Iot Based Smart Parking System Using RFID

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Abstract- This project presents an RFID-powered multilevel elevator parking system that is Internet of Things based. Effective management is essential when the demand for parking spots rises due to urbanization. Our system integrates sensors, microcontrollers, and RFID readers to track parking availability in real-time across several levels. Secure access control is made easier by RFID tags, which guarantee smooth car entry and exit. We verify the system's efficiency in maximizing space use and improving user experience through testing. This scalable method is a viable way to address issues with urban parking management.

Keywords: RFID, Arduino, Multi-level lift parking, Servo motor.

1. INTRODUCTION

The integration of modern technologies like RFID and the Internet of Things (IoT) has emerged as a possible answer to the growing problems associated with urban parking management. The deployment and benefits of an Internet of Things (IoT) multilevel smart parking system that uses RFID technology are the main topics of this research. This system provides dynamic monitoring, effective space distribution, and improved user experience by utilizing IoT devices and RFID tags within parking infrastructure. This paper seeks to shed light on the potential transformative influence of such a system on urban mobility and sustainability by a thorough examination of its architecture, functionality, advantages, and obstacles. This integrated strategy has promise in tackling the challenges presented by real-time data interchange enabled by IoT and seamless vehicle identification enabled by RFID.

2. PROBLEM STATEMENT

Car crashes can occur from unsightly gaps created by improper stopping. Insufficient stopping spaces lead to traffic obstacles and frustrate drivers. Racing is the term used to describe when one vehicle follows another indiscriminately and without a valid reason to differentiate between the two. The majority of the time, entryways are left open, allowing a variety of vehicles to access the range. Because of a weak system of identification, security personnel are weak to admit that certain vehicles have entered the property. The manual gate-opening method is reliant on how close the watch is. It takes a long time to physically find an open spot in a massive stopping part with hundreds of open spots. It is perplexing and requires some time. It is annoying and takes a long time. A number of tasks are involved in the manual parking system, such as issuing tokens, recording arrival and departure times, computing fees, and eventually collecting the money. Given the increasing price of land in cities, it is imperative that the parking solution maximizes car capacity while utilizing the least amount of area. The typical traveler in a big city spends ten to fifteen percent of his time looking for a parking spot.

Objective & Methodology

To design and develop multilevel lift parking system.
To entreated RFID technology for vehicles identification and access control.
To optimize parking space utilization and enhance security.
To evaluate the performance and effectiveness of the system.

Methodology

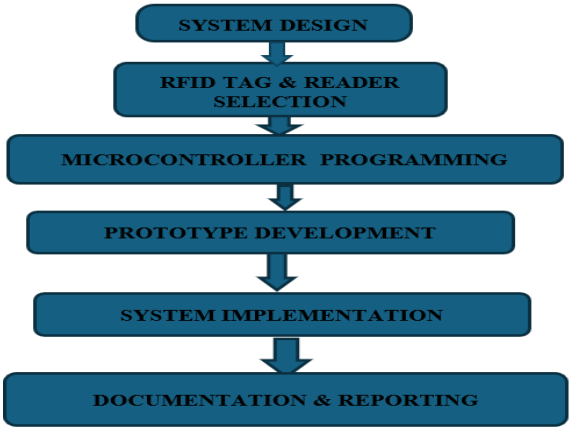

Fig 3.2. Flow diagram of the project

4. WORKING PRINCIPLE

- The user swipes his card to get entry into the system. This requires the organization that verifies the card's balance. If there is sufficient balance, the vehicle advances and vacant spaces are scanned for it according to its dimensions. The user is prompted to recharge the card if not.
- At a different counter, the card can be topped off. Optional toppings include Rs. 50, Rs. 100, Rs. 500, or any one of the mentioned amounts.
- In case there are no empty slots available, the car is made to exit. If not, the car is charged as it occupied in the parking with the help CCTV a background clock that starts to run as soon as the car enters the system and stops at the exit.
- This process will eliminate the unnecessary traffic issue that arises in the parking lots. The use of metal detectors and CCTV cameras (take pictures of the driver and the license plate) will increase the feeling of security.
- To make it easy and much more time saving we also have designed lift in the parking system to avoid the traffic inside the parking.

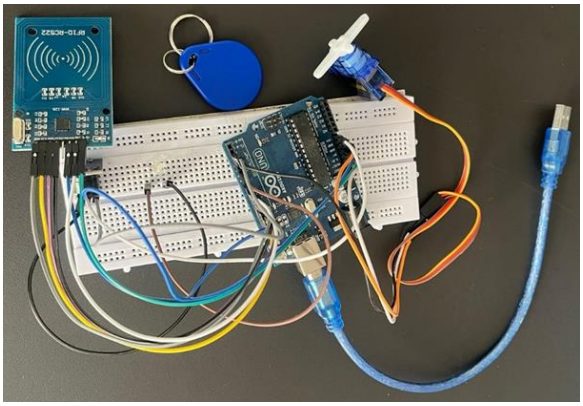

Figure 1 Connection of RFID and Arduino

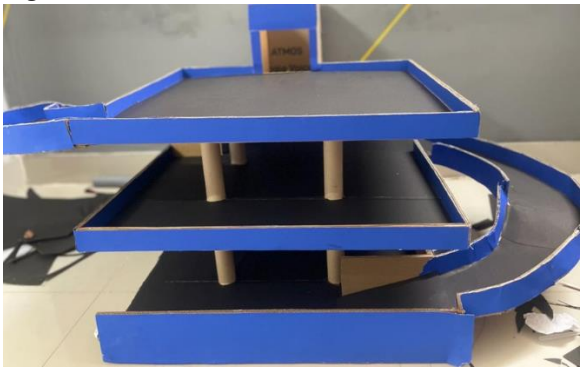

Figure 2: Multi-level Lift Parking System

```
#include <SPI.h>
#include <MFRC522.h>
#include <Servo.h>

#define SS_PIN 10
#define RST_PIN 9
#define LED_G 5 //define green LED pin
#define LED_R 4 //define red LED
#define BUZZER 2 //buzzer pin
MFRC522 mfrc522(SS_PIN, RST_PIN);   // Create MFRC522 instance.
Servo myServo; //define servo name

void setup()
{
  Serial.begin(9600);   // Initiate a serial communication
  SPI.begin();      // Initiate  SPI bus
  mfrc522.PCD_Init();   // Initiate MFRC522
  myServo.attach(3); //servo pin
  myServo.write(0); //servo start position
  pinMode(LED_G, OUTPUT);
  pinMode(LED_R, OUTPUT);
  pinMode(BUZZER, OUTPUT);
  noTone(BUZZER);
  Serial.println("Put your card to the reader...");
```

```
  Serial.println();

}
void loop()
{
  // Look for new cards
  if ( ! mfrc522.PICC_IsNewCardPresent())
  {
    return;
  }
  // Select one of the cards
  if ( ! mfrc522.PICC_ReadCardSerial())
  {
    return;
  }
  //Show UID on serial monitor
  Serial.print("UID tag :");
  String content= "";
  byte letter;
  for (byte i = 0; i < mfrc522.uid.size; i++)
  {
 Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
     Serial.print(mfrc522.uid.uidByte[i], HEX);
     content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
     content.concat(String(mfrc522.uid.uidByte[i], HEX));
  }
  Serial.println();
  Serial.print("Message : ");
  content.toUpperCase();
  if (content.substring(1) == "73 24 8F 0D") //change here the UID of the card/cards that you want to give access
  {
    Serial.println("Authorized access");
    Serial.println();
    delay(500);
    digitalWrite(LED_G, HIGH);
    tone(BUZZER, 500);
    delay(300);
    noTone(BUZZER);
    myServo.write(60);
    delay(5000);
    myServo.write(0);
    digitalWrite(LED_G, LOW);
  }

 else   {
    Serial.println(" Access denied");
    digitalWrite(LED_R, HIGH);
    tone(BUZZER, 300);
    delay(1000);
```

```
    digitalWrite(LED_R, LOW);
    noTone(BUZZER);
  }
}
```

Code Used in Arduino

5. RESULTS AND DISCUSSIONS

5.1. Test of RFID Reader Communication:
Test Goal: RFID tags within the designated range are successfully detected and read by the RFID reader.
Result: There are no problems in establishing communication between the RFID reader and the central parking system.

5.2. Testing the Gates at Entry and Exit:
Test Goal: The entry and exit gates are signaled by the central parking system, and they open and close in the proper sequence.
Results: Because the gate control mechanisms are operating properly cars can enter and exit the parking area with ease.

5.3. Test for Access Control and Authorization:
Test Goal: Unauthorized cars are barred from the parking lot, while authorized cars are let in.
Result: Only vehicles with permission are able to park in allocated spots thanks to the efficient access control mechanism.

5.4. Occupancy monitoring and space availability test:
Test Results: The system accurately tracks and updates the availability of parking spaces in real-time.
Outcome: Users can easily find open parking spaces thanks to the system's efficient occupancy control.

5.5. The readability and reliability test of RFID tags:
Test result: The RFID reader reliably and correctly reads the RFID tags with correct encoding.
Result: The RFID tags work dependably, guaranteeing precise vehicle identification and detection within the parking system.

5.6. Integrity Checking:
Test Result: The user interface, gate control mechanisms, central parking system, and RFID reader all work together perfectly as a car parking system.
Result: A simple integration of all parts enables a well-designed and efficient vehicle parking system.

5.7. Testing User Interfaces:
Test Results: The touchscreens, buttons, and LCDs that make up the user interface work as they should and offer a convenient experience.
Result: Users can effectively complete parking-related tasks, interact with the system, and get the necessary data.

5.8. Exception Testing and Error Handling:
Test Results: The system reacts to errors or exceptions via suitable notifications and by taking the required action. Result: The system takes corrective action to guarantee smooth operation and updates users of any errors or problems.

5.9. Performance and Load Testing:
Results: The system can manage the expected number of vehicles and transactions and shows satisfactory performance, response period, and scalability.

Summary:
The parking system operates at its best in a variety of situations, giving users a seamless parking experience. The park can only be accessed by authorized personnel who possess a valid RFID card, according to the design of this project. The suggested vehicle parking system detects authorized vehicles using an RFID reader at the entrance and allots the available parking spaces to them. arriving at the parking lot and is able to park his or her vehicle there quickly. The data on the display board is updated continuously, and the parking spaces are constantly being observed. The parking system will not allow access by unauthorized individuals.

6. CONCLUSION

An RFID card is included in paid parking systems that are based on RFID and IOT. The RFID card reader at the parking lot's entrance allows you to recharge and swipe this card. The card details would be read by the card reader and transmitted to the microcontroller. In

addition to informing drivers about available spots, this project assists drivers in finding a spot, which helps to lessen traffic issues in the parking lot. The system will recognize the license plate number and use it for security monitoring as well as alerting the driver to where their car is parked. Our hardware and software for this smart parking system are designed with the Internet of Things in mind.

Our study aims to shorten the time needed to park a car, thus optimizing the parking process. To the best of our knowledge, this type of device design for identifying vehicles is unique to us.

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