

# DESIGNING AND DEVELOPING A LoRa-BASED EARLY WARNING COMMUNICATION DEVICE FOR LANDSLIDE DETECTION

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## ABSTRACT

*Landslides are natural disasters that frequently occur in hilly or mountainous areas, especially during the rainy season. These disasters can cause significant damage, including property loss and casualties. To mitigate such impacts, an early warning system is required to detect landslide risks quickly, particularly in areas with limited internet connectivity. This study presents the design and development of a landslide early detection device using LoRa (Long Range) communication technology, which operates without internet access. The system employs an ESP32 Wroom microcontroller integrated with a soil moisture sensor and an MPU6050 tilt sensor. The device consists of a transmitter and a receiver. The transmitter reads data from the sensors and sends it via the LoRa network. The receiver forwards the data to a web-based monitoring platform. When dangerous conditions are detected, the system automatically sends warning messages via WhatsApp based on threat levels (alert level 1, 2, or 3). Test results show the system can transmit data up to approximately 504 meters with a success rate of 96%. The website upload and WhatsApp notification processes also performed well, with average delays of 1.8 and 2.2 seconds, respectively, and a success rate of 90%. The main obstacle encountered was power outages at the receiver site. Overall, the system proves effective and suitable for remote areas to support landslide disaster mitigation using IoT technology.*

**Keywords:** landslide, early warning, LoRa, ESP32 Wroom, WhatsApp.