A River Water Level Prediction System for Flood Early Detection Using Prophet Forecasting

Supervised by Zilvanhisna Emka Fitri, ST. MT

Muhammad Lutfi Hakim

Study Program of Informatics Engineering

Majoring in Information Technology

ABSTRACT

Jember Regency, particularly along the Kalijompo River, is a region highly vulnerable to flood disasters. The existing Early Warning System is still reactive, only providing alerts when the water level reaches a critical threshold. This research aims to develop a proactive river water level prediction system using the Prophet Time Series Forecasting method. Data acquisition is conducted automatically through CCTV cameras and processed using digital image processing techniques to detect the water level boundaries. Based on 109 days of testing, the system successfully collected 10,102 time-series data points. The training and parameter optimization results on the Prophet model (using logistic growth, multiplicative seasonality, and a changepoint prior scale of 0.5) proved to significantly improve accuracy. Performance evaluation showed a decrease in the Mean Absolute Error (MAE) from 4.38 cm to 3.76 cm and the Mean Absolute Percentage Error (MAPE) from 24.57% to 16.90%, while the Root Mean Squared Error (RMSE) experienced a slight increase from 10.63 cm to 10.87 cm. The model was also validated to be capable of precisely capturing the daily fluctuation cycle patterns of the river when compared with field data. The results of this study effectively shift the monitoring paradigm from a reactive system to a proactive early warning system, providing a longer lead time for the community and thereby supporting the effectiveness of disaster mitigation in Jember.

Keywords: *Flood Prediction, Prophet Forecasting, Time Series, Water Level, Early Warning System, Kalijompo River.*