IoT Implementation Using the Blynk App on a Solar Panel-Based Rotary Coffee Roaster Prototype with a *Heater* as the Heat Source

Ir. Mochammad Nuruddin S.T., M.Si (Thesis Supervisor)

Muhammad Eka Rizky
Renewable Energy Study Program
Department of Engineering

ABSTRACT

Small-scale coffee roasting is still largely done manually, making it difficult to monitor in real time and prone to inconsistency. This research implements an IoT system on a solar-powered *Rotary Coffee Roaster* prototype, using a *Heater* as the heat source. An ESP32 microcontroller is integrated with MAX6675, INA219, and PZEM-004T sensors, along with a DC motor actuator and *Heater* controlled via relay and SSR, monitored through the Blynk application. The results show that the system was successfully implemented with real-time data acquisition and control, a motor response time under one second, and responsive *Heater* control. Accuracy testing showed that PZEM-004T was the most accurate sensor (average *error* for voltage, current, and power: 0.501%, 2.821%, and 2.305%, respectively), followed by the MAX6675 *Thermocouple* sensor with an average *error* of 1.97% for *Heater* temperature measurement and 2.42% for drum temperature measurement, while INA219 showed the highest *error* in current and power readings (8.870% and 8.813%) due to the measurement resolution limitations at low current scales. Overall, the system functioned well, with sensor accuracy varying depending on the parameter and measurement point.

Keywords: IoT, Blynk, ESP32, Rotary Coffee Roaster, Solar Panel, Temperature Monitoring