UNDERGRADUATE THESIS

IMPLEMENTATION OF AN IOT-BASED RAINFALL PREDICTION SYSTEM USING LORA AND EXTREME GRADIENT BOOSTING (XGBOOST)

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APPROVAL SHEET

IMPLEMENTATION OF AN IOT-BASED RAINFALL PREDICTION SYSTEM USING LORA AND EXTREME GRADIENT BOOSTING (XGBOOST)

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Hereby declares that this undergraduate thesis contains no part of any other scientific work that has been submitted to obtain an academic degree at any higher education institution. Furthermore, it does not contain any work or opinions previously written or published by others, except for those which are explicitly cited in this thesis and listed completely in references.

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ABSTRACT

Student Name / NPM:	M. Arif/21081010199
Thesis Title:	Implementation of an IoT-Based Rainfall Prediction System Using LoRa and Extreme Gradient Boosting (XGBoost)
Supervisor:	1. Dr. Ir. Mohammad Idhom, SP., S.Kom., MT. 2. Henni Endah Wahanani, ST. M.Kom

Unpredictable weather conditions caused by climate variability present major challenges for the agricultural sector, particularly in determining farming activities such as irrigation and pesticide spraying. Limited access to real-time weather information in rural areas further increases the risk of agricultural losses. Therefore, this study proposes an Internet of Things (IoT)-based rainfall prediction system integrated with LoRa communication and the Extreme Gradient Boosting (XGBoost) algorithm. The developed system consists of an Arduino Uno R3, SHT31 sensor, anemometer, LoRa SX1278 module, ESP32 gateway, and AWS EC2 cloud server using the MQTT protocol. InfluxDB and Grafana are utilized for data storage and monitoring. The prediction model is trained using historical BMKG weather data from 2020–2025 with input features consisting of TN, TX, TAVG, RH_AVG, FF_X, and FF_AVG. Rainfall is categorized into four classes: No Rain, Light Rain, Moderate Rain, and Heavy Rain. Testing results show that the LoRa communication system operated reliably with RSSI values ranging from −81.88 dBm to −74.58 dBm and SNR values ranging from 9.70 dB to 9.96 dB at a testing distance of approximately 483 meters. The Packet Loss Rate (PLR) remained relatively low, indicating stable data transmission. The XGBoost model achieved an accuracy of 74% with weighted precision, recall, and F1-score values of 0.70, 0.74, and 0.71, respectively. Overall, the developed system supports real-time environmental monitoring and rainfall prediction for agricultural applications.

Keywords: Internet of Things (IoT), LoRa, XGBoost, rainfall prediction, MQTT, environmental monitoring.

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The purpose of this undergraduate thesis is to fulfill one of the requirements for completing the Bachelor's Degree (S1) in the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional "Veteran" Jawa Timur.

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The author realizes that there are still many shortcomings in the preparation of this thesis. Therefore, constructive criticism and suggestions from various parties are highly expected in order to improve this thesis. Finally, with all the limitations possessed by the author, it is hoped that this thesis will be beneficial for all parties in general and for the author in particular.

Surabaya, April 7, 2026

M. Arif

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