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EARLY FLOOD DETECTION AND AVOIDANCE USING IOT

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***Abstract* —** This project introduces a flood warning system using the Internet of Things (IoT) and a website to send timely alerts and improve public safety. Sensors are placed in areas likely to flood, where they check water levels, runoff, and overflow in real time. The data from these sensors is sent to a main server and shown on a website. The system checks this data to find signs of possible flooding and sends instant alerts through the website, email, or SMS. This helps both local people and authorities take quick action to reduce damage and stay safe. With real- time monitoring and a web-based alert system, this project provides a reliable and effective way to manage floods and stay prepared for emergencies.

INTRODUCTION

The uses sensors to monitor natural factors and predict floods in advance. By collecting real-time data on water levels and other environmental elements, the system helps reduce flood damage and save lives. With Wi-Fi connectivity, the data can be accessed remotely through the Internet of Things (IoT).

Our model focuses on three main parts: collecting

data with water level sensors,
processing that data, and sending timely flood alerts. While setting up such systems can be costly, especially due to the number of sensor locations, early warnings can significantly reduce the impact of floods.

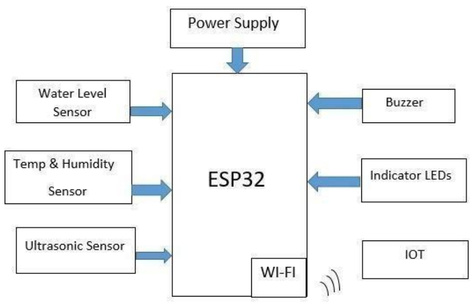

Fig. No. 1: Block Diagram Of System.

1. **ESP32**

Key Features:

Built-in **Wi-Fi** for IoT connectivity.

- Multiple input/output pin to connect sensors and indicators.

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2. **Power Supply**

Provides electrical power to the entire system. Ensures that the ESP32 and all sensors/components operate continuously and reliably.

3. **Water Level Sensor**

Function: Measures the level of water in a river, tank, or other body.

Role:Potential flooding indicates the rise in water.

4. **Temperature & Humidity Sensor**

Function: Measures surrounding temperature and humidity levels.

Role: Monitors atmospheric conditions; high humidity and sudden temperature changes can signal heavy rain or flood- prone weather.

5. **Ultrasonic Sensor**

Function: Uses ultrasonic waves to measure the distance between the sensor and the water surface.

Role: Accurately detects rising water levels without physical contact, especially useful in outdoor conditions.

6. **Wi-Fi (Inside ESP32)**

Function: Sends data wirelessly to the cloud or IoT platform.

Role: Enables remote monitoring and alert notifications (e.g., via app, email, or website).

7. **Buzzer**

Function: Emits sound to alert users locally.

Role: Acts as an audible alarm when flood conditions are detected.

8. **Indicator LEDs**

Function: Show system status using lights (red = alert).

Role: Provides a quick visual cue for monitoring the flood risk level.

9. **IoT (Cloud)**

Function: Receives and displays real-time data from ESP32.

Role: Allows users to access flood data from anywhere via the internet for early warnings and decisions.

ALGORITHM

Step 1 : Start system

Step 2 : Start the system and initialize ESP32.

Step 3 : Connect ESP32 to Wi-Fi network.

Step 4 : Initialize all sensors.

Step 5 : Continuously read data from all sensors.

Step 6 : Analyses the sensor data.

Step 7 : Determine flood risk status (Normal / Flood Risk).

Step 8 : Activate local alerts.

Step 9 : Send sensor data and status to cloud or web server

Step 10 : Update real-time data on the web page dashboard

I. FLOWCHART

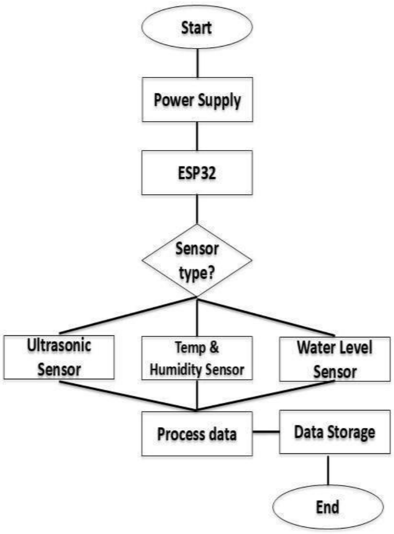

Fig. No. 2: Flowchart of system.

II. COMPONENTS

1. Power Supply

The power supply serves as the energy source for the entire system. It delivers the required voltage to power the ESP32 microcontroller and all connected sensors and devices. This can come from a battery, USB source, or a regulated DC adapter, usually supplying 3.3V or 5V. Stable power is essential for consistent performance and to prevent unexpected resets or data loss.

2. ESP32 Microcontroller

The ESP32 acts as the brain of the system. It comes with integrated Wi-Fi and Bluetooth, which makes it well-suited for Internet of Things (IoT) applications. It collects data from connected sensors, processes that data, controls output devices such as buzzers and LEDs, and transmits information to online services via Wi-Fi. Its energy-efficient design and powerful performance make it a great choice for both portable and remote setups.

2. Water Level Sensor

This sensor is responsible for detecting the water level in a tank or container. It could be a float-based, resistive, or capacitive type, depending on the application. When the water reaches a certain level, the sensor provides data to the ESP32, which can then trigger an alert or store the reading. It is commonly used in irrigation, water management, or liquid storage systems.

3. Temperature and Humidity Sensor

This component monitors the ambient temperature and relative humidity in the environment.Common sensors like DHT11 or DHT22 provide digital readings which the ESP32 can easily process. These measurements are critical in applications such as wea

4. Ultrasonic Sensor

Ultrasonic sensors measure distance by emitting ultrasonic waves and measuring the time taken for the echo to return. This data can be used to determine the level of water in a tank or detect the presence of nearby objects. The ESP32 calculates the distance based on the speed of sound and the time delay, providing real-time measurements.

5. Wi-Fi Module (Built-in to ESP32)

The integrated Wi-Fi module enables the ESP32 to connect to the internet or a local network. Through this connection, the system can upload sensor data to cloud platforms or IoT dashboards. This feature allows users to monitor and manage the system remotely using smartphones or computers.

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6. Buzzer

The buzzer is used for audio alerts. It gets activated by the ESP32 when specific conditions are met, such as low water levels or abnormal temperature. It serves as an immediate attention mechanism for users, ensuring safety and prompt action when required.

7. Indicator LEDs

These LEDs serve as visual indicators to display the current status of the system. For example, a red LED may represent an error condition, a green one can show that the system is operating normally, and a blue LED might indicate that Wi-Fi is connected. This helps users quickly recognize the system's condition without needing to check detailed diagnostics.

8. IoT Integration

This component represents the connectivity and control of physical devices through the internet. By integrating IoT, the system becomes smarter—capable of transmitting sensor data to cloud services, notifying users of alerts, and even receiving remote commands. This makes monitoring and control accessible from anywhere in the world.

III. RESULTS

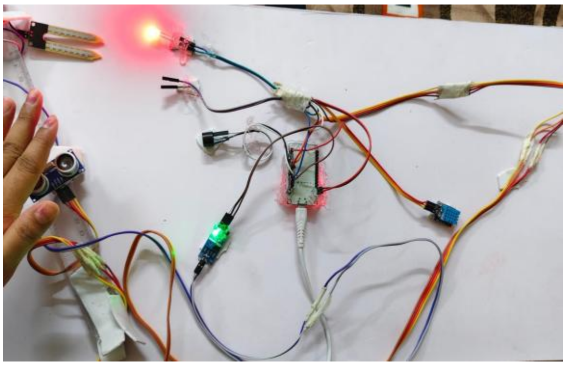

Fig. No. 3 : Hardware Setup.

1. IoT Devices:

- Sensors for water level, rainfall, humidity, temperature, and flow rate.
- Data sent via Wi-Fi, to a central server or cloud.

2. Backend Data Analysis:

- Real-time data processing.
- Analyzes thresholds or patterns to detect flood risk.

3. Web Interface:

- Displays sensor data, analysis results, and warnings.
- Built using HTML + PHP.

4. Early Flood Detection Dashboard:

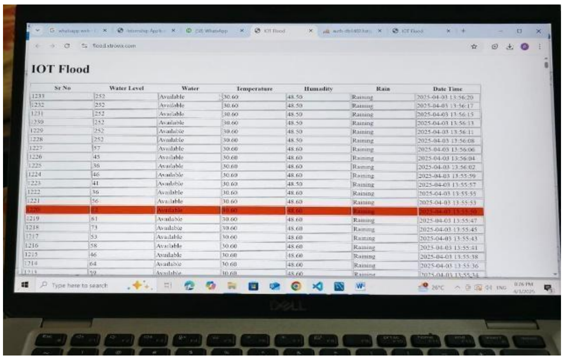

Fig. No. 4 : Dashboard

Constant Monitoring: The dashboard logs frequent real-time updates.
Threshold Detection: If water level exceeds a predefined flood limit (e.g., >20 cm), the system can Trigger warnings(soundbuzzer/SMS/email)Dis play alerts on the dashboard (e.g., color-coded rows)Context Awareness: When high water level + raining are detected together → stronger indication of flood risk.

PROS :

1. **Cross-Platform Accessibility**

Webpages can be accessed from any device with an internet connection. whether it's a desktop, laptop, tablet, or even a mobile browser. This removes the need for a dedicated app and ensures wider accessibility across different platforms**.**

2. **Real-Time Monitoring**

IoT systems continuously collect data from sensors (like water level, rainfall, humidity, and flow rate). This allows authorities and individuals to monitor flood-prone areas in real-time, enabling quick decision-making and rapid response.

3. **Remote Accessibility**

Since IoT is cloud-based, the data can be accessed from anywhere using a smart- smartphone or computer. This means officials or emergency responders don't need to be on-site to evaluate conditions or coordinate responses.

4. **Cost-Effective**

Compared to traditional manual monitoring methods, IoT solutions are less labor-intensive and more scalable. Once installed, they require minimal human intervention and can cover large geographical areas at lower operational costs.

5. **Supports Smart Cities**

Integrating IoT-based flood detection systems into smart city infrastructure enhances urban planning, disaster readiness, and public safety. It creates a more connected and resilient city.

6. **Increased Public Safety**

IV. PROS AND CONS

The combination of early warnings, real-time data, and automation significantly reduces the risk to human lives and property. Communities can act faster, and rescue operations can be planned more efficiently.

CONS :

1. **High Initial Setup Cost**

Installing IoT devices like sensors, gateways and communication infrastru- cture can be expensive at the beginning especially in large or rural areas where coverage is limited.

2. **Power Dependency**

Most IoT sensors and gateways require a stable power supply. In flood-prone or remote regions, maintaining constant power can be a challenge especially during severe weather conditions.

3. **Internet Connectivity Issues**

IoT systems depend on stable internet or network connections. During heavy rains or floods, network failures or signal disruptions can cause data delays or communication breakdowns.

4. **Sensor Maintenance and Calibration**

Sensors can be affected by dust, mud, corrosion, or water damage.

V. CONCLUSION

The flood detection system is designed to alert people early about the risk of floods. It helps everyone including farmers, industries, and local communities to stay prepared. Since floods can happen unexpectedly, it’s important to take precautions. This system checks water levels in specific areas and may cover more locations in the future. The collected data is shown on a website, and decisions can be supported by local authorities. Using IoT technology, the system works in real time to monitor water levels, predict possible floods, and warn people quickly.

VI. FUTURE SCOPE

Real-Time Monitoring: Continuously tracks water levels, rainfall, humidity, and temperature.

Web-Based Dashboard: Displays live sensor data on a webpage accessible from any internet-enabled device.

Automatic Alerts

Sends warnings through the website or email when flood levels cross safe limits.

Remote Access

Authorized users can view data anytime, from anywhere.

Graphical Representation

Uses charts, gauges, and maps to show flood data clearly and interactively.

Multi-Zone Monitoring

Supports tracking of multiple locations on a single webpage.

Data Storage

Keeps historical records for future analysis and reporting.

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