Design and Construction of a Landslide Detection System Based on Wireless Sensor Network (WSN) Using Long Range (LoRa) Technology

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ABSTRACT

Landslides rank third in the most frequent disasters in Indonesia with 293 cases occurring until July 2021, posing significant risks to safety and infrastructure. This research develops a Wireless Sensor Network (WSN)-based early warning system to detect landslide indications through soil moisture and slope gradient parameters in real-time. The system implementation integrates a soil moisture sensor and an MPU6050 sensor (accelerometer) as the main detector, with data sent via the LoRa SX1278 module. Tests were conducted in open and obstructed environments, using Node-RED and Telegram Bot to generate automatic notifications based on three scenarios: soil moisture exceeding 40%, X/Y axis slope above 0.50, and danger conditions when both parameters are met simultaneously. The research results prove that the system accuracy reaches 98.5% in slope detection (MPU6050) and 93.4% in soil moisture measurement. LoRa communication reaches 500 meters (RSSI -104 dBm) in open areas, but decreases to 146 meters in obstructed environments. Notifications were successfully sent in real time for all warning scenarios, confirming the system's effectiveness as an early warning solution with fast response and high accuracy.

Keyword*: Early warning system, landslide, LoRa SX1278, MPU6050, Node-RED.*