Material Sorter

Presenters:

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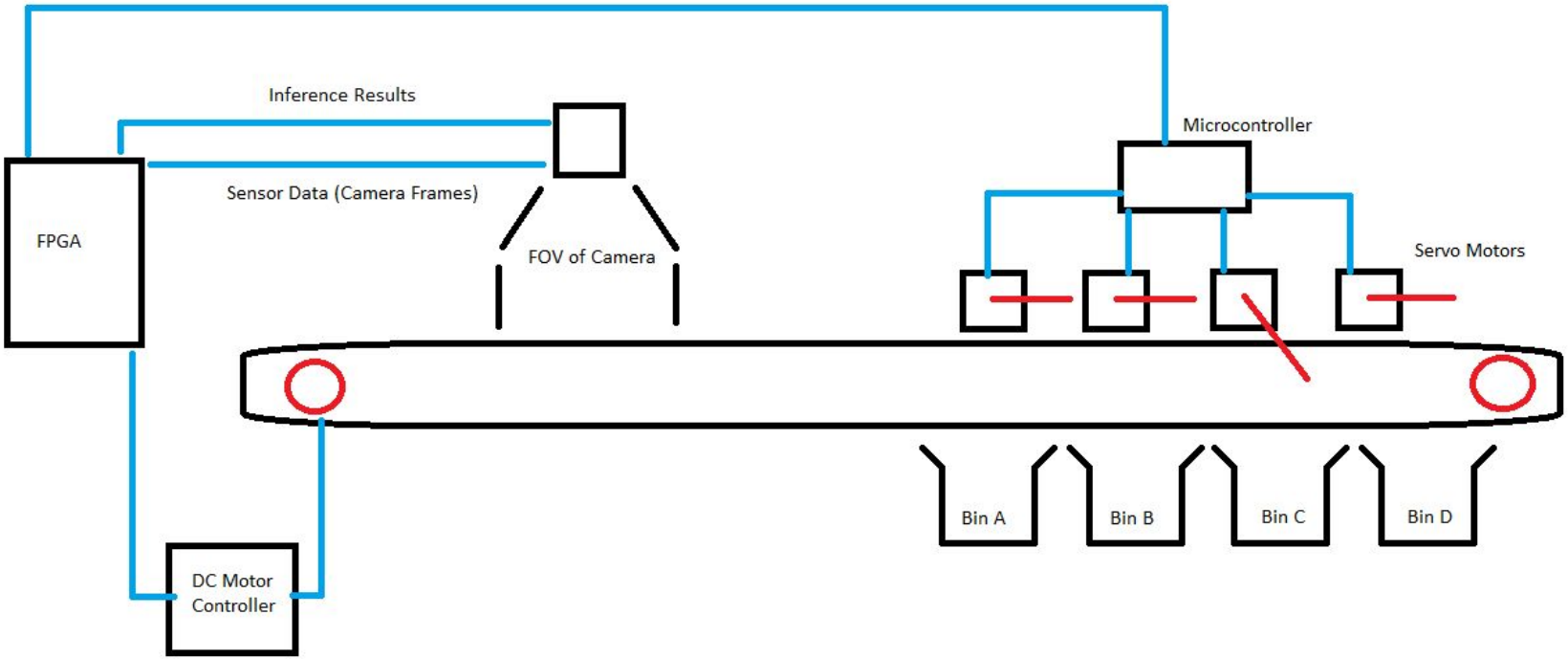
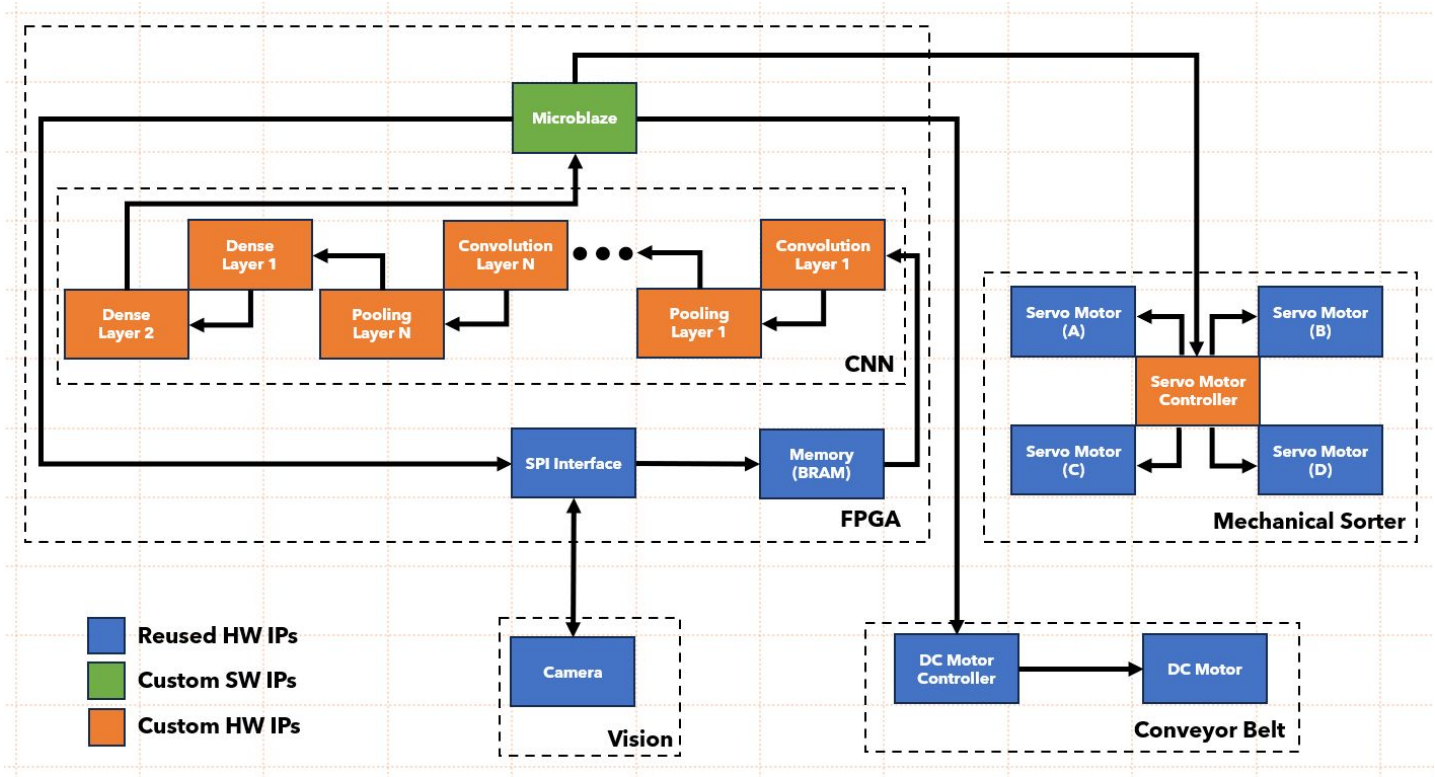
What is material sorting?

Project Description



Block Diagram



Project Complexity

Hardware Components

- DC motor controller
- Servos
- GPIO for servo control
- SPI camera input

Sub-total: **1.6 pts**

Neural Network

- Training model using PyTorch
- Creating custom IP using Verilog or HLS

Sub-total: **2.5pts**

Total: **4.1 pts**

Milestones

Milestone 1

Conduct research on ML for FPGAs. Research and purchase the required components

Milestone 3

Get the camera working and gather training data. Establish PWM controls for motor servos

Milestone 5 - Mid Demo

Design the camera mounting system. Connect the motor controller to the FPGA

Milestone 7 - Final Demo

Clean up and enhance the design aesthetics - time permitting. Plan and rehearse for the final demonstration

Milestone 2

Get the conveyor belt working. Experiment with a toy ML model to run on the FPGA. Start the coding of the actual model in Python

Milestone 4

Begin porting the actual model to the FPGA. Engage in debugging and testing to prepare for the demonstration

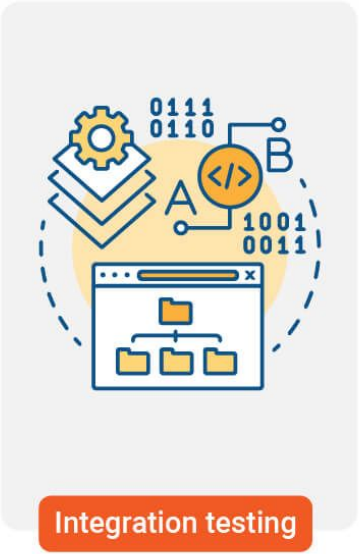
Milestone 6

Integrate all components. Test CNN inference with various objects on the conveyor belt

Testing and Integration

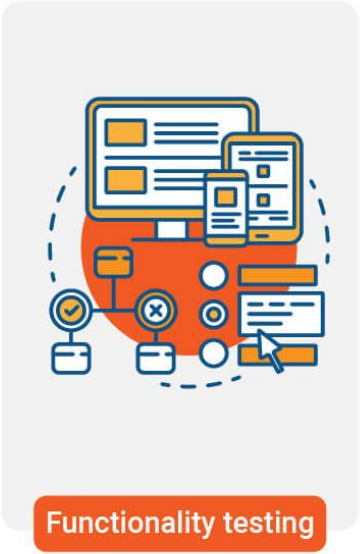
Unit testing

Camera works individually



Integration testing

CNN can provide an inference based on the image from the camera



Functionality testing

Plastic bottle gets sorted into the plastic bin

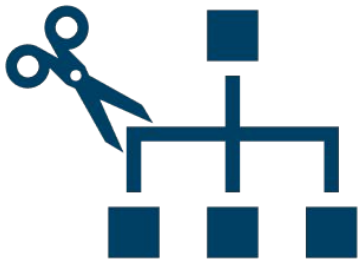
Uncertainties

Neural Network

- Model specifics
  - number of layers, size of our input images, and numerical precision of model parameters
- ML model accuracy may be limited since we're using fixed point weights
- If data transfer is slow, the time elapsed from taking an image to making a sorting decision may be too slow

Risks

System Integration



1. Compatibility checks
2. Standard protocols
3. Version control

Functional CNN

1. Focus on simplicity
2. SW-based fallback

Latency

1. Implement optimization
2. Tiling CNN layers

Questions