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GEOALERT – IOT BASED WEATHER STATION

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ABSTRACT

The "Geo-Alert: IoT Based Weather Station" project is a forward-looking initiative that harnesses the power of Internet of Things (IoT) technology to monitor and respond to environmental conditions, including flood risks, weather changes, and seismic activity. Through a combination of specialized sensors – the Raindrop and Ultrasonic sensors for flood monitoring, DHT11 and MQ series sensors for weather monitoring, and a vibration sensor for earthquake detection – this system provides real-time data to the Blynk IoT cloud, ensuring remote monitoring and analysis. By offering a seamless way to gather and access critical environmental information, this project aims to strengthen early warning capabilities, disaster preparedness, and our understanding of local weather patterns and geological events, ultimately contributing to the safety and resilience of communities in the face of natural hazards.

I. INTRODUCTION

GeoAlert is an innovative Internet of Things (IoT) based weather station designed to provide real-time and location- specific weather information. This advanced system leverages a network of sensors to monitor various meteorological parameters, ensuring accurate and up-to-date data for a specific geographical area. The GeoAlert IoT weather station is equipped with sensors capable of measuring temperature, humidity, air pressure, wind speed, and precipitation levels. In the event of adverse weather conditions or significant changes in meteorological parameters, the GeoAlert system employs a robust alert mechanism. This may include activating visual indicators such as LED displays or digital screens, as well as audible alarms like sirens or buzzers to warn individuals in the vicinity. Additionally, the GeoAlert weather station is connected to the Internet through technologies like Wi-Fi or cellular networks, allowing it to send real-time weather notifications to a dedicated mobile application.

II. LITERATURE SURVEY

Sr. No.	Name of the Author	Paper Title
1.	K. R. Karthik	"IoT-based Smart Agriculture: An Extensive Review"
2.	T. V. Sivaram	"Flood Disaster and Management: A Review"
3.	Ashish Dewan	"Climate Change and India: Issues and Priorities"
4.	B. Mandal and A. S. Maiti	"Early Warning and Disaster Management in India: An Overview"

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III. METHODOLOGY

Data Collection by Sensors:

1. Raindrop Sensor: This sensor detects rainfall intensity. It measures the number of raindrops hitting its surface and provides data on rainfall. 2. Ultrasonic Sensor: It measures water levels in rivers, reservoirs, or other bodies of water. The sensor emits ultrasonic waves and calculates the time taken for the waves to bounce back, which corresponds to the water level. 3. DHT11 Sensor: This sensor records temperature and humidity data. It is essential for weather monitoring. 4. MQ Series Sensors: These sensors monitor air quality by detecting various gases, making them important for weather monitoring as well. 5. Vibration Sensor: It detects ground movements, which is crucial for earthquake monitoring.
2. Flood Conditions: For flood monitoring, the MCU monitors the rainfall intensity and water levels. If predefined thresholds are exceeded, indicating potential flood conditions, the system generates alerts.
3. Weather Parameters: The MCU continuously checks temperature, humidity, and air quality. It can generate alerts if abnormal weather conditions are detected.
4. Seismic Activity: The vibration sensor is designed to detect ground vibrations. If seismic activity surpasses predetermined thresholds, the system generates earthquake alerts.

Alert Generation:

In the event that any of the predefined thresholds are exceeded, the system generates alerts. These alerts can take various forms, such as notifications, warnings, or signals, depending on the specific parameters detected

Data Transmission:

Once data is processed and alerts are generated, it is then transmitted from the MCU to an IoT gateway. The IoT gateway acts as a communication bridge between the MCU and the Blynk IoT cloud

IoT Cloud (Blynk):

The IoT gateway transfers the data to the Blynk IoT cloud. The Blynk cloud is a platform designed to receive, store, and manage IoT data. It provides a user-friendly interface for data analysis and visualization.

Remote Monitoring:

Users can access the Blynk IoT cloud remotely through a mobile application or a web interface. This allows for real- time monitoring of environmental conditions, alerts, and historical data. Users can set up notifications to receive alerts on their mobile device.

IV. PROPOSED METHOD

In this Project, our main Objectives are as follows-

- To Design and connect appropriate sensors (e.g., temperature, humidity, pressure) to gather real-time weather data for the GeoAlert IoT-based weather station.
- Implement a notification system to alert users when severe weather conditions are detected in their area.
- Develop a front-end dashboard for the GeoAlert app, displaying real-time weather parameters such as temperature, humidity, pressure, and wind speed.
- Establish a secure and reliable communication protocol for transmitting weather data from the hardware to the app.
- Test the system thoroughly to validate its functionality and responsiveness to different weather scenarios.
- To Ensure that the GeoAlert IoT-based weather station is user-friendly and easily configurable for different geographical locations.

4.1. BLOCK DIAGRAM

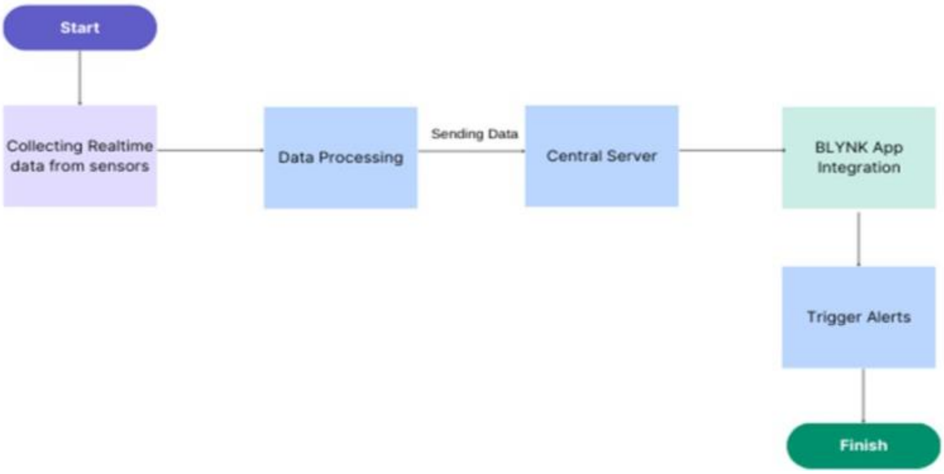

Fig. 1 Block Diagram of GeoAlert Iot Based Weather Station

4.2 HARDWARE

4.2.1 ESP32

The ESP32 employs an Advanced Virtual RISC (AVR) architecture, making it proficient in processing 8-bit data.

Fig. 2 NodeMCU ESP32

ESP32 Specifications-

- Microcontroller: ESP32 dual-core Tensilica LX6 processor.
- Clock Frequency: Up to 240 MHz.
- Wireless Connectivity: Wi-Fi 802.11 b/g/n, Bluetooth v4.2.
- Memory: 520 KB SRAM, 16 MB Flash.
- GPIO Pins: 36 GPIO pins for versatile digital and analog input/output.
- Analog-to-Digital Converter (ADC): 12-bit SAR ADC with up to 18 channels.
- I/O Interfaces: I2C, SPI, UART, I2S, PWM.
- Operating Voltage: 3.3V.
- Power Consumption: Low-power modes for energy- efficient operation.
- Dimensions: Compact size for easy integration into projects.

4.2.2 MQT-135 Sensor

The MQT-135 sensor is commonly used for detecting various gases in the air, including ammonia, sulfide, benzene, and other harmful substances.

Fig. 3 MQT-135 Sensor

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➢ MQ-135 Specifications-

- Operating Voltage: 5V DC
- Power Consumption: ~800mW
- Heater Voltage: 5V±0.2V AC/DC
- Heater Resistance: 33Ω ± 5%
- Preheat Time: Over 24 hours
- Load Resistance: Adjustable via onboard potentiometer

4.2.3 DHT 22 Sensor

The DHT22 sensor, also known as the AM2302, is a commonly used sensor for measuring temperature and humidity.

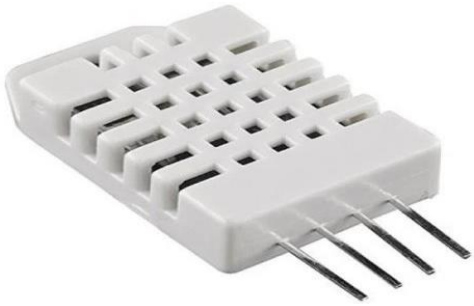

Fig. 4 DHT 22 Sensor

➢ DHT22 Sensor Specifications-

- Operating Voltage: 3.3V to 6V DC
- Current Consumption: 2.5mA (during data communication)
- Temperature Measurement Range: -40°C to 80°C
- Humidity Measurement Range: 0% to 100% RH
- Temperature Accuracy: ±0.5°C
- Humidity Accuracy: ±2% RH

4.2.4 Raindrop Sensor

The Raindrop Sensor is a device designed to detect rainfall or water droplets.

Fig. 5 Raindrop

➢ Raindrop Sensor Specifications-

- Operating Voltage: Typically 3.3V to 5V DC
- Operating Current: Varies by model but generally low
- Detection Principle: Conductivity-based (measures the resistance between two conductive strips)
- Sensitivity Adjustment: Some models may feature sensitivity adjustment through a potentiometer
- Signal Output: Analog or Digital (High/Low) signal indicating the presence of rain
- Interface: Typically provides a simple digital or analog output that can be read by microcontrollers

4.2.5 Adxl335 Sensor.

The ADXL335 is a small, low-power, 3-axis accelerometer sensor designed to measure acceleration in three dimensions.

Fig. 6 Adxl335 Sensor

➢ Adxl335 Sensor Specifications-

- Supply Voltage: 1.8V to 3.6V
- Current Consumption: 320 µA (in measurement mode)
- Sensitivity: Typically 300 mV/g (for the ±3g range)
- Output Resolution: 10-bit (per axis)
- Output Voltage Range: 0.5V to (VDD – 0.5V)
- Output Type: Analog voltage proportional to acceleration on each axis

4.2.6 Water Level Sensor

Ultrasonic water level sensors work based on the principle of sending and receiving ultrasonic sound waves.

Fig. 7 Water Level Sensor

➢ Water Level Sensor Specifications-

- Operating Voltage: Typically 5V DC or 3.3V DC.
- Current Consumption: Low power consumption for efficient operation.
- Detection Method: Various methods such as capacitance, resistive, ultrasonic, or pressure-based.
- Measuring Range: The range over which the sensor can accurately detect water levels.
- Accuracy: The precision of the sensor in measuring water levels.
- Resolution: The smallest change in water level that the sensor can detect.
- Output Type: Analog or digital signal indicating the water level.
- Output Interface: Analog voltage, PWM signal, I2C, or other communication protocols

4.3 SOFTWARE

4.3.1 BLYNK

Blynk is a popular and versatile platform for developing Internet of Things (IoT) and mobile applications. It provides an easy and user-friendly way to create custom apps for controlling and monitoring IoT devices. Blynk is known for its simplicity, flexibility, and compatibility with a wide range of hardware platforms.

Data Processing by MCU:

All the sensor data is collected by a microcontroller unit (MCU), such as an Arduino or Raspberry Pi. The MCU processes this data to ensure accuracy and reliability.

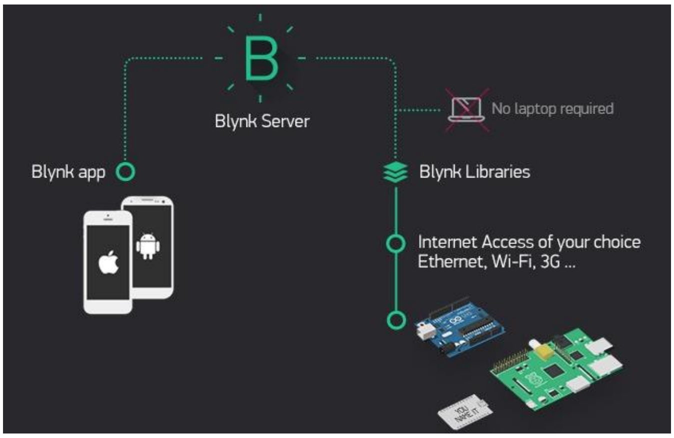

Fig. 8 BLYNK APP

Threshold Checks:

➢ Key Features: -

- Drag-and-Drop App Builder
- Wide Hardware Compatibility
- Cloud Connectivity
- Security

Arduino IDE – For Programming the Entire Project

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.

Fig. 9

V. APPLICATIONS

- Climate Research
- Disaster Management and Preparedness
- Agriculture:
- Environmental Monitoring
- Public Safety

VI. SIMULATION

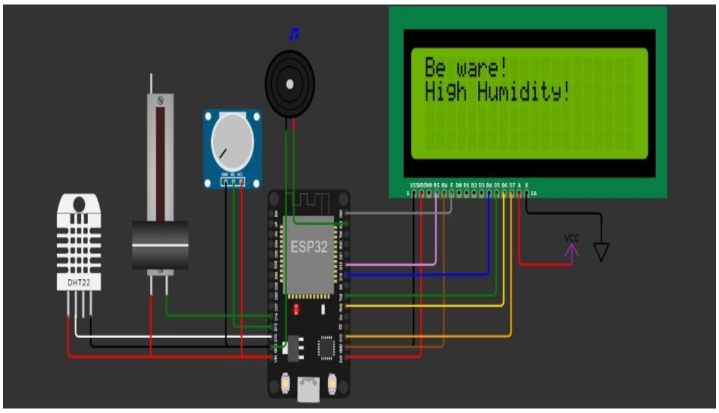

Fig. 10

VII. CONCLUSION

In conclusion, The "Geo-Alert: IoT-Based Weather Station" project represents a significant leap in the field of environmental monitoring, disaster preparedness, and early warning systems. This project, designed to address the pressing need for real-time data collection and analysis, has successfully harnessed the power of IoT technology to create a versatile, adaptable, and effective system. Throughout the course of this project, we have developed a comprehensive solution for monitoring and forecasting environmental conditions, with a focus on flood monitoring, weather tracking, and earthquake detection. The integration of specialized sensors, a microcontroller unit, and an IoT gateway has allowed us to collect and process data with precision. The use of the Blynk IoT cloud platform has made remote monitoring and data analysis accessible to users, further enhancing the project's impact. cThe significance of this project cannot be overstated. Its applications range from providing early flood warnings that can save lives and property to contributing to climate research, earthquake detection, and environmental data analysis. By empowering users with real-time data and alerts, it fosters data-driven and environmental research. As we conclude this project, we are reminded of the continuous pursuit of innovation and improvement. The system's future scope is vast, with possibilities including AI integration, expanded sensor arrays, enhanced user interfaces, and global scalability. These enhancements will contribute to an even more effective and versatile environmental monitoring system. In closing, the "Geo-Alert: IoT-Based Weather Station" project demonstrates the power of technology and innovation in addressing critical environmental challenges. It is a testament to our commitment to creating a safer and more sustainable future. This project is not an endpoint but a beginning, paving the way for continued advancements in environmental monitoring and disaster preparedness.

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