ABSTRACT

This research is motivated by the need for a reliable laboratory room monitoring system to maintain the performance and reliability of the equipment within. In managing laboratory rooms, environmental parameters such as temperature and humidity, as well as electrical parameters like voltage, current, and energy consumption, must be monitored accurately and in real-time to prevent equipment damage caused by unsuitable conditions. However, manual monitoring is often inefficient and may result in delays in detecting issues. Therefore, this study aims to develop an Internet of Things (IoT)-based monitoring system capable of automatically collecting data and transmitting it in real-time using the MQTT protocol. The MQTT protocol was chosen for its ability to produce small-sized data files, making it more efficient for data transmission and storage in IoT-based laboratory room monitoring systems. The system is designed with DHT11 sensors for temperature and humidity, PZEM-004T sensors for voltage, current, and power, and an ESP8266 microcontroller that transmits data via WiFi to the TelkomIoT platform. Testing was conducted to evaluate the accuracy of the sensors and the Quality of Service (QoS) of the MQTT protocol. The results showed that the DHT11 sensor achieved an average accuracy of 97.55% for temperature and 95.36% for humidity, while the PZEM-004T sensor demonstrated high accuracy in measuring voltage and power, although its current measurement accuracy was slightly lower under inductive loads. QoS testing revealed that the MQTT protocol effectively transmitted data in real-time without packet loss, maintaining low latency and a consistent packet size of 163 bytes. Thus, this research successfully produced an efficient, accurate, and reliable laboratory room monitoring system, supporting the optimal management of laboratory room conditions.

Keyword: *DHT11, ESP8266, IoT, MQTT, PZEM-004T*