Lightning Talks

Week 2: User Needs & Requirements

Project Overview

- We will be developing a video pipeline from a MIPI-connected COTS camera module to a video monitor
- The MIPI video data will be sent through a custom FPGA-based video pipeline
- The augmented video will be sent to a monitor connected via an active displayport cable
- The software will execute within a Linux operating system
- STRETCH GOAL: Video may be passed into a machine learning algorithm and the output of the ML algorithm will be used to augment the video sent to the monitor

User Needs

- Ethyl needs a way to consistently navigate and perform her daily tasks without risk of injury or fatigue because she has limited fine motor skills due to her disability.

- Nurse Jackie needs a more effective and efficient way of taking care of their patients that is easy to learn so that they can have more time to take care of multiple patients at the same time.

- Elon needs a device that easily processes video data for machine learning applications because he wants to create an innovative product.

Function Requirements

Functional

- The product will compute machine learning in real-time
- Software that routes data will use a Linux image
- The product will use C and Python code
- The product will need to work in a variety of lighting conditions

Resource

- The product will require a 12V power input

Physical

- The product will use a Sony IMX219PQH5-C image sensor
- The product will use an Ultra96-v2 FPGA board
- The product will utilize off-the-shelf and open source components

User experiential

- Output is sent through mini DisplayPort

Environmental

- The product will take a video feed as input from the image sensor
- The product will need to withstand wear and tear from normal weather conditions
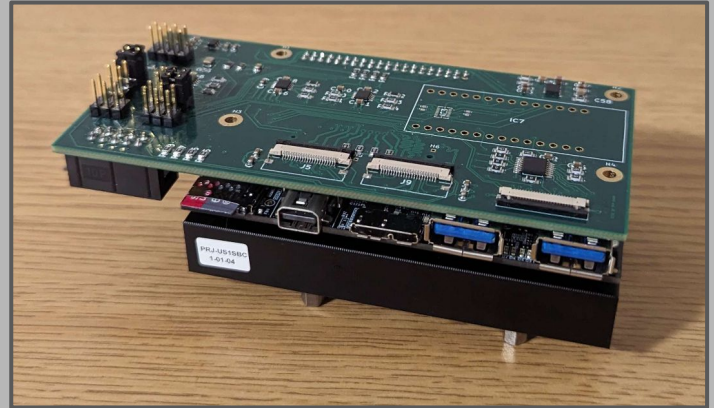
Important Requirements

Product is durable, consistent, reliable and should:

- Function in a variety of lighting conditions

- Withstand wear and tear from normal weather conditions

The product should reliably aid in communication and navigation and must:

- Compute machine learning in real time

Engineering Standards

- The video stream from the image sensor will be sent to a MIPI controller for conversion before being sent to the Ultra96-v2 FPGA board.
    - IEEE MIPI standards: https://standards.ieee.org/ieee/2977/10543/

- I2C protocol
    - https://ieeexplore.ieee.org/document/4762946

- For wifi connectivity
    - https://standards.ieee.org/ieee/802.11/5536/

Conclusion

This product implements a video pipeline for computer vision system in C and Python code working on a Linux image. The hardware is off the shelf commonly available components and sensors designed with a focus in aiding disabled or injured users, however there are many other applications outside of this area of focus.