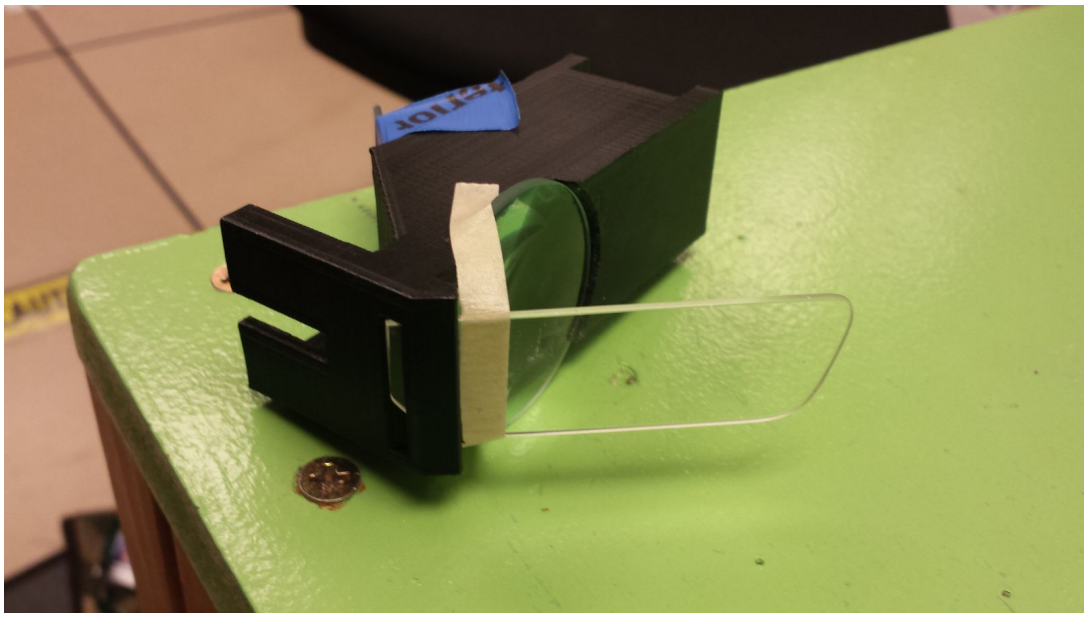
Thermal Imaging HUD



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Document History and Distribution

Revision History:

Revision	Changes	Date
0.1	Initial draft	11/29/2017

Table of Contents

1. Introduction

The Thermal Imaging HUD project is a low cost IR thermal camera device designed to output the environments' thermal temperature to a heads-up-display (HUD). This thermal imaging device is hands free, allowing the user to interact with their environment while still being able to perform complex hands-on tasks. The device continuously reads the ambient temperature of its environment using a IR thermal imaging camera so the user can see real-time temperature data using an OLED display. Problems relating to the environments' ambient temperature can then be observed, trouble-shot, diagnosed and possibly even prevented. This test plan was created to enable the developers of the Thermal Imaging HUD project to quickly and efficiently bring the prototype PCB up to full functionality.

1.1 Objective

This test plan outlines the testing process and also defines each of the individual test cases that will be used to ensure a fully functional prototype is designed. The tests conducted are to be consistent with the Product Design Specification, Revision 1.1, dated 10/17/2017.

1.2 Scope

The objective of this test plan is to safely and efficiently power up the Thermal Imaging HUD prototype board, so that the thermal imaging camera, OLED display, microprocessor and image processing technique can be verified to be operating as expected. The microprocessor will be powered-up and the daughterboards connected (thermal imaging camera and OLED display) onto the prototype board. The software will then be tested in the range of ambient temperatures. The accuracy of the Thermal Imaging HUD's display will be tested against known ambient temperatures to ensure that it meets project specifications. For this version of the test plan the main objective is to have a working prototype consisting of a single board to be demonstrated at 4:30pm on Wednesday, December 6th.

1.3 Testing Strategy

The general strategy for testing is going to be following sequential paths. For circuit testing, this is the current pathway, from where power is put into our board, then following it through essentially in the order current travels through the traces. For structural testing, there is also an order off testing that nicely follows the order of assembly.

1.4 Reference Material

- Thermal Imaging HUD Product Design Specification, Reversion 1.1
- Thermal Imaging HUD Schematic, Reversion 1.1

- Thermal Imaging HUD PCB Layout, Reversion 1.1
- AMG8833 Schematic, Reversion B
- AMG8833 PCB Layout, Reversion B
- Adafruit 94x64 RGB OLED Schematic, Reversion B
- Adafruit 94x64 RGB OLED PCB Layout, Reversion B
- Thermal Imaging HUD Block Diagram

1.5 Definitions and Acronyms

- HUD: Heads-up Display
- PCB: Printed Circuit Board
- OLED: Organic Light-Emitting Diode
- IR: Infrared
- EPL: Electronic Prototype Lab
- PW: Power system testing ID
- CM: IR thermal camera testing ID
- OD: OLED display testing ID
- FP: Final Prototype testing ID

2. Test Items

2.1 Equipment

- Power Supply
- Digital Multimeter
- Object for temperature testing
    - Human (Recognize body temperature)
    - Wall (Ambient temperature of a room)
    - Ice Cube (Lower temperature range)
    - Lighter (Higher temperature range)
- IR laser thermometer

3. Features to be Tested

- Wearability of the HUD device
- Mobility of the HUD device
- Battery power supply
- Battery operation time
- OLED screen isolated functionality
- OLED screen functionality integrated with the prototype
- IR thermal camera isolated functionality

- IR thermal camera functionality integrated with the prototype
- Temperature reading accuracy
- Distance reading accuracy

4. Features not to be Tested

- Operation temperature boundary conditions
- Refresh rate of the OLED screen
- Image alignment of the display

5. Approach

Listed below are each of the test cases with their associated test case IDs. Completed test cases will be included below with generic versions of each test case.

5.1 Test Setup

Most of the necessary test and measurement equipment are available in the EPL. Items need to generate tests for the various temperature ranges (ice, lighter, and IR laser thermometer) will be brought into the EPL by team Thermal Imaging HUD members.

5.2 Component Testing

- Power supply test (ID# PW_00)
- Isolated IR thermal camera test (ID# CM_00)
- Isolated OLED display test (ID# OD_00)
- Battery operation test (ID# PW_01)

Functionality of each component test:

Power supply test: Test the the ability of the power supply unit to charge a LiPo battery. Then test the functionality of the reset bin under operation. Lastly test the voltage of the supply pins on the board.

Isolated IR thermal camera test: Test the basic functionality of the IR thermal camera connected to the microprocessor. This test isolates the IR thermal camera daughter board from the rest of the circuit to make sure it operates as expected before integration.

Isolated OLED display: Test the basic functionality of the OLED display connected to the microprocessor. This test isolates the OLED display daughter board from the rest of the circuit to make sure it operates as expected before integration.

Battery operation test: Test that the operation of circuit with a charged battery to make sure the device functions as expected.

5.3 Integration Testing

- IR camera thermal camera sensor test (ID# CM_01)
- OLED display actuator test (ID# OD_01)
- Wearability/Mobility device test (ID# FP_00)
- IR temperature sensor range test (ID# CM_02)
- IR temperature sensor distance test (ID# CM_03)

Functionality of each integration test:

IR camera thermal camera sensor test: Test the basic functionality of the IR camera thermal camera sensor once integrated with the final prototype.

OLED display actuator test: Test the basic functionality of the OLED display actuator once integrated with the final prototype.

Wearability/Mobility device test: Test the comfortability of wearing the device for long periods of time. Also make sure the device is compact enough to be comfortable when being warn by the user.

IR temperature sensor range test: Test the accuracy of the measured temperature range of the device. This test will require a live human body, a wall in a room, a ice cube, and a lighter for the various temperatures under test.

IR temperature sensor distance test: Test the accuracy of objects at a distance of the measured temperature of the device. This test will require live human body at various distances from the device.

5.4 Completed test cases

Test Writer		Eric Ruhl				
Test Case Name		Charge Circuit			Test ID	PW_00
Description		Measure Power input cutoff regions to battery from micro USB			Type	Black Box X White Box
Test Information						
Name of Tester					Date	
Relevant Version #					Time	
Setup		With the switch in the ON position, plug the micro USB adapter into the micro USB port on the power board. Set the power supply to output 5 volts and set the current limit to 10 mA. While the power supply is in current view mode, connect the power supply to the leads of the micro USB adapter, and slowly bring the current limit up. Attach the multi-meter leads to the capacitor.				
Additional Equipment		Voltage Controlled, Current limited Power supply Multi-meter Bare Wire to Micro USB adapter 100 nF Capacitor with battery port connector				
Stage	**Operation**	**Expectation**	**P**	**F**	**/**	**Comment**
1	Look at the multi-meter	There will be a non-zero voltage reading				
2	Wait	The chip will not be smoking				
3	Look at the multi-meter	The voltage reading has gone up slightly				
Overall Results						

Test Writer		Eric Ruhl				
Test Case Name		Mobility			Test ID	FP_00
Description		Long term continuous use			Type	Black Box X White Box
Test Information						
Name of Tester					Date	
Relevant Version #					Time	
Setup		Attach the optical apparatus to some form of wearable structure.				
Additional Equipment		Wearable structure				
Stage	**Operation**	**Expectation**	**P**	**F**	**/**	**Comment**
1	Don the apparatus	It will stay on your head				
2	Go about your business	There are no notable points of discomfort				
3	Remove apparatus	There are no visible marks left behind by the device				
Overall Results						