Energy Efficiency Analysis on
Wireless Sensor Network Devices
for Automatic Field Irrigation
Using the LEACH-C Algorithm

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ABSTRACT

The use of Wireless Sensor Network (WSN) technology in the agricultural sector is a modern solution in supporting automatic field irrigation systems. The main challenge is the limited energy source at each node, so efficient energy management is needed. This research aims to analyze energy efficiency in WSNs using the Low-Energy Adaptive Clustering Hierarchy - Centralized (LEACH-C) algorithm. The system consists of four Arduino Pro Mini-based nodes equipped with YL-69 soil moisture sensors and INA219 energy sensors, as well as one ESP32-based base station. Communication between devices using the NRF24L01 module using the TDMA method and time synchronization of the RTC DS1307. LEACH-C is used for cluster head selection based on residual energy and distance to the base station. Results show that this algorithm is able to increase energy efficiency to 82.06% of the total tissue energy. Humidity and energy efficiency data are displayed in real-time via Node-RED using the MQTT protocol. Thus, LEACH-C is effective in optimizing energy use in WSN systems for automatic irrigation of fields.

Keywords: *Wireless Sensor Network, LEACH-C, Node-RED***.**