

ABSTRACT

The cultivation of pakcoy faces challenges in manual processes related to irrigation, fertilization, and light intensity *Monitoring*. These practices require constant attention and are not always responsive to environmental conditions. To address this, an Internet of Things (IoT)-based system was developed, integrating automatic drip irrigation, pH-based liquid fertilization, and environmental *Monitoring* of light intensity and temperature.

The system uses an ESP32 microcontroller as the main control unit and an Arduino Nano as a sensor node, communicating via RS485 protocol. The sensors include a soil moisture sensor, soil pH sensor, BH1750FVI light sensor, and DHT22 temperature and humidity sensor. The system operates automatically based on pre-defined thresholds and allows manual control through a mobile application built with Flutter.

Testing showed that the system performed automatic irrigation when soil moisture was below 60% and stopped when it exceeded 80%, with actuator *response time* averaging around 2.6 seconds. Fertilization was triggered when the pH was outside the 6.0–7.0 range, adjusting from 5.4 to 6.4 over three fertilization cycles. Data usage was approximately ± 0.2 MB per day with 20-minute intervals, and RS485 communication remained stable over distances greater than 6 meters. The mobile application was able to display real-time sensor data and execute basic control functions as designed.

Keywords: Automatic Fertilization, Automatic Irrigation, ESP32, IoT, Pakcoy