

## Wireless Underground Sensor Network for Soil Monitoring

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This study introduces a wireless underground sensor network (WUSN) for soil monitoring in Sri Lankan rubber plantations. Utilizing LoRa as the platform for communication between underground sensor nodes and an overground base station, we demonstrate that the robust transmission properties of LoRa radio signals are beneficial in difficult environments such as soil. Keeping the goal of long-term operation in mind, we reduce the battery drain by a logistic regression machine learning model that predicts successful transmissions based on soil moisture measurements to reduce powering up the radio interface. With these findings, the battery lifetime of the WUSN nodes is increased by 20%. We demonstrate the proof-of-concept of the WUSN by example measurements of soil parameters such as moisture, temperature and the concentration of nutrients important for the growth of rubber trees. The system allows monitoring the soil parameters in real time which simplifies the observation of rubber tree plantations, but can also be applied to other cultivations.

**Keywords:** *smart farming, rubber plantation, Wireless Underground Sensor Networks, LoRa, soil condition monitoring, power efficiency, logistic regression*