ABSTRACT

The limited drainage capacity and manual operation of the Cipalasari polder have caused recurrent flooding in Dayeuhkolot, Bandung Regency, resulting in substantial socio-economic losses. This study aims to enhance micro-scale flood preparedness by providing real-time water-level monitoring and automated decision-making on a 1 : 25 polder-pond prototype.

The proposed system integrates three A02YYUW ultrasonic sensors, three YF-S201 flow meters, and two ESP32 micro-controllers. Water-level, discharge, and rainfall data are uploaded to Firebase every minute, processed by four machine-learning models—Decision Tree, XGBoost, Logistic Regression, and SVM—and displayed on the "Floody" web dashboard. Sensor performance is assessed under ISO 5725-1 guidelines, while network quality (latency, jitter, packet loss) is evaluated with Wireshark.

Tests demonstrate an average sensor accuracy of 98 %, a coefficient of variation of approximately 2 %, and a maximum error of ±1 cm. Communication links are classified as "very good," with 54.9 ms latency, 0.9 ms jitter, and 1.46 % packet loss. The Decision Tree model outperforms the others, achieving 99.967 % accuracy, a 99.976 % F1-score, and a 0.0003 MAE; its automated recommendations activate up to three pumps, keeping operational response times below 5 s and projecting a reduction in flood-peak runoff. These findings confirm that a tightly integrated IoT and machine-learning framework can markedly improve flood-mitigation effectiveness and is suitable for replication in similar polder environments.

Keywords: flood, internet of things, machine learning, polder, sensor