An immersive journey preparation tool for people with vision impairment

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Introduction

With almost one in five Australians experiencing some form of disability, a large proportion of the community face challenges to actively participate in city life.

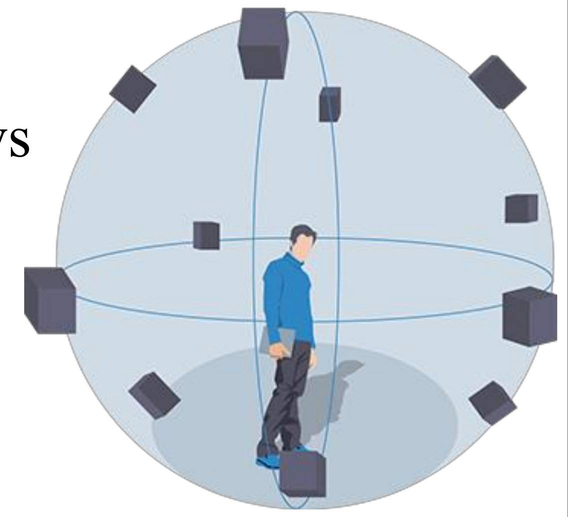
This project is developing

~~This project demonstrates~~ a long-term technology-enabled solution ~~to issues experienced by people with vision impaired.~~ to assist journey preparation for members of the vision impaired community.

Note: You should also mention that the aid specifically aims to reduce anxiety and the cognitive burden associated with navigating an unfamiliar and busy city environment

Methods

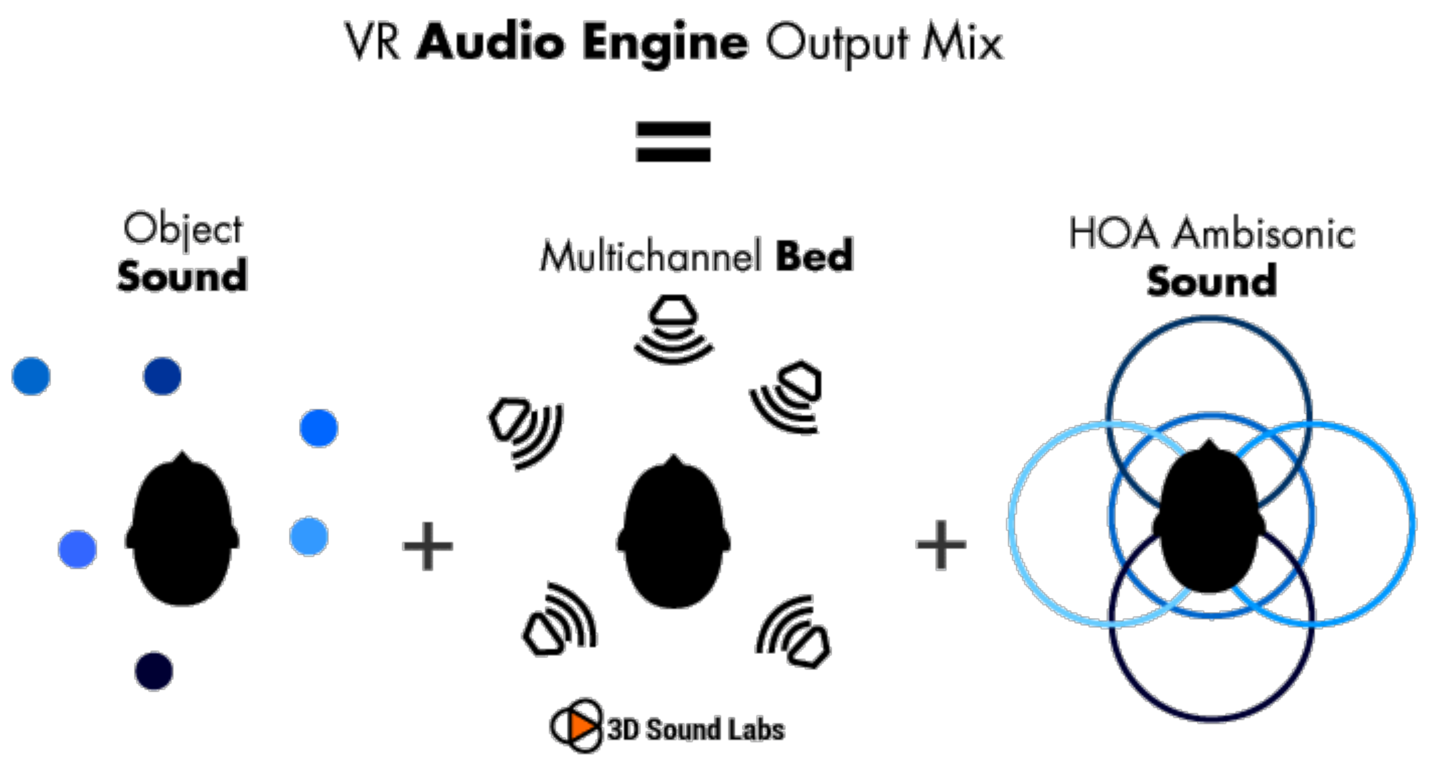
We develop an auditory-based simulator to simulate the sensory experience of a specific location in Melbourne's CBD. The idea is to provide people who have vision impairment and blindness an immersive tool that allows them to experience the sounds of environments they plan to walk through. The simulator would allow them to rotate their body and hear the sounds change as they rotate.



In our experiment, we choose Flinders Street Station as the testing environment

Surround Sound Technology

In order to ~~archive what we call~~ achieve an "immersive" experience, we use Ambisonic Technology [1]: a full-sphere surround sound technique, in addition to the horizontal plane, it covers sound sources above and below the listener



Recording Technique

A Desktop application is also being developed to explore the use of headtracking, allowing the tracking of

Sounds are recorded by a tetrahedron microphone (left image) to get 4-channel monophonic A-format. This is converted into 4-channel B-format using mathematical formula shown below [1]. B-format file contains XYZ directions which covers all 3 dimensions. W channel is called omnidirectional.

$$W=\frac{1}{k}\sum_{i=1}^{k} s_i\left[\frac{1}{\sqrt{(2)}}\right]$$

$$X=\frac{1}{k}\sum_{i=1}^{k} s_i\left[\cos\phi_i \cos\theta_i\right]$$

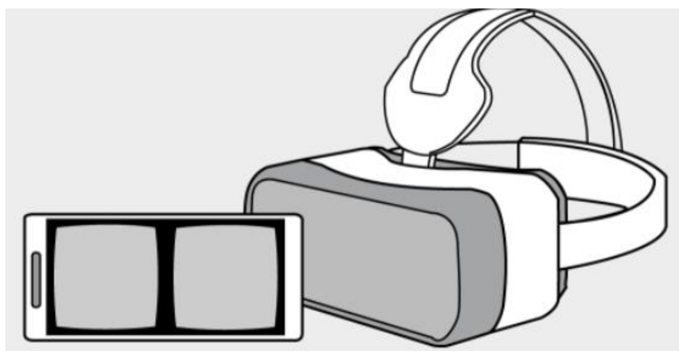
$$Y=\frac{1}{k}\sum_{i=1}^{k} s_i\left[\sin\phi_i \cos\theta_i\right]$$

$$Z=\frac{1}{k}\sum_{i=1}^{k} s_i\left[\sin\theta_i\right]$$

Web Application

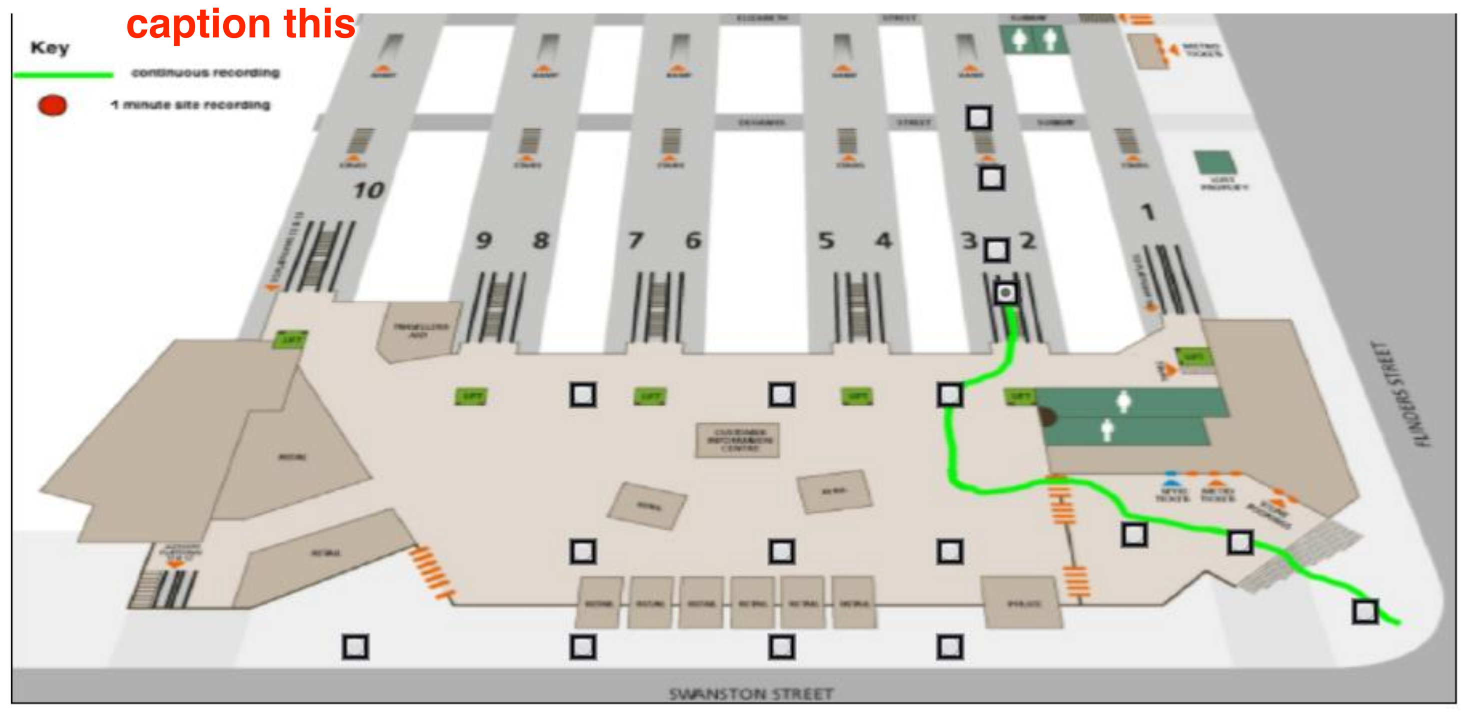
The Ambisonic sound capsule has been encoded in 360 video using Facebook 360 Encoder and deployed in Youtube. This will make the video compatible with VR mode. Users can use Google cardboard or Oculus Rift to navigate and change direction.

The video can also be rotated by sliding the video or using controller on the top left of the video.



For a mobile user, rotating mobile device will also move the direction of the camera.

caption this

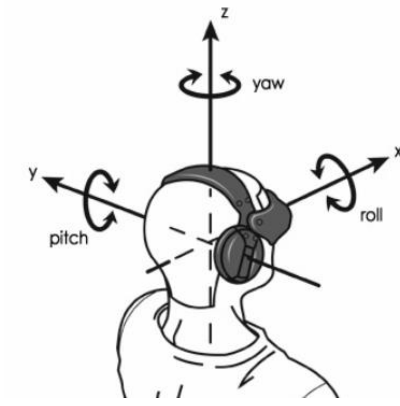


Voice Recognition and Speech Synthesis: Users can interact with the interface using voice command and ~~then~~ then audio cues will be played back upon user's request

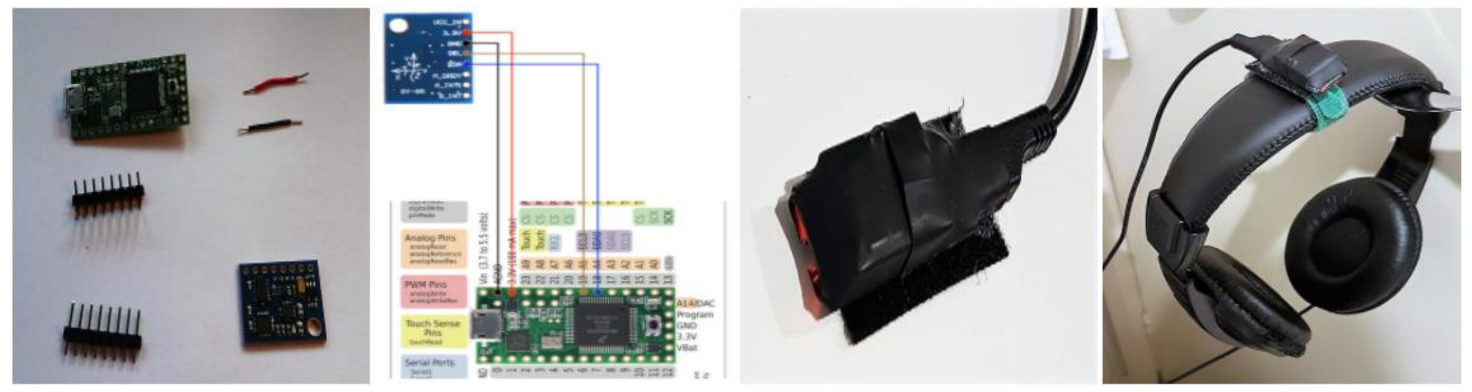
Desktop Application

make this a footnote

~~For this platform,~~ thanks to Stuart Favilla for the idea ~~of using and integrating a head-tracker which can track~~ yaw-pitch-roll value of a user's head. This value is used to change sound field and generate directional narration.

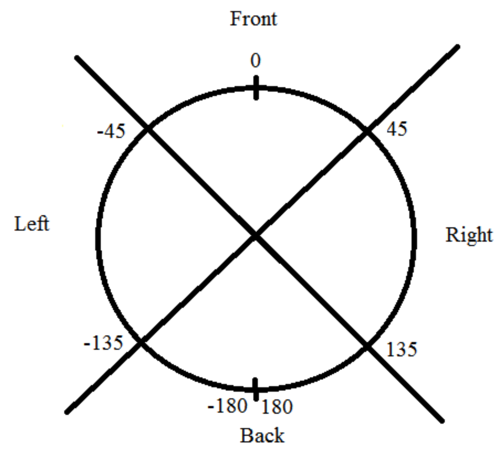


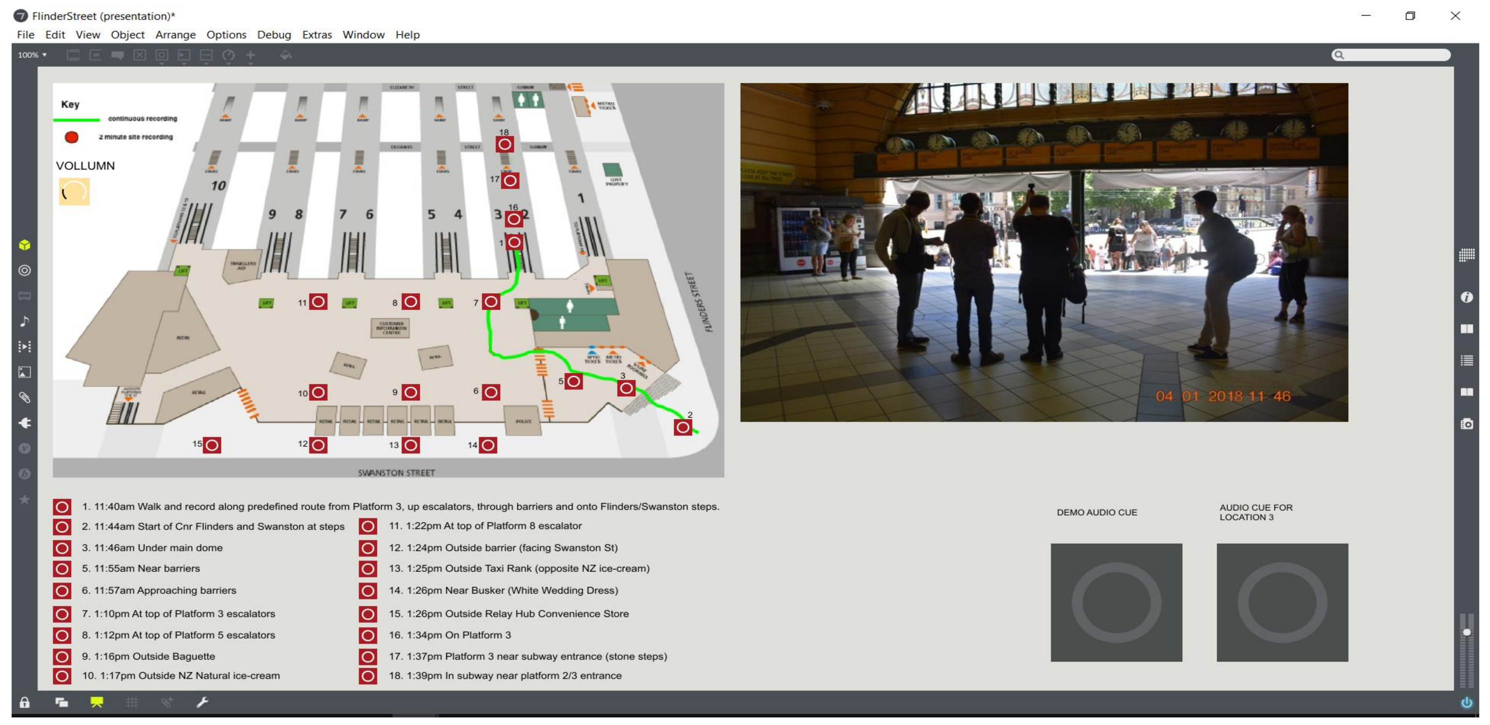
The image below shows the open-source head-tracker we used, called Hedrot and its integration on headphone.



Narration and Audio Description based on user's head direction

The surround area will be described, description is on-request and dynamically adjusted based on head direction.





Main Equipment

- Garmin Virb 360 Video
- Sennheiser Ambeo VR Microphone
- Zoom H6 recoreder
- Teensy 3.2 board, Hedrot headtracker

References

1. An Introduction to Higher Order Ambisonic (http://flo.mur.at/writings/HOA-intro.pdf)

Project website

https:\\dunglai.github.io\COM\index.html