

THERMASURE
MEASURE WITH CONFIDENCE

Thermal Reference Point Device

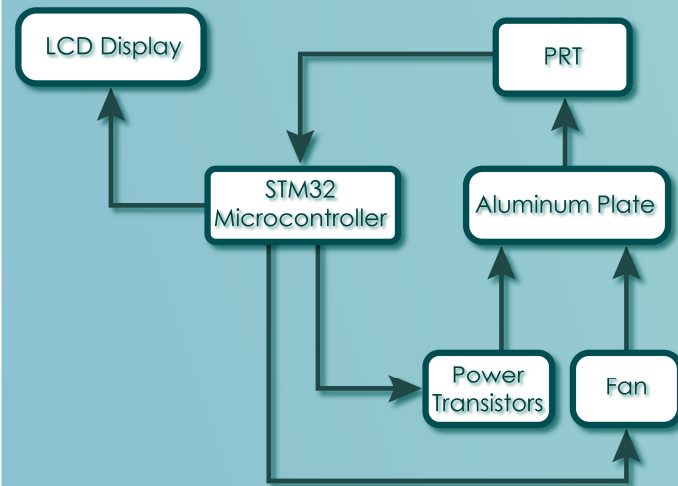
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Background

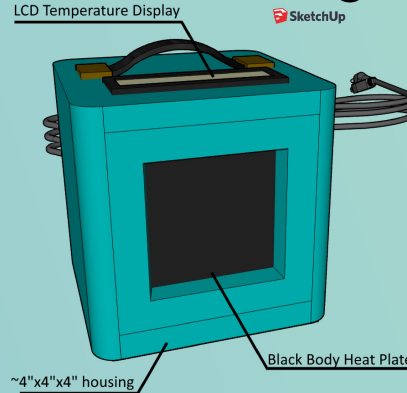
Non-contact optical thermometers are becoming increasingly important for both doctor's offices and at home use. However, these devices lose accuracy over time and can be inaccurate to up to ± 0.5 degrees Celsius. These inaccuracies in a thermometer can potentially lead to a fever being misdiagnosed, which is often a symptom of a more serious, underlying disease. Our device serves as a simple and affordable way to test the accuracy of a thermometer.

Project Overview

The Thermasure is a small heating plate that acts as a temperature reference point device for optical thermometers. A microcontroller is used to maintain the plate at a stable and uniform temperature. The temperature set point is at 40 degrees celsius to emulate the temperature of a high fever.



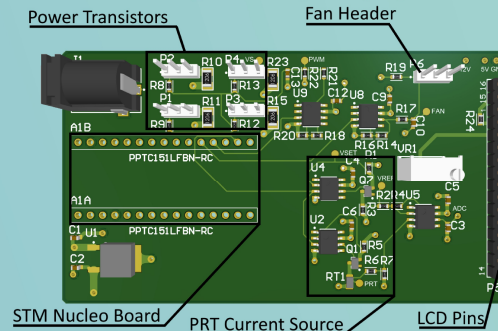
Product Design



Hardware

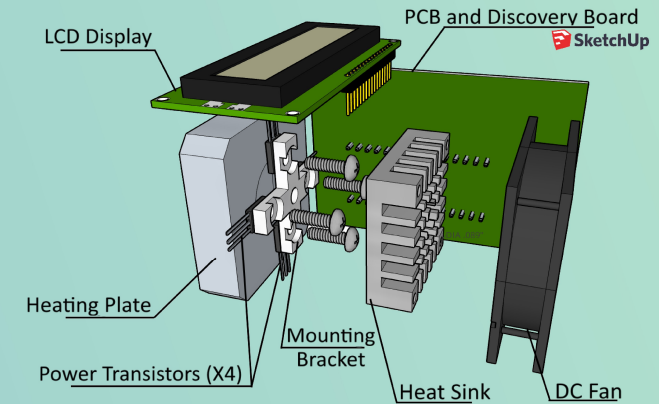
- STM32 Nucleo Board(L301k6):
 - 12 bit ADC for measuring PRT voltage
 - PWM capabilities for driving power transistors
 - Data pins for LCD to display temperature to the user
- Platinum Resistance Thermometer
 - Embedded inside aluminum plate
 - Stable resistance over a wide range of temperatures
 - Linear change in resistance with temperature change
- IRF540 NFETs
 - Physically mounted on aluminum plate
 - NETs will turn on and off to heat up the plate

PCB Render



Results

The device can heat up to the desired temperature in under one minute. Readings are stable well within 0.1°C when the reference point is set to 40°C . Accuracy is improved through noise reducing circuitry and a moving average filter. The PCB Dimensions are $2.5''\times 3.5''$ so they are compact enough to fit into a $4''\times 4''\times 4''$ housing, making an easy, light, and portable product. Pictured below is an exploded view of what the inside of the housing looks like.



Future Improvements

- Integration of the ARM cortex chip rather than the Nucleo board
 - Smaller PCB footprint as well as cost reduction
- More reactive PID controls to make response times faster
 - Faster heat up time as well as increased stability at the set point
- Implement a programmable reference temperature for a wide range of applications
 - To be set anywhere between 40°C and 70°C