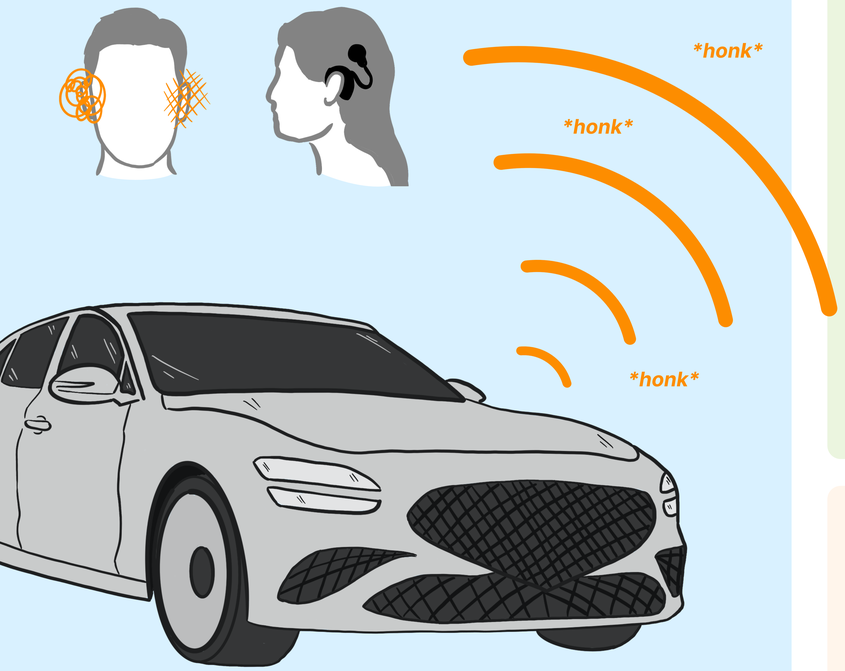
WHEREable

Identifying and communicating the direction of sound

UNIVERSITY OF WATERLOO | FACULTY OF ENGINEERING
Department of Systems Design Engineering

Biomedical Stakeholder Café

People with hearing loss have difficulty identifying where sounds come from.



WHEREable helps improve **safety and awareness**, especially for pedestrians.

8 hours of battery life

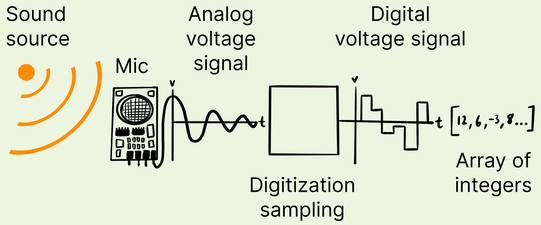
2.3 seconds for user to react

$230 to manufacture – **3.5x** cheaper than hearing aids

1. Sound Reception

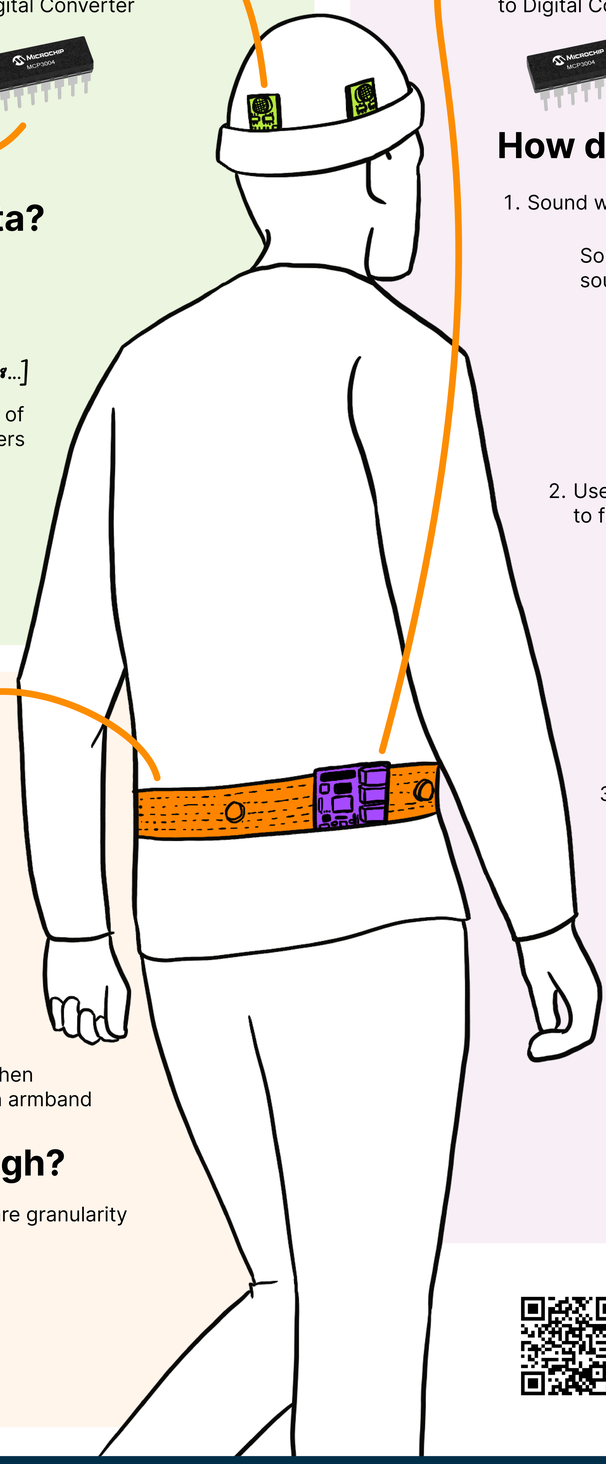
LM386 Sound Sensor x 4 | Hat | MCP3004 Analog to Digital Converter

How does sound become data?



Why a hat?

- Centred on the body - it moves when you move
- Away from disruptive movements and layers

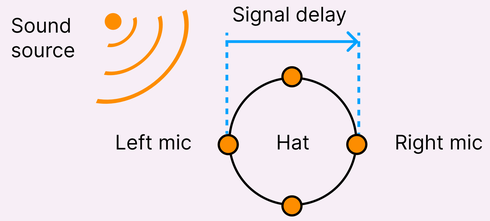


2. Signals Processing

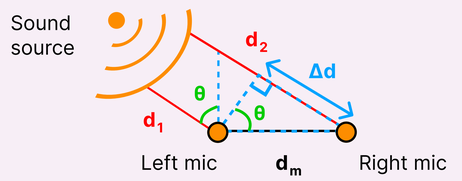
MCP3004 Analog to Digital Converter | Raspberry Pi 5 Microcontroller

How do we determine direction?

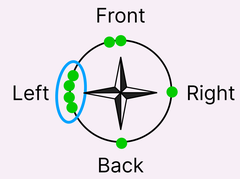
1. Sound waves reach the furthest microphone with a time delay.



2. Use time delay to find distance (Δd) and trigonometry to find the angle of arrival (θ).

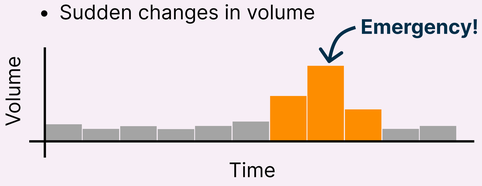


3. Repeat for all pairs of microphones, and choose direction with most estimates.



When do we alert the user?

- Sudden changes in volume



3. User Interface

Raspberry Pi 5 Microcontroller | Fabric Belt | Haptic Coin Motors x 4

Why a belt?

7.4% faster reaction time with haptics than visual signal

55.7% faster reaction time when wearing a belt than an armband

How many directions is enough?

- We tested the user interface in isolation to compare granularity

	4 directions	8 directions
User reaction time	1.637s	2.338s
User accuracy	98.75%	75%

Learn more: **https://bit.ly/whereable**

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