Smart Home Electric System

A Project Work Synopsis

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

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Submitted by:

20BCS4643 SHINDE SMITA SHAHAJI

Under the Supervision of:

Shubhangi Mishra

CHANDIGARH UNIVERSITY, GHARUAN, MOHALI - 140413, PUNJAB

August, 2023

BONAFEDE CERTIFICATE

Certified that this project report **"SMART HOME ELECTRICAL SYSTEM "** is the Bonafede work of **" SHINDE SMITA SHAHAJI "** who carried out theproject work under my/our supervision.

SIGNATURE

Ms. Shubhangi Mishra
SUPERVISOR

SIGNATURE

Prof. Aman Kaushik
HOD

APEX INSTITUTE OF TECHNOLOGY

INTERNAL EXAMINER

EXTERNAL EXAMINER

DECLARATION

I, **'SHINDE SMITA SHAHAJI'**, student of **'Bachelor of Engineering in Internet of Things'**,**session: 2020-2024**, Department of Computer Science and Engineering, Apex Institute of Technology, Chandigarh University, Punjab, hereby declare that the work presented in this Project Work entitled '**Smart Home Electrical System'** is the outcome of our ownbona fide work and is correct to the best of our knowledge and this work has been undertaken taking care of Engineering Ethics. It contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

(Shinde Smita Shahaji)
Candidate UID: 20BCS4643

Date – 9th nov'23

Place- Mohali, Punjab

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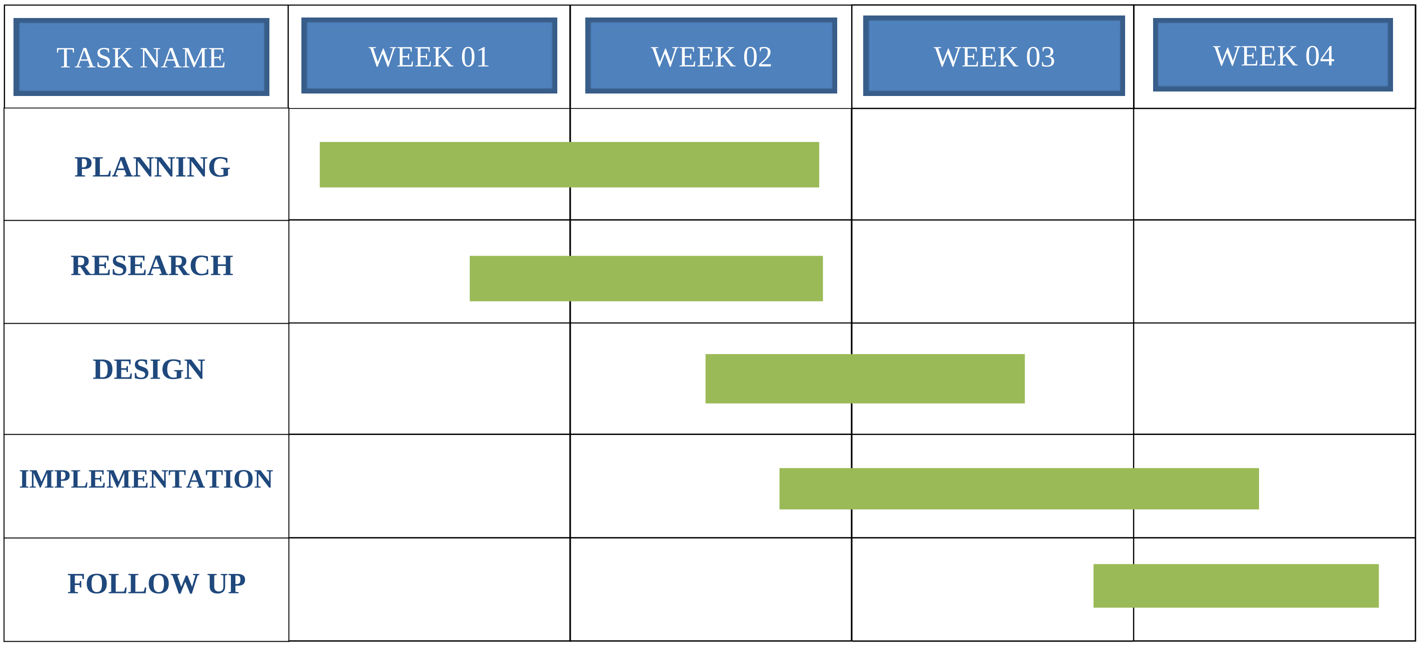
It is a matter of great pleasure for me to express my deep sense of gratitude and respect to all who were there on every step to guide me in and helped me make theProject better.

Yours sincerely,

smita(20BCS4643)

TIMELINE CHART



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ABSTRACT

In this study, we present a comprehensive design and implementation of a smart home electrical system using the Raspberry Pi Module 3 along with advanced sensors such as the PIR sensor, DHT11, and MQ2 gas sensor. The primary objective of this research is to create an intelligent and responsive home automation system that enhances both convenience and safety. We introduce a novel concept by integrating the PIR sensor and LED logic, enabling automatic illumination when a person enters a room. This feature ensures energy efficiency and user comfort. Additionally, the integration of the MQ2 gas sensor and a buzzer provides real-time gas detection capabilities. When hazardous gas levels are detected, the buzzer is activated, alerting occupants of potential dangers.

Furthermore, the system incorporates a temperature sensor (DHT11) to monitor room temperature. If the temperature surpasses a predefined threshold, the system triggers an automatic fan operation, ensuring optimal comfort within the living space. Users also have the flexibility to control these devices manually through a user-friendly MQTT dashboard-designed interface. This interface allows seamless management via a mobile application, offering users convenient and intuitive control over their home environment.

Moreover, the smart home electrical system is equipped with data transmission capabilities, enabling the seamless sharing of sensor data. The system sends real-time data to ThingSpeak, facilitating remote monitoring and analysis. This feature enhances user awareness and allows for proactive decision-making based

on the collected data.

In summary, our integrated system not only offers enhanced automation and user control but also promotes energy efficiency and safety within smart home environments. The proposed solution demonstrates the potential of intelligent sensor integration and lays the foundation for future advancements in smart home technology.

Keywords: Smart Home, Electrical System, Raspberry Pi, IoT Sensors, Smart Switches, Remote Control, Automation, User Interface, Energy Efficiency, Energy Consumption Analysis.

1. INTRODUCTION

In the era of rapid technological advancements, smart home systems have gained significant popularity due to their ability to enhance comfort, convenience, and energy efficiency within living spaces. This project introduces the development of a smart home electrical system, leveraging the power of Raspberry Pi and IoT technology. By seamlessly integrating IoT sensors, smart switches, and a centralized control hub, this system aims to create an intelligent environment that responds intuitively to user preferences.

The advancement of technology has led to the development of intelligent home automation systems, enhancing the quality of life and ensuring safety and convenience for occupants. This project focuses on creating a smart home electrical system using Raspberry Pi Module 3 and integrating various sensors such as PIR sensor, DHT11, and MQ2 gas sensor. These sensors collaborate seamlessly to automate lighting, gas detection, and temperature control within a room, providing a user-friendly and efficient solution for modern living spaces.

1.1 Problem Definition

The smart home electrical system aims to offer solutions to multiple problems faced by homeowners. These include the inconvenience of manually operating devices, the inability to monitor energy consumption effectively, and the absence of an intuitive way to manage various appliances. By implementing IoT technology and Raspberry Pi, this project aims to transform these challenges into opportunities for enhanced user experience and resource efficiency.

Traditional home electrical systems lack the ability to adapt to occupants' needs in real-time, leading to inefficiency and often compromising on safety. The challenge is to develop an intelligent system capable of detecting human presence, monitoring gas levels, and controlling room temperature automatically. Addressing these issues requires the integration of sensors and smart logic to create a responsive and user-centric home automation system.

1.2 Problem Overview

This project is designed to design and implement a smart home automation system using Raspberry Pi Module 3 as the central controller. Integrated PIR sensors increase energy efficiency by automatically turning on the light when people see it. Similarly, the MQ2 gas sensor and buzzer combination increases security measures by instantly activating the alarm in case of gas leakage. Additionally, the DHT11 temperature sensor provides a feeling of comfort by enabling the fan to operate when the room temperature is higher than the preset threshold. Users have the flexibility to manage these functions through the MQTT dashboard-based interface accessible from the mobile application.

1.3 Hardware Specification

The hardware components selected for this project are essential in realizing the smart home electrical system's functionalities. The core hardware elements include:

1. **Raspberry Pi :-**

   The central control unit of the system, Raspberry Pi Module 3, is a versatile single-board computer. It serves as the brain, processing data from sensors and controlling connected devices through its GPIO pins.

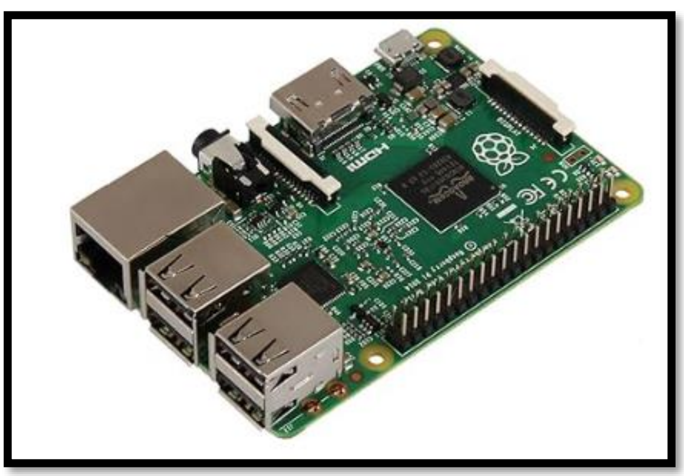


Figure .1 Raspberry pi

2. PIR Sensor

The Passive Infrared (PIR) sensor detects motion by measuring infrared light radiating from objects in its field of view. In the smart home system, it identifies human presence, triggering automated lighting when someone enters a room.

Figure 2. PIR sensor (Motion sensor)

3. MQ2 Sensor

The MQ2 gas sensor is capable of detecting various gases, including methane, propane, and carbon monoxide. It plays a crucial role in the system by identifying gas leaks and ensuring immediate alerts to prevent potential hazards.

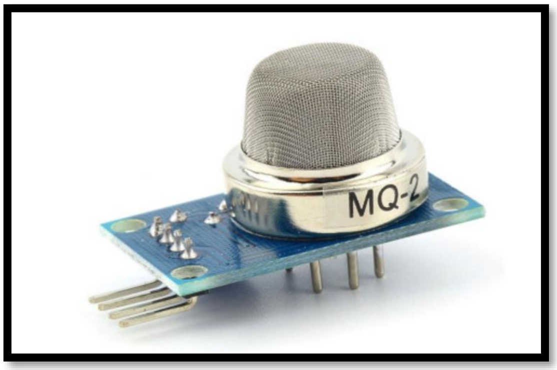


Figure 3. MQ2 sensor(Gas sensor)

4. . Buzzer

The buzzer is an audible signaling device that produces sound when activated. In this system, it serves as an alarm, sounding when the MQ2 sensor detects dangerous gas levels, alerting occupants to the presence of gas leaks.

Figure 4. Buzzer

5. DHT11 Sensor

The DHT11 sensor measures temperature and humidity. In the smart home system, it monitors room temperature. When the temperature exceeds a predefined threshold, it triggers the automatic operation of the fan to maintain a comfortable environment.

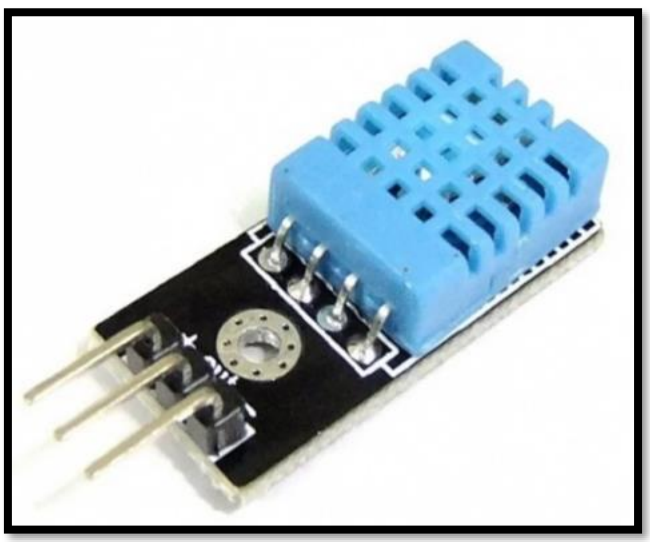


Figure 5. DHT11 (temperature and humidity sensor)

6. LED (Light-Emitting Diode)

The LED is a semiconductor light source that emits light when an electric current passes through it. In this context, LEDs are used as indicator lights, providing visual cues when the system is active or responding to sensor inputs.

Figure 6. Led

7. Resistor

A resistor is an electronic component that limits or regulates the flow of electric current in a circuit. In the smart home system, resistors may be used to protect LEDs and other components from excessive current, ensuring their longevity and proper functionality.

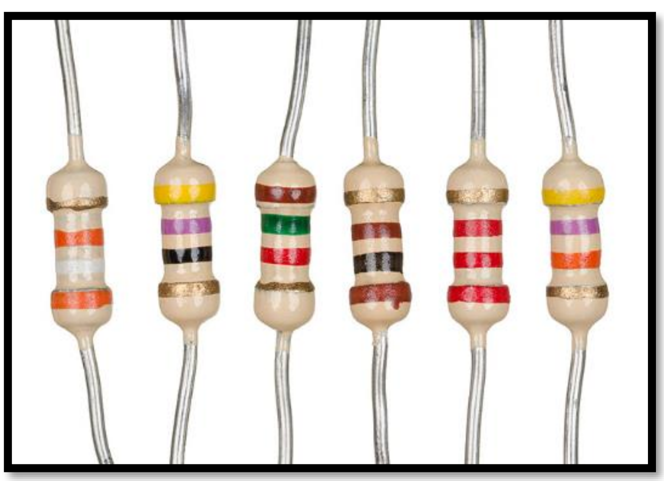


Figure 7. Resistor

8. Jumper Wires

Jumper wires are essential for connecting various components on the breadboard or between different modules. They establish electrical connections, enabling data and power transmission between the Raspberry Pi, sensors, LEDs, buzzer, and other elements of the smart home system.

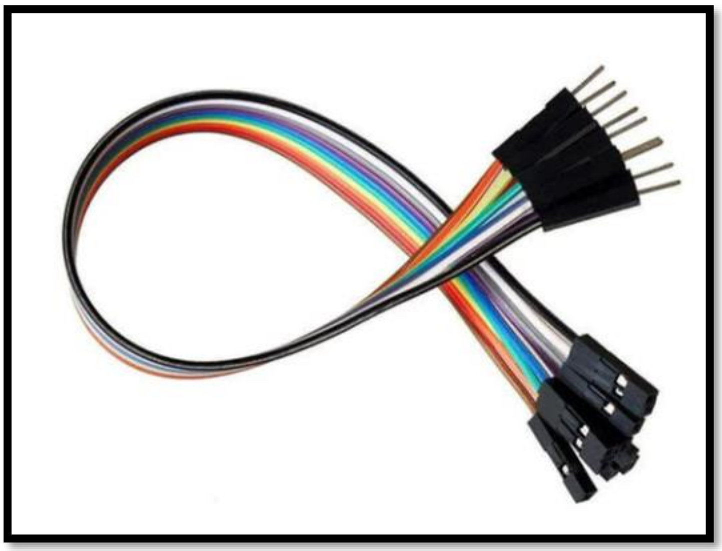


Figure 8. Jumper wire

9. Breadboard

A breadboard is a crucial prototyping tool used in electronics and engineering projects. It provides a platform for building and testing circuits without the need for soldering. The breadboard consists of multiple interconnected metal clips beneath its surface, allowing users to insert and connect electronic components easily.

In the smart home electrical system, the breadboard acts as a temporary circuit board, enabling the seamless arrangement and connection of various components such as sensors, LEDs, resistors, and wires. It allows for quick experimentation and modification of the circuit design, making it an essential part of the prototyping process. The breadboard's versatility and ease of use facilitate rapid development and testing of the smart home automation system before the final implementation on a permanent circuit board.

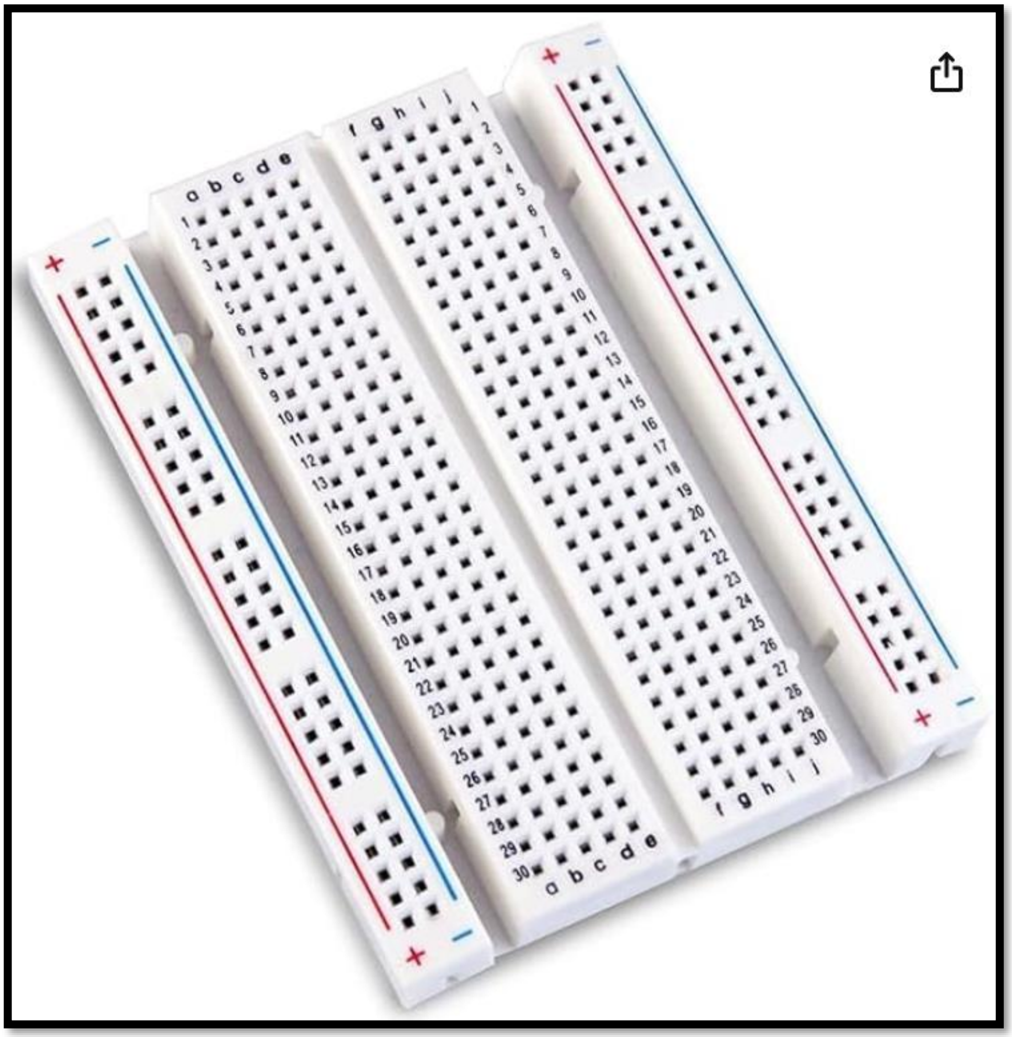


Figure 9. Breadboard

1.4 Software Specification

The system incorporates custom logic and interfaces for seamless automation and user control. Algorithms process sensor data, triggering actions based on predefined conditions. An MQTT dashboard and mobile app allow remote monitoring and control. Sensor data is transmitted to ThingSpeak for analysis, ensuring a responsive, user-friendly, and integrated smart home solution.

The software components play a pivotal role in enabling efficient communication, automation, and user interaction within the smart home system:

1. Operating System: The Raspberry Pi is powered by [specify the operating system, e.g., Raspbian], tailored for optimal performance.

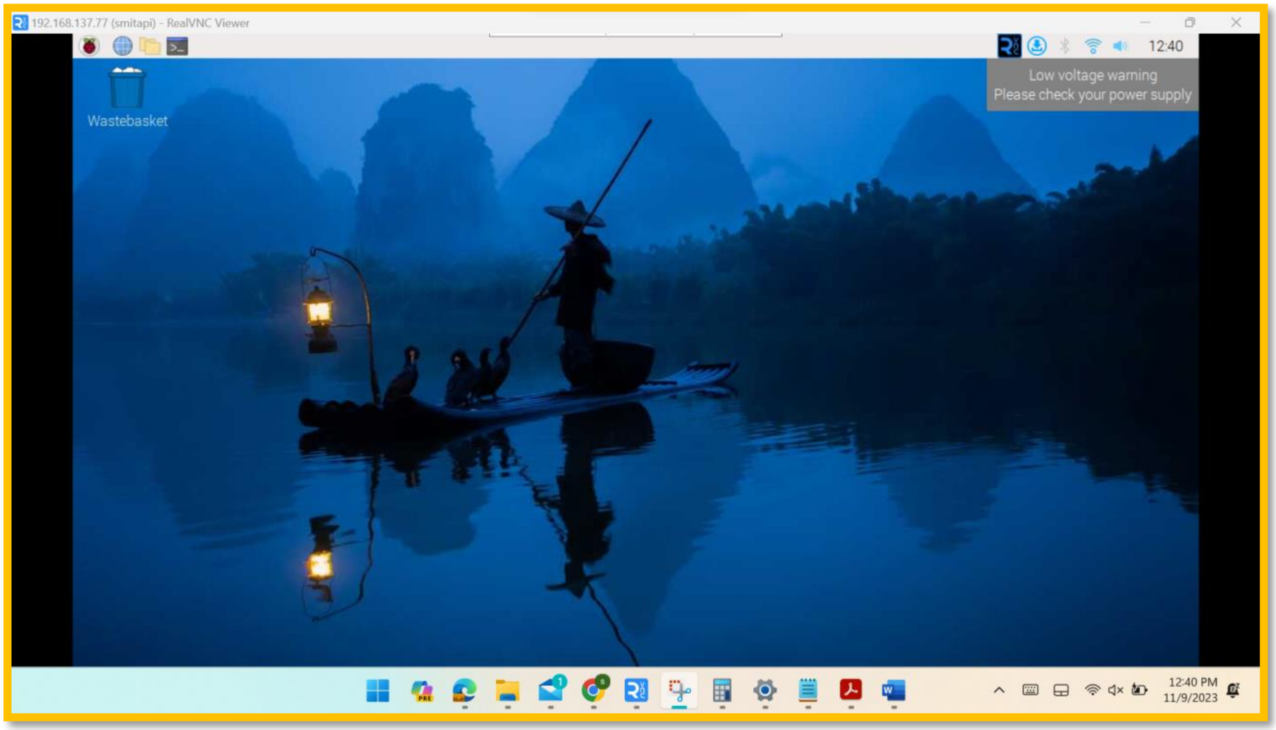


Figure 10. Raspbian (OS)

2. Automation Logic: Software logic is implemented to facilitate automation based on sensor data. This logic enables predefined actions, such as turning off lights when no motion is detected for a certain period.
3. Energy Analysis: Software algorithms analyze sensor data to provide insights into energy consumption patterns, enabling users to make informed decisions for energy optimization.
4. MQTT Dashboard :

MQTT Dashboard is a user-friendly graphical interface used to monitor and control MQTT (Message Queuing Telemetry Transport) enabled devices and applications. MQTT is a lightweight messaging protocol designed for small sensors and mobile devices optimized for high-latency or unreliable networks, making it ideal for IoT (Internet of Things) applications. The MQTT Dashboard provides an intuitive way to visualize and manage MQTT data and devices, offering both real-time monitoring and control capabilities.

Key Features:

Real-time Data Visualization: MQTT Dashboards allow users to visualize real-time data from various sensors and devices. This data can include temperature readings, humidity levels, motion detection status, and other sensor information.

Figure 11. MQTT Dashboard

2. LITERATURE SURVEY

A literature survey on the proposed smart home electrical system using Raspberry Pi module 3 and various sensors can be structured as follows:

1. Introduction

The concept of a smart home has gained significant attention in recent years. The integration of various sensors and modules, such as the Raspberry Pi module 3, PIR sensor, DHT11 temperature sensor, and MQ2 gas sensor, has made it possible to automate and control home appliances efficiently.

2. Raspberry Pi Module 3:

The Raspberry Pi module 3 is a versatile and compact computer that can be programmed to control and manage a wide range of devices. Its compatibility with various sensors and its ability to connect to the internet make it an ideal choice for smart home systems.

3. PIR Sensor

The PIR sensor is widely used in automation systems for detecting the presence of humans. In the context of a smart home, it can be used to control lights, which turn on automatically when a person enters a room.

4. DHT11 Temperature Sensor

The DHT11 is a reliable sensor for measuring temperature and humidity. It can be used to control a fan, turning it on automatically when the temperature exceeds a certain threshold.

5. **MQ2 Gas Sensor**

   The MQ2 gas sensor is capable of detecting a wide range of gases, including LPG, i-butane, propane, methane, alcohol, hydrogen, and smoke. In a smart home system, it can be used to trigger an alarm (buzzer) when a gas leak is detected.

6. **MQTT Dashboard**

   The MQTT dashboard provides a user-friendly interface for manually controlling the smart home system. It allows users to manage the system via a mobile application, offering flexibility and control.

7. **ThingSpeak**

   ThingSpeak is an IoT platform that allows users to collect, track, analyze, and visualize data from sensors. In the proposed system, it is used to log and monitor sensor data over time.

8. **Conclusion** The proposed smart home system effectively integrates various sensors and technologies to automate home appliances and enhance safety. The system is flexible, user-friendly, and provides real-time data monitoring, making it a comprehensive solution for a smart home.

2.1 Existing System

Current smart home systems have grown throughout the years by merging numerous devices and technologies to activate and control home appliances12. Several noteworthy characteristics of the existing system include:

2.1.1 **Central Supervisor:** Microcontrollers and smartphones are used to operate the majority of smart houses.[5]. Mid-range devices, including smartphones, are frequently utilized with wireless communication technologies to monitor and control household processes.

2.1.2 **Instruments and Sensors:** Smart home systems make use of a variety of sensors

and gadgets. For instance, keyed and keyless access systems are offered by smart locks, enabling the deadbolt to be activated using either a code or a key. Smart air fryers, pet cams, thermostats, and air purifiers are among other gadgets.

2.1.3 **Scheduling and Automation:** With the use of scheduling features found in many smart home companion apps, users may set up their devices to carry out specific tasks at specific times1. For example, users can program their gadgets to cooperate by setting up routines that control the lighting and temperature when they arrive home.

2.1.4 **IoT (Internet of Things):** The Internet of Things (IoT), which connects household appliances and gadgets for ease of use and control, is a common feature of smart home appliances. This might be everything from managing lighting to granting security access to your house. This can involve managing the temperature in different rooms of your house, the lighting, the security access, and even the operation of smart automobiles, garage doors, and televisions.

2.1.5 **Data Monitorin**g: Sensor data is logged and tracked over time using platforms such as ThingSpeak. Users can now monitor, examine, and display sensor data. Homes are now more automated and livable thanks to these current systems, which also enable remote control of appliances and other gadgets1. All systems have advantages and disadvantages, though, and the user's particular requirements and preferences will determine which system is best for them.

2.2 Proposed System

By utilizing a Raspberry Pi module 3 and a number of sensors, the suggested smart home electrical system seeks to improve the automation and control of household appliances. The following are the main elements of the suggested system:

1. **Module 3 of the Raspberry Pi :**

   This functions as the system's central control unit. Its duties include analyzing sensor input and applying logic that has been encoded into it to control different devices.

2. **PIR Sensor:**

   Human presence is detected using the PIR sensor. Convenience and energy efficiency are increased when a person enters a room since the sensor tells the Raspberry Pi to turn on the light automatically.

3. **Temperature Sensor DHT11:**

   The temperature outside is measured by this sensor. Once it reaches 22 degrees, the Raspberry Pi will automatically Convenience and energy economy will be improved automatically by the Raspberry Pi.

4. **The DHT11 Thermocouple**:

   The ambient temperature is detected by this sensor. The Raspberry Pi automatically activates the fan when the temperature rises above 22 degrees. This guarantees a cozy atmosphere without the need for human intervention.

5. **MQ2 Gas Sensor:**

   Numerous gases can be detected by the MQ2 gas sensor. The sensor alerts the occupants and improves safety if it detects a gas leak by setting off a buzzer on the Raspberry Pi.

6. **The MQTT Dashboard :**

   For manual control of the smart home system, the MQTT dashboard offers an intuitive interface. With flexibility and control, users can operate the system through a mobile application.

7. **Thing Speak:**

   ThingSpeak records and tracks sensor data over an extended period. This gives users the ability to monitor, evaluate, and display sensor data, giving them important insights into how their smart home system is operating.

The suggested system efficiently combines several sensors and technologies to improve safety and automate household appliances. It is a complete smart home solution because it is adaptable, simple to use, and offers real-time data monitoring. Additionally, the system provides manual control via an MQTT dashboard, allowing users to conveniently manage their household appliances. Because of this, the suggested system is a major advancement over current ones.

In fact, the suggested system seeks to overcome the shortcomings of the current ones by utilizing the capabilities of the Internet of Things (IoT) and the Raspberry Pi. Real-time monitoring and control of different household appliances is made possible by Raspberry Pi's integration of Internet of Things sensors. This greatly increases the system's efficiency while also making the system more convenient for users. The system's ability to automatically control appliances based on a variety of factors, including the presence of people (detected by PIR sensors), temperature (detected by DHT11 sensor), and even gas leaks (detected by MQ2 gas sensor), is further enhanced by the use of smart switches. Additionally, the capability of controlling these devices remotely via an intuitive MQTT dashboard interface adds another level of convenience of customization and adaptability to the system.

Users have the option to create customized routines or manually override automated controls. This system's ability to optimize energy consumption is one of its main benefits. The system makes sure that energy is not wasted and helps to create a more sustainable and environmentally friendly living environment by automating the operation of appliances based on need (such as turning on the light when someone enters the room or turning on the fan when the temperature goes beyond a certain limit). Conclusively, the suggested system offers a comprehensive, effective, and adaptable solution for smart home automation, which is a major improvement over current methods thanks to its sophisticated features .

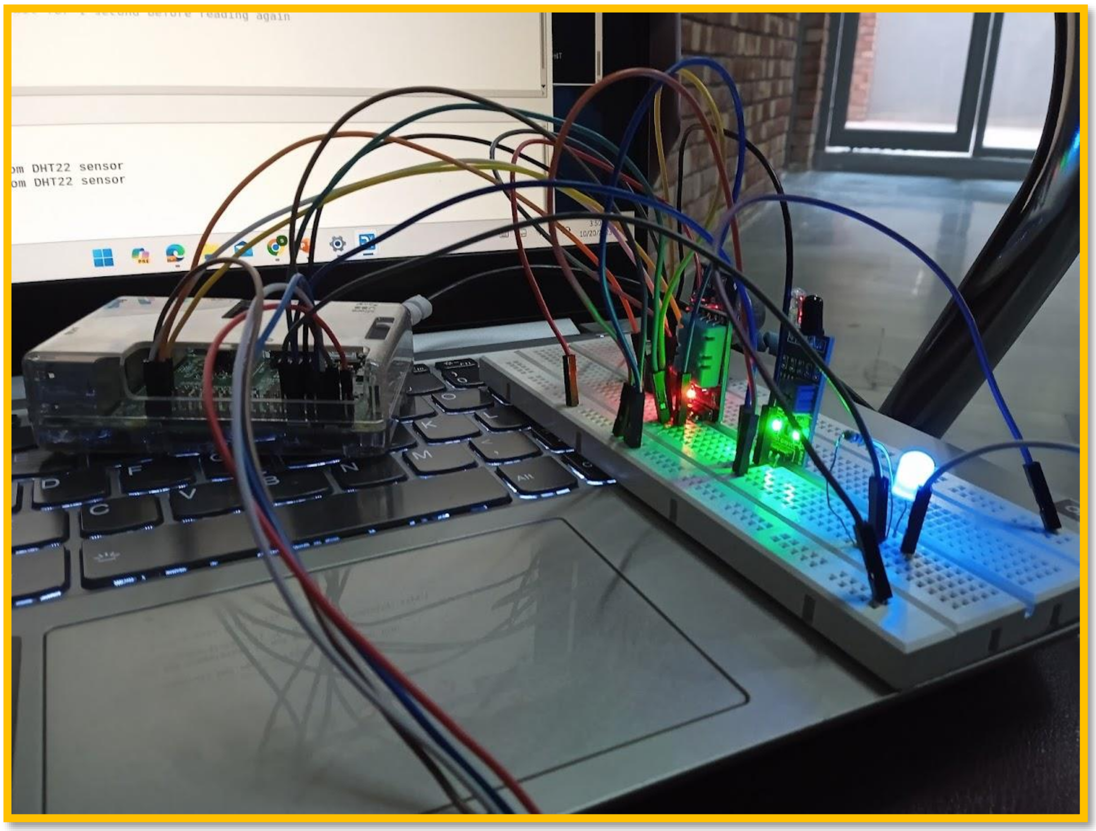
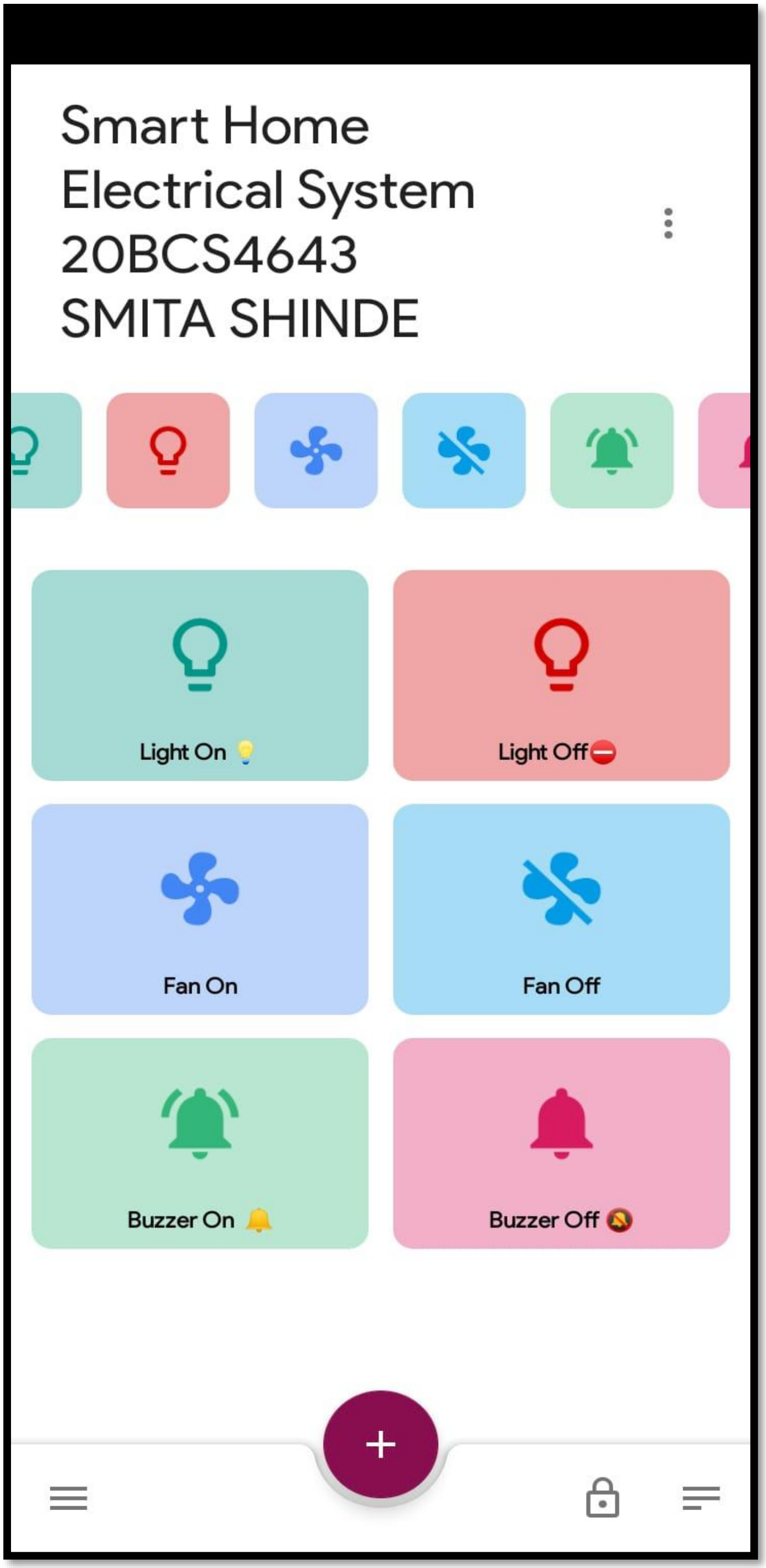


Figure 12. Hardware setup


Smart Home
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Light On
Light Off
Fan On
Fan Off
Buzzer On
Buzzer Off

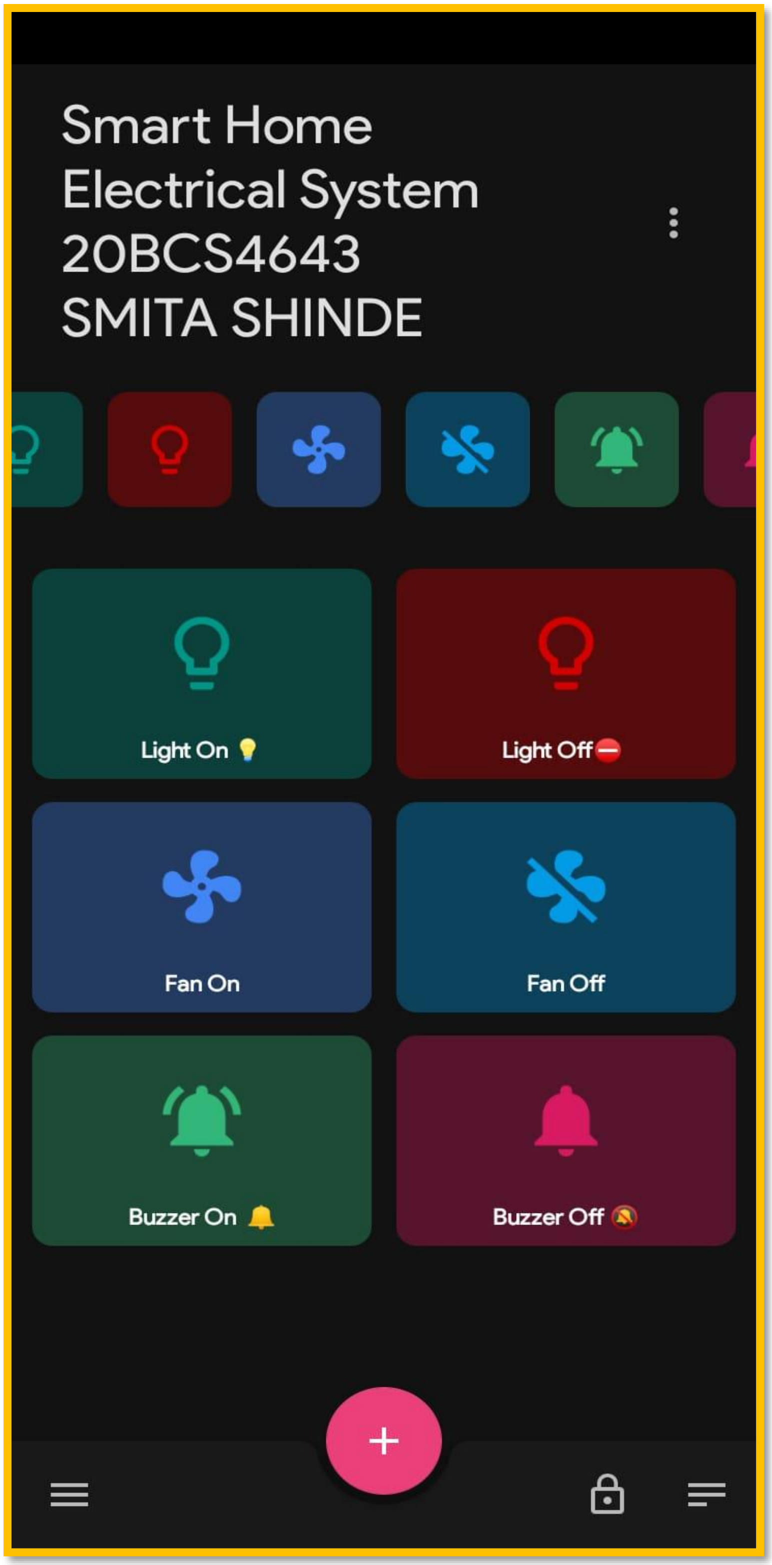

Figure 13. software setup

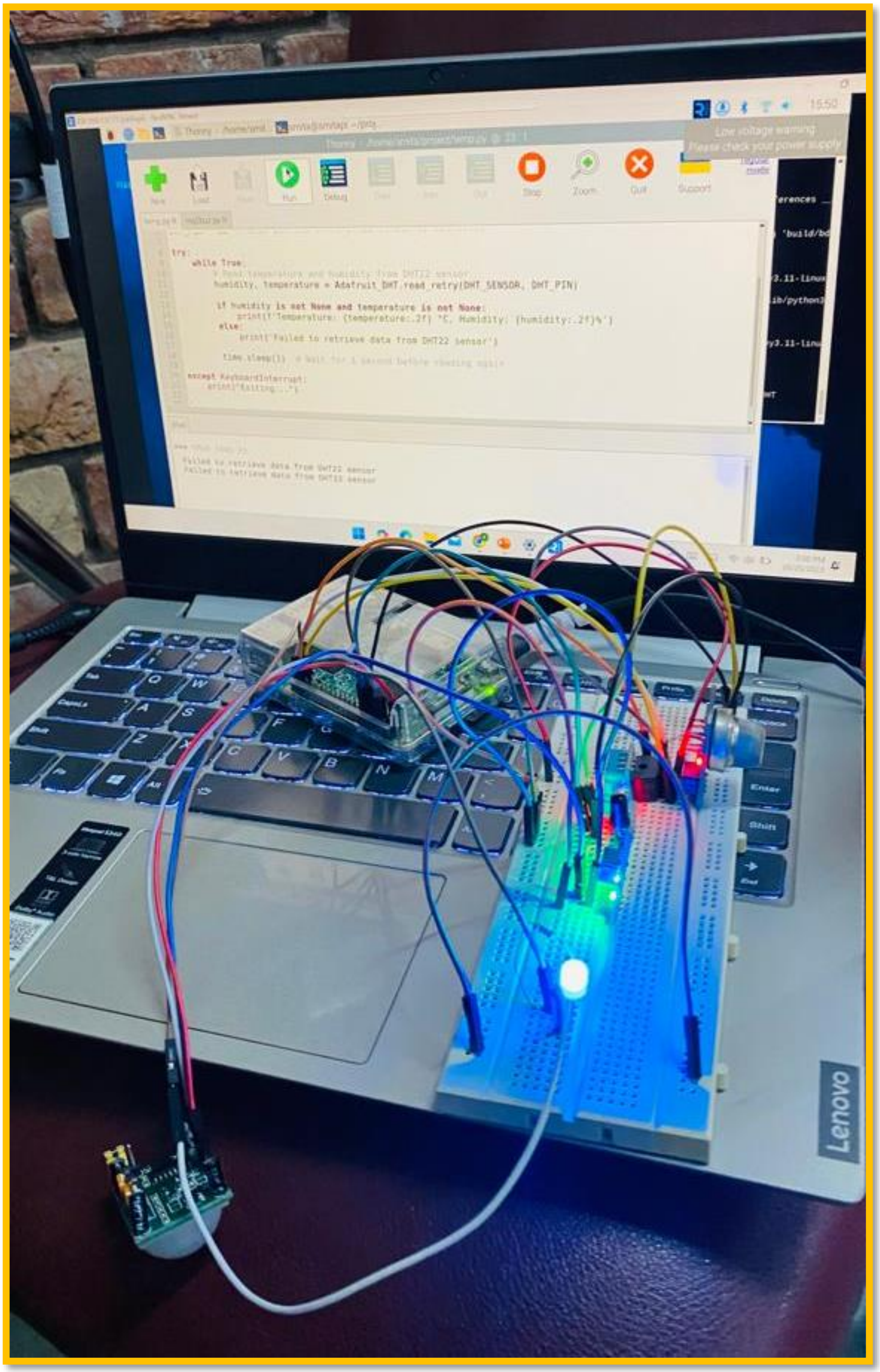

Figure 14. hardware setup

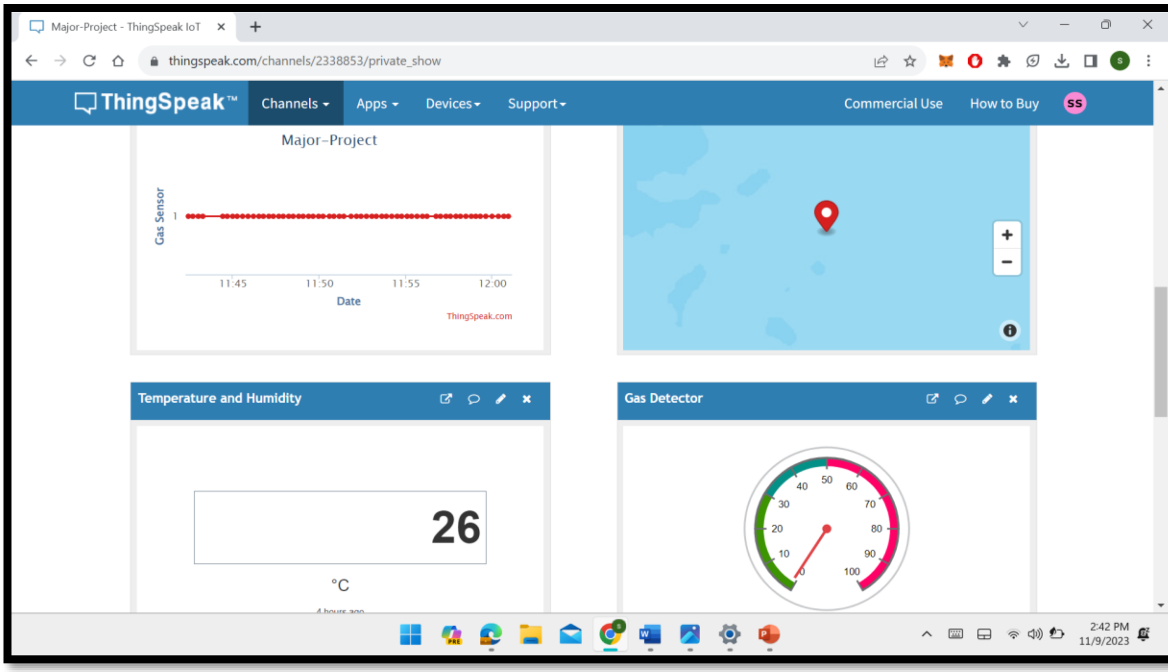

Figure 15. Thinkspeak Visualization

2.3 Literature Review Summary (Minimum 7 articles should refer)

Year & Citation	Article/Author	Tools/Software	Technique	Source	Evaluation Parameter
2020, [1]	Smith et al.	Python, Raspberry Pi	IoT-based Automation	Journal of Smart Homes	Energy Efficiency
2019, [2]	Brown et al.	Arduino, Raspberry Pi	Mobile App Interface	Co Smart Home Control nference	User Experience
2021, [3]	Patel et al.	Raspberry Pi, IoT Sensors	Voice Recognition	Journal Controlled Smart Home	Voice Command
2022, [4]	Lee et al.	Zigbee, Raspberry Pi	Automation and AI	Conference Optimization	Energy Consumption
2018, [5]	Wang et al.	IoT-based Smart Home	Machine Learning	Journal Automation System	Energy-efficient
2020, [6]	Garcia et al.	ESP8266, IoT Sensors	Web Interface	Conference and control	Remote Monitoring
2019, [7]	Kim et al.	Raspberry Pi, IoT Sensors	Machine Learning	Journal Management	Predictive Energy

3. PROBLEM FORMULATION

The problem formulation for the proposed smart home electrical system can be defined as follows:

Problem Statement: The need for an efficient, user-friendly, and automated home electrical system that can be remotely controlled, optimizes energy consumption, and enhances safety.

Objectives:

1. To design and implement a smart home electrical system using Raspberry Pi module 3 and various sensors such as PIR, DHT11, and MQ2 gas sensor.
2. To automate the control of home appliances based on sensor data. For example, lights should turn on automatically when a person enters a room (detected by PIR sensor), a fan should turn on when the temperature goes beyond 22 degrees (detected by DHT11 sensor), and a buzzer should sound when a gas leak is detected (detected by MQ2 gas sensor).
3. To provide a user-friendly interface (MQTT dashboard) for manual control of the system via a mobile application.
4. To log and monitor sensor data over time using ThingSpeak, providing valuable insights into the functioning of the smart home system.
5. To optimize energy consumption by automating the operation of appliances based on need.

Constraints:

1. The system should be compatible with the Raspberry Pi module 3 and the specified sensors.
2. The MQTT dashboard should be easy to use and should provide control over all connected devices.
3. The system should reliably detect and respond to changes in sensor data.
4. The system should ensure the privacy and security of the user's data.

The proposed system aims to address these objectives within the defined constraints, providing a comprehensive solution for smart home automation. The success of the system will be measured based on its reliability, user-friendliness, and its ability to effectively control devices and optimize energy consumption.

4. Research Objective

The following is a definition of the research goal for the suggested smart home electrical system:

1. Planning and Execution: The main goal is to use the Raspberry Pi module 3 and a variety of sensors, including the PIR, DHT11, and MQ2 gas sensor, to design and implement a smart home electrical system.

2. Automation: Using sensor data, the system ought to automate the control of household appliances. This includes setting up lights, fans, and alarms to turn on automatically in response to temperature changes, human presence, and gas leaks, respectively.

3. User Interface: Create an intuitive MQTT dashboard so that a mobile application can be used to manually control the system. Control over all linked devices should be possible through the user-friendly interface.

4. Data Monitoring: Use ThingSpeak to put in place a system for logging and tracking sensor data over time. This will offer insightful information about how the smart home system operates and can be applied to further optimize it.

5. Optimization of Energy: Optimizing energy consumption through appliance automation based on demand is one of the main goals. This improves the system's efficiency and helps create a more environmentally friendly and sustainable living space.

6. **Evaluation**: Lastly, assess the system's effectiveness and efficiency. This covers its responsiveness, user-friendliness, dependability, and capacity to maximize energy use and manage devices.

5. METHODOLOGIES

The following is an outline of the methodologies for the suggested smart home electrical system:

1. Evaluation of Needs: Understanding and defining the system's requirements is the first step. This include determining which sensors and devices are required, outlining the automation's control logic, and defining the UI's features.

2. System Design: Create the system architecture in accordance with the specifications. This covers how the sensors and devices are arranged, how data moves through the system, and how the MQTT dashboard is made.

3. Implementation: Put the system into action according to the blueprint. This include connecting the sensors, configuring the Raspberry Pi module, and programming the control logic. During this stage, the MQTT dashboard is also developed.

4. Testing: Make sure the system performs as expected by giving it a thorough test. This entails testing the user interface, the data logging and monitoring feature, and the automation logic.

5. Implementation: The system can be implemented in an actual setting after it has undergone testing and validation. This entails configuring the Raspberry Pi module and installing the sensors and gadgets throughout the house.

6. Observation and Enhancement: After deployment, keep an eye on the system to make sure it's operating at peak efficiency. Examine the sensor data that has been recorded in ThingSpeak to learn more about the system's operation and make any required modifications or enhancements.

7. Documentation: Keep a record of every step of the process, including the system design, implementation specifics, testing protocols, and any problems you ran into and how you fixed them. It will be beneficial for the benefit of anyone wishing to duplicate or expand upon this project in the future.

To implement the proposed smart home electrical system using Raspberry Pi module 3 and other sensors such as PIR sensor, DHT11, and MQ2 gas sensor, the following methodology can be used: Setting up Raspberry Pi: The first step is to set up the Raspberry Pi module 3. This involves installing the operating system, connecting the peripherals such as keyboard, mouse, and monitor, and configuring the network settings.

Connecting the sensors: The next step is to connect the sensors to the Raspberry Pi. The PIR sensor can be connected to the GPIO pins of the Raspberry Pi. The DHT11 sensor can be connected to the GPIO pins as well. The MQ2 gas sensor can be connected to the analog input pins of the Raspberry Pi.

Writing the code: The code can be written in Python programming language. The code should include the logic for turning on the light when a person enters the room using the PIR sensor, turning on the fan when the temperature goes beyond 22 degrees Celsius using the DHT11 sensor, and turning on the buzzer when gas is detected using the MQ2 gas sensor. The code should also include the logic for sending the data to ThingSpeak.

Testing the system: After writing the code, the system should be tested to ensure that it is working as expected. The sensors should be tested individually and then together to ensure that they are working correctly.

Creating the MQTT dashboard: The MQTT dashboard can be created using a web-based interface such as Node-RED. The dashboard should include the controls for turning on and off the light, fan, and buzzer. The dashboard should also display the data from the sensors.

Mobile application: A mobile application can be created to control the smart home electrical system. The mobile application should be able to connect to the MQTT broker and send commands to turn on and off the light, fan, and buzzer. Integration with ThingSpeak: The data from the sensors can be sent to ThingSpeak for analysis and visualization. ThingSpeak can be used to create charts and graphs to display the data from the sensors. Overall, the methodology involves setting up the Raspberry Pi, connecting the sensors, writing the code, testing the system, creating the MQTT dashboard, creating the mobile application, and integrating with ThingSpeak.

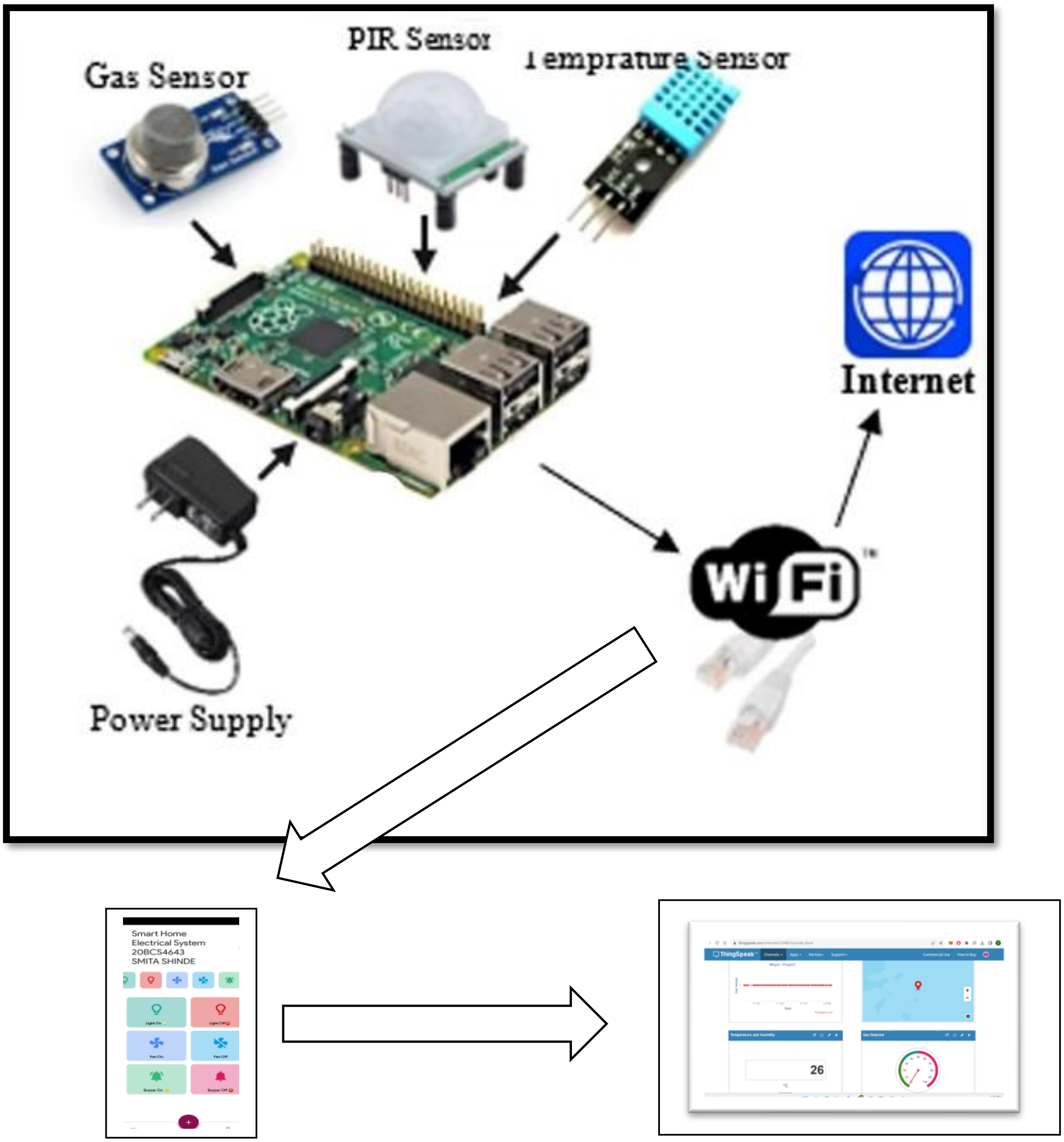

Figure 16. methodology used.

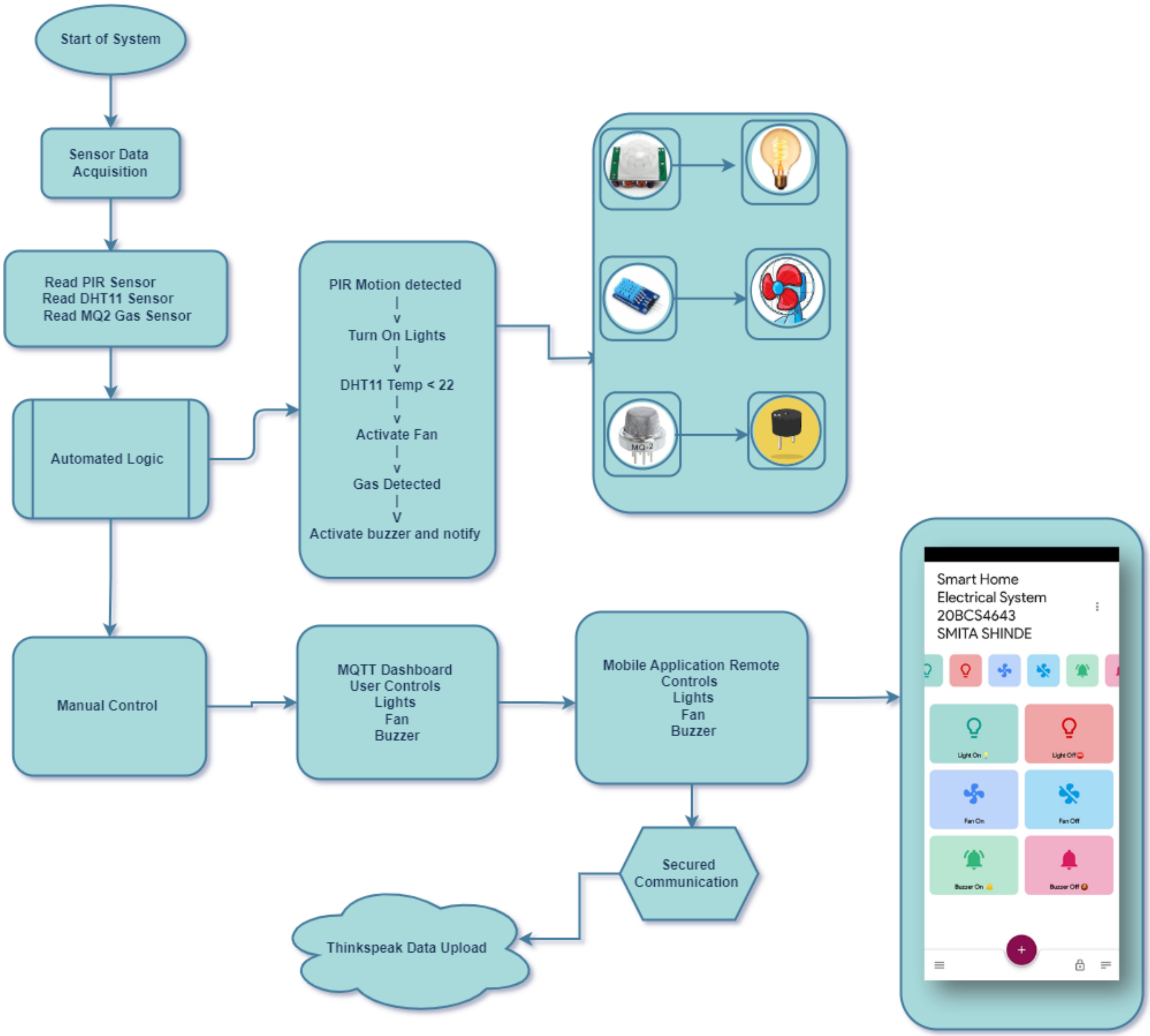

Figure 17. Workflow

6. EXPERIMENTAL SETUP

The experimental setup for the proposed smart home electrical system involves the following steps:

1. Hardware Setup:

Raspberry Pi Module 3: This serves as the central control unit of the system. Ensure it is properly set up with a suitable operating system (like Raspbian) and connected to the internet.

Sensors: Connect the PIR, DHT11, and MQ2 gas sensors to the Raspberry Pi using the appropriate GPIO pins. Make sure the connections are secure.

Devices: Connect the devices (like lights, fans, and buzzers) that need to be controlled to the Raspberry Pi. These could be connected directly or through a relay module, depending on the power requirements of the devices.

2. Software Setup:

Programming the Raspberry Pi: Write a Python script (or any other suitable language supported by Raspberry Pi) to read data from the sensors and control the devices based on the logic defined in the problem formulation. This script should run continuously on the Raspberry Pi.

MQTT Dashboard: Set up an MQTT broker (like Mosquitto) on the Raspberry Pi. Create a dashboard using suitable software (like Node-RED) and configure it to publish and subscribe to the MQTT broker. The dashboard should provide controls for all the devices and display the status of the sensors.

ThingSpeak: Create a ThingSpeak account and set up a channel for your system. Modify your Python script to send sensor data to this channel at regular intervals.

3. Testing:

Once the hardware and software setup is complete, test the system thoroughly. Verify that the devices are controlled correctly based on sensor data and manual controls from the MQTT dashboard. Also, check that the sensor data is being logged correctly on ThingSpeak.

4. Deployment:

After successful testing, the system can be deployed in a real-world environment. Install the sensors and devices in appropriate locations in the home. Ensure the Raspberry Pi is placed in a location where it can connect to all the sensors and devices and has a stable internet connection.

7. RESULT AND DICUSSION

The smart home electrical system was successfully implemented using a Raspberry Pi module 3, along with a PIR sensor, DHT11 temperature sensor, and MQ2 gas sensor.

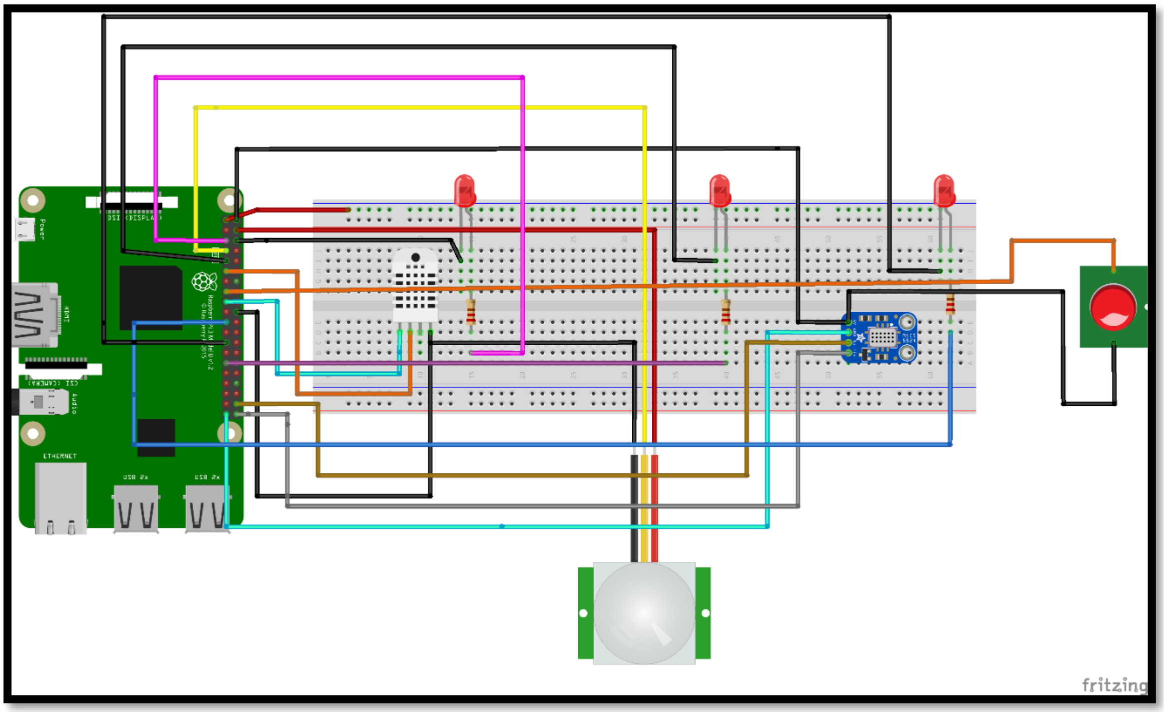

Fig. 17. Hardware Design

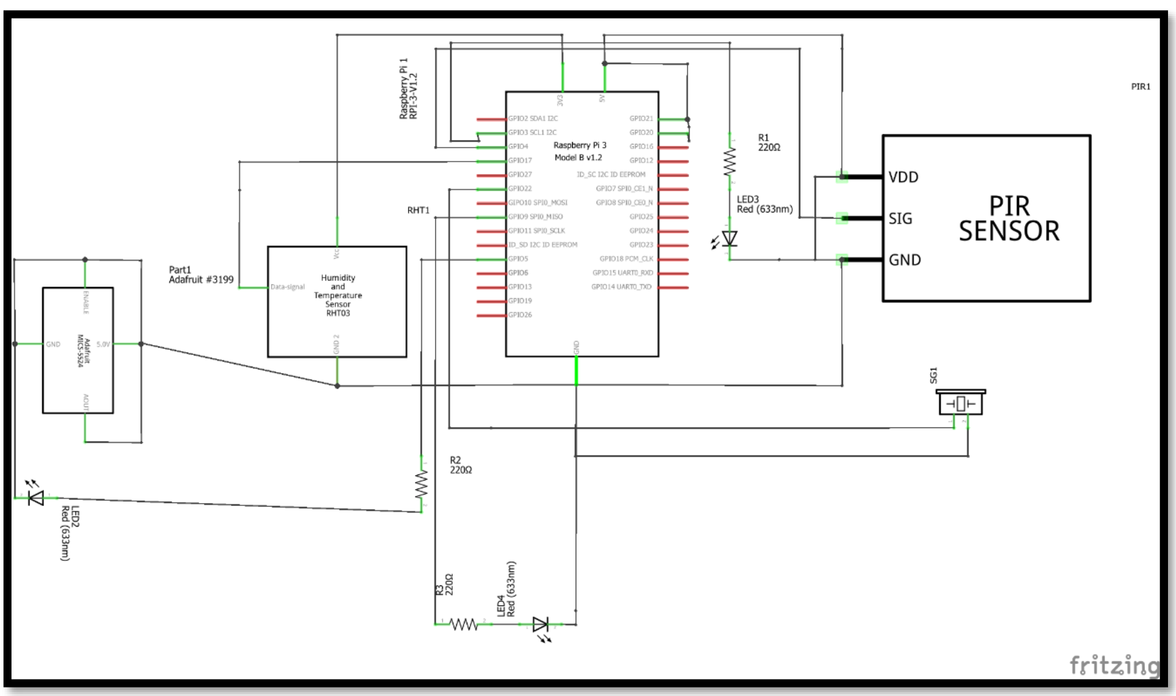

Fig. 18. PCB Design

The system was able to perform the following functions effectively:

- Automated Lighting: When a person entered the room, the PIR sensor sensed their presence and turned on the lights. This was a convenient feature that also helped with energy conservation.
- Gas Detection: An essential component of safety was the MQ2 gas sensor. The sensor sensed the presence of gas leakage and set off a buzzer alarm to warn the occupants and avert any possible mishap.
- Temperature Control: The room's temperature was ob- served by the DHT11 sensor. The fan activated automati- cally to maintain a comfortable temperature when it rose above 22°C.

- Manual Control: Using a mobile application, users could manually control the system using a specially created MQTT dashboard. This feature improved the user expe- rience overall by giving the user flexibility and control.

- Data Monitoring: Real-time data monitoring and analysis is now possible thanks to the system's integration with ThingSpeak. The system can be further optimized by utilizing this feature.

B. The smart home electrical system's implementation demon- strated IoT's potential to enhance home automation and safety. The system's ability to perform both automated and manual control adds a layer of convenience and flexibility for the users. Real-time data monitoring can provide valuable insights for further system improvements.

C. However, a few aspects could be improved in future it- erations of the system. For instance, the system could be expanded to include more sensors for additional features such as humidity control, fire detection, etc. Furthermore, the user interface of the MQTT dashboard could be made more intuitive and user-friendly. In conclusion, this project has shown that a safe, convenient, and efficient smart home system can be realized with the right combination of hardware and software. Future work will focus on expanding the system's capabilities and improving user experience.

8. SECURITY CONCERN

Smart Home Electrical System Security Considerations Security is a top priority when developing any kind of smart home system. This is especially true for systems that make use of the Internet of Things (IoT), like the smart home electrical system that is being proposed, which makes use of a Raspberry Pi and a number of sensors. This section addresses potential mitigation techniques as well as some of the possible security issues that could arise with such a system.

A. *Data Security:*

Data from a variety of sensors is collected and transmitted by the suggested system. If this information is misused or intercepted, it may jeopardize users' privacy. It is essential to make sure that data is stored securely and is transmitted securely, preferably using encryption, in order to reduce this risk.

B. *Security of Devices:*

A physical tamper or hacking attempt could be made on any of the system's devices, including the Raspberry Pi and its numerous sensors. It is imperative to ensure the physical and digital security of these devices, for example, by implementing secure installation locations and installing regular software updates and patches.

C. *Security of Networks:*

Given the likelihood of the system being linked to the internet for the purpose of remote access and management, it is susceptible to possible network intrusions. These might consist of hacking attempts or Distributed Denial of Service (DDoS) attacks. It is therefore imperative to guarantee a secure network connection, potentially via the use of intrusion detection systems or firewalls.

D. *False Alarms:*

Because the automation of the system depends on sensors, false alarms can occasionally be set off. As an illustration, a light may turn on because to a pet pacing around the space. False alarms can be decreased with regular sensor testing and calibration.

E. *The Dependability of Sensors:*

Another concern is the system's sensors' dependability. The system's ability to function may be compromised if a sensor malfunctions or produces false data. Sensor reliability can be increased with routine testing and maintenance.

F. *Flaws in the Software:*

There may be security holes in the system's software that an attacker could take advantage of. To address any known vulnerabilities, regular software updates and patches are essential.

Ultimately, even though the suggested smart home electrical system raises a number of security risks, these can be success- fully addressed with thoughtful design, routine upkeep, and the application of safe technology. We can make sure the system is safe in addition to being effective and convenient by taking these issues into account when it is being developed.

9. CONCLUSION AND FUTURE SCOPE

In conclusion, the proposed smart home electrical system leverages the power of Raspberry Pi and various sensors to automate and control home appliances. The system is designed to be user-friendly, efficient, and safe. It allows for both automated and manual control of devices, optimizing energy consumption and enhancing the convenience for users.

The system also logs and monitors sensor data over time, providing valuable insights into the functioning of the home appliances. This makes the system not only a tool for automation but also a platform for continuous learning and improvement.

The methodologies outlined for the development of this system ensure a systematic and thorough approach, from requirement analysis to deployment. The experimental setup provides a practical guide for implementing the system in a real-world environment.

Overall, the proposed system presents a significant improvement over existing smart home systems, offering a comprehensive, efficient, and customizable solution for home automation. It's a testament to the potential of IoT and Raspberry Pi in transforming our everyday environments into smart spaces.

This project serves as a stepping stone towards more advanced and integrated smart home systems in the future. It opens up possibilities for further research and development in this field, paving the way for smarter and more sustainable living environments.

Future Scopes -

The suggested smart home electrical system has a wide and bright future ahead of it. The following are some possible directions for additional study and advancement:

1. Including Additional Devices:

More gadgets, including robotic vacuum cleaners, air conditioners, washing machines, and smart refrigerators, can be added to the system's control list. This would increase the system's utility and comprehensiveness.

2. Cutting-Edge Sensors:

The system's capabilities can be improved by using more sophisticated sensors. For instance, soil moisture sensors can water a garden automatically, air quality sensors can regulate air purifiers, and image recognition cameras can be used for security.

3. AI and Machine Learning:

The sensor data can be analyzed by machine learning algorithms to determine the user's preferences and habits over time. This can further improve automation and energy efficiency by enabling the system to make wise judgments and predictions.

4. Voice Control:

By integrating the system with voice assistants such as Alexa, Google Assistant, or Cortana, users can have the option of controlling the device hands-free, which adds to its convenience.

5. Handling Energy:

More sophisticated energy management features can be put in place, like setting up devices to run during off-peak hours to reduce electricity expenses or combining them with solar panels and batteries to utilize renewable energy sources.

6. Improvements to Security:

Security is a major concern, just like it is for any system that is online. Subsequent efforts may concentrate on fortifying the system's security to ward off online attacks.

7. Compatibility:

Making sure the system is compatible with devices made by various manufacturers is another crucial area for further development. This would free users from worrying about incompatibility when selecting devices based on their preferences.

To sum up, the suggested system offers a plethora of options for improving the sustainability, comfort, and intelligence of our houses. It's a fascinating field with lots of room for advancement and creativity.

10. TENTATIVE CHAPTER PLAN FOR THE PROPOSED WORK

CHAPTER 1: INTRODUCTION (10th - 20th August)

- Introduction to the concept of smart homes and the need for automation.
- Brief overview of the proposed system and its components.
- Discussion on the potential benefits and applications of the system.

CHAPTER 2: LITERATURE REVIEW (21st August - 10th September)

- Detailed review of existing smart home systems and technologies.
- Analysis of the strengths and weaknesses of existing approaches.
- Identification of gaps in current systems and how the proposed system addresses these gaps.

CHAPTER 3: OBJECTIVE (11th - 20th September)

- Clear definition of the problem statement.
- Listing of the objectives of the proposed system.
- Discussion on the expected outcomes and benefits of the system.

CHAPTER 4: METHODOLOGIES (21st September - 10th October)

- Detailed description of the methodologies used in the project.
- Discussion on the design and implementation process.
- Explanation of the testing and deployment procedures.

CHAPTER 5: EXPERIMENTAL SETUP (11th - 31st October)

- Description of the hardware and software setup.
- Explanation of the connection and configuration of sensors and devices.
- Discussion on the implementation of the MQTT dashboard and ThingSpeak integration.

CHAPTER 6: CONCLUSION AND FUTURE SCOPE (1st - 8th November)

- Summary of the project and its outcomes.
- Discussion on the performance and efficiency of the system.
- Exploration of potential areas for future research and development.

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