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IOT BASED HOME SECURITY AND AUTOMATION

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Abstract: In today's world, safety and security of homes have become one of the primary concerns due to increasing incidents of theft, fire hazards, and environmental threats. To address this issue, our project proposes a smart Home Security and Automation System using Internet of Things (IoT) technology. The system integrates five sensors — PIR sensor for motion detection, MQ2 sensor for gas leakage detection, DHT11 sensor for temperature and humidity monitoring, Fire sensor for flame detection, and an Ultrasonic sensor for automatic water tank level detection and filling.

These sensors are connected to a microcontroller, which continuously monitors the surrounding environment. In the event of any abnormal activity such as intrusion, gas leakage, sudden fire, or critical temperature rise, the system immediately triggers an alert. The system is integrated with the Blynk IoT platform, which enables real-time notifications to be sent via email to the homeowner, ensuring instant awareness of the situation.

Additionally, the ultrasonic sensor automates the water filling process, thus reducing manual effort and ensuring water availability. This project not only enhances security bualso adds automation for convenience and energy efficiency. The system is lowcost, easy to install, and scalable for future improvements like AI-based detection and voicecontrolled automation. Hence, the proposed solution provides a reliable, userfriendly, and effective approach for securing homes while offering intelligent automation features.

Keywords: IOT, Home Automation, Security System, Smart Sensors, Blynk IOT

I. INTRODUCTION

The rapid growth of urbanization and lifestyle changes have increased the demand for advanced home security systems and automation solutions. Traditional security systems, though effective to some extent, often fail to provide real-time alerts and lack automation features. Recent advancements in IoT have enabled the integration of multiple smart sensors with cloud-based platforms to create intelligent home monitoring systems.

This project focuses on developing a Home Security and Automation System that combines safety, convenience, and efficiency. The system uses five different sensors: PIR sensor to detect motion or intrusion, MQ2 sensor to detect gas leakage, Fire sensor for flame detection, DHT11 sensor to monitor temperature and humidity, and an Ultrasonic sensor for automatic water filling in tanks. All the data from sensors are processed by the microcontroller, and alerts are sent through the Blynk IoT platform in the form of email notifications.

The main objective of this system is to provide immediate alerts during critical situations like fire, gas leakage, or intrusion, thereby preventing major damage and ensuring the safety of the residents. In addition to security, the system offers automation features such as water level monitoring and automatic refilling, which add convenience and reduce human intervention. This integration of security and automation makes the proposed system costeffective, efficient, and suitable for smart homes.

II. LITERATURE REVIEW

[1] S. Kumar et al. (2018) developed an IoT- based Smart Home Security System using a PIR sensor to detect motion and intruders. The system could automatically send alerts through the internet, ensuring real-time monitoring. The study emphasized low-cost implementation and reliable performance for household security.

[2] R. Patel and V. Mehta (2019) proposed a Gas Leakage and Fire Detection System using Arduino and sensors such as MQ-2 for gas and flame detection. Their design focused on safety by activating alarms and exhaust fans upon detecting dangerous gas levels, highlighting the role of IoT in preventing fire hazards.

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[3] A. Chavan and N. Patil (2024) presented an IoT-Based Smart Home Security and Automation System utilizing Arduino and Blynk platforms. The system enabled remote control and real-time monitoring of appliances and security devices via smartphones. It demonstrated effective integration of IoT for home automation and energy efficiency.

[4] A. Singh et al. (2019) introduced a Smart Water Tank Monitoring System using ultrasonic sensors to measure water levels. Implemented with IoT connectivity, the system provided automatic control of the water pump and remote level monitoring, reducing manual intervention and water wastage.

[5] P. Sharma and K. Joshi (2020) developed a Home Automation and Monitoring System using IoT that combined multiple sensors and actuators to control lighting, temperature, and appliances. Their research highlighted the scalability of IoT for smart living and energy management.

[6] M. Ali et al. (2021) designed an IoT-based Fire and Gas Detection System that combined smart sensors with cloud connectivity. Their system enhanced early detection and real-time alerts through mobile notifications, emphasizing industrial and residential safety applications.

[7] H. Patel (2022) implemented a Blynk IoT- based Smart Home Automation System allowing users to control home appliances through a mobile app. The study demonstrated the efficiency of the Blynk platform in providing user-friendly interfaces and remote control capabilities without complex coding.

[8] V. R. Gade and S. P. Wankhede (2022) developed an IoT-based Smart Door Lock System using Arduino and Blynk. The system provided enhanced security through password- protected access and mobile app control, showcasing IoT's role in modern smart lock mechanisms.

[9] T. Mishra and P. Agrawal (2022) designed an IoT-enabled Smart Fire Alarm and Gas Monitoring System integrating multiple sensors to detect hazardous conditions. The system was capable of real-time alerts via IoT platforms, enhancing safety and response time during emergencies.

III. METHODOLOGY

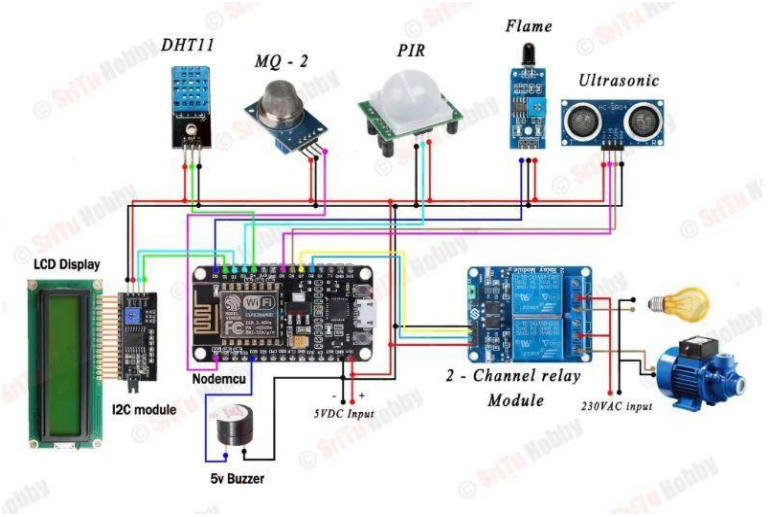

Fig.1.Hardware – Shows complete setup including ESP866, Relay, LCD Display, and Sensors

The methodology of our project involves the design and implementation of a smart home security and automation system using IoT technology. The system makes use of five sensors: PIR sensor for motion detection, MQ2 sensor for gas leakage detection, DHT11 sensor for temperature and humidity measurement, Fire sensor for flame detection, and Ultrasonic sensor for water level monitoring and automatic tank filling.All the sensors are connected to an ESP8266 NodeMCU microcontroller, which is responsible for processing the signals received from the sensors. Whenever any unusual activity is detected (such as human motion, gas leakage, fire, or critical temperature rise), the microcontroller immediately sends the data to the Blynk IoT platform via Wi-Fi.,

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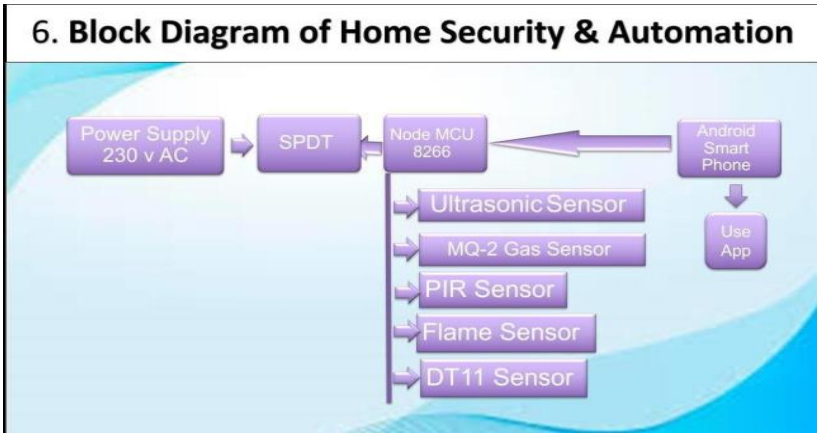

FIG.2.Block diagram of Home Security & Automation

Blynk then forwards real-time alerts to the homeowner through email notifications, ensuring that the person is informed instantly even if they are not at home.The ultrasonic sensor is used to measure the water level inside a storage tank. When the level falls below a certain threshold, the NodeMCU automatically turns on a motor to fill the tank. Once the water level reaches the desired point, the motor is switched off. This automation reduces manual monitoring of water levels and prevents overflow.

Hardware Components

1. NodeMCU (ESP8266) - Main controller for connecting sensors and handling IoT communication.
2. DHT11 Sensor – Measures temperature and humidity.
3. MQ-2 Sensor – Detects harmful gases like LPG, smoke, or CO.
4. PIR Sensor – Detects human motion for security.
5. Flame Sensor – Identifies fire or flame presence.
6. Ultrasonic Sensor – Measures distance for obstacle or intrusion detection.
7. Relay Module (2-Channel) – Controls electrical devices like lights and motor/pump.
8. LCD Display (with I2C module) – Displays sensor readings and system status.
9. 5V Buzzer – Gives alarm alerts during emergency.
10. Power Supply (5V DC) – To power up NodeMCU and sensors.
11. Wires, Breadboard/PCB, and Connectors – For circuit assembly.

Software Components

1. Arduino IDE – Used for programming NodeMCU and uploading the code.
2. Blynk IoT App/Platform – For remote monitoring and controlling devices through a smartphone.

Fig.3. Arduino IDE

The Arduino Integrated Development boards. Environment (IDE) is an open-source software application used to program and develop code for Arduino microcontroller It provides a user- friendly interface and a simplified programming language.

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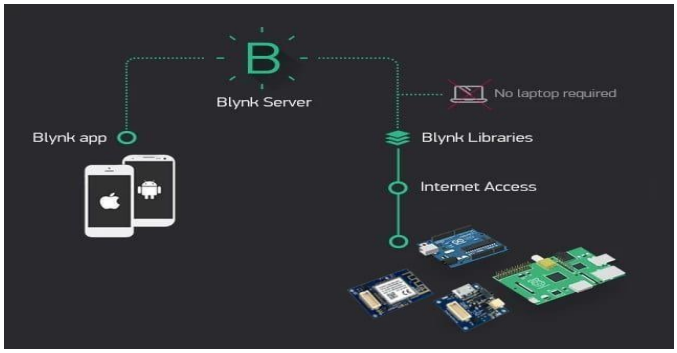

FIG.4. BLYNK IOT SOFTWARE

Blynk IoT is used in home security and automation projects because it allows remote monitoring and control of devices through a mobile app. It helps to receive instant alerts from sensors, control appliances like lights and locks, and automate tasks for safety and convenience, making the home smarter and more secure.

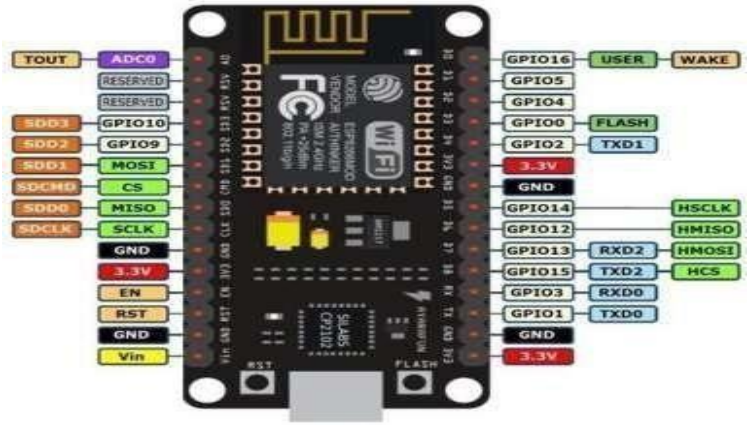

FIG.5.NODE MCU 8266

However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip. You also have to program it in low-level machine instructions that can be interpreted by the chip hardware

FIG.6.RELAY

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.It works on the principle of electromagnetism. The electromagnetic field that creates the temporary magnetic field is energized when the relay's circuit detects the fault current

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FIG.7.UITRASONIC 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). Ultrasonic sensors are used primarily as Proximity Sensor They can be found in automobile self-parking technology and anticollision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology

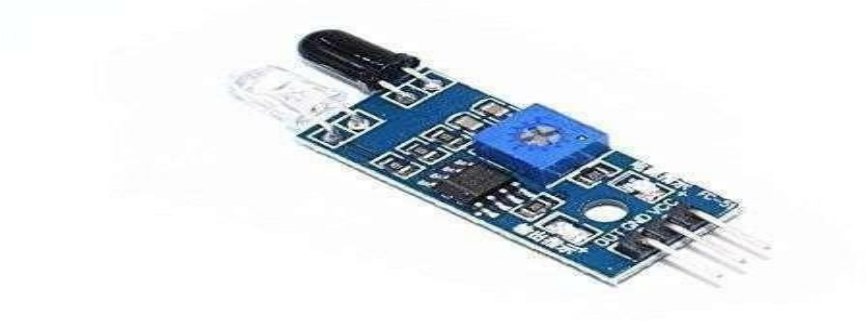

FIG.8.FLAME SENSOR

A Flame sensor is an electronic device that measures and d clects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temp erature just beyond the red light was highest IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum) Infrared sensors work on the principle of reflected light waves. Infrared light reflected from objects or sent from an infrared remote or beacon. Infrared sensors are also used to measure distance or proximity. The reflected light is detected and then an estimate of distance is calculated between sensor and object.

FIG.9.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 detector. PIR sensors are commonly used in security alarms and automatic lighting applications. The PIR sensor circuit consists of three pins, power supply pin, output signal pin, and ground pin. The PIR sensor circuit is having ceramic substrate and filter window as shown in the figure and also having dome like structure called as Fresnel lens.

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FIG.9.MQ-2 GAS SENSOR

The MQ2 sensor, known for its high sensitivity to various gases including methane, propane, alcohol, and smoke, operates on the principle of detecting changes in conductivity when exposed to these gases. This sensor is widely used in gas leakage detection systems, safety alarms, and air quality monitors due to its ability to provide real-time data on gas concentrations. Its affordability, compact size, and ease of integration make it a preferred choice for both DIY enthusiasts and professionals in applications ranging from home automation to industrial safety. Despite its effectiveness, it's important to note that calibration and periodic maintenance are necessary to ensure accurate and reliable gas detection over time.

A. Workflow –

The working of the IoT-based Home Security and Automation system starts with various sensors connected to the NodeMCU
(ESP8266). Each sensor performs a specific task such as monitoring temperature and humidity (DHT11), detecting harmful gases (MQ-2), identifying human motion (PIR), sensing fire (flame sensor), and measuring distance for intrusion detection (ultrasonic sensor).
All the collected data from these sensors is processed by the NodeMCU. Based on the programmed conditions, the controller takes appropriate actions. For example, if motion or gas leakage is detected, the system immediately triggers the buzzer and displays the warning on the LCD screen. The relay module is used to automatically switch ON/OFF electrical appliances such as lights or pumps depending on the inputs received.
The NodeMCU also connects to the internet via Wi-Fi and sends real-time data to the Blynk IoT platform, allowing the user to monitor the status of the home remotely through a smartphone. Notifications or alerts are generated instantly in case of emergency situations like fire, gas leakage, or unauthorized entry.
Thus, the workflow ensures continuous monitoring, automatic control, and remote access, which enhances home security and automation.

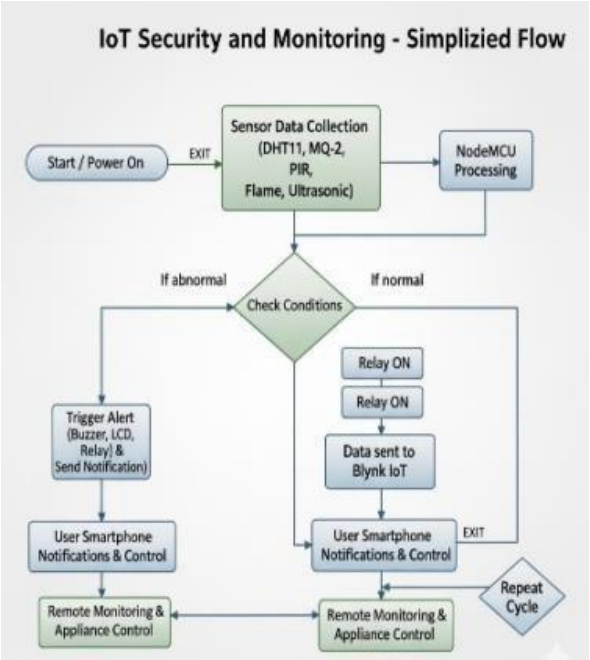

Fig.10. Flowchart for IOT based Home Security

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IV. RESULTS

The IoT-based Home Security and Automation system was successfully implemented. The sensors accurately detected motion, gas, fire, temperature, and distance, while the relay controlled appliances automatically. Real-time alerts and notifications were sent to the user through the Blynk IoT app, and sensor data was displayed on the LCD. The system worked effectively for both home safety and automation.

PROJECT MODEL IMAGES

Fig: - Model for Home Security and Automation Project

Fig: - Mounted LCD and Buzzer

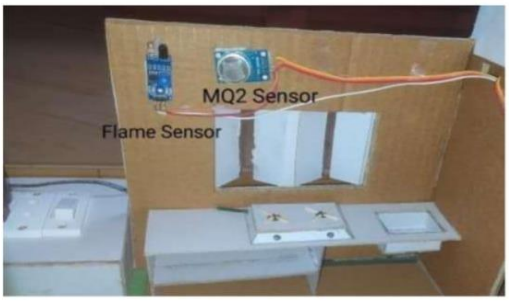

Fig: - Mounted Flame Sensor and MQ2 Sensor

Fig: - All sensor mounting position

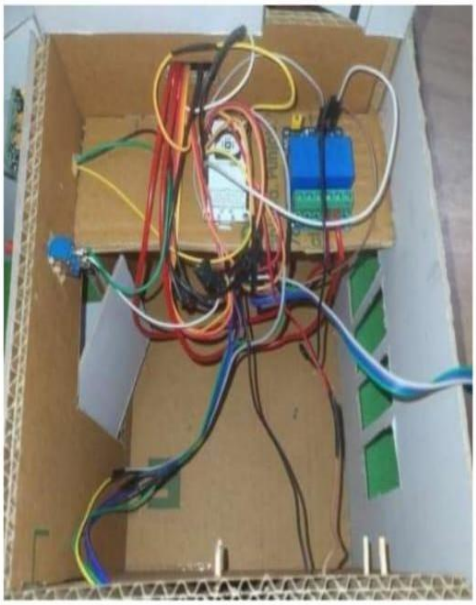

Fig: - NodeMCU circuit and relay module

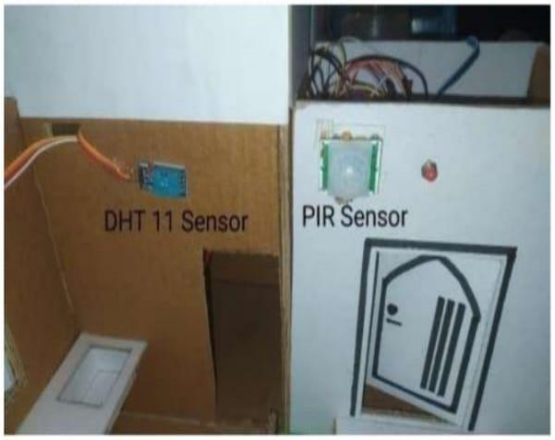

Fig: - Mounted DHT11 sensor and PIR sensor

Fig.11.Actual model of Home security and Automation

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he proposed IoT-based Home Security and Automation system was successfully developed and tested. The system integrates five sensors — PIR, MQ2, DHT11, Fire, and Ultrasonic — with NodeMCU to monitor different home safety parameters. During testing, the sensors responded accurately to critical conditions such as intrusion, gas leakage, and fire, while the ultrasonic sensor effectively controlled the water level through automation. Real-time notifications were delivered to the homeowner using the Blynk IoT platform, and alerts were displayed on both the LCD and buzzer. Thus, the system provided a reliable, low-cost, and efficient solution for enhancing home security and convenience through automation

Fig.12.Actual model of Home security and Automat

V. FUTURE SCOPE

The future of home automation is exciting and holds a lot of potential for making our lives more comfortable, efficient, and secure. Here are some potential future developments in home automation:

1. Artificial Intelligence (AI) Integration: With the integration of AI technology, home automation systems will be able to learn and adapt to our habits and preferences, anticipating our needs and automating routine tasks.
2. Voice Control: Voice-controlled home automation systems are already becoming more popular, and this trend is expected to continue in the future. As voice recognition technology improves, we can expect more advanced and accurate voice control of our home automation systems
3. Energy Management: Home automation systems can help us manage our energy consumption by automatically adjusting temperature settings, turning off lights and appliances when not in use, and even integrating with renewable energy systems like solar panels.
4. Health Monitoring: Home automation systems can be used to monitor and track our health, providing real-time information on vital signs, sleep patterns, and more. This information can be used to improve our overall health and wellbeing.
5. Security and Safety: Home automation systems can be used to enhance security and safety in our homes, by monitoring for intruders, detecting fire and smoke, and even alerting emergency services in case of an emergency.
6. Integration with Smart Cities: Home automation systems can be integrated with smart city infrastructure, allowing homeowners to access information on traffic, weather, and other city services through their home automation systems.

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7. Internet of Things (IoT) Integration: The integration of home automation systems with the Internet of Things will allow for greater connectivity and automation between devices, enabling more seamless and efficient automation of our homes.

Overall, the future of home automation looks promising, with endless possibilities for improving our lives and making our homes more comfortable, efficient, and secure.

VI. CONCLUSION

The home security and automation project, powered by IoT technology and a suite of sensors including MQ2, DHT11, Infrared, PIR, and ultrasonic sensors, along with the Thingspeak mobile app, represents a significant advancement in enhancing residential living.

It offers a comprehensive solution for monitoring, alerting, and controlling the home environment, focusing on security through gas leak detection, temperature/humidity monitoring, and motion/human presence detection. The real-time notifications ensure prompt response to threats, while automation features like water tank management add convenience and promote resource conservation. Overall, this project showcases the transformative potential of IoT in creating safer, more efficient, and connected homes, improving the quality of life for residents.

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