Boston University

Electrical & Computer Engineering

EC463 Senior Design Project

First Prototype Testing Plan

Swing On

Team 20 SwingOn

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Required Materials

Hardware

- A device that can run iOS 15, iPadOS 15, or macOS Catalina (or later) to run and simulate the prototype
- iPhone 6S (or newer for smoother processing)

Software

- Xcode 13
- Swift
- Tensorflow pose estimation pretrained model
- Core ML

Additional material needed

- A tripod to stabilize the iPhone
- A person to move and make motions

Setup

1. Connect the iPhone to the computer
2. Build the SwingOn project on XCode and download the app on the iPhone by running the code
3. Set up a tripod for the iPhone to ensure it is in a stable position

Pre-testing Setup Procedure

1. Find an open area with nothing too distracting in the background (not too much movement)

2. Place the camera (iPhone) on tripod facing towards where user will be situated
3. Run the SwingOn app on the iPhone

<u>Testing Procedure</u>

1. Open the Swing On App on the phone
2. Main screen will appear with the logo and welcoming message
3. Click “Open Camera” on the main screen
4. Users will perform multiple swings or other motions
5. His/her motion will be detected in real time and their body joints will be drawn on the screen
6. Select between different delegates and Tensorflow models (Posenet, MoveNet Lightning and MoveNet Thunder) for real time body pose analysis
7. Click “Back” to go back to the main screen

<u>Measurable Criteria</u>

The criteria for successful running is as follows

1. The Application should be able to successfully run on an iOS device, to be more specific, the iPhone that is used to test.
2. The pages in the application should be clearly displayed
   a. Main screen should have the logo, a welcoming message, and a button directed to the camera screen.
   b. Camera screen should ask permission from users in order to open the camera.
3. The buttons on the device should perform the designated tasks
   a. “Open camera” button should open the camera screen

    b. “Back” Button should return to the previous screen

4. The camera screen should display a person's body poses in real time (>30fps) as well as allow users to make adjustments.
    a. 17 key-points detected
        i. Nose
        ii. Left and right eye
        iii. Left and right ear
        iv. Left and right shoulder
        v. Left and right elbow
        vi. Left and right wrist
        vii. Left and right hip
        viii. Left and right knee
        ix. Left and right ankle
    b. The confidence score indicates the probability that a keypoint exists in that position.
    c. Time: the time it takes for the model to detect the pose of the person
    d. Number of threads: increase the number of threads and speed up execution of operators. However, this will make the model use more resources and power.
    e. 3 delegates (hardware accelerators) to choose from
        i. CPU: safest and simplest choice. However, it is usually slower and consumes more power than running the model on accelerators.
        ii. GPU: the most widely available accelerator and provides a decent performance boost.

        iii. NPU: similar to a GPU, but instead of accelerating graphics, it accelerates neural network operations such as convolutions and matrix multiplies.

    f. 3 Models to choose from

        i. Posenet: state-of-the-art pose estimation model that can detect these 17 key-points

        ii. Lightning: smaller and faster, but less accurate than the Thunder version. It can run in realtime on modern smartphones

        iii. Thunder: more accurate version but also larger and slower than Lightning

5. The Application should be able to run without internet connection

Test Sheet

Object	**Performance**	**Correct?**
APP	Able to open	
Main Screen	Able to display	
“Open camera” Button	Able to direct to next page when clicked	
Camera Screen	Able to display people’s 17 body points with lines connecting them in real time	
Displays on camera screen	Scores and estimated times are displayed on the screen	
Selections on the camera screen	Able to adjust the number of threads, choose between 3 delegates and 3 models	
“Back” Button	Able to go back to main Screen	
Result →		%