Sightless Navigation Assistance Project

Configurable Virtual Environment with Acoustic and Visual Feedback

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Background

The navigation assistance project aims to develop a wearable device which allows those who are visually impaired or completely blind to navigate using a sonar-like feedback system which represents the surrounding environment using audio signals. An easily distributable test bed is needed to experiment with a variety of audio feedback schema, determining how best to convey this sort information to a human. The first such test bed was developed in 2016 which uses the Unity engine to generate a depth map from a user defined 3D environment, then converts that depth map into audio sources. This platform is a great start, but is somewhat limited in configurability, and difficult to install. A second-generation program is needed to fill these gaps, and take the next step toward gathering data.

Project Scope

Fully develop a second-generation test bed for psychoacoustic experimentation. This will include building on top of or rewriting the Unity based virtual environment and audio translation software, improving upon the existing platform in the following ways:

- Improve user interface for modifying acoustic feedback in a compiled package, and allow for greater configurability.
- Provide downloadable package for ease of distribution.
- Port functionality to wearable hardware.

Specifications

The project deliverable is a fully functional program featuring the following:

Virtual Environment:

- User configurable environment allowing new maps to be created and saved.
- Viewable from a first-person perspective within the simulator.
- Free and legal for use in for-profit development.
- A depth map must be generated using spherical coordinates (r,θ,γ) to simulate data collected from a 3D scanning device.
- Toggled visibility of first person view.

The Unity engine was an ideal candidate for its user agreement, ease of use, and adaptability. Reuse of this engine is recommended, but not required.

Audio Feedback:

- Sounds generated should be user configurable in the compiled software.
- Frequency, volume, and waveform should be controlled independently as functions of location (r,θ,γ) in a spherical coordinate system.
- The depth map output from the virtual environment should be sampled according to a user input function, allowing for modulation and sweeping of the sound field.

It is critical that the field of sound generated be easily manipulated according to functions or table inputs. This will allow for iterative improvement of feedback methods. As implied above, the sound field should be configurable in two distinct ways; one allowing control over sampling of the depth field, and the other allowing control over the properties of the sound generated at each point in the field as a function of that points location in spherical coordinates.