

# **CONTROL SYSTEM DESIGN FOR A SIMPLE COFFEE BEAN ROASTING EQUIPMENT FOR HOUSEHOLD SCALE USING PID CONTROL METHOD**

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## **ABSTRACT**

*In line with developments in human consumption patterns, coffee drinks are no longer just for consumption needs, but have transformed into a part of human lifestyle. When enjoying a cup of coffee, coffee roasting is the most important thing in the process of processing coffee beans to get the perfect aroma and taste. However, for coffee lovers, buying a coffee roasting equipment requires quite a lot of money. Therefore, researchers created a simple coffee roasting by utilizing the workings of a rice cooker. This researcher implemented the PID control method to control the temperature of three levels of maturity, namely light roast, medium roast and dark roast in a coffee bean roasting system. The case study uses 1 type of coffee bean, namely robusta coffee from Temanggung. The prototype uses an ESP-32 microcontroller with a type K thermocouple temperature sensor and an actuator in the form of a Solid State Relay (SSR) to control the heating element temperature and a relay to run the motor and fan. Through 30 datasets in testing the type K thermocouple sensor, an accuracy value of 96.2% was obtained. Based on the PID control test data, it can be concluded that the PID control system can maintain temperature stability well. This is proven by the relatively small overshoot (%) and Steady State Error (SSE) values, each with an average value of 2.02% and 1.58%. Meanwhile, the rise time and settling time values have an average value of 263.3 seconds and 329.3 seconds respectively. This value is quite good considering that generally increasing the temperature takes a longer time.*

**Keywords:** *Coffee Roasting, PID Control, Temperature, ESP-32, Thermocouple Sensor*