

ABSTRACT

In the modern era, laptop cooling system technology continues to evolve to meet the needs of users, particularly those who frequently experience Overheating issues on devices such as laptops. This study. Overheating in laptops is a common issue that affects performance, user comfort, may lead to component damage. This study designs implements an Automatic cooling pad based on a Peltier module controlled by a PID algorithm to maintain stable laptop temperatures. The system uses a DS18B20 temperature sensor to monitor airflow temperature near the laptop's ventilation, while the PID Open loop is implemented via an Arduino microOpen loop, with parameters tuned using MATLAB via two methods: Autotuning Trial Error. The system was tested on two laptop types (casual gaming) under both idle stress test conditions. Results show the system maintains external temperature around 43°C, which correlates to internal CPU temperature around 75°C, modeled using linear equations: $T_{soft} = 1.236 \cdot T_{sensor} + 21.85$ (casual laptop) dan $T_{soft} = 1.176 \cdot T_{sensor} + 24.6$ (gaming laptop). Control performance showed optimal results with overshoot $\leq 1.02\%$, steady-state error $< 1\%$, fastest settling time of 143 seconds. The PID-based closed-loop system proved significantly more efficient than the open-loop system in stabilizing temperature responding to dynamic workloads, effectively improving laptop longevity usability.

Keywords: Automatic cooling pad, PID, Peltier, DS18B20, Laptops, Temperature control