Title: Real-Time Water Refill Monitoring and Management System via Wireless Network Using UDP Protocol

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Abastact: Efficient water resource management is critical in mitigating flood risks, ensuring irrigation facilities, and supporting hydrological research. This paper presents a real-time monitoring system for water level and flow using a wireless sensor network (WSN) integrated with the User Datagram Protocol (UDP). This study proposed a water refill monitoring and management system which costs $13.2 (1600 BDT), based on a client–server architecture, comprising ESP-32 as a client and ESP-8266 as a server. The client system incorporates components such as a water flow sensor, pump motor, motor driver, sonar sensor, keypad, and OLED display for real-time monitoring. The system's performance has been rigorously evaluated across six target volumes—30 mL, 60 mL, 100 mL, 130 mL, 160 mL and 200 mL—yielding impressive mean measured values of mL, 29.6 mL, 59.35 mL, 99.9 mL, 130.6 mL, 162.2 mL, and 198.5 mL, respectively. The corresponding absolute errors ranged from 0.1% to 1.38%, reflecting accuracy between 98.62% and 99.9%. Data transmission accuracy has been validated, with 95.56% of water level data transmitted and 96% successfully received, showcasing the system's robust communication capability within a range of 16–22 m. Both client and server OLED displays provided synchronized outputs, displaying parameters such as target of 30 mL, a dispensed volume of 31.26 mL, a bill of 0.62 Taka, and a water level of 87.56%. Despite minor discrepancies from calibration and motor speed variations, the system demonstrated exceptional accuracy, reliability, and potential for scalable applications in automated water refilling and resource management.
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