ABSTRACT

Water quality degradation due to human activities such as domestic, industrial, and agricultural waste pollution is a problem that requires responsive and sustainable solutions. To overcome the limitations of traditional methods in water quality monitoring, this study developed a depth-based water quality monitoring device up to 4 meters. This system is designed to measure key parameters such as temperature, pH, turbidity, and dissolved oxygen with data transmitted and stored in a database. The device uses a buoyancy engine mechanism for vertical control, supported by a PID algorithm for positional stability and adaptive sampling for power efficiency, thereby improving power consumption efficiency and data storage. This system is also designed with IP68 water resistance for submersible components and light weight (<15 kg) to support mobility. With validation that includes static and dynamic characteristic testing. The results of the study show that this device is able to provide power consumption efficiency of up to 12% in 2 hours of testing time, measure water quality at a certain depth with a steady state error of ±15 cm, and facilitate data-based decision making for sustainable water resource management.

Keyword: Adaptive Sampling, Buoyancy Engine, PID Control, Water Quality Monitoring.