
# User Needs & Requirements

## sdMay25-01 "ProJect ELM"

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# ABOUT US

## MASON [SE]

Semantic Segmentation
Optimization

## LINDSEY [SE]

Machine Learning
Eye Detection

## JAMES [CPRE]

Hardware Integration

## ELI [CPRE]

Embedded Systems

# PROJECT OVERVIEW

## OBJECTIVE

Develop a fast an accurate pupil-tracking technology to aid our clients mission of identifying real time medical issues.

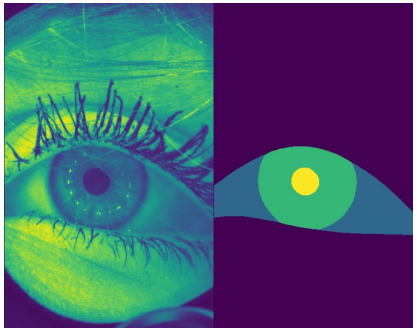
## TARGET AUDIENCE

Our client, wheelchair bound individuals with medical conditions such as cerebral palsy, and their caretakers.

## FEATURES

- Eye Tracking
- Semantic Segmentation
- FPGA Overlay
- Real-time system

# PROJECT OVERVIEW



## Step 1

### Obtain Baseline Metrics

Obtain baseline metrics for latency, accuracy, and FPS from open-sourced model.

## Step 2

### Optimize

Train the ML model and gather more metrics

## Step 3

### Port to FPGA

Use Tensil.ai framework to run the ML model on FPGA

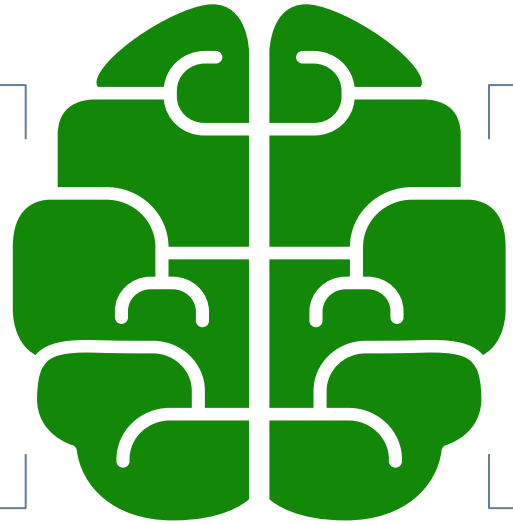
## Step 4

### Run Real-Time System

Camera detects pupil with live video feed.

# PROBLEM STATEMENT

Optimise an FPGA board & software, improving performance and accuracy, in order to help our client make life saving decisions on a real time basis.



# USER NEEDS

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## Wheelchair Users

- Need a way to safely interact with the world because their health and mobility are impaired due to brain development problems or damage.
- Need a way to live life more easily because many unmet challenges exist today.
- Wheelchair-bound individuals need a way to be mobile with minimal effort because many have limited mobility and want to navigate their environment independently.

# USER NEEDS

## Healthcare Workers

- Ability to monitor patient seizure activity in real time
- Must respond to emergencies quickly to prevent further injury.
- Smooth user experience relating to technology
- Provide efficient and accurate care to their patients
- Not invest too much time learning complicated tech.

# USER NEEDS

## Client

- Technical Requirements
  - [NDA] FPS
  - FPGA: Ultra96v2
  - USB Camera
  - Tensil.ai to generate FPGA image
- SdMay25-01 will aid in the handoff process to help future work.
- SdMay25-01 will well-document their work

# REQUIREMENTS

## Technical

- [NDA] FPS
- FPGA: Ultra96v2
- USB Camera
- Tensil.ai to generate FPGA image
- Use PYnq environment
- Use images to train model

## Transition

- SdMay25-01 will aid in the handoff process to help future work.
- SdMay25-01 will well-document their work

## Client: JR

- Low latency
- High accuracy
- Easy handoff to next SrDesign team
- Improve care of wheelchair bound individuals

# ENGINEERING STANDARDS

## IEEE 1016-2009

*Information Technology — System Design - Software Design Descriptions*
This standard covers a documentation standard, which will help towards our handoff requirement.

## ISO/IEC TS 4231:2022

*Information Technology — Artificial Intelligence — Assessment of Machine Learning Classification Performance*
This standard covers methodologies to follow as we work on the Semantic Segmentation.

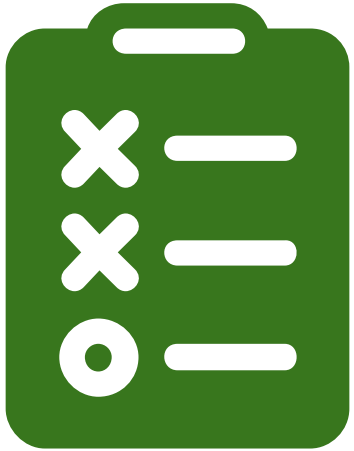
## ISO/IEC 19776-3:2015

*Information Technology — Computer Graphics, Image Processing, and Environmental Data Representation — Extensible 3D (X3D) Encodings Part 3: Compressed Binary Encoding*
This standard covers image processing standards which we can incorporate into our ROI algorithms to locate the eyes.

# CONCLUSION

As a result of our user needs, client preferences, and engineering standards:

- Technical, Client, and Transitional requirements have been compiled
- We plan to develop our project according to these.



# Thanks!

# Any questions?