

## ABSTRACT

The use of technology in office buildings often focuses on glamour and functionality but frequently neglects aspects of sustainability and energy efficiency. The TULT building, as one of the academic facilities, has not fully considered the economic and environmental impacts in its design, especially in terms of lighting energy consumption. Therefore, this capstone design project is focused on developing an efficient energy control system for lecturer rooms in the TULT building, with the main objective of reducing electrical energy consumption caused by inefficient lighting usage.

The project developed a tool based on a PIR sensor and a smart switch to automate light control. Tests were conducted to evaluate the performance of the device, and the system produced. Tests are carried out to measure the range of PIR sensors, power measurements, reliability in data transmission, performance of Blynk dashboard, duration of use and battery charging of the PIR sensor system, as well as the durability of the system devices

Testing showed that the PIR sensor effectively detects up to 7 meters at a 60° angle. Measuring the power with the multimeter showed a mismatch with the data on the Blynk dashboard, indicating a problem with the PZEM 004t sensor. Data transmission from the PIR sensor to the Blynk server using HTTP/HTTPS with NodeMCU ESP8266 worked well. The Blynk Cloud Dashboard displays 21 data streams with data types of double, integer, and string. The QoS Dashboard shows a throughput of 21 kbps, the measured delay is 0,06304 ms, and the jitter is 0,06303 ms, all in the good category. The evaluation of user experience against the dashboard showed high satisfaction with an average rating of 5 on the questionnaire. The duration of use of the PIR sensor indicates that it can be used for about 34 hours and 48 minutes, and the battery charges for about 30 hours and 51 minutes and 36 seconds. The durability of the PIR sensor device and the smart switch indicated minor damage during testing. Overall, this system helps the green and smart goals for the TULT building. The results can be used as a reference for the application of similar technologies elsewhere to improve energy efficiency and reduce negative environmental impacts.

Keywords: Telkom University Landmark Tower (TULT), PIR Sensor, Smart Switch, Blynk Cloud, Dashboard.