VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Jnana Sangama, Belagavi – 590014.

Internship Project

On

"Smart Home Automation System"

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

BACHELOR OF ENGINEERING

In

COMPUTER SCIENCE & ENGINEERING

By

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Under the guidance of:

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2023 - 2024

A P S COLLEGE OF ENGINEERING

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Evaluation Sheet

Title of the Project: Smart Home Automation System

Name of the Students: 1. Kokila J V

2. Mohammed Mudassir Pasha S

3. Sameer

External Supervisor:

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Internal Supervisor:

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Date:

Place:

Project Completion Certificate

,

I **Kokila J V** (Roll No: 1AP21CS022), 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 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

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I **Mohammed Mudassir Pasha S**(Roll No: 1AP21CS028), 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 and Engineering** at the **APS college of Engineering, Bangalore** during the tenure **2 October, 2024 – 12, December, 2024**.

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Advisor's Signature **Guide Signature**

Project Completion Certificate

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I **Sameer** (Roll No: 1AP21CS404), 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 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**

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CHAPTER 1

ABSTRACT

The Smart Home Automation 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 Automation 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 Automation 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

In today's fast-paced world, managing household devices efficiently while ensuring safety and convenience is a challenge. Traditional home management systems lack remote accessibility, automation, and integration capabilities, leading to increased energy wastage, security vulnerabilities, and inconvenience for users. There is a need for a comprehensive solution that enables real-time monitoring and control of home appliances and safety systems, provides alerts during critical events, and optimizes energy usage, all through an intuitive interface.

- **Lack of Remote Accessibility:**

  Traditional home management systems require manual operation, making it difficult to control appliances when away from home.

- **Energy Wastage:**

  Appliances left running unnecessarily lead to increased energy consumption and higher utility costs.

- **Security Vulnerabilities:**

  Homes are prone to unauthorized access, gas leaks, and fire hazards without an effective monitoring and alerting system.

- **Inconvenience in Device Control:**

  Managing multiple household devices individually can be time-consuming and inefficient.

- **Absence of Real-Time Monitoring:**

  Limited visibility into home conditions, such as temperature, humidity, or air quality, prevents proactive actions.

- **Limited Automation:**

  Traditional setups lack the ability to automate repetitive tasks, such as turning lights on/off based on occupancy or scheduling appliances.

CHAPTER 3

APPLICATION

The Smart Home Automation 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.

Remote Appliance Control:

- Users can remotely control devices such as lights, fans, air conditioners, and other household appliances via a smartphone or web application.

Energy Management:

- Automates the operation of devices to ensure they only run when necessary, reducing energy consumption. For example, lights turn off automatically when no motion is detected.

Home Security Monitoring:

- Real-time surveillance using cameras, motion sensors, and door/window sensors to detect unauthorized access or suspicious activity.
- Sends alerts or activates alarms in case of security breaches or safety hazards like gas leaks or smoke.

Automated Lighting Control:

- Adjusts the lighting based on time of day or activity. For example, lights automatically dim in the evening or turn on when entering a room, providing convenience and energy efficiency.

Climate Control:

- Monitors and controls indoor temperature and humidity by connecting to smart thermostats and fans, ensuring optimal comfort in all seasons.

Voice Control Integration:

- Integrates with voice assistants like Amazon Alexa, Google Assistant, or Apple Siri, allowing users to control devices through voice commands.

Smart Scheduling:

- Schedule appliances to turn on/off at specific times (e.g., schedule the coffee machine to start brewing in the morning or have the lights turn off at bedtime).

Health and Environmental Monitoring:

- Tracks environmental factors such as air quality, temperature, humidity, and even soil moisture for plant care, allowing users to ensure a healthy living environment.

Elderly and Disability Assistance:

- Automates tasks for elderly or disabled users, such as controlling lighting, heating, and safety alerts, enhancing comfort and ease of living.

Smart Irrigation:

- Uses soil moisture sensors to control irrigation systems, ensuring gardens and lawns are watered efficiently, saving water and reducing maintenance costs.

Automated Safety Features:

- Monitors smoke, fire, and carbon monoxide levels and triggers alarms or notifies users if a dangerous condition is detected.

Home Theatre or Entertainment Control:

- Automates the setup of home theatre systems, adjusting lighting, screen, sound, and other devices for an optimal entertainment experience.

Package Delivery Alerts:

- Sends notifications when packages are delivered, potentially integrating a camera for live viewing and remote unlocking.

Smart Door Locking:

- Automatically locks doors at a set time or based on user proximity, providing enhanced security and convenience.

CHAPTER 4

COMPONENTS

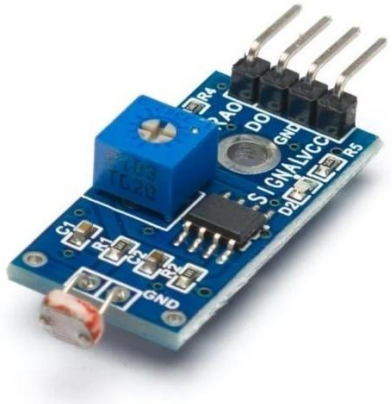
Hardware Components

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 Sensor –**

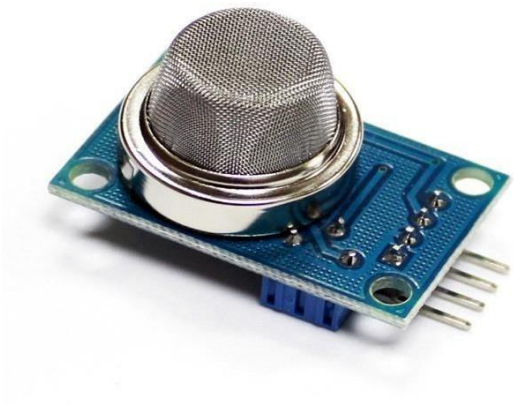
The DHT11 sensor measures both temperature and humidity, providing essential environmental data. It is compact, reliable, and widely used in IoT projects. This sensor ensures accurate monitoring of room conditions. The data collected helps trigger automated system responses to maintain optimal conditions



2, Light Sensor -

A light sensor for Raspberry Pi is a small electronic module used to measure ambient light intensity. It typically connects to the Raspberry Pi via GPIO pins, I2C, or SPI interfaces. Common sensors like the BH1750, TSL2591, or LDR (light-dependent resistor) modules detect light levels, enabling projects such as automatic brightness adjustment, light-activated systems, or data logging. These sensors are widely used in IoT, robotics, and environmental monitoring applications.

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.

2. 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.

i. 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 automation system.

Software Components

1. **Flask Framework –**

   For building the web application.

2. **Adafruit Libraries –**

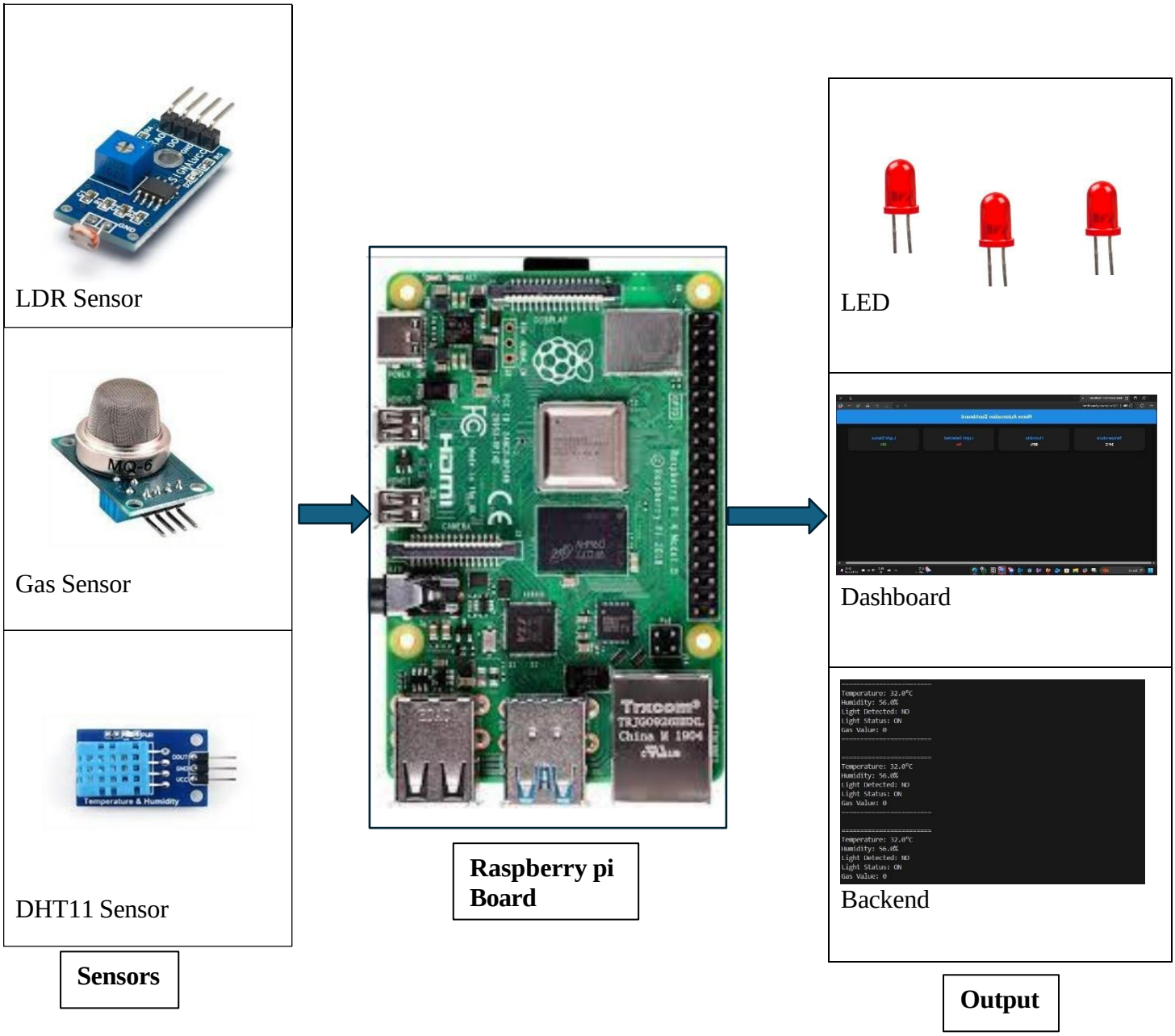
   Interfaces with the sensors.

3. **Python –**

   Implements the logic for hardware interaction and web application functionalities.

CHAPTER 5

FLOWCHART



CHAPTER 6

FUTURE WORK

Predefined settings that adjust multiple devices simultaneously, such as "Away Mode," which turns off lights, adjusts the thermostat, and activates security systems when no one is home.

- **Modes**

1. **Vacation Mode**: Simulates occupancy by randomly turning lights and devices on/off to deter intruders.
2. **Party Mode**: Adjusts lighting to vibrant colors, plays music on connected speakers, and sets the thermostat for optimal comfort.
3. **Eco Mode**: Minimizes energy consumption by dimming lights, lowering thermostat settings, and turning off unused devices.
4. **Night Mode**: Activates dimmed pathway lights, arms security systems, and lowers blinds automatically.
5. **Work-from-Home Mode**: Optimizes lighting, noise-cancellation devices, and ensures a stable Wi- Fi connection for productive hours.

- **Routines**: Scheduled or triggered actions, such as "Morning Routine," which turns on bedroom lights, starts the coffee maker, and plays morning news at a set time or when a motion sensor detects activity.

1. **Movie Night Routine**: Lowers blinds, dims lights, powers on the TV and sound system, and adjusts the thermostat to cozy settings.
2. **Energy Saving Routine**: Automatically turns off all non-essential appliances during peak electricity pricing hours.
3. **Welcome Home Routine**: Activates outdoor lights, unlocks smart locks, and sets indoor lighting and music to greet you when you arrive.
4. **Sleep Routine**: Gradually dims bedroom lights, activates a white noise machine, and locks doors at a set bedtime.
5. **Cooking Routine**: Preheats the oven, adjusts kitchen lighting, and pulls up recipes on a smart display or voice assistant.

6. **Garden Care Routine**: Waters plants at optimal times, adjusts sprinklers based on weather forecasts, and monitors soil moisture levels.
7. **Security Check Routine**: Runs a nightly sweep to ensure doors are locked, cameras are active, and windows are closed.

- ### Smart Lighting

1. **Motion-Activated Lights**: Use PIR sensors to turn on lights when motion is detected in a room.
2. **Remote Light Control**: Control lights via a mobile app or web interface using relays or smart bulbs like Philips Hue (via Zigbee or Wi-Fi).
3. **Custom Light Scenes**: Create predefined lighting setups for activities like reading or movie nights.

- **Climate Control**

1. **Thermostat Control**: Integrate with a DHT22 sensor (for temperature and humidity) and relay to control heating/cooling systems.
2. **Fan Automation**: Turn fans on/off based on room temperature thresholds.
3. **Window Ventilation**: Use servo motors to open/close windows depending on temperature or air quality (measured with MQ sensors).

- **Security and Surveillance**

1. **Smart Door Lock**: Use a solenoid lock and RFID reader or keypad for secure, programmable access.
2. **Camera Surveillance**: Set up a Raspberry Pi Camera Module for live video streaming and motion-triggered recording.
3. **Doorbell with Camera**: Combine a button, camera, and speaker to create a smart doorbell that streams video to your phone or plays preset responses.

- **Entertainment**

1. **Media Center**: Use Kodi or Plex on the Raspberry Pi to serve as a media hub for streaming and local playback.
2. **Smart TV Control**: Integrate with HDMI-CEC to control TV settings through the Raspberry Pi.
3. **Room Ambiance Sync**: Synchronize LED light strips (using WS2812B LEDs) with music or movies.

CHAPTER 7

APPENDIX

7.1 Pseudo Code

Setup Phase

1. Initialize GPIO pins for LDR, O2 gas sensor, DHT11 sensor, and LEDs.
2. Configure SPI for ADC (MCP3008) to read smoke levels.
3. Initialize Twilio client for SMS alerts.

Main System Initialization

1. **Sensors Initialization**:

- Temperature and humidity sensor (e.g., DHT22/AM2302).
- Gas sensor (e.g., MQ-2 or MQ-135).
- Light sensor (e.g., LDR).

2. **Sensor Data Acquisition**:

- Periodically reads data from the temperature/humidity sensor.
- Measures gas levels using the gas sensor.
- Uses the LDR to check light intensity and determines if the light is "ON" or "OFF" based on a predefined threshold.

3. **LED Control**:

- Turns on the LED when the light state is "OFF."
- Turns off the LED when the light state is "ON."

4. **Real-Time Feedback**:

- Prints the readings to the console every second.

Execution Flow

1. Initialize the Sensor System.
2. Continuously:
    - Measure temperature and Humidity
    - Automated control of LED

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CHAPTER 8

CONCLUSION

The Smart Home Automation System is an innovative integration of hardware and software designed to simplify household management. Utilizing a Raspberry Pi, sensors, and a Flask-based web application, The system empowers users to remotely operate appliances such as lights and fans, while also ensuring safety through features like proximity and smoke detection.

By providing real-time alerts and triggering automated actions during emergencies, the system Enhances security and convenience. This project demonstrates the practical application of IoT in daily life, offering a seamless web interface for real-time monitoring and control.

Its scalable and modular design ensures adaptability for future enhancements, paving the way for smarter, safer, and more energy-efficient homes.