

ABSTRACT

Uncontrolled deforestation in Indonesia has led to increased carbon emissions, hydrometeorological disasters, and biodiversity loss. The National Forestry Monitoring System (SIMONTANA) has been developed to oversee forests; however, it still has limitations in data access speed, monitoring coverage, and detection accuracy. This study aims to develop an Internet of Things (IoT)-based deforestation mitigation system integrated with a wireless mesh network and solar energy utilization to enhance real-time forest monitoring effectiveness. The proposed system consists of a vibration sensor (SW-420) to detect suspicious activities, a fire sensor (KY-026) to identify fires, and a temperature and humidity sensor (DHT22) to monitor environmental conditions. Additionally, a wireless communication module (nRF24L01) enables devices to communicate within the mesh network without relying on internet infrastructure. The collected data is processed by NodeMCU and transmitted to an IoT server based on Node.js and Express.js, which is then visualized through a ReactJS-based interface. Experimental results indicate that the vibration sensor achieves 90% effectiveness at a distance of 25 cm, decreasing to 10% at 100 cm. The fire sensor detects heat sources within a range of 10–90 cm, while the temperature sensor demonstrates accuracy with an average deviation of $\pm 0.5^{\circ}\text{C}$. The findings of this study indicate that the developed system can provide fast, accurate, and sustainable forest monitoring data, offering a promising innovative solution for deforestation mitigation in Indonesia.

Keywords: deforestation, Internet of Things (IoT), sensors, mesh network, photovoltaic