

ABSTRACT

Indonesia is an agricultural country that faces significant challenges in maintaining soil fertility, necessary to support agricultural and plantation productivity. These challenges are compounded by fluctuating weather conditions and climate change. According to the Food and Agriculture Organization (FAO), global agricultural production must increase by 70% by 2050 to meet the needs of an estimated world population of 9.6 billion, emphasizing the need for innovative solutions to overcome these challenges.

An Internet of Things (IoT)-based system called Agri-Drone was developed, designed for soil fertility classification using Fuzzy Logic and weather prediction using Machine Learning, to assist farmers in making crop management decisions. The system integrates components including a Soil Test, a Weather Station, a LoRa Gateway carried by an autonomous drone, and a website.

Soil Test and Weather Station components have demonstrated Quality of Service (QoS): end-to-end delays and response times of less than 30 seconds, indicating efficient data transmission. The accuracy of the Soil Test based on the average of each measurement result is as follows: Nitrogen (N) 91.93%, Phosphorus (P) 91.31%, Potassium (K) 88.7%, pH 95.03%, and moisture 93.54%. The consistency of the data generated in repeated tests shows high precision with Relative Standard Deviation (RSD) values: N at 12%, P at 0%, K at 8%, pH at 0%, and moisture at 4%. The LoRa gateway, as a communication system, demonstrates the ability to maintain a stable connection over a wide range of distances, with a reasonable RSSI drop in line with the basic principles of signal transmission. The Weather Station also shows a high level of precision, with RSD values for humidity, rain intensity, air pressure, temperature, wind direction, wind gusts, and wind speed all at 0%, indicating very high precision. Machine Learning for the classification of weather conditions with a total accuracy of 98% while for weather prediction has a mae value of air temperature 0.80, minimum air temperature 1.04, maximum air temperature 1.10, air pressure 2.19, humidity 7.59, wind speed 0.37, wind direction 91.53, and cloudy conditions 10.95. The website is user-friendly, with an average score of 4.584 from 51 questionnaire respondents, and has achieved 100% performance as assessed by GTMetrix, supporting users in monitoring measurement results.

Keywords: Soil Fertility, Weather Forecast, Internet of Things, Agriculture, Monitoring.