Design Check-In

sdmay25-01 "ProJect ELM"

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PROBLEM STATEMENT

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- 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.
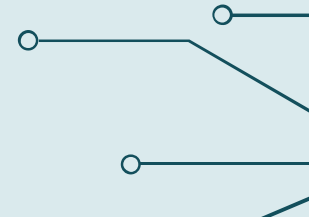
OUR TEAM

- 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.
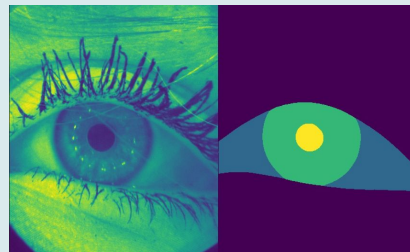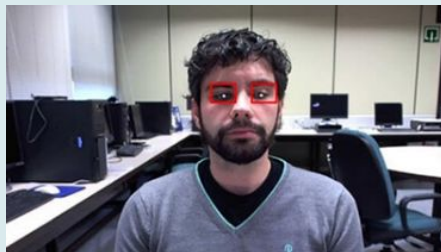
PROJECT OVERVIEW

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

DESIGN CHECK-IN

HUMAN COMPONENT

USER NEEDS

Wheelchair Users

- Higher FPS helps accurately track saccade (fast) eye movements.

Healthcare Workers

- Assistive technology results in better care of patients.

Our Client

- Sub-System optimizations directly meet requirements.

ECONOMIC COMPONENT

PROS

- Build off existing codebase
- Well documented Frameworks
- High Speed Processing

CONS

- Tradeoff of data loss
- Hardware limitations
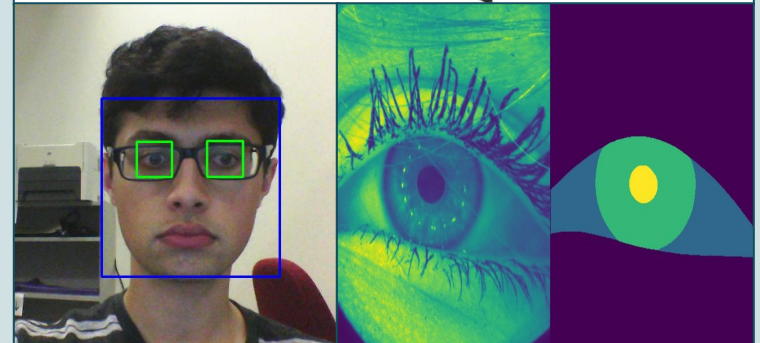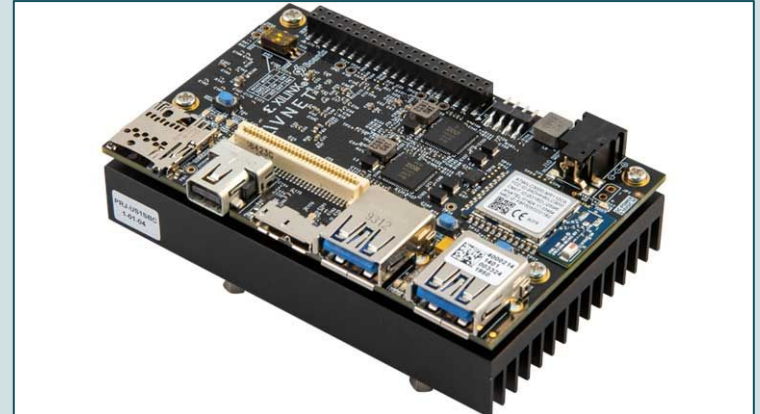
TECHNICAL COMPONENT

ULTRA96v2

- Integrated system into FPGA board.

COMPUTER VISION

- Utilizing real-time eye-location with OpenCV

MACHINE LEARNING

- A trained CNN will be used for pupil detection.

CONCLUSION

As a result

of our given problem and current components of our project

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?