

Project Description

Multispectral Image Capture System

The Sixth Sensor

Jocelyn Ramirez, Javier Hernandez, Yu-Cheol Shin, Jonnathan Terry, Chris Inderweische

Revision History:

Intro:

We will develop a new FLIR product centering around a multi-wavelength image capture system. We will give users the ability to capture a stack of images at different wavelengths with a single shutter click. Four sensors will be used to capture images in the visible light, near-infrared (NIR), short-wavelength infrared (SWIR), and long-wavelength infrared (LWIR) spectrums. We will develop a database to store the images and create a GUI for users to review and manipulate the captured images. We aim to allow users a lot of control over the images within the GUI. Some features we hope to make available are changing the transparency of the images and allowing them to be annotated. Once this basic functionality is complete we will then move onto storing the images on a cloud system, this will allow authorized users to access images from different devices (laptops, PCs, etc.). Agile is the development process being used with the assistance of Trello to manage our workflow.

This product can have many applications, all centering around discovering what cannot be seen by the naked eye. For example, when one has a stroke the left and right side of their face differ in temperature, this asymmetrical behavior cannot be seen with the naked eye but would be captured by a LWIR sensor. Thus, in this situation using our camera system would be advantageous for doctors looking to diagnose a patient as they would be able to clearly see the temperature difference. There are many more possible applications for our product and we hope to discover these different possibilities throughout the development process.

Glossary Terms:

Agile - Philosophy that outlines the most important aspects in product development

Trello - Web application that assists with managing a project's workflow

BitBucket - Web application that assists with managing a project's workflow and documents

Visible - Light wavelengths the naked eye can see

Infrared (IR) - Light wavelengths larger than those in the visible spectrum. Broken into multiple regions. Often used for thermal imaging.

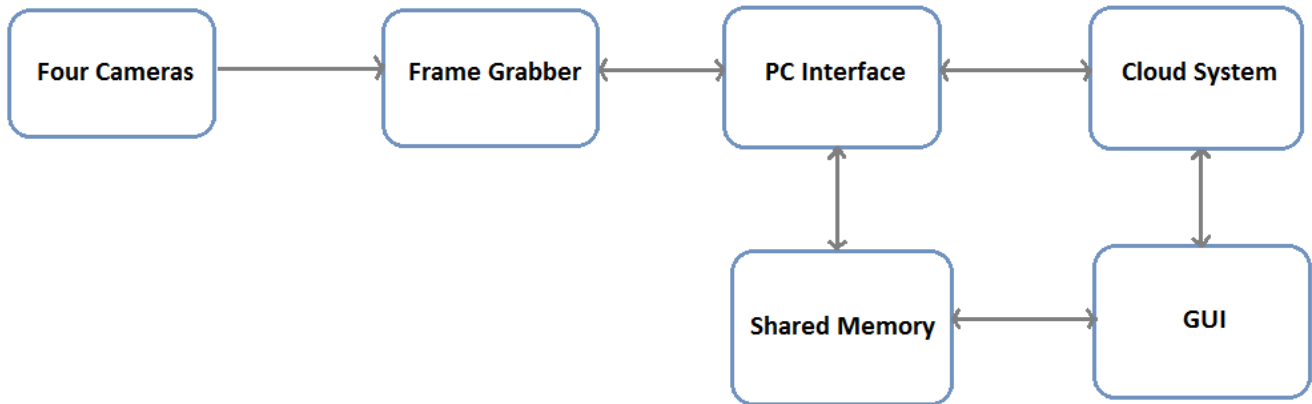
- Long-Wavelength Infrared (LWIR)
- Near-Infrared (NIR)
- Short-Wavelength Infrared (SWIR)

Graphical User Interface (GUI) - Interface between user and electronics

Cloud System - Allows for the outsourcing of computer resources (storage, servers, etc.)

System Architecture Overview

High Level Picture:



Requirements:

Use Cases/User Stories:

GUI Use Cases/User Stories

- As a user, I can see an Image Menu to guide me through the images I took. Test: Ensure the Menu can be seen once images have been taken and analyzed
- As a user, I will be able to press an image from the Image Menu and have it pop up for review. Test: Ensure image pops up and only one image is visible at a time
- As a user, I will be able to zoom in on desired areas of the photo. Test: Ensure that it is possible to zoom into the image
- As a user, I can use a drawing tool to annotate the images, such as being able to draw circles, arrows, etc. Test: Ensure annotation is possible and that a copy of the annotated image is stored.
- As a user, I will be able to create a unique username and password that will allow me to login and access their data. Test: Ensure all users have unique logins, web app can handle multiple log ins at once, and that once logged in their data is available.

Camera System Use Cases/User Stories

- As a user, I can press a button on the camera device, and an image will be captured.
- As a user, I can press a button, and a light will turn on on the front of the system. Test: Press button and verify focus area is lit.
- As a user, I can take a picture, and the camera will auto adjust to the depth. Test: Capture images at different depths and verify focus of images.
- As a user, I can take a single shot, and capture the same image in NWIR, LWIR, NIR, and visible wavelength.

Prototyping Code and Test Cases:

<https://jsyamirez@bitbucket.org/thesixthsensor/multispectral-image-capture-system.git>

Appendices:

Hardware:

FLIR TauSWIR Camera (InGaAs sensor, 640x480 resolution)

FLIR TauLWIR Camera (uncooled micro-bolometer, 640x480 resolution)

Sony DH 960L 1/3" Camera

Matrox Radient eV-CL Frame Grabber

Candescent Lights

Laser Pointers

Software:

Matrox Imaging Library LITE X WIN (Image Acquisition)

Java Play (GUI Implementation)

Matlab (Image Processing)