Real Time Flood Management and Control with Early Warning System using Artificial Neural Network

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Abstract: Floods is the most common natural disaster which occur when excess of water flow onto the land and that can have living life and stability losses Some reason are responsible to cause flooding For e.g. rapid snowmelt, blockage of the drainage system, high rainfall, insufficient water pump capacity in flood prone areas, improper environmental damage . there are different type of flooding. they are such as Storm Surge, Coastal Flood, River Flood etc. The aim of this paper to find out flood prediction using Artificial Neural Network. The aim of this project is to monitor real time the flood data and alert notification if there is an occurrence of risk through IOT. The rising water level is use to detect the floods . The system uses different sensors to detect maximum water reach point, storage of tank, rain fall sensor and measure the value at every stage. The sensor senses the data and processed to microcontroller and is transmitted to internet through wi-fi Module. The system sends data to Mysql database and applies Artificial Neural Network algorithm to perform Classification process. The experimental results show real time data that might be useful to prevent from flood. Artificial Neural Network give us Training data accuracy and validation data accuracy, training data loss and validation data loss respectively.

Index Terms – **height of maximum water reach point, Storage of tank, Rain fall Sensor, Solenoid Valve, Water Flow Sensor, buzzer,MySql, Webhosting etc.**

I. INTRODUCTION

Human lives are one of the best forms of life on earth. But there are different parameters which disturb the earth's atmosphere. One of the such disaster is Floods. Floods affect human lives and have a devastating effect on entire mankind and also on the earth's surface. Escape from such type of the disaster is really a challenging situation and has to be handled with proper planning and implementation. Many nations are trying to solve this issue with proper network and framework and also by studying different perspectives of the situation. The main objective of this project is to develop and design a flood detection system that will detect flood automatically and transmits data through IOT. These systems aim to minimize the impact of flood disaster through the help of early prediction. The prediction system has the effects to decease the extremity of flood influences.

II. LITERATURE REVIEW

Swapnil Bande, Prof. Dr. Virendra V. Shete, this paper present internet of things (iot) is a technology that is a combination of hardware system and software system communication which further transfers data to cloud for analysis in real-time. The main aim of this system is to monitor humidity, temperature, pressure, rainfall, river water level and to find their data information for flood prediction analysis, to predict flood prediction, such as artificial neural networks techniques are used to analyse prediction algorithms. here an iot based flood monitoring and artificial neural network (ann) based flood prediction is designed with the aim of increase the scalability and reliability of flood management and control system[3].

Nikhil Binoy C,Arjun N,Keerthi C, this paper shows flood detection using Artificial Neural Networks and also has proposed that it is implemented and designed a model based on Malampuzha Dam, Palakkad, Kerala.The water from the dam is passed to canals and flow rate and level of water in one portion of canals is used to predict the possibility of a flood in the next portion of the canal. This method the succeeding level of flood prediction[6].

XIA Hong, RAO Qunhua, this paper proposes artificial neural network algorithm that predicts flood level in rivers, lakes and reservoirs. Since a neural network can approach to a nonlinear function which give high accuracy, The algorithm is a process of learning, the errors between predicted value and actual value are taken as feedback,which are used to adjust the weights in the predicting network, so that the algorithm might get excellent predicting result. the network with multiple input neurons is more precise than the one with single input neuron, which are taken as input neurons for the network. Thus, sample size for learning in the network increases and the prediction accuracy can be improved. The method is especially suitable for the condition that there is flood level data from only one place[5]**.**

Ni Komang Ega Kartika, Muhammad Ary Murti, Casi Setianingsih, the aim of this project is to show the result of floods prediction using a technology called Internet of Things (IoT) which is using Radial Basis Function. The data would be received from Citarum River Hall. The Information that used from Citarum River Hall is rainfall and river water. The result from Radial Basis Function Neural Network will be sent to an android application that displays the opportunity of flooding [4].

III. SYSTEM DESIGN AND DESCRIPTION

This proposed system consists of different sensors, nodemcu, Web hosting, MySql Database etc.
Most using Languages.

Front side: HTML, Bootstrap, PHP, CSS and JavaScript.
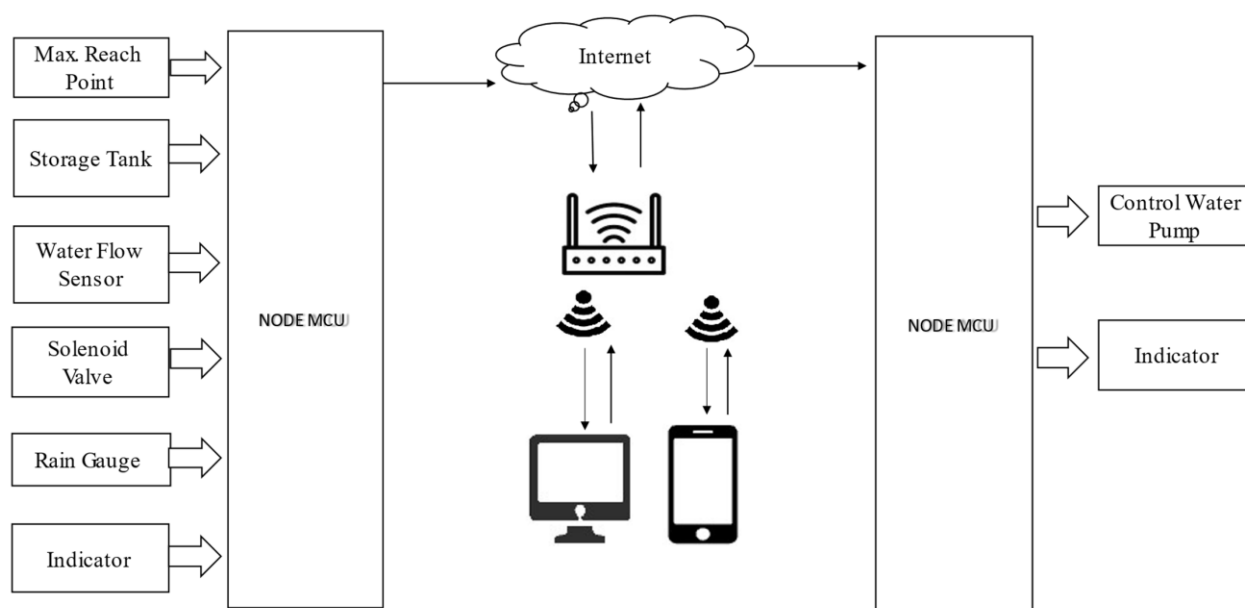Back Side: Use of MYSql for data information, PHP, HTML.

Fig 3.1. Block Diagram

This project shows the design and implement of real time flood management and control with early warning system and give alarm when the flood is detected using sensors. it is done when water level reach maximum point. water level taken for this paper is based on whenever there is high rainfall it will be measured by rainfall sensor and if water crosses the water limit then the overflow of the water that means flood may come and give alarm notification. if water reach beyond the limit the solenoid valve automatically is opened and then water is store in external tank if water goes under limit then solenoid valve is closed and water does not store in external tank. Water which is store in tank can be reuse by Water motor pump. Sensors read the data from environment and send it to microcontroller and then these data are transmitted to internet through wi-fi module and then data store in MYSql database. The proposed system uses Random Forest algorithm for classification process and to analyses the data and to find flood prediction using these data.

IV. METHODOLOGY

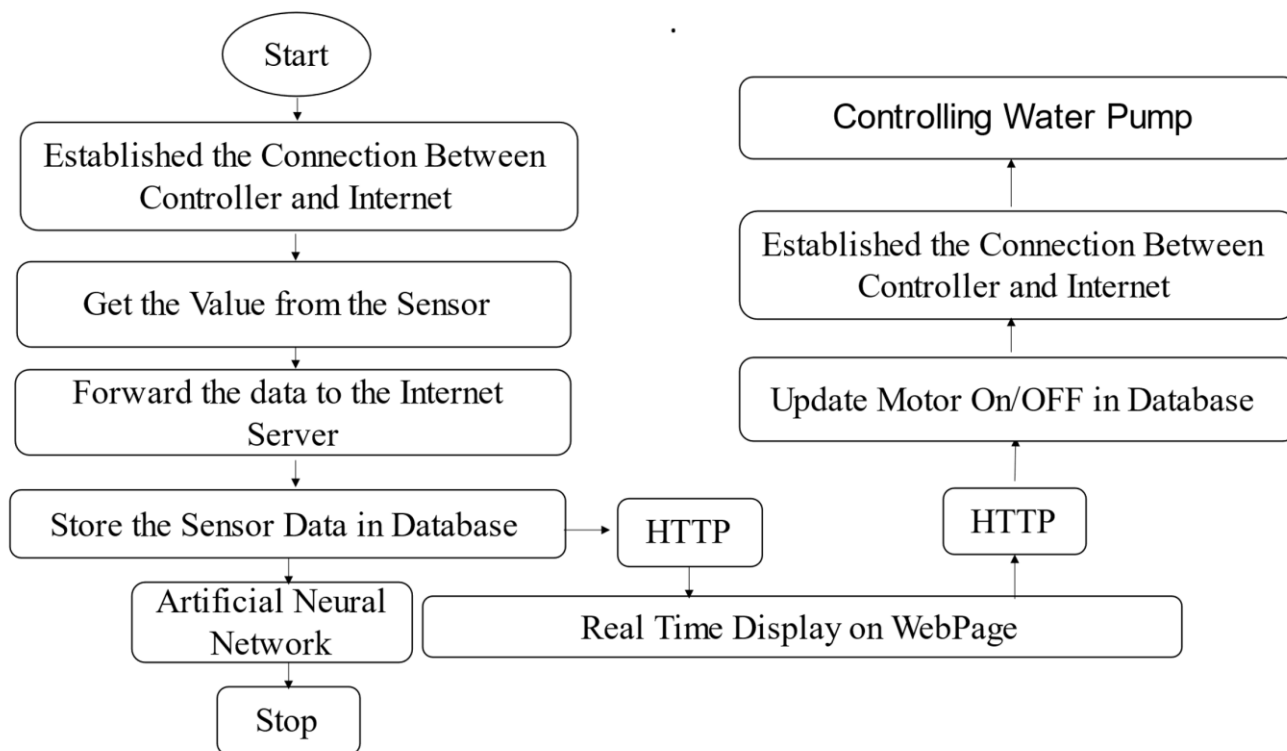The Fig. 4.1 the proposed methodology Shows in below.

Fig.4.1. Flow Diagram

There are two main parts in methodology.

The first step is to establish the connection between Microcontroller and different sensors and it is uploaded in the internet time to time which is completely store in MySql database.

The second step of the implementation is completely based on Machine Learning approach which is Artificial Neural Network utilized to examine the flood.

ANN ARCHITECTURE

The artificial neural network works upon the non-linear data obtained from the sensors' for prediction flood. Figure 4.1 shows the basic ANN Architecture which consists of an input layer, multiple hidden layers, and an output layer. These three layers are connected to each other by the interconnected between them which have specific weights and the bias values. Every node in one layer is connected to every other node in the next layer.
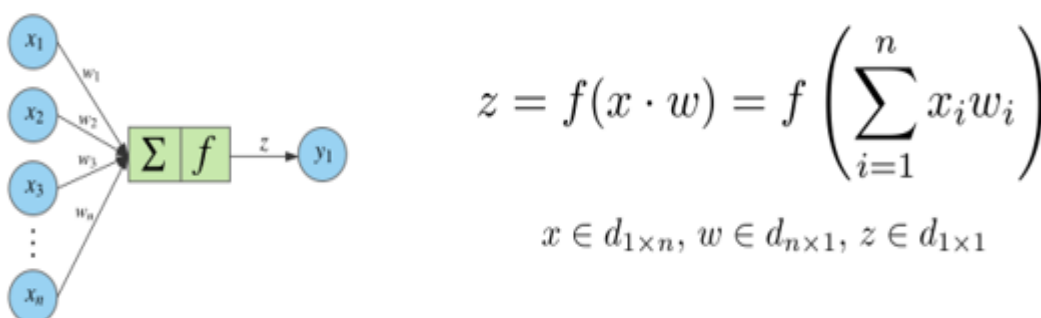

$$z = f(x \cdot w) = f\left(\sum_{i=1}^{n} x_i w_i\right)$$

$$x \in d_{1 \times n}, \; w \in d_{n \times 1}, \; z \in d_{1 \times 1}$$

Fig 4.2 Architecture and ANN equation

The equation for a given node looks as follows. The weighted sum of its inputs passed through a non-linear activation function. It can be represented as a vector dot product, where n is the number of inputs for the node.

V. EXPERIMENTAL RESULT

The experimental result is being showns below.

Fig5.1. Real Time Graphical Representation

Fig .5.1 showing Storage_tank_1 and Storage_tank_2 Storage Tank which is use to store capacity of water in centimeter cube(cc) As per the system implemented design model which store water in real time and showing in graphical.in Fig5.1 showing maximum water limit that mean here is water limit is fixed consider 20cm. when water overflow from maximum water limit solenoid valve opens automatically and extra water is stored in tank. Rain fall sensor is use to measure how much rain fall is recorded in millimeter(mm). water flow sensor showing how much water flow into tank in (L/Min) and Total water showing total water in all tank storage in percentage.

Fig5.2. Controlling water Pump

Fig .5.2 showing how to control water motor pump in real time using IoT. When the button is ON, water pump is automatically ON and water reuse from Storage tank. When the button is OFF ,water pump is automatically OFF that means we can withdraw water from storage of tank.

Fig5.3. MySql Database

Fig 5.3 Designed Model showing all sensor data such as tank_1, Tank_2, River_height, Tot_volume, Rain fall, Solenoid Valve ON/OFF automatically, Flood Detection Yes/NO etc. these parameter store in MySql database in real time. Thsese data can be use for future data analysis and future flood prediction.

VI. CLASSIFICATION RESULT

The water storage, rainfall and automatics system used in flood prediction model.
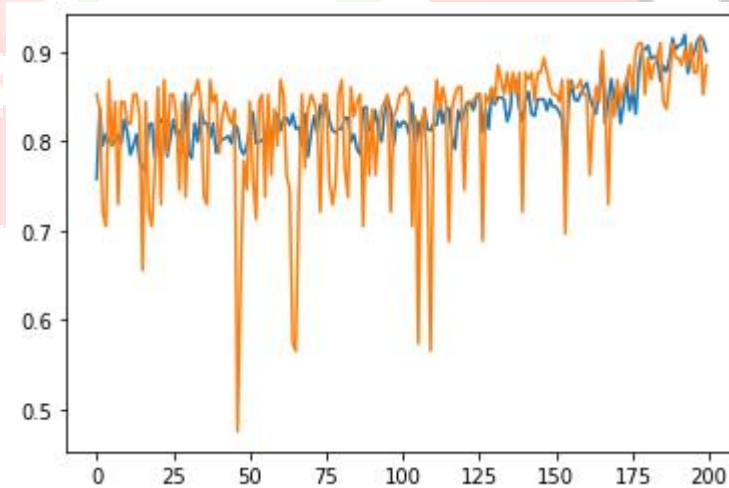The data sets for a month were used to stimulate the for prediction of flood.

Fig6.1. Difference Between Training Accuracy and Testing Accuracy

Fig. Shows the Difference Between Training Accuracy and Testing Accuracy which shows when the training data and validation data train 200 epochs with batch size 8 which shows validation data more decrease accuracy while training data slightly increase accuracy. These epochs are 50,75,110,115 shows validation data decrease accuracy while training data gradually increase accuracy.
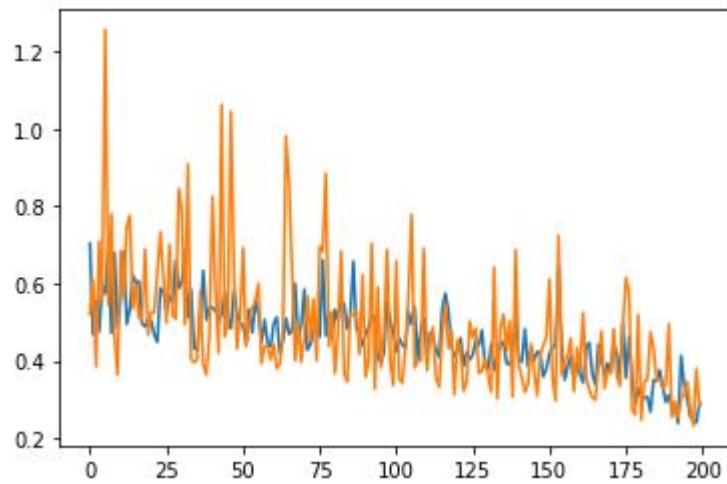
Fig6.2. Difference Between Training loss and Validation Loss

Fig. Shows Difference Between Training loss and Validation data loss which shows at 15 epochs validation data more increase loss while training data slightly increase loss. These epochs are 15,40,45,60 shows more increase validation loss where as slightly increase training data loss.

CONCLUSION

The designed model set up, The results of this project includes maximum storage of rainwater, which can be done by constructing external or internal tanks which will help in some or the other way to store water and transport the extra water to the places wherever required. Not only that it also aims to work on a devastating disaster like flood and also give warning signals whenever the quantity of water goes beyond the limits. It also will deal in displaying the intensity of rainfall which will help in recording the mm of the rainfall , and also deal with the recycling of this water so that the danger of the floods would be limited and utilization of the water could be done at a larger extent through proper channels . The expected result will also show a greater usage of internet and control the floods with early warning systems.

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