

Augmenting Urban Experiences: Concept Proposal

DECO3200 - Assessment 1

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Project Brief: Noise Pollution

Noise pollution is an oppressive and inescapable problem for people working and living in large cities. In city centres there are constant sources of high noise pollution, such as construction, traffic, pedestrians and aircrafts.

This is an important issue as it negatively affects productivity and personal health, causing distraction from work, disrupted sleep and is detrimental to health and wellbeing. By augmenting the urban experience of noise pollution and giving people more agency about their exposure to environmental noise we can create a more positive atmosphere for individuals, improving their wellbeing, and benefitting society as a whole.



Research: Health Problems

According to World Health Organisation, environmental noise pollution causes mental health issues from stress and disturbance in sleep, as well as tinnitus and increased risk of heart disease. It also affects performance, changes social behaviours and causes annoyance (*Stansfeld & Matheson, 2003*). The main sources of noise pollution that affect cities are transport, construction and other people (*Environment Protection Authority (EPA) NSW, n.d.*).

Safe noise levels vary between workplaces, for manufacturing workers, noise levels should not exceed 85 decibels (dB) over an eight-hour shift to minimise hearing damage. However, office workers who require high concentration are distracted above 50 dB. In cities this is often exceeded with heavy traffic producing 80 dB and construction equipment such as drills reaching 120 dB themselves (*Safe Work Australia, 2019*). Noise pollution is also invading parks and greenspaces, especially those near major urban areas, which provide natural environments and sounds which are essential to our wellbeing (*Buxton, 2017*). The overall quality of life for citizens is affected by the constant noise pollution experienced at work, home and in the natural environment.

Research: Opportunity Areas

Whilst noise pollution is a pervasive problem that blankets entire cities, we identified three key opportunity areas to address.

Construction Sites - Responsible for a considerable amount of environmental noise which is often particularly intrusive due to its transient nature. The combination of noise pollution and being visually unappealing has been proven to increase stress, contributing to poorer mental health and lower life satisfaction (*Montgomery, 2013*).

Noise Mapping - Australia has been slow to embrace noise mapping compared to other countries, such as the EU. However the limited successful projects which have been completed here are used solely for urban design, infrastructure and master planning projects and are not available to the general public (*Hinze, 2015*). This information would be highly useful for home buyers and renters so that when choosing a home they could mitigate their exposure to noise pollution.

Greenspaces - Greenspaces are important for city dwellers as they aid in stress reduction, relaxation, pain and anxiety relief through 'tranquillity' (*Van den Berg et al., 2015*) - a psychological state characterized by the intersection of peacefulness and nature (*Kaplan, R., & Kaplan, S., 1989*). However access to tranquillity in cities is increasingly under threat due to rising noise levels.

User Research: Key Areas

First person user research was conducted to understand our key areas from our users' perspective and the spaces in which they these problems exist.

Construction Sites - Informal interviews were conducted with people nearby existing construction sites on the uni campus to gauge their attitude towards both the visual and noise pollution they encountered while using the public space. The reactions confirmed that they were disruptive and oppressive to be around, due to the large dark walls and overpowering sound.

Noise Mapping - Immersion was used to understand the struggles faced by home buyers/renters when trying to access information on noise levels surrounding a potential new residence. The information is lacking or doesn't exist, and the data that is there is hard to interpret and use. The users are forced to discover problems with noise pollution in their area by experiencing it first hand, after they've already committed to the home financially.

Greenspaces - Greenspaces near the city and uni campus were observed audibly and visually to understand the noise levels and sources people using the parks were experiencing. While the parks were mostly used for relaxing, reading or playing, the loud, distracting sound from the nearby roads significantly hindered these activities.

Market Analysis: Existing Solutions



NoiseCapture



Habitat
Soundscaping

An app that collect noise data and turn it into maps of noise pollution.

Strengths: large amounts of data collected due to public access.

Weaknesses: only targeted at people with expertise in sound not all public, separate products for collection and mapping, difficult interface to use, relies on user inputs.

Opportunities: make data publicly available and accessible without previous knowledge, create a simple and intuitive design

Creates a harmonious work environment using nature noises and visuals in office spaces.

Strengths: holistic design using combo of visuals and sound, system readjusts to changing noise levels, natural sounds decrease stress compared to unnatural white noise, increase productivity.

Weaknesses: Only works for an indoor environment, multiple parts needed to buy and install.

Opportunities: applying a holistic design for white noise to an open/public space, product which responds to noise levels automatically.

Market Analysis: Existing Solutions



Decorated Hoarding

Historic images or creative graphics on hoarding and scaffolding for construction sites.

Strengths: blocks out some sound and visuals, transforms traditionally bare hoarding and scaffolding, provides community with historical knowledge or artists an opportunity to showcase their work.

Weaknesses: static images which get boring over time, limited options of designs.

Opportunities: create an interactive experience that is more engaging, change the perception of noise to something more positive and creative.



IQBuds

Wireless earbuds with advanced hearing enhancement to control environmental noise exposure.

Strengths: effective for noise cancellation/control, use in variety of environments, factors in societal awareness/safety, personal control.

Weaknesses: for individual use only, physical product to wear, expensive, not well known.

Opportunities: cheaper or more accessible product with personal control system.

Key Insights

Noise pollution is a complex and layered problem with no clear solution as demonstrated through our background research. The prevention of noise itself within urban environments is impossible, which is why noise management is paramount when considering solutions. The key insights we gathered to tackling this complex problem area are:

- Changing the negative connotations of construction barriers and noise pollution into more positive ones by creating more engaging and emotionally sensitive urban infrastructure.
- Making noise pollution data more common in Australia to aid in urban planning, whilst also making it easily accessible to the public so that citydwellers can make more informed decisions, especially regarding environmental noise pollution when choosing their homes.
- Preserving tranquility in urban greenspaces by transforming road traffic noise and into something more pleasant, improving mental wellbeing by enabling an escape from city stresses.

Concept 1: Painting with Noise

Painting with Noise (PwN) will help restore the temporary reduced aesthetics that come with construction work. By utilizing the big blank canvas that is the construction walls, PwN aims to create beautiful semi-interactive artworks by analyzing noise levels from the construction work and translating it into RBG-light gradients.

Construction hoardings are often used as a canvas for many installations ranging from simple graphics and ads to more complex interactive displays. Hoardings in the context of sound usually serve the sole purpose of reducing noise. There is to our knowledge, not any concepts of hoardings using the noise for a purpose.



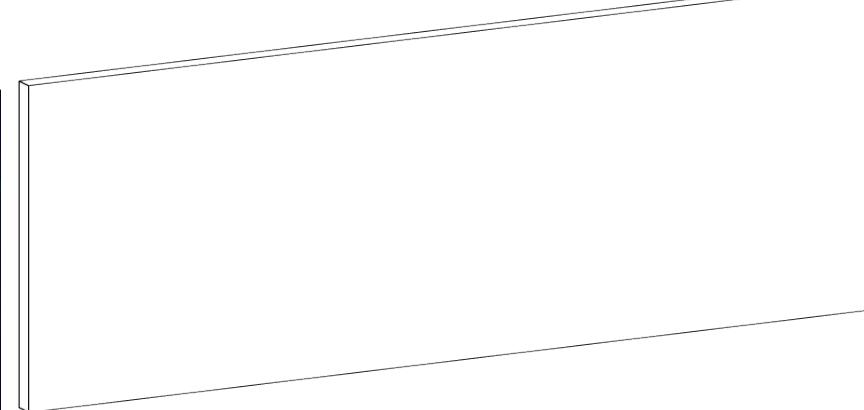
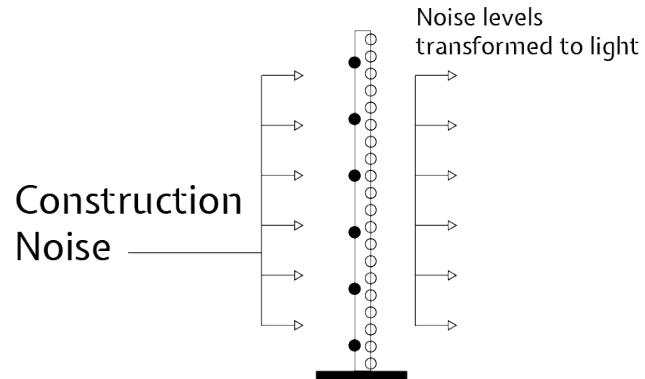
Painting with Noise: How it works?

Utilizing interactive digital construction walls **Painting with Noise** records noise levels from undergoing construction and translate the noise into “paint”, displayed as colourful light on the large canvas that is the construction wall.

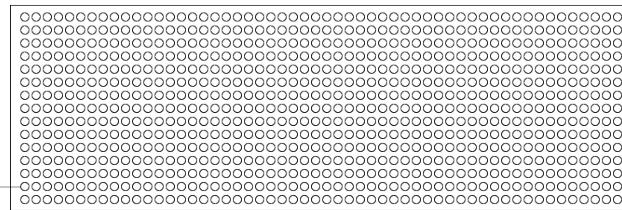
The wall will have densely packed, systematically distributed sensors from top to bottom, recording audio levels throughout the day. On the front side of the unit (the facade facing the street), it will have a *LED curtain* surface (underneath a protective layer) - similar to a screen. The LEDs will work as a measurement of noise, measuring the average noise levels throughout the day - visualising the noise as colourful light, based on how much noise is hitting the specific area of the unit.

The idea is that, with time you can see where noise pollution has been high and where it has been low, visualized as a beautiful life-like gradient painted across the construction walls.

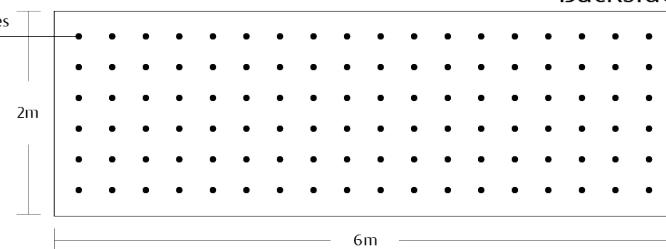
Visualisations



Frontside



Backside



Painting with Noise



Concept 2: City Soundscapes

City Soundscapes addresses the lack of noise mapping in Australia and inaccessibility of existing solutions by utilising IOT sensors. These would be attached to street lights and located at intervals throughout urban environments to record and track noise pollution data, especially around residential areas. The sensors produce an interactive map to provide information to users about noise pollution and history in a particular area, which would be especially useful for real estate and city planning.

There are some similar ideas on the market which map noise or create sound profiles, such as Noise Capture, however they are in the prototyping phase or only display the data, rather than aiming it towards the public for informing decisions and don't include historical information. They are also visually overwhelming and hard to use.



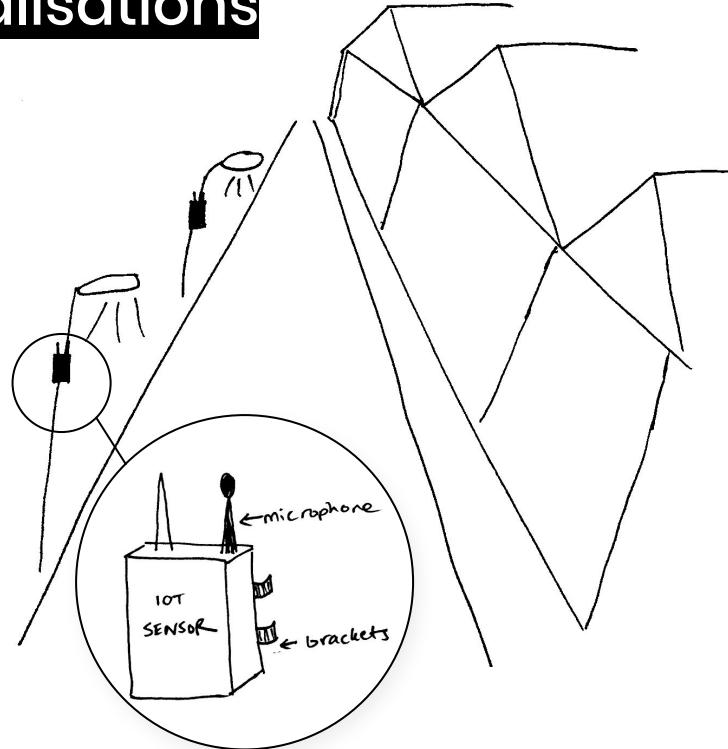
City Soundscapes: How it works?

City Soundscapes uses IOT sensors for measuring decibels of sound, with a system to detect whether the level is harmful. The application will be able to recognise the source of sound based on samples provided and produce a sound profile containing the percentages of the primary sources (e.g. 25% planes, 15% traffic, 12% pedestrians).

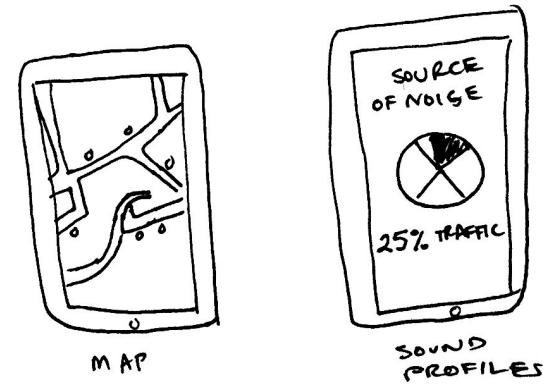
These IOT sensors create a comprehensive network, being mounted on alternating street lights so another physical structure doesn't need to be built and all areas are covered. The sensors are cheap and have a lifespan of up to 5 years, meaning that they are self sustaining and require minimal maintenance.

The map produced by the data from the sensors combines the decibels, period of time the sound lasts for and source of noise. It also track the noise levels over time to provide a history, noting whether the noise pollution has increased. It would be helpful in locating areas of high noise pollution for real estate uses and matters of urban design, infrastructure and city planning.

Visualisations



IOT Sensors placed on street lights in residential areas



Interactive map and sound profiles created from data - viewed on phone

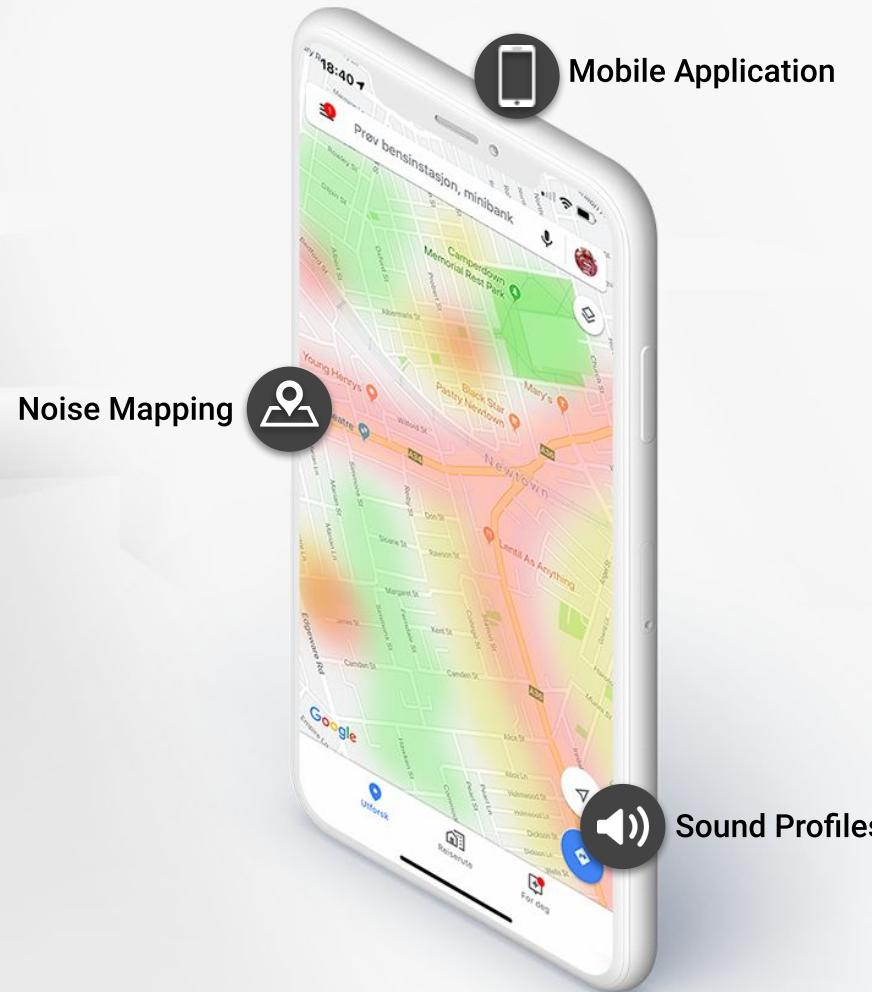
City Soundscapes



IoT Sound Sensor



Street lights +
Existing Infrastructure



Noise Mapping



Mobile Application

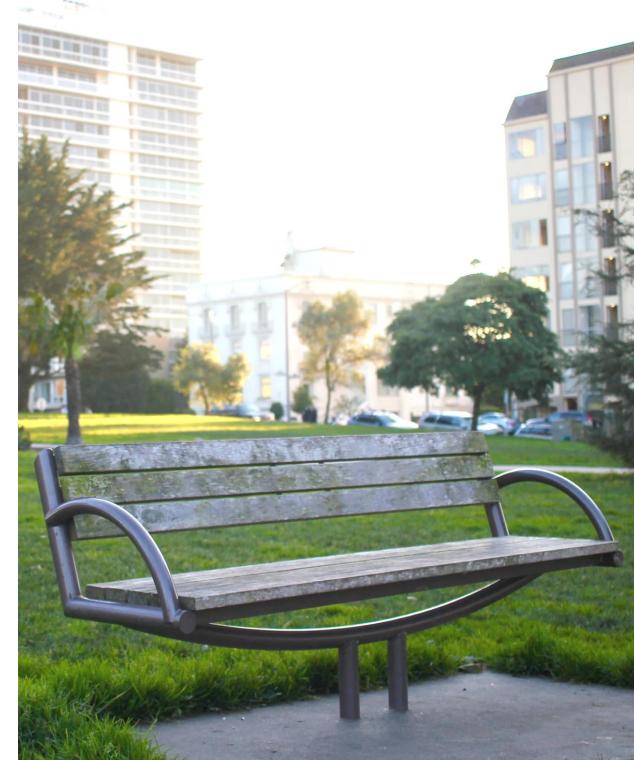


Sound Profiles

Concept 3: Oasis

Oasis will aid in preserving tranquility in urban environments as cities continue to grow and traffic noise booms by augmenting the soundscapes of greenspaces. Transforming the often intrusive and loud traffic sounds typical of cities into more pleasing and soothing listening experiences. This will allow those trying to enjoy urban greenspaces a sense of calm, which is increasingly difficult to find in urban environments.

Currently there are no existing solutions to the problem of environmental noise in greenspaces or the threat this poses to the health and wellbeing of those who reside in cities.

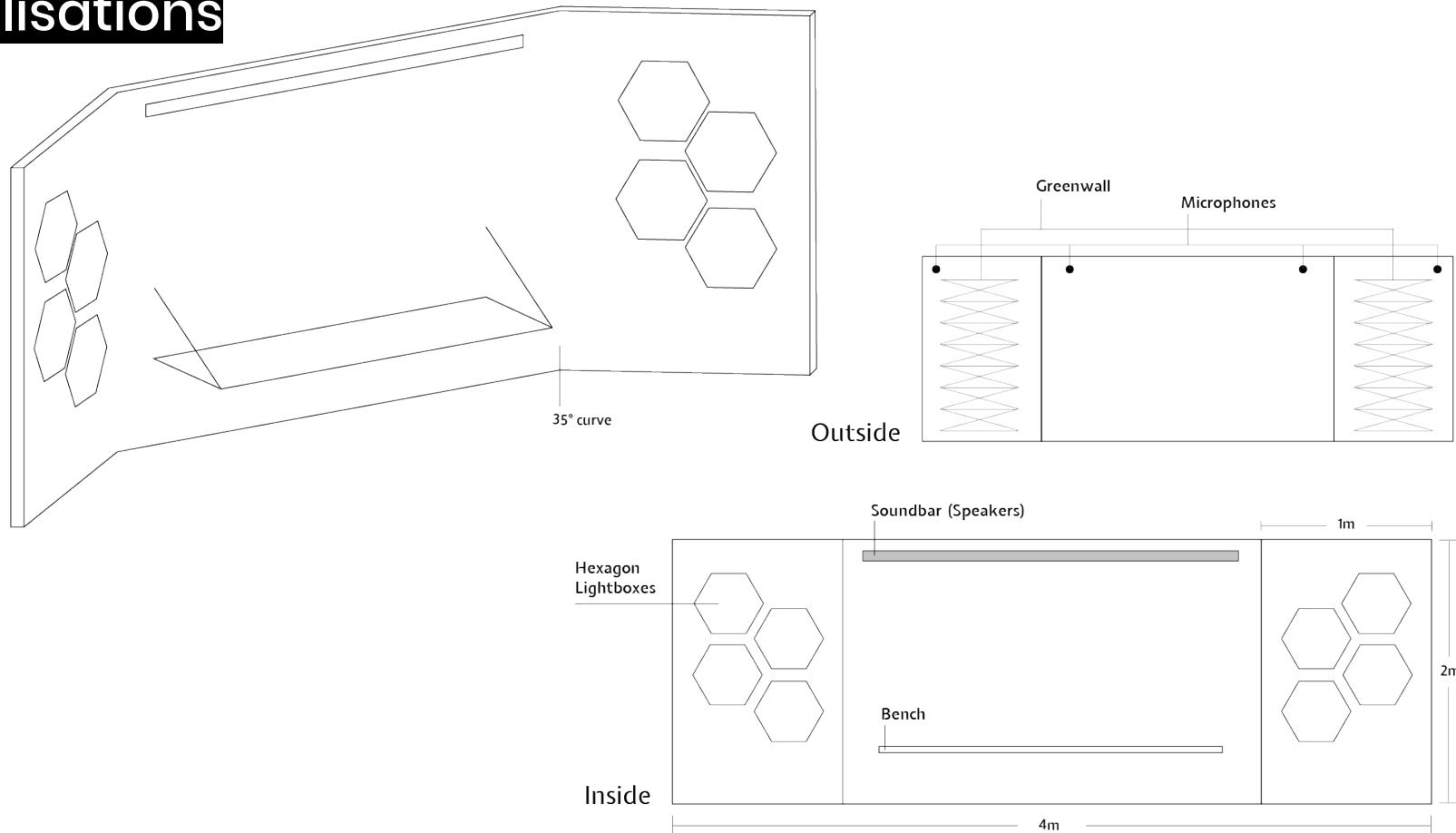


Oasis: How it works?

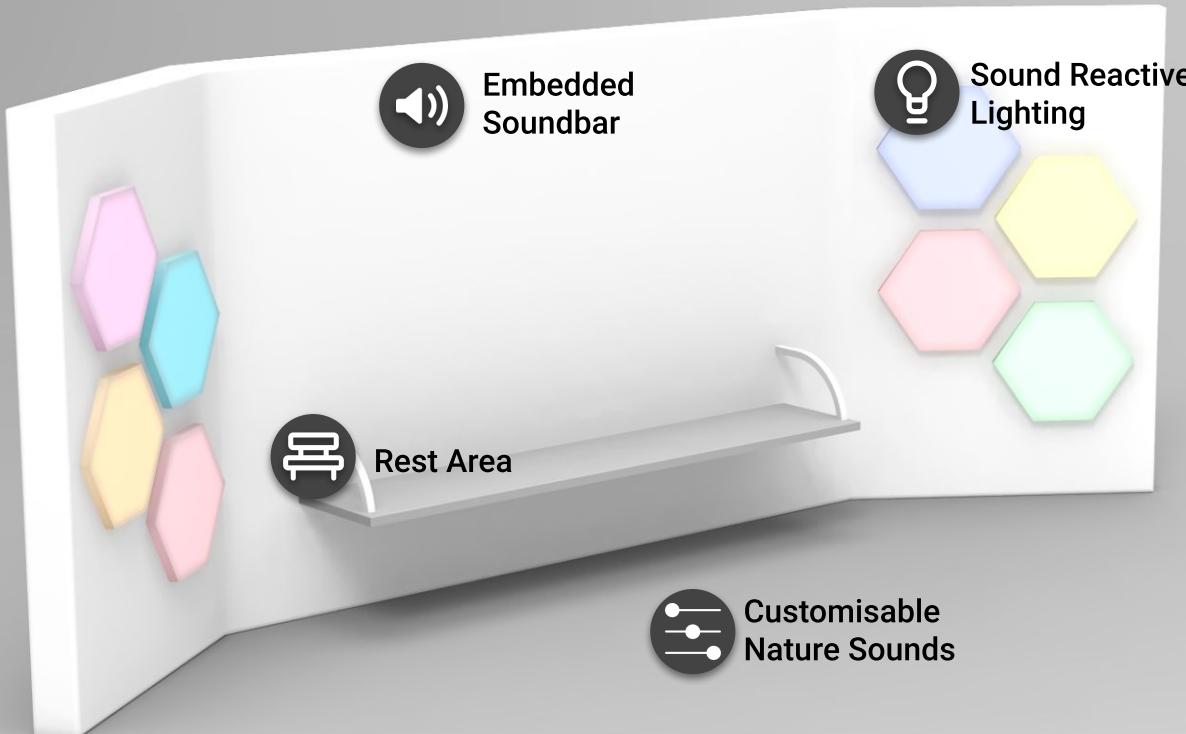
Oasis consists of thoughtfully designed sound shields which create pockets of tranquility within busy and chaotic urban environments. These sound shields use noise transformation to alter the perception of undesirable environmental sounds by applying a small amount of carefully crafted sound 1–3 dB louder than the traffic noise and merging the background with the custom ambient sounds to create a sound that is far more pleasing. It uses a microphone to pick up the background sound which is then transformed and layered with other natural sounds that the active user can customise through an interactive screen mounted on the wall to suit their own personal preferences. This is then played through embedded speakers on the interior of the shield.

Oasis also includes ambient lighting that responds to the transformed noise, heightening the calming experience for the active users and also visually enhancing the space which will make the greenspace more desirable for observers or passer-bys. The outside of the sound shield will feature a vertical garden and a display providing information about the greenspace such as wayfinding, facilities or community events.

Visualisations



Oasis: Sound Shield



INTERIOR

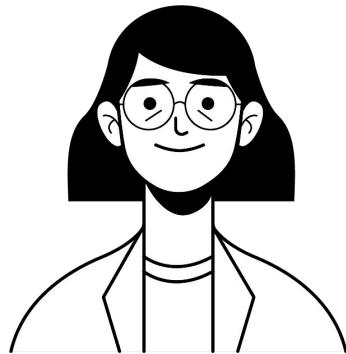
EXTERIOR

- Microphones
- Vertical Gardens
- Information Display





Personas: Who are our users?



Jess
Office Worker

Jess' daily commute to the CBD consists of walking past multiple construction sites. Not only are they loud and annoying but they are barren and ugly as well and she often finds herself feeling irritated and stressed before she even begins her day.



Holly & Tim
Young Couple

Holly and Tim are excited to be moving to the city but aren't sure which suburbs they should be looking at for their first home. They've heard horror stories from their friends not being able to get a wink of sleep because of things like busy traffic, trains roaring past or even rowdy neighbours.



Milton
City Slicker

Milton loves his inner city apartment lifestyle, the only thing it's missing though is some greenery to help him unwind. There's a park not too far away but he can't even hear himself think there over the cacophony of traffic in the background.

Hardware & Software Requirements

Painting with Noise

Networked microphones on the backside of the hoarding - noise levels transformed into a value displayed as light, this can be done using LED Edit or processing, in which case we might have to network the LEDs with Arduinos.

Hardware

- Noise sensors (microphones)
- LED curtains or network of individual RGB LEDs
- Arduinos

Software

- Windows/Linux
- LED Edit (2019) Software
- Processing

City Soundscapes

Networking IoT sensors around the city collecting data on noise. This data will have to be categorized and presented as a heatmap on top of a map (Google Maps). The program has to be written in various languages, mainly Javascript.

Hardware

- Noise IoT sensors (transmitting microphones)

Software

- App + website
- Google maps extension
- Cloud service
- Server service

Oasis

Live recording of traffic noise will have to be transformed with a minimal latency. This can be done using various plugins and programs, similar to guitar pedal effects. As well as a simple program controlling the output of the sound.

Hardware

- Noise sensors (microphones)
- RGB LED lights
- Speakers
- Raspberry Pi

Software

- Noise transformation software; pitch shifter, reverb, autotune ++
- Raspberry Pi /w Linux

Group Charter: Meet the team



Jodie

Interaction Designer



Miriam

UX Researcher



Mikkel

Industrial Designer



Taha

Front-End Developer

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