

ABSTRAK

PERANCANGAN SISTEM PERINGATAN DINI KEDATANGAN AIR DISTRIBUSI BERBASIS IOT MENGGUNAKAN *MACHINE LEARNING*

(2026: xvii + 82 halaman + 21 gambar + 12 tabel + 13 lampiran)

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Distribusi air bersih di Desa Lubuk Raman seringkali tidak menentu, menyebabkan ketidakpastian bagi warga dalam memenuhi kebutuhan sehari-hari. Penelitian ini bertujuan merancang sistem peringatan dini kedatangan air berbasis *Internet of Things* (IoT) dengan integrasi *Machine Learning*. Sistem menggunakan sensor getaran MPU6050 yang dipasang secara non-invasif pada pipa untuk mendeteksi kondisi aliran air. Data getaran berupa fitur *mean* dan *RMS* diolah oleh mikrokontroler ESP32 dan dikirim melalui jaringan seluler GPRS ke *server cloud* Railway. Algoritma *Random Forest* dan *Support Vector Machine* (SVM) dibandingkan untuk klasifikasi status aliran air. Hasil pengujian menunjukkan *Random Forest* memiliki performa terbaik dengan akurasi 96,94%, *precision* 96,48%, *recall* 98,21%, dan *F1-score* 97,33%. Sistem memberikan notifikasi otomatis melalui WhatsApp dengan rata-rata *delay* 8,8 detik. Pengujian menunjukkan sistem mampu memantau distribusi air secara *real-time* dan memberikan informasi akurat kepada warga melalui *dashboard* berbasis *Streamlit*. Penelitian ini memberikan solusi teknologi tepat guna yang efektif untuk meningkatkan efisiensi penggunaan air dan memberikan kepastian jadwal distribusi bagi masyarakat pedesaan.

Kata Kunci: IoT, *Machine Learning*, MPU6050, *Random Forest*, Sistem Peringatan Dini, WhatsApp.

ABSTRACT

DESIGN OF AN IOT BASED EARLY WARNING SYSTEM FOR WATER DISTRIBUTION ARRIVAL USING *MACHINE LEARNING*
(2026: xvii + 82 pages + 21 pictures + 12 tables + 13 appendixes)

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Clean water distribution in Desa Lubuk Raman is often unpredictable, causing uncertainty for residents in fulfilling their daily needs. This research aims to design an early warning system for water arrival based on the Internet of Things (IoT) integrated with *Machine Learning*. The system utilizes an MPU6050 vibration sensor mounted non-invasively on the pipe to detect water flow conditions. Vibration data, specifically mean and RMS features, are processed by an ESP32 microcontroller and transmitted via GPRS cellular network to a Railway cloud server. Random Forest and Support Vector Machine (SVM) algorithms were compared for flow status classification. The results demonstrate that Random Forest outperformed with 96.94% accuracy, 96.48% precision, 98.21% recall, and 97.33% F1-score. The system delivers automatic WhatsApp notifications with an average delay of 8.8 seconds. Testing shows that the system is capable of real-time monitoring and providing accurate information to residents through a Streamlit-based dashboard. This research provides an effective, appropriate technological solution to improve water usage efficiency and ensure distribution schedule certainty for rural communities.

Keywords: IoT, *Machine Learning*, MPU6050, Random Forest, Early Warning System, WhatsApp.