

ABSTRACT

Lake is a vital water resource that plays a crucial role in human life; however, the quality of aquatic environments and their surroundings continues to decline due to human activities such as air and water pollution. According to the WHO, 99% of the global population breathes polluted air, with air pollution causing 7 million premature deaths annually, mainly due to harmful gas emissions such as CO and CO₂. To address the limitations of conventional monitoring systems, which are static and costly, this research designs an air and environmental quality measurement system based on a Solar Autonomous Boat as part of swarm USV technology. The system integrates sensors including DHT22 (temperature, humidity), MQ-135 (CO, CO₂, NH₄), BH1750 (light intensity), CJMCM-GUVA-S12SD (UV), and FC-37 (rain) with Arduino Nano V3 as the main controller, and TTGO LoRa32 OLED for data transmission via LoRa. Testing at Situ Tekno Lake showed that the system successfully measured environmental parameters in real-time, such as temperature (26.2–32.1°C), humidity (55.6–79.6%), light intensity (17.19–17,066.4 lux), gas concentrations (CO: 0.12–13,296.8 ppm; CO₂: 0.34–1,040.43 ppm), and UV indeks (0–33,36). These results demonstrate that the system is a dynamic, energy-efficient, and effective solution for aquatic environmental monitoring.

Keywords: *Solar Autonomous Boat, air quality, environmental sensors, Arduino Nano, LoRa, swarm USV.*