IOT BASED FLOOD PREDICTION SYSTEM

Problem Statement Understanding

In the recent past years, natural catastrophes have caused immense loss of life, loss of property and infrastructure and loss to agriculture which is of prime importance in an agrarian country such as India.

Floods are calamities caused due to a multitude of reasons. The physical factors[4] affecting the flood risk are amount, duration and type of precipitation, temperature, humidity, soil geology and terrain & topography, Vegetation type and coverage. Other factors which are pertinent to precipitation of heavy floods are global warming resulting from deforestation, urbanization and use of technology causing increased carbon footprint and ecological imbalance.

IOT, an interconnected system of sensors, geo-satellites, and other processing and publishing technologies over the internet is widely used for flood monitoring and prediction systems. IOT enables the user to access the real time data and assists in timely perception, and proactive action of precaution.

The system proposed in this abstract, focuses on creating an early warning flood prediction system using sensors and ML algorithms. A web interface for the same will be designed which displays a colour themed map with its respective flood prediction.

Literature Review

The following papers were reviewed for the system proposed below:

Eric Samikwa has built this system using IOT and ANN along with Edge Computing. Despite the various advancements in flood prediction systems through the use of ANN, there has been less focus on the utilisation of edge computing for improved efficiency and reliability of such systems. In this thesis, a system for short-term flood prediction that uses IoT and ANN, where the prediction computation is carried out on a low power edge device is proposed. [1]

Vignesh Baalaji and Sandhya have proposed a system that analyses the dataset using Multilayer Perceptron Classifier (MLP) algorithm to train the predictive model, and with a developed graphical user interface, real time flash flood predictions are made. As this system uses machine learning it helps in better performance over the physical model. [2]

Swapnil A. Bande has developed a system that monitors the environment conditions or the ambient conditions in real-time using IOT and WSN. In this work, an IoT and machine learning based embedded system is proposed to measure different atmospheric conditions to predict the weather information like temperature, pressure, humidity, wind speed and

direction, rainfall etc and predict the upcoming natural disasters like floods after analysing the trend of climate change. The proposed system uses a mesh network connection over ZigBee for the WSN to collect data, and a Wi-Fi module to send the data over the internet and also consumes low power. [3]

Hardware and Software Requirements

Hardware Components

1. Temperature & Humidity Sensor: The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and gives out a digital signal on the data pin. Range: 0 to 50 degrees Celsius with a 2-degree accuracy.

2. Rain Drop Detection Sensor Module: Raindrop Sensor is a tool used for sensing rain.

3. Ultrasonic Sensor: The sensor is mounted over the water and used to determine the distance to the water it transmits a sound pulse that reflects from the surface of the water and measures the time it takes for the echo to return. Range: 11 meters.

Software

1. Arduino IDE: Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

2. Proteus: PCB Design and circuit simulation software.

3. Firebase: The Firebase Realtime Database is a cloud-hosted NoSQL database that lets you store and sync data between your users in real-time.

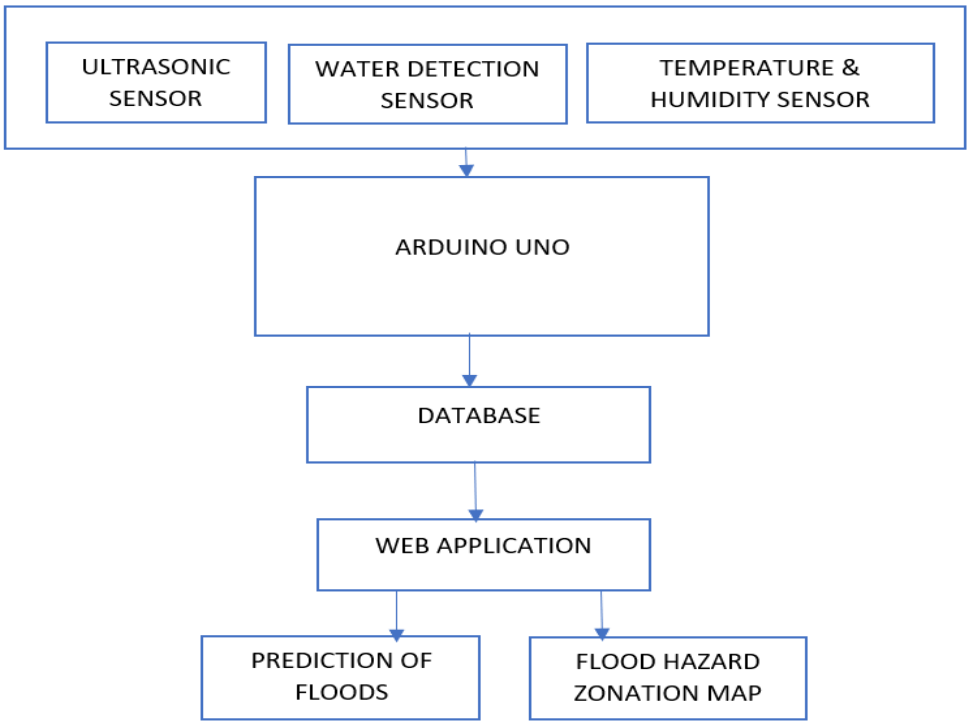
4. C language: C is a powerful general-purpose programming language**.** It is also used to write programs in Arduino IDE.

5. Python: Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. It is best fit for machine learning and AI-based projects due to its simplicity and consistency.

6. HTML: HTML (Hypertext Markup Language) is the code that is used to structure a web page and its content.

7. CSS: CSS (Cascading Style Sheets) is part of the core technologies for building Web pages used for the (visual and aural) layout, for a variety of devices.

Block Diagram



Proposed Working

The proposed system aims to devise a solution to effectively handle the prediction of floods in various locations including reservoirs, coastal areas and floodplains. The data received from the input sensors is passed on to the microcontroller. The values of the various parameters thus collected are run through ML Algorithms to predict the occurrence of floods in that particular area. The data to be published is sent to the website through the database. The website displays the prediction along with a zonation map indicating the severity of flood hazard.

The system proposed above will be implemented by performing simulation using the Proteus Software.

Possible Additions and Updates

1. The website can be made more comprehensive by adding various zones based on the intensity of rainfall to denote the predictions of flood risk. For example, the zone in which the amount of rainfall is heavy and water level surpassing the mean sea level (MSL), it could be colour graded as dark red to indicate warning.
2. A flash flood light can be installed near coastal areas for early warning.

Applications

1. Hazard management system in Talukas and cities
2. Flood forecasting for coastal areas, river floodplains.
3. Prediction of overflow at reservoirs.

Advantages

1. Provides the real time information of the flood risk status.
2. Helps for prior intimidation to the coastal areas.
3. As ML is used, better effectiveness and performance of the system than physical model.[2]

Challenges

1. The work done in studies such as [1] have suggested that the real time data must be sent in a timely manner to the cloud services for accurate predictions. For real time flood early warning systems, information delivery is key. Thus, there is a need to ensure that information delivery must be concise. There are several factors that are attributed to the efficiency and effectiveness of early warning systems for floods. These include the correctness of prediction of a flood occurrence, the amount of time needed to make a prediction, the reliability of the communication networks used in the early warning system, the deployment and maintenance cost of the systems, etc.

Conclusion

The work mentioned above aims to make use of technologies such as IOT and Machine learning to facilitate and improve the efficiency of flood forecasting.

References

[1]Eric Samikwa, Flood Prediction System Using IoT and Artificial Neural Networks with Edge Computing, Stockholm, Sweden 2020. Available: https://www.divaportal.org/smash/get/diva2:1464464/FULLTEXT01.pdf

[2]] Vignesh Baalaji, Sandhya, Flood Prediction System using Multilayer Perceptron Classifier and Neural Networks, IRJET,May 2020.

[3]Swapnil A. Bande, Review Paper on IoT Based Flood Prediction Model, IJSR, June 2017.

[4]https://www.coolgeography.co.uk/GCSE/AQA/Water%20on%20the%20Land/Flooding/Flooding.htm