DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON

SYSTEM REQUIREMENTS SPECIFICATION
CSE 4316: SENIOR DESIGN I
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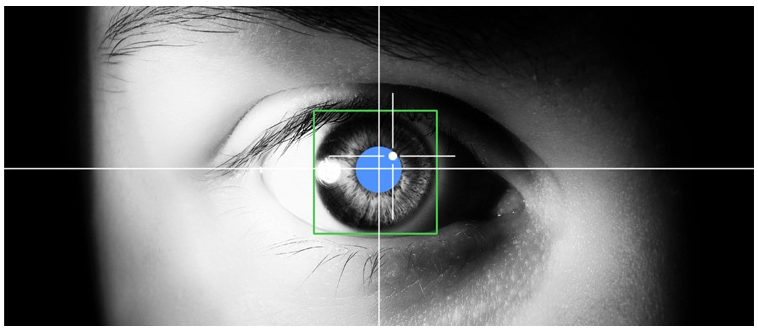

OPTIFIND
EYE TRACKER

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Revision History

Revision	Date	Author(s)	Description
0.1	10.28.2015	KB, JT	Document Creation
0.2	04.22.2016	JT	Update Jetson TK-1
0.2	04.25.2016	FDN, JT	Update Jetson TK-1 & Raspberry Pi 3

CONTENTS

List of Figures

1 PRODUCT CONCEPT

A cost effective, accurate, modern looking, and powerful eye tracking system is to be built. Its ultimate application would be helping people living with disabilities such as ALS.

1.1 PURPOSE AND USE

It should accurately track the pupil movement of the user using various computer vision algorithms.

1.2 INTENDED AUDIENCE

People with ALS, hospitals, Virtual Reality enthusiasts

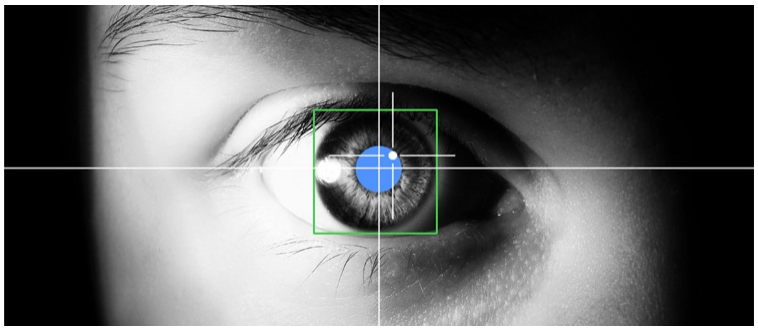

Figure 1: X conceptual drawing

2 PRODUCT DESCRIPTION

2.1 FEATURES & FUNCTIONS

The main function of the product will be to keep track of the eye pupil, and will accomplish this using a combination of the Raspberry Pi 3 to pull the camera data and the Jetson TK1 to process the images and track the pupil.

2.2 EXTERNAL INPUTS & OUTPUTS

There will be no external data processed by the product. The only output from our product will be what the camera is seeing and the position of the pupil in the image.

2.3 PRODUCT INTERFACES

A simple user interface may be implemented depending on the availabilty of time.

3 CUSTOMER REQUIREMENTS

The Eye Tracker shall meet all of the following requirements for the intended audience.

3.1 FEELING

3.1.1 DESCRIPTION:

The eyewear may be comfortable

3.1.2 SOURCE:

Dr. McMurrough

3.1.3 CONSTRAINTS:

A comfortable feeling is subjective.

3.1.4 STANDARDS:

None

3.1.5 PRIORITY:

High

3.2 PRICING

3.2.1 DESCRIPTION:

The system shall be affordable compared to competition.

3.2.2 SOURCE:

Dr. McMurrough

3.2.3 CONSTRAINTS:

The cumlative cost of the parts used to create the product.

3.2.4 STANDARDS:

None

3.2.5 PRIORITY:

High

3.3 PORTABILITY

3.3.1 DESCRIPTION:

The system shall be portable.

3.3.2 SOURCE:

Dr. McMurrough

3.3.3 CONSTRAINTS:

The size of the parts used to make the product.

3.3.4 STANDARDS:

None

3.3.5 PRIORITY:

Moderate

3.4 PERCEPTION

3.4.1 DESCRIPTION:

The system shall operate in real time.

3.4.2 SOURCE:

Fernando Do Nascimento

3.4.3 CONSTRAINTS:

Jetson TK-1 processing speed (CPU & GPU), VLC streaming latency, and the ethernet connection speed.

3.4.4 STANDARDS:

UDP/TCP/IP

3.4.5 PRIORITY:

High

4 PACKAGING REQUIREMENTS

The following items shall describe the packaging and what will be included with the product upon delivery. These requirements have potential to change over time, but all items included will have a purpose and be necessary to the functionality of the Eye Tracker.

4.1 EYE-WEAR

4.1.1 DESCRIPTION:

The product shall provide eyewear or goggles to operate the device

4.1.2 SOURCE:

Fernando Do Nascimento

4.1.3 CONSTRAINTS:

The eyewear may not be comfortable for all users to use

4.1.4 STANDARDS:

None

4.1.5 PRIORITY:

Critical

4.2 CABLES

4.2.1 DESCRIPTION:

The product shall provide all the necessary cables (USB, Power, etc) for the user to operate the Eye Tracker.

4.2.2 SOURCE:

Fernando Do Nascimneto

4.2.3 CONSTRAINTS:

The length of the cables may not meet the needs of the customer and the power cable will only be compatible with U.S. Power Standards (110V 120V)

4.2.4 STANDARDS:

United States Voltage Standards.

4.2.5 PRIORITY:

High

4.3 CAMERA

4.3.1 DESCRIPTION:

The product shall provide the user with a camera mounted to the eyewear.

4.3.2 SOURCE:

Fernando Do Nascimento

4.3.3 CONSTRAINTS:

The camera shall only be a MIPI camera module.

4.3.4 STANDARDS:

None

4.3.5 PRIORITY:

Critical

4.4 PROTECTIVE CASE

4.4.1 DESCRIPTION:

The product may be enclosed in a case in order to protect the item from water and dust.

4.4.2 SOURCE:

Fernando Do Nascimento

4.4.3 CONSTRAINTS:

Provide a case that will protect the device, but also provide the ventilation necessary to prevent

4.4.4 STANDARDS:

IP55

4.4.5 PRIORITY:

Moderate

4.5 EYEWEAR SAFETY CORD

4.5.1 DESCRIPTION:

The eyewear may come with a safety cord.

4.5.2 SOURCE:

Fernando Do Nascimento

4.5.3 CONSTRAINTS:

The safety cord may not be convenient for the customer to use.

4.5.4 STANDARDS:

None

4.5.5 PRIORITY:

Low

4.6 MANUALS

4.6.1 DESCRIPTION:

The product shall include all the instruction manuals that properly explains how to operate the Eye Tracker and how to install all the necessary software.

4.6.2 SOURCE:

Fernando Do Nascimento

4.6.3 CONSTRAINTS:

The customer must have a PDF document reader in order to access the manuals.

4.6.4 STANDARDS:

None

4.6.5 PRIORITY:

Moderate

4.7 SOFTWARE

4.7.1 DESCRIPTION:

The product shall provide the necessary software for the customer to operate the Eye Tracker.

4.7.2 SOURCE:

Fernando Do Nascimento

4.7.3 CONSTRAINTS:

The software is compatible with Linux OS, MAC OS X, and Windows OS.

4.7.4 STANDARDS:

None

4.7.5 PRIORITY:

Moderate

5 PERFORMANCE REQUIREMENTS

The following items describes the requirements for performance that are necessary for the Eye Tracker to perform at a more than acceptable level for extended periods of time, and with a reasonable product life.

5.1 REAL TIME COMPUTATION

5.1.1 DESCRIPTION:

The system shall operate in real time.

5.1.2 SOURCE:

Fernando Do Nascimento

5.1.3 CONSTRAINTS:

Jetson TK-1 processing speed. VLC streaming latency, and Raspberry Pi CPU speed.

5.1.4 STANDARDS:

UDP/TCP/IP

5.1.5 PRIORITY:

High

5.2 PIXEL AND FRAME RATES

5.2.1 DESCRIPTION:

The system shall operate at 60fps.

5.2.2 SOURCE:

Joseph Trinh

5.2.3 CONSTRAINTS:

The camera used in the project.

5.2.4 STANDARDS:

None

5.2.5 PRIORITY:

High

5.3 MINIMUM PIXEL AND FRAME RATES

5.3.1 DESCRIPTION:

The system may have a minimum of 30fps.

5.3.2 SOURCE:

Dr. McMurrough

5.3.3 CONSTRAINTS:

The camera used in the project.

5.3.4 STANDARDS:

None

5.3.5 PRIORITY:

Moderate

5.4 DATA STORAGE

5.4.1 DESCRIPTION:

The system may store the information read by the eye tracker on the eMMC of the Jetson TK1

5.4.2 SOURCE:

Fernando Do Nascimento

5.4.3 CONSTRAINTS:

The storage size of the eMMC.

5.4.4 STANDARDS:

None

5.4.5 PRIORITY:

Moderate

5.5 STORAGE OVERFLOW COMPENSATION

5.5.1 DESCRIPTION:

When the eMMC is full, the system may overwrite the data on the eMMC.

5.5.2 SOURCE:

Fernando Do Nascimento

5.5.3 CONSTRAINTS:

The programming of this function.

5.5.4 STANDARDS:

None

5.5.5 PRIORITY:

Moderate

5.6 CAMERA MODULE COMPATIBILITY

5.6.1 DESCRIPTION:

The system shall be compatible with a variety of camera modules.

5.6.2 SOURCE:

Fernando Do Nascimento

5.6.3 CONSTRAINTS:

The camera must have MIPI specifications.

5.6.4 STANDARDS:

MIPI

5.6.5 PRIORITY:

Moderate

5.7 USB CONTROLLER COMPATABILITY

5.7.1 DESCRIPTION:

The system shall be compatible with a Jetson TK1 controller.

5.7.2 SOURCE:

Fernando Do Nascimento

5.7.3 CONSTRAINTS:

The controller must have the specific interfaces necessary to connect with the rest of the hardware used in the project.

5.7.4 STANDARDS:

MIPI, CSI-2, USB 3.0

5.7.5 PRIORITY:

High

5.8 EYE TRACKING

5.8.1 DESCRIPTION:

The system may track the movement of both eyes.

5.8.2 SOURCE:

Fernando Do Nascimento

5.8.3 CONSTRAINTS:

Acquisition of a second camera module.

5.8.4 STANDARDS:

MIPI

5.8.5 PRIORITY:

Low

5.9 USER INTERFACE (UI)

5.9.1 DESCRIPTION:

The system may have a UI.

5.9.2 SOURCE:

Dr. McMurrough

5.9.3 CONSTRAINTS:

Time required to create the UI.

5.9.4 STANDARDS:

None

5.9.5 PRIORITY:

Low

5.10 PRODUCT USAGE ENVIRONMENT

5.10.1 DESCRIPTION:

The system should work indoors.

5.10.2 SOURCE:

Dr. McMurrough

5.10.3 CONSTRAINTS:

Halogen lights must not be used within the environment.

5.10.4 STANDARDS:

None

5.10.5 PRIORITY:

Moderate

5.11 INTERNATIONAL PROTECTION RATING (IP)

5.11.1 DESCRIPTION:

The system shall adhere to IP code 51.

5.11.2 SOURCE:

Dr. McMurrough

5.11.3 CONSTRAINTS:

The material used to encase the electronic portions of the project.

5.11.4 STANDARDS:

The IP Code

5.11.5 PRIORITY:

Moderate

5.12 INFORMATION ROUTING

5.12.1 DESCRIPTION:

The system shall transfer information via an Ethernet Connection between the Jetson TK-1 & Raspberry Pi 3

5.12.2 SOURCE:

Fernando Do Nascimento

5.12.3 CONSTRAINTS:

Speed of ethernet connectivity

5.12.4 STANDARDS:

Ethernet Cat 5e

5.12.5 PRIORITY:

Moderate

6 SAFETY REQUIREMENTS

The Eye Tracker will provide the necessary protection to the user while operating the system. Since the systems uses numerous electrical components, the user shall be protected from any electrical shocks, short circuit, or any other electrical issue. In order for the Eye Tracker to operate, it needs an IR LED to track the pupil; this system shall only implement IR LEDs that will not cause any harm to the human eye. Finally, the Eye Tracker will provide the necessary protection to the user in case the electronic components begin to overheat.

6.1 HALOGEN LIGHT

6.1.1 DESCRIPTION:

The system shall block Halogen Light.

6.1.2 SOURCE:

Dr. McMurrough

6.1.3 CONSTRAINTS:

Finding the required filter to successfuly block the Halogen Light.

6.1.4 STANDARDS:

None

6.1.5 PRIORITY:

Moderate

6.2 LED

6.2.1 DESCRIPTION:

The IR LED shall not cause any harm to the user.

6.2.2 SOURCE:

Fernando Do Nascimento

6.2.3 CONSTRAINTS:

Use a IR LED between 800mm and 900mm.

6.2.4 STANDARDS:

None

6.2.5 PRIORITY:

Critical

6.3 HEAT PROTECTION

6.3.1 DESCRIPTION:

The user shall not be harm if the Eye Tracker overheats.

6.3.2 SOURCE:

Fernando Do Nascimento

6.3.3 CONSTRAINTS:

Designing and building a protective case for the system.

6.3.4 STANDARDS:

None

6.3.5 PRIORITY:

Critical

6.4 ELECTRICAL SHOCK

6.4.1 DESCRIPTION:

The user shall not be harm if the Eye Tracker has electrical problems.

6.4.2 SOURCE:

Fernando Do Nascimento

6.4.3 CONSTRAINTS:

Providing basic protection and fault protection. Double or reinforced insulation.

6.4.4 STANDARDS:

BS EN 61140

6.4.5 PRIORITY:

Critical

6.5 ULTRA-VIOLET LIGHT

6.5.1 DESCRIPTION:

The user shall not be harm by any UV light.

6.5.2 SOURCE:

Dr. McMurrough

6.5.3 CONSTRAINTS:

Implementing the required filter to block UV light.

6.5.4 STANDARDS:

Enviromental Health & Radiation Safety.

6.5.5 PRIORITY:

Critical

REFERENCES

[1] Kenneth S Rubin. *Essential Scrum: A Practical Guide to the Most Popular Agile Process*. Addison-Wesley Professional, 1st edition, 2012.