Haptic Smart Glasses

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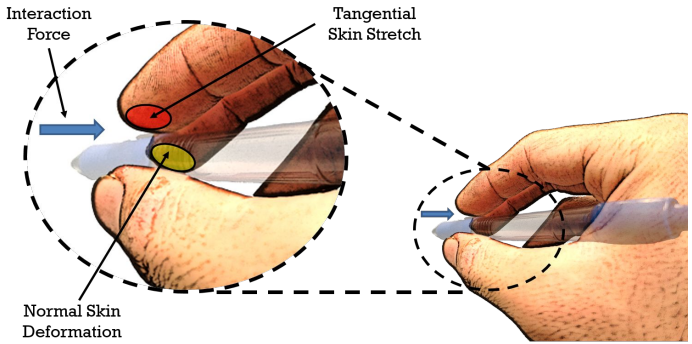
Vision and Goals

Vision

Develop a better user interface experience for augmented reality users through haptic feedback.



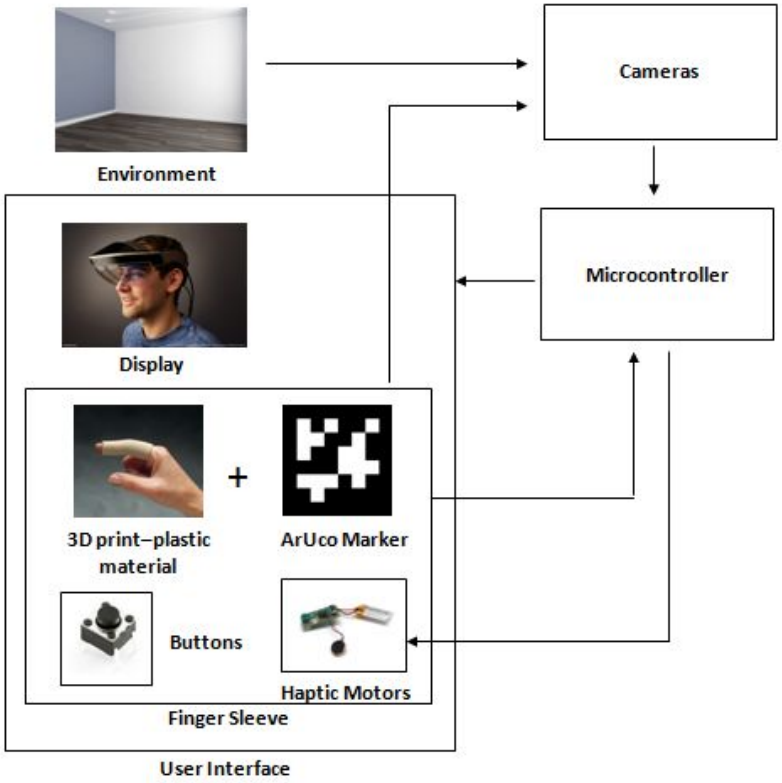
source: [www.kotaku.com](), [www.apple.com](), [www.stanford.com]()

Goals and Deliverables

Should be able to do ....

1. Make an AR capable headset
2. Receive feedback through peripherals
3. Design a UI which contains:
    a. The ability to draw, mimicking a “Paint” application
    b. Pick up and move virtual objects

Overall Design



Technical Specifications - Hardware

Item	Specification
Glasses Dimensions	25 cm wide
Field of View	Temporarily undecided
Finger Sleeve Dimensions	Adjustable Size
Processor	1.2 GHz ARM-8 Cortex
Number of Buttons	1 Capacitive Button
Camera(s)	1 stream of 1080p @ 30fps
Haptic Motors	2 Linear Resonant Actuators
Screen Display	4.3" 40-pin TFT Display - 480x272

Technical Specifications - Software

Item	Specification
Sensor Software	OpenCV
UI Software	Google Cardboard

Design Steps

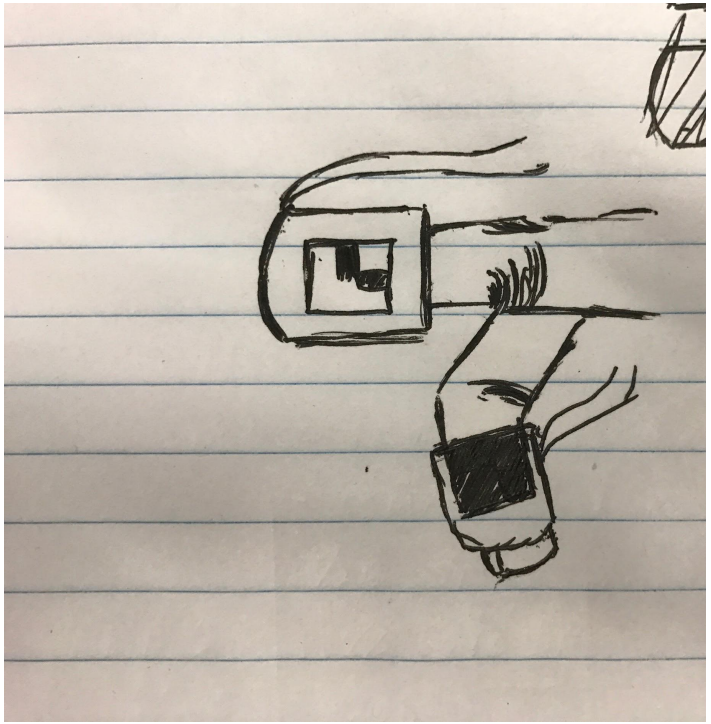
Glasses Construction

- Building off Polylens Schematic
- Lenses: Plastic aspheric lens, 49.80mm FL, 51.00mm diameter
- May change lenses to improve FOV.

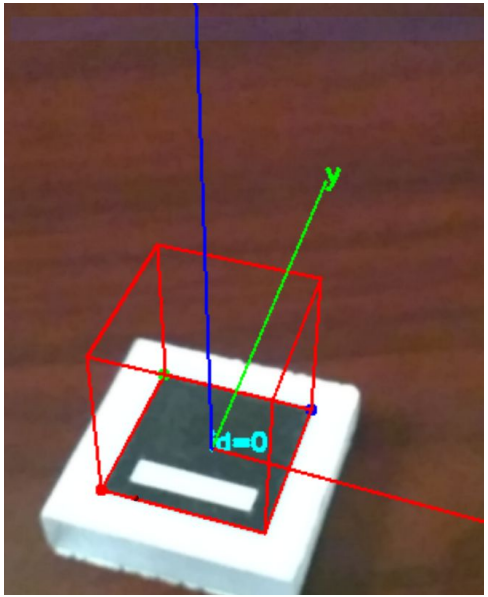
source: www.polylens.io

Finger Sleeves Construction

- Aruco Markers on Index Finger Sleeve.
- Capacitive Button on Middle Finger Sleeve.
- Linear Resonant Actuators on the Two Sleeves.
    - Located at tip of index finger and on one side of the middle finger sleeve.



Finger Sleeves - ArUco Markers



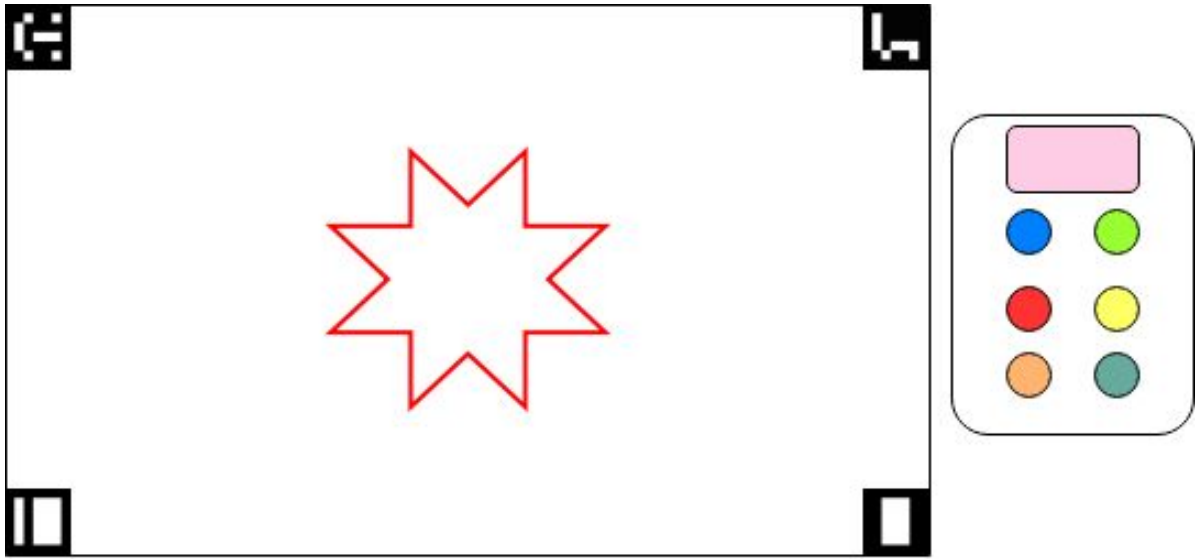
- ArUco Markers are generated and put on the finger sleeve
- There is an OpenCV library that can use these to track location and orientation.
- With these on 4 locations around the finger, the direction and location can be determined - this will help the user interact with the virtual objects.

source: https://paradigmshiftright.files.wordpress.com/2014/12/wp_ss_20140522_0001.png

Virtual User Interface Design - Demo 1

- Movable Object Demo:
  - Virtual Objects like cubes, spheres, or other everyday objects
  - User will be allowed to grab and move these virtual objects and place them wherever in space using a button.
  - When picking up, placing, or hovering over objects, user will be provided feedback from the haptic motors.
  - This feature can help in fields like architecture, interior design, or even health care - anything where visualizing things in space can be beneficial.

Virtual User Interface Design - Demo 2



Potential Issues

- Dealing with physics for virtual objects
  - Objects falling
- Calibrating the finger sleeve with glasses
  - Pointing and calculating correct angles
- Getting images and screens to project onto a wall?
  - A screen might be bigger than
- “Remembering” where drawings are in a view
  - Turning your head and turning back - will your drawings still be there?

Division of Work

Schedule - Major Deadlines

Oral Presentation - Jan 19

Start Building/Ordering - Jan 24 (Pending approval)

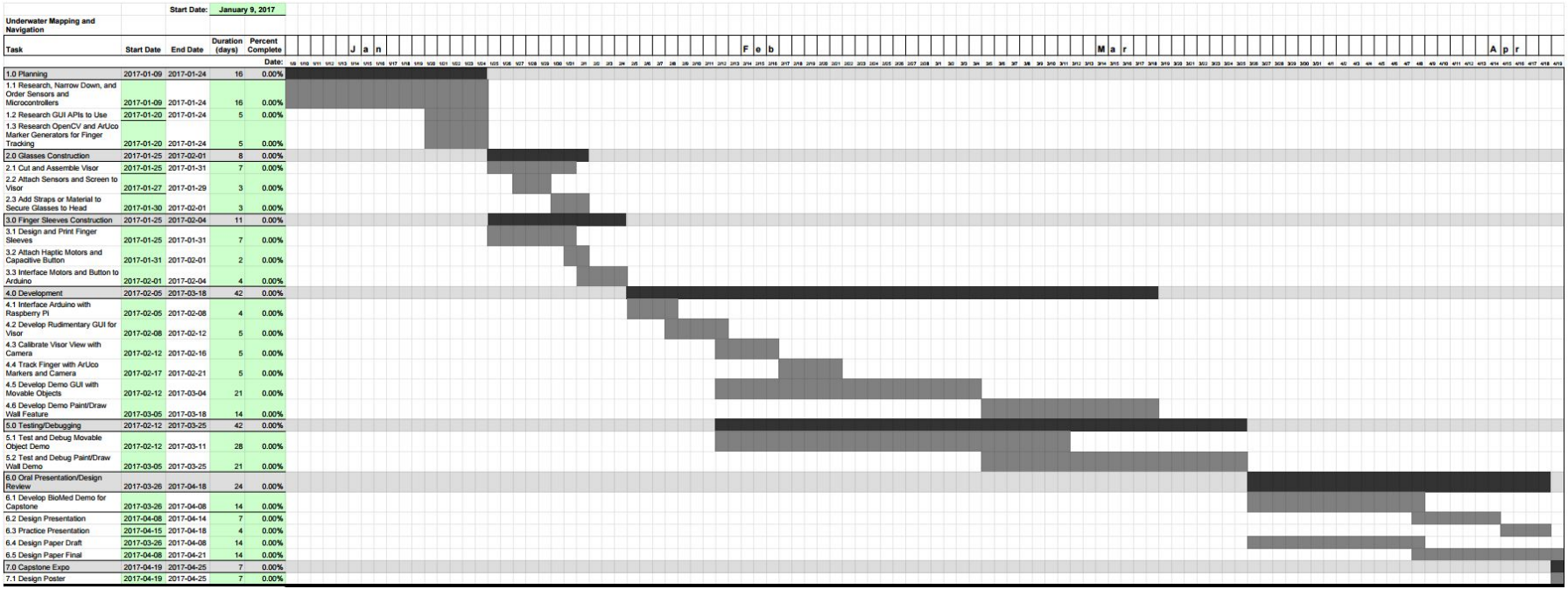
Capstone Design Expo - April 25

Project and Website Demonstration - Before May 4

Work Breakdown Structure

- Planning: All
- Glasses Construction: Abraham Kancherla, Varun Nambiar
- Finger Sleeve: Adwait Lele, Samir Vedantham
- Development of Paint Demo: Adwait Lele, Varun Nambiar
- Development of Objects Demo: Abraham Kancherla, Samir Vedantham
- Debugging: All
- Testing: All
- Medical Device Demo for Capstone: All
- Presentations: All
- Communications: Adwait Lele
- Website Management: Samir Vedantham

Gantt Chart



Underwater Mapping and Navigation		Start Date:	January 9, 2017	
Task	Start Date	End Date	Duration (days)	Percent Complete
1.0 Planning	2017-01-09	2017-01-24	16	0.00%
1.1 Research, Narrow Down, and Order Sensors and Microcontrollers	2017-01-09	2017-01-24	16	0.00%
1.2 Research GUI APIs to Use	2017-01-20	2017-01-24	5	0.00%
1.3 Research OpenCV and ArUco Marker Generators for Finger Tracking	2017-01-20	2017-01-24	5	0.00%
2.0 Glasses Construction	2017-01-25	2017-02-01	8	0.00%
2.1 Cut and Assemble Visor	2017-01-25	2017-01-31	7	0.00%
2.2 Attach Sensors and Screen to Visor	2017-01-27	2017-01-29	3	0.00%
2.3 Add Straps or Material to Secure Glasses to Head	2017-01-30	2017-02-01	3	0.00%
3.0 Finger Sleeves Construction	2017-01-25	2017-02-04	11	0.00%
3.1 Design and Print Finger Sleeves	2017-01-25	2017-01-31	7	0.00%
3.2 Attach Haptic Motors and Capacitive Button	2017-01-31	2017-02-01	2	0.00%
3.3 Interface Motors and Button to Arduino	2017-02-01	2017-02-04	4	0.00%
4.0 Development	2017-02-05	2017-03-18	42	0.00%
4.1 Interface Arduino with Raspberry Pi	2017-02-05	2017-02-08	4	0.00%
4.2 Develop Rudimentary GUI for Visor	2017-02-08	2017-02-12	5	0.00%
4.3 Calibrate Visor View with Camera	2017-02-12	2017-02-16	5	0.00%
4.4 Track Finger with ArUco Markers and Camera	2017-02-17	2017-02-21	5	0.00%
4.5 Develop Demo GUI with Movable Objects	2017-02-12	2017-03-04	21	0.00%
4.6 Develop Demo Paint/Draw Wall Feature	2017-03-05	2017-03-18	14	0.00%
5.0 Testing/Debugging	2017-02-12	2017-03-25	42	0.00%
5.1 Test and Debug Movable Object Demo	2017-02-12	2017-03-11	28	0.00%
5.2 Test and Debug Paint/Draw Wall Demo	2017-03-05	2017-03-25	21	0.00%
6.0 Oral Presentation/Design Review	2017-03-26	2017-04-18	24	0.00%
6.1 Develop BioMed Demo for Capstone	2017-03-26	2017-04-08	14	0.00%
6.2 Design Presentation	2017-04-08	2017-04-14	7	0.00%
6.3 Practice Presentation	2017-04-15	2017-04-18	4	0.00%
6.4 Design Paper Draft	2017-03-26	2017-04-08	14	0.00%
6.5 Design Paper Final	2017-04-08	2017-04-21	14	0.00%
7.0 Capstone Expo	2017-04-19	2017-04-25	7	0.00%
7.1 Design Poster	2017-04-19	2017-04-25	7	0.00%

Questions?

Citations

-- mostly for images--

http://www.roadtovr.com/2-vr-gloves-promising-haptic-feedback-2-different-approaches/

http://muro.ucsd.edu/Localization/localization.html

http://www.tomshardware.com/news/meta-2-augmented-reality-glasses,31314.html

http://projects.mbientlab.com/metawear-and-coin-vibrating-motor/