

ABSTRACT

Agriculture and aquaculture are vital sectors in Indonesia, yet both face significant challenges such as decreasing land availability due to urbanization, declining interest from younger generations in farming, and limited water resources. Conventional cultivation methods tend to be inefficient in utilizing space and time and rely heavily on manual monitoring. The main issue addressed in this research is the low efficiency and effectiveness of manual aquaponic systems in fulfilling food needs and maintaining environmental sustainability.

As a solution, this study developed an Internet of Things (IoT)-based aquaponic system called AquaPonics Automation System (APAS), which enables automatic monitoring and controlling. The system uses an ESP32 microcontroller integrated with various sensors including temperature, water pH, light intensity, and water level, and is equipped with a monitoring camera and an automatic feeding feature. Sensor data is transmitted in real time to a mobile application based on Firebase, allowing users to easily control and monitor fish tanks and hydroponic plants remotely.

This research shows that the system is capable of monitoring environmental parameters such as temperature, pH, water level, and light intensity in real time with a response time of less than 2 seconds and an accuracy rate above 90%. The automation of fish feeding integrated through this system succeeded in increasing feeding efficiency by 28.6%, as well as reducing the risk of water quality fluctuations by 35% compared to conventional methods. These results prove that the application of Internet of Things (IoT) technology in aquaponic systems can be an effective innovative solution in improving the efficiency and sustainability of the agriculture and fisheries sector, especially in urban areas with limited land and resources.

Keywords: aquaponics, IoT, monitoring, ESP32, automation, real-time