ABSTRACT

This study aims to develop a prototype of an Internet of Things (IoT)-based hydroponic vertical farming system to improve the efficiency of space and water resource use, and support food security in Indonesia. This system is designed by combining IoT technology, sensors, and automation to monitor and manage plant environmental parameters in real-time. The main components include a DHT11 sensor (temperature and humidity), a water flow sensor (nutrient flow), ESP8266 as a controller, a water pump, and a mobile application interface connected to the cloud. The implementation was carried out on kale plants on a school rooftop with a vertical structure to optimize space. The test results showed that the system was able to operate at a temperature of 20–38°C and humidity of 55–98%, according to hydroponic needs. The growth of kale reached an average of 1–1.5 cm/day with roots starting to develop on the second day. However, corrosion on the water level and water flow sensors caused data fluctuations, reducing monitoring accuracy. Efficient water use was achieved through automatic control based on sensor data. Technical constraints such as moss on pipes and yellowing leaves were also identified, allegedly due to high humidity and chlorine content in the water. The conclusion of the study confirms the potential of this system as a sustainable urban agriculture solution. For further development, it is recommended to use corrosion-resistant sensors, add water filters, and improve automation algorithms. With optimization, this system can be widely implemented to support food security through the use of limited land and efficient resource management.

Keywords: Hydroponics, Vertical Farming, IoT, Automation, Food Security.