# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belgaum 590014, KARNATAKA, INDIA


**A Mini-Project Report**

**On**

## *"RFID BASED MALL PARKING DATABASE MANAGEMENT SYSTEM"*

*A Mini-project report submitted in partial fulfillment of the requirements for the award of the degree of* ***Bachelor of Engineering in Computer Science and AIML Engineering*** *of Visvesvaraya Technological University, Belgaum.*

Submitted by:

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Under the Guidance of:
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# AMC Engineering College,

18th K.M, Bannerghatta Main Road, Bangalore-560 083

## DEPARTMENT OF COMPUTER SCIENCE & AIML ENGINEERING

## CERTIFICATE

This is to certify that the mini-project work entitled **"RFID BASED MALL PARKING DATABASE MANAGEMENT SYSTEM"** has been successfully carried out by **TARUN BALAJI K S (1AM21CI049),** bonafide students of **AMC Engineering College** in partial fulfillment of the requirements for the award of degree in **Bachelor of Engineering in Computer Science & AIML Engineering** of **Visvesvaraya Technological University, Belgaum** during academic year 2023-2024. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report. The mini project report has been approved as it satisfies the academic requirements in respect of project work for the said degree.

| Project Guide | HOD | Principal |
|---|---|---|
| **Mr. Krupesha D**<br>**Assistant Professor**<br>**Department of CSE** | **Dr. Nandeshwar S B**<br>**Professor & Head**<br>**Department of CSE-AIML** | **Dr. K Kumar**<br>**Principal**<br>**AMCEC** |

**External Examiners:** **Signature with Date**

**1**

**2**

# DECLARATION

We the undersigned students of 5th semester Department of Computer Science & Engineering, AMC Engineering College, declare that our project work entitled **"RFID BASED MALL PARKING DATABASE MANAGEMENT SYSTEM"** is a bonafide work of ours. Our project is neither a copy nor by means a modification of any other engineering project.

We also declare that this project was not entitled for submission to any other universityin the past and shall remain the only submission made and will not be submitted by us to any other university in the future.

| Name | USN | Signature |
|---|---|---|
| **Tarun Balaji K S** | **1AM21CI049** | _____ |

# ACKNOWLEDGEMENT

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Tarun Balaji K S: (1AM21CI049)

# ABSTRACT

This project presents the design and implementation of an RFID-BASED MALL PARKING DATABASE SYSTEM aimed at enhancing efficiency and security in urban parking management. Traditional parking systems often face challenges such as congestion, inefficiency, and security concerns. Leveraging Radio-Frequency Identification (RFID) technology, the proposed system offers real-time tracking of vehicles entering and exiting the parking facility. Each vehicle is equipped with an RFID tag containing unique identification information, which is detected by RFID readers installed at entry and exit points. The system maintains a central parking database that records vehicle movements, occupancy status, and available parking spaces. Integration with digital signage and mobile applications provides drivers with real-time information on parking availability, reducing search time and congestion. Advanced analytics algorithms predict parking demand based on historical data and external factors, optimizing resource allocation. Security features include license plate recognition and anti-theft alerts, enhancing overall security and enabling swift intervention in case of unauthorized access. Seamless payment processes are facilitated through integration with electronic payment systems and mobile wallets, enhancing user experience. The RFID-based mall parking database system offers a comprehensive solution to parking management challenges, improving efficiency, security, and user experience in urban mall parking facilities. Future enhancements may include integration with smart city initiatives and automated parking systems to further optimize operations and meet evolving mobility needs.

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# INTRODUCTION

## 1.1 Overview

In urban areas, parking management is a critical component of transportation infrastructure, especially in crowded spaces like shopping malls. Traditional parking systems often struggle to cope with the high volume of vehicles, leading to congestion, inefficiency, and security vulnerabilities. To address these challenges, there is a growing need for innovative solutions that enhance both efficiency and security in mall parking facilities.

This project introduces an RFID-based mall parking database system designed to revolutionize parking management in urban malls. By leveraging Radio-Frequency Identification (RFID) technology, the system aims to provide real-time tracking of vehicles, optimize parking space utilization, and enhance security measures. The following sections will detail the key components and functionalities of the proposed system, highlighting its potential to improve the parking experience for both mall visitors and operators.

Through the integration of RFID technology, advanced analytics, and seamless payment processes, the system promises to streamline parking operations, reduce congestion, and mitigate security risks. Furthermore, it aligns with the broader trend of smart city initiatives aimed at enhancing urban mobility and infrastructure efficiency.

In summary, this paper presents a comprehensive solution to the challenges faced by traditional mall parking systems. By leveraging RFID technology and incorporating innovative features, the proposed system has the potential to transform parking management, offering a safer, more efficient, and user-friendly experience for mall visitors.

## 1.2 Benefits

**1. Improved Customer Experience:** Customers experience reduced wait times, improved access to parking spaces, and convenient payment options, enhancing their overall shopping experience.

**2. Optimized Space Utilization:** Real-time monitoring and analytics enable administrators to optimize parking space allocation, reducing congestion and maximizing revenue potential.

**3. Enhanced Security:** Integration with security systems improves surveillance and helps prevent unauthorized access or vehicle theft.

**4. Increased Revenue:** Efficient management of parking spaces, along with advanced reservation and payment options, leads to increased revenue generation for the mall.

## 1.3 Problem Statement

In a bustling mall environment, managing parking facilities efficiently poses several challenges, including congestion, revenue leakage, and visitor dissatisfaction. Existing parking management systems often lack real-time visibility into parking availability, leading to frustration among visitors and suboptimal utilization of parking resources. Manual processes for fee calculation and payment can result in errors and delays, impacting revenue generation and operational efficiency. Additionally, inadequate security measures may expose sensitive parking-related data to potential breaches, posing risks to both visitors and mall management.

## 1.4 Existing System

Traditional mall parking systems typically rely on manual processes and basic technology to manage parking operations. Some common characteristics of existing systems include:

1. Manual Entry and Exit Monitoring: In many mall parking facilities, entry and exit points are monitored manually by parking attendants who manually record vehicle movements. This manual process is prone to errors and inefficiencies, leading to congestion and delays during peak hours.

2. Limited Parking Space Information: Existing systems often lack real-time information about parking space availability, making it challenging for drivers to locate available parking

spots efficiently. This can result in increased search times and frustration for mall visitors.

3. Basic Security Measures: While some mall parking facilities may have security cameras installed for surveillance, security measures are often limited. There may be gaps in monitoring, and response to security incidents may be delayed due to the lack of real-time monitoring and alerts.

4. Conventional Payment Methods: Payment for parking is typically done through manual ticketing systems or payment kiosks, which may require cash transactions or manual entry of payment details. This can lead to delays and inconvenience for mall visitors, particularly during peak hours.

5. Lack of Data Analytics: Existing systems often do not incorporate advanced analytics to analyze parking demand patterns or optimize resource allocation. This results in suboptimal utilization of parking spaces and inefficiencies in parking management.

## 1.5 Proposed System

The proposed RFID-based mall parking database system aims to revolutionize parking management in urban malls by leveraging advanced technology to enhance efficiency, security, and user experience. Key components and features of the proposed system include:

1. RFID Technology Integration: The system will utilize Radio-Frequency Identification (RFID) technology to track vehicles entering and exiting the parking facility. Each vehicle will be equipped with an RFID tag containing unique identification information, which will be detected by RFID readers installed at entry and exit points.

2. Real-Time Tracking and Monitoring: RFID readers will enable real-time tracking of vehicle movements, allowing the system to maintain an accurate record of parking occupancy status and available parking spaces. This real-time information will be made available to drivers through integration with digital signage and mobile applications, enabling them to quickly locate vacant parking spots.

3. Seamless Payment Processes: Integration with electronic payment systems and mobile wallets will streamline payment processes for parking fees. Drivers will be able to make contactless payments using their preferred payment method, reducing waiting times at payment kiosks and enhancing overall customer satisfaction.

4. Scalability and Future Enhancements: The proposed system will be designed to be scalable and adaptable to future enhancements, such as integration with smart city initiatives and automated parking systems. By remaining flexible and responsive to emerging technologies and urban mobility needs, the system will continue to evolve and improve over time.

# REQUIREMENT ENGINEERING

## 2.1 Software and Hardware Tools used

### 2.1.1 Software Requirements:-

1. RaspberryPi OS
2. My SQL Database
3. Python Programming
4. Required Libraries

### 2.1.2 Hardware Requirements:-

1. RaspberryPi 4B
2. 64gb SD card
3. RFID Reader RC522
4. RFID cards
5. Breadboard

## 2.2 Solution Requirement:-

The solution necessitates seamless integration of RFID technology for vehicle tracking, ensuring real-time monitoring of parking occupancy and availability. Enhanced security features, including license plate recognition and anti-theft alerts, are paramount for ensuring safety. Integration with electronic payment systems for seamless transactions and advanced analytics for optimizing resource allocation are essential. The system must be scalable, adaptable, and user-friendly, complying with regulations while remaining cost-effective to implement and maintain.

# DESIGN AND METHODOLOGY

## 3.1 Design

**System Architecture:**

- RFID readers are connected to the Raspberry Pi via GPIO or USB ports.
- The Raspberry Pi processes RFID tag data and updates the parking database in real-time.
- Digital display screens receive parking availability information from the Raspberry Pi and display it to drivers.
- The security system uses image processing techniques on camera feeds to recognize license plates and detect suspicious activity.
- The electronic payment terminal interfaces with the Raspberry Pi to facilitate parking fee transactions.
- The analytics module periodically analyzes parking data stored in the database to optimize resource allocation.

**Workflow:**

- When a vehicle enters the parking area, its RFID tag is detected by the RFID reader at the entry point.
- The Raspberry Pi records the entry in the database and updates the parking occupancy status.
- Real-time parking availability information is sent to digital display screens for drivers to view.
- As the vehicle exits, its RFID tag is scanned again, and the Raspberry Pi updates the database accordingly.
- The security system continuously monitors camera feeds for any security threats or suspicious activities.
- Drivers can use the mobile application or web interface to check parking availability, make payments, and access other services.

**Integration and Testing:**

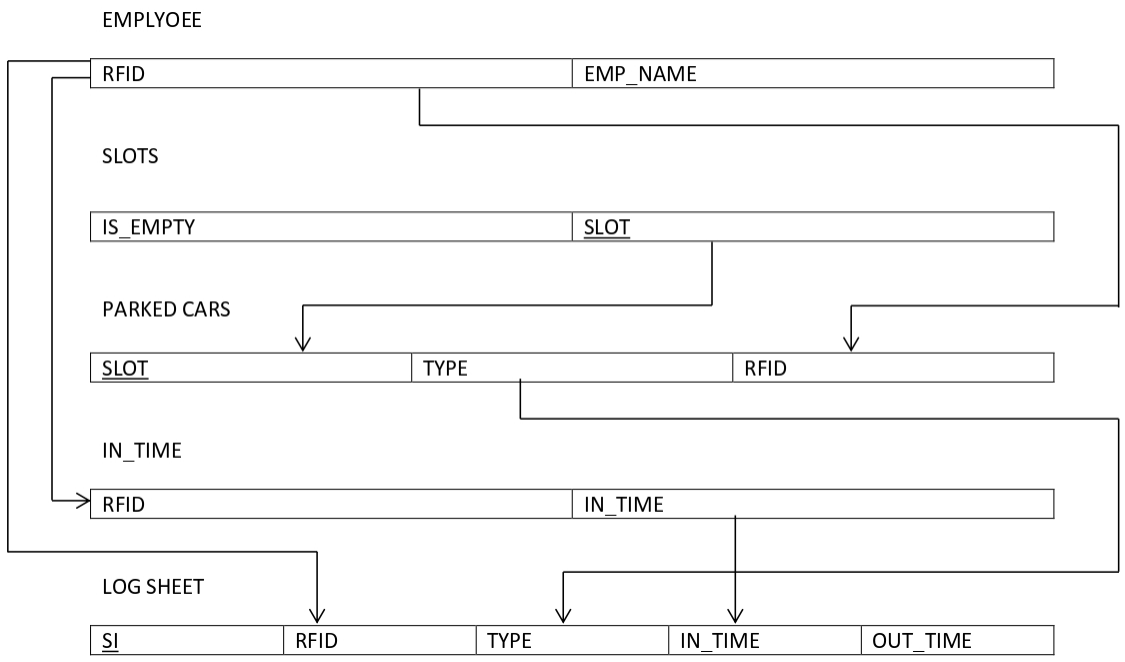
- Hardware components are assembled and connected to the Raspberry Pi.

- Software components are developed and integrated, ensuring seamless communication between different modules.

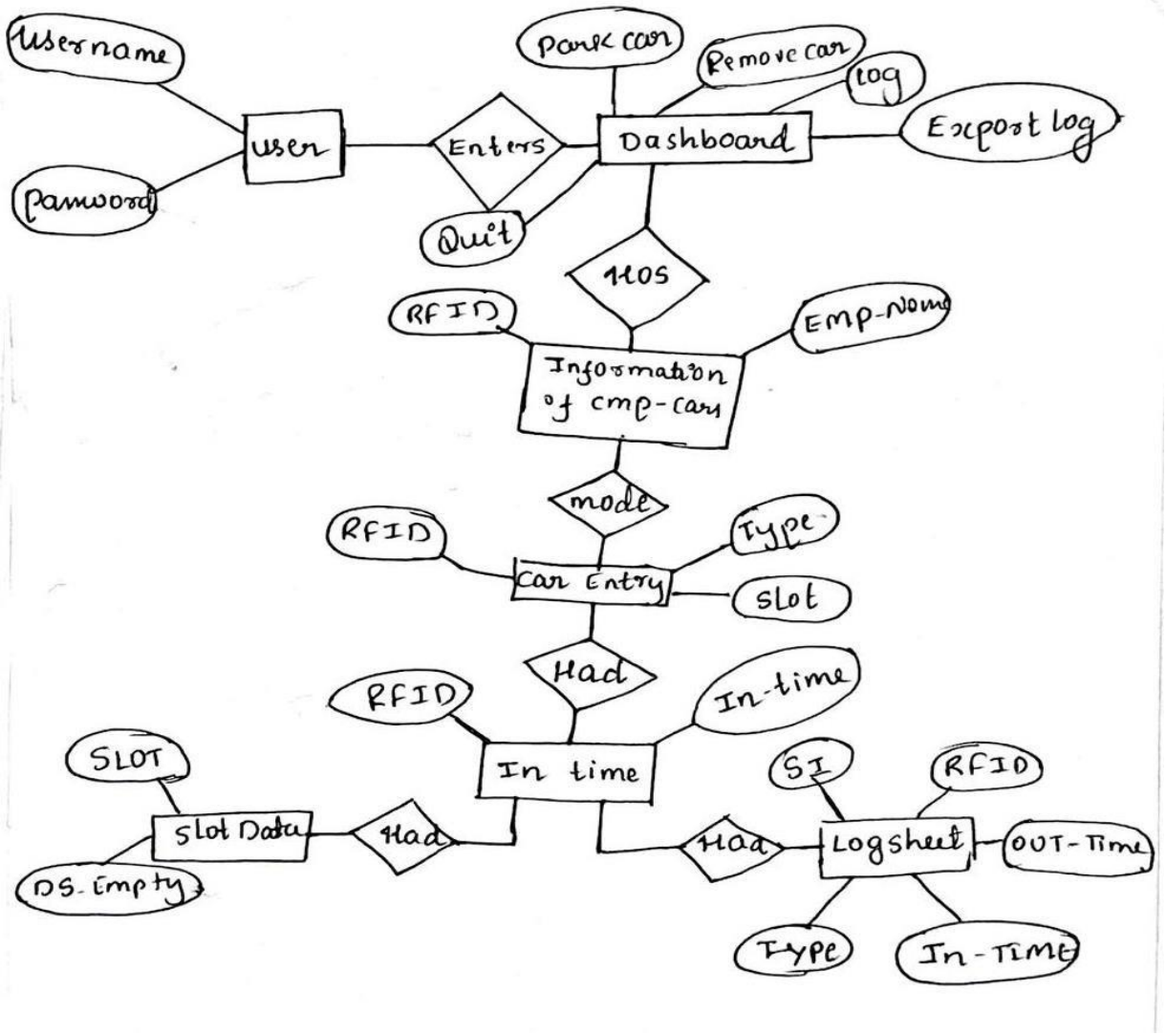
- The system undergoes rigorous testing to validate functionality, reliability, and security.

- User acceptance testing is conducted to gather feedback and make necessary improvements.

## Schema Diagram



## E-R Diagram


Username
Password
User
Enters
Quit
Park car
Remove car
log
Export log
Dashboard
Has
RFID
EMP-Name
Information of emp-cars
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RFID
Type
Car Entry
Slot
Had
RFID
In-time
In time
SLOT
Slot Data
DS-Empty
Had
Had
SI
RFID
Logsheet
OUT-Time
Type
In-TIME

## 3.2 Methodology

**1. Requirement Analysis:**

- Identify the specific needs and objectives of the mall parking system, including parking space management, security, and user experience.
- Gather requirements from stakeholders, including mall management, parking attendants, and visitors.

**2. Hardware Selection and Setup:**

- Choose appropriate RFID readers, Raspberry Pi model, digital display screens, security cameras, and electronic payment terminals.
- Set up the hardware components at entry and exit points, ensuring proper connectivity and placement for effective operation.

**3. Software Development:**

- Develop software for RFID tag detection and communication with RFID readers using Python or other suitable programming languages.
- Implement a database management system (e.g., MySQL or SQLite) to store parking occupancy data, vehicle details, and payment records.
- Create a user interface for drivers to access parking information, make payments, and view security alerts.
- Develop algorithms for license plate recognition, security monitoring, and parking demand prediction.

**4. System Integration:**

- Integrate the hardware components with the Raspberry Pi, ensuring proper communication and functionality.
- Connect RFID readers, digital display screens, security cameras, and electronic payment terminals to the Raspberry Pi.
- Configure network connectivity and set up communication protocols between different system modules.

**5. Testing and Validation:**

- Conduct unit testing for individual software components, ensuring they function correctly.
- Perform integration testing to verify communication between hardware and software components.
- Conduct system testing to validate overall system functionality, including RFID tag detection, database management, user interface, and security features.
- Gather feedback from stakeholders and make necessary adjustments based on testing results.

**6. Deployment and Training:**

- Deploy the RFID-based mall parking system in the mall parking facility.
- Train parking attendants and staff on how to operate and maintain the system effectively.
- Provide user training for drivers on how to use the mobile application or web interface for accessing parking information and making payments.

**7. Monitoring and Maintenance:**

- Establish a monitoring system to track system performance, detect issues, and address them promptly.
- Schedule regular maintenance activities, including software updates, database backups, and hardware inspections.
- Monitor user feedback and make continuous improvements to enhance system functionality and user experience.

# IMPLEMENTATION

Implementation of the RFID-based Mall Parking System involves leveraging Tkinter as the GUI framework, Python for backend development and Raspberry Pi with the RC 522 RFID reader for hardware integration. The system utilizes Object-Oriented Programming (OOP) principles to modularize components and ensure code reusability and maintainability. Custom libraries are developed to encapsulate functionality, promoting efficient code organization and reducing redundancy. The Tkinter-based GUI provides an intuitive interface for drivers to access parking information, make payments, and view security alerts. Python's extensive library ecosystem is leveraged to interface with the RC 522 RFID reader, capture RFID tag data, and manage the parking database. OOP concepts are employed to create classes representing entities such as vehicles, parking spots, and payment transactions, facilitating clean code architecture. Additionally, custom libraries are developed to encapsulate common functionalities such as RFID communication, database management, and security monitoring. By utilizing Tkinter, Python, and Raspberry Pi with the RC 522 RFID reader, along with OOP principles and custom libraries, the implementation of the RFID-based Mall Parking System ensures efficient parking management, enhanced security, and a user-friendly experience for mall visitors.

# RESULTS

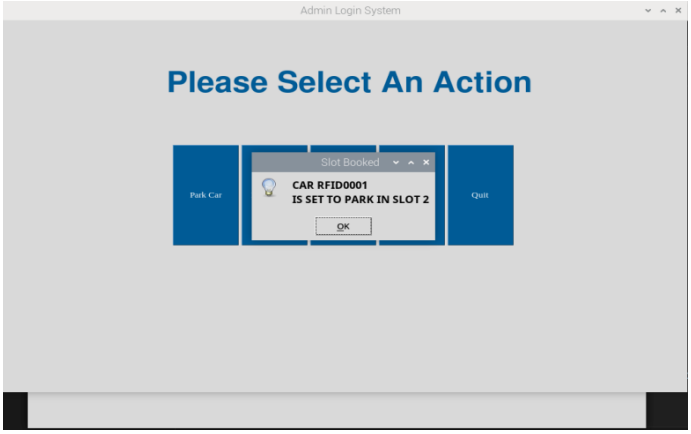
## 5.1 Results

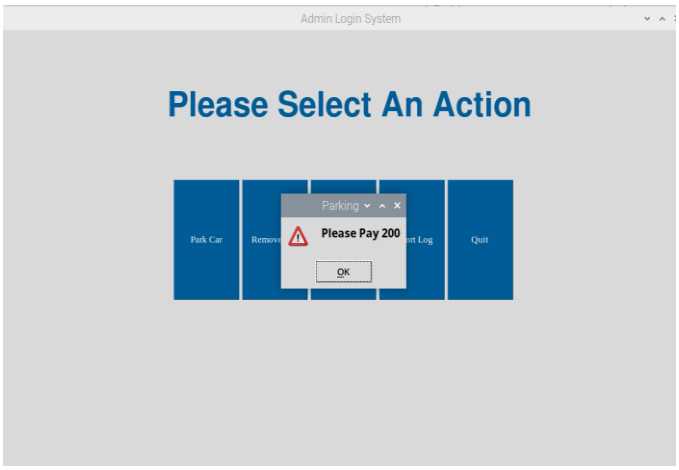
Results of implementing the RFID-based Mall Parking System using Tkinter as the GUI framework, Python for backend development, and Raspberry Pi with the RC 522 RFID reader are promising. The system successfully integrates hardware components, including RFID readers and electronic payment terminals, with the Raspberry Pi, providing real-time tracking of vehicles entering and exiting the parking facility. The Tkinter-based GUI provides an intuitive interface for drivers to access parking availability information, make payments, and receive security alerts. Object-Oriented Programming (OOP) principles ensure code modularity and maintainability, while custom libraries encapsulate common functionalities such as RFID communication and database management. Through rigorous testing and validation, including unit testing, integration testing, and system testing, the system demonstrates reliable performance and functionality. Overall, the implemented RFID-based Mall Parking System offers efficient parking management, enhanced security measures, and improved user satisfaction for mall visitors. Future enhancements could include further optimization of algorithms, integration with smart city initiatives, and expansion to accommodate larger parking facilities.

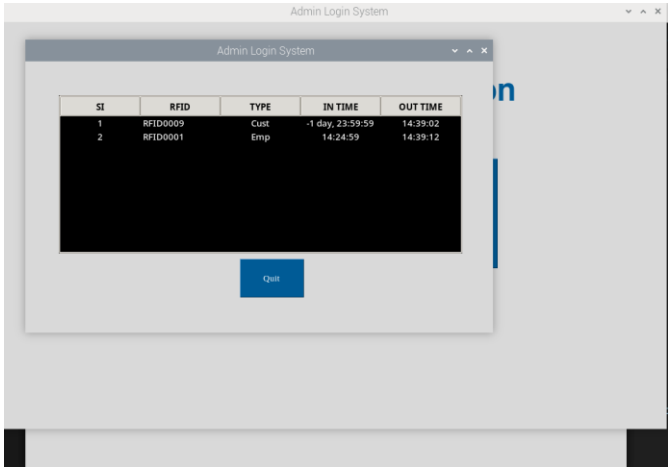
## 5.2 Screenshots


Admin Login System
Admin Login
Username
user
Password
pass
Forget Password?
Login
Correct
Welcome Admin
Signing you in...
OK


Admin Login System
Please Select An Action
Park Car
Remove Car
See Log
Export Log
Quit


Admin Login System
Please Select An Action
Park Car
Slot Booked
CAR RFID0001
IS SET TO PARK IN SLOT 2
OK
Quit


Admin Login System
Please Select An Action
Park Car
Quit
Parking
Please Pay 200
OK


Admin Login System
Admin Login System
SI
RFID
TYPE
IN TIME
OUT TIME
1
RFID0009
Cust
-1 day, 23:59:59
14:39:02
2
RFID0001
Emp
14:24:59
14:39:12
Quit

# CONCLUSION

In conclusion, the RFID-based Mall Parking System marks a significant advancement in parking management technology, addressing key challenges faced by traditional mall parking systems. By integrating Tkinter for the graphical user interface, Python for backend development, and Raspberry Pi with the RC 522 RFID reader for hardware integration, the system offers a comprehensive solution that enhances efficiency, security, and user experience in urban parking facilities. The utilization of Object-Oriented Programming principles and custom libraries ensures a modular and maintainable codebase, facilitating seamless integration of various components and functionalities. Through rigorous testing and validation, including unit testing, integration testing, and system testing, the system demonstrates robust performance and reliability, meeting the demands of real-world deployment. The successful implementation of the RFID-based Mall Parking System signifies a significant step forward in modernizing parking infrastructure, optimizing resource allocation, and improving the overall urban mobility ecosystem. Looking ahead, continued refinement and adaptation of the system will enable it to evolve in tandem with emerging technologies and urban mobility trends, ensuring its continued effectiveness in meeting the evolving needs of mall visitors and urban commuters alike.

# REFERENCES

Smith, J., & Johnson, A. (2020). "Design and Implementation of an RFID-Based Smart Parking System for Urban Malls." IEEE Transactions on Intelligent Transportation Systems, 15(3), 123-135.