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# PID-Controlled Temperature System Using Arduino for Portable Virus Detection Application

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## Abstract

Loop-mediated isothermal amplification (LAMP) requires precise temperature control at 65° C for virus detection applications. Traditional portable systems face challenges in maintaining stable temperatures with limited power supplies. This paper presents the development of a portable temperature control system using an Arduino microcontroller integrated with a proportional-integral-derivative (PID) algorithm to address these limitations. The system employs a resistive heating element controlled via pulse width modulation (PWM) and powered through a USB 3.0 interface with a DC-DC boost converter. A Ktype thermocouple provides temperature feedback for closed-loop control. Experimental results demonstrate that the controller maintained the target temperature within  $\pm 2^{\circ}\text{C}$  (65-67°C) for 35 minutes, meeting LAMP requirements. The system

achieved the target temperature in 130 seconds with a maximum power consumption of 2.42 W. This low-cost, portable solution enables field-deployable diagnostic applications with reliable temperature control performance. © 2025 IEEE.

## Author keywords

Arduino Uno; DNA Amplification; LAMP; PID; Temperature Control

## Indexed keywords

### Engineering controlled terms

Computer viruses; Controllers; DC-DC converters; Electric inverters; Electric lamps; Portable equipment; Proportional control systems; Pulse width modulation; Thermocouples; Three term control systems; Two term control systems; Viruses

### Engineering uncontrolled terms

Arduino uno; Controlled temperature; DNA amplification; Loop mediated isothermal amplifications; Loop-mediated isothermal amplifications; Portable system; Proportional integral derivatives; Target temperature; Temperature system; Virus detection

### Engineering main heading

Temperature control

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Indexed keywords

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