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Early Flood Detection Based on Iot Using Machine Learning

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A B S T R A C T

The end outcome of climate change is flooding, a complex process that occurs all across the planet. Although certain gauging stations are used to forecast the likelihood of flooding, they are not very reliable. Unexpected flooding events are damaging not only people's lives but also important infrastructure. Our project's goal is to use deep learning to create a system for real-time and accurate flood monitoring and detection. The dependable, low power, wide-area communication method for flood detection that is proposed in this research uses wireless sensor networking technology. Additionally, we use a convolutional neural network to look for any living things that were impacted by the flood.

Keywords:machine learning, rain detection, flood

1. Introduction

Today, flooding is a problem that affects people all around the world, but it is particularly prevalent in coastal areas. This flood's unpredictability is a direct outcome of climate change. When we consider the factors that contribute to floods, we discover that rainfall is the main factor. We typically consider flooding to be a natural phenomenon, however human activities like deforestation, crumbling infrastructure, bridge building, building flood embankments, etc. also significantly contribute to its occurrence. Floods have devastating impacts, including the immediate loss of life, destruction of valuable property, destruction of crops, and the spread of water-borne illnesses like cholera and hepatitis B. The aftereffects also prevent land from being used for other purposes.

2. LITERATURE SURVEY

In the literature, a number of flood prediction methods have been put forth. The performance of a fault-tolerant system for flood prediction employing the ns-3, MLP, and RPL routing protocols has been developed and analyzed in reference [4]. Additionally, the LEACH clustering technique is utilized to demonstrate how disruptions like node or communication failure improve system utilization and fault tolerance measures. A thorough investigation of the use of computational intelligence-based technologies in flood management systems has been carried out in [5]. For instance, the artificial neural network and the ANN/GA combination had the greatest and lowest RMSEs among the combined approaches, respectively. Reference [6] used a comparison of multiple linear regression and MLP techniques on a dataset to estimate the water level in the downstream.An IoT, big data, and CDNN-based flood detection system has been presented in [7]. It can be seen through a comparison of CDNN, DNN, and ANN that CDNN outperformed them all in terms of sensitivity, accuracy, F-Measure, specificity, and recall. Sequence-to-sequence (seq2seq) learning and the LSTM structure's predictive model suggest in [8] that estimates runoff for the following 24 hours and once per hour. The findings of the model with and without taking into account upstream stations demonstrate that the distributed model's correlation coefficient and NSE are greater and its NRMSE is lower than in the case without taking into account upstream and other models. Additionally, a station's results will be more pleasing the more it makes use of upstream station data.The objective of [8] is to

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develop real-time data-driven models that can simulate and predict the rainwater runoff process using the available data. According to [12], LSTM performs better because it is more stable than ANN and has lower RMSE and MAE. As a result, LSTM is better equipped to simulate nonlinearly. Reference [9] demonstrates that MLP and SVM are outperformed by deep learning in both the learning and validation phases. [10] created an LSTM model to predict discharge for the next one, two, and three days of flowrate forecasting.The results by [11] demonstrate that if the input data of the model consists of the observed discharge data in all stations will forecast the flow value better than the scenario that takes into account time series of both rainfall and discharge measured as the input data. This is because by [12] the correlation between the series of precipitation data and the flowrate at the target station is frequently significantly lower than the correlation between flowrate stations.

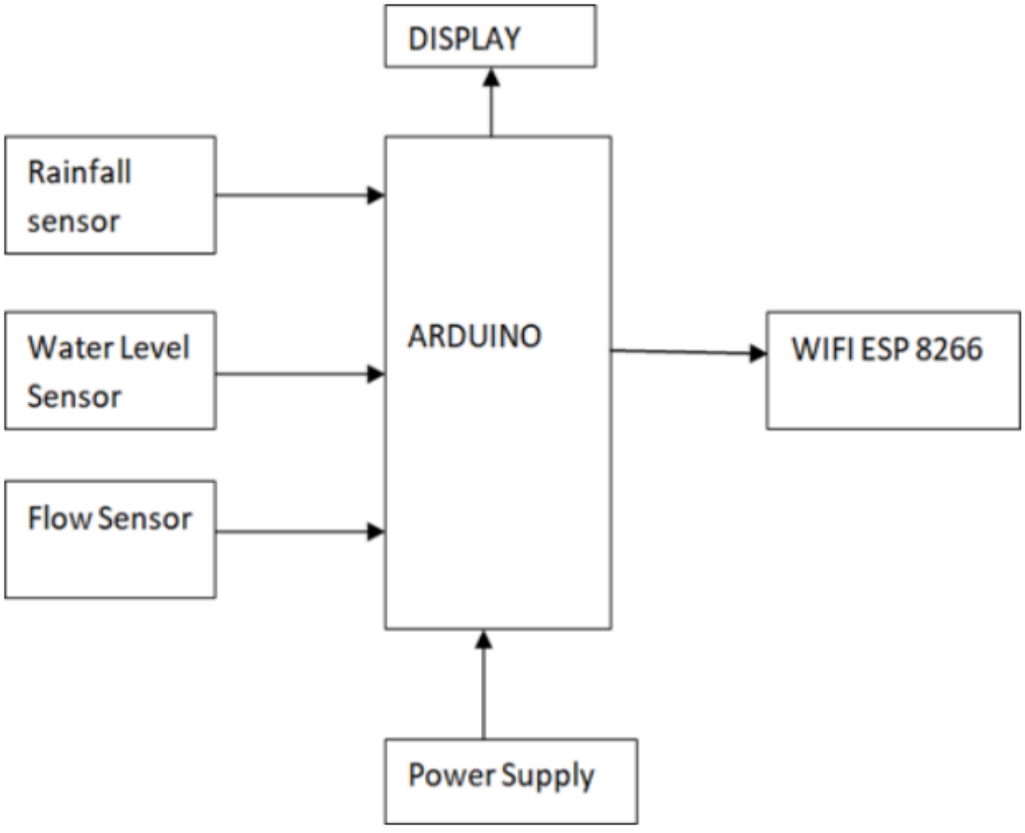
2.1. PROPOSED SYSTEM

- We have developed a low cost, reliable and real time flood detection and prediction system utilizingWireless Sensor Networking Technology in IOTenvironment.
- In this system, we are employing ConvolutionNeural Network algorithm to detect living beings inflood affected zone.

2.2. OBJECTIVES

- To detect the occurrence of flood and alert the people living around the flood zone.
- Detection of living beings in flood affected areas.

3. ARCHITECTURE



4. METHODOLOGY

A base station and several sensing nodes that connect to one another make up the WSN design. A wireless transducer, a set of sensors, and an Arduino microcontroller are all included in the group of nodes. The group of sensors consists of a rainfall sensor, a water level sensor, and a water flow sensor. Water level is measured using a water level sensor, water flow is measured using a water flow sensor [15], and rainfall is detected using a rainfall sensor. These three sensor nodes are connected to an Arduino microcontroller and have the appropriate programming. At regular intervals, each sensor will take a reading of the parameters and promptly update its data.The updated information is kept in the BLYNK Cloud. Each sensor has a threshold value, and if any sensor's reading exceeds the threshold value, the TCP app immediately sends a message via the WIFI module [16] to the relevant government authorities, assisting them in taking further action. According to [12], who designed and implemented the system, it will also be able to identify any living things that were harmed by the flood. It makes use of the CNN algorithm, which processes images, assigns values to each pixel, passes them through kernels and filters, and then classifies them [14]. The device can also recognize different human positions.

4.1.SYSTEM REQUIREMENTS

Hardware Requirements:

1. Arduino uno:

A microcontroller called Arduino features 14 digital I/O pins, 6 analog I/O pins, a quartz crystal operating at 16 MHz, a USB port, a power jack, an ICSP header, and a reset button. The Italian word "Uno" for one was chosen to symbolize the launch of the Arduino Software (IDE) 1.0. The Uno board with the Arduino Software (IDE) version 1.0 served as the foundation for later generations of Arduino. The Arduino Uno board is the first in a line of USB Arduino boards and serves as the platform's reference model. For a comprehensive list of all the platform's previous, present, and future boards, visit the Arduino index of boards.

Water flow Sensor:

A scientific tool used to gauge water flow is called a water flow sensor. Three cables are included with the sensor: black (ground), red (5-24VDC power), and yellow (Hall effect pulse output). It is simple to determine the water flow by counting the pulses that the sensor's output produces. Approximately 2.25 millilitres make up each pulse..

2. Water level Sensor

A scientific tool used to gauge the amount of water in a container is a water level sensor. It functions to transmit the message via IOT as the water rises and reaches the highest Level or danger level. We are employing a normally closed type, corrosion-free material, and advanced magnetic technology water level. This level sensor primarily uses 2 to 12 V DC and currents of 5 to 50 mA DC. Its maximum switch current and maximum switch power are 500 mA (DC) and 10 W, respectively.

3. Rain fall sensor

A simple tool for detecting rain is the rain sensor module. If a raindrop passes through the rainy board, it can be used as a switch. It can also be used to gauge how heavily it rains. The module has a separate control board and rain board for more convenience, a power indicator LED, and a potentiometer to regulate the sensitivity.

4. LCD

Liquid Crystal Display is a type of flat panel display which uses liquid crystals in its primary form of operation.

5. Wi-Fi ESP 8266

In order to host the program or to offload all Wi-Fi networking tasks from another application processor, ESP8266 delivers a comprehensive and self-contained Wi-Fi networking solution. When the ESP8266 is the only application processor in the device and is hosting the program, it can boot up directly from an external flash. It includes an inbuilt cache to reduce memory needs while enhancing system performance in Wi-Fi Module applications. A self-contained SOC with an integrated TCP/IP protocol stack, the ESP8266 Wi-Fi Module allows any microcontroller to access your WiFi network. The ESP8266 is capable of offloading all Wi-Fi networking tasks from another application processor or hosting an application.An AT command set firmware is pre-programmed into each ESP8266 module. The ESP8266 module is a very affordable board with a sizable and expanding community.

6. Power Supply

A power supply is a hardware component that supplies power to an electrical device. It receives power from an electrical outlet and converts the current from AC (alternating current) to DC (direct current), which is what the computer requires.

SOFTWARE REQURIMENTS

1. Arduino IDE

Java was used to create the cross-platform Arduino integrated development environment (IDE), which is available for Windows, macOS, and Linux. It is used to create and upload applications to boards that are compatible with Arduino as well as other vendor development boards with the aid of third-party cores. The Arduino IDE has specific code organization guidelines to support the languages C and C++. Because it is an official Arduino program, code compilation is so simple that even the average individual with no prior technical expertise may get started learning. The primary code, often referred to as a sketch, written on the IDE platform will eventually produce a Hex File, which is transported to and uploaded into the controller on the board.The primary code, often referred to as a sketch, written on the IDE platform will eventually produce a Hex File, which is transported to and uploaded into the controller on the board.

2. EMBEDDED C

The C programming language has an extension called Embedded C that helps programmers create effective applications for embedded hardware. It is not a component of C. The most popular programming language for embedded controllers and processors is C. Assembly is also utilized, however it is mostly employed to implement those parts of the code that require extremely high timing accuracy, code size efficiency, etc. Since the Arduino IDE (Integrated Development Environment) can compile both Arduino code and AVR standard code, it is fully functional and packed with libraries, making it possible to program the Arduino UNO in Embedded C..

3. Telegram Bots

Bots are third-party applications that run inside Telegram

CONCLUSION

The nature of and timing of natural disasters cannot be predicted. Natural disasters are caused by a variety of factors, such as rainfall and water levels in bodies of water. In this project, we have taken into account the water level in dams, the flow of the water, as well as the detection of rain fall by installing various sensors, so that continuous monitoring of the water level, the flow of the water, and the occurrence of rain is done. If the threshold value of the sensor is exceeded, an alert about the flood is sent. Another goal of this project is to locate victims in disaster-affected areas using CNN (Convolution Neural Network), a component of ANN (Artificial Neural Network). The actual outcome was 97.7722 percent of what was expected..

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