

Real-Time Tackling of Flash Flood Forecasts Using Artificial Neural Networks (ANNs)

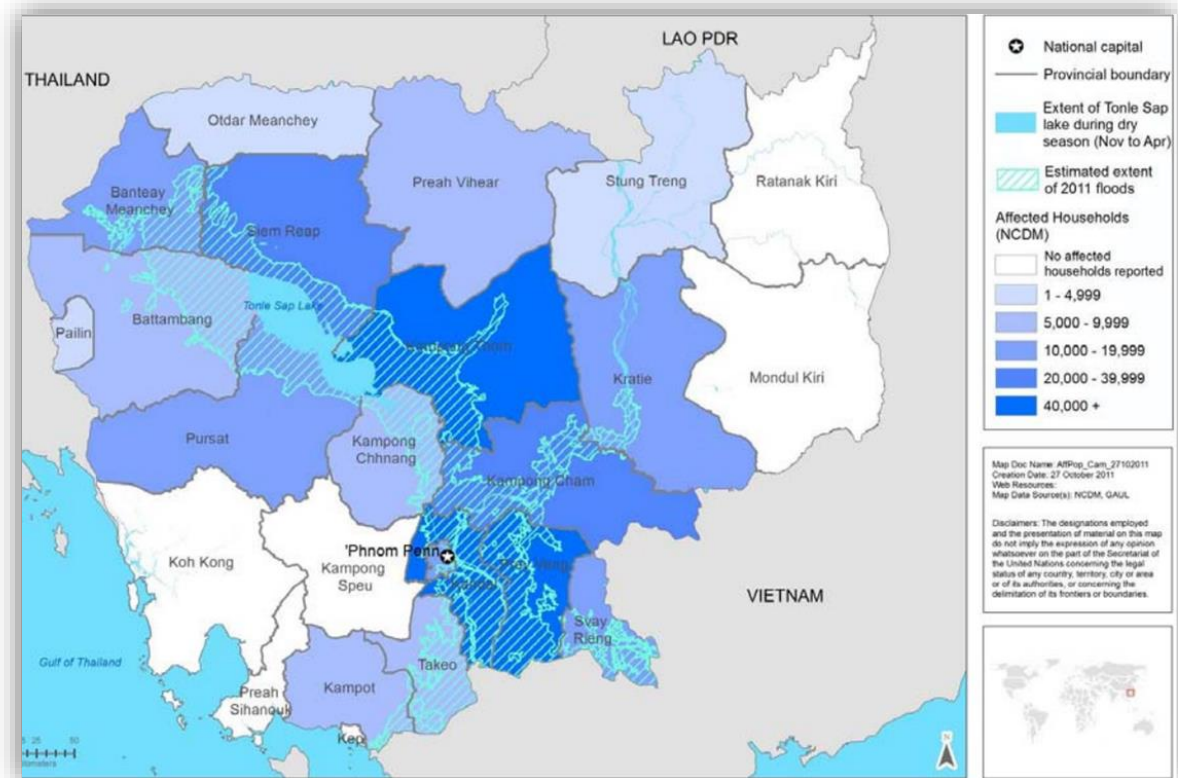
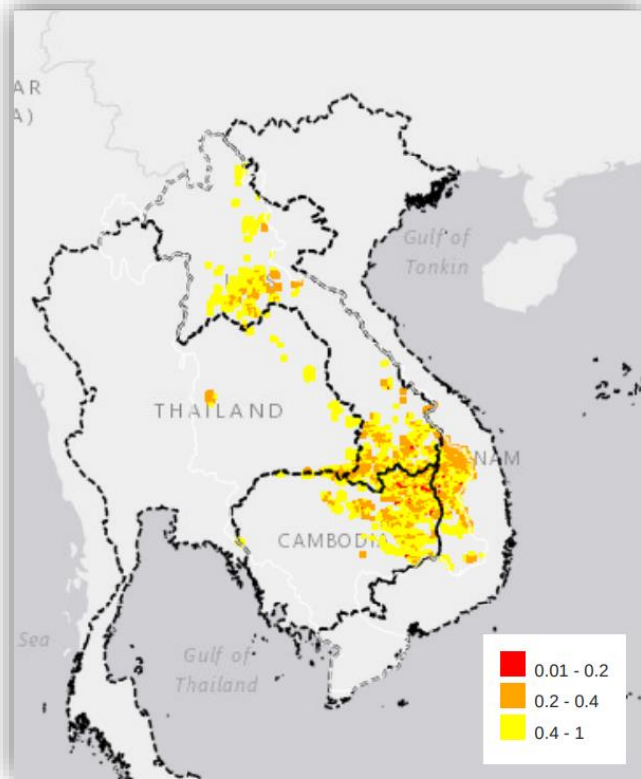
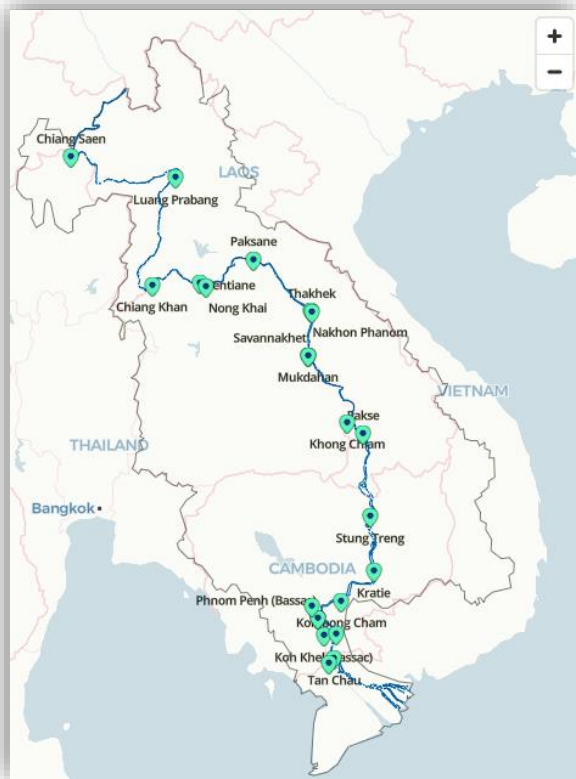
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Flash Flood refers to sudden and unexpected flooding that occurs within 6 hours period and often within 3 hours of heavy rainfall, dam break, mudslides.

It occurs so quickly that people are caught off-guard and becomes dangerous if it encounter high level and fast-moving water.



In 2020, flash flood affect up to **67,000 households**, causing widespread economic losses and serve damage to infrastructure in Cambodia alone.

Floods significantly hinder economic development and poverty reduction in LMB, with annual cost from \$60-\$70 million, Cambodia and Vietnam account for about two-thirds of the region's total flood damage.

- Develop and implement a comprehensive flood prediction system utilizing ANNs integrated with IoT solutions for flood risk assessment, monitoring, forecasting, and early warning that aims to prevent, minimize or mitigate people's suffering and economic losses.
- Forecasting and Early Warning provide daily information of flash flood forecasting and early warning for potential floods, allowing residents and authorities to take necessary precautions
- Informed Decision Making – flood forecast system can provide valuable data for decision-making such as evacuation plans, allocate resources effectively, and manage infrastructure.
- Long-Term Planning – identifies flood-prone areas and develops strategies to mitigate flash floods, encouraging information sharing and tailored solution for specific regions.



Monitoring System

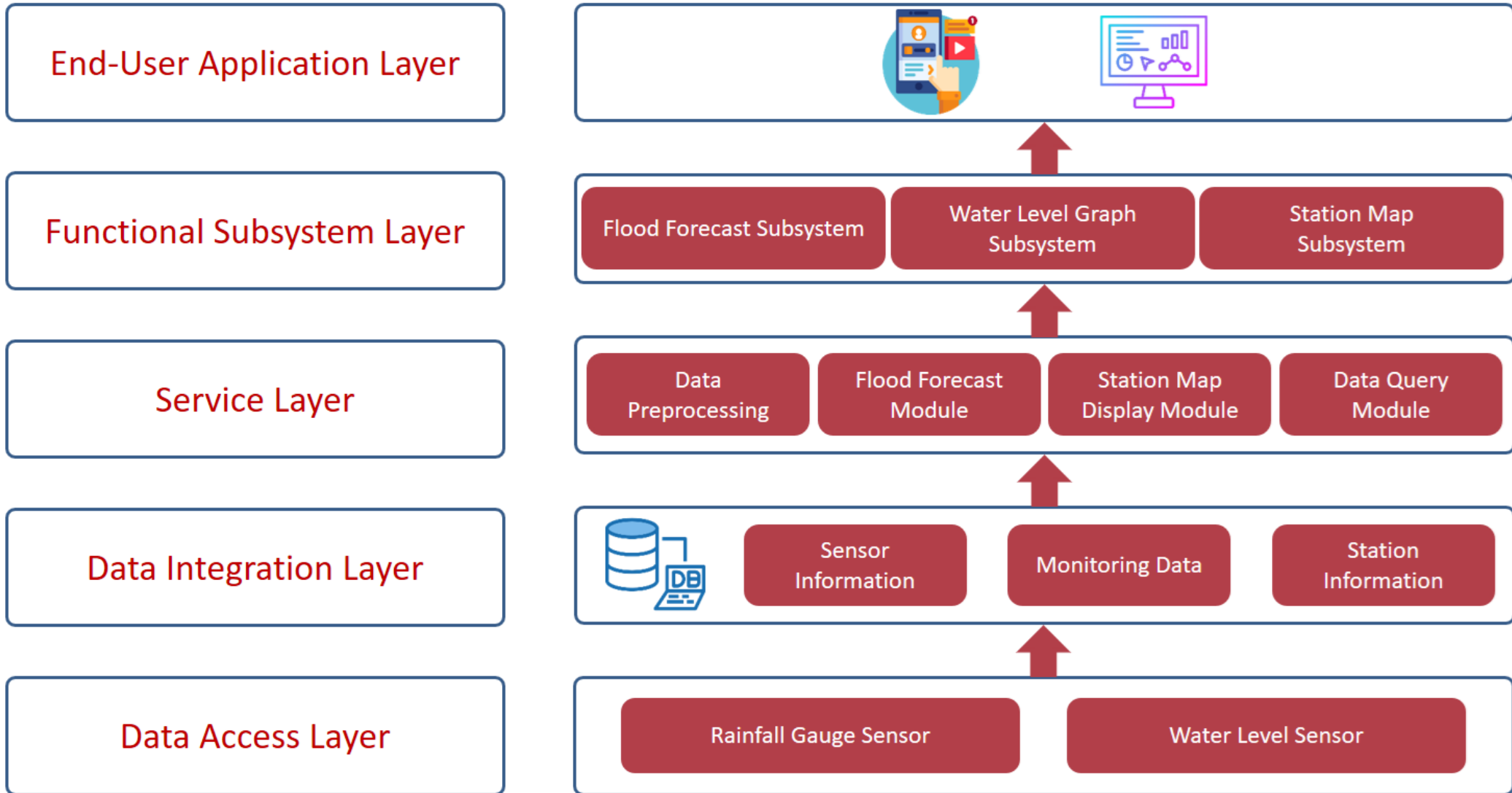


Real-Time Forecast

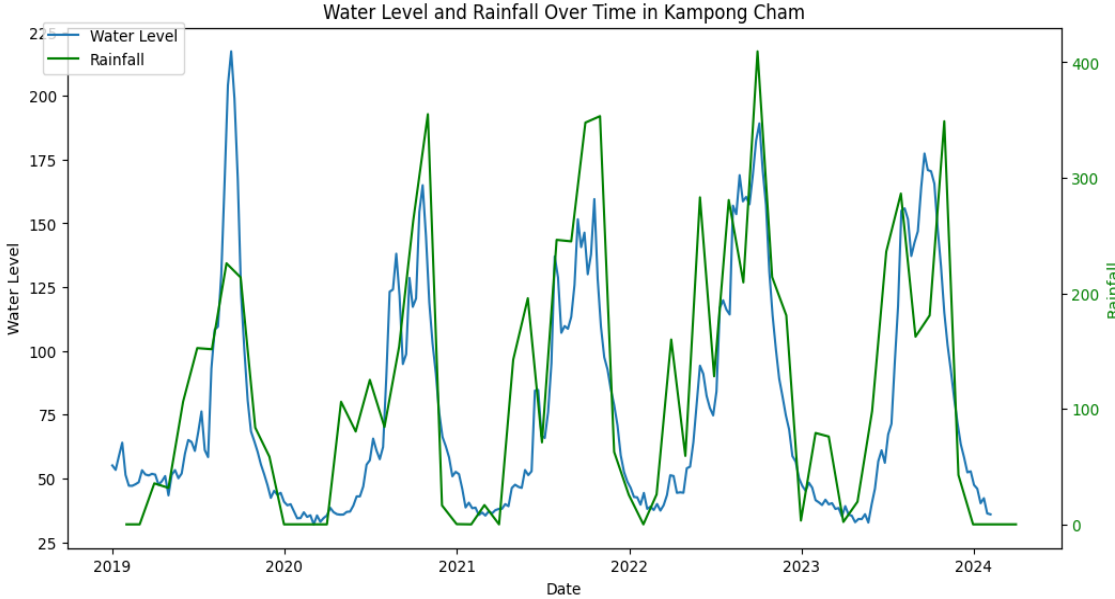
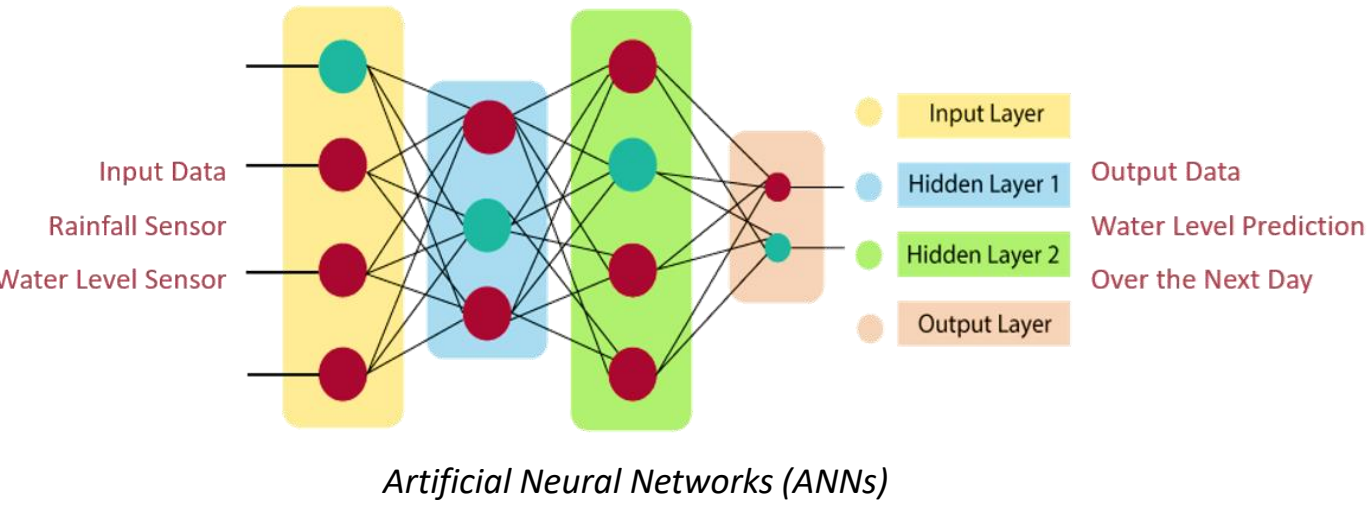


Early Warning System

Proposed Method: Early Warning System (EWS)



Proposed Method: Artificial Neural Networks (ANNs)



Phase 1
Data Collection and Preprocessing

Collect water level and rain fall data from sensors along the Mekong river with a focus on the Lower Mekong Basin. Use statistical methods to better understand the data.

Phase 2
Research

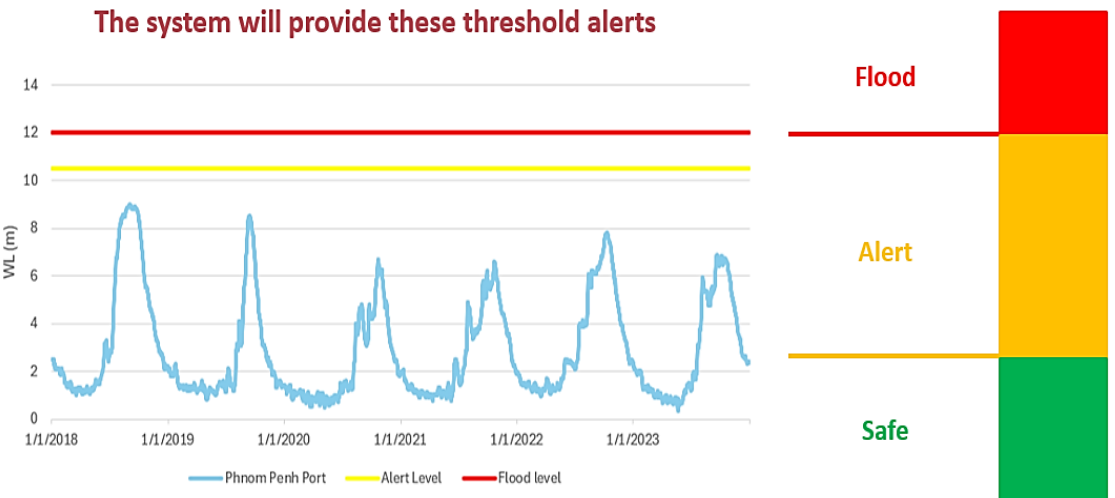
On methods of training time series data with ANN models.

Phase 4
Experimental Validation and Optimization

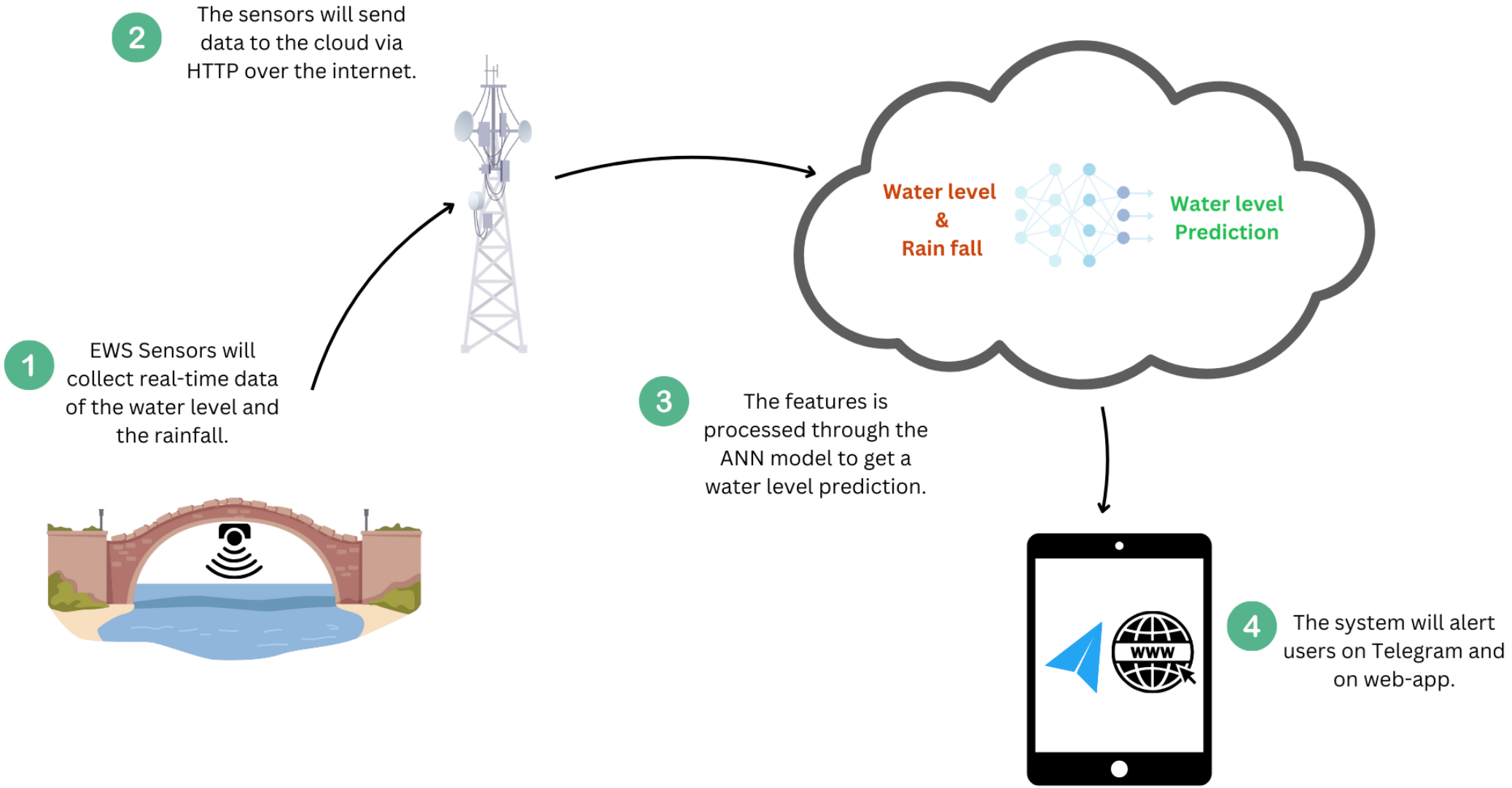
Deploy the sensors and feed real-time data through the ANN model. More parameter tuning will be acquired to get the best output results.

Phase 3
Modeling Training and Tuning

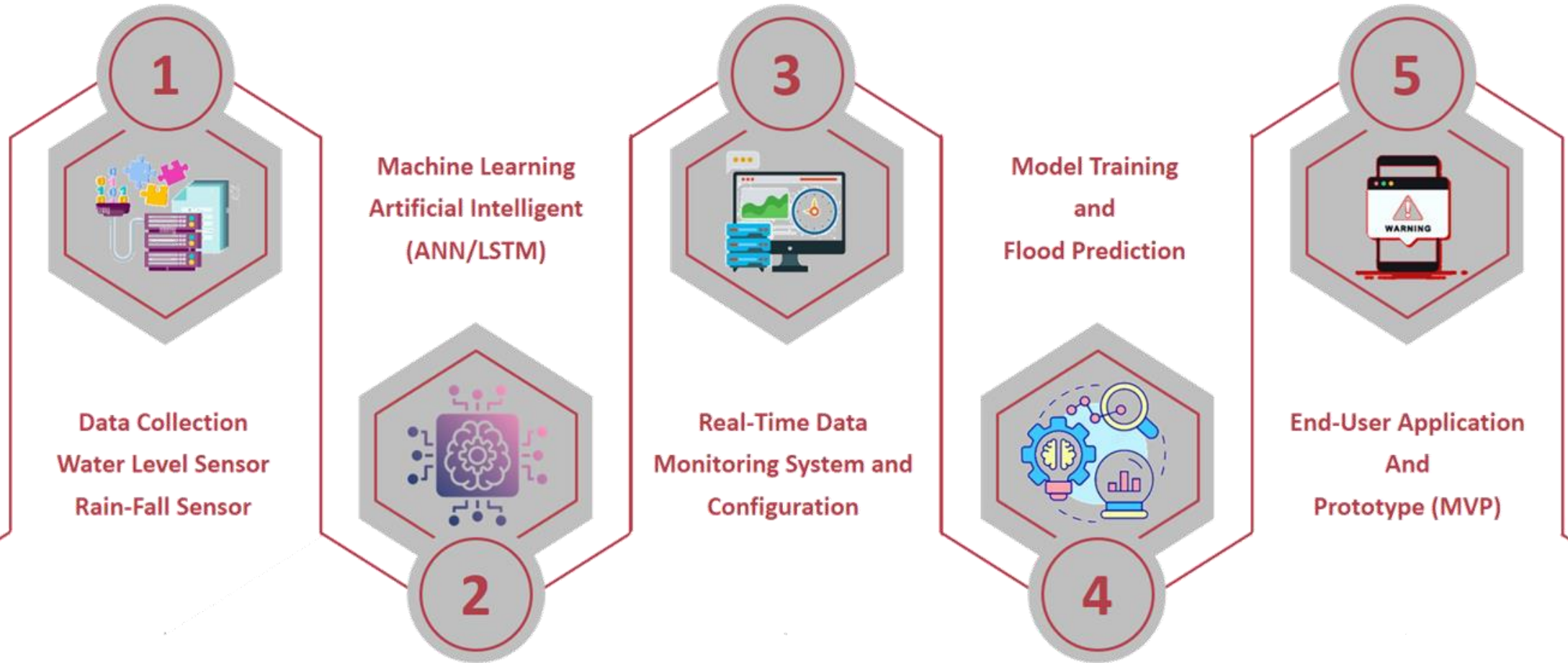
Train the data through ANN and tune hyperparameters to get the best output results.



Proposed Method: Early Warning System (EWS)



Proposed Method: Implementation and Experiments





Enhanced Safety

Early warning systems can save lives by providing timely alerts to communities at risk, allowing people to evacuate or take necessary precautions.



Reduced Financial Loss

By forecasting flash floods, local governments and businesses can prepare and protect assets, reducing damage costs and economic losses.



Improved Emergency Response

Real-time data enables emergency services to allocate resources more effectively, ensuring a quicker response to affected areas.



Public Awareness and Preparedness

These systems can educate communities about flood risks and encourage the development of personal and community preparedness plans.



Improved Prediction Accuracy

ANNs analyze large datasets to identify complex patterns, improving accuracy in predicting flash floods and enabling timely warnings and preparedness.



Real-Time Monitoring

Advancements in technology allow ANNs to monitor in real-time, enabling quick decision-making during severe weather events and helping to save lives and property.



Enhanced Decision-Making

ANN models enhance decision support systems for emergency management, aiding authorities in developing better flood response strategies.



Data Utilization

The collection of real-time data can lead to improved long-term planning and infrastructure development to better handle potential flood events.

- 1** Develop a flood prediction system using ANN and IoT solution for risk assessment and early warning by providing daily forecasts and alerts for potential floods, enabling residents and authorities that aims to reduce suffering and economic losses.
- 2** Investigate the existing research and literature on technological advancements in ANNs and their applications for real-time flash flood forecasting. This will enhance decision support systems for emergency management, environmental science and hydrology.
- 3** Examine the impact of precise flash flood forecasts on community safety and emergency response systems, highlighting potential benefits for local communities, such as enhanced disaster preparedness and improved response strategies.
- 4** Provide decision-makers with reliable data, processed every 15 minutes, to anticipate and mitigate flash flood risks. This includes low maintenance costs, accurate forecasting, and real-time acquisition that allows people to evacuate or take necessary precautions
- 5** Explore collaboration opportunities between academia, industry, and governmental agencies in developing forecasting models, enhancing environmental sustainability, and adapting to climate change, thereby handling the management of potential flood events.

- ❑ Develop a flash flood prediction system utilizing ANNs by integrated with IoT based solution for risk assessment, monitoring, forecasting, and early warning to mitigate suffering and economic losses.
- ❑ Provide daily updates data on flash floods to help residents and authorities prepare evacuation plans, allocate resource, and management strategies.
- ❑ Equip decision making with reliable data processed every 15 minutes, enabling them to anticipate and mitigate the flash flood risks, including low maintenance cost, accurate forecasting, and real-time data acquisition.
- ❑ Aim to improve the system's capabilities by adding more IoT sensors and refining the artificial neural network (ANN) model to enhance predictive accuracy.
- ❑ This project also creates opportunities for collaboration among key institutions in the region, promoting research activities and practical applications for flood risk management.
- ❑ Improve flash flood forecasting, connect meteorological experts from each member country and enhance the dissemination of warning information to the affected communities.
- ❑ This collaboration research will ensure better preparedness and response to the flash floods.