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IOT Based Gas And Smoke Detector

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Abstract: This work design and implementation of an IoT-based air quality, temperature and humidity measurement and alert system. The system leverages a Node MCU microcontroller to connect to the Blynk cloud platform, providing real-time monitoring and alerts. The primary sensors used in this work include the MQ135 sensor for detecting air quality and the DHT11 sensor for measuring temperature and humidity. A buzzer serves as the alert mechanism when predefined thresholds are surpassed. The work involves connecting the MQ135 sensor to the Node MCU's analog input, the DHT11 sensor to a digital pin, and the buzzer to another digital pin. The Node MCU is programmed using the Arduino IDE, and the Blynk library is utilized to facilitate communication between the microcontroller and the cloud. Data is sent to virtual pins on the Blynk app, where it can be visualized using widgets.

Index Terms **– Microcontroller, Humidity Measurement,Blnk app**

I. Introduction

In recent years, the importance of monitoring environmental conditions has increased significantly due to rising concerns over air quality, temperature fluctuations, and humidity levels. These factors greatly influence human health, comfort, and safety, making it imperative to develop efficient systems for real-time monitoring and alerting. The advent of Internet of Things (IoT) technology has opened new avenues for creating smart, connected devices that can collect, process, and share data seamlessly.

This work leverages IoT to design an air quality, temperature, and humidity measurement and alert system, aimed at providing a comprehensive solution for environmental monitoring. he system utilizes the NodeMCU microcontroller, a versatile and low-cost platform, to interface with sensors and connect to the Blynk cloud platform. The MQ135 sensor is employed to measure air quality by detecting various harmful gases and pollutants, while the DHT11 sensor monitors temperature and humidity. These sensors provide the necessary data to assess environmental conditions accurately.

The Blynk platform offers an intuitive interface for users to monitor sensor data on their smartphones, ensuring easy access to vital information. Additionally, the system features a buzzer that activates when specific thresholds are exceeded, such as poor air quality, high temperature, or excessive humidity. This work demonstrates the practicality and effectiveness of IoT in environmental monitoring. The system is designed to be scalable and adaptable, making it suitable for various applications, including homes, offices, and industrial settings. Future enhancements could include advanced data analytics, integration with additional sensors, and more sophisticated alert systems to further improve functionality and reliability. Through this work, we aim to highlight the potential of IoT in creating smart, responsive systems that contribute to better living environments

II. METHODOLOGY

Environmental conditions such as air quality, temperature, and humidity significantly impact human health, comfort, and productivity. Poor air quality can lead to respiratory issues and other health problems, while extreme temperature and humidity levels can cause discomfort and adversely affect both human activities and sensitive equipment. Despite the critical importance of monitoring these parameters, many existing solutions are either too expensive, lack real-time monitoring capabilities, or fail to provide timely alerts for dangerous conditions. This gap highlights the need for an affordable, efficient, and user friendly system to continuously monitor and alert users to changes in environmental conditions. The primary challenge is to develop a system that can accurately measure air quality, temperature, and humidity in real-time and provide immediate alerts when conditions become hazardous. This system must be easily accessible, allowing users to monitor data remotely and receive alerts promptly, regardless of their location. Additionally, the system should be cost-effective to ensure widespread adoption, particularly in residential and small scale industrial settings. This work aims to solve these problems by developing an IoT-based air quality, temperature, and humidity measurement and alert system using a NodeMCU microcontroller. By incorporating sensors like the MQ135 for air quality and the DHT11 for temperature and humidity, the system will collect accurate data and upload it to the Blynk cloud. Users can then access this data in real-time via a mobile application and receive immediate alerts through a buzzer when thresholds are exceeded. This solution promises to enhance environmental monitoring, ensuring better health, comfort, and safety for its users.

The design methodology for the air quality, temperature, and humidity measurement and alert system involves several key stages, from component selection to system integration and testing. The project begins with selecting appropriate sensors and a microcontroller to achieve the desired functionalities. The MQ135 sensor is chosen for its ability to detect a wide range of air pollutants, while the DHT11 sensor is selected for its simplicity and reliability in measuring temperature and humidity. The Node MCU microcontroller, equipped with Wi-Fi capabilities, is used to interface with these sensors and facilitate data communication. The system design starts with wiring the sensors and buzzer to the Node MCU. The MQ135 sensor's analog output is connected to an analog input pin on the Node MCU, allowing it to read the air quality levels. The DHT11 sensor's digital output is connected to a digital pin for temperature and humidity readings. The buzzer is connected to another digital pin, enabling it to provide alerts based on predefined thres holds.In the software development phase, the Node MCU is programmed using the Arduino IDE. The code is designed to periodically read data from the sensors, process this data, and upload it to the Blynk cloud platform. The Blynk app is configured to visualize the data and set thresholds for generating alerts. When the sensor readings exceed these thresholds, the Node MCU activates the buzzer to notify users immediately. Once the hardware is assembled and the software is programmed, the system undergoes rigorous testing. Sensor accuracy is validated, and the alert system is evaluated to ensure timely notifications. The Blynk app is tested for real-time data display and threshold configuration to confirm that users can monitor and manage their environment effectively. The complete working of the project involves the continuous monitoring of environmental conditions. The sensors collect real-time data, which the Node MCU processes and transmits to the Blynk cloud. Users access this data through the Blynk app, where they can view current readings and receive alerts if conditions are unsafe. The system's design ensures that users are promptly informed of any potential hazards, enabling them to take necessary actions to maintain a safe and comfortable environment.

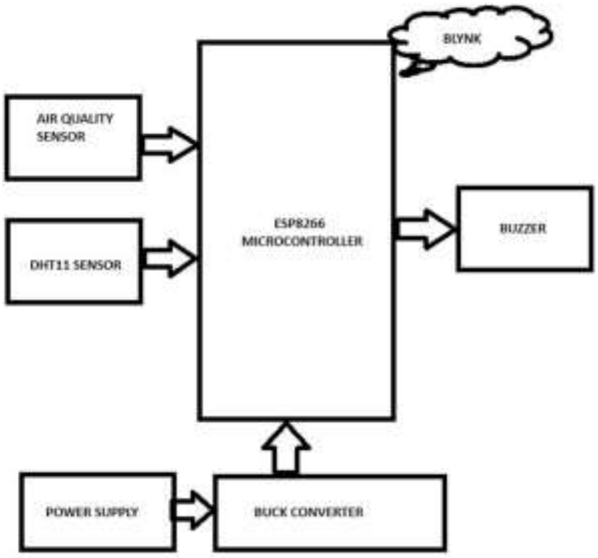

Figure 1: Block Diagram

1. Node MCU ESP8266 .

Acts as the central processing unit of the system. It interfaces with the sensors to collect data, processes this data, and communicates with the Blynk cloud platform via Wi-Fi. The Node Mcu reads the analog signal from the MQ135 sensor and the digital signal from the DHT11 sensor. It also controls the buzzer for alert notifications. The NodeMCU ESP8266 is a popular microcontroller board used for IoT projects. Here are some key features:

- Wi-Fi capability: Built-in ESP8266 chip provides Wi-Fi connectivity.
- Microcontroller: 32-bit RISC CPU with 80 MHz clock speed.
- Programming: Supports Lua scripting language and Arduino IDE.
- Memory: 4 MB flash memory, 64 KB RAM.
- GPIO pins: 16 digital input/output pins.
- Analog input: 1 x ADC input (0-3.3V).
- Communication: UART, SPI, I2C, I2S.
- Power: USB or battery-powered (3.3V).

2. MQ135 sensor MQ135 Sensor:

Measures air quality by detecting the concentration ofvarious gases and pollutants.The sensor provides an analog voltage output proportional to the air quality level The MQ-135 sensor uses a tin dioxide (SnO_2) semiconductor material to detect gases. When a gas molecule comes into contact with the sensor, it changes the resistance of the material, which is measured by the sensor and output as an analog voltage signal.

Key specifications:

- Operating voltage: 5V
- Operating current: 150mA
- Operating temperature: -10°C to 50°C
- Humidity: 20-90% RH
- Sensitivity: 0.1-10 ppm (parts per million)
- Output signal: Analog voltage (0-5V)

3. LCD display

A 7-segment LCD display is a type of display that uses seven individual segments to form numbers and characters. Here are some key aspects:

Each segment is a separate LCD element that can be turned on or off to create:

Numbers: 0-9

- Characters: Limited alphabet and symbols
- Custom characters: Using combinations of segments Key characteristics:

- Commonly used for displaying numbers and basic information
- Low power consumption

Easy to interface with microcontrollers
- Available in various sizes and colors

4 .Buzzer

A buzzer is an audio signaling device that is commonly used in various applications to provide audible alerts or signals. Buzzers can be found in a wide range of devices and systems, from simple household appliances to complex industrial machinery. Here are some key aspects of buzzers. Buzzers are versatile and widely used components that play a crucial role in providing audible alerts and signals across many different fields.

Types of Buzzers:

I. Piezoelectric Buzzers:

Construction: These buzzers use a piezoelectric element that vibrates when an electric current is applied, producing sound.

Characteristics: They are typically small, lightweight, and consume low power. They can generate a wide range of frequencies and are often used in low-power applications.

2. Electromechanical Buzzers:

Construction: These buzzers use an electromagnet to move a diaphragm or armature, creating sound.

Characteristics: They are usually louder than piezoelectric buzzers and can produce a continuous tone. However, they may consume more power and are generally larger.

5. DHT11 sensor:

- Affordable and Accessible: The DHT11 sensor is a low-cost solution for temperature and humidity measurement, making it an ideal choice for hobbyists, students, and professionals alike.
- Compact and Lightweight: The sensor's small size and lightweight design allow for easy integration into various projects and applications.
- Easy to Use: The DHT11 sensor features a simple, single-wire interface that simplifies connection and communication with microcontrollers or other devices.
- Reliable and Accurate: The sensor provides reliable and accurate readings, with a temperature accuracy of ±2°C and humidity accuracy of ±5% RH.

Versatile: The DHT11 sensor can be used in a wide range of applications, from basic temperature and humidity monitoring to more complex projects like weather stations and home automation systems.

- Low Power Consumption: The sensor requires minimal power to operate, making it suitable for battery-powered or energy-efficient projects.
- Digital Output: The DHT11 sensor provides a digital output, eliminating the need for analog-to-digital conversion and simplifying data processing

6. Battery or Power supply:

A 4V battery is a type of electrochemical cell or battery that provides a nominal voltage of 4 volts. These batteries are commonly used in various applications, including portable electronics, toys, backup power supplies, and small lighting systems. Here are some key aspects of a 4V battery. A 4V battery is a versatile power source that can be tailored to a wide range of applications depending on its chemical composition and design.

7. Buck converter:

Efficient Power Conversion: Buck converters expertly step down voltage levels while minimizing energy loss, making them a crucial component in power management systems.

Compact and Space-Saving: With their small footprint and low profile, buck converters are perfect for applications where board space is limited, such as in portable electronics or automotive systems.

Fast Switching and High Frequency: Buck converters operate at high frequencies, allowing for rapid voltage conversion and reduced heat generation, making them ideal for high-power applications.

Precise Voltage Regulation: By adjusting the switching duty cycle or frequency, buck converters deliver a stable and accurate output voltage, ensuring reliable performance in sensitive electronic circuits.

Low Heat Generation: Buck converters' high efficiency and fast switching minimize heat generation, reducing the need for heat sinks or cooling systems, and increasing overall system reliability.

Flexible and Adaptable: Buck converters can be designed to accommodate a wide range of input and output voltages, making them versatile components for various power conversion applications.

Robust and Reliable: With proper design and component selection, buck converters offer high reliability and durability, withstanding harsh environments and operating conditions.

III. CONCLUSION

"In conclusion, the IoT-based gas and smoke detector system developed in this project demonstrates a reliable and efficient solution for detecting hazardous gases and smoke in real-time. By leveraging IoT technology, the system enables remote monitoring, automated alerts, and data analytics, enhancing safety and reducing response times in emergency situations. The system's scalability, accuracy, and ease of use make it an ideal solution for various applications, including smart homes, industries, and public spaces. With its potential to save lives and prevent property damage, this IoT-based gas and smoke detector system is a significant advancement in the field of safety and security. this project lays a solid foundation for more sophisticated environmental monitoring solutions and underscores the importance of leveraging technology to create safer and more comfortable environments. The continued evolution of IoT and sensor technologies will likely drive further improvements and innovations, expanding the scope and impact of such monitoring systems in various applications"

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