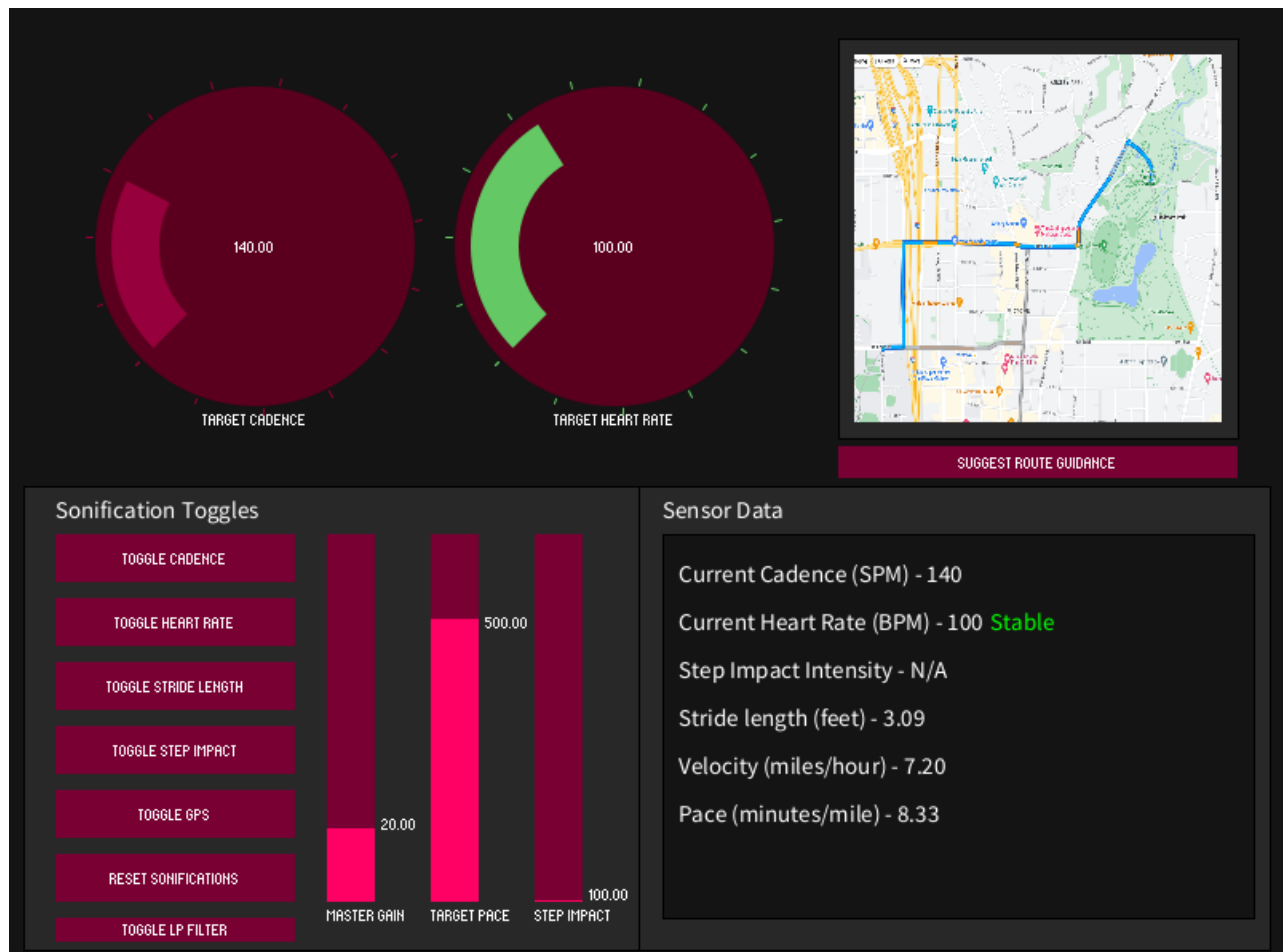# Distance Running Simulator – User Manual

How To Use the Simulator

The simulator starts in user interaction mode, providing an interactive user interface upon opening, allowing users to experience and control five main sonifications. These sonifications are co-dependent on different data streams within the simulation engine and can be toggled using buttons on the left side of the screen. The interface includes three sliders on the right, allowing users to adjust the master gain, their selected pace (in minutes per mile), and the forcefulness of their foot strikes.

At the top left of the screen, two knobs enable users to control both their cadence (steps per minute) and heart rate. It's recommended that users start by toggling cadence, heart rate, and stride length individually to hear how each sonification interacts with the others.

This way, users can understand the interdependency of each sonification without feeling overwhelmed. Conversely, if users wish to reset all the sonifications, a convenient "Reset All" button is provided to return to the default state.

The bottom right of the screen displays sensor data, providing real-time updates whenever a data stream changes its value. The data streams shown are Cadence (SPM), Heart Rate (BPM), Step Impact, Stride length (feet), Runner Velocity (miles/hour), and Pace (minutes/mile). Additionally, the simulator supports a demo mode, where cadence and heart rate JSON data is loaded into the simulator and a running simulation initiate. Users can disable demo mode simply by clicking on the "toggle demo" button again to enable interactive mode.

On the top right, there's a static GPS integration that allows users to request sonifications from the GPS tracking system when enabled. This way, users can experience additional context-specific sonifications related to their location.

List of manipulable data streams in the interface:

- Cadence (Steps Per Minute)
- Heart Rate (Beats Per Minute)
- Step Impact

The interplay between these three data streams enables various sonifications, providing users with an immersive and interactive experience with the simulation.

Sonification Scheme

Runner cadence is indicated by a rhythmic ticking sound that corresponds to how many steps a user is taking per minute. Increasing cadence will increase both the frequency and amplitude of the rhythmic ticking. Heart rate also shares a similar function. Enabling heart rate allows the user to listen to their heart rate in live time and monitor the intensity. Once a user's heart rate gets too high however (> 185 BPM), the system utilizes TTS and alerts the user to lower their cadence using linear interpolation. If a user's heart rate and cadence both reach a certain level of intensity, the system will again utilize TTS and recommend the user optimal breathing patterns as a reminder to maintain consistent breathing. The frequency of the user's cadence will start to decrease in value until the user's heart rate reaches a healthy level, promoting heart health and proper physical exertion.

These two data-streams will also affect the sonification of a user's stride length, as indicated by a non-intrusive, seamlessly looped synth wave. The user's stride length is a function of both a user's cadence, and pace. Any combination of changing the user's desired pace, and cadence will in turn affect the stride length of a user. As stride length

increases, the frequency and attenuation of the synth will decrease indicating longer strides.

The user also has the option to enable GPS. Ideally this enabling of the GPS would be done by voice, so the user does not have to interact with a UI, but once the GPS is enabled, the GPS provides audio cues indicated upcoming turns, landmarks, and other points of interest and potential obstacles along the desired route. These audio cues act as essential information about the user's current location and enhance situational awareness.

Demo Mode
The simulator features a demo button that allows users to enable or disable the demo functionality. For the best experience, it is advised that users enable the cadence, heart rate, and stride length sonifications before clicking the toggle demo button. This way, they can listen to the dynamic interplay between these variables. When the user activates the "toggle demo" button, the engine will simulate dummy cadence and heart rate sensor data from JSON files.