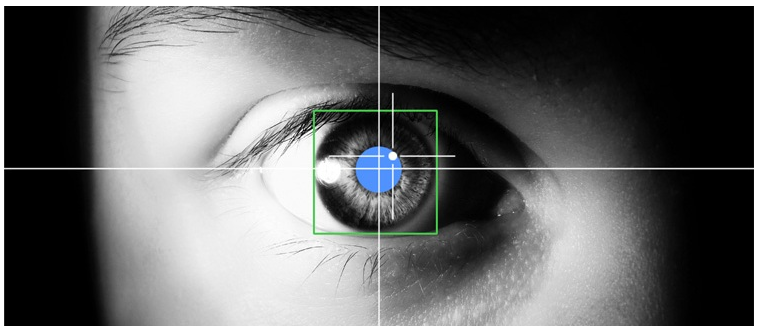
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON

SYSTEM REQUIREMENTS SPECIFICATION
CSE 4316: SENIOR DESIGN I
FALL 2015



EYELLUMINATI
EYE TRACKER

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Revision History

Revision	Date	Author(s)	Description
0.1	10.28.2015	KB, JT	Document Creation

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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

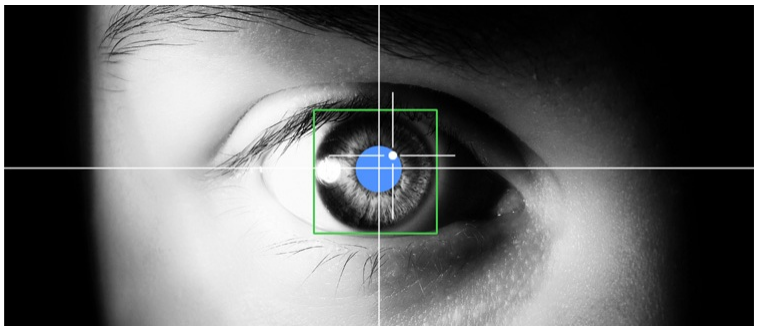

Figure 1: X conceptual drawing

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 Cypress-CX3 MIPI to USB interface board to pull the camera data and the Odroid-XU4 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. Customer requirements are those required features and functions specified for and by the intended audience for this product. This section establishes, clearly and concisely, the Ïook and feelöf the product, what each potential end-user should expect the product do and/or not do. Each requirement specified in this section is associated with a specific customer need that will be satisfied. In general Customer Requirements are the directly observable features and functions of the product that will be encountered by its users. Requirements specified in this section are created with, and must not be changed without, specific agreement of the intended customer/user/sponsor.

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:

Odroid and Cypress processing speed.

3.4.4 STANDARDS:

UDP/TCP/IP

3.4.5 PRIORITY:

High

4 PACKAGING REQUIREMENTS

This paragraph shall describe the pakcaging 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. Include a header paragraph here. Packaging requirements are those requirements that identify how the delivered product will be packaged for delivery to the end-user; or how it will l̈ookẅhen finished and delivered. For example, you might specify that the software required for operation will be pre-loaded on the hard drive, delivered on CD/DVD, or available via download. Software might be customer installable, or not, etc. Hardware components could be all in a single package, provided as a b̈ag of partsẗo be assembled/installed by the user, painted a certain color, logos affixed, etc. Care should be taken not to duplicate requirements found in other sections of this document.

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 lenght of the cables may not meet the needs of the customer and the power cable will only be

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 will only be compatible with Linux OS.

4.7.4 STANDARDS:

None

4.7.5 PRIORITY:

Moderate

5 PERFORMANCE REQUIREMENTS

The following paragraph 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. Include a header paragraph specific to your product here. Performance requirements address items such as: how fast specific critical operations must complete; how long it takes to start/stop activities; how long the battery must last; maximum time it must take to set up; etc.

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:

Odroid and Cypress processing 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 720p 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 640x480 at 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 EEPROM of the Cypress CX3

5.4.2 SOURCE:

Fernando Do Nascimento

5.4.3 CONSTRAINTS:

The storage size of the EEPROM.

5.4.4 STANDARDS:

None

5.4.5 PRIORITY:

Moderate

5.5 STORAGE OVERFLOW COMPENSATION

5.5.1 DESCRIPTION:

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

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 Cypress CX3 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 usb 3.0.

5.12.2 SOURCE:

Fernando Do Nascimento

5.12.3 CONSTRAINTS:

The product's usb controller must use USB 3.0.

5.12.4 STANDARDS:

USB 3.0

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

7 MAINTENANCE & SUPPORT REQUIREMENTS

This paragraph includes all requiremtents that pertain to the maintenance of the product, how software updates will be release, etc. All of these requirements will be implemented following the realease of the initial product. Include a header paragraph specific to your product here. Maintenance and support requirements address items specific to the ongoing maintenance and support of your product after delivery. Think of these requirements as if you were the ones who would be responsible for caring for customers/end user after the product is delivered in its final form and in use ïn the field: What would you require to do this job? Specify items such as: where, how and who must be able to maintain the product to correct errors, hardware failures, etc.; required support/troubleshooting manuals/guides; availability/documentation of source code; related technical documentation that must be available for maintainers; specific/unique tools required for maintenance; specific software/environment required for maintenance; etc.

7.1 Requirement Name

7.1.1 Description

Detailed requirement description...

7.1.2 Source

Source

7.1.3 Constraints

Detailed description of applicable constraints...

7.1.4 Standards

List of applicable standards

7.1.5 Priority

Priority

8 OTHER REQUIREMENTS

The following paragraph lists all other requirements that are unrelated to any other requirements section. Include a header paragraph specific to your product here. In this section specify anything else that is required for the product to be deemed complete. Include requirements related to customer setup and configuration if not specified in a previous requirement. Add any known requirements related to product architecture/design, such as modularity, extensibility (for future enhancements), or adaptation for a specific programming language. Consider requirements such as portability of your source code to various platforms (Windows, Linux, Unix Mac OS, etc.).

8.1 REQUIREMENT NAME

8.1.1 DESCRIPTION

Detailed requirement description...

8.1.2 SOURCE

Source

8.1.3 CONSTRAINTS

Detailed description of applicable constraints...

8.1.4 STANDARDS

List of applicable standards

8.1.5 PRIORITY

Priority

9 FUTURE ITEMS

The following lists all requirements of the highest priority that will not be met for the prototype. In this last section, you will reiterate all requirements that are listed as priority 5. This is repetitive, but necessary as a concise statement of features/functions that were considered/discussed and documented herein, but will NOT be addressed in the prototype version of the product due to constraints of budget, time, skills, technology, feasibility analysis, etc. Use the following format for this section.

9.1 Requirement Name

9.1.1 Description

Detailed requirement description...

9.1.2 Source

Source

9.1.3 Constraints

Detailed description of applicable constraints...

9.1.4 Standards

List of applicable standards

9.1.5 Priority

Priority

REFERENCES

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