Design Review:

PosePal

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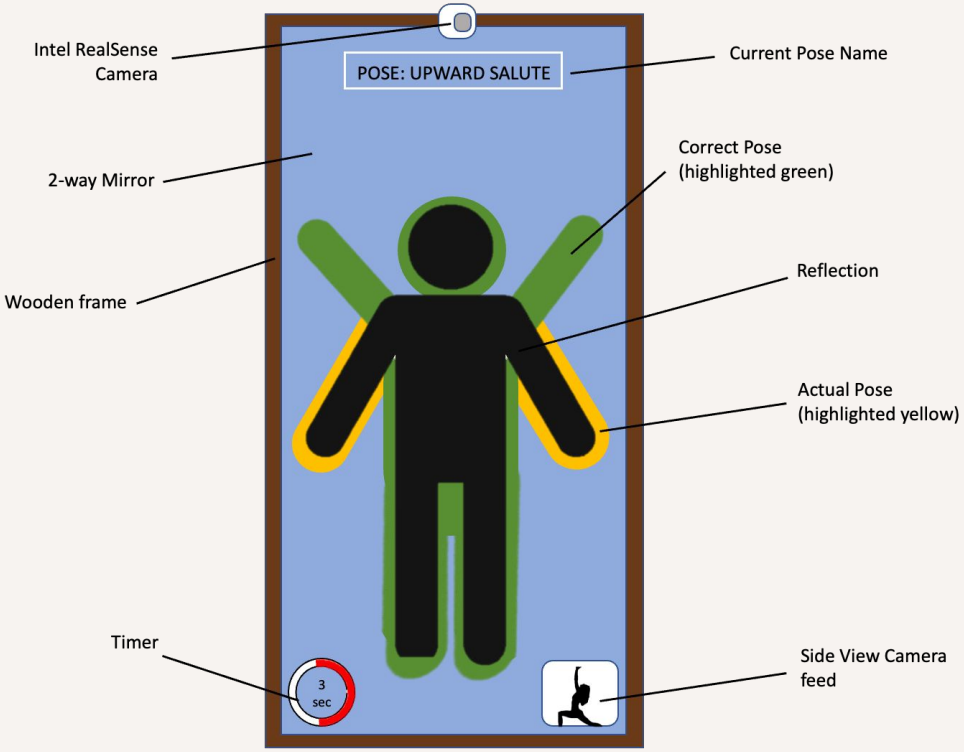
Use Case + Design Requirements

- Many beginners find yoga to be difficult!
- Learning in front of a mirror helps to self-correct and track improvement over time
- Users are looking for a self-paced, low cost, and convenient yoga learning solution

Requirement	Metric
Live Feedback	<= 100 ms from pose estimation to correction rendering
Accuracy	>= 90% accuracy on pose correction
Accessibility	>= 90% user satisfaction rate

Solution Approach

Overall Solution

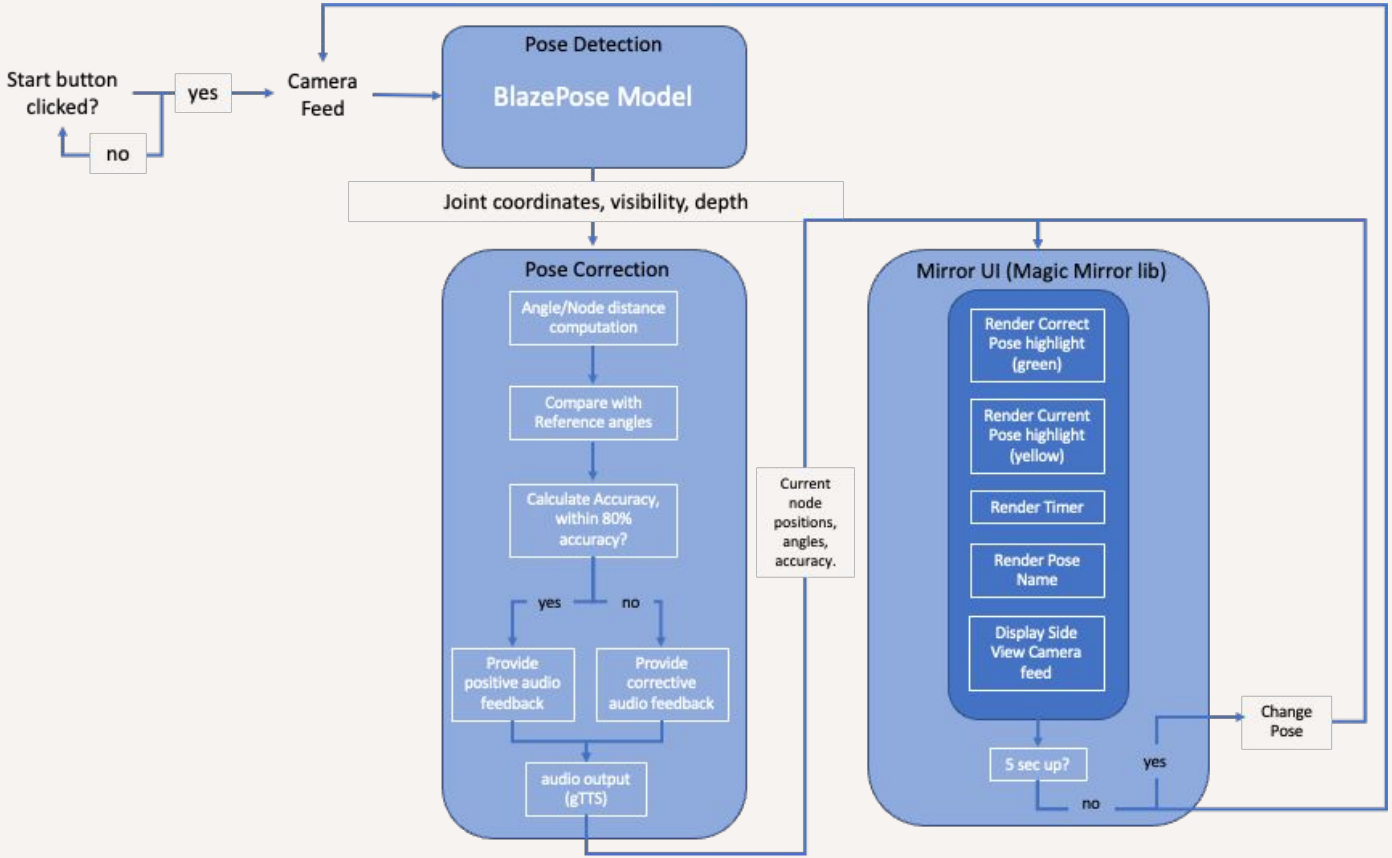


Mirror User Interface

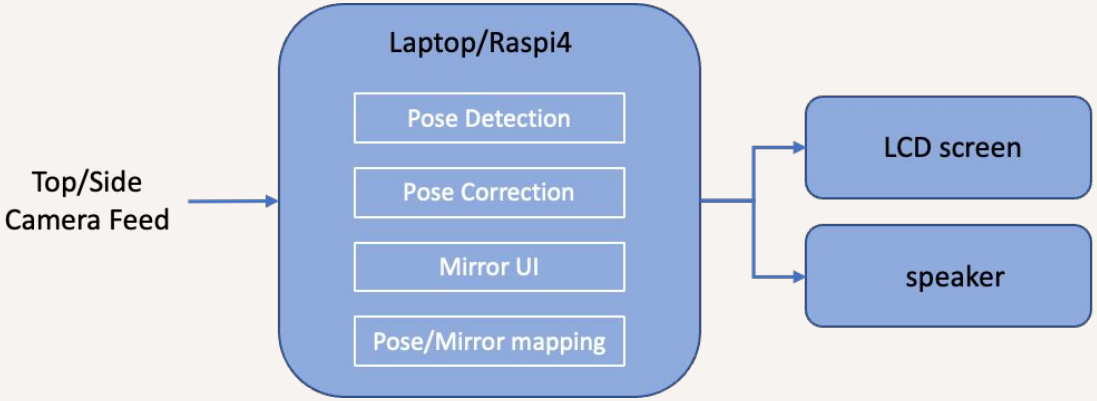
PosePal Design Overview

- Real-time camera feedback loop system highlighting limb/joint positioning corrections
- Additional audio feedback to provide an easy and accessible way to self-correct
- Accessible user interface that works naturally with the flow of yoga poses PosePal users move through
- Highly accurate and reliable pose correction system to effectively replace in-person yoga classes

Software Specification



Hardware Specifications



Implementation Plan - Software

Pose Estimation:

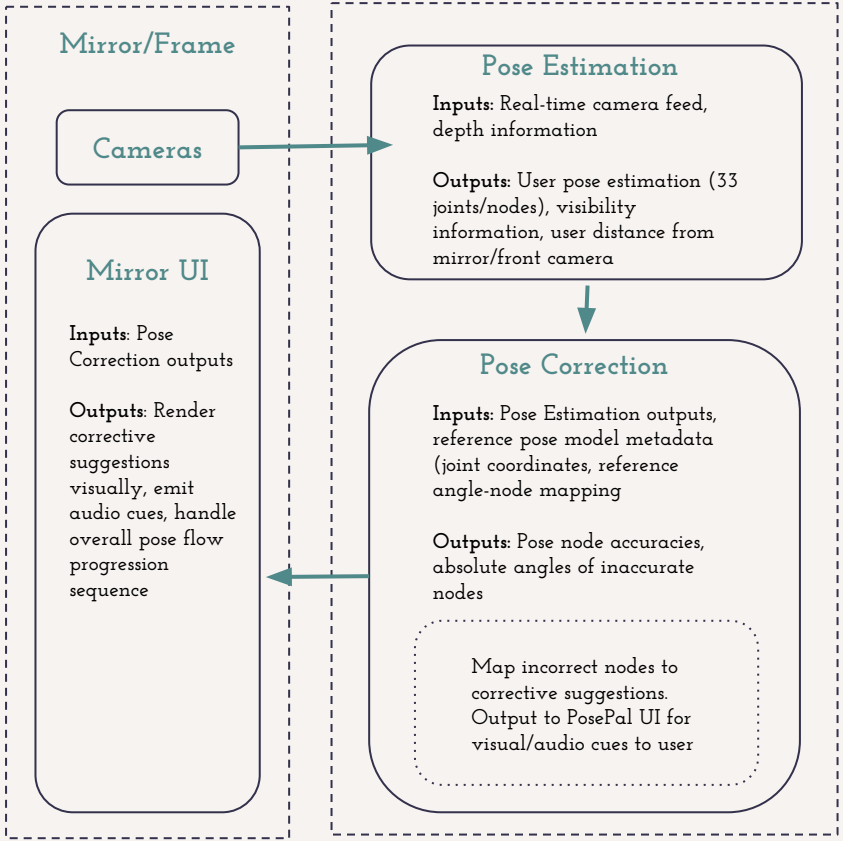
- Open-source BlazePose CNN model
- Has accuracy above required threshold (93%)

Pose Correction:

- Build custom library for metrics computation
- Use numpy for vectorized operations in 3D

Mirror UI:

- Use lightweight/fast graphics library (tkinter) for rendering of error detection/corrections
- Google Text-to-Speech (gTTS) for audio cues



Working Pose Estimation

Warrior Pose (Side)

Tree Pose (Front)

Implementation Plan - Hardware

Frame:

Cut wooden frame, disassemble computer monitors, add in frame and secure with back strips, add acrylic mirror layer

Cameras:

Attach camera to top of frame and one at side-view position

Speaker:

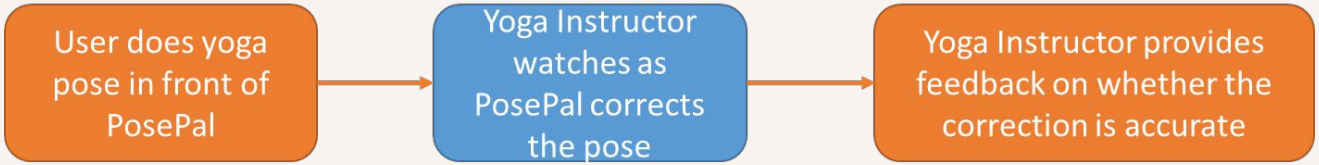
Attach to bottom or top of frame, connect via cable to play appropriate mp3 sound for corrective feedback

Integration:

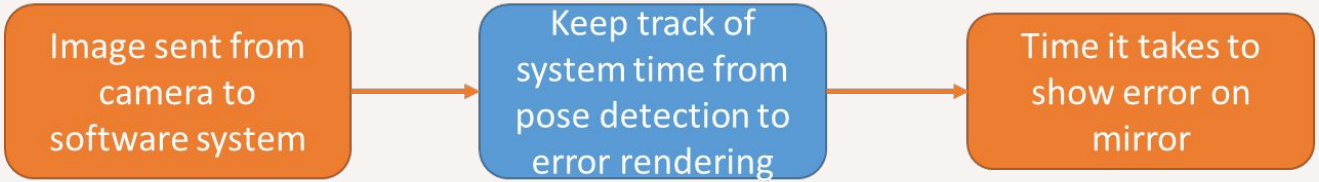
Software systems running on laptop, take in camera feed and manage UI rendered on monitors/audio cues emitted

Testing

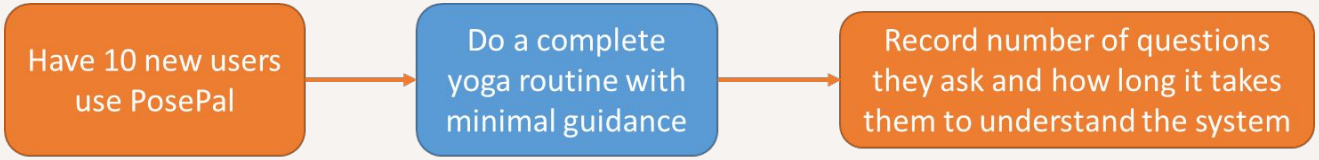
Pose Correction Accuracy:



Latency:



Accessibility:



Verification and Validation

Test	Metric	Metric Goal
Pose Correction Accuracy	Absolute Error (%) based on how many nodes of the pose correction are incorrect	>= 90%
Latency of the system	Number of millisecond between camera input and pose correction output (ms)	<= 100 ms
Accessibility	- Average number of questions per user (#) - Average time it takes a person to understand the instructions (sec)	- <= 2 questions per user - <= 5sec to understand instruction

Gantt Chart + Task Breakdown

Topic	Task	Week ->	February				March				April			
			3	4	5	6	7	8	9	10	11	12	13	14
Yoga Expert Interview	Gather ideal yoga poses													
	Identify currect error detection methods													
Pose Teaching	Pose Detection													
	Pose Comparison													
	Error Identification													
Hardware Construction	Material Acquisition													
	Woodworking													
	Physical Contstruction													
	Camera Integration													
Mirror-Camera Coordination	Camera Callibration													
	Coordinate Mapping													
Mirror UI	Error Display													
	Magic Mirror Library Integration													
	Audio Feedback on error													
Testing & Validation	Pose Accuracy testing													
	Latency testing													
	User Testing													
Slack & Bonus	Yoga Mat usage													
	Adding user profile													
	Hand gesture interaction													

Ankita:
- Hardware construction
- Mirror UI

Sruti:
- Error Display
- Mirror Camera Integration

Youssef:
- Pose Detection
- Pose Comparison