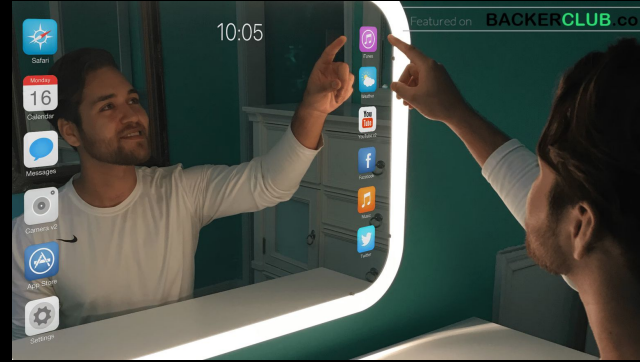## Use-Case

The goal of our project is to create a device that will <u>assist our users in picking an outfit</u> for their busy day.

By implementing <u>AI Vision technology</u> and a <u>user-driven database</u> consisting of their wardrobe, we can create a smart mirror that is able to <u>analyze your top and give you suggestions</u> on how to complete your outfit.

Use-Case Requirements

| Requirement	Predicted Value
Database Latency	< 200 ms
Database Input Time	< 1s
Outfit Recommendation	< 5s
Torso Detection Accuracy	> 99%
Color Detection Accuracy	100% (Within range)

The goal of our project is to create a device that will <u>assist our users in picking an outfit</u> for their busy day.

The major factor that we took into account when deciding our project requirements was <u>what is comfortable for the user</u>.
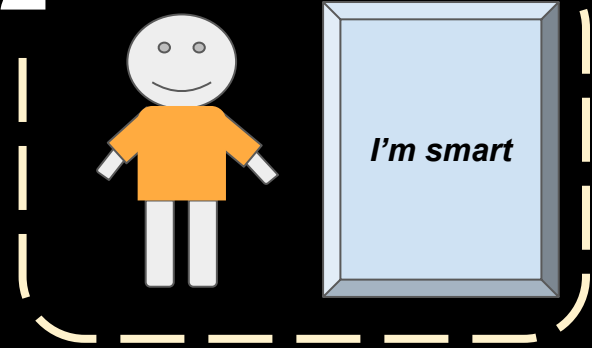
Long response times might make the user conceive our mirror as being slow and unresponsive, which <u>can become a frustrating experience</u>. In the same sense, providing a wrong outfit, or not being able to properly store the users wardrobe <u>may also be annoying</u> from the user's perspective.
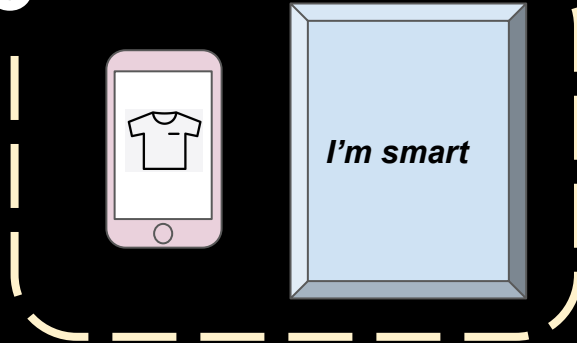
Solution Approach

1 Register wardrobe
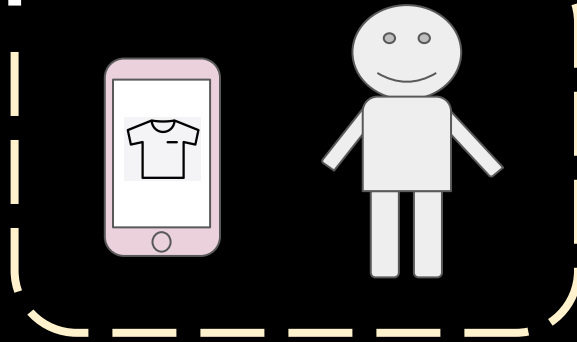
2 Stand up in front of My-flection

I'm smart

3 Transfer data & computation

I'm smart

4 Recommend outfits
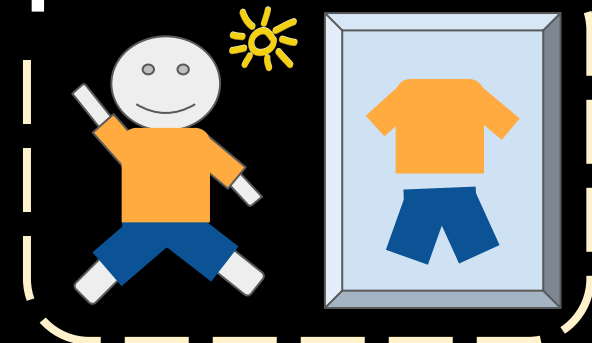
Complete Solution
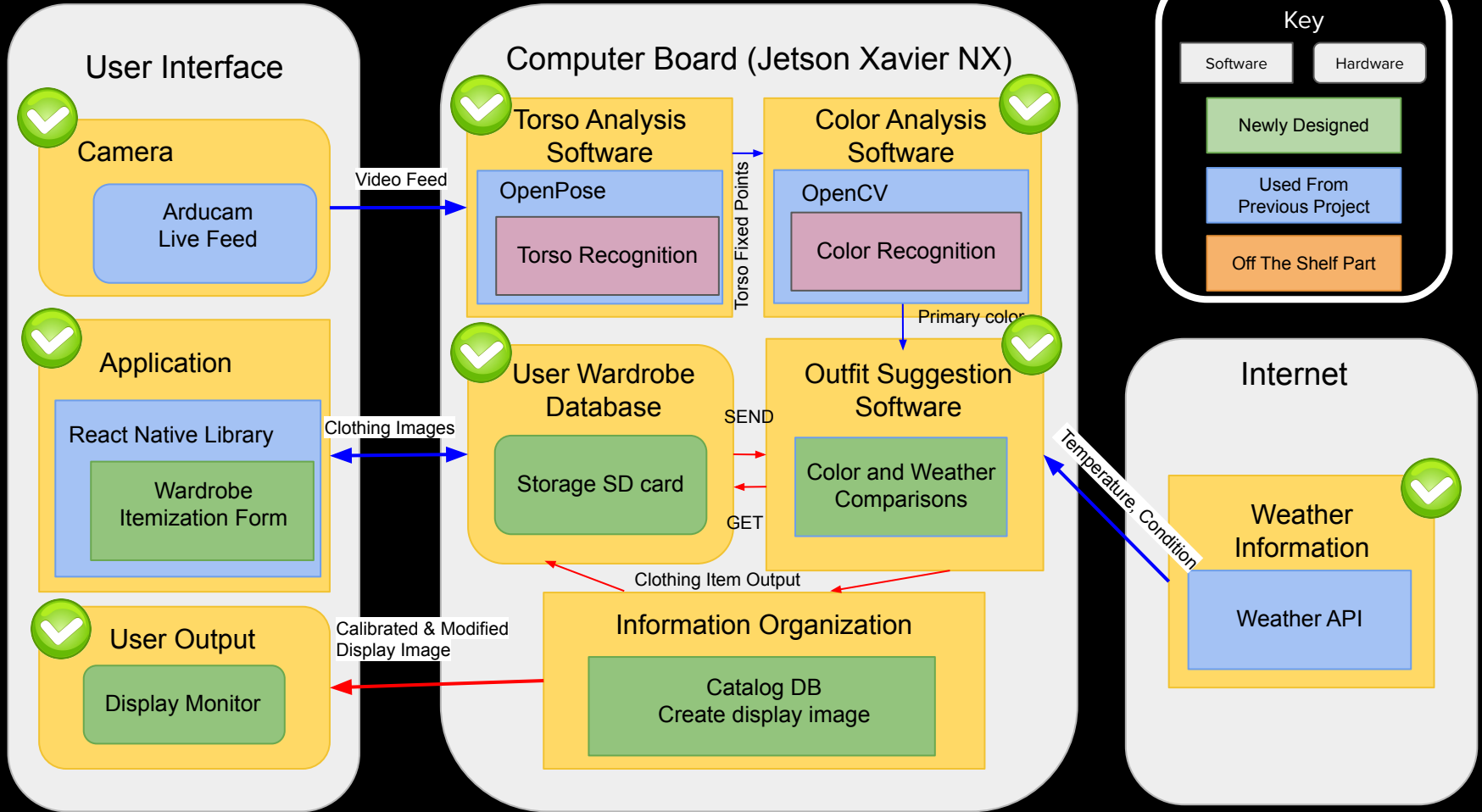
Complete Solution

- Mirror Frame
- OpenCV Based Color Detection
- Openpose Libraries
- Weather Information System
- Interactive Application UI

— Arducam 12MP

27 inch Monitor

Jetson Xavier NX

36x24 2-way Mirror
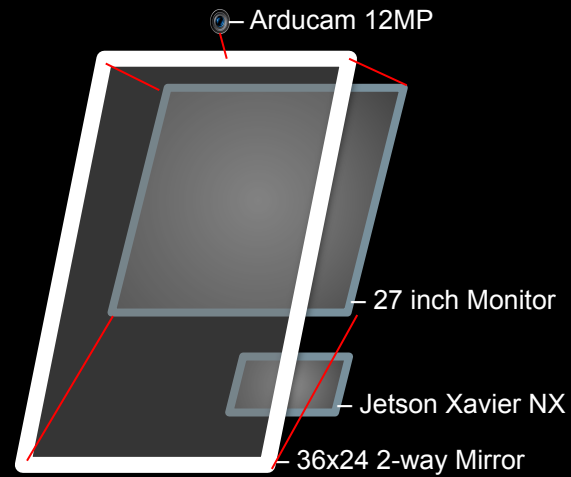
Input tags   *Choose photo*   *Upload photo*   *Choose formality*   *Start OpenPose*

Category
Select the category

Type
Select the type of clothing

Formality
Select the formality

Length
Select the length

Color
Select the color

Season
Select the season

Next

Choose Photo

Finished

Add another

Upload Photo
Choose Photo

Finished

Add another

Choose your formality.
Formal
Informal

Start outfit recommendation!
Start

UI Start Screen

Testing

Requirement	Test	Metrics	Expected Values
Torso Detection	Analyze fixed points	99% accuracy	99% <
Color Detection	Within range	100% within	100%
Outfit recommendation time	Average over 10 trials	0.5s margin of error	< 5s
Database input time	Average of 10 trials	0.1s margin of error	< 1s
~~Mirror On/Off response time~~	~~Average over 10 trials~~	~~0.1s margin of error~~	~~< 1s~~

Testing Plans

- Torso & Color Detection
  - Compare examples with different poses/lighting and body shapes/colors, and manually compare observed results to expected results over 10 trials
- Outfit Recommendation Times
  - Record and average observed runtime over 10 trials
- Mirror On/Off & Database Input Delay Times
  - Record the time it takes to observe a reaction from the mirror/database, and average over 10 trials
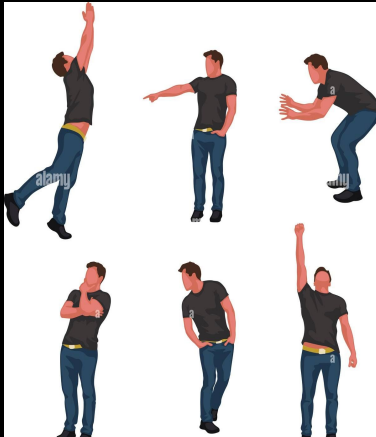
Testing Database Input Time (Tags + Photo URL Upload)

"network_XMLHttpRequest_https://sheet.best/api/sheets/725a3d83-79cc-4a91-90ec-aefe53604c53": Object {
  "endExtras": undefined,
  "endTime": 428927382.28116673,
  "startExtras": undefined,
  "startTime": 428925587.58137506,
  "totalTime": 1794.6997916698456,

Time taken for POST request and receiving response from API

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
1.794s	0.997s	1.037s	1.574s	0.881s	1.04s	1.159s	1.186s	0.868s	0.830s

Average: 1.1366s

"network_XMLHttpRequest_https://api.cloudinary.com/v1_1/dmunxqdae/upload": Object {
  "endExtras": undefined,
  "endTime": 431416563.78425014,
  "startExtras": undefined,
  "startTime": 431415061.0882084,
  "totalTime": 1502.6960417628288,
},

Free cloud service API that allows uploading photos very fast, returns secure public url

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
1.424s	1.502s	1.027s	0.735s	1.173s	0.881s	1.598s	1.373s	1.085s	0.871s

Average: 1.1669s

Testing Results

- Torso Detection (just running OpenPose on one image)
  - Try out different poses and see if it detects upper torso correctly
  - Check output JSON file and see if key points 1~8 are identified

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Average: 100%

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7	Trial 8	Trial 9	Trial 10
21.4s	16.5s	26.7s	20.3s	19.0s	24.5s	17.6s	22.3s	25.6s	18.4s

Average: 21.23s

- Results
  - Expected: 5s total for outfit recommendation
  - Actual: 21.23s just for running OpenPose

Design Trade-Offs

- Hardware Integration - **Nvidia Jetson Xavier nx** vs **Nvidia Jetson Nano**
  - Although more expensive, the Nvidia Jetson Xavier provides more computing power, allowing us to run lengthy torso and color detection algorithms, and algorithms that search through the user's entire wardrobe to build multiple outfits, without the user feeling a delay.

- Outfit Recommendation Algorithm - **Providing Multiple Recommendations**
  - Outfit recommendation quality is subjective, so instead of focusing too heavily on one recommendation, it is better to provide multiple options where the user can pick to their own tastes, even if it costs a little extra run time.

- Removed Health & Quality of Life Features
  - When we first visualized Myflection, we had other useful morning routine features, such as providing the user with their schedule, or various health related features. We decided to remove these features to focus on one clear main objective, and to avoid from an interface that distracted from that goal.

Division of Labor & Budget

- Hardware Applications
  - Ramzi and Wonho
- Color Detection
  - Wonho
- Torso Detection
  - Wonho
- Outfit Recommendation Algorithm
  - Ramzi
- Mirror UI
  - Yun
- Weather Information Retrieval
  - Yun
- Application & Database Design
  - Jeremy
- Frame Construction
  - Everyone

Item	Manufacturer	Model Number	Source	Cost
Nvidia Jetson Xavier nx			ECE Inventory	$0
Arducam B0250			ECE Inventory	$0
36x24 Two-Way Mirror	SPEEDYORDERS		Amazon	$192
27-inch HP Monitor	Hewlett Packard	M27ha	Amazon	$174.08
16 GB micro-SD card	Sandisk	SDSQUAR-016G-GN6MA	Amazon	$8.83
2 2"x10"x8' Wooden Planks	Home Depot		Home Depot	$47.54
Logitech C270 HD Webcam	Logitech		Amazon	$17.99
SELFILA Led Vanity Mirror Lights Kit	selfia		Amazon	$15.99

Budget	$600
Total Costs	$456
Available Budget	$144

D4

Project Management Schedule

TASK TITLE	WEEK 6					WEEK 7					WEEK 8					WEEK 9					WEEK 10					WEEK 11					WEEK 12					WEEK 13					WEEK 14					WEEK 15			
	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R
Date	21	22	23	24	25	28	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	30	31	1	4	5	6	7	8	11	12	13	14	29	18	19	20	21	22	25	26	27	28

Phase 3: Implementation

- Jetson setup
- Jetson - Camera connection
- Jetson - Camera - OpenPose connection
- Torso detection
- Torso detection automation
- Database buidling for color palette
- Database buidling for user wardrobe
- Color & weather data retrievel
- Outfit recommendation based on weather
- Outfit recommendation based on color
- Outfit recommendation integration
- Familiarize with App development(Swift)
- App frontend (basic structures)
- App gallery and photo upload
- App backend (basic structures)
- Interim Demo prep

Phase 4: Integration

- Build Frame
- Mirror UI
- Frame Integration
- Top color detection + Outfit recommendation
- App + Software Integration

Phase 5: Testing and Demo

- Hardware Component Testing
- Software Modular Testing
- Full system testing
- Improve based on requirements check
- Final Presentation Slides & Prep
- Demo Prep
- Final Demo & Poster Prep
- Final Demo, Poster, and Report

Spring break

carnival