VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590014.

Internship Project

On

"Smart Door Opening System"

Submitted in partial fulfillment of the requirement for the award of degree of

BACHELOR OF ENGINEERING

In

COMPUTER SCIENCE & ENGINEERING

By

1. DEVIKA C R (1AP21CSO17)
2. DIVYA S (1AP21CS018)
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Under the guidance of:

AKHIL SAI

2024 - 2025

A P S COLLEGE OF ENGINEERING

Anantha Gnana Gangothri,
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Project Completion Certificate

I, **Devika C R** (Roll No: 1AP21CS017), hereby declare that the material presented in the Project Report titled **"Smart Door Opening System"** represents original work carried out by me in the **Department of Computer Science and Engineering** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

With My signature, I certify that:

- I have not manipulated any of the data or results.
- I have not committed any plagiarism of intellectual property and have clearly indicated and referenced the contributions of others.
- I have explicitly acknowledged all collaborative research and discussions.
- I understand that any false claim will result in severe disciplinary action.
- I understand that the work may be screened for any form of academic misconduct.

Date: **Student Signature**:

In my capacity as the supervisor of the above-mentioned work, I certify that the work presented in this report was carried out under my supervision and is worthy of consideration for the requirements of the B.Tech. Internship Work.

Advisor's Name: **Dr.Shivamurthaiah** **Guide Name: Akhil Sai**

Advisor's Signature **Guide Signature**

Project Completion Certificate

I, **Divya S** (Roll No: 1AP21CS018), hereby declare that the material presented in the Project Report titled **"Smart Door Opening System"** represents original work carried out by me in the **Department of Computer Science and Engineering** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

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Advisor's Name: **Dr. Shivamurthaiah** **Guide Name: Akhil Sai**

Advisor's Signature **Guide Signature**

Project Completion Certificate

I, **Kotresh Yettinatti** (Roll No: 1AP21EC004), hereby declare that the material presented in the Project Report titled **"Smart Door Opening System"** represents original work carried out by me in the **Department of Electronics and Communication Engineering** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

With My signature, I certify that:

- I have not manipulated any of the data or results.
- I have not committed any plagiarism of intellectual property and have clearly indicated and referenced the contributions of others.
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Date: **Student Signature**:

In my capacity as the supervisor of the above-mentioned work, I certify that the work presented in this report was carried out under my supervision and is worthy of consideration for the requirements of the B.Tech. Internship Work.

Advisor's Name: **Dr. Prakash Jadhav** **Guide Name: Akhil Sai**

Advisor's Signature **Guide Signature**

Evaluation Sheet

Title of the Project: Smart Door Opening System

Name of the Students: 1. Devika C R

2. Divya S

3. Kotresh Yettinatti

External Supervisor:

_____

Internal Supervisor:

_____

_____

Date:

Place:

TABLE OF CONTENTS

Chapter 1

ABSTRACT

This project involves the implementation of a stepper motor control system using a Raspberry Pi, facilitated by the RPi.GPIO library. The setup includes GPIO pins configured for the stepper motor and LEDs, which visually indicate the state of the system (door opening or closing). A predefined stepper motor sequence ensures precise movement in clockwise or counterclockwise directions, controlled by a Python script. The motor operates for a specific number of steps, mimicking the opening and closing of a door. LEDs toggle during motor operation to provide status feedback. The code is robust, with proper GPIO initialization and cleanup to ensure safe operation. This implementation can be extended by integrating sensors or switches for enhanced functionality, such as obstacle detection or user input. The project demonstrates a practical application of Raspberry Pi for motorized automation tasks.

Chapter 2

INTRODUCTION

The smart door opening system is a technologically advanced security and automation solution designed to provide controlled access and enhance safety. The system leverages a Raspberry Pi to orchestrate the interaction between various hardware components, including an ultrasonic sensor, a keypad, a stepper motor, LEDs, and a buzzer. The ultrasonic sensor detects the presence of a person or object near the door by measuring the distance to the obstacle using sound waves. Once a presence is detected, the system prompts the user to input a password through the keypad. The keypad serves as the primary input interface, allowing users to securely enter a predefined password. If the password matches the stored value, the system activates the stepper motor to unlock the door. The motor's precise control ensures smooth and reliable door movement.

Visual feedback is provided through LEDs, with one indicating the door is open and the other signalling it is closed. In case of incorrect password entry or emergency situations, a buzzer sounds an alert, enhancing security by notifying nearby individuals. Additionally, a panic button on the keypad allows users to lock the door instantly in emergencies, triggering the buzzer for added safety.

This system combines functionality and security, offering a user-friendly and automated method for managing access while ensuring quick responses to potential threats. Its modular design and integration of common electronic components make it an ideal solution for homes, offices, and other secure environments.

2.1 Objectives

The objective of this smart door opening system is to enhance security and convenience by automating door access control. It aims to provide a reliable solution for detecting a person's presence, verifying their identity through a password, and granting or denying access accordingly. Additionally, the system incorporates emergency features like a panic button and an alarm to ensure safety during critical situations. By integrating sensors, a keypad, motorized locking, and alert mechanisms, this project seeks to combine efficiency, user-friendliness, and robust security in a single system.

2.2 Problem Statement

- **Lack of Advanced Security Features**: Traditional locks lack modern security enhancements, making them more vulnerable to unauthorized access.
- **Physical Keys Are a Security Risk**: Keys can be lost, duplicated, or stolen, posing a risk to the security of the premises.
- **Limited Emergency Functionality**: Manual locks do not offer emergency mechanisms or alerts, leaving users unprepared for critical situations.
- **No Visual or Audible Alerts**: Traditional systems do not provide immediate feedback to alert users of security breaches or attempted access.
- **Difficult Operation in Emergencies**: Manual locks can be challenging to operate under stress or in urgent situations.

Chapter 3

APPLICATIONS

- **Home Security:** Ensures secure access to residential properties with password protection and intrusion alerts.
- **Office Access Control:** Manages entry in workplaces, enhancing security and restricting unauthorized access.
- **Emergency Situations:** Panic button feature enables quick door locking and alarm activation in emergencies.
- **Retail and Commercial Spaces:** Offers controlled access to sensitive areas such as storage rooms or cash counters.
- **Educational Institutions:** Enhances security in restricted zones like laboratories or staff rooms.
- **Healthcare Facilities:** Provides secure entry to areas like pharmacies and data-sensitive departments.
- **Hotels and Rentals**: Automates access for guests with enhanced security features.
- **IoT and Automation Projects:** Serves as a model for integrating smart security in broader home automation systems.
- **Industrial Applications:** Restricts access to hazardous areas or equipment for safety compliance.
- **Warehouses:** Secures valuable inventory by controlling and monitoring access points.
- **Smart Homes:** Integrates with home automation systems for centralized control and enhanced convenience.
- **Banking and Finance:** Protects vaults, lockers, and other sensitive zones with automated security.
- **Public Institutions:** Enhances security in libraries, museums, or government offices by limiting unauthorized access.
- **Data Centres:** Provides controlled access to servers and IT infrastructure to prevent breaches.
- **Parking Facilities:** Automates gate control and improves safety in parking areas.
- **Event Venues:** Secures entry points during public events to manage and monitor attendees.
- **Research Labs:** Ensures restricted access to sensitive research equipment and materials.

- **Temporary Workspaces:** Facilitates secure, time-bound access for temporary staff or contractors.
- **Educational Demonstrations:** Serves as a learning tool for teaching concepts of automation and security in technical education.
- **Military or Defense Facilities:** Enhances access control for restricted or classified areas.

Chapter 4

COMPONENTS

4.1 Raspberry pi 4 Model B

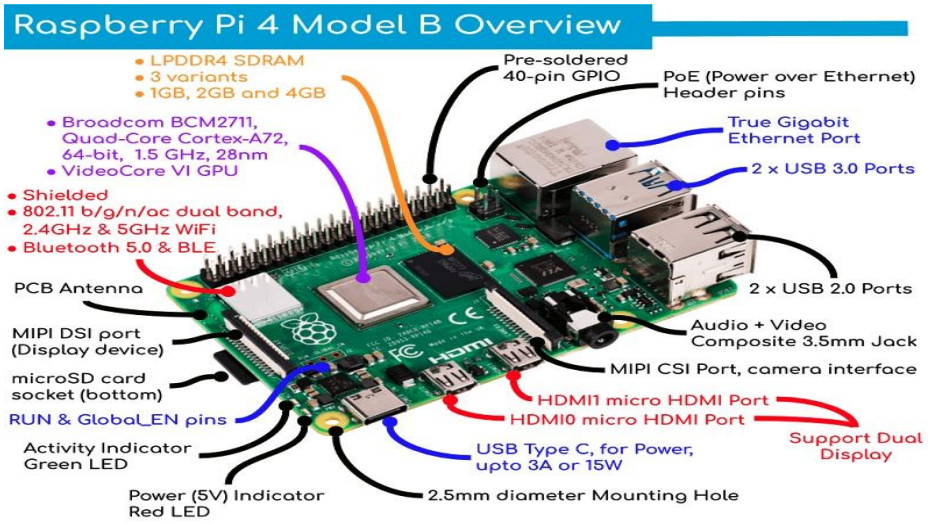

Figure 4.1: Raspberry pi 4 Model B.

The Raspberry Pi 4 Model B is a powerful single-board computer designed for a variety of applications, from education to industrial automation. It features a quad-core ARM Cortex-A72 processor, up to 8GB of RAM, dual micro-HDMI ports supporting 4K output, and USB 3.0 connectivity. Its GPIO pins enable easy interfacing with sensors, motors, and other peripherals, making it ideal for hardware projects. Built-in Wi-Fi, Bluetooth, and Ethernet provide versatile networking options. The Pi 4 is a versatile platform for learning, prototyping, and deploying IoT and embedded systems solutions.

4.2 Stepper Motor

Figure 4.2: Stepper Motor.

A stepper motor is a type of electric motor that rotates in discrete steps, making it highly precise for position control. It is commonly used in applications like robotics, CNC machines, and automated door systems. The motor's direction and steps are controlled by energizing specific coils in a sequence. The stepper motor

in this system is used to physically lock or unlock the door. It operates based on a sequence of electrical pulses defined in the motor sequence array. The direction of rotation (clockwise or counterclockwise) determines whether the door is being opened or closed. The motor rotates a specific number of steps to complete each action.

4.3 Ultrasonic Sensor

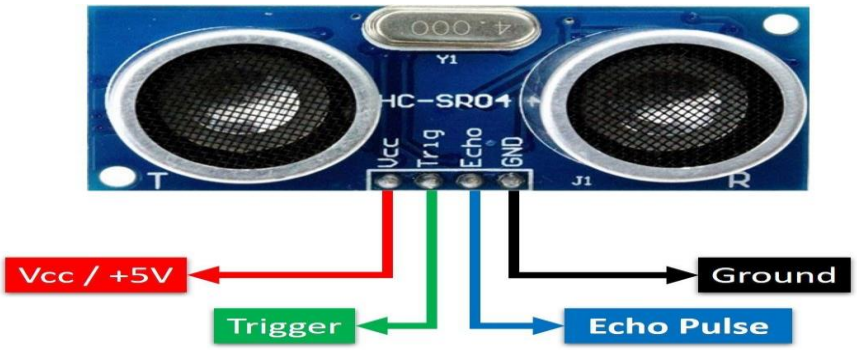

Figure 4.3: Ultrasonic Sensor.

An ultrasonic sensor measures distance using sound waves. It sends out ultrasonic pulses through the TRIG pin and measures the time it takes for the reflected sound to return to the ECHO pin. The time difference is used to calculate the distance. These sensors are widely used in robotics and security systems to detect obstacles or movement. The ultrasonic sensor in the code is used to detect the presence of a human or an object by measuring the distance between the sensor and the obstacle. It uses the TRIG pin to emit ultrasonic pulses and the ECHO pin to receive the reflected signal. The time taken for the pulse to return is used to calculate the distance. If the detected distance is less than 50 cm, the system assumes a human is present and activates further functionalities.

4.4 4x4 Matrix keypad

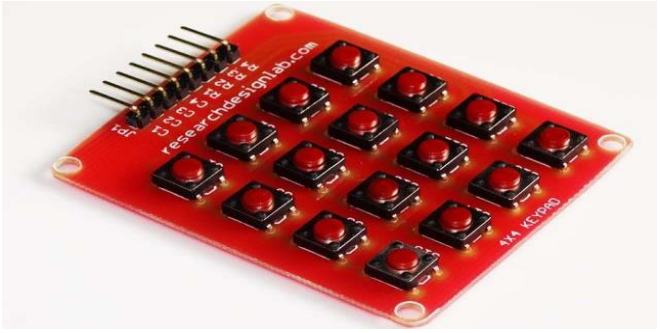

Figure 4.4: 4 x4Keypad

A keypad is an input device consisting of buttons arranged in a matrix format. In this project, the

4x4 matrix keypad is used to enter the password and trigger specific actions, such as unlocking the door or activating panic mode. Each button press sends a signal to the Raspberry Pi through row and column pins, which are scanned to determine the pressed key. Keypads are commonly used in security systems, ATMs, and other devices requiring numeric or alphanumeric input.

Each button press connects a specific row and column, allowing the microcontroller to detect the pressed key. It uses 8 GPIO pins: 4 for rows and 4 for columns, to scan the keypad using techniques like row-column scanning. This keypad is commonly used for numeric input in devices like calculators, locks, and user interfaces. Its compact design and straightforward operation make it ideal for embedded systems and DIY projects.

4.5 LEDs

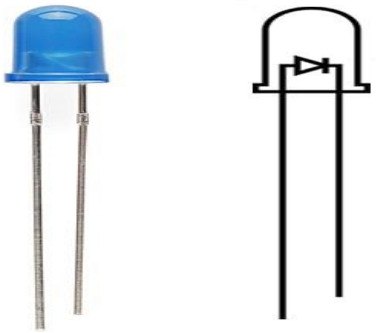

Figure 4.5: LEDs

LEDs (Light Emitting Diodes) are energy-efficient lights used as indicators. In this project, they provide visual feedback about the system's state, such as whether the door is open or closed. LEDs are essential for user-friendly designs in electronics. Two LEDs provide a visual indication of the door's state. The first LED (connected to led3) lights up to indicate the door is open, while the second LED (led4) signals that the door is closed. These LEDs ensure clear communication to the user about the system's current status.

4 .6 Buzzer

Figure 4.6: Buzzer

A buzzer is an audio signaling device that emits a sound when powered. It is used in alarms, alerts, and notification systems. In this project, the buzzer acts as a security alarm, alerting users to incorrect passwords or emergencies. The buzzer serves as an alarm system in the application. It is activated to alert the user in case of incorrect password entry or panic mode activation. When triggered, the buzzer emits a high-pitched sound for a set duration to notify nearby individuals of a potential security breach or emergency.

Chapter 5

FLOW CHART

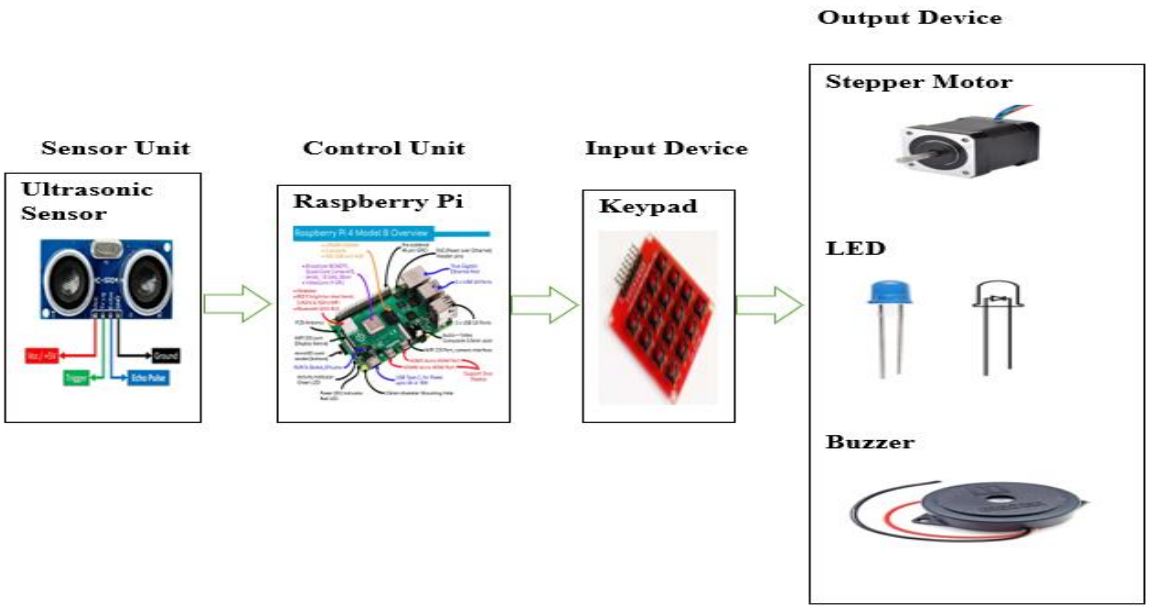

Figure 5.1: Flowchart

The brief explanation of the components in the figure 5.1 which is the flowchart of the project is as follows

- **Sensor Unit:**

  Ultrasonic Sensor: Detects human presence by measuring distance.

- **Control Unit:**

  Raspberry Pi (GPIO): Handles input processing, decision-making, and triggering actions.

- **Input Devices:**

  Keypad: Captures user input for password verification and panic control.

Output Devices:

- Stepper Motor: Opens/closes the door.
- LEDs: Indicate door status (open/closed).
- Buzzer: Signals alarms for incorrect password or panic state.

Chapter 6

CONCLUSION

The system combines input sensors, a control unit, and output devices to enable automated door operations. The ultrasonic sensor detects human presence, the keypad ensures secure user input, and the Raspberry Pi (GPIO) handles decision-making. The stepper motor executes door movement, while LEDs provide status indicators. This configuration is effective for secure and automated door management.

Chapter 7

FUTURE WORK

- **Battery Backup:** Add a power backup system to ensure continuous operation during outages.
- **Multi-Door Control:** Expand functionality to manage multiple doors for larger spaces like offices or apartments.
- **Energy Efficiency:** Optimize components to reduce power consumption and improve sustainability.

Chapter 8

APPENDIX

8.1 Pseudocode