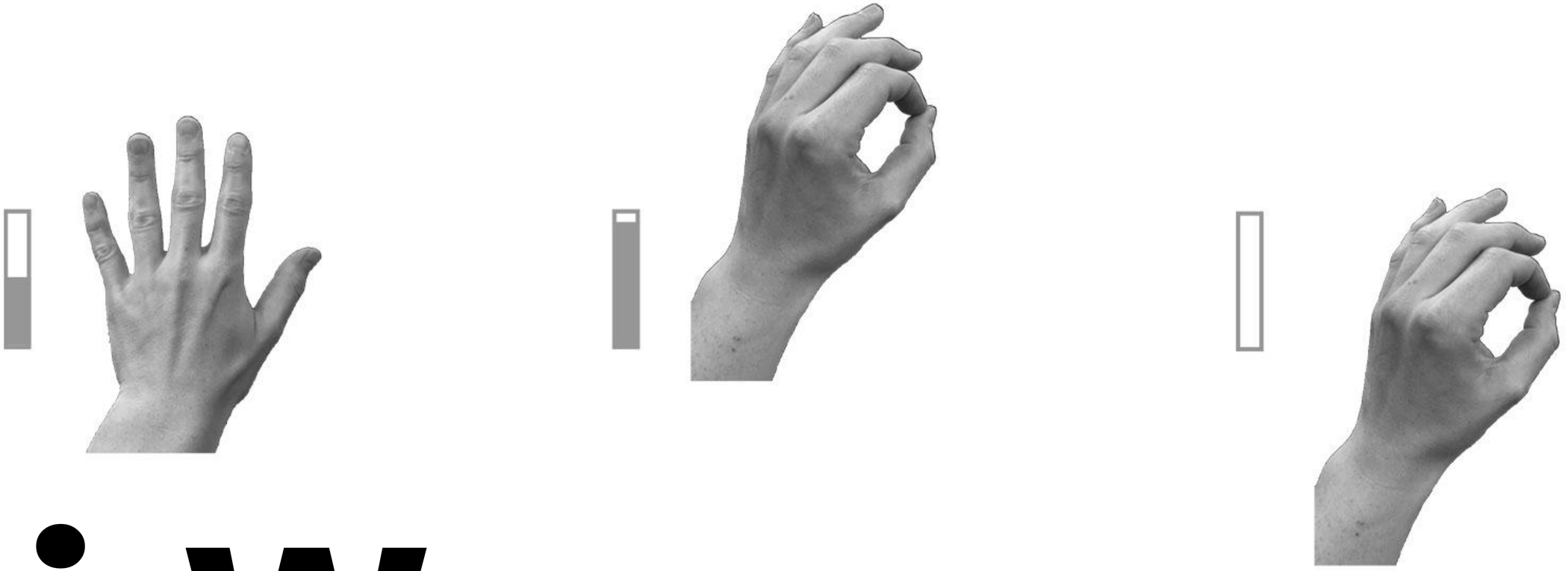
Garg, Singhal and Yadav

DIS Group-2 Project

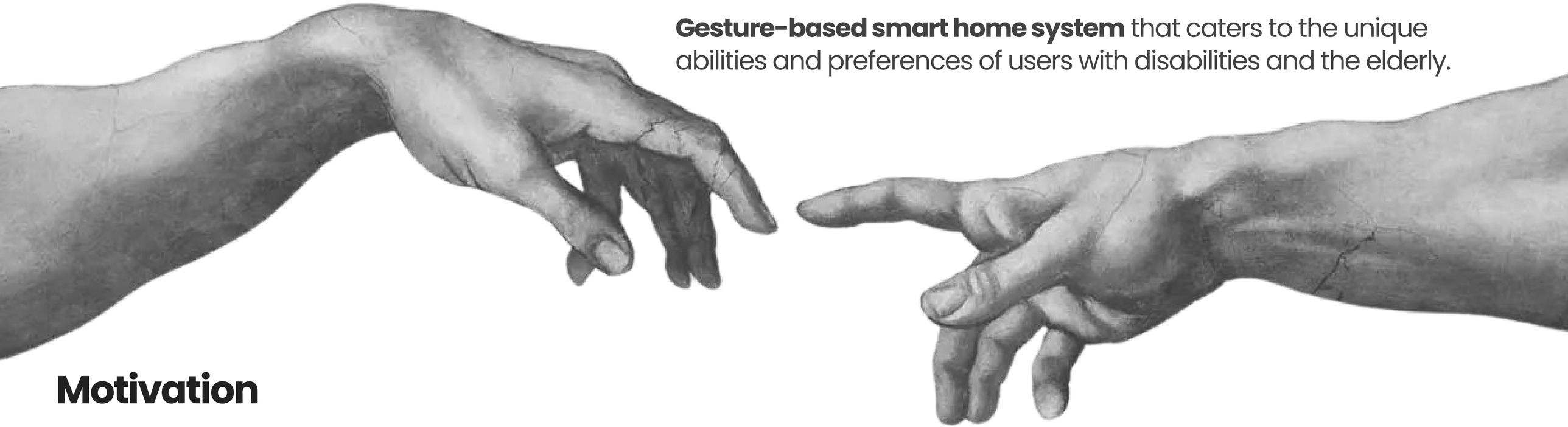


AirWave

an inclusive way to undertake your daily activities.

Problem Statement

Gesture-based smart home system that caters to the unique abilities and preferences of users with disabilities and the elderly.



Motivation

“The current landscape of home systems often overlooks the specific needs and challenges faced by individuals with disabilities and the elderly. Traditional control interfaces, such as switches, buttons, and voice commands, may pose **barriers** to **accessibility** and **usability** for these users, leading to frustration and dependency on caregivers.”

Methodology

1
Research

2
Competitor Analysis

3
Design Decisions

4
User Analysis

Quick glance over research presented before

Research and User Analysis

Elderly face **mobility issues** with far placed applications. They also face problems with devices having minute touch points. **Fitt's law** ratio needs to maintained high for them.

Lingual barriers, voice clarity, **intonation** quality, and background disturbance come in the way of **audio based input**.

Ease of learning and **low error** rates make gestures preferable for command passing -
user acceptance was high in our **survey**.

Competitor Analysis

Our **gesture-based** smart home system offers a very accessible way to interact with your environment, providing effortless control through intuitive gestures. Unlike conventional systems reliant on touchscreens or voice commands, ours **operates entirely on the local network**, ensuring **privacy** and **reliability**. With just a wave of the hand, users can seamlessly control their devices, enhancing **convenience** and **accessibility** in the modern home.

Research

Pros: User-friendly interface, strong security features.
Cons: Limited device compatibility, higher cost compared to some alternatives.

Competitor Analysis

Pros: Unparalleled flexibility and compatibility, Open Source.
Cons: Complexity may deter novice users, setup requirements can be demanding.

Design Decisions

Pros: Ease of use and wide compatibility.
Cons: limitations in customization and complex workflows, hinders advanced automation needs.

User Analysis

Pros: Robust features catering to sophisticated automation needs.
Cons: Premium pricing and dependence on professional installation.

Design Decisions

Choice of using **interviews** to gather insights about appliance usage patterns and the problems our **user group** encounter while using them. We additionally used **surveys** to corroborate our findings with a bigger group.

We explored multiple **modalities** however **sound** imposed problems with coherence. There were also **language barriers** with the plethora of dialects we have in India. Then there were the **learnability** issues. After weighing all of these factors in we decided on use **gestures:** easy to learn and remember, and **universally** understood - **inclusive** and **accessible**.

The Indian Context: All the decisions we took, be it deciding to make our product work offline(due to **unavailability of fast internet** in some places). To not using **english** or any other language as that hinders our commitment towards **accessibility**.

development

Implementation

Challenges

Servo motors not working for the fan, electric overlaod on the arduino, raspberry pi unable to handle the load of our model.

ML Model training and CAD Prototyping

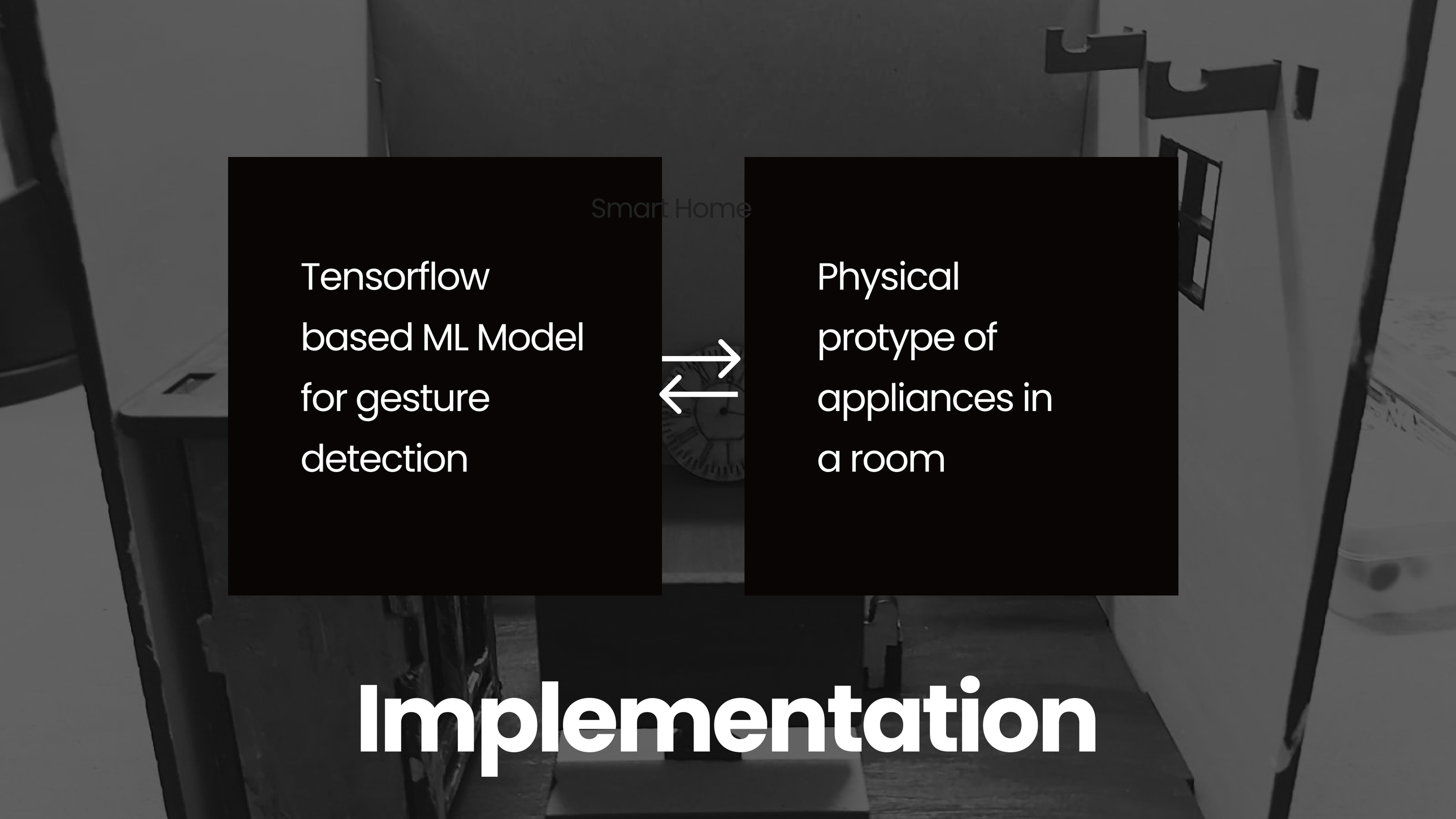
controlling smart appliances and building the physical prototype.

Assembling and Circuitry

Putting together the laser cut components and completing the circuitry - connecting electrical devices.

Testing

User testing on gesture recognition and how the latency of the system is. The error rate etc.



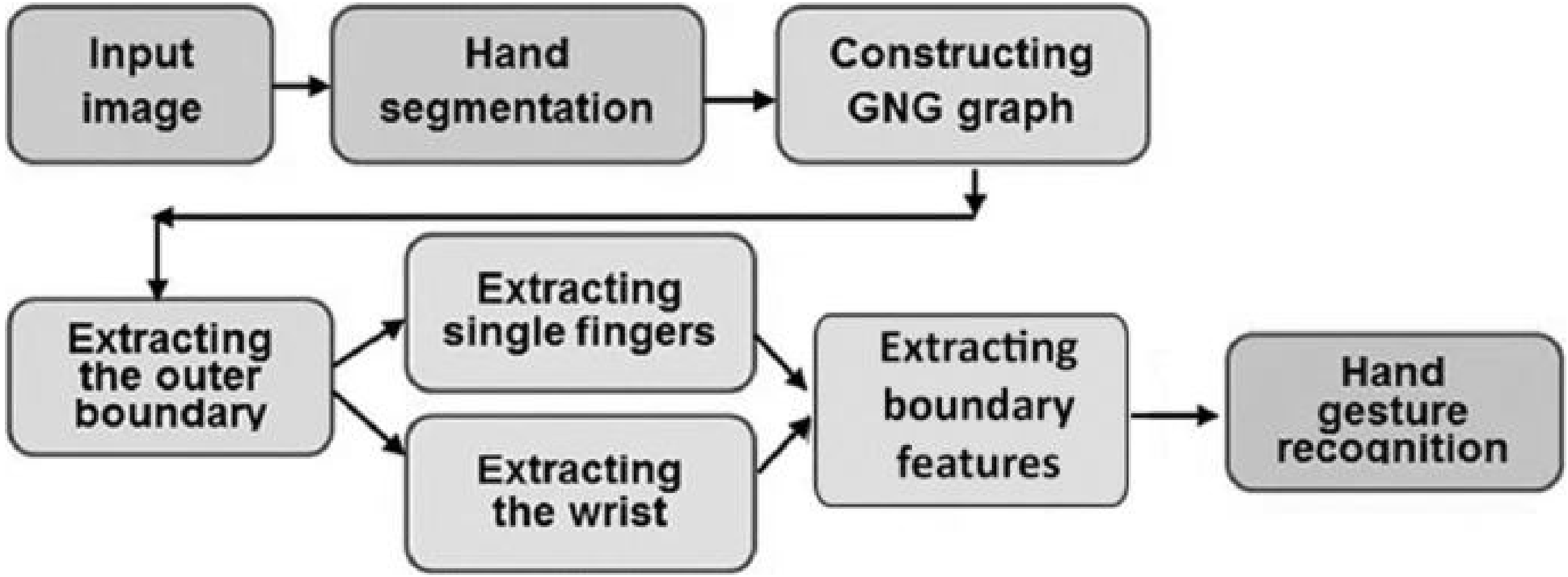
Tensorflow based ML Model for gesture detection

Physical protype of appliances in a room

Implementation

ML Model

Flow



testing

Results and Findings

Accessibility and Usability

People across all age groups and accessibility needs were able to efficiently use the system

Users

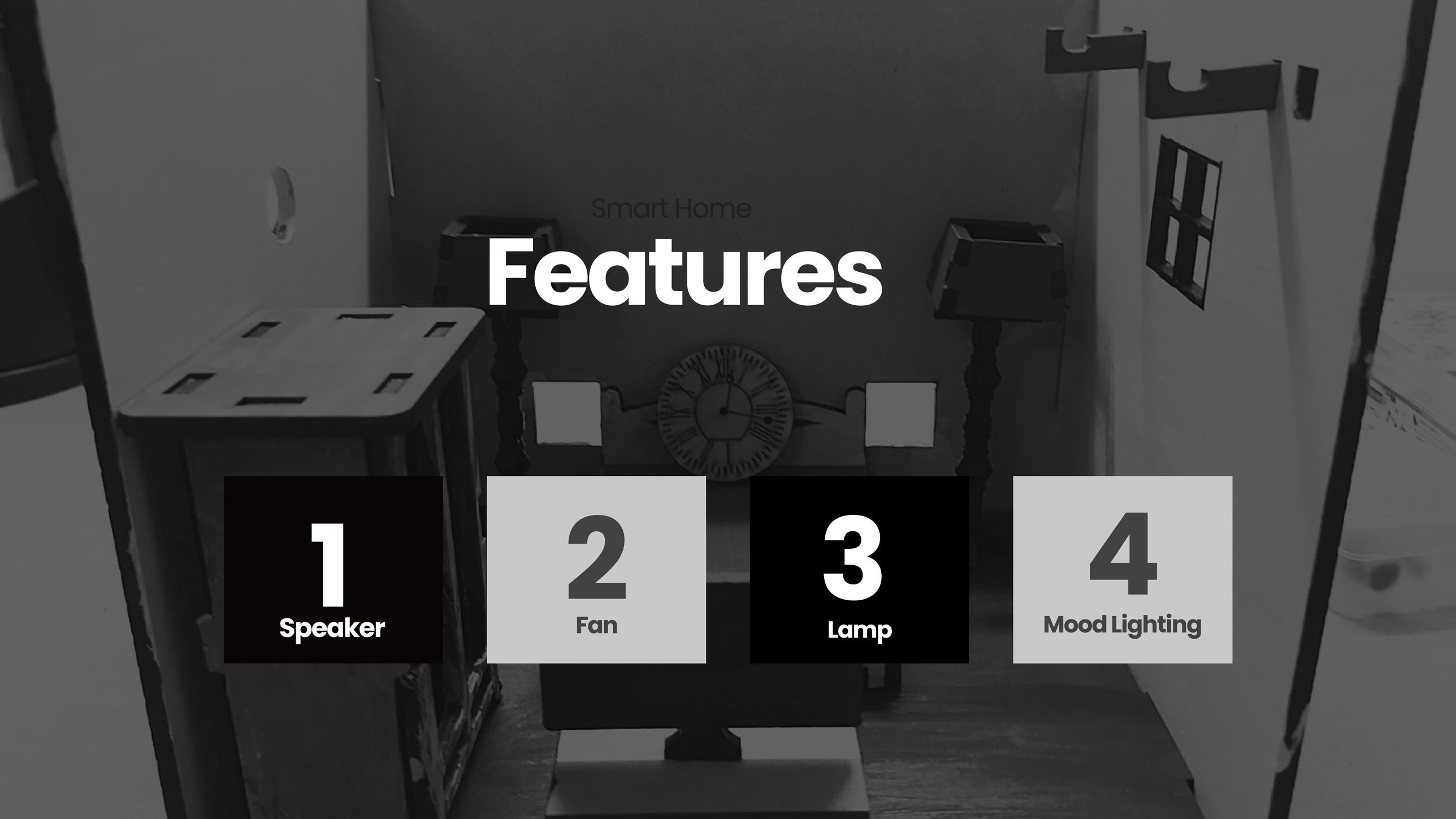
People were easily able to adjust themselves to using the gesture based control system. Lingual and accessibilities barriers overcome.

Context/Background

The model faces difficulty in recognising actions in a visually noisy environment.

Gestures

People across different lingual backgrounds were easily able to learn the gesture-action mapping given to them



Smart Home

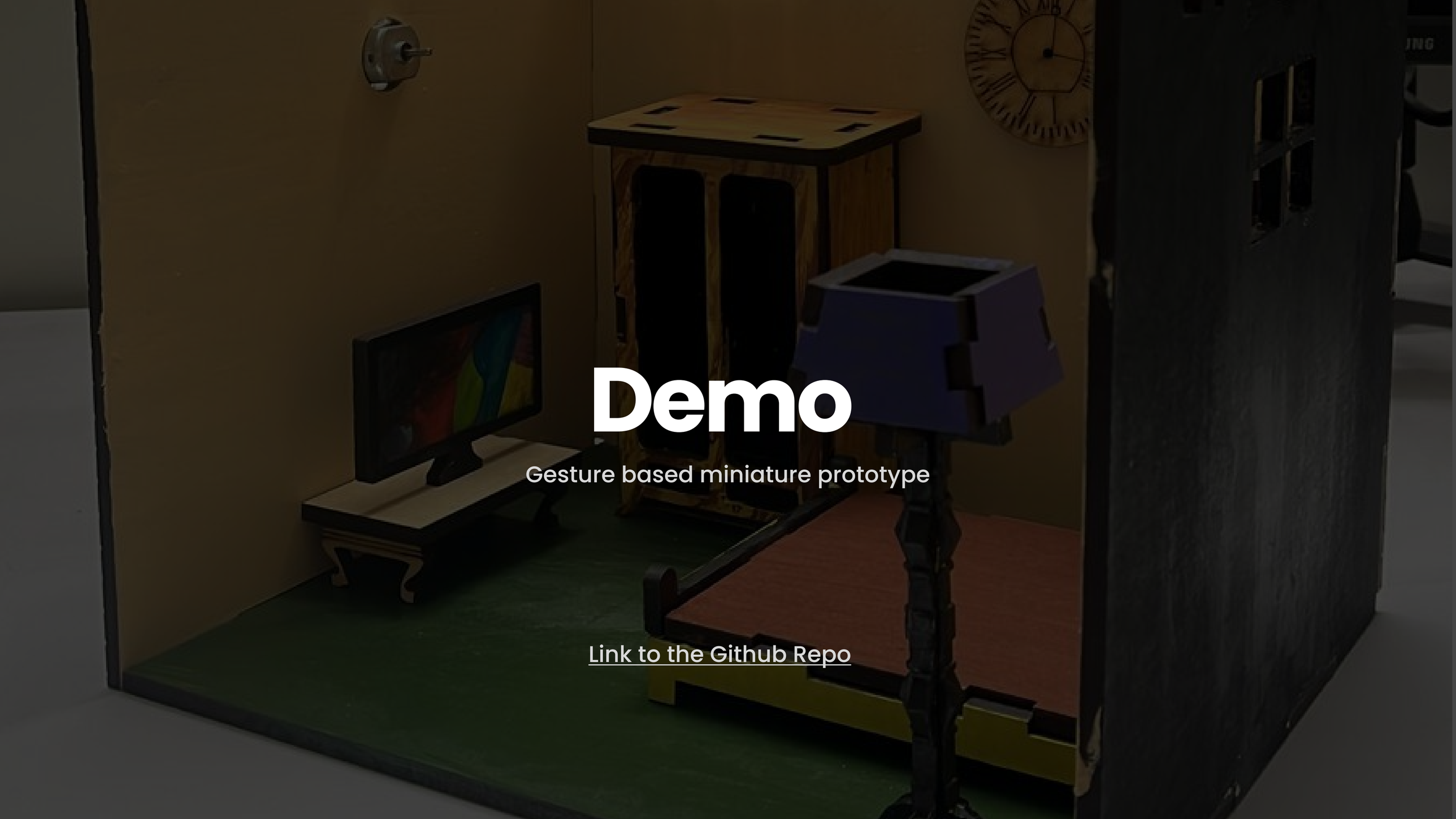
Features

1
Speaker

2
Fan

3
Lamp

4
Mood Lighting



Demo

Gesture based miniature prototype

Link to the Github Repo

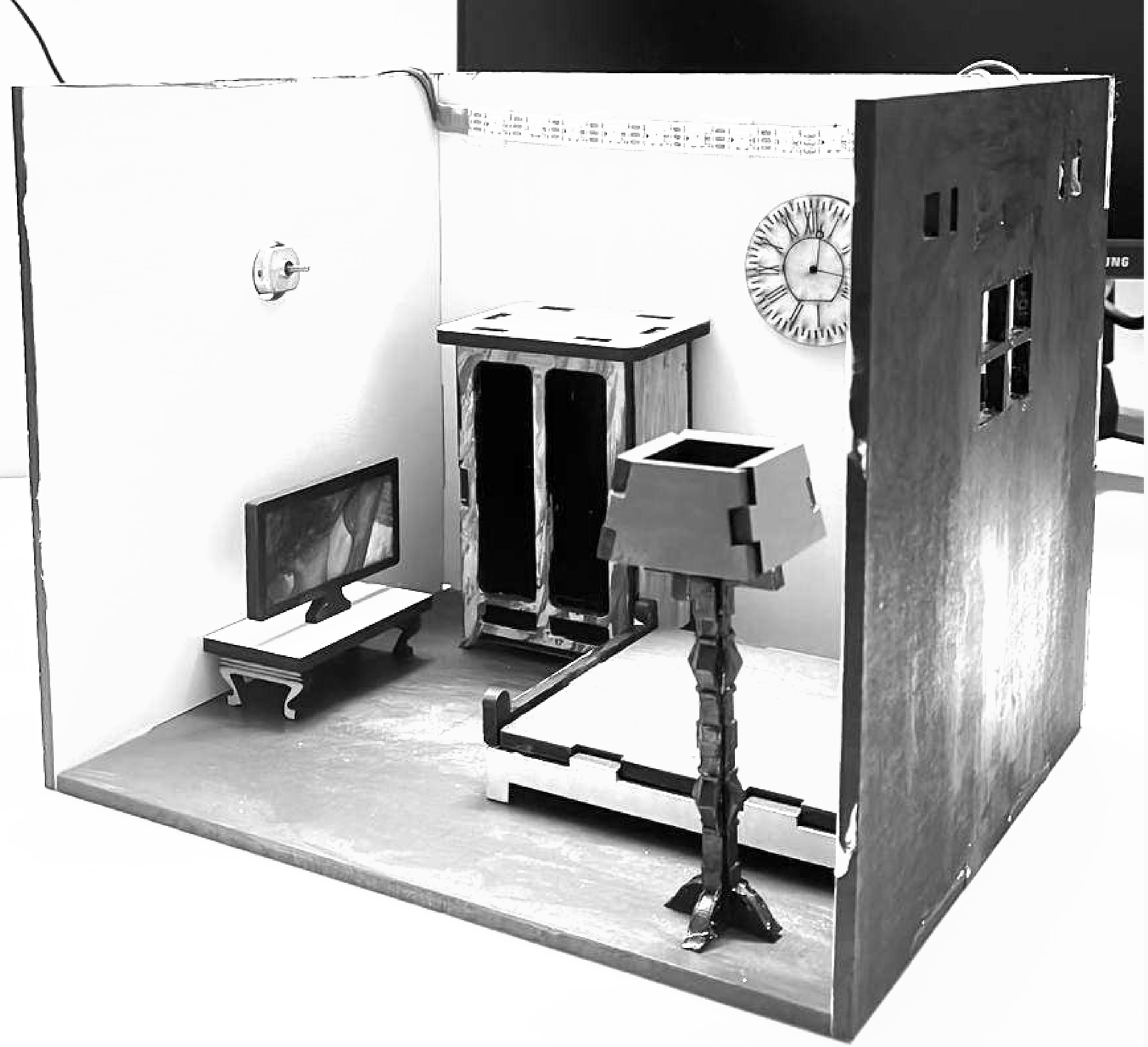
Future Work

Working in **visually noisy** environments

Working with **multiple gestures** being input simultaneously - parallel working across people and time

Ability to work for more **nuanced appliance** : like changing shows on TV.

Conclusion



This, once scaled to a full size **prototype** will make using home systems **universally accessible** and **usable.**

Thank You.

Group 02