

ABSTRACT

Unpredictable extreme weather often poses a serious threat to human life, especially in the form of floods that hit vulnerable areas such as Dayeuhkolot, Bandung Regency. The area is located between the confluence of the Citarum and Cikapundung rivers, making it vulnerable to rising water levels during high rainfall. Early warning efforts through a manual system based on information from BBWS officers still face obstacles, especially in terms of speed and data integration. To overcome the limitations of the manual system, a more adaptive and automated technological approach is needed to monitor weather conditions and flood potential.

This research designs a weather prediction and early flood warning system based on Wireless Sensor Network (WSN) and Internet of Things (IoT) technology, combined with machine learning algorithms to generate local weather prediction information.. The system is equipped with a mobile application and the We-Weather website as a means of weather monitoring. The weather station devices will be deployed in two different areas: Teras Cikapundung and Polder Cipalasari. The system relies on weather sensors connected via an IoT network to collect real-time data, which is then analyzed using the XGBoost model. With this approach, the system is not only capable of accurately classifying weather conditions but also has the potential to detect flood risks earlier based on measured water levels. To ensure sensor data is more representative, a linear regression method is used to calibrate sensor readings against reference standards.

The test results show that the developed machine learning model achieved an accuracy of 96.37%, precision of 97.74%, recall of 96.37%, and an F1-score of 96.79%. These metrics indicate that the model has high and consistent classification capabilities and is suitable for implementation in a real-time data-based weather prediction system. In addition to the model's superior performance, usability testing using the System Usability Scale (SUS) yielded scores in the “very good” category, indicating that the application and website were designed with user-friendliness in mind for various segments of society. It is hoped that the implementation of this system will strengthen the capacity for mitigation and early warning of hydrometeorological disasters and support strategic decision-making by the public and stakeholders.

Keywords : extreme weather, flood, Machine Learning, Wireless Sensor Network, XGBoost,