the parking facility owners. It would also help reduce the need for manpower in the parking facility which would greatly reduce the cost and errors in the process. Also, this method would minimize the usage of paper ensuring a green system. This work can be further

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