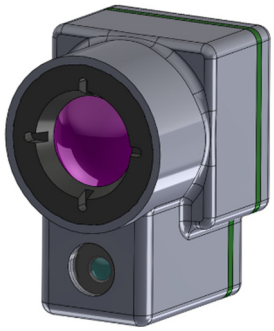
Super Radiometric IR Camera

Background

Infrared (IR) cameras see the world by detecting temperature differences in the scene. They can be used to see in complete darkness and/or to measure the temperature of objects without physical contact. In order to get an accurate temperature reading the sensors must be carefully calibrated and compensated for radiation from objects outside the scene (like the camera itself). Low cost high resolution thermal camera sensors are made from microbolometers that are very sensitive to ambient temperature changes which makes it hard to achieve high radiometric accuracy. A carefully designed and calibrated camera can achieve ±2°C absolute accuracy but more typically they can vary up to ±5°C. On the other hand, spot temperature measurement devices, such as fever thermometers, are made from thermopiles that are much more stable, but harder to make into imaging arrays. Some medical grade thermopiles are specified down to ±0.1°C in narrow temperature ranges.

In this project we take a high-resolution bolometer-based IR camera (FLIR Boson) and combine it with a single pixel thermopile to adjust the readings of the camera and achieve high radiometric accuracy in the whole image. There will be a lot of systems thinking needed to figure out how to align and calibrate the two devices, and software to fuse the sensor data depending on the scene. FLIR can support with mechanical parts for the integrated camera but the team will develop a calibration system and test performance. Algorithms can run on off-the-shelf hardware like a RaspberryPi keeping in mind that it would be integrated on a custom PCB in a final product.



System

- Define and test calibration process for Boson and thermopile alignment
- Define and test methods to combine Boson and thermopile measurements
- Define and track system level requirements and constraints such as high-level architecture, performance, calibration system etc.

Software

- SW to read/write calibration data and read temperature from thermopile
- SW to analyze IR image and determine offset correction based on thermopile reading
- SW to adjust Boson video signal according to calculated correction
- Test SW for hardware and software

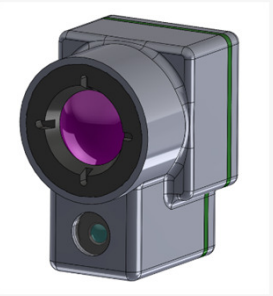
FLIR has a patent pending approach to using a high-resolution bolometer-based IR camera (e.g. FLIR Boson) that is combined with a single pixel thermopile to adjust the readings.

Super-radiometric thermal camera

How to make an IR camera 10x more accurate

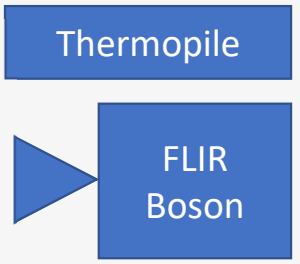
Solution 1 + 1 > 2

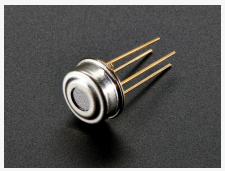
- Image: FLIR Boson Focal Plane Array 640x512
- Temperature: Medical grade 1x1 Thermopile



Challenges

- Sensor fusion between thermopile and IR camera
  - How to match the two data sources?
- Alignment algorithm thermopile and IR camera
  - What are the sensors pointing at?
- What are the corner cases and how to handle them?





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