Workout Helper User Manual

Graphical user interface, application

Description automatically generated

**How to Use**

The simulator has radio buttons available at the top that provide the options of a training mode or various exercise demos. The simulator won’t play any audio at all even if you manipulate the controls until one of these options is selected. For the exercise demos you can select either a bench-press or a push-up. If one of the exercise demos is selected it will start the simulator where it will begin manipulating the audio from data provided in the JSON files. It is expected that the controls should not be configured by a user while the demo is running.

The training mode will allow the user to freely manipulate the sounds of the system. In this training mode you can configure the controls provided below the volume meter. The sliders that are all in the “extension” category can be moved up and down which will play audio of a sine wave with varying harmonics. Extension in this simulator refers to when that muscle group is extended such as when your arms are extended in front of you that means you would have a higher extension level. The toggle button below each slider allows the user to mute that specific sine wave for the specific muscle group. The buttons that are the “alert” category just play audio of a text-to-speech message of the specific muscle group. The weight distribution 2D slider manipulates the audio by panning if the X value is manipulated and pulses the audio if the Y value is manipulated. In this simulator weight distribution refers to how the weight is distributed relative to your core, in other words this is a way to check for balance. All exercises will require balance so a value of x,y = (0,0) represents the ideal balance. For the wrist rotation angle knob, it just applies a low pass filter to the audio if the wrist rotation angle differs from the target rotation angle knob. In the knob it has the label (-Flexion, Extension), this just refers to how the negative values are a flexion (rotating your wrist inwards) and extension (rotating your wrist outwards). If the audio has any effects being applied to it such as a filter, panning, or pulsating then that means the form for an exercise is incorrect.

**Sonification Scheme**

* The muscle extensions modify the sounds by playing a sine wave depending on the extension level from the extension sliders. It does this by how each muscle group’s sine wave has a different frequency as they are all assigned a constant multiplier that differs across the muscle groups. As the slider is manipulated by either increasing or decreasing the value, the sine waves frequency is modified by multiplier \* slideValue.
* The non-optimal/dangerous muscle extensions that are performed by the user modify the sounds through a text-to-speech message that will alert the user. This alert will say the name of the muscle group that is at risk for injury or is incorrectly being used.
* The weight distribution modifies the sounds based on the distribution of the users weight relative to their core. The 2D Slider labeled weight distribution is used for this sonification. The weight distribution 2D slider values range from x = [-5, 5] and y = [-5, 5].
  + When the weight distribution has an X value that is approaching -5, the audio will pan towards the left. At x = -5 the audio will be completely panned to the left.
  + When the weight distribution has an X value that is approaching 5, the audio will pan towards the right. At x = 5 the audio will be completely panned to the right.
  + When the weight distribution has a Y value that is approaching -5 or 5 the audio will pulse which is done through the use of amplitude envelopes. As the value approaches closer to either -5 or 5 the audio of the pulsating will increase.
  + When the weight distribution has the X and Y equal to 0 then the pulsating/panning will cease.
* The two knobs of wrist rotation angle and target rotation angle represent the ideal wrist rotation for a given exercise. This data modifies the sound by applying a low pass filter to the overall audio of the system. This low pass filter is only applied when the wrist rotation angle differs from the target rotation angle. The more the wrist rotation angle is farther apart from the target, the low pass filter will have a higher cutoff value. This will make the audio sound louder. If the wrist rotation angle is closer to the angle of the target wrist rotation then the low pass filter will filter out even more frequencies as the cutoff is lowered. This will make the audio sound lower. Any time the wrist rotation angle and target rotation angle are equal, then the low pass filter will not be applied, the audio will be normal.

**Scenarios**

Compared to my proposal in Project Deliverable #3, I made many huge changes to my implementation compared to what I had originally planned. The overall concept is still the same as this simulator’s purpose is just being able to provide auditory assistance during a workout for an experienced gym goer for their form. I created four different scenarios to provide examples on how this simulator could provide that assistance.

*JSON#1 – bench\_press\_correct*

This JSON file allows the user to experience the scenario where a perfect bench press is performed. This JSON file can be observed by pressing the “Perfect Bench-Press” radio button. This file just sonifies the muscle extensions of a correct bench press being performed. There aren’t any alerts present or the audio being manipulated by any effects.

*JSON#2 – bench\_press\_incorrect*

This JSON file allows the user to experience the scenario where an incorrect bench press is performed. This JSON file can be observed by pressing the “Incorrect Bench-Press” radio button. In this scenario you will be able to observe certain muscle groups not being used properly as well as the rotation angle of the wrists being incorrect.

*JSON#3 – pushup\_correct*

This JSON file allows the user to experience the scenario where a perfect push-up is performed. This JSON file can be observed by pressing the “Perfect Push-Up” radio button. This file just sonifies the muscle extensions of a correct push-up being performed. There aren’t any alerts present or the audio being manipulated by any effects.

*JSON#2 – pushup\_incorrect*

This JSON file allows the user to experience the scenario where an incorrect push-up is performed. This JSON file can be observed by pressing the “Incorrect Push-Up” radio button. In this scenario you will be able to observe certain muscle groups not being used properly as well as the weight distribution during the exercise being incorrect.