



ENLIGHTEN THE UNSEEN

EOI/UCSB 2021-2022 Capstone Project Proposal

Low cost, Non-Contact Infrared Reference for Hand Held Thermometers

Decisions are made every day in Industry and in Doctors' offices using inexpensive non-contact thermometers, but how close are these devices' readings to the true temperature? This project will create a commercially viable reference to perform quick checks for low-cost thermometers.

Company and Personnel Background

Electro Optical Industries (EOI) was founded in Santa Barbara 55 years ago. We are a long-standing company both in the Santa Barbara area and in the Optics Industry. We design and manufacture optical test equipment for all camera and sensor applications from UV and Visible to Infrared. EOI was instrumental in the development of the Infrared Detector industry in Goleta by supplying the first commercially available blackbody infrared sources. Now we supply precision photonics instrumentation for camera manufacturers on a worldwide basis. We also have a line of Security and Surveillance systems based on Infrared imaging and real time machine vision analysis used to protect people, airports, power plants, and naval ships.

Jefferey Anderson will be the Point of Contact for this project. Jeff is the CEO and Lead Engineer at EOI. He has been in the optics industry for decades; contributing his mastery of subject to each team he works with while building businesses into highly profitable entities. He holds a BS in Electrical Engineering & MS in Optical Sciences from University of Central Florida in addition to an MBA from Pepperdine University.

Product Justification

There are a wide variety of non-contact hand held thermometers used in doctors' offices and industrial settings. Many of these devices are calibrated at the factory and never checked again. This is not an ideal situation for measurements that a decision is based on. Does the patient have a fever or is this circuit board running too hot? This product will provide a low cost, single temperature to check the thermometer's current accuracy. The goal is to provide a low-cost reference that will prevent a child's fever from going untreated or allowing a circuit to fail because of a bad read from a "cheap" thermometer. The customer will learn the bias of the readings from the hand-held thermometer and confidently make decisions using the thermometer reading plus the bias correction.

Project Goal

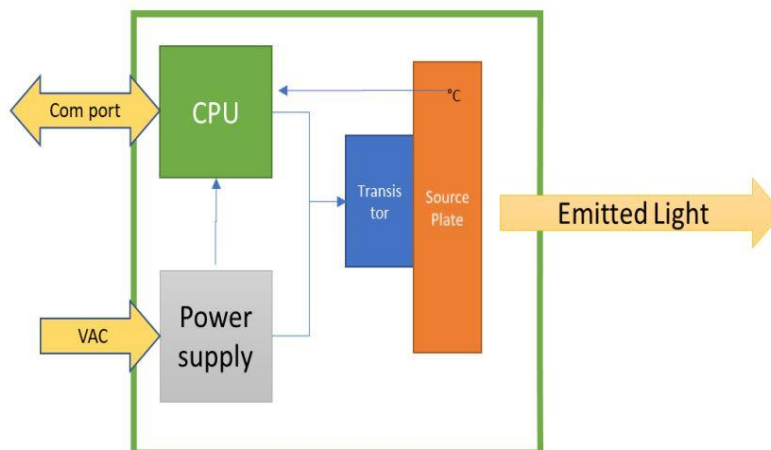
Create a small (3 x 3 in.) IR source that can be set to a single temperature in the range from 0°C to 100°C. The total cost of the parts shall not exceed \$350, lower is better. The heating element is to be a thermoelectric cooler and the thermal sensor will be a platinum resistance thermometer (PRT). The microcontroller shall read signals from the ADC temperature board and will create loop feedback to maintain the temperature setpoint. A user interface will be used to set the temperature from a mobile application and/or the system's display screen.

Design Challenges for the team:

- Create circuitry to accurately read the temperature sensor
- Firmware configuration/Serial Communication protocol
- Network programming
- Developing printed circuit boards for the product
- Closed loop feedback control

Design Challenges to be handled by EOI

- Design of target plane
- Mechanical mounting of the plate
- External packaging and internal insulation for the final product
- Calibration method



Support provided by the sponsor

- Provide emissive source plate and system housing
- Access to EOI's test & measurement equipment
- 1 on 1 mentorship with EOI's Engineering staff
- Calibration reference sources

Project Deliverables

- System verification document and functional printed circuit boards for Winter quarter.
- One fully functioning prototype including software to set temperatures, perform loop control, and external communication to complete the project.
- Costed Bill of Materials (including the sponsor supplied parts)

Ideal Team Makeup

- 2-3 EE and 2-3 CE students
- Ability to develop microcontroller software coding (C++ preferred) with interface to hardware
- PCB design and layout
- Ability to test and troubleshoot system performance

Student Requirements

Team participants must sign a nondisclosure agreement and an invention assignment agreement.

What you will learn doing this project

- Real world closed feedback control
- Custom PCB design skills
- Validation of performance against the product requirements
- Monitoring product cost during each step of the design phase
- Official Engineering documentation
- Integration and debugging skills (microcontroller, circuit design)
- Mobile app development

Point of Contact:

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Final Pitch: EOI is well known among the IR companies in the local area among startups and the much larger companies; this will be good association if you plan to work in the area after graduation.