ABSTRACT

The rapid growth of the Internet of Things (IoT) has had a major impact on our daily lives, providing a variety of innovative solutions. However, IoT-connected devices require longer battery life, wide coverage, and low deployment costs. The main challenge in LoRa networks is selecting the optimal Spreading Factor (SF) and appropriate Power that affect network performance, coverage, data rate, and energy consumption.

To address these challenges, machine learning offers a promising solution. Machine learning models can analyze data, recognize patterns, and make informed decisions to select the best SF and Power values based on various conditions. This study focuses on developing a machine learning model to optimize SF and Power selection using real-world data from rice fields in Banyumas, Central Java, Indonesia. This study evaluates several classification algorithms, including k-NN, Random Forest, and Decision Tree, to determine the most effective model for SF assignment and Power usage in LoRa networks.

The study results showed that the SF value classification process using the KNN algorithm obtained an accuracy of 96.63% with a training time of 5.065 s and a testing time of 103.96 s. The Random Forest algorithm obtained an accuracy of 96.88% with each training time of 611.786 s and testing 9.455 s. The Decision Tree algorithm in the SF value classification process obtained an accuracy of 96.46% with each training time of 25.622 s and testing 0.083 s. In the power value classification process, the KNN algorithm obtained an accuracy of 96.18% with a training time of 2.243 s and a testing time of 157.343 s. Using the Random Forest algorithm in the power value classification obtained an accuracy of 96.88% with each training time of 634.483 s and a testing time of 14.608 s. In the power value classification process, the Decision Tree algorithm obtained an accuracy of 96.46% with each training time of 30.225 s and testing of 0.169 s. It can be concluded that the system is designed to classify SF and power values with high accuracy.

Keywords: Spreading Factor, LoRa, Machine Learning.