SMART HOME MONITORING

A Mini project report submitted

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DEPARTMENT OF COMPUTER SCIENCE AND TECHNOLOGY

CERTIFICATE

This is to certify that the project titled "**SMART HOME MONITORING**" is a bonafide record of work done by **M. Balaji (21BQ1A4929), Sk. Abdul Rasheed (22BQ5A4904), K. Durgarao (21BQ1A4920)** underthe guidance of **Dr. Ch. V. Suresh, Professor** in partial fulfillment of the requirement of completion of the course **Sensors and Actuators** (20CO4C01) as part of the Bachelor of Technology in Computer Science and Engineering (CSO), JNTUK during the academic year 2022–23

Dr. Ch. V. Suresh	**Dr. Ch. Venkata Suresh**
Project Guide	**Head of the Department**

DECLARATION

We, **M. BALAJI (21BQ1A4929), SK. ABDUL RASHEED (22BQ5A4904), K. DURGARAO (21BQ1A4920),** hereby declare that the Project Report entitled "**SMART HOME MONITORING**" done by us under the guidance of **Dr. Ch. V. Suresh, Professor, Department of CSO** is submitted in partial fulfillment of the requirements for the award of degree of **BACHELOR OF TECHNOLOGY** in **COMPUTER SCIENCE AND ENGINEERING (IOT).**

DATE :

PLACE :

SIGNATURE OF THE CANDIDATES

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SK. ABDUL RASHEED

K. DURGA RAO

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We express our sincere thanks wherever it is due

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ABSTRACT

Over 65% of world population are having necessary needs in their homes like gas, water. As now a days the expenditures are increasing a lot even women are working out to meet their needs. In such situations its being difficult to monitor the wastage of resources like leakage of gas, water and protection in their houses. To help the needs for above problems this project comes with best solution where we can be able to monitor home from a smart phone itself. In this we need to implement basic sensors like MQ2 sensor, Ultra Sonic Sensor, DHT11, PIR Sensor by connecting to raspberry pi and monitor by Blynk app.

CHAPTER 1

INTRODUCTION

1.1 PROBLEM DEFINITION

Over 65% of world population are having necessary needs in their homes like gas, water. As now a days the expenditures are increasing a lot, even women are working out to meet their needs. In such situations its being difficult to monitor the wastage of resources like leakage of gas, water and protection of their houses. Also we know that due to leakage of gas there are heavy loses for lives and property and due to leakage of water the percentage of pure water has reduced a lot for the future generation.

1.2 PROBLEM STATEMENT

In today's modern world, homeowners seek ways to enhance the safety and security of their living spaces. Smart homes offer a variety of automated features, but there is a need for an advanced smart home monitoring system that can provide comprehensive security and monitoring capabilities. Security, real time monitoring, user friendly interface, accuracy, data privacy, scalability are the key measures for the smart system.

1.3 OBJECTIVE

The aim of smart home monitoring project is to design and implement a comprehensive system that utilizes advanced technologies to enhance the security, safety, and convenience of homeowners in their living spaces. The specific aims of a smart home monitoring project can include:

- Enhance home security.
- Centralise and simplify monitoring.
- Enable remote access.
- Implement intelligence automation.

1.4 APPLICATIONS

Smart home monitoring has several applications that enhance security, safety, and convenience for homeowners. Some key applications include:

Intrusion Detection: Smart home monitoring systems can detect unauthorized entry or intrusions by utilizing sensors, motion detectors, and door/window sensors. Homeowners receive real-time alerts on their smartphones or other devices when a breach is detected, allowing them to take immediate action.

Gas and Water Leak Detection: These systems use sensors to monitor for gas leaks or water leaks in the home. If a leak is detected, homeowners receive immediate notifications, allowing them to take prompt action and prevent potential damage or safety risks.

Elderly Care and Assisted Living: Smart home monitoring systems can be utilized to enhance the safety and well-being of elderly individuals. Motion sensors, fall detection devices, and health monitoring systems can alert caregivers or family members in case of emergencies or changes in any status.

CHAPTER 2

EXISTING SYSTEMS

2.1 DIFFERENT MODELS

There are several different models and approaches to smart home monitoring, depending on the specific requirements and goals of the monitoring system. Here are a few common models:

2.1.1 Camera-based monitoring: This model utilizes cameras strategically placed in different areas of the home to monitor activities and detect events. These cameras can be traditional CCTV cameras or smart cameras equipped with features like motion detection, facial recognition, and object tracking. They can be connected to a central monitoring system or integrated with a smart home platform for real-time monitoring, recording, and alerting.

fig:2.1.1 camera monitoring.

2.1.2 Behaviour-based monitoring: This model focuses on monitoring the behaviour patterns of occupants in the home. Machine learning algorithms can be used to learn and analyse the typical behaviour of individuals or the entire household. Any deviation from the learned patterns, such as abnormal movement or absence of activity during usual hours, can trigger alerts or actions.

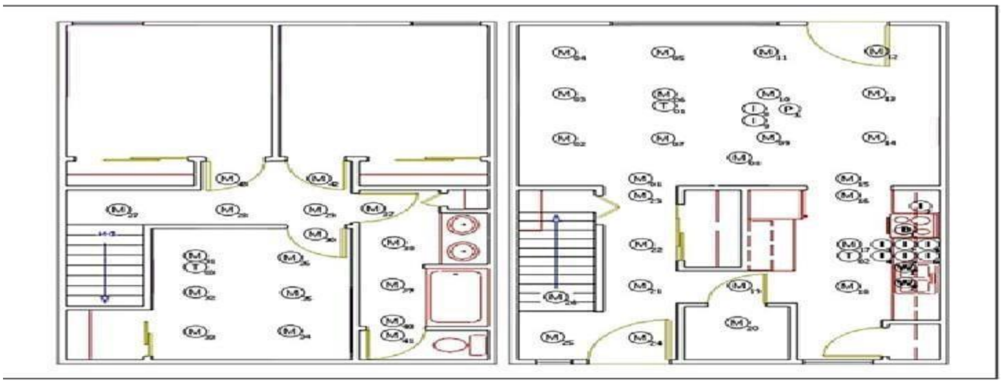

fig:2.1.2 behaviour monitoring.

2.1.3 Energy consumption monitoring**:** This model involves monitoring and analysing the energy consumption of various devices and appliances in the home. Smart meters or energy monitoring devices can be installed to track the electricity usage patterns. By analysing the data, homeowners can gain insights into their energy consumption habits, identify potential energy-saving opportunities, and receive alerts for abnormal or wasteful energy usage.

fig:2.1.3 energy monitoring.

2.1.4 Integration with virtual assistants: Smart home monitoring can also be integrated with virtual assistants like Amazon Alexa, Google Assistant, or Apple Siri. These virtual assistants can provide voice-based control and monitoring of various smart devices and systems in the home. Users can use voice commands to check the status of devices, receive alerts, and perform actions like adjusting thermostat settings, locking doors, or turning on/off lights.

fig:2.1.4 virtual assistance monitoring.

2.2 DISADVANTAGES

As every system has some disadvantages to cope up with the expectations.

2.2.1 Camera-based home monitoring systems offer several advantages, but it's important to be aware of the potential disadvantages as well. Here are some disadvantages of camera-based home monitoring:

- Invasion of privacy
- Legal and ethical considerations
- False sense of security
- Technical vulnerabilities
- Cost and maintenance

2.2.2 Behaviour-based home monitoring refers to systems that use artificial intelligence and machine learning. While this technology has its benefits, there are also some potential disadvantages to consider:

- Ethical implications
- Over-reliance and complacency
- Cost and complexity
- Psychological impact

2.2.3 Energy-based home monitoring systems, also known as energy management systems or smart home energy monitors, track and analyse energy usage within a home. While these systems have numerous advantages, there are also some potential disadvantages to consider:

- Complexity
- Data accuracy and reliability
- Compatibility limitations
- Behavioural changes

2.2.3 Integrating monitoring with virtual assistants in home monitoring systems can have some disadvantages. Here are a few potential drawbacks:

- False Positives
- Inadequate Coverage
- Complexity and Configuration Challenge
- Limited Flexibility and Customization.

CHAPTER 3

SYSTEM MODEL

3.1 BLOCK DIAGRAM

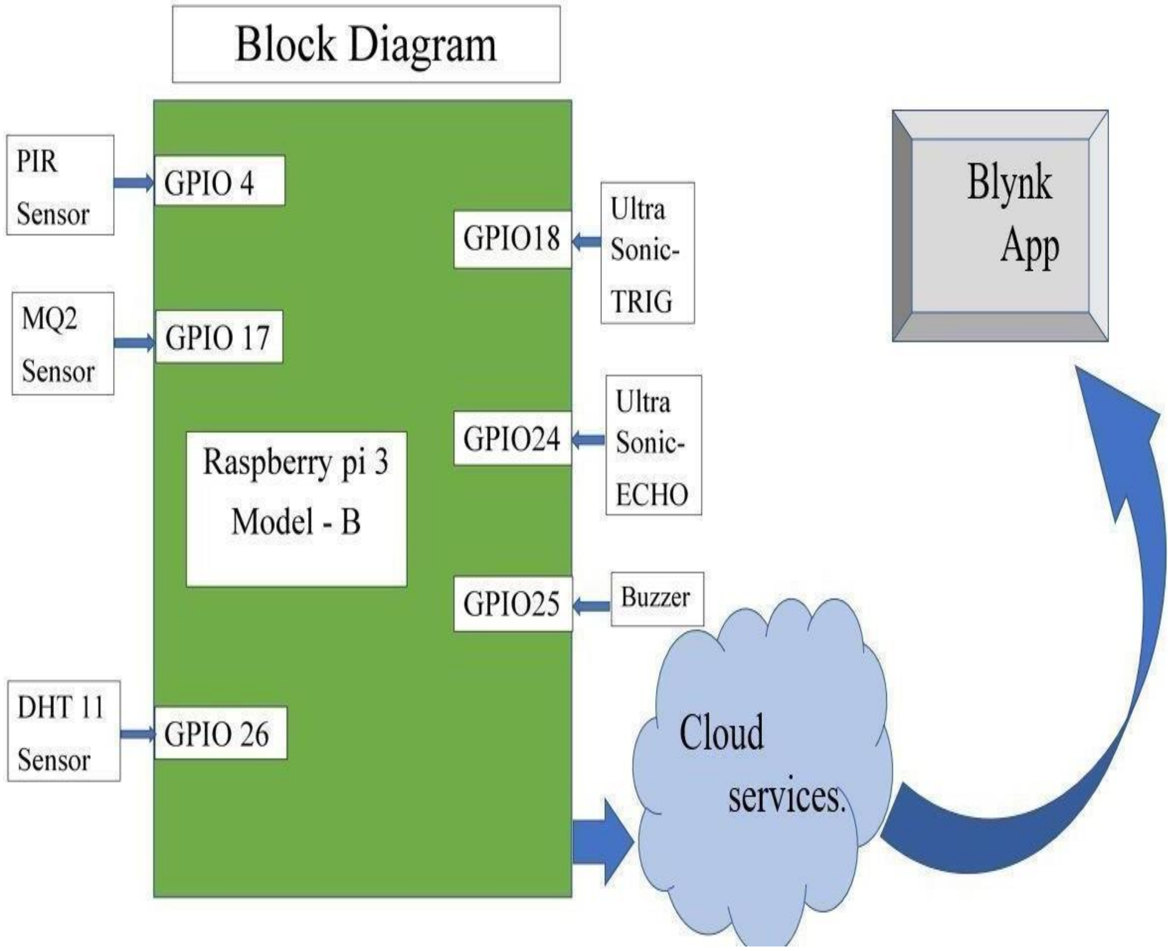

fig:3.1.1 block diagram

As shown in the above block diagram the various types of sensors (PIR, MQ2, DHT11, UTRASONIC, and BUZZER SENSORS) are connected to the various pins of Raspberry Pi. When these sensors are connected to Raspberry Pi, each sensor is typically connected to specific GPIO (General Purpose Input/Output) pins on the Raspberry Pi. The data collected from these sensors is then sent to the ThingSpeak cloud, which acts as a centralized storage and analytics platform for IoT data. The PIR sensor data indicates the presence or absence of motion in the monitored area. It provides information about when and where motion is detected. The MQ2 sensor data provides the analog readings of the detected gases. These readings can be used to monitor the concentration of gases in the environment, such as detecting gas leaks or monitoring air quality.

The DHT11 sensor data includes the temperature and humidity readings, allowing you to monitor and track changes in the ambient temperature and humidity levels. The ULTRASONIC sensor data represents the distance between the sensor and an object. This data can be used for various applications, such as detecting the presence of objects or measuring distances. The BUZZER sensor is an output device, and the data sent to ThingSpeak could indicate whether the buzzer is activated or not, depending on specific conditions or events. Once the data from these sensors is stored in the ThingSpeak cloud, it can be accessed by the Blynk app. The Blynk app can retrieve and display this data, providing a user-friendly interface to monitor and control the connected sensors and devices.

3.2. HARDWARE REQUIRED

3.2.1. ULTRASONIC SENSOR

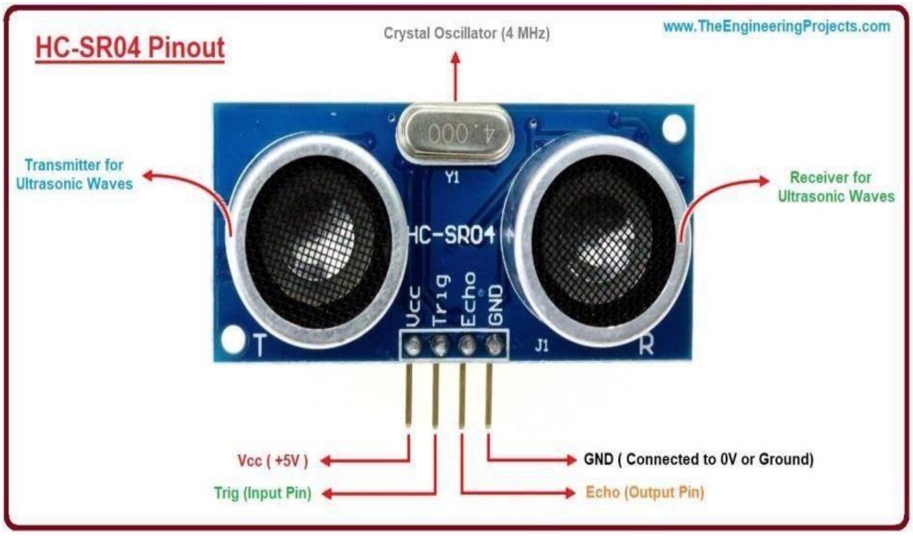

fig:3.2.1 ultrasonic sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

3.2.2. PIR SENSOR

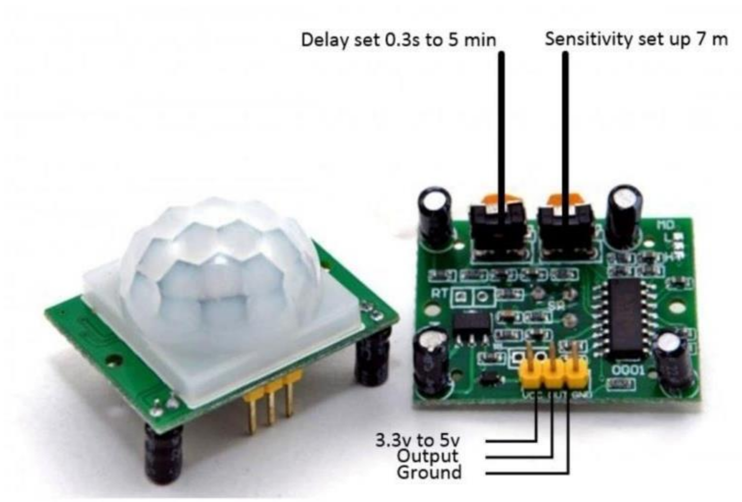

fig:3.2.2 PIR sensor

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications.

3.2.3 DHT11 SENSOR

fig:3.2.3 DHT11 sensor

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any microcontroller such as Arduino, Raspberry Pi, etc… to measure humidity and temperature instantaneously. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor. The temperature range of DHT11 is from 0 to 50 degrees Celsius with a 2-degree accuracy. The humidity range of this sensor is from 20 to 80% with 5% accuracy.

3.2.4 MQ2 GAS SENSOR

fig:3.2.4 MQ2 sensor

The MQ2 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemi resistors because sensing is based on the change in resistance of the sensing material when exposed to gasses. It also protects the sensor and filters out suspended particles, allowing only gaseous elements to pass through the chamber. A copper-plated clamping ring secures the mesh to the rest of the body. The MQ2 gas sensor operates on 5V DC and consumes approximately 800mW. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane, and Carbon Monoxide concentrations ranging from 200 to 10000 ppm.

3.2.5 BUZZER SENSOR

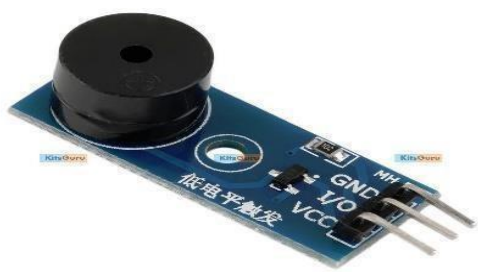

fig 3.2.5 BUZZER sensor

An audio signalling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarms, music, bell & siren.

3.2.5 RASPBERRY PI 3B

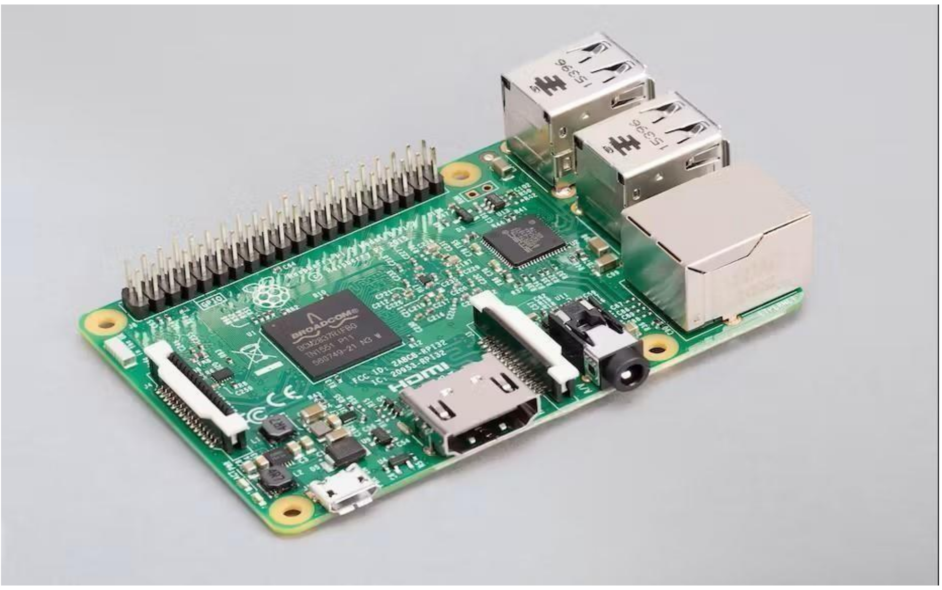

fig 3.2.5 Raspberry pi 3b

The Raspberry Pi can be used for many of the things that a normal desktop PC does, including word processing, spreadsheets, high-definition video, games, and programming. USB devices such as keyboards and mice can be connected via the board’s four USB ports. The Raspberry Pi is a credit card-sized computer with an ARM processor that can run Linux. This item is the Raspberry Pi 3 Model B, which has 1 GB of RAM, WiFi, Bluetooth 4.1, Bluetooth Low Energy (BLE), an Ethernet port, HDMI output, audio output, RCA composite video output (through the 3.5 mm jack), four USB ports, and 0.1″-spaced pins that provide access to general purpose inputs and outputs (GPIO). The Raspberry Pi requires a microSD card with an operating system on it (not included). The Raspberry Pi is very popular.

3.3. SOFTWARE REQUIRED

3.3.1. RASPBERRY OS

Raspberry Pi OS, formerly known as Raspbian, is the official operating system for Raspberry Pi single-board computers. It is a free and open-source operating system based on the Linux kernel, specifically Debian. Raspberry Pi OS is optimized for Raspberry Pi's hardware and provides a user-friendly interface and a suite of pre-installed software.

fig:3.3.1 raspberry pi os

Some key features and details about Raspberry Pi OS:

Linux-based: Raspberry Pi OS is based on the Debian distribution of Linux, which makes it highly reliable, secure, and customizable. GPIO support: Raspberry Pi OS includes libraries and tools that make it easy to interface with the GPIO (General-Purpose Input/Output) pins on the Raspberry Pi. This feature enables users to connect and control external devices, sensors, and electronics. Software compatibility: Raspberry Pi OS supports a wide range of software developed for the Debian Linux distribution. This means you can access a vast repository of software packages, including programming languages, libraries, and applications. Software availability: Raspberry Pi OS comes with a suite of pre-installed software, including programming tools, web browsers, office suites, media players, and more.

3.3.2. PYTHON 3.2.

Python 3.2 is a previous version of the Python programming language. It was released on February 20, 2011, and introduced several new features and improvements compared to its predecessor, Python 3.1. However, it's worth noting that Python 3.2 has reached its end-of-life status, which means it is no longer officially supported by the Python development community. The current stable release of Python is Python 3.9 as of my knowledge cut-off in September 2021.

fig:3.3.2 python

3.3.3. THING SPEAK

Thing Speak is an IoT analytics platform developed by MathWorks, the same company that develops MATLAB. It provides cloud-based services for collecting, analysing, and visualizing data from connected devices or sensors.

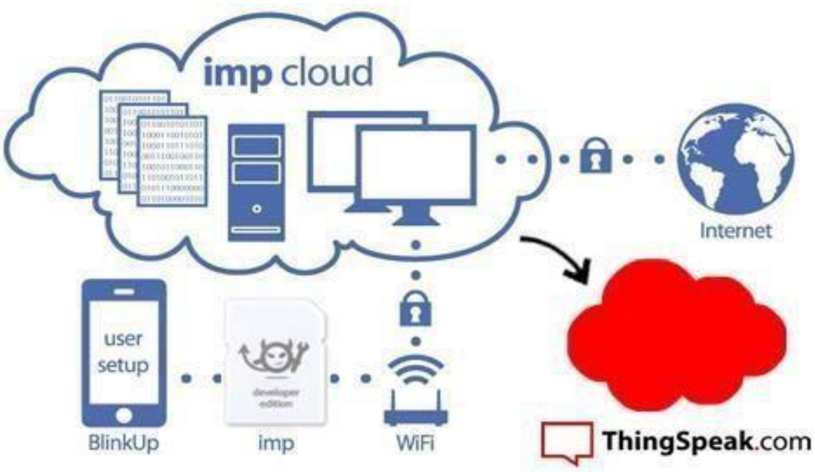

fig:3.3.3 thing speak cloud

Data collection: ThingSpeak allows you to collect data from IoT devices and sensors using a RESTful API or MQTT protocol. You can send data to ThingSpeak in real-time and store it in channels. Real-time data processing: ThingSpeak provides an easy-to-use web-based interface for performing real-time data processing. You can create MATLAB-based analytics that runs on the collected data, enabling you to perform calculations, transformations, and analyses. ThingSpeak is a popular platform among IoT enthusiasts, developers, and researchers due to its ease of use, cloud-based infrastructure, and integration with MATLAB.

3.3.4. BLYNK INTERFACE

Blynk is a popular IoT platform that provides a user-friendly interface for building mobile and web applications to control and monitor connected devices. With Blynk, you can create customizable dashboards and control panels that allow you to interact with your IoT devices and visualize data in real time.

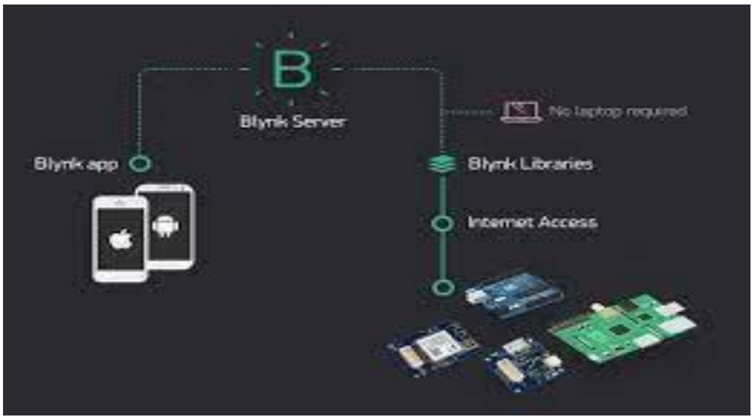

fig:3.3.4 blynk app

Blynk provides an intuitive and user-friendly interface for developing IoT applications.

CHAPTER 4

RESULT

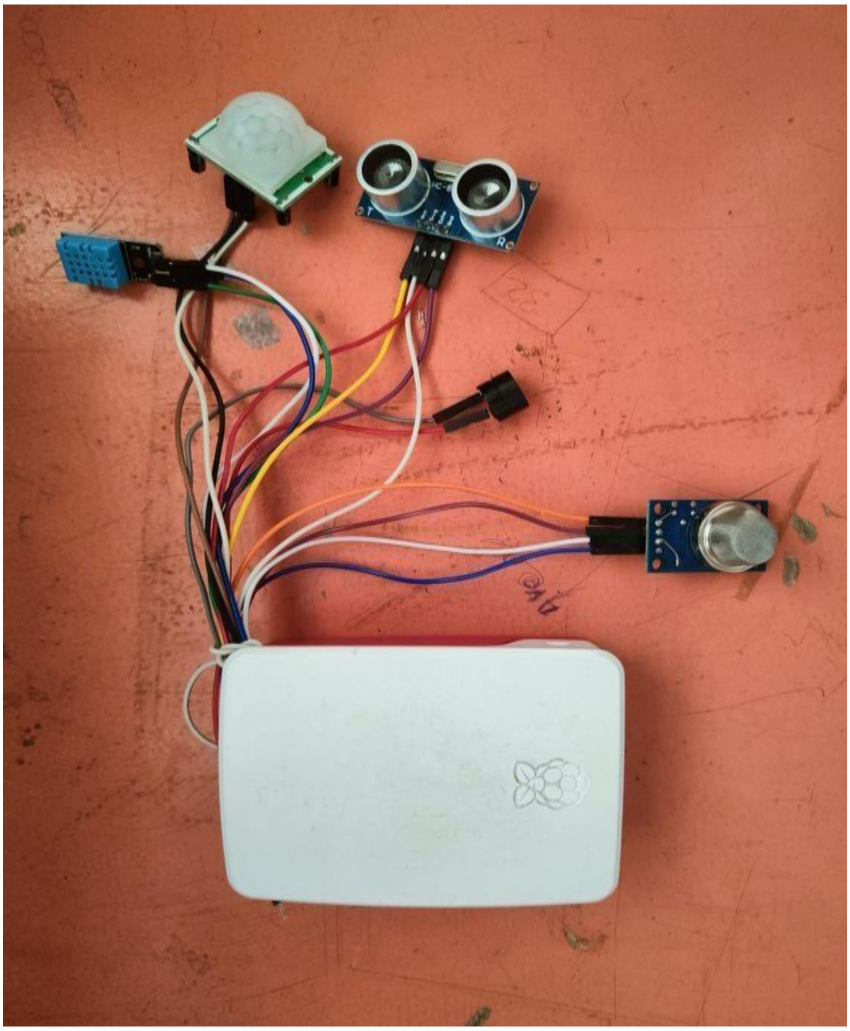

fig:4.1 Connections to sensors

Our project successfully captures sensor readings from various types of sensors and securely stores them in the cloud using ThingSpeak. These readings are then presented in real-time through the user-friendly Blynk IoT app, which serves as an efficient interface for users to interact with and monitor the data.

What sets our project apart is its ability to seamlessly integrate with diverse sensor types, providing a flexible and adaptable solution. By leveraging ThingSpeak's cloud capabilities, we ensure that the data is easily accessible and can be utilized for further analysis or integration with other systems.

Furthermore, our project's innovative approach and optimized design have resulted in superior outcomes compared to existing projects in the same domain. Through improved data collection, storage, and presentation, we have enhanced the overall user experience and efficiency of monitoring and controlling sensor data.

In summary, our project excels in its capacity to collect and store sensor readings, offer an intuitive user interface through the Blynk IoT app, and deliver superior results compared to similar existing projects.

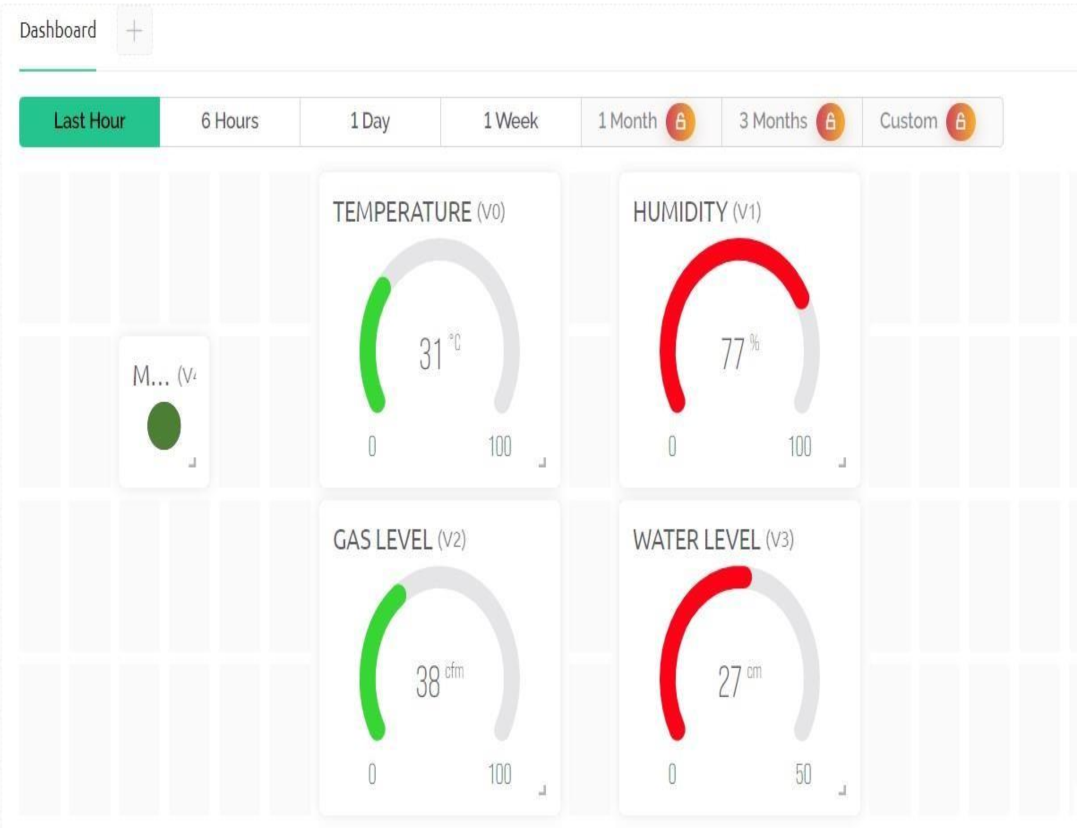

fig:4.2 Output of project

CHAPTER 5

CONCLUSION & FUTURE SCOPE

5.1 CONCLUSION

The conclusion of smart home monitoring is that it offers numerous benefits and has the potential to greatly enhance the safety, security, and convenience of our homes. By integrating various devices and technologies, such as sensors, cameras, smart locks, and voice assistants, smart home monitoring systems provide homeowners with remote access and control over their homes, even when they are away. Here are some key points to consider:

Enhanced Security: Smart home monitoring systems can include features such as motion sensors, door/window sensors, and security cameras, allowing homeowners to monitor their property and receive real-time alerts in case of any suspicious activities or breaches. This enhances the overall security of the home, providing peace of mind.

Remote Monitoring: One of the significant advantages of smart home monitoring is the ability to remotely monitor and control various aspects of the home. Through smartphone apps or web interfaces, homeowners can view live camera feeds, lock/unlock doors, adjust thermostats, turn lights on/off, and even manage appliances. This level of control and accessibility improves convenience and energy efficiency.

Energy Efficiency: Smart home monitoring systems enable homeowners to optimize energy usage by integrating with energy management devices. For example, smart thermostats can learn your preferences and adjust the temperature accordingly, reducing energy wastage. By monitoring energy consumption patterns, homeowners can identify areas where they can make improvements to save energy and reduce utility bills.

Home Automation: Smart home monitoring often goes hand in hand with home automation, allowing for the creation of routines and automated tasks. For instance, you can set your lights to turn on when you enter a room or have your coffee maker start brewing at a specific time in the morning. These automated routines make life more convenient and comfortable.

Peace of Mind: With smart home monitoring, homeowners have greater peace of mind knowing that they can monitor their homes and receive instant notifications in case of emergencies, such as fires, floods, or break-ins. This can lead to faster response times and better outcomes in critical situations.

5.2 FUTURE SCOPE

The future scope of sensor-based Raspberry Pi home monitoring is quite promising technology continues to advance, we can expect to see further developments and innovations in this field. Here are some potential areas of growth:

Increased Sensor Integration: Raspberry Pi, combined with various sensors, can monitor a wide range of environmental factors such as temperature, humidity, air quality, and even detect motion, sound, or vibrations. In the future, we can anticipate even more advanced sensors being integrated, enabling comprehensive monitoring and analysis of our homes' conditions.

Artificial Intelligence and Machine Learning: With the increasing capabilities of Raspberry Pi and advancements in artificial intelligence (AI) and machine learning (ML), home monitoring systems can become more intelligent and adaptive. AI algorithms can learn from patterns and data collected by sensors to make predictions, identify anomalies, and provide personalized recommendations for optimizing energy usage, security, and comfort.

Energy Optimization and Sustainability: Raspberry Pi home monitoring systems can provide valuable insights into energy consumption patterns, helping homeowners identify areas where energy can be optimized. With the integration of renewable energy sources and smart grid technologies, Raspberry Pi can play a crucial role in creating sustainable and energy-efficient homes.

Health and Wellness Monitoring: Raspberry Pi-based sensors can be utilized for health and wellness monitoring within the home. For example, sensors can track air quality, monitor sleep patterns, detect falls or emergencies, and provide recommendations for a healthier living environment. This can be particularly beneficial for the elderly or individuals with specific health concerns.

In summary, the future scope of sensor-based Raspberry Pi home monitoring is vast. With advancements in sensor technology, AI, IoT integration, security, and energy optimization, Raspberry Pi can revolutionize the way we monitor and manage our homes, making them smarter, safer, and more sustainable.

REFERENCES

For smart home monitoring using Raspberry Pi, there are various resources available. Here are some references I used:

- **Raspberry Pi Foundation**: The official website of Raspberry Pi Foundation (https://www.raspberrypi.org/) offers extensive documentation, tutorials, and projects related to Raspberry Pi, including smart home monitoring. You can find step-by-step guides, sample codes, and community forums to seek assistance.
- **GitHub**: GitHub (https://github.com/) is a code hosting platform that contains a vast repository of open-source projects. You can search for smart home monitoring projects using Raspberry Pi, explore the code, and find valuable resources.
- **Magazines and Books:** Magazines and books dedicated to Raspberry Pi and smart home automation can provide in-depth knowledge and practical examples.
- **YouTube Tutorials**: YouTube is a rich source of video tutorials for Raspberry Pi projects. Many content creators share detailed instructions and demonstrations for smart home monitoring using Raspberry Pi. Some popular channels in this domain include "ExplainingComputers," "Raspberry Pi Guy," and "Novaspirit Tech."