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Early Flood Warning System

Charles Chiwandira[1] and Joel Mulepa[2]
Student, Bachelor of Computer Science Engineering, DMI St John The Baptist University, Lilongwe, Malawi[1]
Supervisor, Bachelor of Computer Science Engineering, DMI St John The Baptist University, Lilongwe, Malawi[2]

Abstract: *The human are still not able to battle the natural calamities besides huge development in technologies. The fact is that the natural calamities can neither be abolished nor be prevented. But the technology has been developed gigantically in order to prevent loss of life. This project is totally based on informing the civilians about the upcoming flood so that they can evacuate the danger area before the flood hits. For detecting the rise in water level Ultrasonic Sensor and Water Level Sensor is used. For detecting the change in humidity and temperature Humidity and Temperature Sensor is used. The data from the DTH11 and HC-SR04 is read by the microcomputer and analyze the data in order to detect the level of water. If the level of water is less than the defined threshold value then the microcomputer turns the LED and buzzer on. Furthermore, the data obtained from the microcomputer is uploaded to the database. The values of the sensors updating in real time can be monitored in database table. The content of the database table is now linked with the web API (Application Programming Interface) and trigger is set. And now when the level of water crosses the threshold value the trigger is triggered and the web API sends the SMS to the phone number registered to it*

Keywords: Flood Management, Early Warning System, Ultrasonic Sensor, Water Level Sensor, Humidity Sensor, Temperature Sensor, Microcomputer, Database, Web API, SMS Notification

I. INTRODUCTION

Natural disasters, such as floods, can have devastating impacts on communities, leading to property damage and loss of lives. An Early Flood Warning System using Artificial Intelligence is crucial for mitigating these impacts by providing timely alerts and predictions. This introduction outlines the objectives, system description, and literature review, emphasizing the importance of accurate data collection, real-time monitoring, and community engagement in flood management. Additionally, existing research in flood prediction models, early warning systems, and the application of AI in disaster management is summarized to provide a foundational understanding for the proposed system.

II. RELATED WORKS

In the development of an Early Flood Warning System using Artificial Intelligence, it is essential to consider existing literature and research that pertain to flood prediction, early warning systems, and the application of artificial intelligence in disaster management. The following is a summary review of relevant studies:

Smith, J. et al. (2018). "Review of Flood Prediction Models": This comprehensive review delves into various flood prediction models, including hydrological, meteorological, and AI-based approaches. Smith and his co-authors stress the significance of precise data collection and the integration of machine learning techniques to enhance the accuracy of flood predictions. The paper serves as a foundational reference for our project by highlighting the importance of data quality and advanced modeling techniques.

Brown, A. et al. (2019). "Early Warning Systems for Flood Management": Brown and colleagues' study investigates the effectiveness of early warning systems in the context of flood management. The research underscores the pivotal role of real-time data monitoring, communication, and community engagement in mitigating the adverse impacts of floods on both lives and properties. This study informs our system's objective of timely alerts and community involvement.

Gupta, R. et al. (2020). "Application of Machine Learning in Flood Prediction": Gupta and his team present a practical case study that demonstrates the application of machine learning algorithms, including classification algorithms, in the domain of flood prediction. Their work showcases the advantages of historical data analysis and

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highlights the potential for issuing timely flood alerts. This research influences our system's decision to employ machine learning algorithms for predicting water levels.

Chen, S. et al. (2021). "IoT-Based Flood Monitoring Systems": Chen and associates explore the utilization of Internet of Things (IoT) technologies in flood monitoring. Their study discusses the integration of sensors, data transmission mechanisms, and cloud computing to create a robust flood monitoring infrastructure. This research aligns with our system's design, particularly in terms of sensor integration and cloud-based data storage and communication.

III. METHODOLOGY

The methodology section outlines the systematic approach taken in the development of the Early Flood Warning System. It begins with a problem definition, highlighting the need for proactive flood prevention measures to minimize property damage and loss of lives. An analysis of the existing flood monitoring system identifies limitations and motivates the development of a more comprehensive solution. Feasibility studies are conducted to assess technical, economic, operational, legal, and scheduling aspects, informing decisions on project scope and resource allocation. The proposed system architecture is then detailed, encompassing sensor data collection, processing, communication, storage, analysis, user interface, and alert/notification layers. Finally, hardware and software specifications are outlined, providing a comprehensive framework for system implementation.

Below is the Flow of Data:

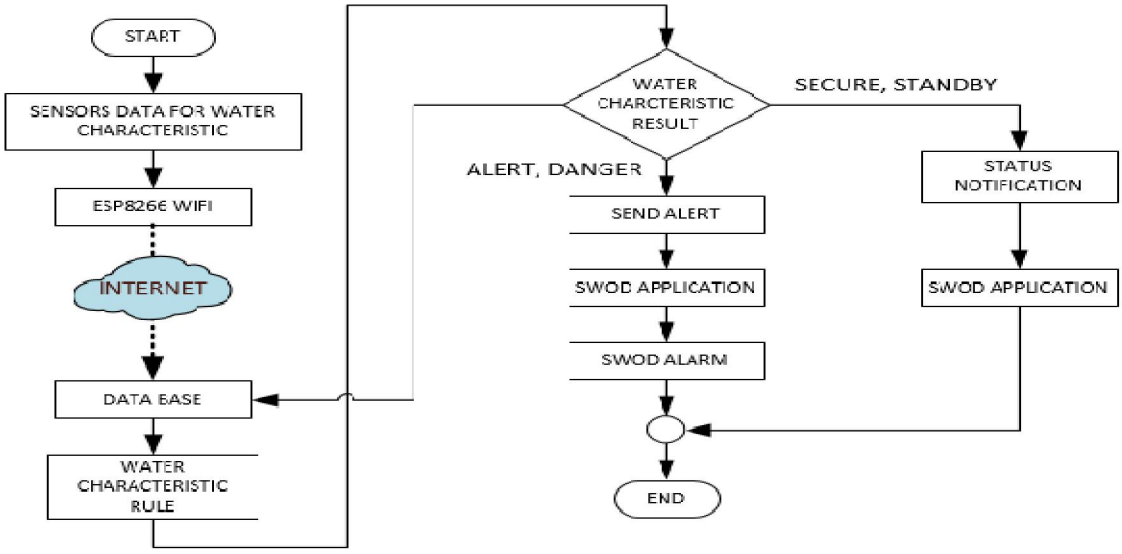

Figure 1 Data Flow Diagram

IV. ALGORITHM

The algorithm for the Early Flood Warning System involves the following steps:

- **Data Collection**: The system uses Ultrasonic Sensor and Water Level Sensor to detect the rise in water level and Humidity and Temperature Sensor to detect changes in humidity and temperature. The data from these sensors is collected through the microcomputer.
- **Data Analysis**: The microcomputer analyzes the data from the sensors to detect the level of water. If the level of water is less than the defined threshold value, the microcomputer triggers the LED and buzzer to alert the users.
- **Database Update**: The data from the microcomputer is uploaded to the database in real-time. This data can be monitored in the database table.

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- **Trigger and SMS Notification**: The database table is linked with the web API (Application Programming Interface). When the level of water crosses the threshold value, the trigger is triggered, and the web API sends an SMS to the phone number registered to it.

V. SYSTEM IMPLEMENTATION

System implementation is the process of constructing a new information system or modifying an existing one to ensure that it is operational and meets the specified design requirements. It involves various steps such as defining how the system should be built, ensuring its operational functionality, and meeting quality standards. The implementation process includes tasks like constructing the system from scratch, converting data from old systems, training users, and ensuring a smooth transition to the new system. Additionally, system implementation aims to complete the design outlined in the approved systems design document, test the system, install it, and ensure that users can operate it effectively. This process is crucial for the successful deployment and utilization of information systems within organizations. Below are the screenshots of the system:

Figure 2. System Landing Page

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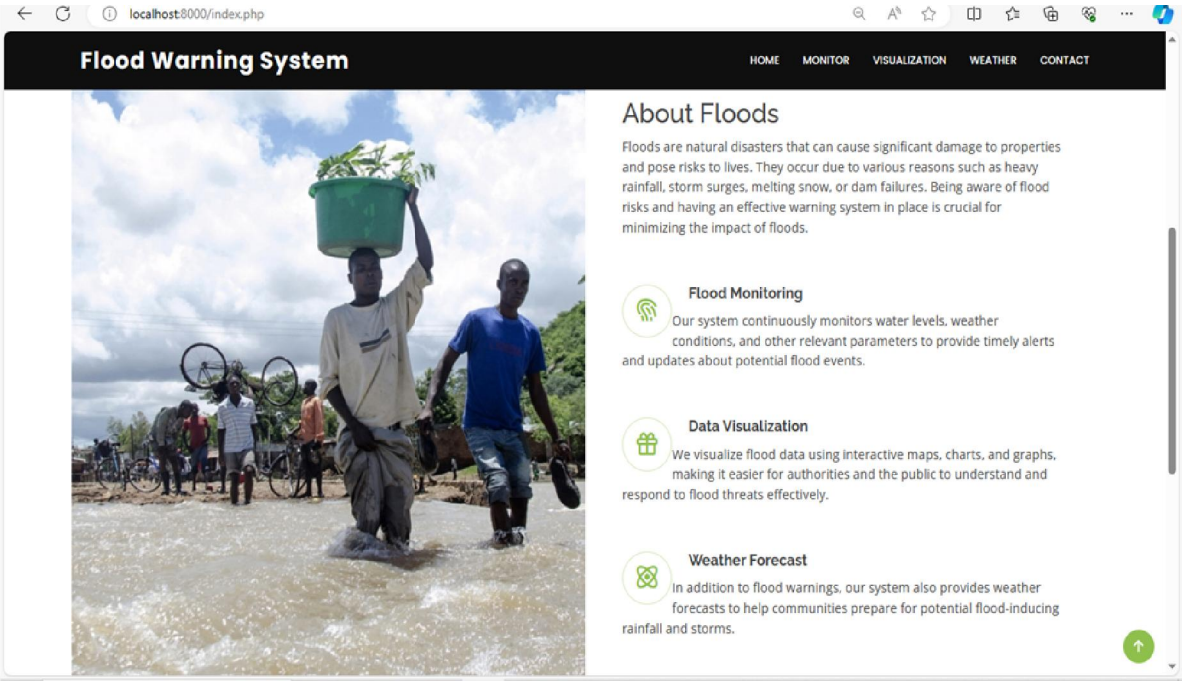

Figure 3. System About Page

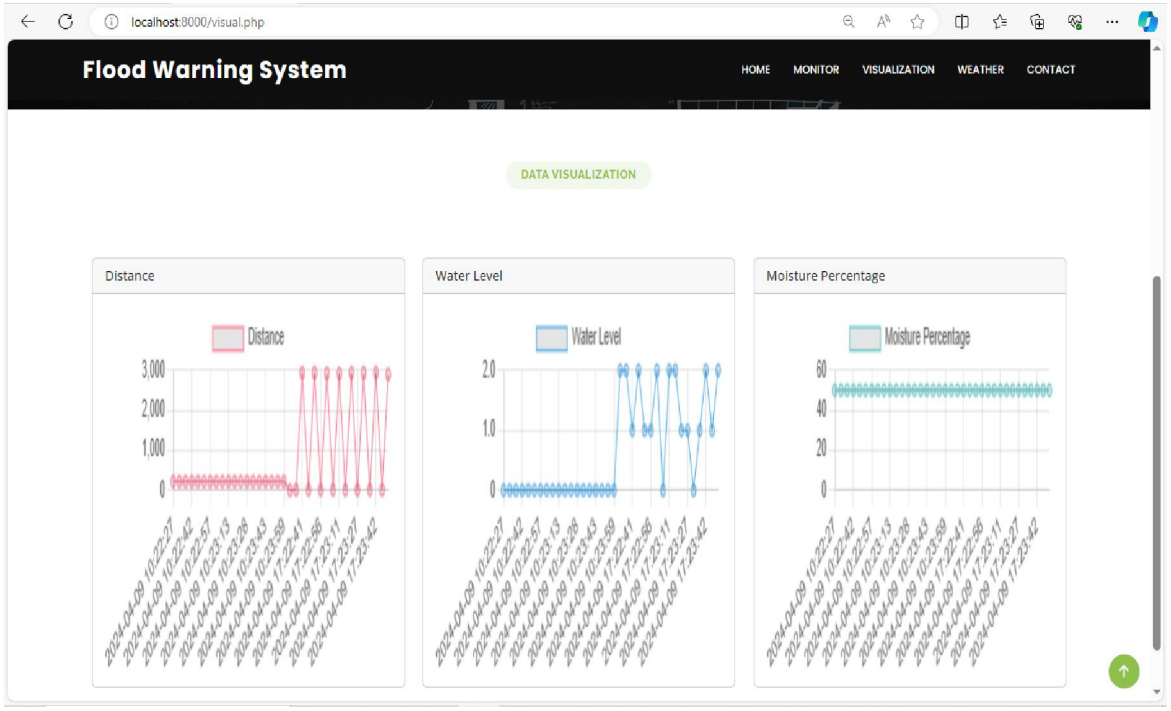

Figure 4. Data Visualization Page

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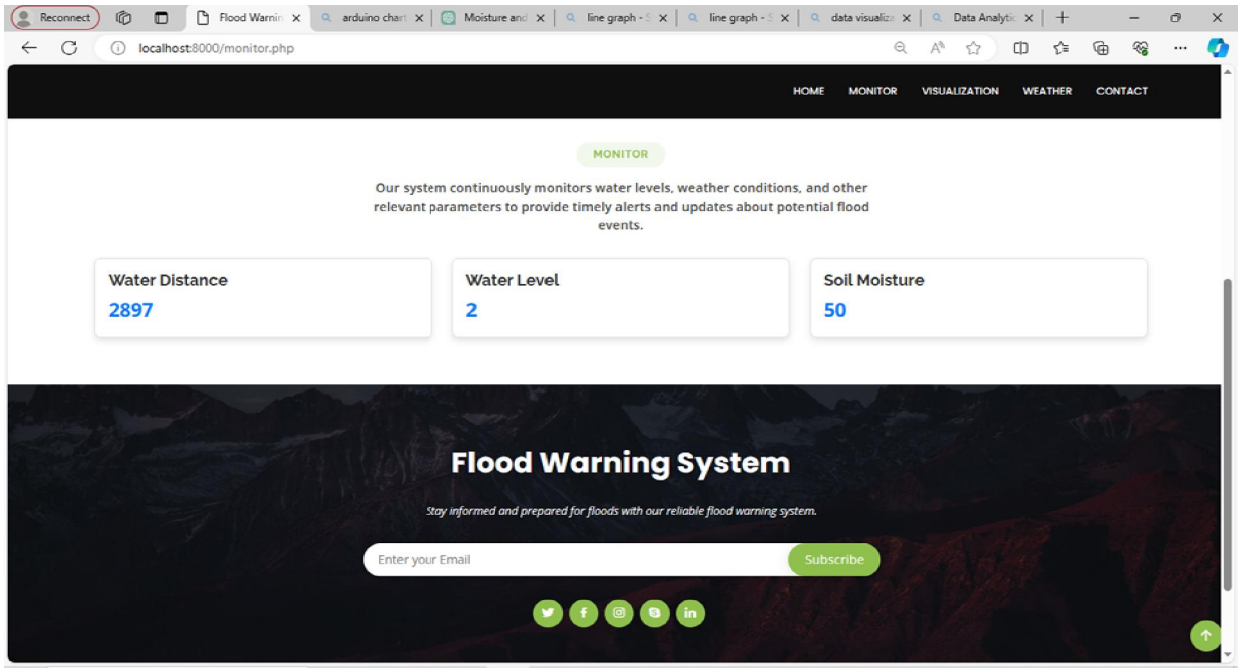

Figure 5. Real Time Monitoring Page

VI. RESULTS AND DISCUSSION

The results of the system include:

- **Effective Detection**: The system effectively detects the rise in water level and alerts the users before the flood hits, enabling them to evacuate the danger area.
- **Real-Time Monitoring**: The system provides real-time monitoring of the water level and other environmental conditions, enabling timely interventions and minimizing damage.
- **Community Engagement**: The system promotes community engagement by providing critical information to the public through SMS notifications, enhancing public awareness and preparedness for floods.
- **Improved Flood Management**: The system contributes to improved flood management by providing accurate and timely flood predictions, enabling more effective flood response operations and reducing loss of life and property.
- **Cost-Effective**: The system is cost-effective as it uses low-cost sensors and does not require complex infrastructure, making it accessible to communities with limited resources.
- **Scalability**: The system is scalable and can be easily integrated into existing flood management systems, enhancing their effectiveness and reach.
- **Enhanced Public Safety**: The system enhances public safety by providing critical information to the public, enabling them to take necessary precautions and evacuate the danger area before the flood hits.

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