Testing of Multi-wavelength Temperature Sensors at Low Temperatures

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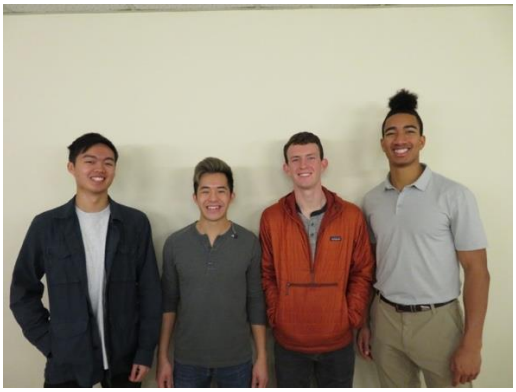
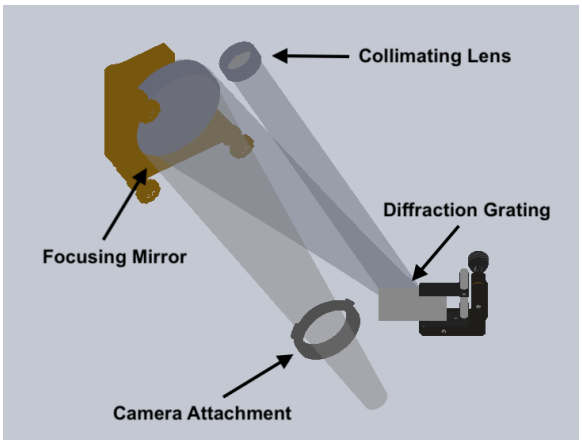


Problem Statement

Design, develop, and experimentally evaluate the feasibility of a multi-wavelength temperature sensor that measures temperature across phase changes more accurately than existing infrared camera technology used in Selective Laser Sintering (SLS) Machines.

Requirements and Constraints

The temperature sensor must measure two Infrared Spectral Wavebands in the Mid-Wave Infrared Region to yield emissivity-independent temperature measurement between 100℃ and 220℃ with a maximum allowable error of 3℃. The sensor must also operate to evaluate the temperature of a 5 mm^2 spot at a measurement distance of at least 350 mm. The temperature sensor design must incorporate a FLIR SC8240 infrared camera for measurements at a minimum frequency of 3 Hz, and is also constrained by a $3000 budget.



Solution

The UTME Sensor group recommends the development of an Infrared Camera attachment operating similarly to a spectrometer to enable highly accurate spectral intensity measurements within the 4-4.5 micron waveband.

Though external conditions prevented our group from actualizing our design, we have developed detailed testing and calibration procedures, as well as mapped future work for the next team.

The recommended calibration procedure uses a blackbody to map the relationship between the ratio of spectral intensities and temperature. This technology can then be verified by heating Nylon 12 on a hot plate, measuring temperature using our device, and then comparing the results to the true temperature.

Lastly, we recommend that the future team modify our sensor design according to experimental constraints and develop software to process intensity measurements from the FLIR SC8240 to yield emissivity-independent temperature measurement.