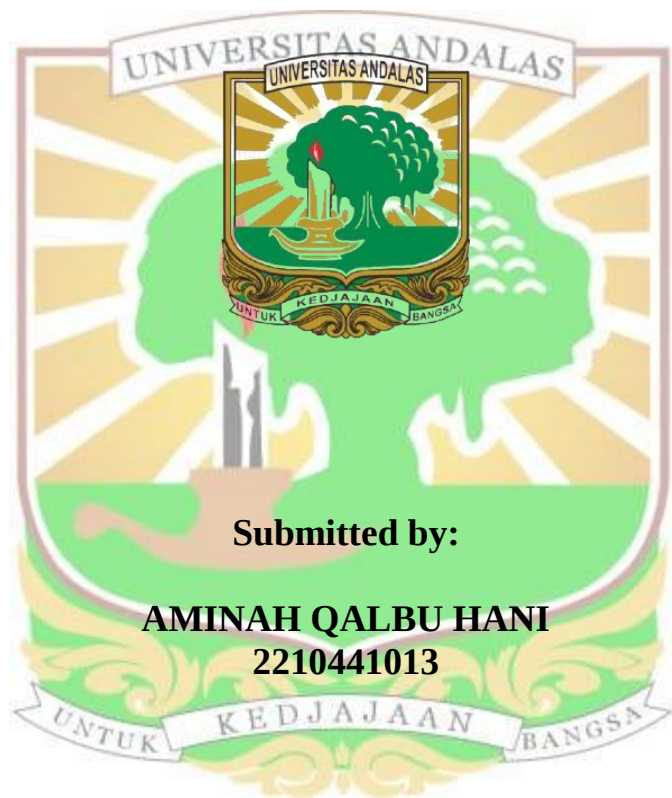


**IoT AND MACHINE LEARNING BASED SYSTEM
FOR PREDICTING TIME TO pH OR TDS THRESHOLDS
IN REFILL DRINKING WATER**

BACHELOR'S THESIS



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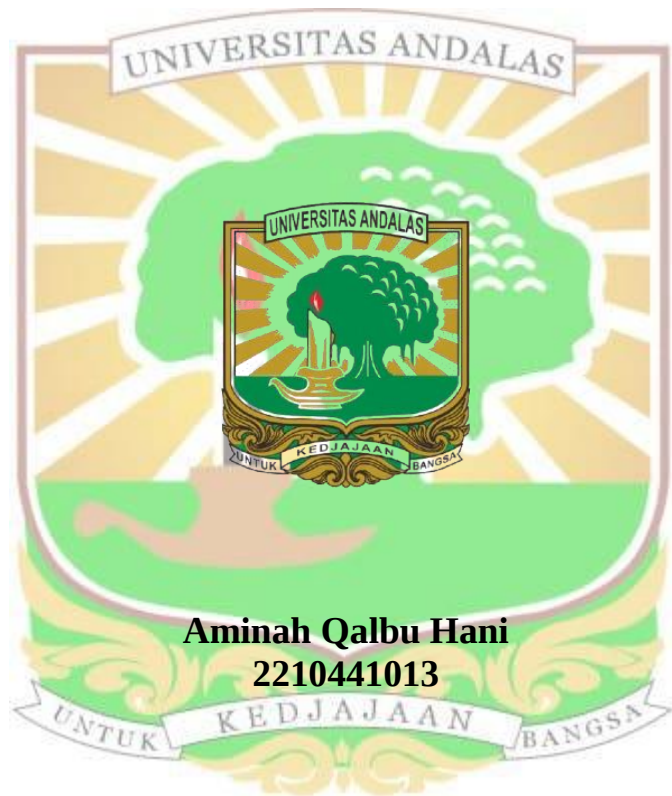
**DEPARTMENT OF PHYSICS
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
UNIVERSITY OF ANDALAS
PADANG**

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**A paper is one of the requirements
to obtain a Bachelor of Science Degree
From the Andalas University**



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IoT AND MACHINE LEARNING BASED SYSTEM FOR PREDICTING TIME TO pH OR TDS THRESHOLDS IN REFILL DRINKING WATER

ABSTRAK

Air minum merupakan kebutuhan dasar yang berperan penting dalam menjaga kesehatan dan keberlangsungan aktivitas manusia. Air galon isi ulang menjadi salah satu pilihan masyarakat karena tersedia dengan harga yang relatif lebih ekonomis. Pemantauan parameter air minum menjadi penting untuk membantu pengguna memperoleh informasi mengenai perubahan kondisi air yang digunakan sehari-hari. Penelitian ini bertujuan untuk membuat prototipe sistem prediksi waktu menuju $TDS \geq 300$ ppm atau pH berada di luar rentang nilai 6,5 sampai 8,5 berbasis *IoT* dan *machine learning* pada air minum galon isi ulang. *IoT* pada sistem ini memungkinkan data hasil pengukuran sensor dan hasil prediksi dikirim dari ESP32 ke Cloud Firestore database untuk ditampilkan pada aplikasi mobile. Sistem dilengkapi dengan sensor suhu DS18B20, sensor TDS SEN0244 dan sensor pH 4502C. Sistem menggunakan tiga model *machine learning* yg meliputi Random Forest Regressor, XGB Regressor dan SVR untuk melakukan prediksi waktu. Berdasarkan hasil evaluasi, Random Forest Regressor dipilih untuk diimplementasikan pada sistem, dengan MAE sebesar 0,3388 jam, RMSE sebesar 0,9675 jam dan R^2 sebesar 0,9990. Sistem merekam sebanyak 26.480 data hasil monitoring beserta hasil prediksinya. TDS menjadi parameter pertama yang melampaui batas yang diperbolehkan dengan nilai 302,01 ppm, sedangkan nilai pH tetap berada dalam rentang yang diperbolehkan yaitu 6,5 sampai 8,5.

Kata kunci : air minum galon isi ulang, batas nilai pH atau TDS yang diperbolehkan, *IoT*, *machine learning*, prediksi waktu



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ABSTRACT

Drinking water is a basic necessity that plays an essential role in maintaining human health and supporting daily activities. Refill drinking water has become one of the preferred choices because it is available at a relatively affordable cost. Monitoring drinking water parameters is important to help users obtain information regarding changes in the condition of the water used daily. This study aims to develop a prototype of an IoT and machine learning based system for predicting the remaining time until TDS reach ≥ 300 ppm or pH falls outside the permissible range of 6.5 to 8.5 in refill drinking water. The IoT technology in this system allows sensor measurement data and prediction results from the ESP32 to a Cloud Firestore database to be displayed on a mobile application. The system is equipped with a DS18B20 temperature sensor, an SEN0244 TDS sensor, and a 4502C pH sensor. The system uses three machine learning models including Random Forest Regressor, XGB Regressor and SVR to predict time. Based on the evaluation results, the Random Forest Regressor was selected for implementation in the system, achieving a MAE of 0.3388 hours, a RMSE of 0.9675 hours, and an R^2 of 0.9990. The system recorded 26,480 monitoring data points together with their corresponding prediction results. TDS was the first parameter to exceed the permissible limit, reaching 302.01 ppm, whereas the pH remained within the permissible range of 6.5 to 8.5.

Keywords : IoT, machine learning, pH or TDS thresholds, refill drinking water, remaining time prediction

