Senior Design

ENG EC 464

Test Report

To: EC463

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Subject: 2nd Prototype Test Report

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1 Equipment and Set-up

1.0 Hardware Equipment

1.0.1 A computer and mobile device

1.0.2 Integrated or connected camera

1.0.3 Spacious and flat area

1.1 Software Equipment

1.1.1 Internet connection

1.1.2 Web browser that can run JavaScript

1.2 Set-up

1.2.1 Connect one of our laptops to the internet.

1.2.2 Place the laptop onto a desk or bench, with the integrated webcam facing forward.

1.2.3 Open the ExerSights web app at exersights.web.app.

1.2.4 Demonstrate our web app giving real time feedback to the user.

1.2.5 Open ExerSights on mobile device and download the application as a PWA.

1.2.6 Place mobile device on table propped up by water bottle.

1.2.7 Demonstrate our web app as a mobile application, with all the same features as on the laptop.

2 Metrics

2.0 The webapp should be able to run from any chosen computer and navigate all pages.

- We were able to do this successfully via a setting up unique, public hostname and demonstrated navigation of the website.

2.1 The camera module will display the live feed and computer vision model with negligible lag (<200ms).

- We performed latency testing on our application with both the legacy Pose model and the newer Tasks Vision model (to be integrated soon). The results are as follows:

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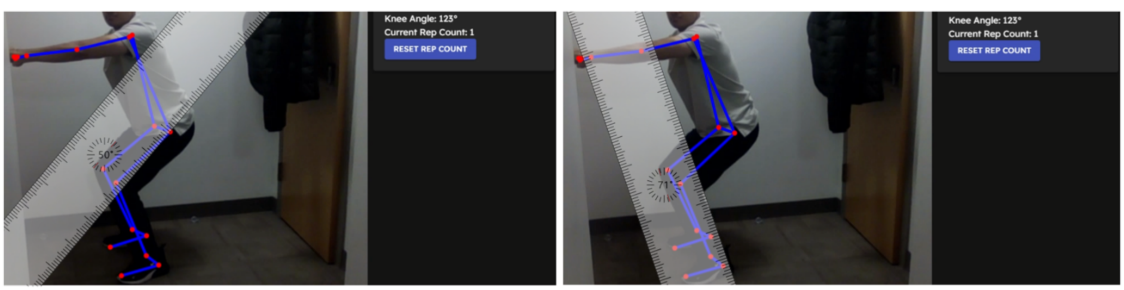
Trial #	Pose Model Latency (ms)	Tasks Vision Model Latency (ms)
0	33.35954198491482	40.17283236980438
1	33.33729729716842	42.24635761620983
2	33.271631206181034	44.49808917227824
3	33.20324675293712	42.09617224834752
4	33.38036809815951	42.26687116564417
5	33.434666666984555	42.41165644186406
6	33.309248554913296	44.10306748437004
7	33.39238095283508	42.44832214813104
8	33.53850931632593	42.04844720467277
9	33.26433566483584	46.52785388138741
AVERAGE	33.34912264952557	42.88196697327094

2.2 The computer vision model will accurately detect limb and joint angles, with less than 5° margin of error.

- We took screenshots and used a protractor to calculate the joint angle of the user.
- We measured the angles from the horizontal line and obtained an angle of 121° (50 + 70). Our application gives a measurement of 123°, within our 5° margin.



	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5	Avg
Margin of Error (°)	2°	4°	2°	2°	4°	2.8°

2.3 The new visual feedback feature allows feedback to be seen further away via a colored border around the webcam output. Previously, we were only able to read the text feedback standing 1.5 feet away from the screen. With the new visual feedback, it is possible to stand 5 feet away from the screen and still be able to see the border color reflecting the state of the user (completed a repetition in green vs. in the process of completing a repetition in yellow). The repetition count is also updated and shows in larger in the middle of the webcam output whenever a repetition is successfully performed.

3 Conclusions

Our web app is at a good place in terms of navigation, usability, and latency on our laptops. There is no noticeable latency or lag (~50ms), and we have reached our MVP goal in this context. With the integration of the PWA there is no longer increased application lag on mobile devices and they run at similar latency as the computer. As we transition to the new model, we will find ways to focus on optimizing the code for integration of the new model in order to reduce our latency by 10ms, so that it can be similar if not faster than our previous model.

In terms of accuracy, our computer vision model does a great job of accurately detecting the human limbs and joints. Our manual measurements matched very closely with the angles calculated from the computer vision model. We do note that the computer vision model does make some invalid assumptions when limbs leave the frame. To counteract the invalid assumptions when the user's limbs leave the webcam frame, we disable the exercise feedback temporarily and inform the user to bring their limbs back in frame when their limbs leave the frame. We are currently working on improving those edge cases by detecting when they happen, disabling the exercise feedback temporarily, and informing the user to bring themselves back in-frame to cooperate with the model.

Finally, in regards to the feedback distance, users can now see the progress of their repetition by the colored border around the webcam output. They are also able to see their repetition count update in larger text on the webcam output upon successful completion of a repetition. This allows users to see the feedback on the exercise easily from a distance of 5 feet. As for the audio feedback, this is largely controlled by the user's volume settings on their device, but can be heard from much farther than 5 feet in general.