ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR2438

IoT Based Early Flood Alerting System

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Abstract:- The frequency and intensity of floods have increased recently in many parts of the world, increasing the need for cutting-edge technology solutions to mitigate the effects of these natural disasters. It is crucial to keep aneye on the water flow and get early emergency alerts regarding the water level based on the riverbed in order toprevent such disasters. The goal of this project is to create asystem that employs cutting-edge sensors and a Wi-Fi module to detect the water level. The suggested system has a number of sensors that can track important variables, including temperature, humidity, and water level. If the level crosses a certain threshold, The system will send out early warnings to everyone, alerting them to the likelihood of floods. To process and store data, we have linked the Arduino UNO to each sensor. The system can notify a wider audience by sending email alerts, ensuring that individuals in flood-prone areas receive timely warnings. Additionally, the use of a Wi-Fi module enables real-time data transmission and remote monitoring of water levels, allowing authorities to take preemptive measures and minimize the impact of potential floods. By integrating advanced sensors with communication technology, this project aims to enhance early warning systems and contribute to more effective disaster management strategies in vulnerable regions. Ultimately, the implementation of such innovative solutions can significantly improve community resilience and reduce the adverse consequences of flooding events.

Keywords:- *IoT (Internet of Things), Arduino UNO, Social Media Integration, GSM (Global System for Mobile Communications) Technology, Blynk Application.*

I. INTRODUCTION

Floods are natural disasters characterized ed by the overflow of water onto land that is normally dry. floods are caused by a confluence of hydrological, meteorological, and human elements. Strong rainstorms, cyclones, and tropical storms that deposit a lot of water over short distances are examples of meteorological causes. Such occurrences have the potential to overwhelm natural drainage systems and cause extensive flooding, particularly in places with poor water management infrastructure.

Floods can be caused by hydrological causes such as abrupt temperature changes or quick snowmelt during warmer seasons. This may lead to an influx of water that fills rivers and streams to capacity and overflows them. In colder climates, ice jams can also Impede water movement and cause localised floods as the ice builds up and suddenly melts.Storm surges, which occur when powerful winds from hurricanes or typhoons force saltwater inland, put coastal communities at risk of flooding. Stormy weather combined with high tides can result in coastal flooding, which affects ecosystems and coastal towns alike. Floods are also largely influenced by human activity. Deforestation lessens the amount of vegetation that naturally collects rainfall and lessens soil erosion. Urbanisation increases the risk of flooding and surface runoff by replacing natural surfaces with impermeable materials like concrete. The effects of floods are made worse by poorly designed infrastructure, such as inadequate drainage systems or buildings built in high-risk areas.Floods also cause severe damage to both human life and propery thus Highlighting the need for early alerting systems, In this project IoT(Internet of things) have been used to create an alerting System.

II. LITERATURE SURVEY

Astile Peter, Bhavana P. Rajeev, Abin Thomas Jolly, and Albert Joshy Varghese developed an Internet of Things (IoT)-based disaster monitoring and management system for dams [1]. For monitoring and control, these are sent via WiFimodule ESP8266 to the cloud server. All of the issues pertaining to water will be helped by the suggested system. Vikram B. Gaikwad, Nilesh S. Bawa, Kalpesh R. Deshpute, and Sagar S. Sawkar [2] created an IOT-based flood detection system. They created a system where, in the event of a flood, anultrasonic sensor would transmit a signal to the microprocessor circuit, displaying the sensed water level on the user interface and automatically sending Short Message Services (SMS) to the residents who were identified. Dirk Draheim, Sufian Hameed, Zafer Sekedursun R, and Syed Attique Shah [3] Big Data Analytics and IoT's Growing Significance in Disaster Management: Current Developments, Taxonomy, and Future Outlook. This study presents a new and more efficient method for executing the essential tasks of disaster management procedures through the integration of BDA and IoT. Withcutting-edge big data analysis capabilities and a properly maintained IoT.

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Shah Abdullah, Amrul Faruq, and Mohammed Syafiq Mohd Sabre together [4] suggested the use of internet of things technologies to create a flood warning and monitoring system. This study is centred on the creation of an intelligent flood monitoring system with Blynk applications and the affordable, effective, and flexible. The Blynk iot platform-based wireless sensor node is the perfect platform for keep an eye on affordable ,effective and flexible alerting systems The Blynk platform-based wireless sensor node is the perfect platform for keeping an eye on flash floods. Gowthamy J., Saransh Shrivastava, Pijush Meher, and Chinta Rohith Reddy Guddu Kumar [5] This study presents a prototype IoT-based water monitoring system. A few sensors are used for this. The data gathered from every sensor is analysed to provide improved solutions for water-related issues. The Wi-Fi module ESP8266 is used to transmit the data to the cloud server. Thus, this application will be the greatest rival for real-time monitoring and control systems and be used to address any issue pertaining to water.[6] by Pradhan B., Verstaevel N., Ogie R., Barthelemy J., Arshad B., and Perez P. This study examined various IoT and computer vision-assisted solutions for improved flood mapping and monitoring.

Wahidah Md. Shah, F. Arif, A. A. Shahrin, and Aslinda Hassan proposed an Internet of Things-based flood warning system [7]. It could detect the water level, calculate the rate at which the water level increased, and notify the local population. In order to test the implemented system, the experiments were carried out in a controlled setting. By utilizing three techniques—dictionary learning, deep learning, and the method of difference—Pan, J.; Yin, Y.; Xiong, J.; Luo, W.; Gui, G.; and Sari, H. [8] developed an automated surveillance network that consists of remote measuring stations and a control center. Elena Ridolfi and Piergiorgio Manciola [9] proposed using drones to measure the water level at a dam site. They did this by using a sensing equipment that consisted of a drone and a camera. Barthelemy J., Pradhan B., Arshad B., Ogie R., and Verstaevel N., and Perez P. summarised a plethora of literature [11] related to IoT-based sensors and computer vision for flood monitoring and mapping. This study explored various IoT and computer vision-assisted solutions for improved flood mapping and monitoring.A flood warning system [12] based on the Internet of Things was presented by Wahidah Md. Shah, F. Arif, A. A. Shahrin, and Aslinda Hassan. It could detect the water level, calculate the rate at which the water level increased, and notify the local population. To test the implemented system, controlled environments were used for the trials. Pan, J.; Yin, Y.; Xiong, J.; Luo, W.; Gui, G.; and Sari, H. developeda network of automated surveillance composed of distant measuring stations and a control centre [13]. Theyconducted tests using three methods, including the method of difference, dictionary learning, and deep learning. Elena Ridolfi and Piergiorgio Manciola proposed water level observations from drones at a dam site [14], which make use of a sensing device composed of a drone and a camera to assess the water level. Amina Khan and Sachin Kumar[15] Gupta co-authored a paper proposing Het sen model for flood management strategies.

III. METHODOLOGY

A. Existing Methods

Earlier , a water level sensor of the Contact type was used in the system's initial design. Because of corrosion, these kinds of sensors need to be maintained on a regular basis. Additionally, their levels are regularly checked using analogue metres that arelocated at dams. The accuracy of the sensor data used by this system is not as high as it could be due to maintenance..Geographic Information Systems (GIS) and remote sensing technologies are useful for mapping areas that are susceptible to flooding, tracking changes in land use, and evaluating the amount of vegetation present. Aerial surveys and satellite photos offer important information for analysing flood risk.,However this method offers less flexibility and covers on a large scale, not suitable for alerting the end user in real time.

B. Proposed Methods

In this project, we have created a novel way to trackthe water levels in the dam using this suggested system, utilising the Internet of Things and ultrasonic sensors. A waterlevel monitoring system that uses an ultrasonic sensor is contactless. It doesn't need any particular upkeep. Users can monitor real-time sensor data, including temperature, humidity, and water level, from a distance using Internet technology by utilising Blynk technology, which is based on the Internet of Things.In order to successfully anticipate and decrease the effects of flooding, the project offers a state-of-the-art, IoT-based centralised flood detection system. With floods presenting serious concerns like In order to minimise thedamage caused by the flood. The method makes use of a number of natural characteristics to identify floods in order to minimise or completely eradicate their effects. Because the system is wifi enabled, users may simply access the data it has collected utilising the Internet of Things from any location.

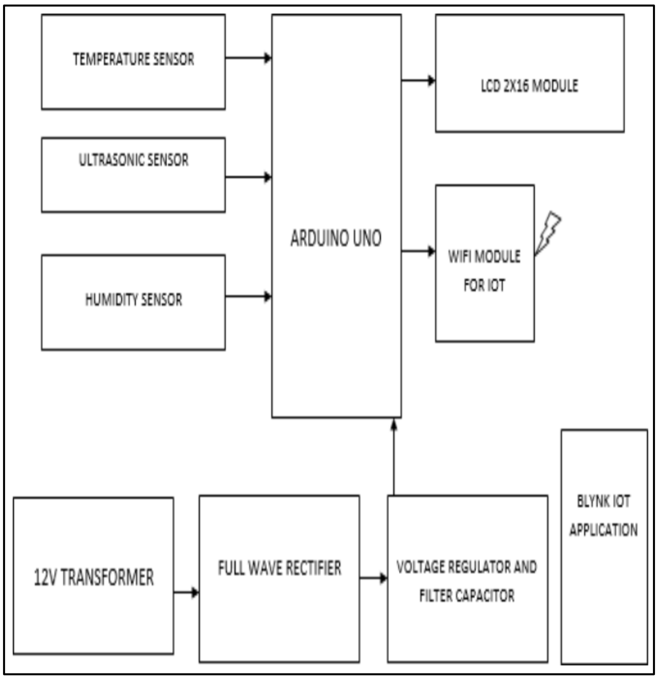

Fig 1 The Block Diagram of the Proposed System

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C. Specification of Hardware

➢ *Power Supply*

The system's power supply configuration includes a 230/12V step-down transformer, which lowers the voltage to 12VAC. A bridge rectifier is utilised to convert it to DC. In order to eliminate ripple, a capacitive filter is employed, which uses a 7805 voltage regulator to regulate it to +5V, which is required for the operation of a microcontroller and other components.

➢ *Arduino Uno*

Arduino Uno is a microcontroller board used for in this project.Programming in the embedded C language is utilised to create the programme. Code is uploaded using the Arduino IDE Compiler and the onboard USB programmer. The Arduino board's analogue pins are used to link sensor modules, and an LCD with WiFi Modules are linked to the microcontroller board'sdigital pins.

Fig 2 Arduino Uno

➢ *Sensors*

The system monitors a number of environmental variables, such as humidity, temperature, and dam water level, in order toidentify flooding. The system is made up of various sensors that gather data for distinct metrics in order to gather data on the natural components stated. The system is equipped with a DHT11 Digital Temperature Humidity Sensor to monitor variations in temperature and humidity. This sophisticated sensor module includes resistive components for temperature and humidity detection.

An ultrasonic sensor is continually monitoring the water level. The ultrasonic sensor uses ultrasonic waves to detect distance in order to calculate the distance of water from the sensor. It operates on the SONAR concept. The Arduino UNO Microcontroller Board, which analyses and stores data, is attached to every sensor.

➢ *NODU MCU*

NodeMCU is a development board based on the ESP8266 WiFi module, which has GPIO ports for connecting to external sensors and devices and integrated WiFi. Because of its inexpensive cost, compatibility with multiple IoT platforms, and ease of programming with the Arduino IDE or Lua scripting language, it is commonly utilised in IoT applications. Because NodeMCU has built-in WiFi, it can connect to networks, use cloud services, and offer remote control and monitoring features for Internet of Things applications.


Fig 3 NODU MCU

The system has Wi-Fi access, which is useful for Internet of Things access to the system and its data. A blynk Android application is given to the user so they can use internet connectivity to monitor the flood-causing parameters from anywhere in the world.

➢ *Outputs*

This project Consists of LCD for dislaying the results and alerts. a Buzzer , and a LED.

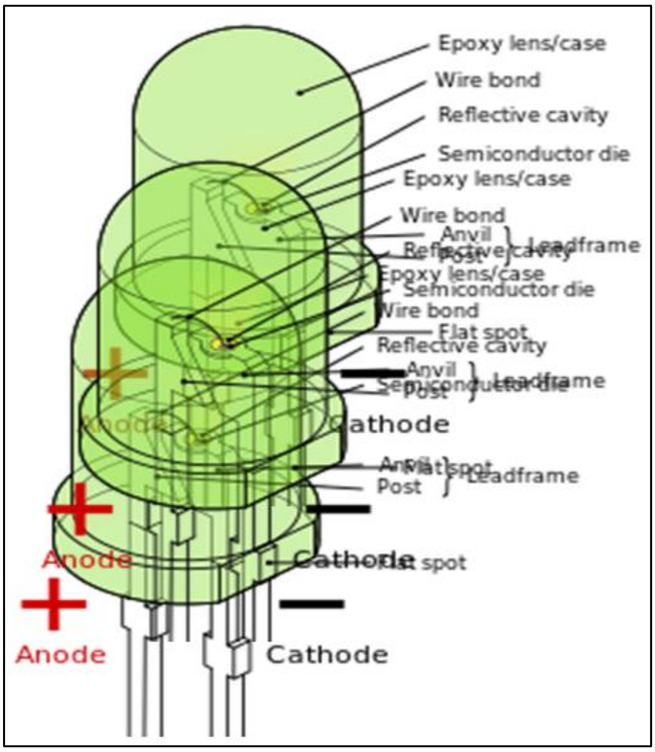

Fig 4 LED Light

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Fig 5 LCD Display

➢ *Blynk*

Blynk serves as a user-friendly platform that streamlines the development of IoT applications. To establish connectivity between a NodeMCU device and the Blynk platform, the initial step involves installing the Arduino IDE and incorporating NodeMCU board support.

Subsequently, utilizing the Arduino IDE Library Manager facilitates the installation of the Blynk library. Following this, create a project within the Blynk mobile application and take note of the authentication token provided. Within your Arduino code, include the necessary libraries, input Wi-Fi credentials along with the authentication token, and initialize the Blynk connection.

Upon uploading the code to the NodeMCU device, leverage the Blynk widgets within the mobile application to manage the pins of the NodeMCU board. Concurrently, monitor the Serial Monitor within the Arduino IDE for debugging purposes. Adjustments to both the code and widgets can be made as required, ensuring seamless integration and functionality between the NodeMCU device and the Blynk platform. This structured approach optimizes the development process and facilitates effective control and monitoring capabilities for IoT applications developed using the Blynk platform.

IV. RESULTS AND DISCUSSION

To The implemented IoT-based early flood alerting system leverages various sensors, including an ultrasonic water level sensor, a Dallas Temperature sensor for water temperature measurement, and a DHT11 sensor for monitoring temperature and humidity levels. Additionally, the system incorporates a buzzer for audible alerts and a LiquidCrystal display (LCD) for visual output.

During system initialization in the setup function, sensors, pins, and the LCD display are configured. The main loop function continuously reads sensor data and updates the LCD display accordingly. The ultrasonic sensor plays a crucial role in measuring water levels; if levels drop below a predefined threshold, signaling a potential flood situation, the system triggers high alert mechanisms such as activating the buzzer and displaying warning messages on the LCD.

Data transmission to a NodeMCU occurs in a customized format, including water level, humidity, and temperature readings. This allows for remote monitoring and analysis of flood-prone areas based on real-time sensor data.

The flood detection algorithm monitors critical environmental factors, including humidity, temperature, and water levels, utilizing respective sensors. Constant monitoring of water levels by the ultrasonic sensor ensures timely alerts during abnormal conditions. When water levels decrease to safe levels, the system deactivates alerts, returning the buzzer and LED indicators to normal status.

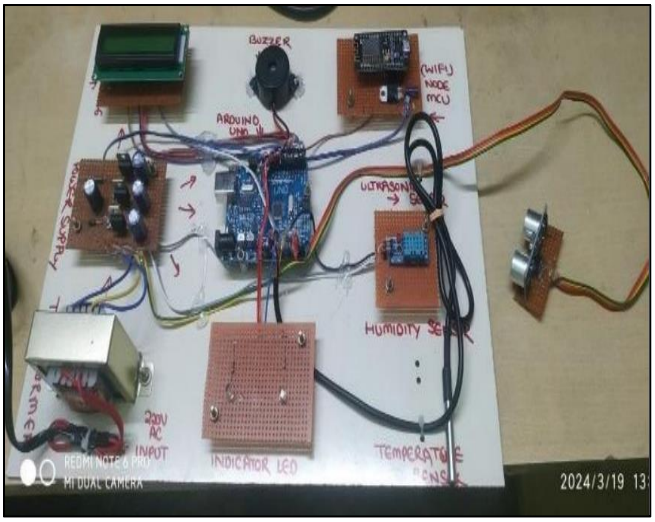

Fig 6 Set up of the Project

The integration of Arduino Uno with sensors and alert mechanisms demonstrates an effective early warning system for potential flood emergencies. This system's ability to monitor, analyze, and communicate real-time data contributes significantly to proactive flood risk management and disaster preparedness efforts in vulnerable regions.

Fig 7 LCD Displays Water Level

Fig 8 LCD Displays Alert

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V. CONCLUSION

In Conclusion, the creation and execution of an Internet of Things (IoT)-based early flood alerting system employing the constitute a noteworthy advancement in the field of disaster management technology. Through the use of these technologies, the system makes it possible to monitor water levels in flood-prone locations in real time the system makes it possible to monitor water levels in flood-prone locations in real time, giving early warning systems vital information. The combination of ultrasonic sensors and Arduino Uno makes it possible to detect water levels with accuracy and dependability, and NodeMCU makes it easy to connect to the internet for data analysis and transmission. By allowing stakeholders to remotely monitor flood conditions using their cellphones or other devices and receive timely alerts, the Blynk platform improves the usefulness of the system.

This IoT-based solution emphasizes the value of accessible and user-friendly interfaces in boosting community resilience in addition to showcasing the potential of networked devices in disaster preparedness. The method reduces the amount of lives and property lost during flood events by enabling authorities and individuals to take proactive steps including resource mobilization, infrastructure reinforcement, and evacuations by means of early warnings.

FUTURE SCOPE

The envisioned future reach of the suggested Internet of Things (IoT) flood warning system includes an extensive and resilient architecture intended to forecast flood risk analysis and evaluate negative impacts in low-lying areas with increased accuracy and effectiveness. Machine learning models with real-time data from IoT sensors measuring water levels, rainfall, humidity, and temperature, the system aims to improve the accuracy and timeliness of flood risk predictions. This holistic approach enables early warning dissemination and informed decision-making for stakeholders and emergency response teams.

The inclusion of GSM technology for SMS alerts, along with potential integration with other communication channels, is crucial for promptly notifying relevant authorities, such as dam operators, when water levels exceed critical thresholds. This proactive notification system facilitates timely response actions and helps mitigate potential damages during flood events.

Moreover, leveraging Geographic Information System (GIS) mapping tools and visualization techniques provides a clear spatial representation of vulnerable areas, evacuation routes, and critical infrastructure. This aids in developing targeted emergency response strategies and optimizing resource allocation during flood events through collaboration with disaster management systems and local governmental agencies.

Continuous algorithm refinement, scalability considerations, and strategic partnerships ensure the system's adaptability across diverse geographical regions and evolving flood scenarios. These efforts reinforce community resilience, minimize damages, and protect lives and infrastructure from the adverse impacts of floods. Overall, the system's comprehensive approach and collaborative framework are vital for effective flood risk management and disaster response strategies.

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