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IoT Based Smart Home Automation System

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Abstract: ***The aim of this project is to control the lights, fans and detecting of fire and gas leakage at home using the IoT Blynk cloud platform, an ESP32, and an L298N motor driver. By doing so we can enable remote control of these devices, providing greater convenience and flexibility for the end-user. The ESP32 will act as the central hub of the project, receiving and processing data from the Blynk cloud platform. The L298N motor driver will be used to control the lights and fans, with the ESP32 sending signals to the driver to turn the devices on or off as required. Through the Blynk cloud platform, the user will be able to remotely control the lights and fans, turning them on or off as needed from a mobile device or computer. This will be achieved through the creation of a customized interface in the Blynk app, allowing the user to interact with the devices using buttons or switches. Overall, this project offers a practical and effective solution for remotely controlling the lights and fans in a home, and also detects fire and gas leakage and enhancing the comfort and convenience of the living space.***
Keywords: IoT, ESP32, L298N motor driver, Blynk cloud platform.

I. INTRODUCTION

The Internet of Things is a revolutionary concept in the world of technology, that is transforming the world into a better and convenient place. IoT refers to the interconnection of devices that are embedded with sensors, software and allow them to communicate through collection and exchange of data. IoT applications can be found in different industries such as in smart home, healthcare, agriculture, insurance, transportation etc. This paper describes how IoT is applied to home to make it smarter and more convenient. By seamlessly integrating IoT technologies a system is made which provides users with the ability to control lighting and fans in their homes through mobile application. It can be done through a web page as well. Not only controlling lights and fans, system also integrated with crucial safety features. Gas leakage detection is one such important element. The system continuously monitors the air for the presence of dangerous gases. When such gas is detected by the system it acts swiftly, sending immediate notifications to the user's mobile app and to web dashboard as well. This rapid response capability ensures that homeowners can take prompt action to mitigate risks and protect their homes. Moreover, the system doesn't stop there, it also incorporates fire detection technology. By integrating smoke and heat sensors, it can identify the presence of fire within the home. When a fire hazard is detected, the system springs into action, sending real-time notifications to the user's connected devices. This immediate alerting feature enables homeowners to respond quickly to fires, saving lives and property. The heart of this project lies in its notification system. Whether it's a gas leakage or a fire emergency, the system ensures that are users are promptly informed. Notifications are dispatched to the user's mobile devices as well as accessible via web dashboard. This means that homeowners are always in the known, allowing them to take swift and decisive actions to address any emerging issues and ensure the safety and security of their homes.

II. LITERATURE SURVEY

Smart home has the capacity to communicate with the other devices. Many researchers approached different methods to construct a smart home integrated with Internet of Technology. Some of the research papers considered shows that:

1) In the year 2022, few authors along with A. P. Nirmala [1] worked on IoT based secure smart Home Automation systems. They made the system using Arduino uno and Wi-Fi technology.
2) In the year 2019, T. K. Palaniyappan proposed an IoT based energy efficient home automation system. To make the system efficient, smaller Node MCU microcontroller was used which is easy to utilize and code. Different controlling methods and strategies were used to get updated outcomes.

III.PROPOSED SYSTEM

The proposed system is an IoT based smart home automation system, which aims to control the lights and fans through mobile dashboard or through web dashboard. Apart from controlling home fans and lights it also aims to detects the fire and harmful gas leakages. If it detects any leakage of the toxic gas, it sends the real time alert to the blynk mobile application. Even in case of fire detection it sends the notification to the mobile. The microcontroller used in this system is ESP32 and also sensors like MQ-2 Sensor and flame sensor are used. It also used L298N motor driver.

The below diagram shows the system architecture which includes hardware setup of the home automation and its connection with Blynk Application and server, an IoT platform for both android and iOS.

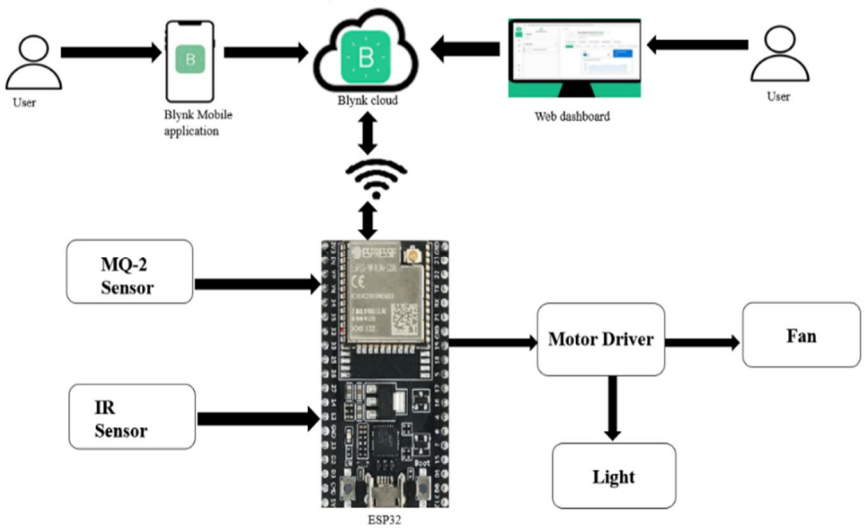

Fig. 1. Architecture of the system.

Firstly, the connection of a hardware circuit using components such as ESP32, Sensors, Motor driver, a fan and a light as shown in proposed system. Once the physical connections are established, the development process continues with the creation of software code in the Arduino IDE. Using Arduino IDE, a code is written and uploaded it to ESP32 board. It sets the digital pins to initial states, such as turning off LED, and fan and sets up two digital input pins to read sensor data. If any data is detected by these pins, it sends real-time alerts and notifications to a mobile application allowing users to monitor and respond to the sensor data remotely. Additionally, the system may be set up to send email notifications as part of its alerts mechanism.

IV. HARDWARE DESCRIPTION

Hardware components used in this system are:

1) *ESP32:* The ESP32 is a microcontroller and system-on-chip (SoC), which is designed for Internet of Things applications. It is integrated with Wi-Fi and Bluetooth, and various peripherals and low-power modes. It is affordable and compatible with popular development frameworks like Arduino. It is mostly used for sensor data collection, wireless communication and other control applications.

Fig. 2. ESP32 Microcontroller.

2) *L298N Motor Driver***:** It consists of L298N motor driver IC which is capable of handling medium-sized motors with high current requirements.

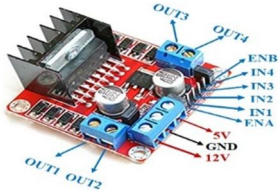

Fig. 3. L298N Motor Driver.

3) *MQ-2 Sensor:* The MQ-2 sensor is a gas sensor module which is used to detect various types. This is commonly used in gas leakage detection, fire detection and air quality monitoring applications.

Fig. 4. MQ-2 Sensor.

4) *IR Sensor:* An Infrared sensor is a device that detects and measures infrared radiation, which is invisible to human eye but it is emitted by objects with a temperature above absolute zero.

Fig. 5. IR Sensor.

5) *Breadboard*
6) *Connecting wires*
7) *LED and 12V DC fan*

V. SOFTWARE DESCRIPTION

The following software is used in the implementation of the project:

1) *Arduino IDE*: The Arduino Integrated Development Environment is a software application. It is used to write your program in the Arduino programming language, which is based on C and C++. In this project C++ programming language is utilized along with a set of standard libraries provided by the Arduino IDE. After code is written, it is compiled and uploaded to the ESP32 microcontroller. And this microcontroller is used control and coordinate communication modules and sensors.

Fig. 6. Arduino IDE.

2) *Blynk:* Blynk is a software that empowers users to connect their hardware to the cloud and create iOS, Android, and web applications, analyses real time and historical data from devices, remotely control them and receive important notifications.

Fig. 7. Blynk App.

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VI. RESULTS

The implemented home automation system shown in Fig. 8. successfully controlled lights and fans using Blynk IoT application and web dashboard. Interaction with the system is done based on the preferences such as turning lights and fans on or off. The below figure Fig. 9. shows the system when both lights and fans are turned off.

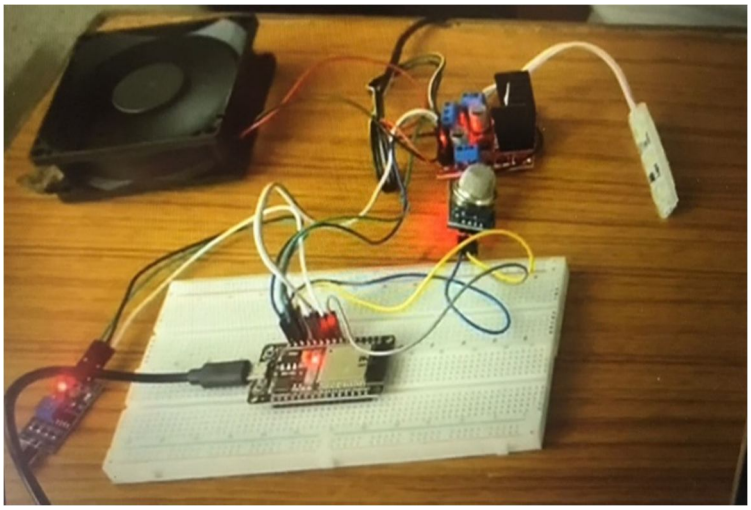

Fig. 8. Hardware connection of the proposed system.

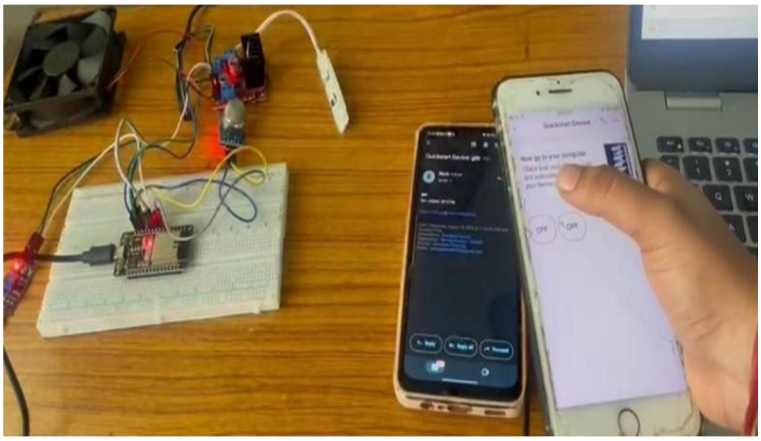

Fig. 9. System when light and fan are turned off.

The system is controlled through mobile dashboard whenever we turn on light using mobile the lights get turned on. Similarly, the fan can be controlled as shown in below figure:

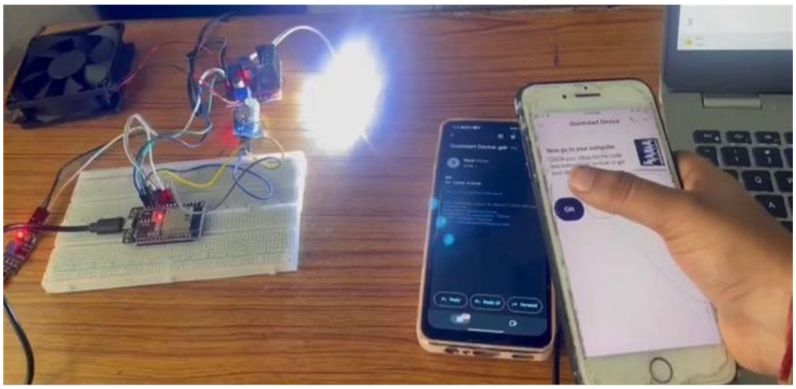

Fig. 10. Light is turned on through blynk IoT mobile app.

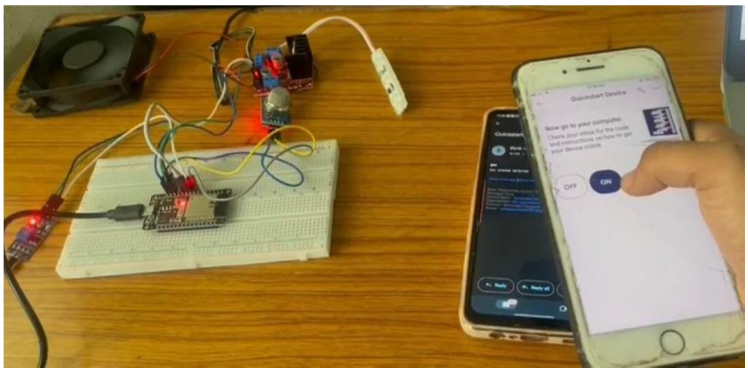

Fig. 11. Fan is turned on through blynk IoT mobile app.

The gas detection module was integrated into the system to monitor for the presence of potentially harmful gases in the environment. When sensor detects the presence of gas, the system triggers an immediate alert as shown below:

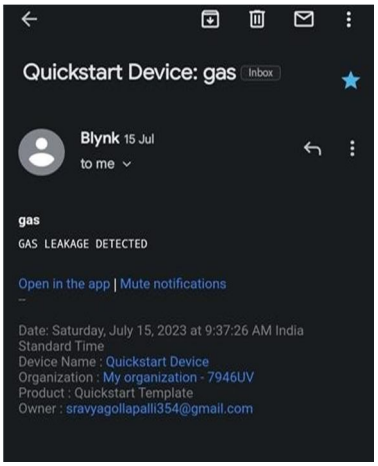

Fig. 12. Gas leakage detected notification.

The MQ-2 sensors play a critical role in smart home automation by detecting the presence of various gases and contributing to safety, security, and environmental monitoring within the home. The MQ-2 sensor is a versatile component in smart home automation system that enhances safety, security, and environmental quality by detecting gases and triggering appropriate responses. The fire detection component was designed to identify the occurrence of a fire within the monitored area. Smoke and heat sensors were strategically positioned to accurately detect the early stages of a fire. Upon detection, the system promptly initiated an alert to notify the user of the potential danger.

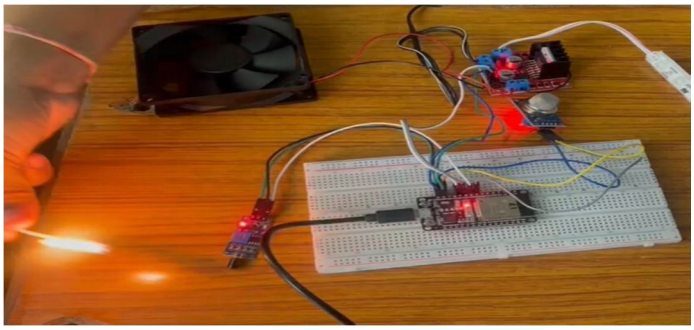

Fig. 13. Fire detection test.

When an IR sensor is used for fire detection in a smart home automation system and notifications are sent through email. It's essential for a smart home automation system to have a robust and reliable fire detection and notification process to ensure the safety of occupants and property.

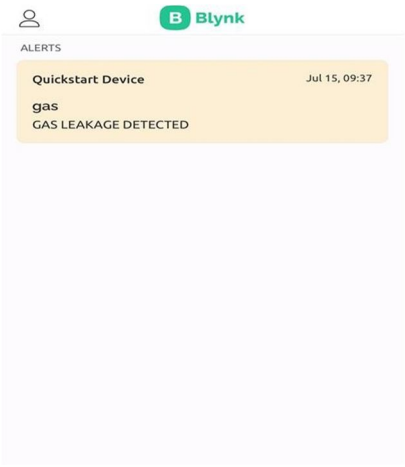

Fig. 14. Alert from blynk IoT app.

VII. CONCLUSIONS

The IoT-based smart home automation system presented in this project offers a comprehensive solution for enhancing convenience, energy efficiency, and safety within residential environments. By integrating control over lights and fans through the Blynk IoT mobile app and web dashboard, along with the capability to detect gas leakage and fire incidents, the system brings together the advantages of modern technology to create a secure and user-friendly living space.

The gas and fire detection components represent a significant advancement in home safety. Through strategically placed sensors, the system can promptly identify the presence of hazardous gases and the onset of fire. These critical functionalities contribute to early warning, enabling occupants to take swift and appropriate actions to mitigate potential risks. The integration of real-time notifications, both through the Blynk app and email, ensures that users are immediately informed of any detected anomalies, regardless of their location.

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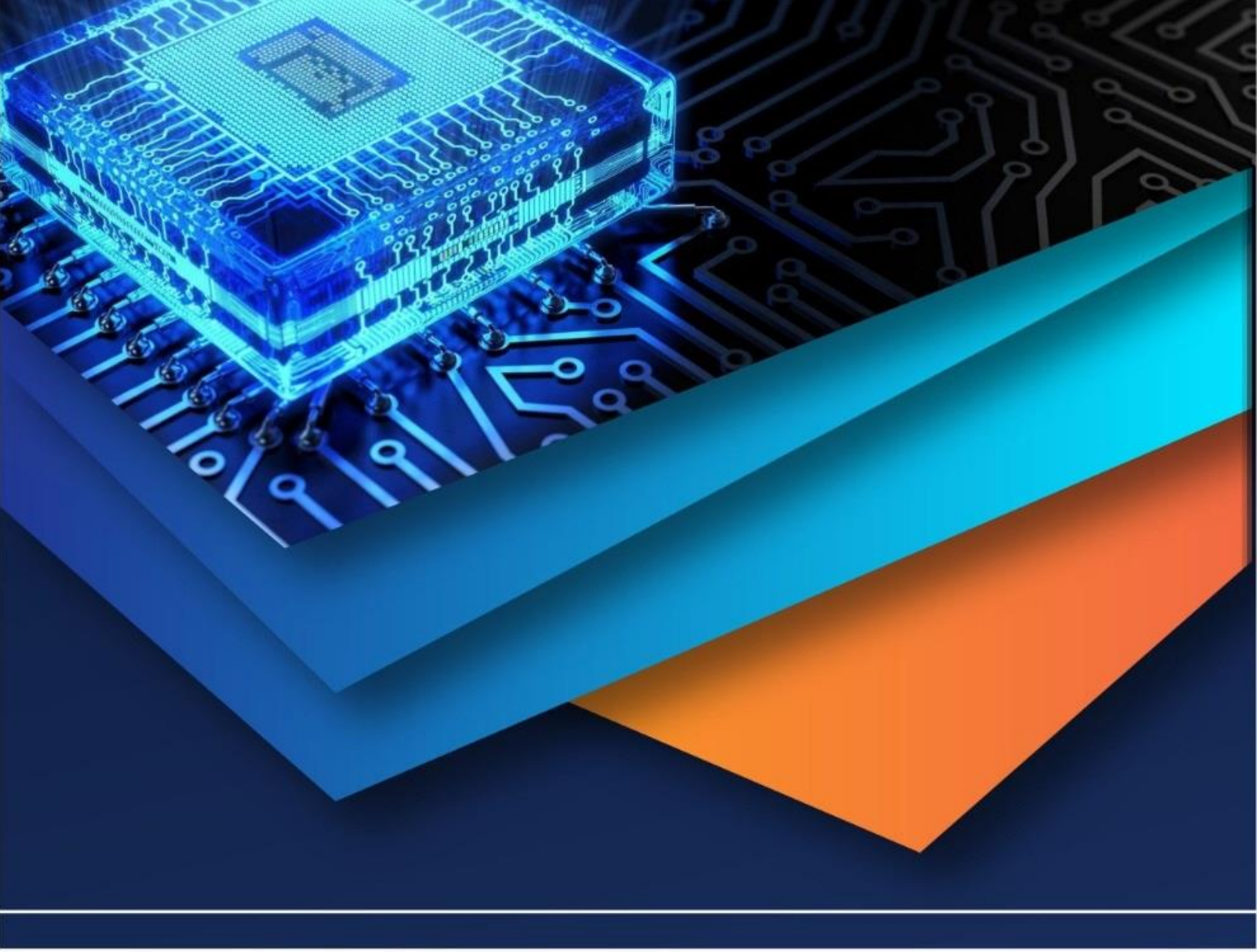

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