Design Check-In

sdmay25-01 “ProJect ELM”

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SDMay25_01

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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.

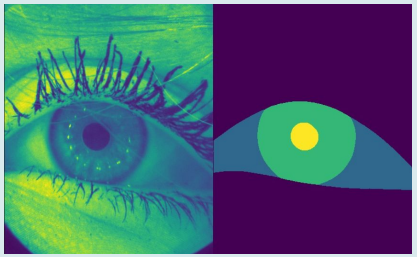
PROJECT OVERVIEW

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



Ethics

Responsibilities: Work Competence

Relevance

- Our team is the 22nd Sr Design team to contribute to this project – all Sr Design teams have worked with the same client.
- We want the client's support to continue
- We want to add value to our clients project

Team's Approach

- Open communication

  weekly standups, deliver status, challenges, and forward plan
- Weekly deliverables to maintain consistent progress

Ethical & Professional

- Maintain expectations through communicating struggles, successes, and goals
- Make valuable contributions to the project and team
- Plan and accomplish goals in a timely manner

Area To Improve: Communication

RELEVANCE

- Important for a multi-team and multi-year project to ensure smooth handoffs
- Important to stay consistent with the client's vision

OUR APPROACH

- Participate in weekly meetings between client, advisors, and the team
- Update documentation when new information is learned
- Gaps in understanding long-term goals and specific implementation decisions

IMPROVEMENT

- Continuously check in with the client to clarify evolving expectations and confirm alignment on deliverables
- Adopt a collaborative task board to visualize responsibilities and priorities

Broader Context Principles Chart

	Beneficence	Nonmaleficence	Respect for Autonomy	Justice
Public health, safety, welfare	Enhance user safety	Avoid false positives that harm users	Enable use control with accessible interfaces	Provide equal access to assistive technology
Global, cultural, societal	Increase accessibility for wheelchair-bound individuals	Avoid cultural insensitivity	Respect diverse user needs and preferences	Address unfairness in assistive technologies
Environmental	Use energy-efficient hardware	Avoid waste by upgrading existing wheelchairs	Respect environmental regulations	Ensure fair distribution of resources
Economic	Develop a cost effective solution	Avoid unnecessary expenses for users	Give users cost effective design tailored to their needs	Avoid financial barriers to assistive technology

Ethical Concerns

Bias

- Will the ROI algorithm have unintentional ethnicity bias?
- Training data must be diverse.

Liability

- Our system in the long-term may be used to determine life saving decisions.
- We must produce and be confident on the metrics we present.

Contextual Limitation

- How will the system's performance (accuracy) be impacted in non-ideal environments?
- Thoroughly test sub-systems in different environments.

OUR VIRTUES

SDMay25-01 highly values honesty through work and communication.

CONCLUSION

As a result

of our given problem and ethical considerations 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?