Thermal Imaging HUD

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Project Proposal

Project Description:

Our team is going to build a thermal imaging device. Our device will use a sensor to obtain a thermal image of the environment and an actuator to display the thermal image. Then we will use lenses to create a virtual image of the thermal image. The device should be able to take a thermal image produced by the sensor and then increase the resolution of the image before being displayed to the actuator.

Our first idea is to create a thermal image using a thermal imaging camera. The thermal imaging camera will transmit the data to a processor where it will preform the task of increasing the resolution of the image before displaying it to an LED display. We want the design to be compact, so it can be worn by the user in the form of glasses. At this point we are still trying to figure out the exact method that we need to use in order to increase the resolution of the image without requiring too much storage space.

Image #1: Example of the virtual image display

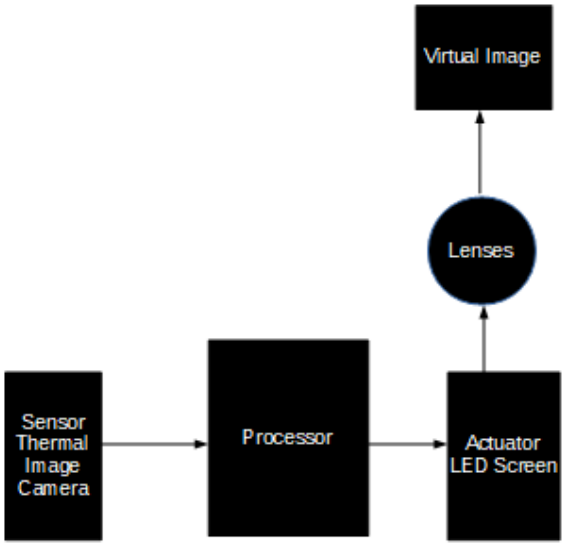

Image #2: Basic dataflow of the Thermal Imaging HUD

Requirements:

- The device must be able to product a real-time thermal image of the environment.
- The device must be compact enough, so that it can be worn in the form of glasses.
- The resolution must be clear enough to analyze the thermal image.

Deliverables:

- One working prototype of a thermal imaging HUD.

Product Design Specifications

Needs:

Our team has decided to create a device that will display thermal images in real-time for our ECE-411 practicum project. In order to produce a thermal image we will use a thermal imaging camera. Thermal imaging cameras are devices that translate thermal energy into images that can be displayed and analyzed. Thermal imaging technology is currently being used by the military, firefighters, law enforcement, and technicians to name just a few. As most thermal imaging technology costs upwards of $500 our groups' mission is to try to create a thermal imaging device that will be low cost compared to what's currently on the market. This device would be useful for anyone that wants to build a thermal imaging device on a budget. It could be used for fun or tackling problems that involve thermal energy. We believe that we will be successful because of our teams' various engineering backgrounds. Ideally, this project will help us achieve a good grade in this class, look great on a resume and allow us to gain valuable team project development skills. Although we are taking on the risk of failing the class if unsuccessful. The cost will be affordable for a student and be able to be completed in one term (~ 10 weeks). Obtaining a working prototype with a thermal camera, OLED screen, and microprocessor will be our “midterm” and a fully functional final project will be our “final” for the class.

Objectives:

Our objective is to create a thermal imaging device using a thermal imaging camera and screen to display the thermal image. This will be a hands-free device that will display the thermal image to the user of the device as a virtual image. The device will receive input from a thermal camera produced by a thermal image. The thermal image will be processed by the processor in order to increase the resolution of the image and then be outputted to a screen. The screen will produce the image in order for glass lenses to create a virtual image. The device will be portable and compact so the user can wear them as glasses.

Background:

All of the other similar products on the market are more expensive; costing upwards of $500. Many of the devices are expensive because they're used in situations that require extreme reliability. Our device won't require that kind of reliability which allows for the device to be less expensive. This allows for our device to be used by hobbyist on a budget.

Marketing Requirements:

- The device should be compact enough so it can be worn as glasses.
- The device should process the thermal image fast enough to produce a video feed.
- The device should respond to the environment and changes in the environment.
- The device should be cheap to build.
- The device shouldn't cause harm to the user.
- The device should be simple to use.

Constraints:

- Must have at least one input sensor.
- Must have at least one output actuator.
- Must have some kind of digital or analog processor.
- Must have the microprocessor located on the PCB.
- Must be able to fit on a two-layer PCB.
- Must have documentation and use version control.
- Must be published with MIT license.

Engineering Requirements:

Functionality

The device need to refresh an image at a minimum of 10 Hz.
The image need to be viewable from a heads-up lens that is 1 sq. inch.

Performance

The thermal images need to be recognizable from the heads-up display.

Economic

Total parts cost will not exceed $200.

Energy

The device should be able to operate from a battery for at least 2 hours.

Environmental

At least 50% of the devices modular components will be able to be replaced.

Health and Safety

The device shouldn't become hotter than 75° F.

Legal

The project will use a MIT license.
Maintain 10 Hz or less for the thermal camera (export requirement).

Maintainability

Both the actuator and sensor should be easily replaceable on daughter boards.

Manufacturability

PCB should be greater than 2 sq. inches and less than 20 sq. inches.
All the casing for the project will be commercially source-able.

Operational

The device needs to weigh between 1 lb and 5 lbs.
The device should be no more than 100 sq. inches total.

Reliability and Availability

The device should be able to detect thermal images between 1 ft to 20 ft.

Usability

The device can be used in a mobile capacity.