

ABSTRACT

Grapes require an optimal growing environment. Current grape nurseries are still done manually, requiring more labor and increasing the risk of failure. This research designs and builds an automated grape nursery monitoring system based on NodeMCU ESP8266 with solar power. DHT11, capacitive soil moisture, and pH sensors are used to collect environmental data transmitted to Firebase Realtime Database. Users can access real-time data through web or mobile applications. Test results show high accuracy levels for temperature (99%), humidity (98%), soil moisture (96%), and soil pH (98%) measurements. This system is efficient, energy-saving, and sustainable, assisting farmers in making the right decisions to improve grape productivity and quality.

Keywords: *Environmental Monitoring, grape nursery, NodeMCU ESP8266, solar energy, environmental sensors, web-based application, energy efficiency*