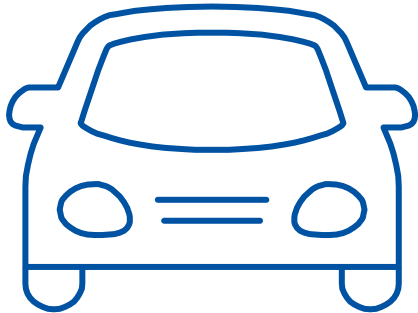




# **Mid-Air Gesture Interaction for Passengers in Cars**

**Catriona Murphy- 2312695M**

# 1. Introduction



A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines. The nodes are represented by small circles, some of which are larger and have concentric circles, suggesting a hierarchical or multi-layered structure. The lines are thin and gray, connecting the nodes in a non-linear fashion.

## **2.**

# **Background Research**

A decorative network diagram in the bottom-right corner, similar to the one in the top-left. It shows a cluster of nodes connected by lines, with some nodes being larger and having concentric circles, indicating a similar hierarchical or multi-layered structure. The lines are thin and gray.

# Features of a Range Rover



## Basic controls:

- ⦿ Temperature
- ⦿ Volume
- ⦿ Windows

## Luxury technologies available:

- ⦿ Ambient Lighting
- ⦿ Rear Entertainment System
- ⦿ Champagne Cooler
- ⦿ Massage Chairs

Finnerty, J., 2017. This £177k SUV is most expensive Range Rover EVER - with TVs and fridges [WWW Document]. The Irish Sun. URL <https://www.thesun.ie/motors/1862771/range-rover-svautobiography-is-most-expensive-model-ever-and-the-177000-suv-has-tv-screens-a-fridge-for-two-wine-bottles-massage-chairs-and-a-digital-butler/> (accessed 3.16.21).

# Status of Mid-Air Gesture Interaction Technology



- ⊙ Household appliances: thermostats
- ⊙ Games
- ⊙ Driving



Shakeri, G., Williamson, J.H., Brewster, S., 2018. May the Force Be with You: Ultrasound Haptic Feedback for Mid-Air Gesture Interaction in Cars, in: Proceedings of the 10th International Conference on Automotive User Interfaces and Interactive Vehicular Applications. Presented at the AutomotiveUI '18: 10th International Conference on Automotive User Interfaces and Interactive Vehicular Applications, ACM, Toronto ON Canada, pp. 1–10. <https://doi.org/10.1145/3239060.3239081>

Moser, C., Tscheligi, M., 2015. Physics-based gaming: exploring touch vs. mid-air gesture input, in: Proceedings of the 14th International Conference on Interaction Design and Children. Presented at the IDC '15: Interaction Design and Children, ACM, Boston Massachusetts, pp. 291–294. <https://doi.org/10.1145/2771839.2771899>


Haselton, T., 2020. Google announces new Nest Thermostat that uses radar to detect when you're nearby [WWW Document]. CNBC. URL <https://www.cnbc.com/2020/10/12/google-announces-new-nest-thermostat-with-soli-radar.html> (accessed 2.18.21).

# Gestures and Gesture Sensors




## Gesture categories:

- ⦿ Static
- ⦿ Non-static

A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines, with some nodes highlighted in blue and others in grey.

# **3.**

# **Requirements Gathering**

A decorative network diagram in the bottom-right corner, featuring a complex web of interconnected nodes and lines, with some nodes highlighted in blue and others in grey.

# Gesture Elicitation Surveys

## Why ?

- ◎ Learn how users interact with different systems
- ◎ Obtain a wide range of gestures for different controls

## How ?

- ◎ Zoom
- ◎ Google Forms





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# **4.** **Design**

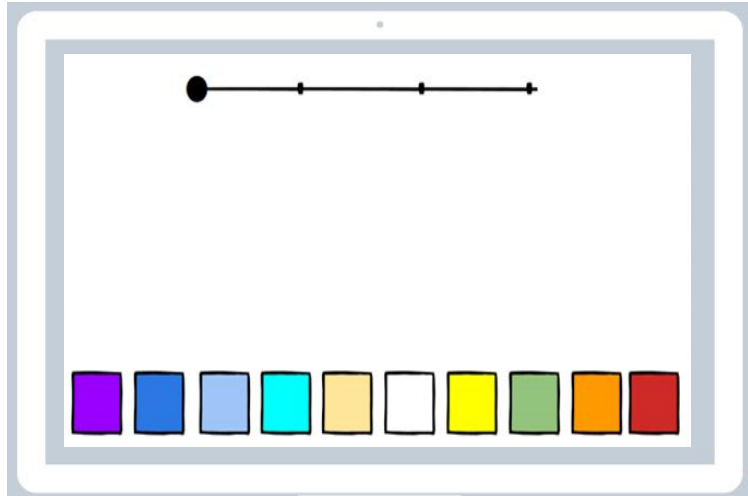
A decorative network diagram in the bottom-right corner, similar to the one in the top-left. It shows a cluster of nodes connected by lines, with some nodes being larger and more prominent than others, creating a sense of depth and complexity.

## Gesture Set

<b>Action</b>	Adjust Temperature	Adjust Volume	Turn on Massage Chair	Wave Format	Pulse/ Pulse Duo
<b>Corresponding Gesture</b>	Dial	Dial	Circle	<u>Hello Wave</u>	Flash
<b>Action</b>	Hot Stone	Intensity Level	Change Colour of Ambient Lighting	Change Brightness Level	Open Champagne Cooler
<b>Corresponding Gesture</b>	Hold	Count Fingers	Swipe Left/ Right	Swipe Up/ Down	Drink



# Wireframes



Change Ambient Lighting



Open Champagne Cooler

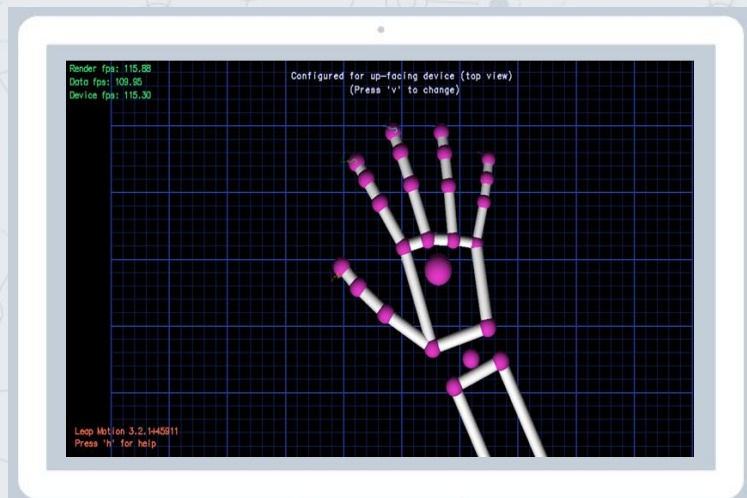


# **5.** **Implementation**

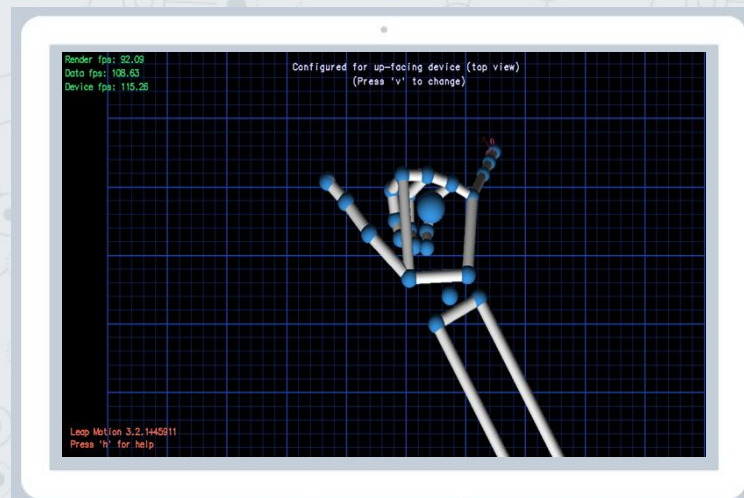
## Development Environment



# Using the Leap Motion Sensor



Hand - Open Palm



Hand - Drink Gesture  
Position

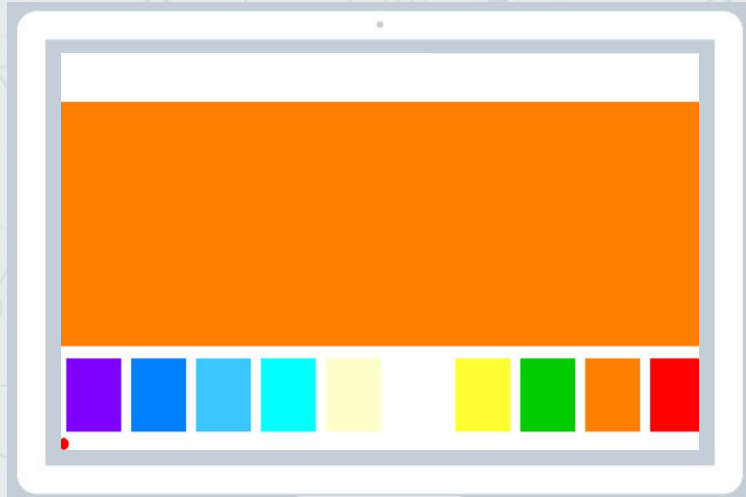
# Implementing the Gestures

- ◎ 10 Python Scripts
- ◎ Listener Class
- ◎ on\_frame function
- ◎ Recognisable gestures





# Implementing the User Interfaces



Change Ambient Lighting Colour



Open Champagne Cooler



# Final Product





# **6.** **Experiment & Evaluation**

# Experiment

- ◎ Aim
- ◎ Test Conditions
  - Set-Up
  - Structure
- ◎ Feedback



# NASA Task Load Index Survey

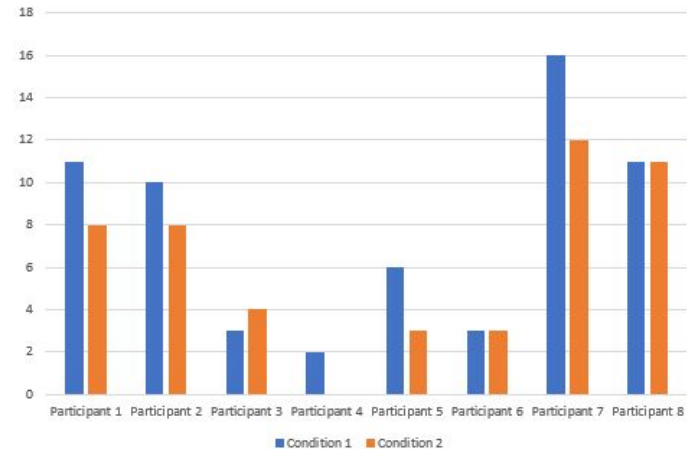
## Workload Scale

- ⦿ Mental Demand
- ⦿ Physical Demand
- ⦿ Time Pressure
- ⦿ Effort Expended
- ⦿ Performance Level Achieved
- ⦿ Frustration Experienced
- ⦿ Annoyance Experienced

Time pressure

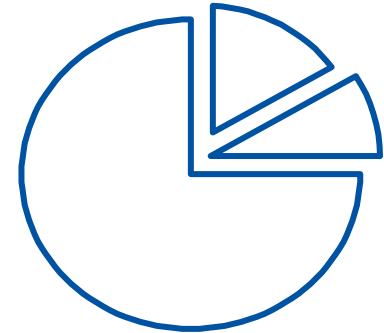
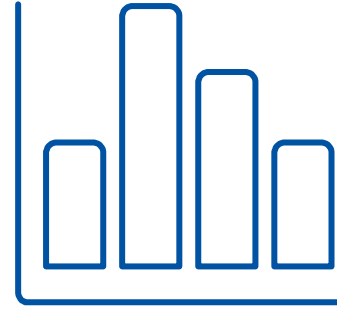


Time Pressure



# Surveys

- ⊙ Usability
- ⊙ Feedback
- ⊙ Gestures
- ⊙ Position in Car
- ⊙ General



## Further Development

- ◎ Gesture to Develop
  - Dial gesture
  - Focus on Temperature Control
- ◎ Development
  - “segmentation” and “clutch”
- ◎ Resulting Improvement
  - Reduces awkward hand positions



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# **7.**

# **Conclusion**

A decorative network diagram in the bottom-right corner, similar to the one in the top-left. It shows a cluster of nodes connected by lines, with some nodes being larger and more prominent than others. The overall style is clean and modern, using a light gray color scheme.


## Conclusion

- ◎ Delivery of a project on passengers using mid-air gestures to operate controls from the back seat of a car
  - Compiled a list of controls in luxury cars
  - Established a set of mid-air gestures to associate with each control
  - Implemented a set of mid-air gestures
  - Analysed the performance of each gesture through observation and survey results
- ◎ To conclude
  - all of the gestures were able to be performed to a high standard
  - participants found it an interesting and novel concept



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# **8.** **Future Work**

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The background is a solid light blue color. It is decorated with several small blue dots and larger blue-outlined circles scattered across the page, primarily along the left and right edges.

**Thank You**