VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590014

A Mini Project Report

On

"Smart Home Automation System"

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

BACHELOR OF ENGINEERING

By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

A.P.S. COLLEGE OF ENGINEERING

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Project Completion Certificate

I, **Abhishek V** (Roll No: 1AP21CS003), hereby declare that the material presented in the Project Report titled **"Smart Home Automation System"** represents original work carried out by me in the **Department of Computer Science & 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.
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- I have explicitly acknowledged all collaborative research and discussions.
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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.E. Internship Work.

Advisor's Name: **Prof Dr Shivamurthiah** Guide Name: **Akhil Sai**

Advisor's Signature **Guide Signature**

Project Completion Certificate

I, **Diya k Patel** (Roll No: 1AP20IS004), hereby declare that the material presented in the Project Report titled **"Smart Home Automation System"** represents original work carried out by me in the **Department of Information Science & Engineering** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

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Advisor's Name: **Prof Dr Shivamurthiah** Guide Name: **Akhil Sai**

Advisor's Signature **Guide Signature**

Project Completion Certificate

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Evaluation Sheet

Title of the Project: Smart Home Automation System

Name of the Students: Abhishek V, D C Pooja, Diya K Patel

External Supervisor:

_____

Internal Supervisor:

_____

_____

Date:

Place:

ABSTRACT

This project focuses on the development of a **Smart Home Automation System** using **Artificial Intelligence (AI)** and the **Internet of Things (IoT)**, collectively referred to as AIoT. The system employs a **Raspberry Pi** as the central processing unit, which seamlessly integrates multiple sensors and devices to enable intelligent home automation. Key sensors include the **DHT11** for real-time temperature and humidity monitoring, a **gas sensor** to detect harmful gases, and an **LDR (light sensor)** to measure ambient light levels. These sensors work together to provide accurate environmental data, which the system uses to automate devices such as lights, fans, and a coffee maker, represented by LEDs in the prototype.

The system demonstrates how affordable and readily available hardware components can be harnessed to create a scalable and customizable smart home solution. By integrating **real-time monitoring**, **automated control**, and **intelligent decision-making**, this project provides a practical and forward-looking approach to home automation. The results showcase the immense potential of AIoT in addressing modern challenges such as energy wastage, safety, and the demand for convenience, setting the stage for future advancements in smart home technologies.

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CHAPTER 1

INTRODUCTION

1.1 Objective

The primary goal of this project is to leverage AIoT technologies to transform ordinary homes into intelligent living spaces. The system integrates environmental monitoring, device automation, and user-friendly dashboards into one cohesive solution, aiming to:

- Provide real-time data on environmental parameters such as temperature, humidity, air quality, and light levels.
- Automate the operation of household devices, reducing the need for manual intervention.
- Ensure safety through timely alerts and notifications in case of abnormal conditions.
- Optimize energy consumption, making homes more sustainable and cost-efficient.

1.2 Problem Statement

Traditional home systems require manual operation, which can lead to inefficiencies and missed safety hazards. For example:

- **Energy Wastage**: Devices like fans or lights remain on even when not needed.
- **Lack of Safety Monitoring:** Gas leaks or extreme temperatures may go unnoticed, risking property and human lives.
- **Limited Control Options:** Most systems lack centralized control, requiring users to operate devices individually.

  This project addresses these issues by providing a centralized, intelligent, and real-time solution that improves both the functionality and safety of home environments.

CHAPTER 2

APPLICATION

- **Environmental Monitoring**
  - Continuously tracks indoor temperature and humidity, ensuring optimal comfort for inhabitants.
  - Monitors gas levels to detect leaks or harmful concentrations for safety.

- **Device Automation**
  - Automatically turns devices on/off based on environmental inputs, like activating the fan when temperatures rise above a set threshold.

- **Energy Management**
  - Saves energy by turning off lights when natural light is sufficient or devices when not in use.

- **Alerts and Notifications**
  - Sends real-time alerts for critical conditions, such as high gas levels or extreme temperatures, via the dashboard.

- **Interactive Dashboard**
  - Provides users with an interface displaying real-time data, upcoming weather conditions, and operational status of devices.

CHAPTER 3

COMPONENTS

1. **Raspberry Pi (Model 4)**

    - **Function:** Acts as the system's brain, processing sensor inputs and executing control commands.
    - **Features:** Supports multiple sensors and modules via GPIO pins, has built-in Wi-Fi for cloud and dashboard connectivity, and runs Python scripts to manage the system.

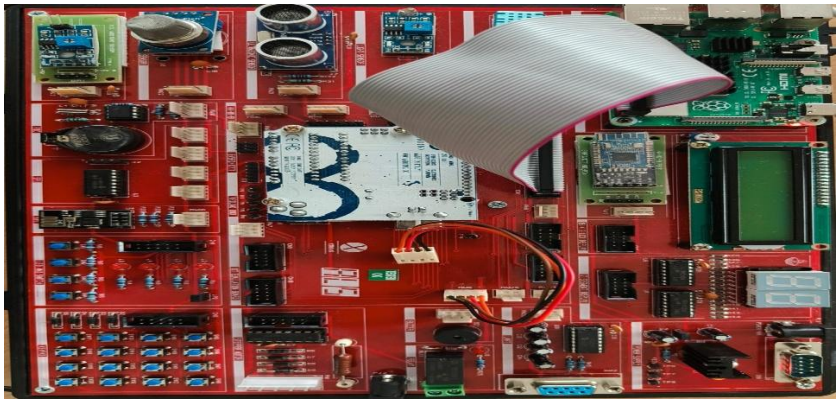


Fig 1.1 Raspberry Pi Kit (model 4)

2. **DHT11 Sensor (Temperature and Humidity)**

    - **Function:** Measures the indoor temperature and humidity levels.
    - **Specifications:**
        - Accuracy: ±2°C for temperature, ±5% for humidity.
        - Operating Voltage: 3.3–5V.
    - **Role:** Provides data for comfort monitoring and automating fans or HVAC systems.

Fig 2.1 DHT11 Sensor

3. **Gas Sensor (e.g., MQ-2 or MQ-5)**

- **Function:** Detects the presence of hazardous gases like LPG, methane, or smoke.
- **Specifications:**
  - Detectable Concentrations: 200-10000 ppm (parts per million).
  - Operating Voltage: 5V.
- **Role:** Alerts users in case of gas leaks, enhancing safety.

Fig 3.1 Gas Sensor

4. **Light Sensor (LDR - Light Dependent Resistor)**

- **Function:** Measures ambient light levels to determine if artificial lighting is needed.
- **Specifications:**
  - Resistance varies inversely with light intensity.
  - Operating Voltage: 3.3–5V
- **Role:** Automates lights based on daylight availability.

Fig 4.1 Light Sensor

5. LEDs

- **Function:** Represent household appliances like Coffee Maker, Lights, and Fan in the prototype.
- **Specifications:** Operate at 2 – 3.3V.
- **Role:** Visually indicate device statuses and mimic actual appliance behaviors.

Fig 5.1 LED

6. Dashboard

- **Function:** A user interface for monitoring and controlling the system.
- **Features:**

  Displays real-time data from sensors.

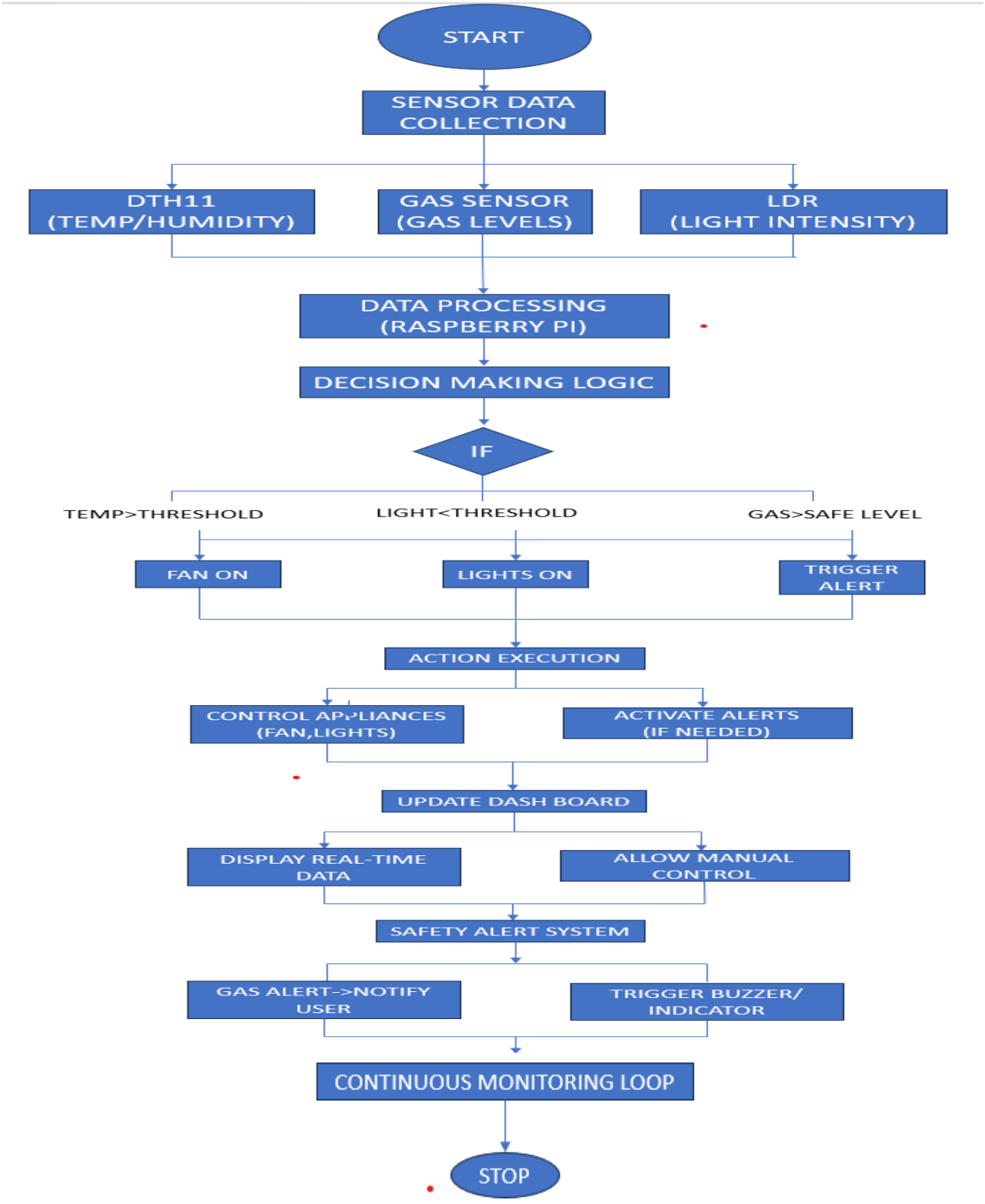
  Allows users to turn devices on/off manually.

  Includes weather updates and time-based greetings.

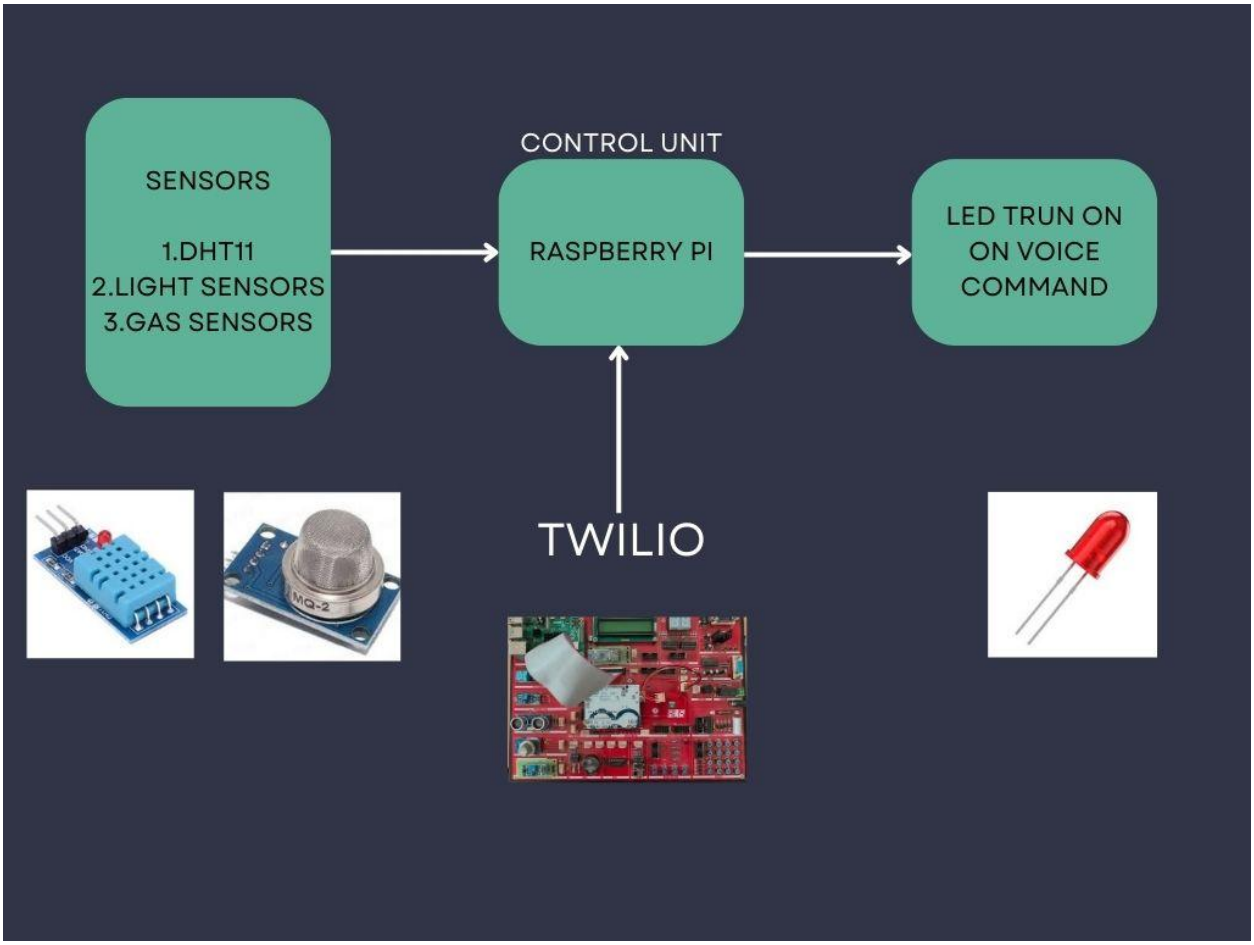
- **Tools used:**
  Developed using frameworks like Flask or Django for backend and HTML/CSS/JavaScript for frontend.

CHAPTER 4

Flow Diagram



BLOCK DIAGRAM



CHAPTER 5

CONCLUSION

The AIoT Smart Home Automation System presented in this project is a step forward in leveraging cutting-edge technology to transform living spaces into intelligent, responsive, and efficient environments. By integrating the power of Artificial Intelligence (AI) with the Internet of Things (IoT), the system addresses critical needs in modern homes, including energy efficiency, safety, convenience, and personalized user experiences.

This project showcases how commonly available hardware like the Raspberry Pi and sensors (DHT11, gas sensor, LDR) can be utilized effectively to achieve sophisticated functionality. The system combines real-time environmental monitoring, automated control of appliances, and a visually appealing dashboard, offering users seamless interaction and control over their homes.

The project underscores the potential of AIoT in reshaping residential spaces. As smart homes become a significant aspect of the future, solutions like this demonstrate how technology can simplify lives, promote sustainability, and enhance safety in a cost-effective manner.

CHAPTER 6

FUTURE WORK

1. **Advanced Predictive Analytics**:
   Using machine learning to predict user behaviour and automate device operations accordingly.

2. **Expanded Device Compatibility**:
   Including additional appliances such as smart locks, security cameras, or thermostats.

3. **Mobile Application**:
   Developing a dedicated app for remote control and monitoring from anywhere.

4. **Power Usage Analytics**:
   Monitoring energy consumption patterns and providing suggestions to improve efficiency.

5. **Integration with Renewable Energy Sources:**
   Connect the system with solar panels or other renewable energy sources to make the home more sustainable and energy-independent.

CHAPTER 7

APPENDIX

The AIoT Smart Home Automation System uses a Raspberry Pi as the central unit, integrating sensors like the DHT11 (temperature and humidity), gas sensor, and LDR (light intensity) with LEDs representing appliances. The system is programmed in Python using libraries such as RPi.GPIO, Adafruit_DHT, and Flask for hardware control, sensor data collection, and dashboard development. The dashboard displays real-time data, manual control options, and weather updates. Automation is based on predefined thresholds for temperature, gas levels, and light intensity, ensuring efficient appliance operation and safety alerts. The modular design supports scalability, with successful testing validating its reliability and user-friendliness.

8.1 Pseudo Code

System Initialization

1. Import Required Libraries
    - GPIO Control for device interaction.
    - DHT Library for temperature and humidity sensor.
    - Flask/Django for dashboard management.
    - Sensor Modules for gas and light sensors.
2. Initialize Components
    - Set up GPIO pins for:
        - DHT11 sensor (Data pin).
        - Gas sensor (Analog pin).
        - LDR sensor (Analog pin).
        - LEDs for appliances (GPIO pins).
    - Configure GPIO mode to BCM.
3. Define Constants
    - Temperature range for fan control.
    - Threshold gas levels for alert.
    - Light intensity limits for turning lights on/off.

Data Acquisition

1. Read Sensor Data
    - Use DHT.read() to fetch:
        - Temperature in °C.
        - Humidity in %.
    - Fetch gas levels from GasSensor.read().
    - Fetch ambient light intensity from LDR.read().
2. Process Data
    - Normalize gas and light sensor values if necessary.
    - Log real-time values to local storage or cloud for tracking.

Automation Logic

1. Fan Control (Based on Temperature)
    - If temperature > upper_threshold:
        - Turn ON fan (GPIO.output(Fan_PIN, HIGH)).
    - Else:
        - Turn OFF fan (GPIO.output(Fan_PIN, LOW)).
2. Lighting Control (Based on Light Intensity)
    - If light_intensity < threshold:
        - Turn ON lights (GPIO.output(Light_PIN, HIGH)).
    - Else:
        - Turn OFF lights (GPIO.output(Light_PIN, LOW)).
3. Gas Leak Alert
    - If gas_level > safe_threshold:
        - Display ALERT on dashboard.
        - Activate buzzer or LED indicator (GPIO.output(Alert_PIN, HIGH)).
    - Else:
        - Keep alert status OFF (GPIO.output(Alert_PIN, LOW)).

Dashboard Interaction

1. Update Dashboard
    - Display:
        - Temperature and humidity.
        - Gas levels and light intensity.
        - Device statuses (fan, lights).
        - Time-based greetings.
        - Weather forecast data (API integration).
2. User Manual Controls
    - Detect manual ON/OFF commands from dashboard.
    - Override automated decisions for fan, lights, or other appliances.
3. Notification System
    - If critical_condition_detected:
        - Send alerts via email/SMS.
    - Log the event in the database for future reference.

Event Loop

1. execute the following steps:
    - Read sensor data.
    - Execute automation logic.
    - Update dashboard with current readings.
    - Handle manual inputs or system overrides.
    - Check for alerts and send notifications as needed.

Shutdown Procedure

1.Turn OFF all devices (GPIO.output(Device_PIN, LOW)).
2.Clean up GPIO configurations (GPIO.cleanup()).
3.Safely exit all running processes.