IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 2, April 2024

Flood Detection through AI & IOT

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Abstract*: The climate is changing as a direct result of global warming, which is causing a range of extreme weather events to take place, including floods and intense downpours. The floods are an unexpected increase of water levels is an issue in many places of the world, and it has been known to cause damage to infrastructure as well as human fatalities. The economic effect of this flood event is accentuated for developing nations and countries with a weaker level of economic development. Based on the most recent reports from different parts of the world, terrible floods have resulted in the loss of many lives and have had an impact on a diverse spectrum of people. The last several years have seen significant advancements in technological and computer-based methods to evaluation and collaboration, both of which have contributed to improved detection performance. As a consequence of this, there is an immediate need for a means of recognizing floods. As a result, the Internet of Things devices that have the potential to detect flooding are included into the work that is planned. In order to speed up the process and guarantee precise flood detection, the Decision Making model is combined with the ESP 32 microcontroller.*

Keywords: Artificial Intelligence, Internet of things, Flood Detection, ESP32, Machine Learning

I. INTRODUCTION

Flood disasters have caused incalculable damage to the nation's economy, way of life, and houses as a result of their widespread distribution, frequent occurrence, and numerous, topographical, and possibly fatal qualities. These factors have contributed to the disasters' broad spread. India's tropical climate, lengthy wet seasons, and relative isolation all contribute to the country's high risk of floods, both on their own and as a result of the ecosystem. This risk can be broken down into two categories: floods that are caused by the climate and floods that are caused by the ecosystem. It is impossible to exaggerate how important it is to have a grasp of the floods that are created by rain. Monitoring floods is one of the most difficult, complicated, and essential challenges in engineering. Its primary purpose is to cut down on the number of human and economic deaths.

Recent weeks have seen widespread devastation around the world in the form of disastrous floods, which has resulted in a significant number of lives lost and considerable damage to infrastructure. The prediction of floods has to be carried out rationally in order to allow for the establishment of advanced warning signals, which will serve to warn people of an impending disaster. If there is sufficient warning, it may still be possible to save lives and livelihoods by providing the chance to evacuate or make improvements to the infrastructure. Through the use of intricate computer modeling, it is possible to produce a massive acceleration in the forward march of time. Several modifications are developed with the goal of predicting a broad variety of phenomena, including floods, hurricanes, and other similar occurrences, among other things. It has been shown that computational methods from the area of artificial intelligence, which include neural networks and support vector machine analyzers, are helpful and may be used in a variety of contexts. However, it has become clear that a significant constraint is the inability to confidently offer very exact results owing to values that are beyond the spectral range.

Accurate weather forecasts may be made up to five days in advance. This is the maximum amount of time for which they can be made. Nevertheless, if there is an unexpected change in the world that surrounds us, these facts could be revised. The acquisition of information such as that might be challenging at times. The lack of data presented a significant challenge when it came to attempting to forecast the destruction that would be inflicted by the floods that occurred on the Indian subcontinent. Because to the dams' inability to accurately estimate the runoff velocities, significant damage was done to the infrastructure. This demonstrates the need of having an effective flood forecasting system that takes into consideration several parameters, such as the amount of rainfall, the velocity of streamflow, and the pressure of the water. Floods may often be predicted with the help of these three elements. However, when dealing with a greater amount of data from the real world, the findings indicated a decreased efficacy of the forecast.

A subsystem is to predict massive flooding in Kelaniya, Sri Lanka, by combining the information collected by suspended detectors with the real-life information procured from the Emergency Relief Management Of the organization, the Weather forecasting Bureau, and the Agricultural Division. These three departments are responsible for humanitarian assistance and strategic planning, weather forecasting, and water management, respectively. The unfortunate loss of life and the vast damage of property that are the results of floods are reported in the media on an annual basis. Flooding has been a persistent problem in the Kelaniya area for the last five years, but nobody appears ready to acknowledge that a catastrophe is on the horizon.

Aim:

To early alert the peoples staying near flood zone to save their lives and properties.

Objective

- To study the requirements of the hardware and analyse them properly
- To integrate the APIs properly
- To stream the sensor data to the ThingSpeak cloud
- To access the sensor data seamlessly from ThingSpeak cloud
- To rise the alert properly.

II. LITERATURE SURVEY

The field this project is based on has been researched many times before; in order to get an overview of the previously done work, this chapter analyses some of those documents for each part of the project.

D. Samarasinghe [1] established a subsystem to predict massive flooding in Kelaniya, Sri Lanka, by combining the information collected by suspended detectors with the real-life information procured from the Emergency Relief Management Of the organization, the Weather forecasting Bureau, and the Agricultural Division. These three departments are responsible for humanitarian assistance and strategic planning, weather forecasting, and water management, respectively. The unfortunate loss of life and the vast damage of property that are the results of floods are reported in the media on an annual basis. Flooding has been a persistent problem in the Kelaniya area for the last five years, but nobody appears ready to acknowledge that a catastrophe is on the horizon. The Smart Guardian Flood Emergency alert Technology was designed by the authors as a means of protecting individuals from the dangers of floods. If individuals could accurately anticipate what would happen during a flooding, they would take the required precautions to protect themselves along with the most valuable possessions they could take with themselves. The purpose of this research is to measure storm water runoff, user circumstances, and water depth using multiple Internet of Things Devices that have been fitted with monitors and a surveillance system. The user's smartphone will then get a notification when this process is complete. The categorization of the stages was achieved by the use of machine learning techniques.

M. Khalaf [2] research that involve utilization machine learning methods to conduct through machine learning strategies for the diagnosis of flood water severity and frequency may utilize the information acquired via the internet of things framework and devices that have been put on the waterways. The aggregation model used in this study fared well in flood monitoring studies conducted in the past and has the potential to act as a forerunner to flood monitoring tools. When doing an analysis of flood data, this study takes into consideration several categories of water levels, including ordinary, exceptional, and hazardous. The effectiveness of the proposed approach for collective learning algorithms is evaluated using several parameters for measuring performance, such as specificity and sensitivity, in addition to various ways for representation. According to the results, it may be able to provide advance indication of the magnitude of floods by using the appropriate data science approaches and combinations of model-based machine learning.

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S. Bande [3] developed a forecasting model to anticipate the occurrence of flood catastrophes by analyzing the data collected from the surrounding ecosystem. A set of sensors collect information and then wirelessly communicate it to a microprocessor so that many aspects of the environment, including climate, moisture, elevation, rainfall patterns, and more, may be monitored. In addition, artificial neural network simulation methodologies are employed in order to develop connections in between information that are fed into the system and the precipitation that is produced as a consequence. Real-time monitoring of the surroundings is possible if the historical values are periodically updated to reflect the most recent measurements and set at frequent basis. Using a Wi-Fi module, low-power endpoints inside the Internet of Things are able to communicate among themselves via the web. An artificial neural network model is used to predict the incidence of flooding and alert inhabitants to an imminent collapse by analysing the connection between someone precipitation increase and a subsequent increase in water depth in low-lying territories near river discharge regions. This is possible as a result of connection that exists between factors. The information that is gathered from the sensors is uploaded to a repository that is hosted in the cloud. From there, it is transmitted to the users through their smartphones in the form of alerts including such messages or posts on twitter

A system that was built on the Internet of Things was given by N. K. Ega Kartika [5] in order to predict the effects of floods. In order to make this flood prediction, the Radial Basis Function was employed. The Citarum River Hall is the source of the details that will be received. A number of different data sets, including totals of rainfall and rainwater withdrawals, are made available by the Citarum River Hall. The findings of the Radial Basis Function Neural Network, which indicate the possibility of flooding, will be included in an upgraded version of a mobile application. Drainage projections may be created with an epoch that is as big as possible, which results in a plausible error value. In addition, the error value is highly restricted, which contributes to an excellent learning rate.

III. METHODOLOGY

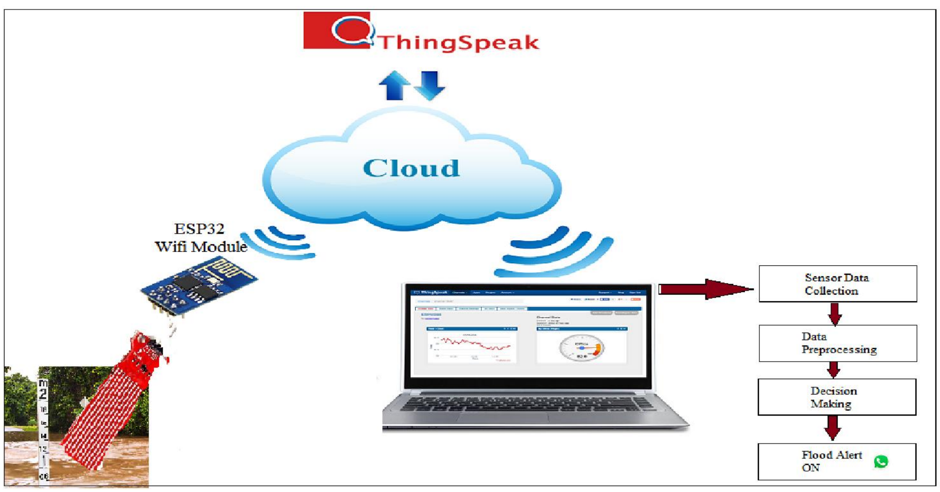

Fig. 1. Block Diagram

Module Description

Module A: Sensor Data collection

Sensor data is the information that is gathered by a Data Sensor component when, at a given point in time, it scans one or more IMS database environments and measures the defined circumstances (or states) that are occurring in those environments. This information is then stored in the Data Sensor component.

Module B: Cloud Streaming

Your data, as well as the data of others, can be streamed and stored in the cloud by using a service known as cloud streaming. A strong cloud streaming service will be able to host, reliably transmit it whenever you want, be scalable, and have the ability to reach millions of people with its content.

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Module C: Decision Making

The act of determining a course of action by defining a problem, amassing relevant data, and weighing the pros and cons of potential solutions is referred to as decision making. You will be able to make decisions that are more careful and thoughtful if you use a step-by-step decision-making process since it will help you organize relevant information and define alternatives.

Proposed Methodology with relevant Diagrams and Figures

DFT Level 0

The DFD 0 diagram for the data flow diagrams describes the flow of the approach. The DFD diagram provides the simplest flow where in the Live Streaming is provided and the pre-processing and decision making implemented and the Voice Alert generation is achieved

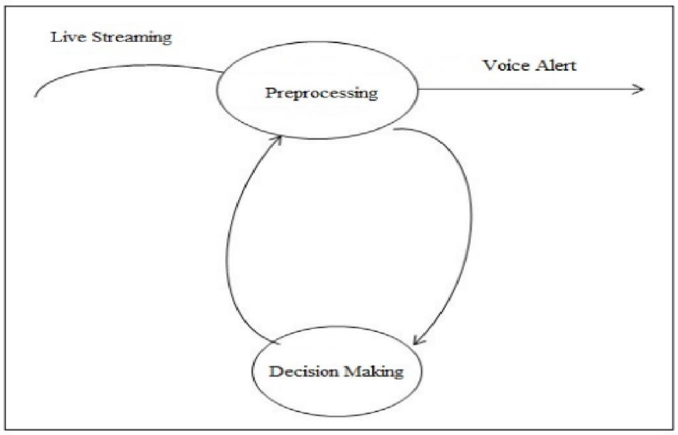

Fig. 2.DFT Level 0

DFT Level 1

The DFD 1 diagram provides even more details wherein the user provides the Live Streaming which is provided for Pre-processing which results in the pre-process list. The X-CNN is deployed through the segmentation by which trained data is achieved decision making is applied and the Voice Alert is achieved.

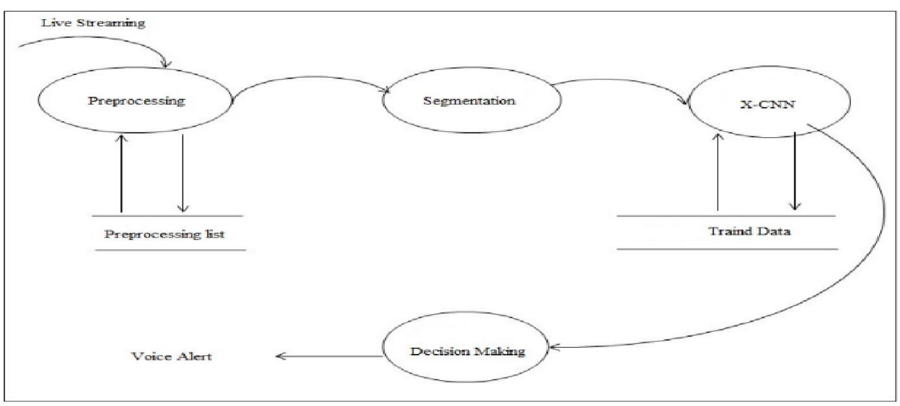

Fig. 3.DFT Level1

DFT Level 2

The DFD 2 diagram is the most detailed wherein the user provides the Live Streaming from which the Pre-processing and pre-process list is generated and Segmentation is utilized and labelling is performed. Then X-CNN is deployed through Segmentation and trained data is achieved then if-then rules is applied to do decision making which achieve voice alert

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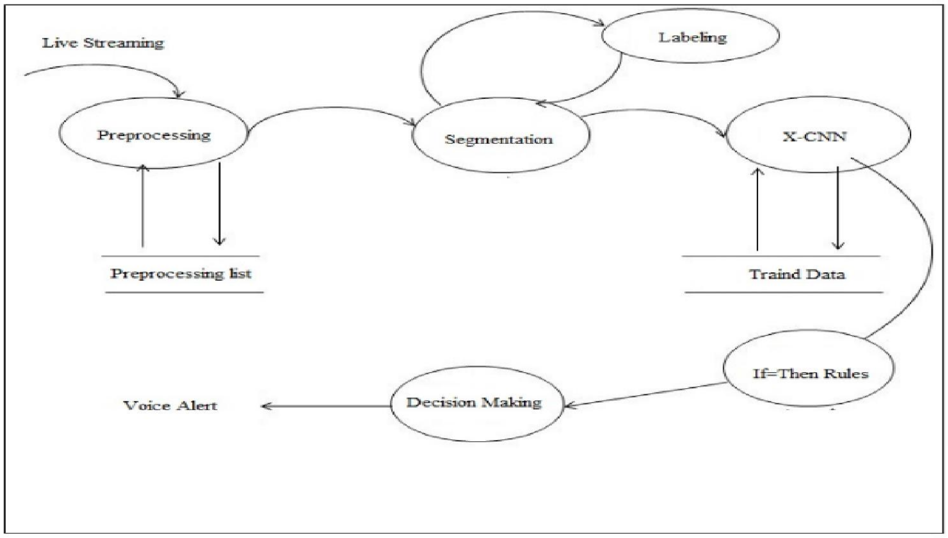

Fig. 4.DFT Level 2

Activity Diagram

Fig. 5. Activity Diagram

The activity diagram lists the various activities that are performed in the proposed methodology, the start state is initiated and the user provides the Live Streaming, pre-processing, X-CNN, Decision Making which results in the Voice Alert.

Usecase Diagram

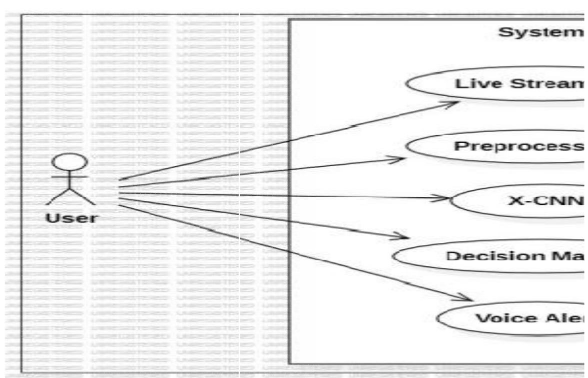

Fig. 6.Usecase Diagram

The Use case Diagram depicts the various use cases that are performed by the user in the proposed model. The use cases include, live streaming, pre-processing, X-CNN, decision making and finally the Voice Alert.

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IV. RESULT

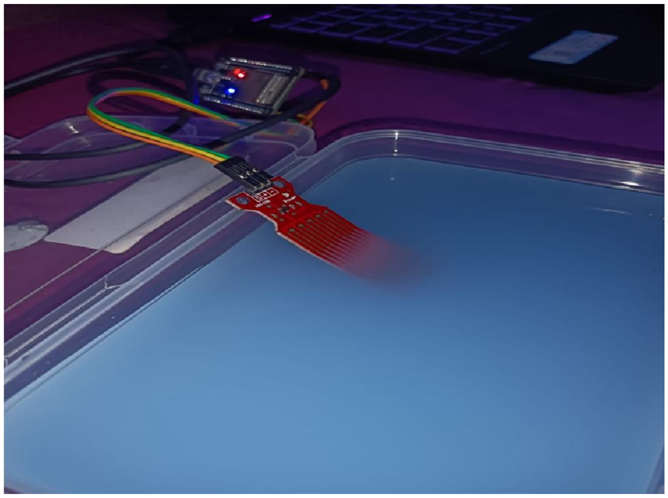

Fig. 7.Working Model

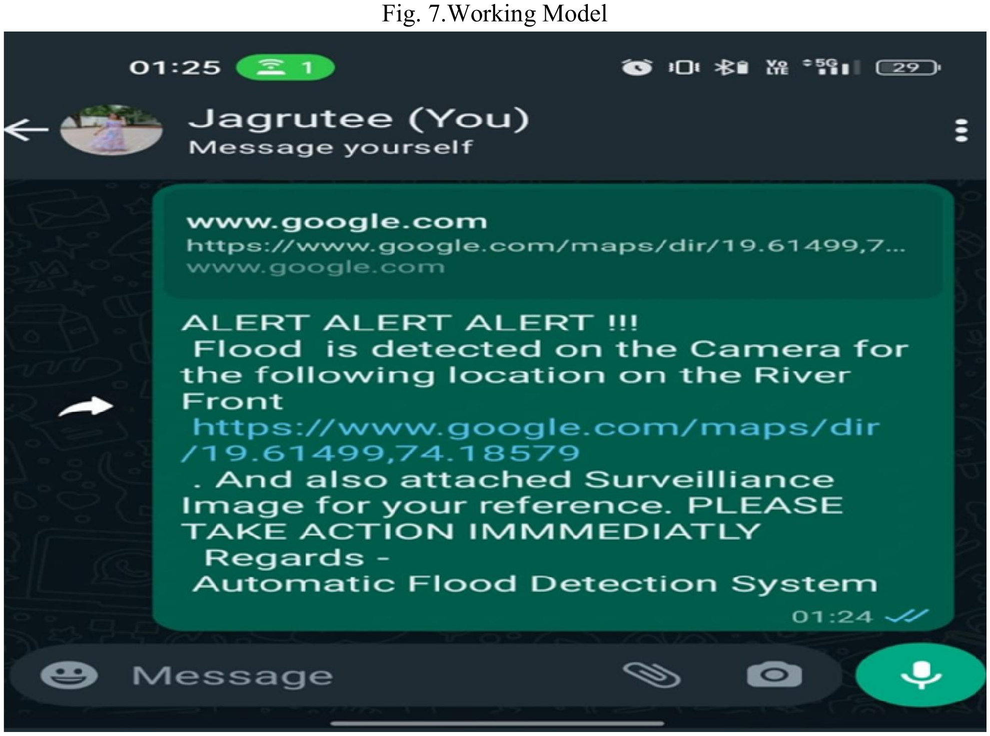

Fig.8. Alert Message on whatsup using flood detection system

V. CONCLUSION

The proposed methodology for the flood detection and alert generation has been elaborated in detail in this research paper. In many parts of the globe, flooding caused by an unanticipated rise in water levels is a problem. Flooding has been known to inflict damage to structures as well as human deaths. The economic impact of this flood event is magnified for nations still in the process of growing their economies as well as for those that have reached a lower degree of economic development. According to the most recent reports coming in from various regions of the globe, devastating floods have caused the destruction of a great number of lives and have had an effect on a wide variety of individuals. There is a requirement of an effective approach that can considerably improve the flood detection and achieve the alert to save large scale losses of property and life. The presented approach initiates with the water level sensors being deployed across the river bed and the flood plains. These sensors are in turn connected to the microcontroller the collects the values and transmits it to the system. The sensor data collected is preprocessed to remove any unneeded values from the collected data. The preprocessed data is then utilized for the purpose of Decision Making that leads to the flood alert. The approach has been evaluated for its effectiveness which has resulted in highly useful outcomes.

ACKNOWLEDGMENT

It gives us great pleasure in presenting the paper on “Flood Detection through AI & IOT” We would like to take this opportunity to thank our guide, Prof. Wawale S.N., Professor, Department of Information Technology Engineering Department, Amrutnahini Polytechnic, Sangamner, for giving us all the help and guidance we needed. We are grateful to him for his kind support, and valuable suggestions were very helpful.

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