

AUSIGN - An AUSLAN Interpreter

Needs Assessment

Who are you designing the product for? What is your target audience?

We are designing this product predominantly for people who have hearing and/or speech impairment and use sign language to communicate. Of the many people around the world who use sign language, our target audience is the Australian community who use Auslan, the Australian sign language.

Why do they need it?

Our target audience of Auslan users need our product due to the lack of availability and accessibility of existing solutions. From our market research, we found that a good percentage of Australians with hearing and/or speech impairment feel ostracized from society due to not being able to properly communicate with the wider public. There is significant research and projects targeting ASL, the American Sign Language, but very little for Auslan, leaving them in the dust. Furthermore, our product will provide a simple solution that allows users to maintain their independence and reduce costs, compared to the current primary solution of a dedicated Auslan interpreter. This will be particularly beneficial in situations such as emergencies, workplace, school and university, doctors, and social events.

What do they need?

The target audience needs a solution that is portable and easy to use with a low cost, a lot of Auslan users don't have the luxury of affording an interpreter. Looking at our primary and secondary market research, there is a lack of a sure front and easy way for our target audience to communicate with the larger public. A lot of them use smartphone apps or text-to-speech devices but are not satisfied with the current scope of technology available to them. They are sceptical of previous products as they do not consider the context issues associated with it. E.g. The word for "chair" could mean "sit" depending on the context. They need a product that can reliably translate Auslan to spoken English in real time. The product needs to have a long battery life, with the ability to charge, as needs to last a whole day of use and be intuitive.

Where and how will it be used?

The product will be used anytime and anywhere, when the user is at home, or leaves their home, i.e. workplace, school, university, doctors, social hangouts, restaurants, etc. Any setting where the user needs to communicate Auslan to spoken English, this

product can be used. It will be available as an easy to wear gloves and will convert their hand movements into audio through a speaker attached on the glove.

What features do they need in it?

Features that are required for this product include:

- Long battery life: for lasting all day and in case of emergencies which can occur at any time.
- Portable and lightweight: for ease of use and portability
- Simple user interface: easy to access button to turn on/off the gloves
- Customisable settings: for adjusting the gloves based on personal preferences (e.g. volume, special signals etc)
- Large database of signs with context awareness: to differentiate between two words based on context
- Offline functionality: for use without the need for network coverage
- Comfort and durability: for user satisfaction and product longevity

What are the issues/limitations of existing products/solutions?

As mentioned before, most devices are based on ASL with little to no support for Auslan. They also lack context awareness which severely limit the usage of these devices as it could be very different to traditional sign language. Also, existing solutions fail to recognize facial expressions as they affect what the sign could mean (e.g. signs with a tensed look on face could be associated with more strong meanings which the products in the market fail to identify). Cost is another factor as existing glove-based products are very expensive and typically sold out, making them very inaccessible.

Requirements Analysis

Lightweight – Each glove must weigh no more than 50 grams

- This is a strong requirement among most of our respondents from the survey. Light cotton gloves weigh around 15-30 grams per glove; winter-fleeced gloves weigh around 40-60 grams per glove and mechanics/work gloves can weigh up to 100 grams per glove. We want our users to be comfortable so would want to keep our gloves weight to around 50 grams per glove.

Long battery life – System must function for a minimum of 12 hours of continuous use on a single charge

- Another strong requirement desired by respondents through the survey. They expect a reliable product for constant use throughout the day and in emergency situations which could occur at any given time, where charging might not be possible.

Durable – Each glove must withstand a minimum of 6 months of regular daily use without degrading.

- Survey respondents highlighted the need for a reliable and low-cost solution. Many users, particularly those with lower incomes won't be able to afford to replace or repair the product frequently.

High accuracy – The product must correctly translate Auslan to spoken English with 90% accuracy

- Incorrect translations could lead to miscommunication. This would be critical in emergencies where users may need to quickly and accurately communicate their situation to get the correct help they need. Survey respondents also highlighted that inaccuracies in existing solutions cause frustrations.

Low latency – The output speech must be within 2 seconds of the sign gesture completion

- A delay between the sign gesture and output audio can undermine natural conversation. It can also lead to confusion in the listener, particularly if the user is constantly gesturing signs.

Customisable – The product must allow user to adjust output volume and speed, and conserve battery life

- Depending on the situation and environment, the user may need to be louder or quieter. A method to turn on or off the product is necessary to preserve battery life.

Offline functionality – The product must operate without network coverage

- Users may need to use the product where they don't have access to internet or cannot afford constant internet access.

Cost effective – The product must cost under \$100 AUD to manufacture

- Existing solutions are very expensive and those particularly with a low income, can't access sufficient solutions. Survey respondents also expressed their need for a low-cost solution as they aren't willing to spend over \$200 at most.

Problem Statement

Deaf and non-verbal people in Australia need an effective, real-time communication tool to translate Auslan to spoken English. Current solutions, such as text-to-speech apps and sign language gloves, fail to interpret the full complexity of Auslan, often lacking contextual awareness and facial expression recognition. Other solutions such as an interpreter are very costly and hard to obtain. This communication barrier limits

independence and inclusivity in everyday social, professional, and emergency situations.

Product Concept

AUSIGN is a wearable communication aid designed to empower deaf and nonverbal individuals by translating Auslan (Australian Sign Language) gestures into spoken English. It aims to reduce communication barriers in everyday settings such as public transport, workplaces, retail, and healthcare. By doing so, it helps users gain more independence within the broader community without needing an interpreter present.

The product is intended to be lightweight, comfortable, and easy to use throughout the day. It will support user-specific preferences and context-aware communication to make interactions feel more natural and intuitive. AUSIGN directly addresses the unmet needs identified through our user research, especially around portability, reliability, and the lack of Auslan-specific solutions in existing products.

Design Concept

AUSIGN will consist of pair of lightweight, durable gloves with flex sensors along the fingers to detect stretching or folding of fingers. An Inertial Measurement Unit (IMU) will be placed along the wrist. This combines an accelerometer (to measure linear motion), gyroscope (to measure rotational motion) and potentially a magnetometer (to measure orientation). These can be combined to help us understand the Auslan hand movements made by the user in sufficient detail. The values from these sensors will be fed into an ESP32 microcontroller, which will process these signals and convert them to spoken English to drive the audio output on the speaker attached to the glove.

To enhance context-awareness, a heartbeat sensor will be incorporated into the glove system. By monitoring the user's physiological state (e.g. elevated heart rate during stress), the device can infer emotional tone or urgency behind signs. This serves as a partial substitute for facial expressions and body language, which are key components of Auslan communication but difficult to capture with sensors alone.

The ESP32 was chosen as it has Bluetooth capabilities which would allow us to make a frontend app to enhance user experience and modify certain settings such as voice output volume, gesture sensitivity, preferred Auslan dialect, and custom sign mappings to their needs.

We will use a 3.7V 800mAh Li-Po battery as this is lightweight, rechargeable with a good energy density allowing for a long battery life. An easy-to-use button will also be included to turn on/off the gloves and for emergency situations (e.g. to shout "help" in case of emergency, this would be user customizable).

Unique Selling Points

1. First Auslan-focused wearable translator. Unlike most sign-to-speech devices built for American Sign Language (ASL), AUSIGN is designed specifically for Auslan, addressing regional sign variations and grammar, unique to the Australian Deaf community.
2. Context-aware translation using biometrics. AUSIGN uses a heartbeat sensor to infer emotional tone (e.g. urgency or stress), adding contextual awareness that conventional gloves lack.
3. Gesture + motion fusion for high accuracy. Combines flex sensors on fingers with a wrist-mounted IMU to recognize both static hand shapes and dynamic gestures, improving recognition accuracy for complex Auslan signs.
4. Lightweight and comfortable design. Designed to weigh under 50g per glove, AUSIGN prioritizes long-term comfort for daily use, exceeding the wearability of most commercial smart gloves.
5. Bluetooth-enabled personalization app. Built on the ESP32, AUSIGN supports wireless communication with a companion mobile app, allowing users to adjust settings like output volume, speed, gesture sensitivity, and dialect preference.
6. Custom sign mapping and user training. Allows users to add personal or region-specific signs and train the system to recognize them, increasing inclusivity for diverse signers.
7. All-day battery life with USB charging. Powered by a 3.7V Li-Po battery optimized for energy-efficient use, the gloves can run for a full day and recharge via standard USB.
8. Voice output through onboard or phone speaker. Offers both onboard audio output and phone-based speech relay, giving users flexibility based on environment and preference.