# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590014.

Internship Project

On

# "Smart Home Control System"

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

**BACHELOR OF ENGINEERING**

In

**COMPUTER SCIENCE & ENGINEERING**

By


**1. DEVANTH K R (1AP21CSO16)**
**2. SHASHANK R (1AP21CS032)**
**3. VENKATESH MARUTI SHETH (1AP21IS045)**


**Under the guidance of:**

**SAI CHARAN TEJA**

**2023 - 2024**


## A P S COLLEGE OF ENGINEERING

**Anantha Gnana Gangothri,**
**NH-209, Kanakapura Road, Somanahalli, Bengaluru-560116.**

# Evaluation Sheet

**Title of the Project: Smart Home Control System**

**Name of the Students: 1. Devanth K R**

**2. Shashank R**

**3. Venkatesh Maruti Sheth**

**External Supervisor:**

_____

**Internal Supervisor:**

_____

_____

**Date:**

**Place:**

# Project Completion Certificate

I, **Devanth K R** (Roll No: 1AP21CS016), hereby declare that the material presented in the Project Report titled **"Smart Home Control 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**:

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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: Sai Charan Teja**

**Advisor's Signature** **Guide Signature**

# Project Completion Certificate

I, **Shashank R** (Roll No: 1AP21CS041), hereby declare that the material presented in the Project Report titled **"Smart Home Control 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:

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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.Shivamurthaiah** **Guide Name: Sai Charan Teja**

**Advisor's Signature** **Guide Signature**

# Project Completion Certificate

I, **Venkatesh Maruti Sheth** (Roll No: 1AP21IS045), hereby declare that the material presented in the Project Report titled **"Smart Home Control System"** represents original work carried out by me in the **Department of Information 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.
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**Advisor's Name: Dr.Shivamurthaiah** **Guide Name: Sai Charan Teja**

**Advisor's Signature** **Guide Signature**

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# CHAPTER 1

# ABSTRACT

The Smart Home Control System is a groundbreaking innovation that aims to redefine the way people interact with their homes. By leveraging the capabilities of the Raspberry Pi and a variety of sensors, this system will provide seamless control over household appliances such as lights and fans through a user-friendly web interface. The project envisions creating a centralized platform for efficient and remote management of home functionalities, offering unparalleled convenience to users.

In addition to appliance control, the system will incorporate advanced security features to ensure the safety of residents. Proximity sensors will detect when someone comes close to the door, triggering a buzzer and sending an immediate SMS alert to the homeowner. This real-time alert system will provide users with enhanced situational awareness, reducing the risk of unauthorized access.

The Smart Home Control System will also include environmental monitoring capabilities to detect temperature, humidity, and smoke levels. These features will ensure that users are promptly informed about any hazardous conditions within their homes, enabling timely action to mitigate risks. By integrating all these functionalities, the project aims to deliver a comprehensive solution for modern, interconnected living.

Looking forward, the system will be designed to accommodate future enhancements such as voice assistant compatibility, cloud-based analytics, and the integration of additional smart devices. These improvements will make the system more versatile, scalable, and aligned with the evolving needs of smart homes.

# CHAPTER 2

# INTRODUCTION

## 2.1 Objective

The objective of this project is to create a Smart Home Control System that enables users to remotely operate appliances like lights and fans via a web application. Additionally, the system will provide real-time security and environmental alerts to ensure a safer and smarter living experience

## 2.2 Problem Statement

Smart home systems are transforming the way we interact with our living spaces, yet many challenges persist in their widespread adoption. These include inefficiencies in appliance control, lack of integrated safety measures, and barriers to affordability and accessibility. A unified solution is needed to seamlessly manage appliances, monitor environmental conditions, and provide security features, all while being cost-effective and user-friendly.

**Manual Appliance Control:** Traditional methods of operating home appliances require physical presence, leading to inconvenience, especially for individuals with mobility issues or busy schedules.

**Energy Wastage:** Forgetting to switch off lights, fans, or other appliances results in unnecessary energy consumption, increasing costs and environmental impact.

**Security Risks:** Homes are vulnerable to potential intrusions without real-time monitoring systems to detect motion or proximity threats.

**Environmental Monitoring Gaps:** Existing systems lack capabilities to monitor essential parameters like temperature, humidity, and smoke levels, which are critical for ensuring a safe and comfortable living environment.

**Fragmented Solutions:** Many available smart home systems address only specific problems, such as appliance control or security, without providing an integrated approach.

**High Costs:** Comprehensive smart home solutions are often expensive, making them inaccessible to average households or small-scale applications.

**Complex Interfaces:** Users often struggle with overly complicated control interfaces, limiting the usability and adoption of these systems.

**Lack of Alerts:** Most conventional systems fail to provide timely alerts for hazardous situations like smoke detection or unexpected motion near the house.

**Integration Challenges:** Compatibility with a diverse range of sensors and appliances remains a challenge, limiting the system's ability to adapt to various household needs.

By addressing these challenges, this project aims to develop a holistic Smart Home Control System that integrates appliance control, environmental monitoring, and real-time security features into a single, easy-to-use web-based platform.

# CHAPTER 3

# APPLICATION

The Smart Home Control System has a wide range of applications, offering convenience, security, and efficiency to modern households. Below are some of its key applications:

**Home Automation:**

The system allows seamless control of home appliances, such as turning lights and fans on or off through a web interface. This eliminates the need for manual operation, making everyday tasks more convenient and efficient.

**Energy Management:**

By enabling users to remotely monitor and control appliances, the system helps reduce unnecessary energy consumption. Automated scheduling of appliances, such as switching off lights when not in use, can significantly lower electricity bills.

**Home Security:**

Equipped with a proximity sensor and buzzer, the system detects any unauthorized motion near the door. In case of an intrusion, it triggers an alert, sends an SMS notification to the homeowner, and activates a buzzer, enhancing home security.

**Environmental Monitoring:**

The system continuously tracks environmental parameters such as temperature, humidity, and smoke levels using integrated sensors. This is especially useful for maintaining optimal living conditions and ensuring early detection of potential hazards like fires or extreme temperature fluctuations.

**Real-Time Alerts:**

In addition to local alarms, the system provides real-time alerts via SMS, ensuring that users can respond promptly to critical situations, even when they are away from home.

**Health and Safety:**

By monitoring indoor air quality for smoke or hazardous levels of temperature and humidity, the system promotes a healthier and safer living environment. This is particularly

beneficial for families with young children, elderly individuals, or those with respiratory conditions.

**Smart Integration:**

The system can be integrated into larger IoT ecosystems, working alongside other smart home devices to create a fully interconnected smart home. For example, the smoke sensor can trigger the activation of exhaust fans or air purifiers automatically.

**Remote Accessibility:**

Through its web-based interface, the system allows users to access and control their home environment remotely. This application is particularly valuable for frequent travelers or those managing multiple properties.

**Educational and Experimental Use:**

The project demonstrates the practical implementation of IoT principles, making it a valuable educational tool for students and researchers. It can also serve as a foundation for experimenting with new smart home features and technologies.

**Affordable Smart Home Solution:**

Unlike high-cost commercial solutions, this project provides an affordable and customizable smart home automation system, making it accessible to a broader audience, including middle-income households and small businesses.

# CHAPTER 4

# COMPONENTS

## Hardware Components

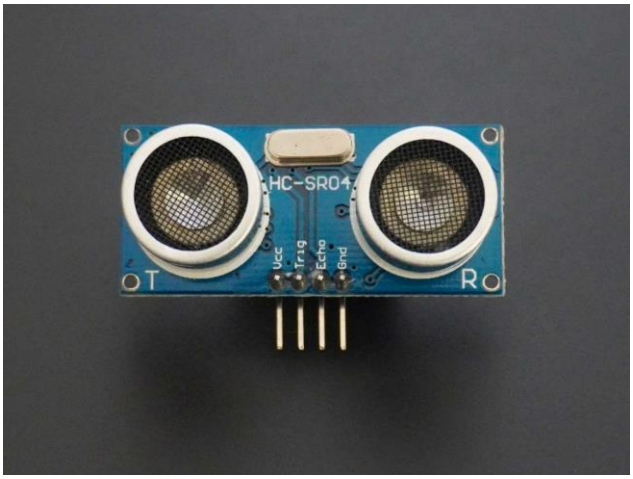
1. **Raspberry Pi –**

The Raspberry Pi is a small, affordable, and powerful single-board computer used to manage the entire project. It acts as the brain of the system, interfacing with sensors and actuators, processing data, and hosting the control application

2. **DHT11/DHT22 Sensor –**

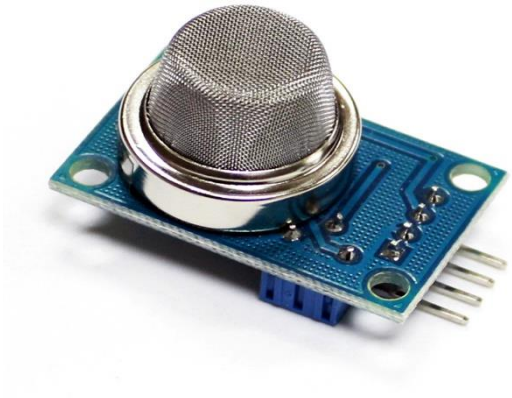

The DHT11 sensor measures both temperature and humidity, providing essential environmental data. It is compact, reliable, and widely used in IoT projects. This sensor ensures accurate monitoring of room conditions. The data collected helps trigger automated system responses to maintain optimal conditions

**Ultrasonic Sensor (HC-SR04) –**




The Ultrasonic Sensor is used to measure the distance to nearby objects. It emits ultrasonic waves and calculates the time taken for the echo to return, providing accurate distance measurements. It helps detect proximity for alert purposes.

3. **Smoke Sensor –**



The Smoke Sensor detects flammable and harmful gases, including methane, propane, and smoke. It provides real-time readings, triggering alerts when gas concentrations exceed safe thresholds. This ensures timely actions in case of emergencies. Its inclusion enhances the safety aspect of the smart system.

4. **Buzzer –**

3.5-5.5V Standard Active Buzzer Module For Arduino

The buzzer serves as an audio alert system to notify users of emergencies or unusual events. It emits a loud sound when triggered by conditions such as high smoke levels or proximity breaches. This immediate auditory feedback ensures users are quickly aware of potential hazards. Its integration enhances the safety and responsiveness of the system.

5. **LEDs –**


The LEDs act as visual indicators for the system's status or alerts. They light up to signify specific conditions, such as proximity detection, system activity, or smoke level warnings. By providing immediate and clear visual cues, LEDs enhance user awareness and complement the auditory alerts from the buzzer.

6. **Power Supply –**

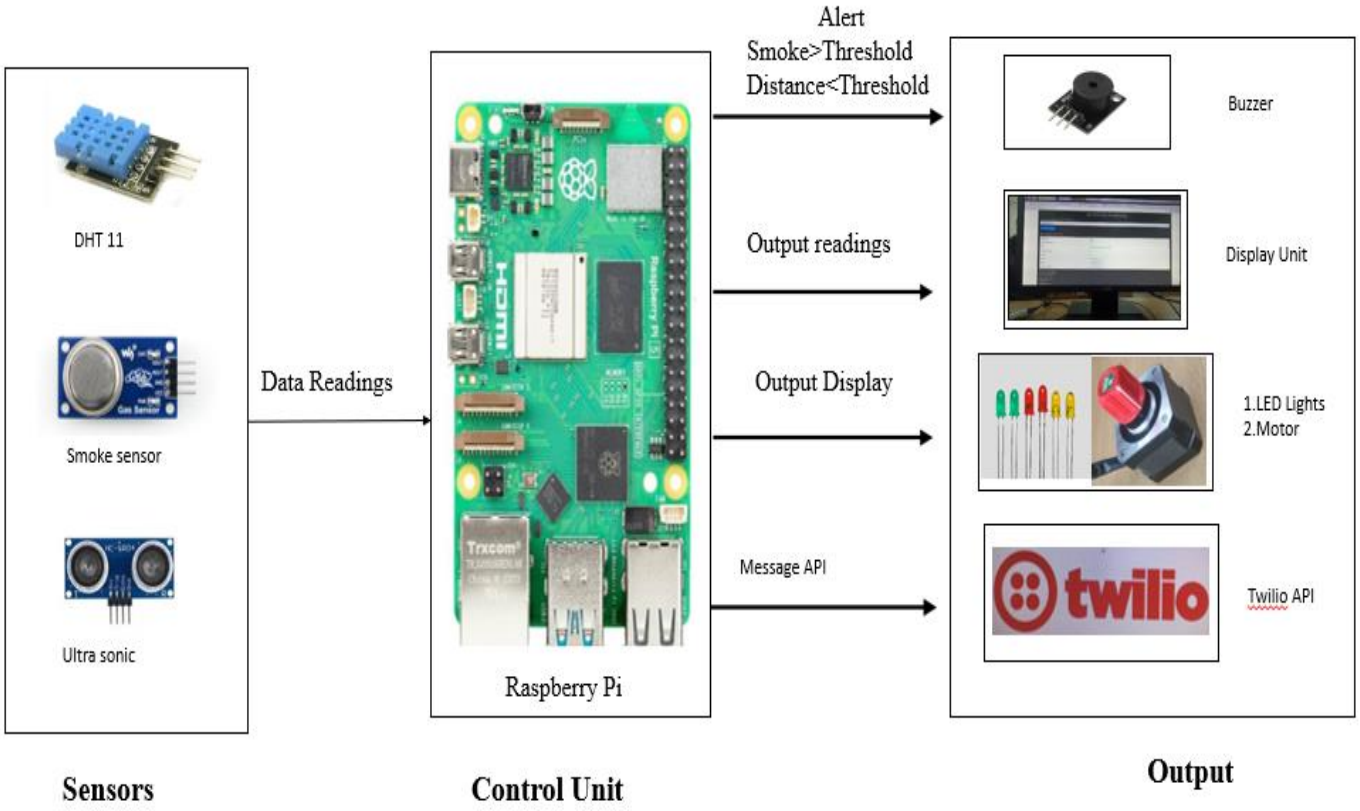

The power supply is essential for providing the necessary electrical energy to the entire system. It ensures stable and sufficient power for the Raspberry Pi, sensors, and actuators like the buzzer, relay, and LEDs. A reliable power supply is critical for the consistent operation of the smart home control system.

## Software Components

1. **Flask Framework –**
   For building the web application.
2. **Twilio API –**
   Sends SMS alerts to the user.
3. **Adafruit Libraries –**
   Interfaces with the sensors.
4. **Python –**
   Implements the logic for hardware interaction and web application functionalities.

# CHAPTER 5

# FLOWCHART



# CHAPTER 6

# FUTURE WORK

- **Integration with Voice Assistants:**
  Incorporate support for voice assistants like Amazon Alexa, Google Assistant, and Apple Siri, enabling voice-based control for enhanced convenience.
- **Advanced Security Features:**
  Add face recognition and motion detection capabilities using cameras to improve home security. This would allow identification of visitors or intruders and trigger alerts or notifications.
- **Energy Efficiency and Smart Scheduling:**
  Implement smart scheduling for devices like lights, fans, and air conditioners based on user routines, optimizing energy usage and reducing electricity consumption.
- **AI-based Predictive Analytics:**
  Introduce machine learning algorithms to predict environmental needs, like adjusting the temperature based on patterns or warning users about potential issues (e.g., appliance malfunctions).
- **Mobile App Development:**
  Develop a mobile app for remote control and monitoring, offering real-time notifications, system status updates, and energy consumption insights for greater user flexibility.
- **Integration with Smart Home Ecosystems:**
  Expand compatibility with smart home platforms like Google Home and Apple HomeKit for seamless integration and unified control across devices.
- **Cloud-Based Data Storage and Remote Access:**
  Utilize cloud storage for sensor data and system logs, providing users with remote access and enabling features like data analytics, automatic updates, and remote troubleshooting.

# CHAPTER 7

# APPENDIX

## 7.1 Pseudo Code

**1. Setup Phase**

1. Initialize GPIO pins for ultrasonic sensor, relay, buzzer, LEDs, and fan.
2. Configure SPI for ADC (MCP3008) to read smoke levels.
3. Initialize Twilio client for SMS alerts.

**2. Main System Initialization**

1. Create a SensorSystem class.
    - Set up GPIO and SPI configurations.
    - Initialize flags and states:
        - **Stop stepper flag** for fan control.
        - **Alert triggered** flag for SMS notifications.

**3. Distance Measurement**

1. **Function: measure_distance**
    - Trigger ultrasonic sensor and calculate the duration of the sound pulse.
    - Convert the duration into distance in centimeters.
    - Return the calculated distance.

**4. Smoke Level Detection**

1. **Function: read_smoke_level**
    - Read analog smoke data from the MCP3008 ADC.
    - Return the smoke level value.

**5. Temperature and Humidity Measurement**

1. **Function: read_temperature_humidity**
    - Read temperature and humidity using the DHT11 sensor.
    - Return temperature and humidity values.

**6. Alert Checking and Notification**

1. **Function: check_alerts**
    - Measure distance and smoke level.
    - Compare values with predefined thresholds:
        - Trigger **distance alert** if the distance is below the threshold.
        - Trigger **smoke alert** if the smoke level exceeds the threshold.
    - If any alert is triggered:
        - Turn on the buzzer.
        - Send an SMS alert (only if not previously triggered).
    - If no alert:
        - Turn off the buzzer.
        - Reset the alert state.

**7. Fan Control**

1. **Function: start_fan**
    - Define a sequence of states for stepper motor coils.
    - Run the motor continuously while the stop flag is unset.
    - Cycle through the sequence with a short delay for smooth operation.
2. **Function: stop_fan**
    - Set the stop flag to halt the fan.
    - Turn off all fan control pins.

**8. Buzzer Control**

1. **Function: buzzer_on**
    - Set the GPIO pin controlling the buzzer to HIGH.
2. **Function: buzzer_off**
    - Set the GPIO pin controlling the buzzer to LOW.

### 9. LED and Additional Device Control

1. **Function: led_on**
    - Set the GPIO pin for the LED to HIGH.
2. **Function: led_off**
    - Set the GPIO pin for the LED to LOW.
3. **Function: l2_on**
    - Set the GPIO pin for the second device (L2) to HIGH.
4. **Function: l2_off**
    - Set the GPIO pin for the second device (L2) to LOW.

### 10. Alert Notification

1. **Function: send_alert**
    - Use the Twilio API to send an SMS with the alert message.

## Execution Flow

1. Initialize the SensorSystem.
2. Continuously:
    - Measure distance and smoke levels.
    - Check for alerts and take appropriate actions (buzzer, SMS).
    - Read and log temperature and humidity data.
3. Manage fan, LEDs, and other devices based on user or alert triggers.

# CHAPTER 8

# CONCLUSION

The Smart Home Control System integrates both hardware and software to provide a user-friendly solution for managing household devices. By utilizing a Raspberry Pi, sensors, and a Flask-based web application, the system allows users to control appliances like lights, fans, and monitor safety aspects such as proximity and smoke detection. The system's ability to send alerts and activate alarms in critical situations enhances home security and convenience.

This project has successfully demonstrated the potential of IoT systems in modern homes, offering real-time monitoring and remote control through a web interface. It highlights the value of automation in improving safety, energy efficiency, and comfort in households. The system's modular design offers scalability, making it adaptable for future enhancements and further integration with other smart technologies.