Carnegie Mellon

Smart Mirror
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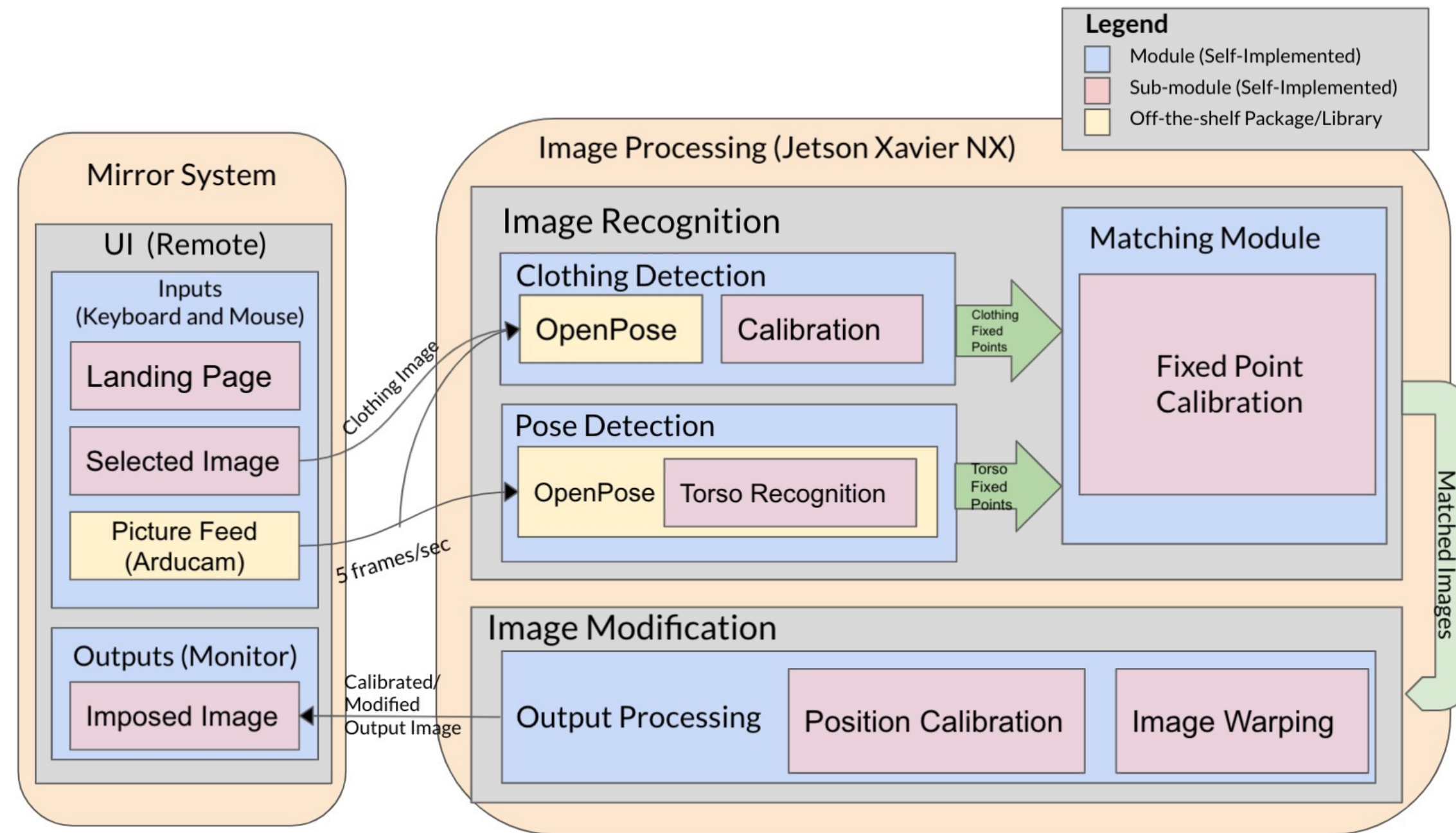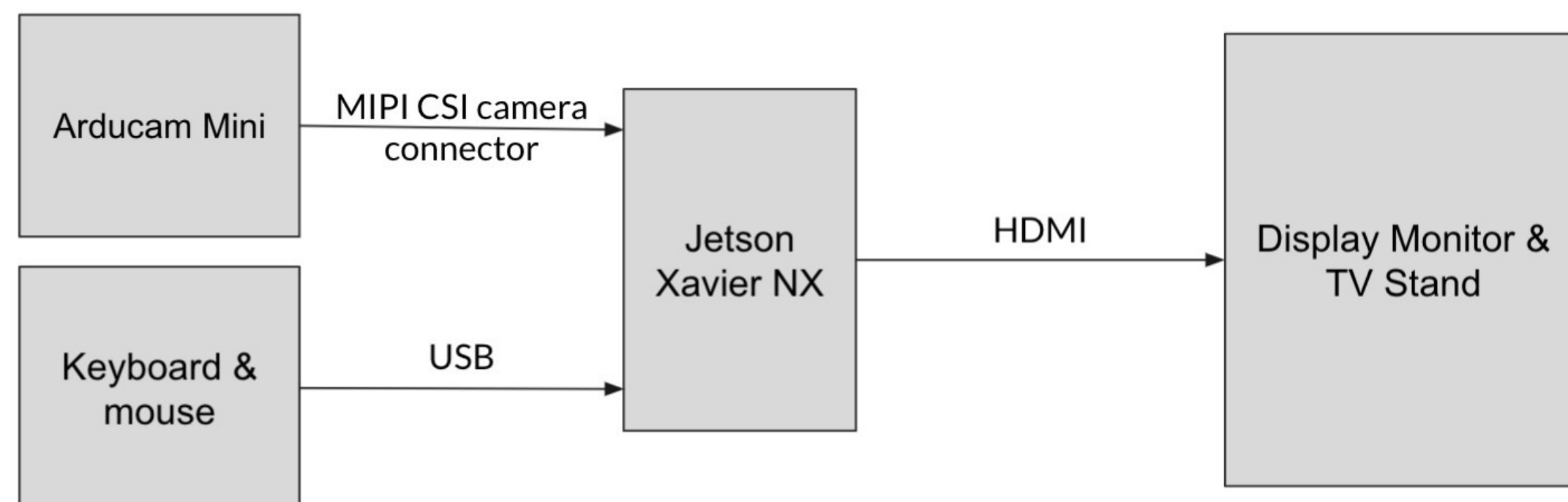**Electrical & Computer ENGINEERING**

Product Pitch

With the COVID-19 pandemic, we are no longer able to shop in store and try on clothes. Consumers waste millions of dollars a year buying clothes online that they don't wear because they don't know how it would look on them before buying. Smart Mirror is a simple, inexpensive and accessible mirror that utilizes a torso recognition computer vision algorithm to allow users to select and try on tops. This gives the user the ability to try clothes on before purchasing, therefore saving them money in addition to reducing the environmental impact of online shopping. This project involves both hardware and software components.
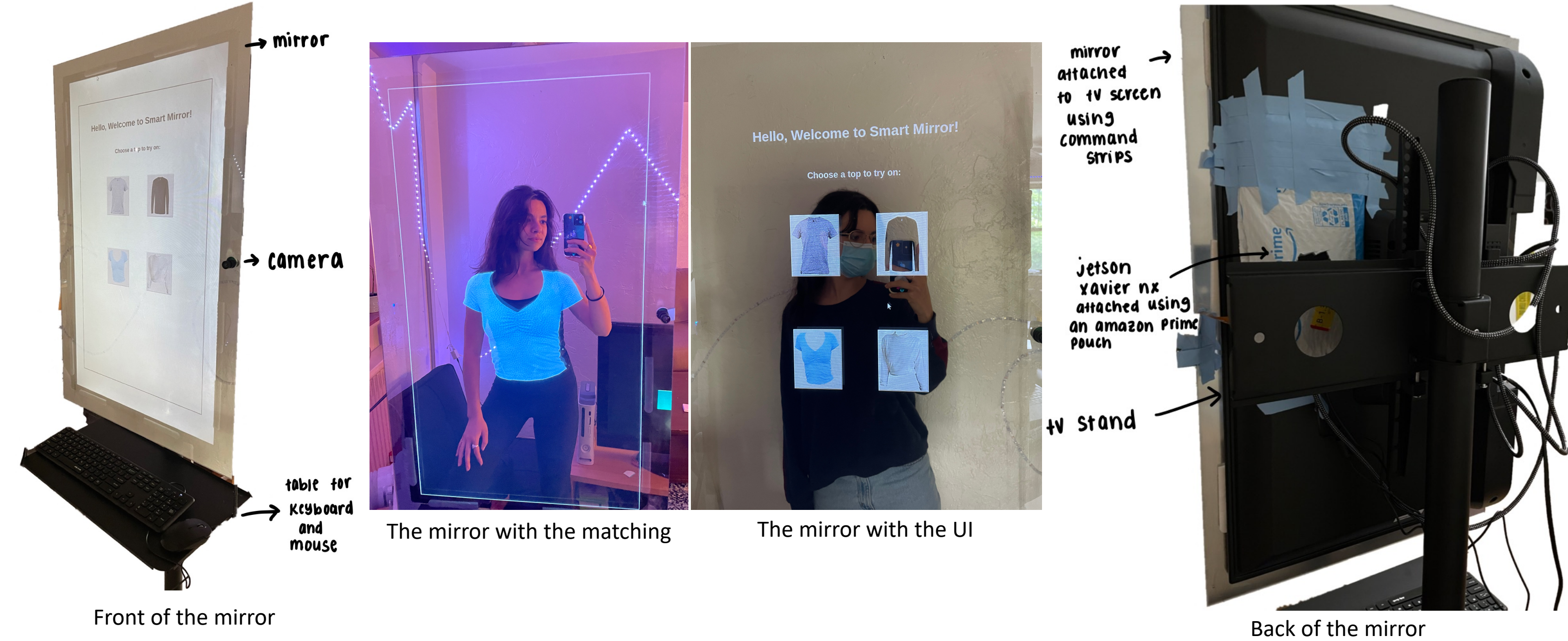
System Architecture

Software Block Diagram

Legend
- Module (Self-Implemented)
- Sub-module (Self-Implemented)
- Off-the-shelf Package/Library

Mirror System — UI (Remote): Inputs (Keyboard and Mouse), Landing Page, Selected Image, Picture Feed (Arducam), Outputs (Monitor), Imposed Image

Image Processing (Jetson Xavier NX) — Image Recognition: Clothing Detection (OpenPose, Calibration), Pose Detection (OpenPose, Torso Recognition); Matching Module: Fixed Point Calibration; Image Modification: Output Processing, Position Calibration, Image Warping

Hardware Block Diagram

Arducam Mini —(MIPI CSI camera connector)→ Jetson Xavier NX —(HDMI)→ Display Monitor & TV Stand
Keyboard & mouse —(USB)→ Jetson Xavier NX

System Description

Front of the mirror

The mirror with the matching

The mirror with the UI

Back of the mirror

System Evaluation

Testing, Verification, and Metrics

Requirement	Test	Metrics
Clothing Image Processing Speed	Time Decorator/Stopwatch	~4.5 seconds
OpenPose Torso Detection	Analyze fixed points	100% precision
Clothing/Torso Matching	Ran on 2032 model images, manually pick passable images	68% precision

We followed the following criteria in order to determine which images "passed" and which "failed". The shirts were not resized, so we were looking for torso coverage more than "fit"

This is the output of the Adaptive Content Generating and Preserving Network model. We used this model to warp the shirt image to the body to give a more accurate fit for the user.