EARLY WARNING FOR PRE AND POST FLOOD RISK MANAGEMENT

Project ID: 2021-124

Project Proposal Report

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B.Sc. (Hons) Degree in Information Technology
Specialization in Information Technology

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Declaration

I solemnly declare this is my own work and this research proposal does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other university or institution and according to the best of my knowledge it does not contain any material previously published or written by any other person except where the acknowledgment is made in the document.

Name: - Ilukkumbure S. P. M. Kaveesha W.

Registration Number: - IT18022902

Signature: -

The above-mentioned candidate is carrying out the research for the undergraduate dissertation under my supervision.

Signature of Supervisor: _____ Date: 11/5/2021

Abstract

Flooding and landslides have become a very treacherous situation in Sri Lanka, where more and more areas are flooded with the slightest rain. This flooding situation occurs for numerous numbers of reasons, these reasons can be categorized in to main two categories as human and natural causes. In order to address the above factors, we purpose development of early warning structure to mitigate the catastrophic impact it could have been on the public. The main research will be performed on real-time weather monitoring and predictions, data mining-based flood forecasting with the aid of weather situations, crowdsourcing information collection techniques, and third-party API utilization of current weather situations. The solution will not Monitor flooding and also rainfall detection, temperature, water level using IoT devices that will allow the public to plan for any extreme weather conditions and take the required precautions.

For post flood risk solution, we will provide an early warning to all users. Usually, end-users are public crowds, government officials, non-government officials. All of the above-mentioned solution components are integrated into our proposed solution and the information will be offered to end-users in the most important and relevant and greatly simplified manner. The implementation of the solution will aim to make the life easier for the public under extreme weather conditions and hope that this design structure can be of great benefit to the government authorities to plan ahead and be prepared to meet the emergency.

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1 Introduction

1.1 Background & Literature Survey

Most individuals in Sri Lanka suffer from flooding.

Floods are one of society's most dangerous and threatening disasters that people face.

It may be attributed to heavy flooding, poor land use and landslides that can lead to unsafe living conditions for individuals living in those areas. Flooding has been a frequent disaster for past years in Sri Lanka.

Flooding is primarily caused by heavy rainfall and unsuitable land use. The idea of flood risk management is now increasing rapidly globally [2] to extract alerts about flooding, tracking, and flood detection, forecasts, and what are the possibilities could emerge as a result of flooding in a certain area with the aim of reduce the human and economic losses caused by flooding events.

In many countries, the weak structure for the flood surveillance has resulted in injury, death loss and financial losses when a flood situation occurs due to weak and poor flood monitoring. The community should receive reliable real-time data about the current status when water level increases in their living area or whether there is a heavy rainfall situation that can cause floods and the community should receive these vital data before flooding happens in their living area.

The world is increasingly progressing in technology evaluation every day.

And, regardless of the age group, all individuals use digital technology systems to make their lives simple and profitable.

To evaluate all factors related to flood causes, we will use acceptable information management practices and provide an early warning structure to resolve all flooding situations well positioned in a timely manner.

1.2 Research Gap

Flood Prediction	**Integration of Hydrological Model**	**Integration of Neural Network**	**Integration of Decision-Making Model**
***Development of A Flood Forecasting and Data Dissemination System for Kalu River Basin In Sri Lanka* [1]**	Yes	No	No
***River Flood Forecasting with A Neural Network Model*[2]**	Yes	Yes	No
***On the Operational Flood Forecasting Practices Using Low-Quality Data Input of a Distributed Hydrological Model* [3]**	Yes	Yes	No
Proposed System	Yes	Yes	Yes

1.3 Research Problem

We have faced flooding disasters multiple times throughout years. This can be an instant quick flooding because of heavy rainfall or a seasonally occurring because of weather patterns. In relation to time, location and severity, most catastrophes occur spontaneously.

These catastrophes occur unpredictably, and insufficient planning will make the people who become victims of flooding more distress. Pre-planning can be helped in these scenarios to alleviate the victims of natural, for the flood forecasting for disaster pre-management is more efficient and more applicable.

Building a system to forecast rainfall, flooding and real-time monitoring system will help the first responders and the people live that area to get ready before a disaster occurs and provide estimations on the area that this flood can be occurring will minimize the fatality and help the relief distribution later on. Most importantly making a decision whether to inform to evacuate people or not and affect their normal data today life is a critical which will be high risk situation. For this an intelligent system must be built.

2 Objectives

2.1 Main Objectives

The main objective of the development of the proposed early warning system is to provide an advance warning mechanism to forecast flooding for the selected specific area using historic data collected about past 3 years obtained by Metrological Department of Sri Lanka. The main purpose of the implementation of the early warning system is therefore to provide the public, the relevant authorities and officials with forecasts and flood monitoring information to take the required decisions, and this solution would be more productive for the above-mentioned individuals to resolve the catastrophic problems caused by flooding.

2.2 Specific Objectives

- Analysis of river basin flooding using a Hydrological model and a data-driven model.

  To address the shortcomings of the hydrological model, combine it with a data-driven model to construct a hybrid model that will provide improved performance and data accuracy. [4]

- Provide a strategy for overcoming the problem of low performance and accuracy.

  The existing forecasting mechanisms already forecast for flood levels use high computing power [5] and with use of low amount of data will result in low accuracy.

3 Methodology

This study aims to prevent problems caused by recurrent flooding disaster due to lack of preparement. Due to flooding in Kalaniya district near Kalu River area providing a suitable flood disaster management solution by forecasting flooding in riverside area and information the residents in that area. [6] The above-mentioned goal is accomplished identifying flood zones and analyze past and real-time flood data factors and then try to find a resolve using data analysis. With the data collected by metrological department, water levels be weather stations by the Kalu river and District Secretariat's office in Kalaniya. I will be performing the bellow functionality in this research for forecasting longer time durations of flood forecasting, near Kalu river basin area.

Creation of flood forecasting model to predict the flooding for the selected area using the historic data from past years.

With the data collected by past 3 years such as amount of rainfall occurrences and real-time basis, water levels change in river on time-basis, number of water levels discharged in a specific station, real-time water levels, rainfall durations, precipitation, elevation, flow directions of the river and rainfall model prediction's data which is a model will be built by one of research colleagues.

A data-driven hydrological model (Hybrid model) [7] will be used to provide accurate predictions. Which will be presented and passed on to the results in order for the decision-making model to make the final decision about the situation.

Selecting the optimal model and data to be use and optimize the accuracy and the performance will be derived through the completion [8] of this research.

3.1 System Architecture

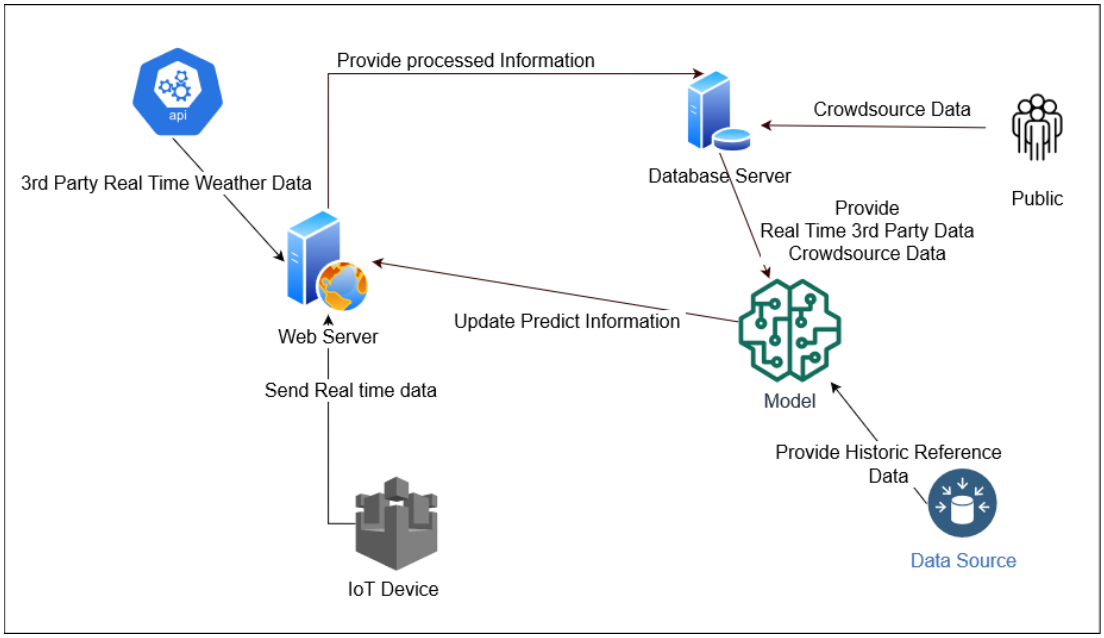


Figure 1 System Architectural Diagram

3.1.1 Model Solution

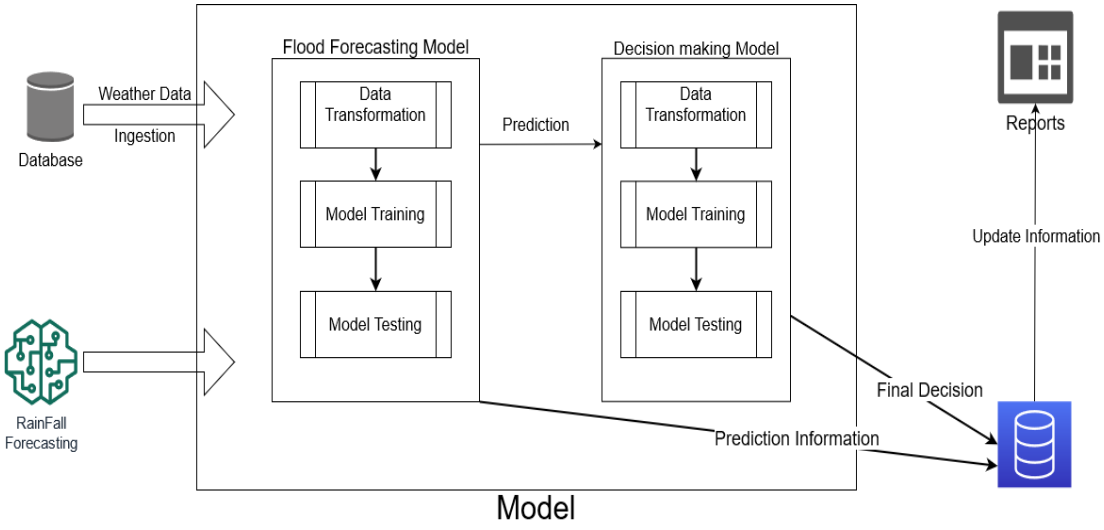


Figure 2 Hardware Architecture Diagram

3.1.2 Study Area in Research

Figure 3 Study Area of the Research

4 Project Requirements

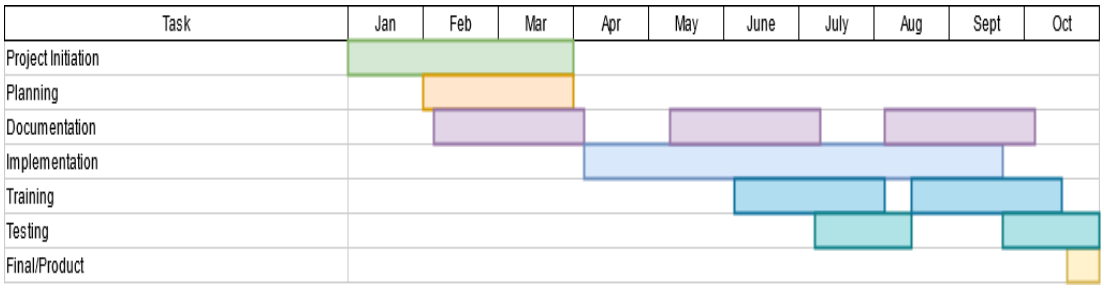
Technological and Software Requirements

- Machine Learning Frameworks (Keras, PyTorch, Scikit)
- Deep Learning
- Artificial Neural Network
- Programming Language (Python)

Knowledge Requirements

- Exigences for intelligence on weather forecast.
- Geospatial Data of the selected area.
- Data mining.
- Machine learning and Artificial Neural Networks.

5 Gantt Chart



6 Budget

Table 1 Cost of components.

Phase		Amount (LKR)
Historic Data Obtained by Metrology (Past 3 years)	LKR	5,925.00
Real-time Data from API provider (9 months)	LKR	4,560.00
Model Training Cost (On-Demand) (Nvidia Tesla K80)	LKR	19,000.00
Storage	LKR	7,600.00
Ingest Database Cost	LKR	3,900.00
Web server Cost	LKR	1,900.00
Other	LKR	1,350.00
Total	**LKR**	**44,235.00**

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