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Design and Implementation of Real Time Landslide Monitoring and Prediction System using Internet of Things and Machine Learning Technique

M. Mathivanan¹, Prof. Mr. S. Shanmugam², Prof. Mr. L. Prakasam³, Prof. Mr. S. Karthik⁴,
Prof. Mr. V. Senthil⁵

PG Scholar, Department of Embedded System Technologies, PSV College of Engineering and Technology
(Autonomous), Krishnagiri, Tamil Nadu, India¹

Assistant Professor, Department of ECE, PSV College of Engineering and Technology (Autonomous), Krishnagiri,
Tamil Nadu, India²⁻⁵

ABSTRACT: The purpose of the proposed work is to develop an early flood recognition and surrounding monitoring system using IoT, and to create a system that includes sensors, transceivers for data transfer, and computing devices for monitoring and predicting floods. This system uses an LM35 sensor and an ultrasonic sensor. Anemometers are used to calculate wind speed. The LM35 sensor is used to monitor soil moisture and temperature, while the ultrasonic sensor is used to monitor dam water levels. The data collected by these sensors is saved on the thingspeak-iot platform and in a CSV file. In the next phase, this data is used with atmospheric speeds and trains the model using an algorithm from an artificial neural network (ANN). Using ANN, various parameters such as weather conditions, soil moisture, water levels, and airways are analyzed to predict flood and landslide potential in real time. This interface shows important metrics such as soil moisture levels, dam water levels, and ambient conditions, allowing users to visualize trends and potential risks. When sensor data reaches a predefined threshold value, warnings and notifications are automatically created. By integrating IoT and ML technologies, the project not only aims to improve situational awareness, but also aims to predict decision makers, thereby improving disaster prevention and response strategies.

KEYWORDS: Flood recognition, ANN-Algorithm, IoT-Cloud platform, machine learning, anemometer sensors.

I. INTRODUCTION

The purpose of the proposed work is to develop early flood recognition and an surrounding monitoring system using IoT and create a system that includes sensors, transmitter for data transmission and computer devices for monitoring and predicting floors. It is not used to calculate wind speed. The LM35 sensor is used to monitor soil moisture and temperature, while the ultrasonic sensor is used to monitor dam water levels. The data collected by these sensors is stored in Thingspeak IT platform and CSV files. In the next phase, this data is used at atmospheric speeds and trains the model with an algorithm from an artificial neuronal network (ANN). Using Ann, various parameters such as weather conditions, soil moisture, water levels and airways are analyzed to predict the flood and landslide potential in real time. In addition to data acquisition and analysis, the system implements a user -friendly interface with which stakeholders can monitor real -time sensor data via web applications. This interface shows important metrics such as level of soil moisture, dam water level and environmental conditions, so that users can When sensor data meets predefined thresholds, warnings and notifications are automatically created. By integrating IoT and ML technologies, the project aims to improve situational awareness as well as improve strategies for preventing disasters and reactions.

OBJECTIVES

- The main goal of this proposed work is to design and implement early flood recognition and environmental monitoring systems using IoT and machine learning technologies (ML).

- These sensors collect data that is transferred to a cloud-based IoT platform (Thingspeak), and store and analyze it on it. The collected data is used to train models of artificial neural networks (ANNs).
- This predicts the likelihood of flooding and landslides by analyzing the relationships between weather conditions, soil moisture, water levels, and air velocity.

II. LITERATURE SURVEY

[1] Patel, S., & Patel, H. (2021). "IoT-based Flood Monitoring and Detection System Using Machine Learning Techniques." *International Journal of Engineering and Technology*, 10(3), 121-130. A landslide is movement of a mass of rock, debris, or earth down a slope. In monsoons the rain water percolates and develops hydraulic pressure which exceeds the elastic limit of the soil or rocks. Due to this the strain gets accumulated which forces the soil and rocks to loosen their adhesive strengths entailing landslides. [2] Ahmed, M. A., & Ali, A. M. (2020). "A Review on IoT-based Environmental Monitoring Systems." *Environmental Monitoring and Assessment*, 192(2), 75-85. Landslides destroy agricultural/forest lands, road transports, destroys earth's natural environment as a whole causing great loss to life. Landslides can also be said of "Mass Wasting", which refers to any down slope movement of soil and rock due to gravity. [3] Choudhury, M., & Jha, A. K. (2021). "Artificial Neural Network for Flood Prediction in River Systems." *Journal of Hydrology*, 570, 28-40. Landslide detection is also done based on image processing, video processing and machine learning algorithms. One such image processing work is discussed for the landslides occurring in Konkan region of India, where due to landslide the railway tracks shift and there is a loss. [4] Soni, R., & Tripathi, R. (2022). "A Smart IoT-based Flood Monitoring System Using Ultrasonic and DHT Sensors." *Journal of Smart Cities*, 8(4), 159-170. Real time monitoring of landslides is one of the challenging research areas available nowadays within the field of geophysical research. The event of an actual field deployment of a wireless device network primarily based landslide detection system. This system uses wireless sensor nodes, MQTT protocol. [5] Chatterjee, S., & Bandyopadhyay, S. (2021). "Flood Prediction and Monitoring Using IoT and Cloud Computing." *Environmental Systems Research*, 10(1), 45-59. Occasion-based landslide inventories are fundamental sources to expand how we might interpret the causal connection between setting off occasions and the happening of landslides. However there is a requirement for effective advance notice framework and by the manner in which it assumes a significant part for the security of our well creatures. Many individuals lost their lives because of the landslide.

III. EXISTING & PROPOSED SYSTEM

EXISTING SYSTEM

The CNN Translocal Global Functional Extraction Network (CTLGNET) exhibits strong performance in landslide sensitivity mapping (LSM), and also shows some drawbacks. The combination of CNN and transformer models improves compensation complexity, with higher storage requirements and longer training times, especially for large data records or high resolution data. There is also the risk of overfitting, especially if the training data records are not diverse or large enough. This can reduce the ability of the model to generalize new, invisible data. Model performance depends heavily on landslide quality and diversity. In areas where data is insufficient or inaccurate, model predictions may be unreliable. Deep learning models such as CTLGNET often act as black boxes, making it difficult to interpret specific factors that influence landslide sensitivity that welcomes the model. Although the model is often blocked in certain regions, its generalization can obtain regions with different geological, climatic, or topographical conditions, limiting their applicability to other regions without proper adaptation.

3.1 DISADVANTAGES

- CTLGNet combines CNN and transformer architectures, which significantly increases training time and memory usage. This makes it less suitable for real-time applications like flood detection, where immediate decisions are critical.
- Deep learning models, especially ones as complex as CTLGNet, require large, diverse datasets to avoid overfitting. In environmental monitoring, such data might be sparse or imbalanced, especially in remote or under-monitored regions.

2. PROPOSED SYSTEM

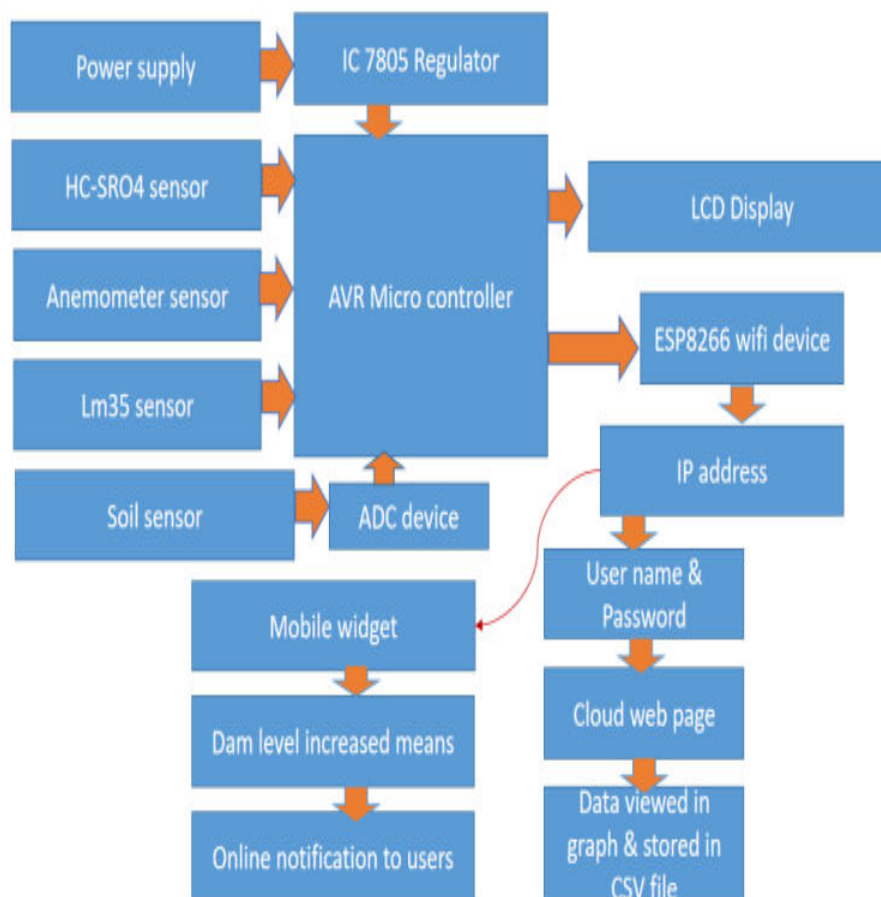
The proposed method for early flood recognition and environmental monitoring systems includes several important stages. First, a system is used to calculate wind speed and monitor the LM35 sensor using an anemometer, and is used to monitor soil moisture and temperature along with ultrasonic sensors to measure insulation or river water levels.

Sensor data is transferred to the microcontroller and uploaded from Thingspeak to the IoT platform for monitoring in CSV files and real-time memory. The collected data is prepared including data cleaning, normalization, and characterization extraction to prepare for analysis. The next stage trains the artificial neuronal network (ANN) using pre-processed data, including variables such as soil moisture, water level, temperature, and air velocity, to predict the likelihood of flooding and landslides. It provides real-time predictions that trigger incoming sensor data and threshold-based notifications as soon as the model is trained, if the data exceeds a predefined risk level. The web-based user interface goes beyond stakeholders, sensor data, historical trends and forecasts, but notifications and warnings are generated to allow users to report potential risks. The system aims to improve disaster prevention and response by making predictive knowledge available and allowing timely measures to reduce flooding and landslides.

3.2 ADVANTAGES

- The system uses IoT sensors (Anemometer, LM35, and UltrA sound) to continuously collect and transmit environmental data in real time, so that risk conditions can be immediately traced.

3.3 BLOCK DIAGRAM



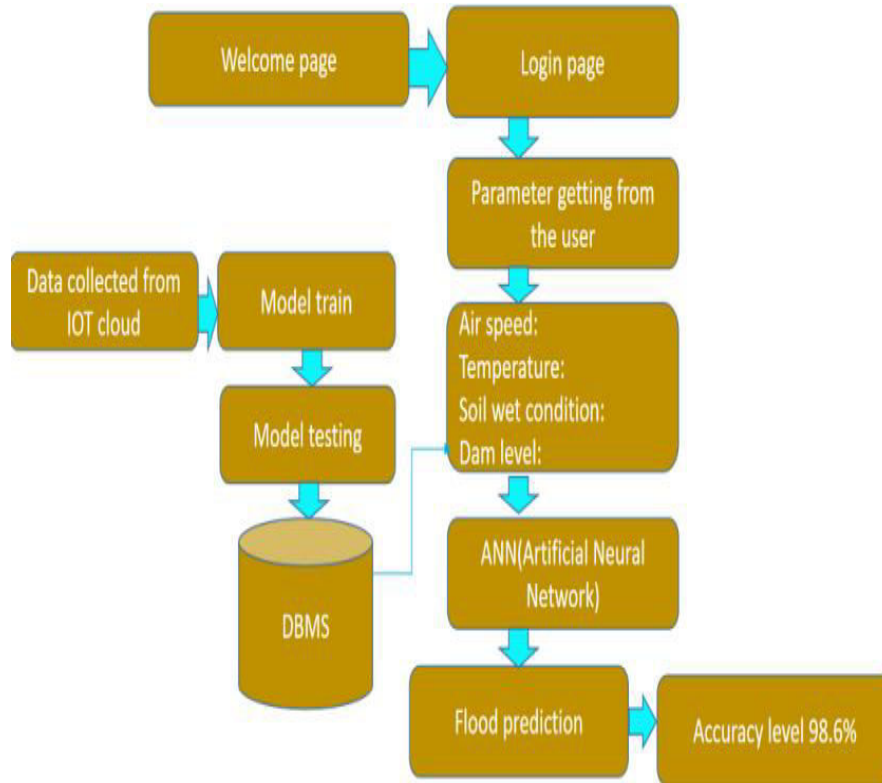


Fig No:1 Hardware Block Diagram and Software Block Diagram

IV. HARDWARE REQUIREMENTS

1.POWER SUPPLY

A 12V power supply (or 12VDC power supply) is one of the most common power supplies used today. A transformer, diode, and transistor combination is commonly used to obtain a 12VDC output from the 120VAC or 240-VAC input.



Fig No:2 12V Power supply

2.HC-SRO4 SENSOR

With 2.5 V-5.5 V current, the LV-Max Sonar offers very short to long term detection and levels in a very small package. LV-Maxsonarezi records objects from 0 inches to 254 inches.

3.ANEMOMETER SENSOR

This type of unmotor has a rotating wheel. . An anemometer counts the number of revolutions used to calculate wind speed.



Fig No:3 Anemometer sensor

4.LM35 SENSOR

Temperature can be measured more accurately than with thermistors. The sensor circuit is sealed and not exposed to oxidation.



Fig No:4 LM35 SENSOR

5.Soil Moisture Sensor Pin Configuration

The FC-28 soil moisture sensor includes 4-pins

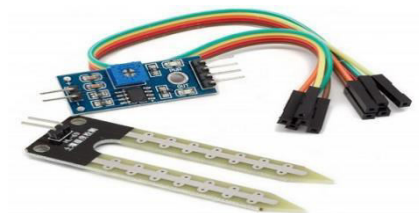


Fig No:5 Soil-moisture-sensor

V. RESULT

A surveillance system for flood recognition and environmental surveillance using Internet (IoT) technology. The system includes a variety of sensors that collect real-time environmental data, then transmitted and analyzed to predict the likelihood of flooding and landslides. In particular, the system uses the LM35 sensor to calculate the moisture and temperature of the soil, the ultrasonic sensor, wind speed, to measure the water level of the dam, which is the ultrasonic sensor. These sensors provide important information on weather conditions, soil conditions and water levels that are essential for assessing flood risk. Data collected by the sensor is transferred from thingspeak to the IoT platform, then stored in a CSV file for easy access and further analysis. The next phase of the project will use these sensor data, including wind speed, to train the predictive model using artificial neural networks (ANN) algorithms. The ANN model analyzes several factors, such as weather patterns, soil moisture, water levels, and air velocity, to assess the potential for floods and landslides in real time. This approach allows for more accurate predictions based on current ambient conditions.

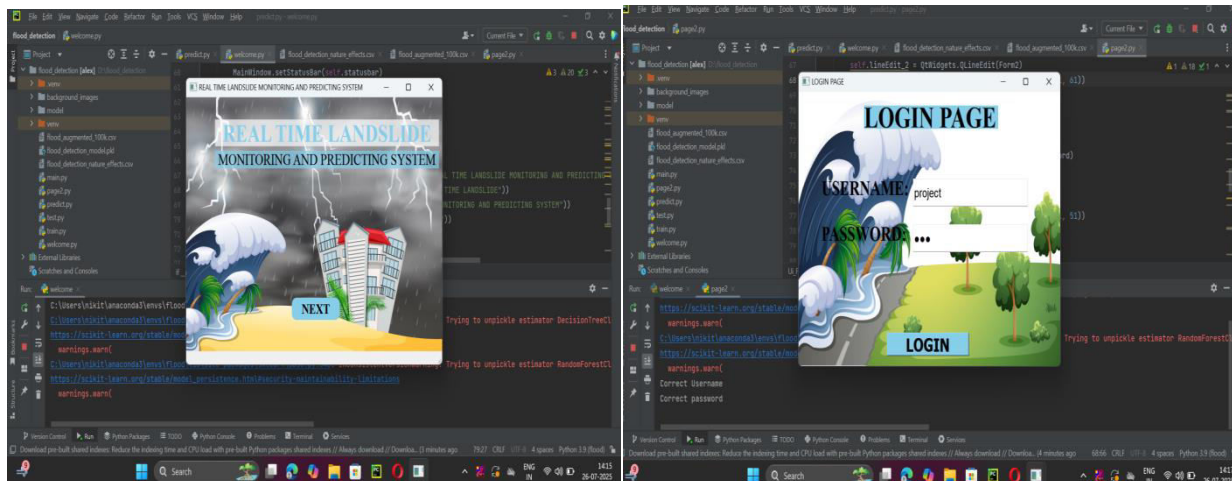


FIG NO:6 WELCOME PAGE AND LOGIN PAGE

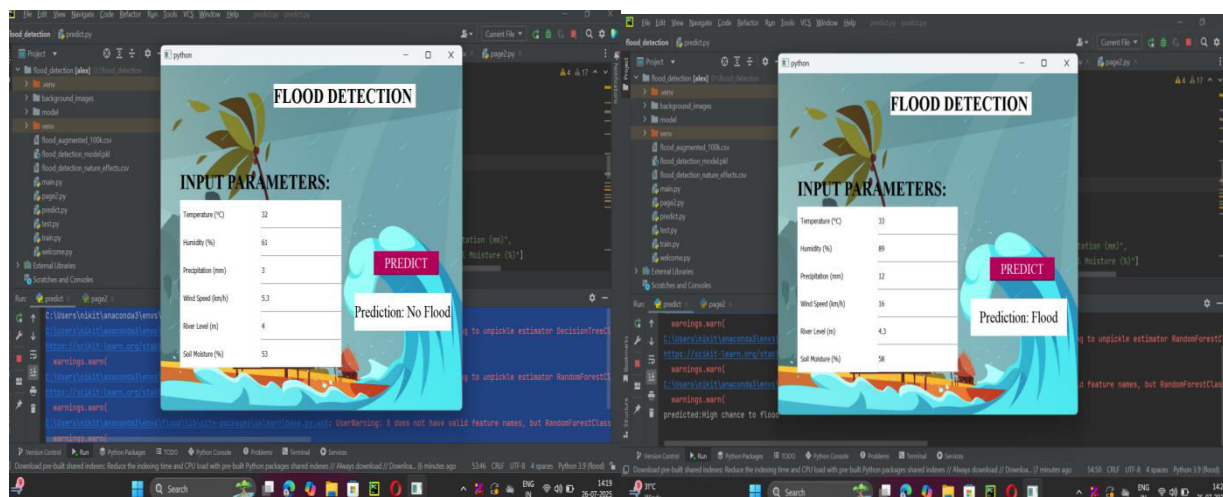
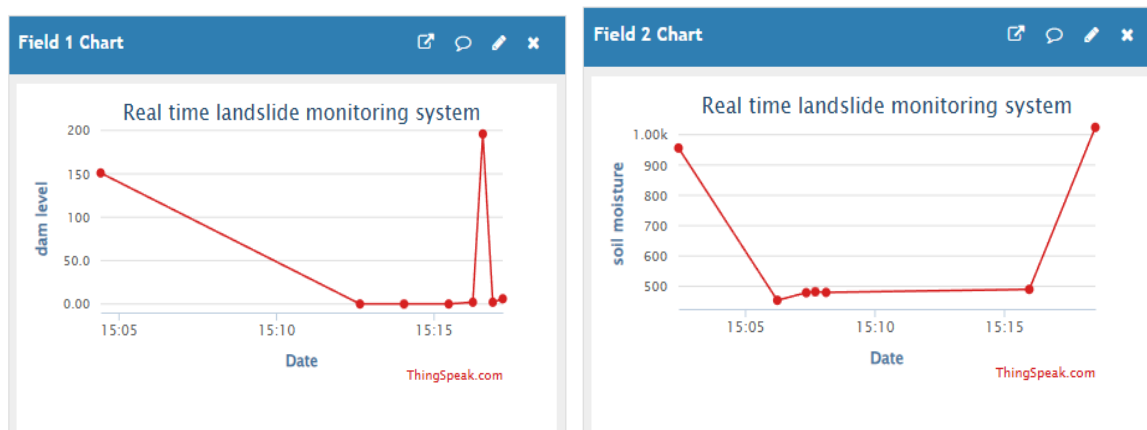


FIG NO:7 PREDICTION PAGE (NO FLOOD) AND PREDICTION PAGE (FLOOD)



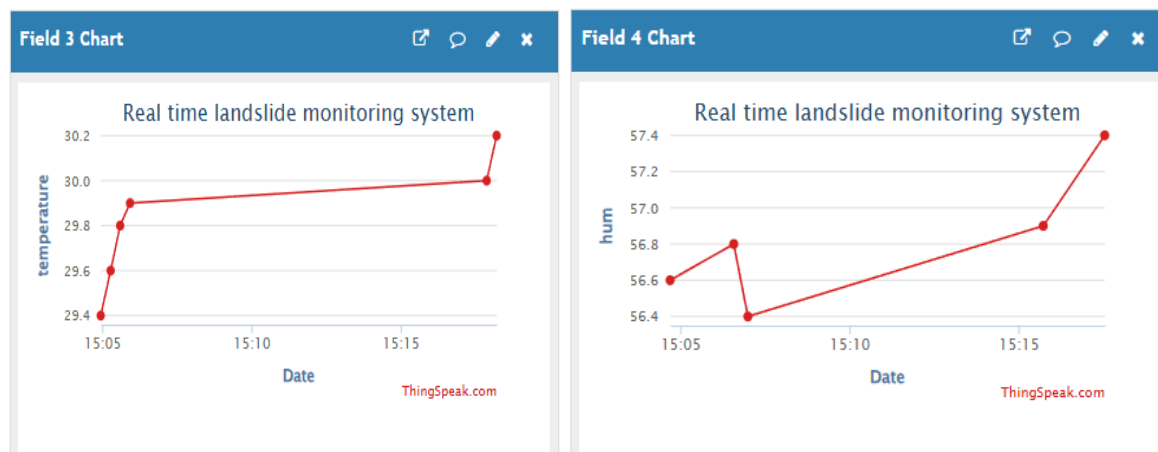


FIG NO:9 TEMPERATURE AND HUMIDITY

VI. CONCLUSION

In summary, the proposed system for recognizing and monitoring IoT-based early floods presents a comprehensive approach to disaster management through the integration of advanced sensor technology and machine learning. The use of LM35, ultrasound sensors, sensors for data collection combined with the Peak IoT platform for real-time storage and analysis provides a robust framework for environmental monitoring. By using the artificial neuron network (ANN) algorithm, the system effectively predicts potential floods and earth quakes by analyzing key parameters such as soil moisture, water levels, air velocity, and weather conditions. User-Friendly Web applications improve accessibility with monitoring of Monitory Environmental Metrics, maintain alerts quickly, and drive appropriate decisions. This innovative solution provides a scalable and efficient way to close the gap between technology and disaster prevention and reduce the impact of natural disasters and protected communities.

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