Interactive Secure Headset

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Problem Statement

- Testing is important
 - Used in varied aspects of professional or academic life
- Problem
 - Current testing solutions for online exams are vulnerable to cheating
 - Cameras can record the exam
 - Test taker could have additional material outside of camera view
- Solution
 - A full enclosed head mounted display that connects to testing server



Market Survey

Two notable examples:

Google CardboardProject North Star

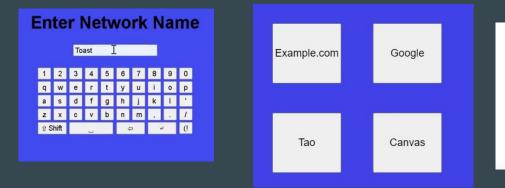


Requirements

- Functional
 - Connect to internet \bigcirc
 - Access test \bigcirc
 - Interact with test Ο
 - Cannot access outside \bigcirc resources

Non-functional

- Comfort of headset
- Ο
- Speed of loading pages Intuitiveness of user interface 0



Connect	to the TAO platform	
Login	sdmay21-01	
Password	I	0
		Log in



Constraints

- Cost
 - Must cost under \$1000 for prototype

• Time

- Must be developed within a semester
- Weight
 - Must be under 400 grams
- Power
 - Must remain charged





Standards

- Question and Test Interoperability (QTI)

 IMS Global Learning Consortium

 Systems and software engineering -- Software life cycle processes

 IEEE

 HTML Standard

 WHATWC
 - WHATWG

Risks and Mitigation

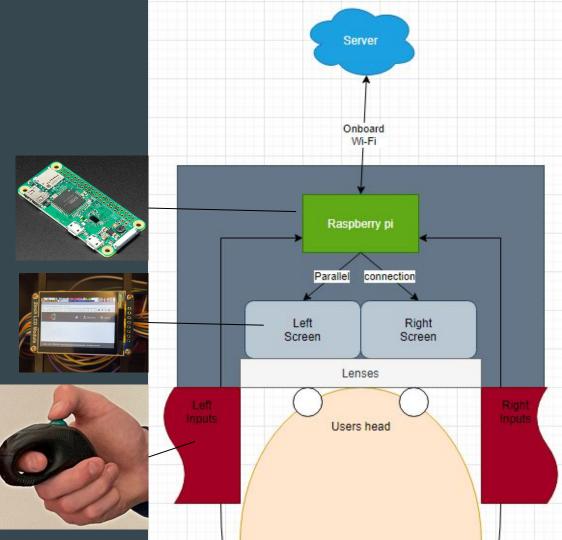
Scope too vast	Reduce features
Time overrun	Build buffer time into schedule
Cost overrun	Research alternative resources
Limited expertise	Contact ISU resources

	1/25/2021	2/1/2021	2/8/2021	2/15/2021	2/22/2021	3/1/2021	3/8/2021	3/15/2021	3/22/2021	3/29/2021	4/5/2021	4/12/2021	4/19/2021	4/26/2021	5/3/2021
Define problem															
Brainstorm ideas															
Narrow down with research															
Build Screen															
Build Power															
system											Buffer int	tentionally	left blanks		
Build view test															
Build Controls															
Build Data transfer									1						
Test															
Reiterate over design															

Hardware Design

Three main parts:

- Raspberry Pi Zero W
- Waveshare 2in 320x240 IPS LCD Screens
 - Connected via GPIO headers and SPI interface
- Input devices
 - Wireless trackball mouse
 - Mini-USB port
 - \circ Touchpad
 - Mini-USB port



Headset Casing Design

Design Decisions:

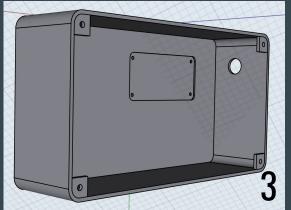
- Comfort and weight
- Software
- Redesign of headset casing designed by Rene Meeh of Arizona 360 VR

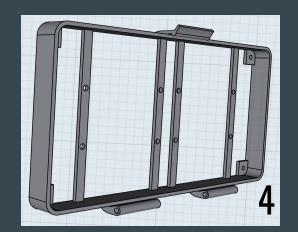
Iterations:

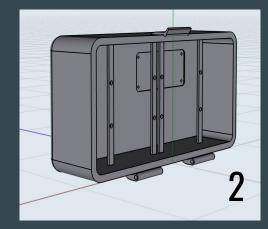
• 3 major iterations

Final Result:

• 393.55 grams

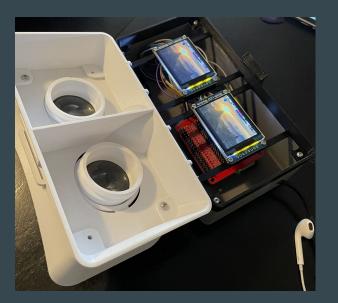


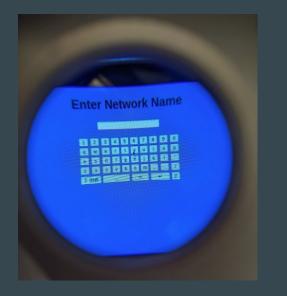






Hardware Demo

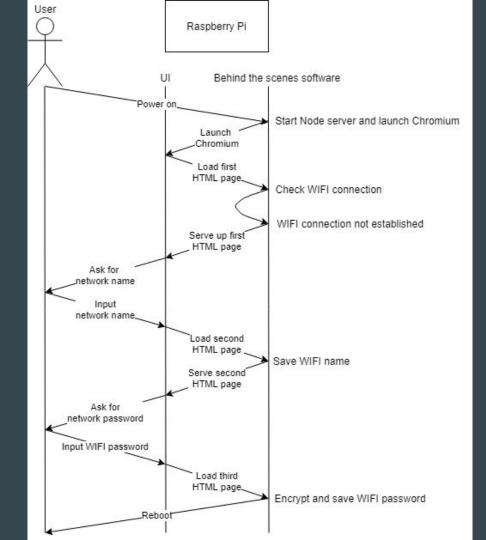






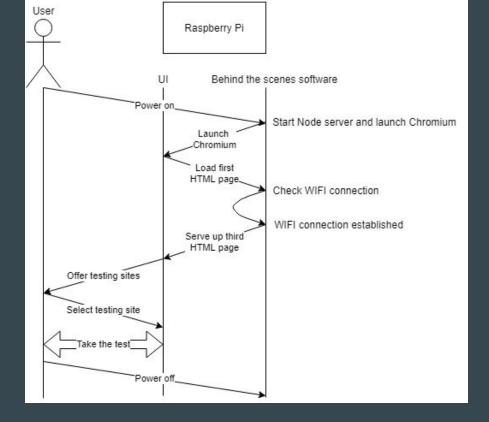
Software Design

- PI OS
- NodeJS
- Html and JavaScript
- Chromium in kiosk mode
- Tao server on Linux VM



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Development Testing

- Unit Testing
 - Tested individual software modules
 - Examples:
 - Opens Chromium in kiosk mode on boot
 - Stored network password is encrypted
 - Reboots after network configuration
- Interface Testing
 - Tested communication between modules
 - Examples:
 - Raspberry Pi to screens
 - Controls to Raspberry Pi
 - Raspberry Pi to Tao server



Enter Network Name







Acceptance Testing

- User can connect to a nearby WiFi network
- User can access various URLs from the navigation screen
- User can log into Tao
- User can open and take a test from the headset after logging into Tao

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vord	·····r···	0
vord	I	



During more than 30 years, the American Space Shuttle transported 355 astronauts in space over 135 orbital launchings from Cap Canaveral, Fiorida. This 2046-ton Behemoth traveled 870 million kilometers around the Earth from 12th of April 1981 to 21st of July 2011. The National Aeronautics and Space Administration (NASA) built 5 Space Shuttles: Columbia, Challenger, Discovery, Atlantis and Endeavour.

Which was the last Space Shuttle going into space during the STS-135 mission in July 2011?

- Discovery
 Challenger
 Pathfinder
- O Atlantis
- O Endeavour

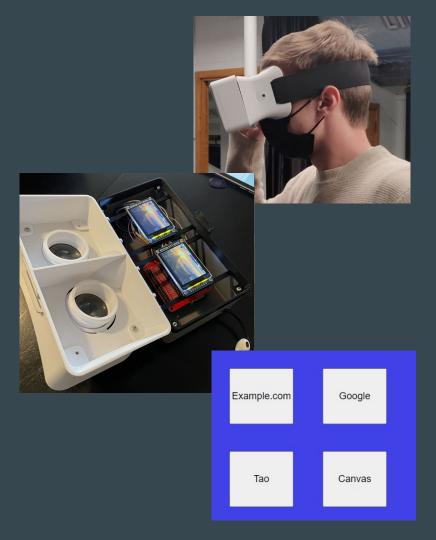
Results

- Functional Prototype
- Simple Software Interface
 - Sign-in for network
 - Landing page to go off to testing platforms
 - User prevented from accessing anything else
- Reasonable Cost
 - Development cost: \$191.05
 - Estimated production cost: \$101.16
- Comfortable Weight
 - Final weight: 393.55g
 - Less than 400g constraint
- Limitations
 - Slow test data access due to insufficient on-chip memory



Conclusion & Future Work

- Challenges & Setbacks
 - Communication with client to understand vision
 - Initial scope of project was too broad
 - Prioritizing features
 - Virtual learning and work during pandemic
- Lessons Learned
 - Remote teamwork
 - More testing and iteration time
- Future Work
 - Sensors
 - D Battery
 - Upgrade system components
 - Raspberry Pi
 - Case security







Appendix: Cost

ltem	Quantity	Unit Price	Total Price	Estimated Bulk Price (seems to be about 17 % off when in bulk)
Raspberry Pi Zero W	1	\$37.30	\$37.3	\$26.11
Raspberry Pi Zero W	1	\$36.30	\$36.3	N/A* _[1]
LCD Screen	2	\$10.95	\$21.9	\$15.33
Jumper Cables	1	\$1.95	\$1.95	\$1.37
Triple GPIO Expansion Board	1	\$7.95	\$7.95	\$5.57
Lenses	2	\$21.99	\$43.98	\$1.80* _[2]
Foam for Casing	1	\$12.67	\$12.67	\$8.87
Headset Strap	1	\$8.00	\$8	\$5.60
Touchpad	1	\$21.00	\$21	\$14.70* _[3]
Wireless Handheld	1	\$30.35	\$30.35	\$21.25* _[3]
3d Print/Casing	1	\$46.20	\$46.2	\$21.00
Hardware & Tools	1	\$15.00	\$15	minimal* _[4]
Power Switch	1	\$3.11	\$3.11	\$2.18
Shipping	1	\$37.89	\$37.89	
		Total Expenses:	\$191.05	\$101.16* _[5]
			Development	Product Estimate