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Project Proposal

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Table of Contents

Abstract.....	3
Introduction	4
Literature Review.....	7
Motivation Behind This Project	9
Goal	10
Application in Real Life.....	11
Tools and Technology Used	11
Projected Plan	12
Weekly Plan.....	13
Conclusion.....	14
Contribution.....	14
Reference	15

Abstract

Bangladesh is a country highly vulnerable to floods. Every year, Bangladesh faces mild to severe floods, leading to significant loss of life and financial damage. If there were a way to predict floods in advance, it would help mitigate these losses. In this project, we aim to develop a website that can forecast floods ahead of time. Another feature of this website will assist flood victims in finding safe shelters and enable rescuers to provide them with food, medical supplies, and other forms of support. The website will also include a navigation system, allowing both victims and rescuers to easily find the quickest route to the nearest flood shelter. We will use location-based forecasting and strive for the highest accuracy to ensure the maximum number of lives are saved. Additionally, we will integrate a mapping system to display the status of mobile towers near the user's location. A prediction system will also be included to help rescuers estimate the necessary amount of food and medicine.

Introduction

Flooding is one of the most devastating natural disasters faced by Bangladesh, a country where geographical and environmental factors make it highly subject to frequent and destructive floods. Each year, floods in Bangladesh cause extensive loss of life, displace millions of people, destroy homes, and severely damage infrastructure and agricultural productivity. The combination of heavy monsoon rains, low-lying floodplains, and the presence of numerous rivers exacerbates the problem, leading to a cycle of destruction that disrupts both urban and rural communities. The unpredictability of flood events, often worsened by climate change, further complicates the country's ability to effectively manage and respond to such disasters. Existing systems, while offering some level of early warning, often lack the necessary accuracy, real-time data processing are crucial for saving lives and minimising damage. Recognizing these gaps, our project, "Flood Guard," is designed to be a comprehensive, AI-powered flood prediction and rescue management system tailored specifically for Bangladesh. By analysing historical flood data, current weather patterns, and real-time water levels, Flood Guard will provide accurate and timely predictions of flood events. It will assist communities to prepare for potential disasters more effectively. The project structure is divided into three major components: the Home Page, Rescue Portal and Prediction Page. The Home Page provides essential information such as a weather widget that offers real-time updates from the prediction system, rescue statistics that give an overview of ongoing rescue operations, and links to articles on flood precautions to educate users on safety measures. Additionally, the Home Page features a donation section that redirects users to reputable foundations where they can contribute funds or resources to support flood victims. The Prediction Page is a critical feature of Flood Guard, designed to provide daily updates on the water level along with a visual representation of the danger level. Using a colour-coded system the page offers clear, easy-to-understand signals to users, helping them understand the immediate flood threat in their area. The hydro-level map on the same page displays real-time water levels in different regions, enabling users to visualise which areas are at the highest risk. The weather forecasting system provides additional data to give users a comprehensive understanding of potential flood events, offering predictions based on real-time weather conditions and river levels. One of the most important features of Flood Guard is its Rescue Portal, which allows users to log in as either

victims or rescuers and access customised dashboards assigned to their roles. For victims, the rescue portal provides crucial features such as location and directions to the nearest shelters, which are updated in real-time to reflect flood conditions ensuring that victims can find safe refuge as quickly as possible. Victims also have access to information on active mobile towers, ensuring that they can stay connected to rescue teams and loved ones even if they are in a flooded area. Another key feature for victims is the ability to request help directly from nearby rescuers through the contact for rescuers section, which allows them to specify their location, the number of people in need of rescue, and the supplies required (such as food, medicine, or other essentials). Victims can also view shelter details, including the total population of the shelter and the availability of resources such as food, medicine, medical support, as well as specific information about the number of children, women, and mothers in each shelter, which helps them make informed decisions about where to seek refuge. Lastly, victims can access the flood prediction system through the rescue portal, redirecting them to the prediction page for the latest updates on water levels and flood risks. Rescuers can view a detailed list of victims, which is sorted by danger level, allowing them to design their rescue plan effectively. This sorting system will help the rescuers to find the victims in the most dangerous areas first, ensuring them to be the top priority. Rescuers can also contact victims directly through the portal, enabling real-time communication to coordinate rescue efforts. Another critical feature for rescuers is the ability to collaborate with other rescuers through the rescue portal, which allows different teams to work together in planning and executing rescue missions. Rescuers also have access to a list of donors, which includes detailed information on the type of donations received, whether it be food, money, or clothing. This feature helps rescuers track and manage the flow of donations, ensuring that resources are delivered to the areas where they are needed most. The portal also includes a list of currently stored items such as food and medical supplies. Additionally, the shelter details tab provides rescuers with important information about the needs of each shelter, including the number of people currently sheltered there, required food, medicine and medical support etc. This allows rescuers to allocate resources more effectively, ensuring that no shelter is left without any resource. Finally, the rescue status tab allows rescuers to monitor the progress of their missions, with categories such as Pending, Ongoing, and Successful. With these combined features, Flood Guard offers a comprehensive, user-friendly platform that integrates flood prediction with

rescue management, ensuring that communities in Bangladesh are better prepared and supported in times of crisis. Using machine learning to predict floods accurately and organising a coordinated rescue system, Flood Guard aims to greatly reduce the destructive impact of floods in Bangladesh, while improving the impact of the disaster management system.

Literature review

In a country like Bangladesh where floods and natural disasters are a great danger to its people, the necessity of an organised platform for disaster management is always a necessity of a reliable flood prediction system. Many previous research shows how these floods did harm to Bangladesh over the years and how these floods can be predicted.

For example, study by FAO [1] provides a comprehensive understanding of the geography, climate, and water resource challenges of the Ganges-Brahmaputra-Meghna (GBM) River Basin. Covering vast regions in Bangladesh, the GBM Basin's intricate river network, high population density, and erratic rainfall patterns contribute to the high frequency of floods. While this resource focuses on environmental characteristics rather than predictive models, it offers valuable insights into the natural conditions that exacerbate flood risks in Bangladesh.

Another research by National River Conservation Commission (NRCC) of Bangladesh [2] gives us an insight into the challenges of flood management in Bangladesh, examining government efforts, causes of flooding, and the socio-economic effects on communities. It emphasises the need for integrated management systems to mitigate the consequences of floods, particularly in rural areas where infrastructure is insufficient. Existing strategies, such as embankments and early-warning systems, have limited effectiveness due to their inability to adapt to rapidly changing weather conditions.

Gauhar et al. [3] demonstrated a method using the k-Nearest Neighbors algorithm for flood prediction in Bangladesh. They used historical flood data of 65 years, from 1949 to 2013 to make this prediction. In their research, they applied techniques such as Correlation Analysis and Data Scaling.

Chowdhury et al. [4] approached with finding the collinearity of Sea-surface temperature (SST) with a flood-affected area (FAA). They found the statistical relationship using principal component analysis. To construct a model to predict flood, multiple regression analysis was done. The statistical model uses SST, rainfall, and streamflow in Bangladesh to serve as predictors.

Rudra and Sarkar [5] explore the use of Artificial Neural Networks (ANNs) for mapping flood susceptibility across Bangladesh. By integrating topographic data, rainfall patterns, and other environmental factors, the ANN model accurately identifies high-risk flood zones. The authors successfully demonstrate how ANNs can be used for predictive flood mapping, further improving the precision of flood warnings in vulnerable regions.

Matias [6] from Flood Hub by Google shows how AI is used for reliable flood forecasting at a global scale and demonstrates the application of machine learning technology for predicting floods, utilising data from rain gauges and meteorological sources to provide accurate forecasts in real-time. Although not specific to Bangladesh, this tool showcases the capability of AI in improving flood predictions through large-scale data integration and real-time analytics.

In summary, the existing research shows a critical need for advanced and adaptive flood prediction and management systems, particularly in flood-prone areas like Bangladesh. Flood Guard will not only provide a platform for rescuers and victims to communicate, but it will also predict the flood by analysing historical data that includes flood, rain and other variables.

Motivation Behind This Project

Bangladesh faced a severe flash flood in **August 2024**. Which caused a lot of casualties and losses. We saw this flood from very close and watched the horror of it. During this flash flood **5.8 million** people have been affected across **11 districts**, with over **502,501 peoples** displaced in **3,403 evacuation shelters**. In which **0.52 million** children (under 4 years) and **1.54 million** children/adolescents (5 to 19 years) have been affected. **1.76 million** people are in immediate need of food assistance. Till now **52 deaths** have been reported, primarily from **drowning** and other flood-related causes. There are also severe impacts on rural roads, agriculture, and fisheries, causing significant economic losses. Over **296,852 hectares** of **crops** have been damaged, and **fisheries** have suffered losses of **USD 122 million**. **USD 34 million** losses reported for **livestock**, with poultry farms and fodder also affected. Health facilities are struggling due to increased demand and damaged infrastructure. Shortage of essential medical supplies, shelter materials, and food. **4.5 million** temporary and mud houses are susceptible to destruction, with flooding damaging essential household items. Over **7,000 schools** are closed, affecting **1.75 million** students. Flooded roads and damaged transport networks hinder aid delivery. We were disheartened by seeing these losses and felt responsible for not being able to contribute to this situation. After the anti-discrimination student movement in July 2024, our country faced great economic instability due to a power shift in the government. Right after the movement, the flood hit the country's North-Eastern area, collapsing its economy and communication system. So, we felt responsible to reform the country with the knowledge we gathered by studying Computer Science and Engineering.

Goal

The primary aim of Flood Guard is to create a comprehensive, AI-powered flood prediction and rescue management system tailored specifically for Bangladesh. The system seeks to improve the country's ability to predict, manage, and respond to frequent and destructive floods. Flood Guard aims to:

- Reduce the destructive impact of floods on lives, homes, and infrastructure, while enhancing the overall disaster management system in Bangladesh.
- Assist communities in preparing for floods more effectively by offering easily understandable, real-time updates on flood risks.
- Support victims and rescuers through a user-friendly platform that enables victims to find safe shelter and request assistance.
- Predict sudden flood events by analysing historical flood data, real-time water levels, and current weather patterns, providing communities with timely and precise flood alerts.

Application in Real Life

This project can help it's user in the time of crisis. Here are some applications of it:

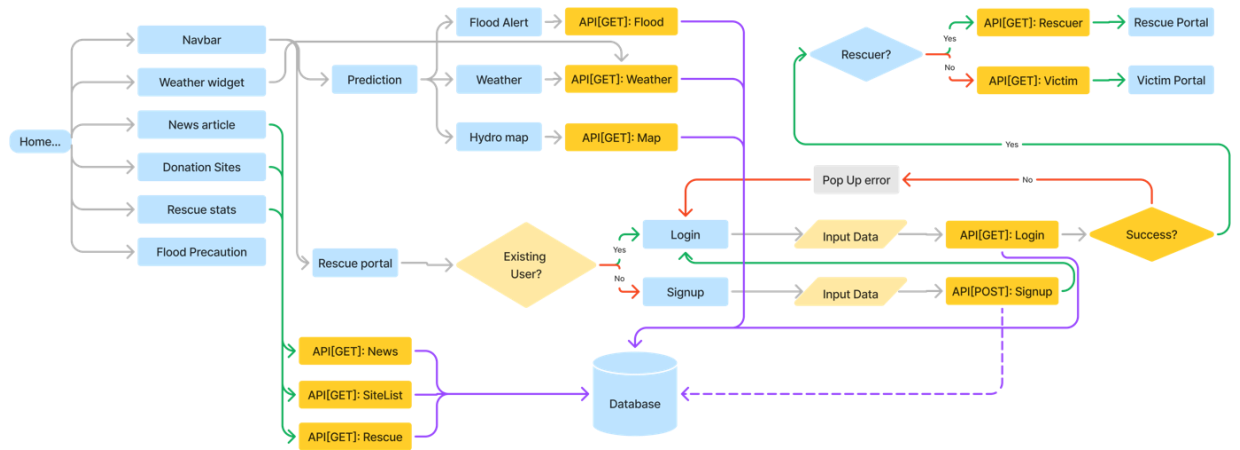
- **Early Flood Warning System for Villages:** Small villages often lack access to accurate flood warnings. Our system's real-time water level detection and prediction page can send early alerts to rural communities, giving them time to evacuate or prepare.
- **Shelter Navigation for Victims:** Flood victims can use the platform to find nearby shelters quickly. The system can provide real-time updates on the availability of food, medicine, and space in shelters, ensuring efficient sheltering for displaced people.
- **Real-time Resource Management for Rescue Teams:** Rescuers can manage donations, track resources, and organise their rescue missions effectively. They'll know exactly what is needed in shelters and how many people need help. This feature will allow them to efficiently distribute the resources.
- **AI-powered Disaster Response Planning:** Our AI-driven predictions can help government agencies and disaster management authorities plan large-scale rescue operations and allocate resources where they're needed most, improving their response speed and accuracy.
- **Flood Preparedness Education:** Through articles and precaution guidelines linked on the home page, users can educate themselves on flood risks, safety measures, and how to protect their families during floods.

Tools and Technology Used

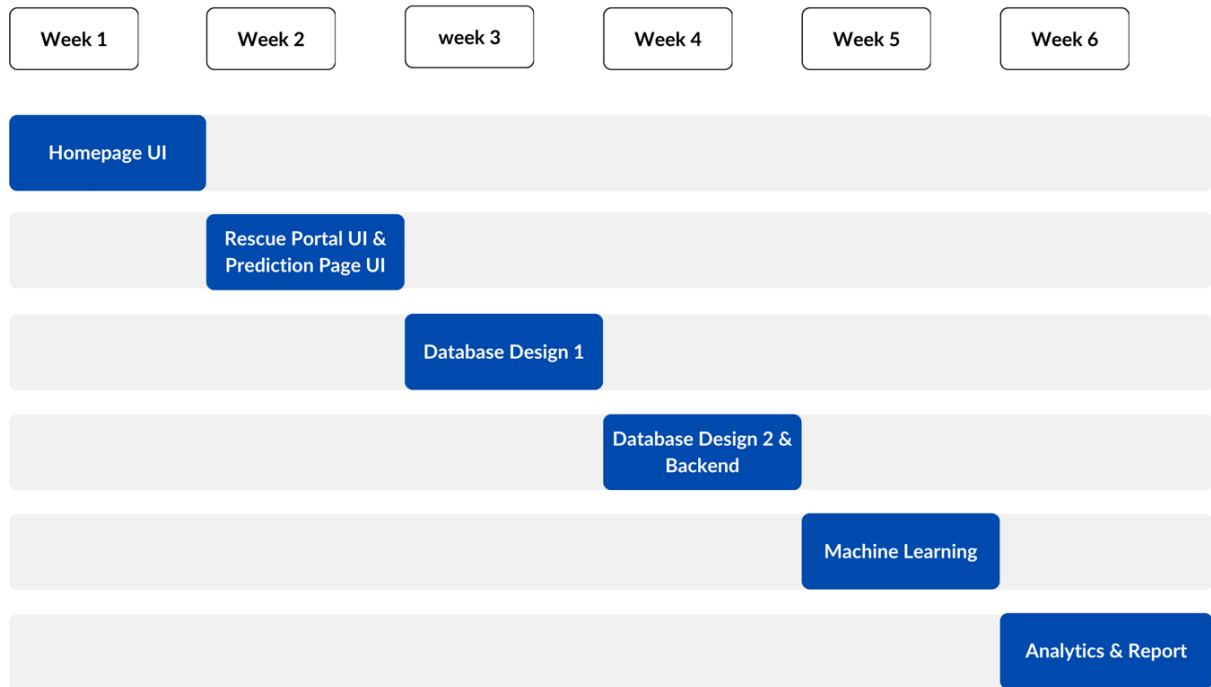
Application	Tools	Function	Other tools	Why select this tool
Frontend	React	Building User Interface	HTML, CSS	Organised coding structure
Backend	Express Js	Backend development and fetching data of Database	Django	Easy to use and faster server response.
Database	MySQL	Storing information	PostgreSQL, MongoDB	Structured query, faster and secure response.

Prediction	Python	Building ML model	R	Widely used for ML.
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Projected Plan



Weekly Plan



Conclusion

Bangladesh often faces severe floods, making it essential to have a strong and flexible system for predicting and managing these disasters. Flood Guard aims to be that solution, providing a complete platform tailored to the specific challenges in Bangladesh. This easy-to-use system will help both communities and rescue teams prepare for and respond to floods more effectively. With AI-driven flood predictions, real-time data analysis, and clear ways to communicate, Flood Guard hopes to lessen the harmful effects of floods on people, buildings, and livelihoods. The project will give communities the information they need to get ready for potential floods while also guiding victims to safe places and necessary resources during emergencies. By using technology and encouraging teamwork between rescue teams and citizens, Flood Guard could change how floods are managed in Bangladesh. This project reflects the strong spirit of the Bangladeshi people, who continuously work toward a safer and more resilient future, even in tough times. We believe that Flood Guard will be crucial in protecting lives and easing the pain caused by floods in Bangladesh.

Contribution

Member	Contribution
Aritra Islam Saswato	Abstract, Introduction, Conclusion, Projected Plan
Sabbir Hossain	Motivation, Aim, Application, Projected Timeline
Md. Misbah Khan	Literature review, Reference, Tools Used, Projected Plan

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