ABSTRAK

Kebutuhan air bersih merupakan aspek esensial dalam mendukung kesehatan masyarakat. Sayangnya, distribusi air layak konsumsi di berbagai wilayah, khususnya pedesaan, masih belum optimal akibat keterbatasan infrastruktur dan tingginya tingkat pencemaran lingkungan. Salah satu parameter penting dalam menentukan kualitas air bersih adalah tingkat kekeruhan yang diukur dalam satuan NTU (Nephelometric Turbidity Unit). Penelitian ini bertujuan untuk merancang dan membangun sistem filterisasi air berulang serta monitoring kekeruhan otomatis berbasis mikrokontroler ESP32 yang terintegrasi dengan aplikasi IoT Blynk. Sistem ini dirancang untuk menurunkan tingkat kekeruhan air hingga mencapai standar WHO, yaitu di bawah 5 NTU. Metode penelitian meliputi tahap perancangan mekanik, perancangan rangkaian elektronik, perancangan perangkat lunak menggunakan Arduino IDE, serta pengujian fungsional dan kinerja sistem. Komponen utama yang digunakan antara lain sensor turbidity SKU:SEN0189, sensor ultrasonik HC-SR04, pompa air DC 12V, solenoid valve, dan LCD I2C 16x2. Hasil pengujian menunjukkan bahwa sistem mampu menurunkan nilai kekeruhan air dari 167,7 NTU menjadi 1,0 NTU dalam waktu 2 jam 15 menit. Pengujian sensor ultrasonik menunjukkan akurasi 100% tanpa error, sementara sensor turbidity menunjukkan kestabilan hasil pembacaan nilai kekeruhan yang konsisten. Proses filtrasi berlangsung efisien, di mana penurunan signifikan nilai kekeruhan dimulai setelah menit ke-63, ditandai dengan pergantian otomatis operasi dari Pompa 1 ke Pompa 2. Selain itu, hasil monitoring nilai kekeruhan melalui aplikasi Blynk berjalan real-time dan sesuai dengan nilai tampilan pada LCD I2C. Keseluruhan sistem berhasil berfungsi otomatis sesuai parameter yang diprogram. Dengan demikian, sistem ini dapat menjadi solusi praktis dalam upaya penyediaan air bersih di kawasan dengan akses terbatas serta mendukung pengembangan teknologi kontrol berbasis IoT di Indonesia.

Kata kunci: Filterisasi Air, ESP32, IoT, Turbidity Sensor, Blynk.

DESIGN AND DEVELOPMENT OF A REPEATED WATER FILTRATION SYSTEM AND AUTOMATIC TURBIDITY MONITORING BASED ON MICROCONTROLLER

ABSTRACT

Clean water is a vital necessity for human life and public health. However, the distribution of safe and consumable water, especially in rural areas, remains uneven due to limited infrastructure and increasing environmental pollution. One crucial parameter in determining water quality is turbidity, measured in Nephelometric Turbidity Units (NTU). This study aims to design and develop a repeated water filtration system equipped with automatic turbidity monitoring based on the ESP32 microcontroller, integrated with the Blynk IoT application. The system is designed to reduce water turbidity levels to meet the WHO standard, which is below 5 NTU. The research method includes mechanical design, electronic circuit design, software development using the Arduino IDE, as well as functional and system performance testing. The primary components involved are the SKU:SEN0189 turbidity sensor, HC-SR04 ultrasonic sensor, 12V DC water pump, solenoid valve, and LCD I2C 16x2. Based on the test results, the system successfully reduced water turbidity from 167.7 NTU to 1.0 NTU within 2 hours and 15 minutes. The ultrasonic sensor demonstrated 100% accuracy without error, while the turbidity sensor consistently produced stable and reliable readings. The filtration process ran efficiently, with a significant turbidity reduction observed after the 63rd minute, marked by the automatic shift of operation from Pump 1 to Pump 2. Moreover, real-time monitoring through the Blynk application showed consistent values with those displayed on the LCD I2C, proving the reliability of the system's automatic control and monitoring functions. This system provides a practical and efficient solution for providing clean water in areas with limited access while supporting the advancement of IoT-based water quality management technology in Indonesia.

Keywords: Water Filtration, ESP32, IoT, Turbidity Sensor, Blynk.