UTM

UNIVERSITI TEKNOLOGI MALAYSIA

FACULTY OF COMPUTING
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SECJ3553 – ARTIFICIAL INTELLIGENCE

SECTION 3

PROJECT PROPOSAL: SMART URBAN APPLICATION

THEME: SMART CITY

LECTURER: DR. NORSHAM BINTI IDRIS

GROUP 7

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PROBLEM STATEMENT

In many areas of Malaysia, flooding is a common problem, especially in cities where the drainage systems are unable to cope with heavy rain. The existing flood management system largely relies on manual monitoring and slow data reporting. This leads to decision delays and poor response effectiveness to floods. Therefore, residents, local authorities, and emergency teams all encounter difficulties in predicting, preparing for, and responding to floods. There is an urgent need for a more intelligent real-time solution that can analyze environmental data and issue alerts in advance, in order to help reduce property losses and protect community safety.

AI SOLUTION

The proposed AI-based flood management system aims to enhance flood prediction and early warning capabilities by leveraging machine learning, IoT sensors, and real-time data analysis. The system collects data from various sources, including rainfall and river level sensors, satellite meteorological information, and historical flood records. IoT devices deployed in key areas continuously gather environmental data such as rainfall intensity, humidity, and water depth, ensuring a steady supply of reliable real-time information.

After data collection is completed, a detailed processing and model training phase follows. Raw data is cleaned, standardized, and organized before being used to train machine learning models based on historical flood patterns and weather information. Techniques such as random forests and long short-term memory (LSTM) networks are employed to identify the relationships between weather conditions, drainage performance, and flood occurrence. As the models learn from new data, their predictive accuracy improves over time.

The system conducts real-time flood prediction and early warning by analyzing current weather and sensor data. Once certain thresholds are exceeded, the AI predicts potential flood areas, severity, and expected timing. Early alerts are immediately sent to residents and relevant authorities via web dashboards, mobile notifications, and text messages to enable timely preventive measures.

All predictions and sensor data are displayed on a centralized dashboard that utilizes GIS technology to provide real-time flood maps, rainfall intensity charts, and risk level indicators. This helps users easily monitor and understand flood conditions in various regions. Users can also access historical data for performance tracking and event analysis, supporting better planning and decision-making.

In the long term, this system helps improve a city's resilience to disasters. The insights it provides can assist government agencies and urban planners in developing better flood prevention infrastructure and drainage systems. Over time, it can reduce the impact of floods, enhance overall disaster response capabilities, and support the sustainable development of the city.

GOAL OF AI SOLUTION

The main objective of the suggested AI-based flood management system is to develop a smart, data-driven system that will greatly improve the prediction, tracking, and early warning of a flood in Malaysia. The system will overcome the shortcomings of the traditional flood management techniques, which are heavily based on manual monitoring and reporting, and thus automation and real-time analytical features will be introduced. The AI system attempts to find the correct prediction of possible flood instances through environmental factors including the intensity of rainfall, the height of rivers, humidity and the efficiency of drainage systems.

Through constant data gathering and analysis of data of various sources, such as on-site sensors, satellite data, and historic flood information, the AI will be able to identify imminent threats, pattern variations and how likely and intense the occurrence of floods are possible, prior to its occurrence. This facilitates the delivery of early warnings and alerts to residents, local authorities, and emergency response teams in real-time via mobile applications, SMS messages and via a centralized dashboard.

Besides making real-time predictions of floods, the AI system will enhance long-term disaster management planning because it will offer useful information on the trends of floods and vulnerability of infrastructure. The studied data can help policy-makers, engineers, and city designers to create a more efficient drainage network, allocate the resources more efficiently, and create sustainable approaches to flood prevention.

Finally, the objective of the AI system is not to reduce the immediate risks and damage inflicted by floods only but also to construct smarter, safer, and more resilient cities. Using artificial intelligence and constant learning based on new information about the environment, the system would help to save lives, minimize economic damages, and improve the overall sustainability of disaster-prone areas and preparedness.

PROCESS OF EMPATHIZE IN DESIGN THINKING

In the empathize phase, we want to utilize our time to understand our users and all their needs. We aim to understand the real pains and gains of all our users affected by flood, whether it is flooding residents, city planners and disaster response teams. This allows our design thinking to be fully equipped with all important user centricity which is the setting stone of a good product.

WHO are we empathizing with?

Our target users for this product are the residents living in flood-prone areas, city planners responsible for urban drainage, and emergency response teams managing flood evacuations.

What do they need to DO?

They need to receive accurate and timely flood alerts, understand the severity and location of the risk, and take appropriate action as an example, evacuate, open drainage, deploy rescue teams and retreat to shelters.

What do they SEE?

The residents see sudden water level rises with little warning. The planners see outdated data systems. Emergency teams see difficulty coordinating actions due to poor communication and real-time data access.

What do they SAY?

Residents say flood warnings come too late or are not specific to their area. Planners say they lack integrated data to make predictive decisions. Emergency teams say coordination is hard when information is delayed or inaccurate.

What do they DO?

Residents manually monitor weather updates and rely on social media for flood news. Planners react to flooding after it happens. Emergency teams wait for reports before acting.

What do they HEAR?

Complaints from residents about delayed alerts and insufficient response. Feedback from authorities about the need for smarter systems to reduce losses.

What do they THINK and FEEL?

Pains:

- Fear and anxiety during rainy seasons due to unpredictable floods.
- Frustration with delayed responses and unclear communication.
- Loss of property and disrupted livelihoods.

Gains:

- Sense of safety with early, accurate warnings.
- Confidence in authorities' ability to respond quickly.
- Reduced damage and smoother evacuation processes.

PROCESS OF DEFINE IN DESIGN THINKING

USER	NEED	INSIGHT
Residents living in easily flooded areas, city planners responsible for urban drainage systems, and emergency response teams managing flood evacuations.	**Need 1:** To receive accurate and timely flood alerts. Users want reliable early warnings about rising water levels and potential floods to take actions such as preparation and evacuation. **Need 2:** To have better coordination and communication when a flood occurs. City planners and emergency teams need real-time information sharing to plan responses efficiently. **Need 3:** To understand the severity and location of floods easily. Users need clear, visual, and localized flood information to estimate personal or community risk levels. **Need 4:** To feel safe and confident during flood seasons. Users want guarantees that authorities can respond quickly and effectively to minimize injuries.	**First Insight:** Is there a real-time system providing accurate early warnings? Users lack access to flood detection and alert systems. Solution that provides predictive alerts and localized updates would reduce anxiety and losses. **Second Insight:** Do effective communication channels between agencies and residents exist? Poor communication causes delays in decision-making and response. A system enabling real-time data sharing and coordination is essential. **Third Insight:** Do users know which areas are at risk? Residents often receive general warnings without specific location details. Providing precise, map-based risk visualization would enhance understanding and prompt faster action. **Fourt Insight:** Do users trust the flood prediction system? Inconsistent responses and outdated systems have reduced trust. Building a data-driven and user-centered system can restore confidence and strengthen preparedness.