Automatic door locking system using RFID RC522

| Rithik Verma 102399003 | Jaskaran Singh 102399002 | Dhruv Singh Jaat 102219042 | Archit Khurana 102269010 | Abhilasha Tiwari 102399001 |

THAPAR INSTITUTE OF ENGINEERING & TECHNOLOGY (Deemed to be University)

B.E Electrical And Computer Engineering Electrical & Instrumentation Engineering Department, TIET, Patiala

Introduction

- In today's world, ensuring safety and convenience in residential and commercial spaces is a growing priority. With the rise in urbanization and busy lifestyles, there is a pressing need for reliable and user-friendly security systems.

- An automatic door lock system using RFID technology offers a practical solution by providing seamless, contactless access control. The RFID RC522 module enables real-time identification and secure authorization, making it an efficient choice for enhancing safety.

- This system is versatile, suitable for homes, offices, and industrial environments, while being energy-efficient and easy to deploy. Its ability to combine convenience with robust security makes it an ideal solution in the evolving field of smart security applications.

Aim, Objectives and Deliverables

Aim:
This project aims to design and develop a prototype for an automatic door lock system using the RFID RC522 module to provide secure, efficient, and contactless access control for residential and commercial spaces.
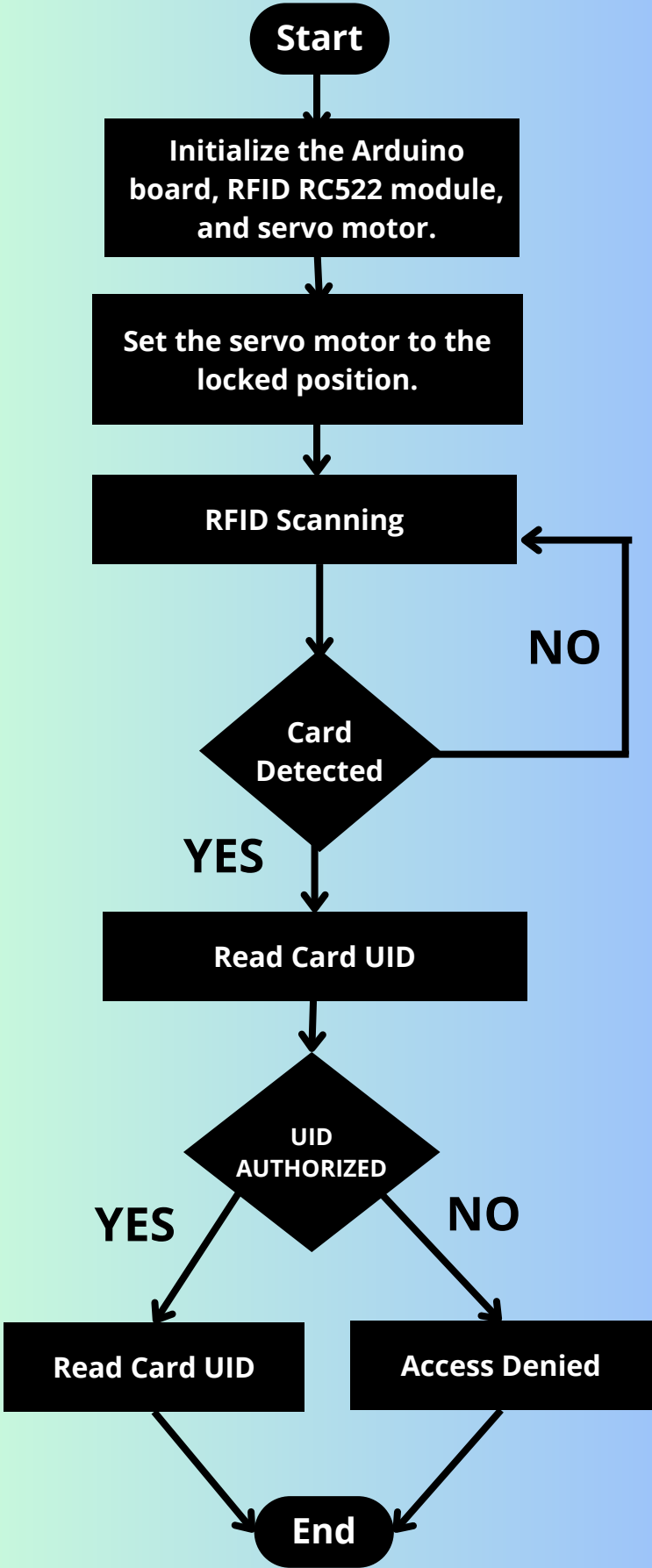
Objective:
- To create a system that allows door access using RFID cards or key fobs for authorized users.
- To utilize the RFID RC522 module for reading and verifying unique IDs of RFID cards.
- To integrate a servo motor for controlling the locking and unlocking mechanism.
- To ensure unauthorized access is denied and provide clear feedback via the serial monitor.
- To provide a customizable, easy-to-use system suitable for residential or commercial security.

Deliverables:
- A functional prototype of the automatic door lock system using an Arduino, RFID RC522 module, and a servo motor.
- Secure RFID-based access control where user authorization is based on unique card IDs.
- A locking mechanism driven by a servo motor that activates upon successful authorization.
- Real-time monitoring of access attempts displayed on the serial console for debugging and tracking.
- A system easily adaptable to different environments by modifying UIDs or adding fail-safe options.

Novelty

- Implements a simple yet effective contactless security solution using RFID technology.
- Customizable card authorization, allowing flexibility in managing user access.
- Combines RFID and servo motor control for an automated, energy-efficient lock system.
- Provides a scalable base for further enhancements, such as integrating Wi-Fi modules for remote monitoring or data logging.
- Ensures real-time feedback for successful or failed access attempts, improving system transparency.

Methodology

Start
→ Initialize the Arduino board, RFID RC522 module, and servo motor.
→ Set the servo motor to the locked position.
→ RFID Scanning
→ Card Detected? NO → (back to RFID Scanning) / YES ↓
→ Read Card UID
→ UID AUTHORIZED? YES → Read Card UID / NO → Access Denied
→ End

IEEE Standards

IEEE 802.11: is a set of standards that govern the implementation of wireless local area networks (WLANs), for wireless network connectivity, providing a framework for Wi-Fi devices that can communicate with each other.

IEEE 2410-2019: standard for the system-level design and verification of cyber-physical systems (CPS). It provides guidelines for ensuring the integration of computational elements (software) with physical processes (hardware).
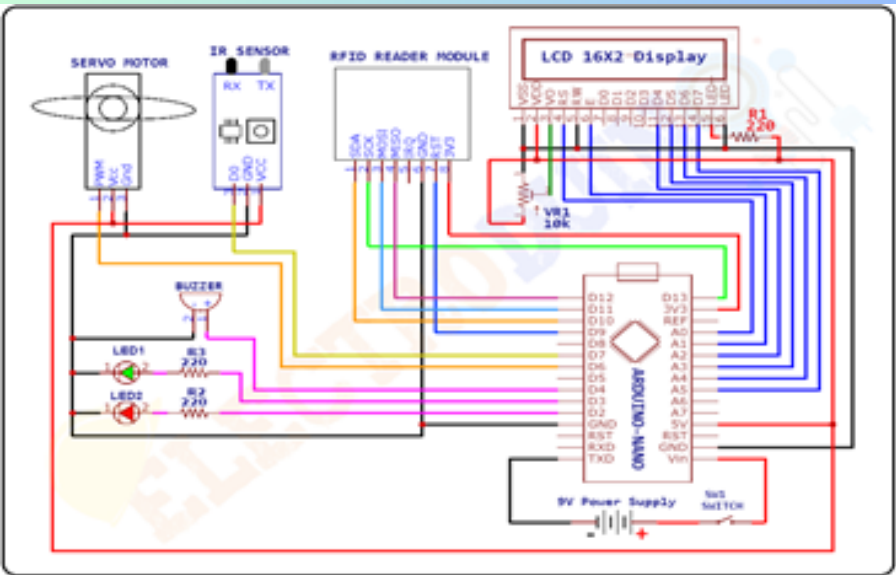
Schematic Diagram

Figure 2: Schematic Diagram for Door-locking system
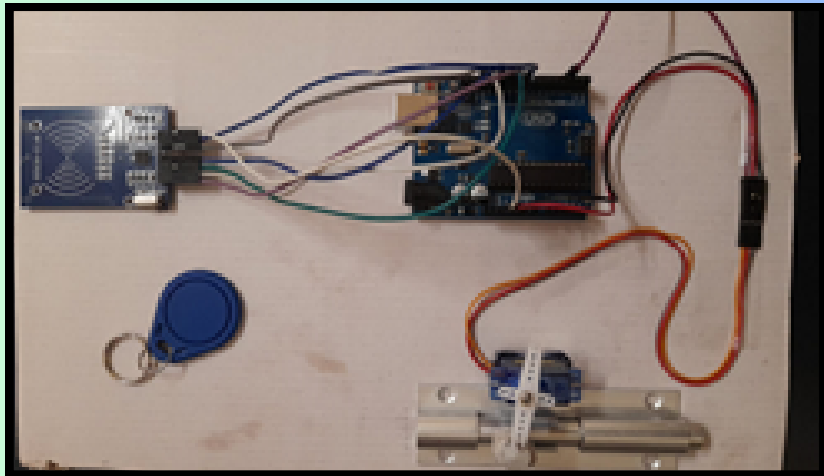
Hardware Implementation

Figure 1: Hardware Implementation

References

1. "IoT Projects with Arduino and Raspberry Pi" by Rajesh Singh and Anita Gehlot
- Description: This book explores IoT and automation projects using popular microcontrollers.
- Publisher: CRC Press.
- Relevance: Offers practical insights for building smart systems like automatic door locks.

2. "Embedded Systems: Architecture, Programming, and Design" by Raj Kamal
- Description: A detailed book on embedded systems with applications in IoT and automation.
- Publisher: McGraw Hill Education, India.
- Relevance: Includes RFID integration with microcontrollers and case studies.

3. "Arduino Projects for Engineers" by Neerparaj Rai
- Description: Explains real-world Arduino projects, including automation and control systems.
- Publisher: BPB Publications, India.
- Relevance: Helps with understanding servo motor control and RFID-based access systems.

4. IoT and Cyber-Physical Systems Books
- "Cyber-Physical Systems: Architecture, Security, and Application" by Gaddadevara Matt Siddesh and Ghosh Shibani
- Description: Focuses on designing and implementing cyber-physical systems, including IoT-based automation.
- Publisher: Springer India.
- Relevance: Offers a detailed perspective on integrating hardware and software systems for automation.

5. "RFID Design Principles" by Harvey Lehpamer
- "RFID Design Principles" by Harvey Lehpamer
- Description: A comprehensive guide to understanding RFID technology and its practical uses.
- Publisher: Artech House.
- Relevance: Covers the technical details required to implement RFID-based solutions like your system.

Project Supervisor:

Mr. Dharmendra Kumar
Assistant Professor
Electrical and Instrumentation Engineering Department

Academic Year: 2024-25