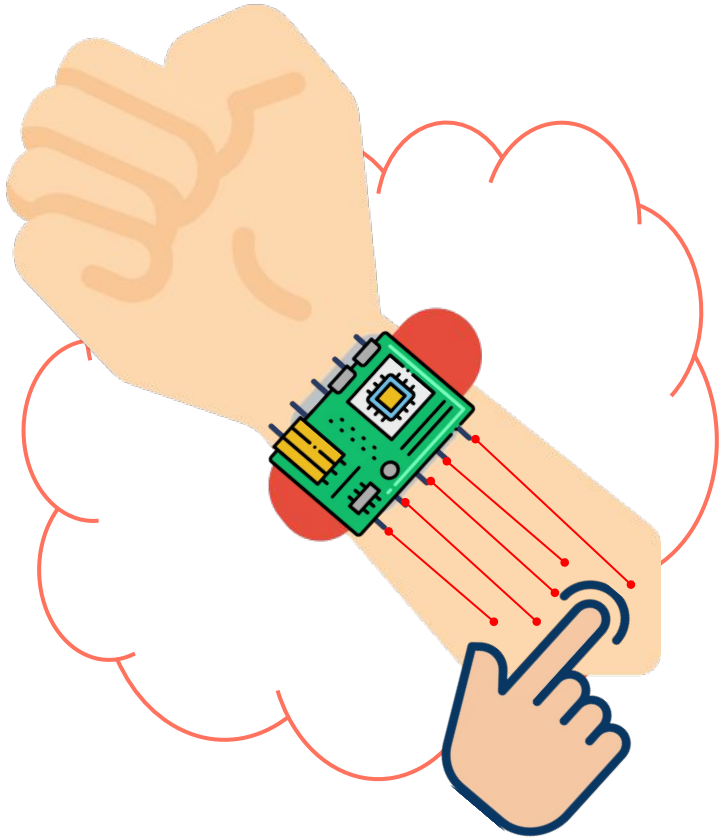
W.R.I.S.T.

Project Proposal

Edward, Joanne, Anushka



W.R.I.S.T.

WeaRable Immersive Sensing Technology

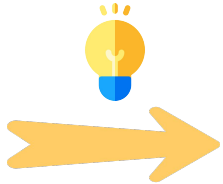
ECE Areas:
Software Systems
Hardware Design
Signal Processing

PROBLEM

Want to make interacting with 3D models a more immersive experience

KEY INSIGHTS

1. Everyone knows how to use a trackpad
2. Everyone owns a 2D display



PROPOSAL

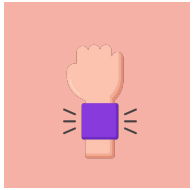
Improve existing trackpad technology and provide a holographic interface for 3D model viewing

Allow users to use their arm as a surface for trackpad gestures!

USE CASES

- Teaching scenarios involving 3D models
    - i.e. biology, architecture, engineering
- Traditional interfaces for viewing 3D models restricts user
    - Lack of mobility
    - Trackpad/mouse requires flat surface
    - Restricted to 2D screen

REQUIREMENTS for TRACKPAD



PORTABILITY

We want to limit our device to a small wristband that will allow our arm to be used as a trackpad.

GOAL

Size should be < 65mm x 60mm and < 100g.

ACCURACY

We need to ensure that our device accurately identifies the gesture inputted by the user.

GOAL

Aiming for a 90-95% accuracy rate on our tests.

LATENCY

The latency between recognizing and applying those gestures to the 3D model should be minimal.

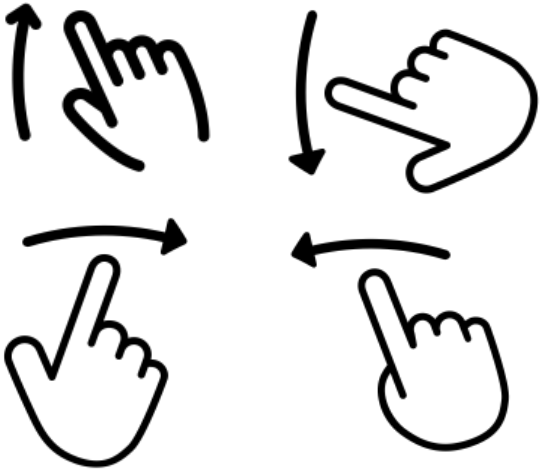
GOAL

Around 50-100ms, or 10-20Hz.

TARGET GESTURES

Zoom Out

Zoom In

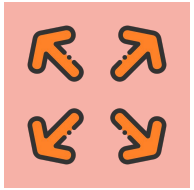


Rotate Any Direction

REQUIREMENTS for HOLOGRAM

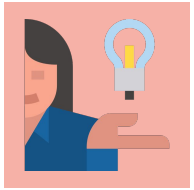
ACCESSIBLE

Users should be able to upload any 3D model through the Web and interact with it using all our target gestures.



PRECISE

Model should proportionally scale according to finger displacement.



FEASIBLE

The hologram interface needs to be easily built from cheap materials.

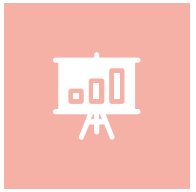
GOAL

Total material price should be < 100$.

TECHNICAL CHALLENGES

PROBLEM 1

How can we detect trackpad gestures (tapping, swiping, pinching)?

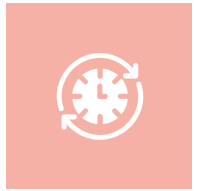


PROBLEM 2

How can we map gestures to actions performed on a 3D model?

PROBLEM 3

How can we achieve low latency for data transfer?



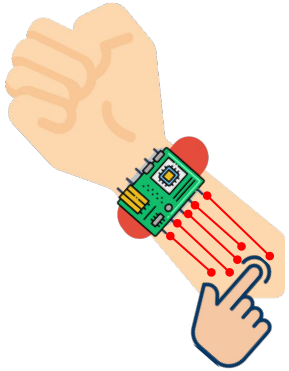
PROBLEM 4

Can we make our device small enough?

SOLUTION

TRACKPAD

Distance sensors will be embedded into a wristband on top of an embedded device. It will detect and process displacement of finger.



JETSON NANO

Processes sensor data and detects finger gestures.

3D MODEL

3D hologram pyramid for viewing.

TESTING

All tests will occur over 20 trials.

TEST	DESCRIPTION	TARGET METRIC
Accuracy of Gesture Detection	Compare intended gesture vs what our classifier identifies	90-95% accuracy
Preciseness of Gesture Detection	Compare *true* displacement of the finger paths vs *measured* displacement of the sensors	90-95% precision
Latency	Determine how long it takes for sensor data to be collected, processed, and sent to hologram	50-100 ms

TASKS AND DIVISION OF LABOR

There are 6 main phases. We'll all be working on each phase, but the designated lead for each is indicated below.

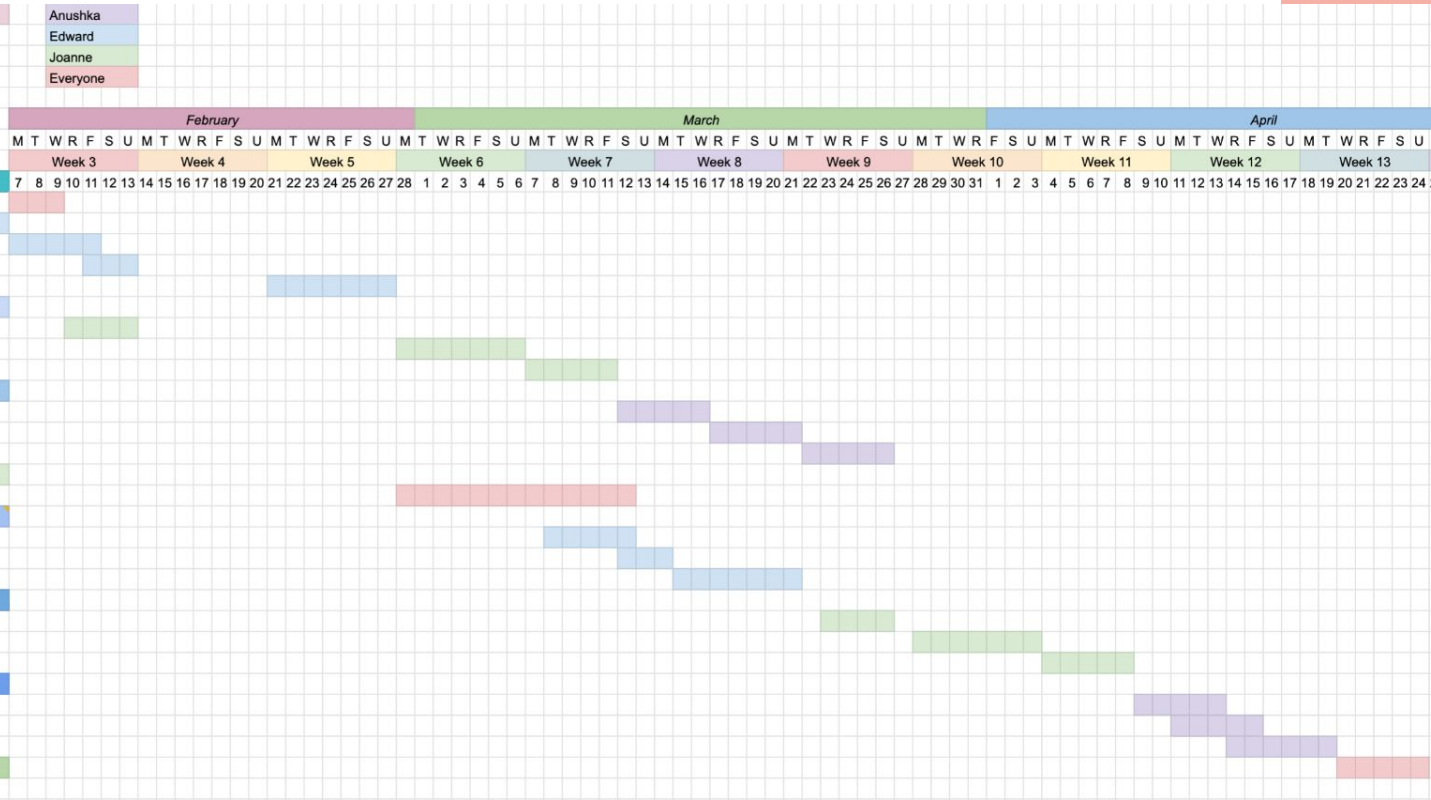
1. Board creation - designing the hardware
    a. Edward
2. Wearable prototyping - building the wristband
    a. Joanne
3. Gesture recognition - computationally applying potential scenarios to outcomes
    a. Anushka
4. Communication between devices - testing latency between WiFi vs Bluetooth
    a. Edward
5. 3D object modeling and scripting - playing around in Unity
    a. Joanne
6. Hologram prototyping - building a simple interface
    a. Anushka

SCHEDULE

Important Due Dates		
February 5	Website Setup	
February 6	Proposal Presentation	
February 20	Design Presentation	
March 2	Design Report	
April 24	Final Presentation	

Anushka
Edward
Joanne
Everyone

Task Name	Task Owner	Status
Pre-Build		
Finalize material list and order parts	Everyone	Incomplete
Phase 1		
Designing the PCB	Edward	Incomplete
Sending order	Edward	Incomplete
Initial Testing	Edward	Incomplete
Phase 2		
Designing Band	Joanne	Incomplete
Initial Build	Joanne	Incomplete
Integrating with Sensors	Joanne	Incomplete
Phase 3		
Mathematically computing different cases	Anushka	Incomplete
Initial Testing	Anushka	Incomplete
Redesign	Anushka	Incomplete
Midpoint Check		
Testing, Redesign, and Reordering	Everyone	Incomplete
Phase 4		
Research WiFi vs Bluetooth	Edward	Incomplete
Implement both and test	Edward	Incomplete
Test Jetson	Edward	Incomplete
Phase 5		
Figure out how to import mouse movemen	Joanne	Incomplete
How to import images on the web	Joanne	Incomplete
Build simple web app	Joanne	Incomplete
Phase 6		
Desigining Hologram	Anushka	Incomplete
Figuring out the 4 perspectives from mode	Anushka	Incomplete
Building glass pane	Anushka	Incomplete
Final Check		
Final Testing and Presentation	Everyone	Incomplete



CONCLUSION

PROPOSAL

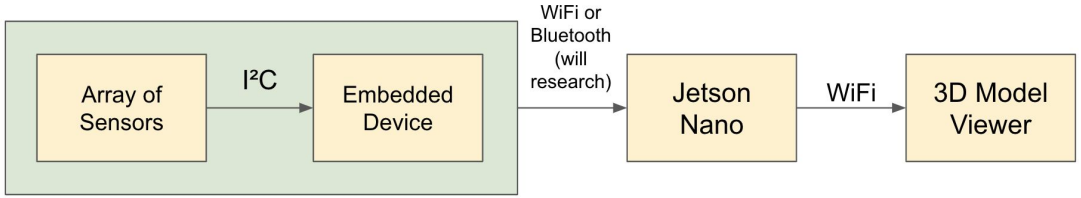
We propose W.R.I.S.T., a system that will enable a user to use their arm as a trackpad to control the view of a 3D model.

KEY POINTS

- Immersive
- Intuitive
- Interactive
- Mobility

VISION

We hope that through W.R.I.S.T. viewing 3D models can become a more immersive and mobile experience.



Project Layout