Project Planning

sdmay25-01 “ProJect ELM”

James Minardi, Eli Ripperda, Lindsey Wessel, Mason Inman

PROBLEM STATEMENT

PROBLEM

- People with **mobility** and **cognitive impairments** face many challenges including maintaining **independence** and **safety**.
- Lack of advanced wheelchair technologies, leaving **gaps in autonomy**, communication, etc.

OUR CLIENT

- Formerly volunteered to help with individuals with cerebral palsy and is motivated to help them further.
- Wants to develop assistive wheelchair tech with features including mobility assistance and real-time seizure detection.

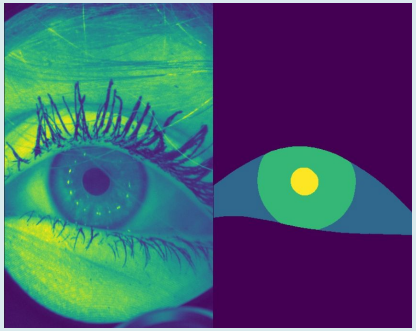
OUR TEAM

- Create a subsystem that detects, locates, and presents info on a user's eye in a camera.

OBJECTIVE

Develop a fast and accurate pupil detection subsystem using machine learning algorithms on an FPGA to support our client's vision of advanced assistive technologies.

PROJECT OVERVIEW

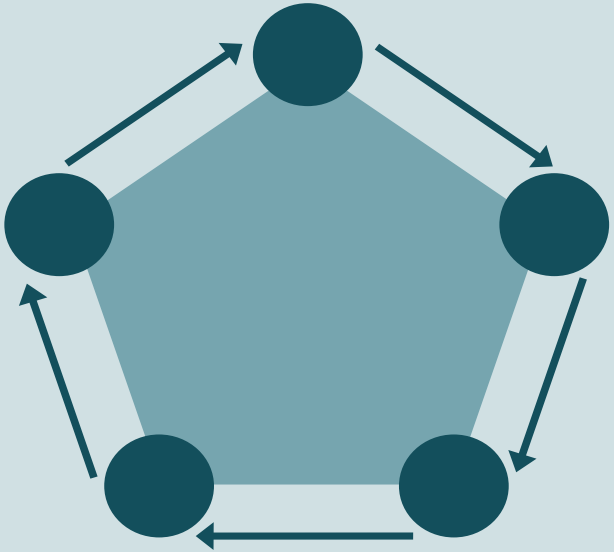


SYSTEMS

- Camera
- Eye location algorithm
- Semantic segmentation ML model
- Ultra96 v2 FPGA
- Display

REQUIREMENTS

- Real-time
- Accurate and performant to [NDA] fps
- Display model outputs and debugging information



PROJECT MANAGEMENT

PROJECT MANAGEMENT STYLE

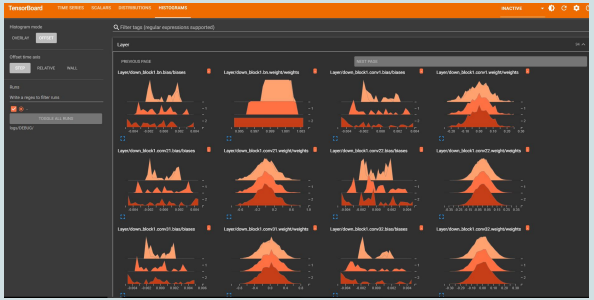
Agile

- ➔ Weekly client, team and advisor meetings.
- ➔ Requirements are flexible and changing per client request.

Waterfall

- ➔ Given a list a requirements at the start.
- ➔ Work sequentially.

MILESTONES



Milestone 1

Obtain Baseline Metrics

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

Milestone 2

Optimize

Train the ML model and gather more metrics.

Milestone 3

Port to FPGA

Use Tensil.ai framework to compile the model onto the FPGA.

Milestone 4

Run Real-Time System

Camera locates eye and detects pupil with live video feed.

GANTT CHART

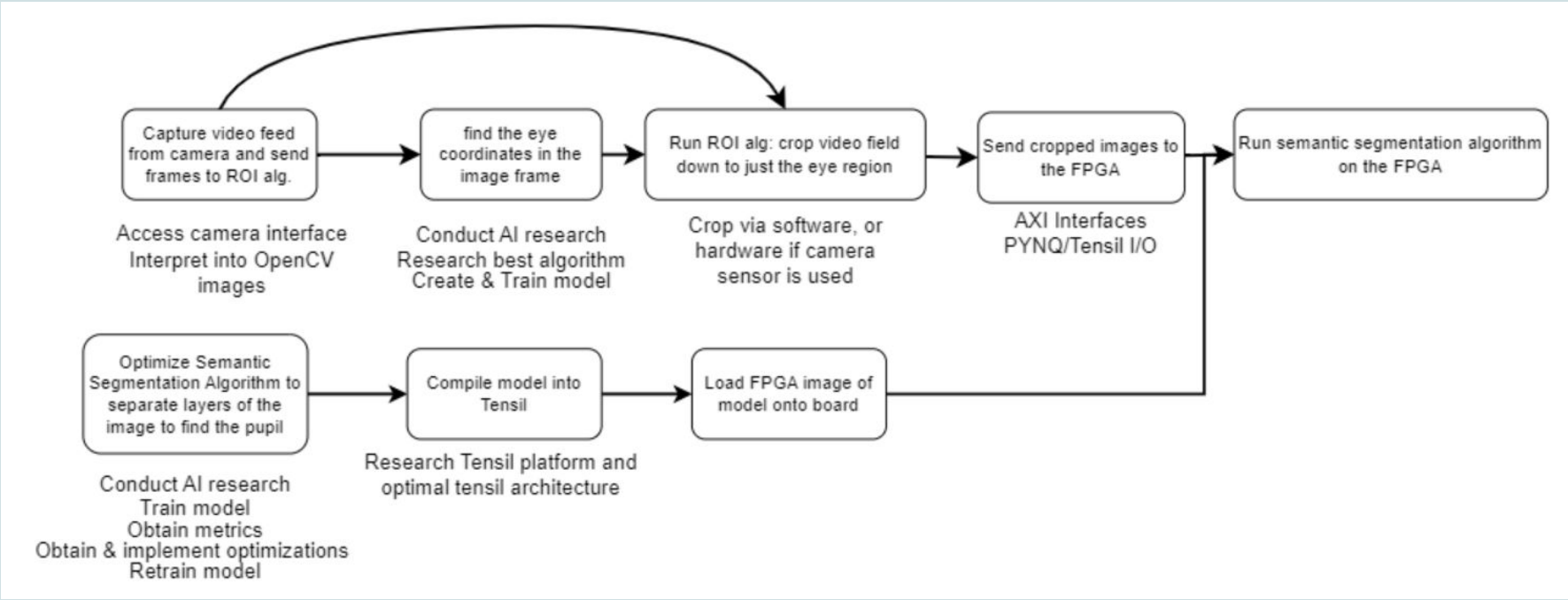
WBS NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE
2	**Run Compiled ML Model on FPGA**			
2.1	Create Compiled ML Model	James	Week 8	Week 11
2.1.1	Research Tensil	Eli	Week 8	Week 8
2.1.2	Make first Compilation	James	Week 9	Week 9
2.1.3	Compile Mason's Model	James	Week 10	Week 10
2.2	Download Model onto FPGA	James	Week 10	Week 11
2.3	Connect & Setup I/O for ML Model	Eli	Week 11	Week 14
2.3.1	Connect & Setup Webcam	Eli	Week 11	Week 12
2.3.2	Understand & Define ML Model Output	James	Week 12	Week 13
2.3.3	Determine How to Display Output	Eli	Week 13	Week 14
2.3.4	Display Output	James	Week 14	Week 15
3	**Region of Interest**			
3.1	Gather Initial Understanding	Lindsey	Week 2	Week 6
3.2	Environment Setup	Lindsey	Week 6	Week 8
3.3	Research	Lindsey	Week 6	Week 14
3.3.1	Compare algorithms	Lindsey	Week 8	Week 14
3.3.2	Test model	Lindsey	Week 11	Week 32
3.3.3	Compare models	Lindsey	Week 12	Week 32
3.4	Create optimized solution with research	Lindsey	Week 17	Week 32
4	**Sementic Segmentation Optimization**	Mason	8/22/24	12/20/24
4.1	Research	Mason	Week 8	Week8
4.2	Environment Setup	Mason	Week 9	Week 10
4.3	Obtain Training Data	Mason	Week 10	Week 10
4.4	Obtain baseline model to put on board	Mason	Week 11	Week 11
4.5	Identify/Research points of optimization	Mason	Week 12	Week 13
4.6	Implement Optimizations	Mason	Week 13	Week 13
4.7	Train model with Optimizations	Mason	SEM 2	SEM 2

PHASE ONE | PHASE TWO | PHASE THREE

WEEK 8 | WEEK 9 | WEEK 10 | WEEK 11 | WEEK 12 | WEEK 13 | WEEK 14 | WEEK 15

M T W R F M T W R F M T W R F M T W R F M T W R F M T W R F M T W R F M T W R F M T W R F

TASK DECOMPOSITION



METRICS & EVALUATION CRITERIA

Metrics

- Test Latency Script (MS)
- Compare to Training Data
- Track FPS

Evaluation Criteria

- Latency
- Accuracy
- Speed

RISKS & MITIGATION

HAND OFF (to us)

Often openly communicate with prior teams about their status (accomplishments, changes, and struggles).

SYSTEM INTEGRATION

Start integration & module testing early often.
Use our resources for help.
Document system communication (how each subsystem team communicates with each other).

HAND OFF (from us)

Communicate (research slides, good documentation) .

CONCLUSION

As a result

of our given problem and project management strategies

We will

Increase the performance of an existing FPGA system

To achieve

Throughput high enough to make real-time decisions.

Linking to Our Client's Problem

This increase in data throughput will supplement our client's system, unlocking the ability to predict when end-users might have health-affecting events such as a seizure.

Thanks!

Any questions?