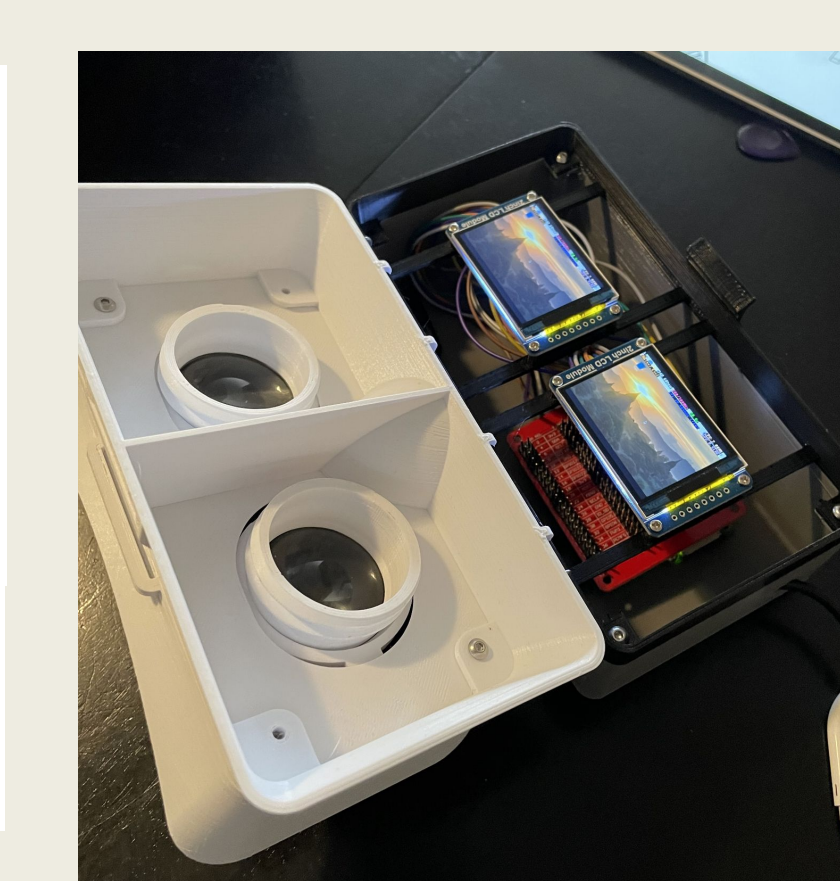




Interactive Secure Headset

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Introduction

- Testing is important and will not go away even through Covid-19
- Shift to online/remote testing leads to concerns with cheating
- Current solutions (lockdown browsers, webcam proctoring) have faults
- Solution is to create a remote testing environment, like a wearable headset, where it is harder to cheat

Design Requirements

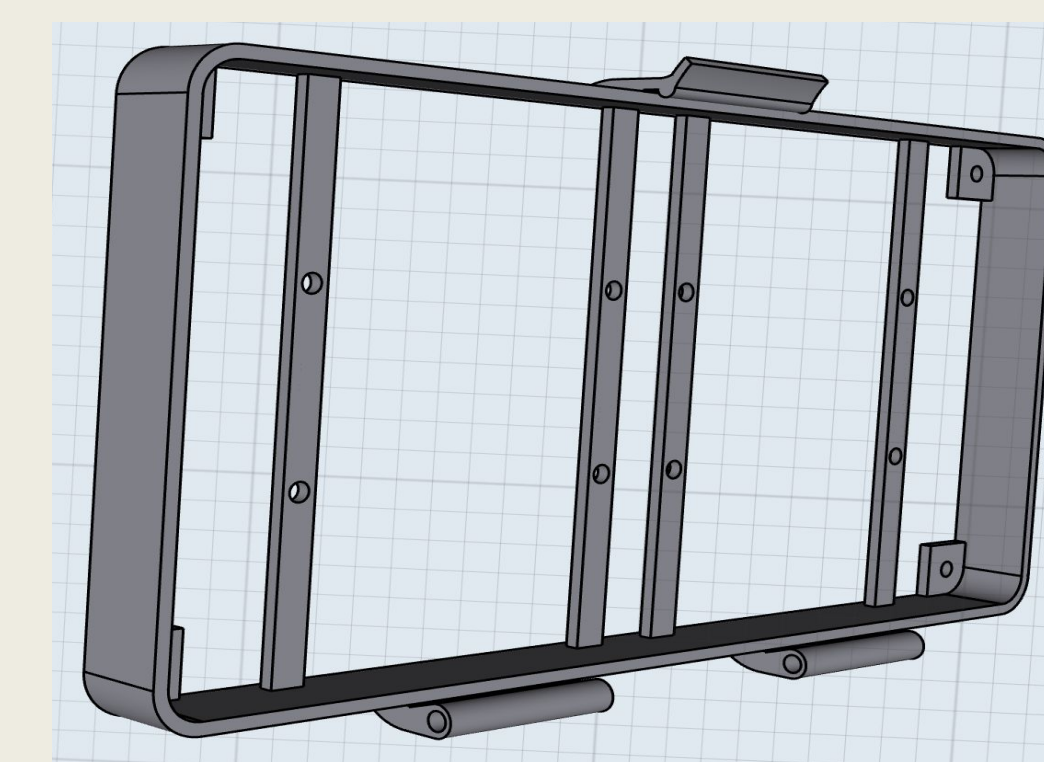
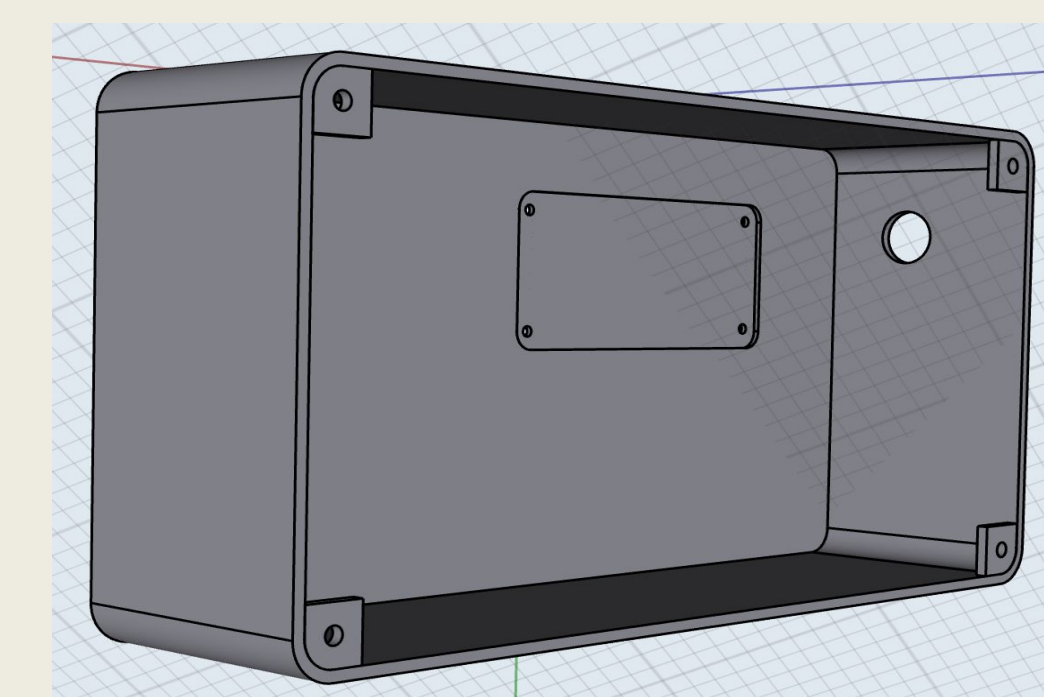
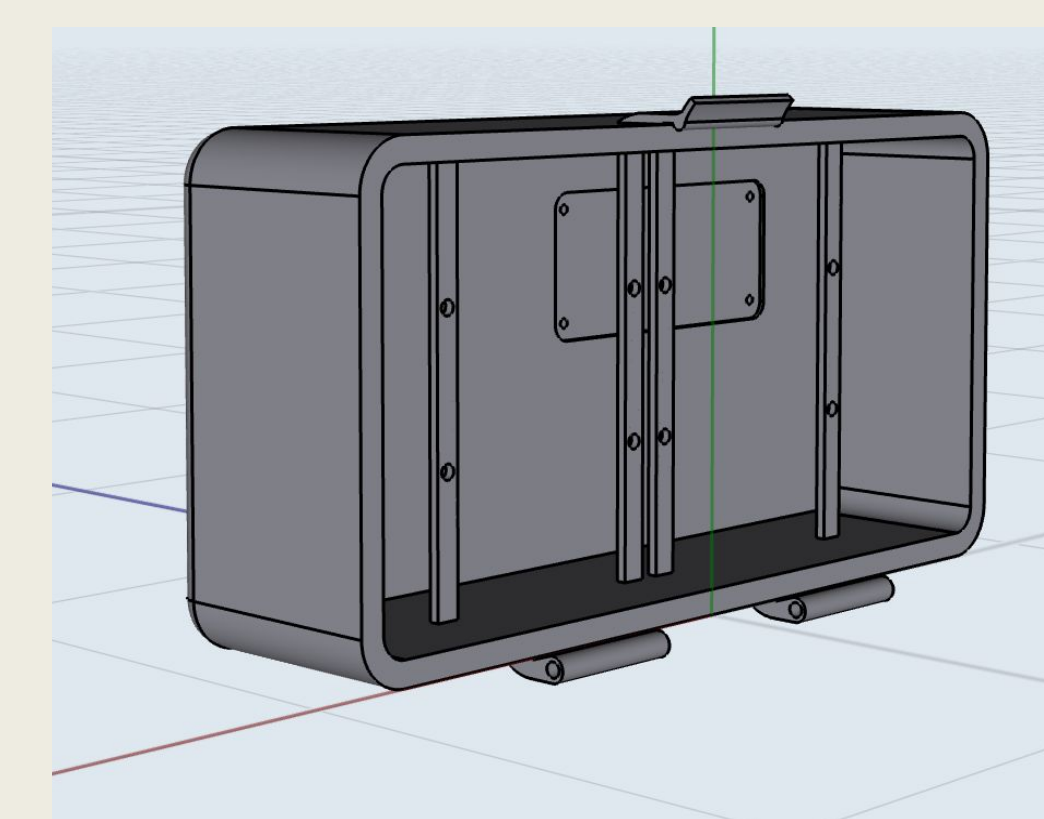
- **Functional requirements**
 - Power on and off the device
 - Connect to internet
 - Access tests
 - Interact with test
 - Cannot access outside resources
- **Non-functional requirements**
 - Headset Comfort
 - Remains charged
 - Speed (access pages within 3 seconds)
 - Intuitive and easy to use UI (can access different test drivers, network information remembered, few clicks to desired screens, readable text)
 - Security (network information encrypted, testing information not accessible outside of headset)
- **Engineering constraints**
 - Cost: \$1000 prototype budget, \$145 product price estimate
 - Time: development time had to be within a semester
 - Power: weight of a battery would add to the headset weight, so continuous charging used instead
 - Weight: suggested weight is under 400g, actual weight is 393.55 grams, 66.64g if adding touchpad
- **Operating environment**
 - Expected to be used indoors
 - Needs to be durable, droppable, water-resistant
- **Standards**
 - Question and Test Interoperability (QTI)
 - IEEE International Standard - Systems and software engineering -- Software life cycle processes
 - C Code Style Guidelines - Swarthmore Computer Science Department
- **Intended users and uses**
 - Students (standardized test, college exams)
 - Professionals (Certification exams (Pilot/BAR exam))

Design Approach

- **Main focuses for device**
 - Security
 - Comfort
- **Main functional modules**
 - Raspberry Pi Zero W
 - Runs the entire exam environment
 - 2 Waveshare 2in IPS LCD screens
 - Displays the web pages needed to take the exam
 - Input devices
 - Trackpad
 - Wireless trackball mouse
 - Headset casing
 - Houses all components
 - TAO server
 - Where the exam is housed
 - Access to Chromium
 - How the TAO server is accessed
- **Security Concerns**
 - Cameras to record test content
 - Not addressed outside of little space in the headset and the entire environment is enclosed
 - Input can not be tracked due to randomized mouse cursor
 - Student can take off headset
 - Not addressed in this iteration
 - Student can load extra programs onto the headset
 - On boot only certain programs are allowed to run access to Chromium or the Linux kernel are prevented
 - Physical Access
 - Not addressed in this iteration outside of listing countermeasures. Specifically disable ports from the kernel, glue the SD card into the Pi, and break off extra inputs.

Technical Details

- Raspberry Pi Zero W running PI OS
- NodeJS server handling local setup
- Html and JavaScript for user interface application
- Chromium in kiosk mode displaying to user
- Tao server for demo test
- Shapr3D Software for headset casing design



Testing

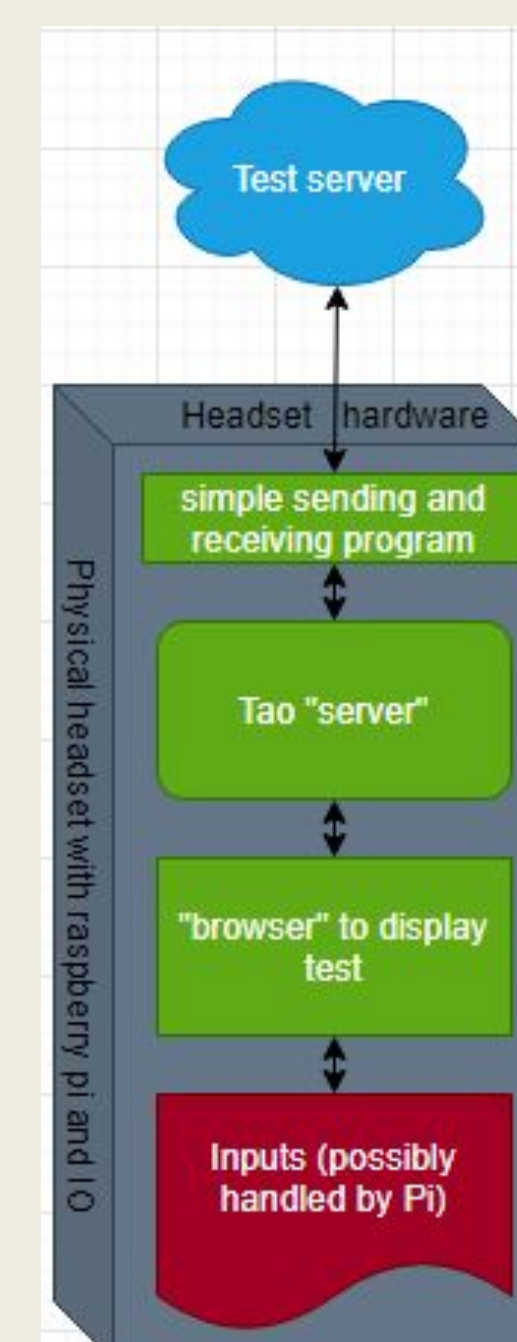
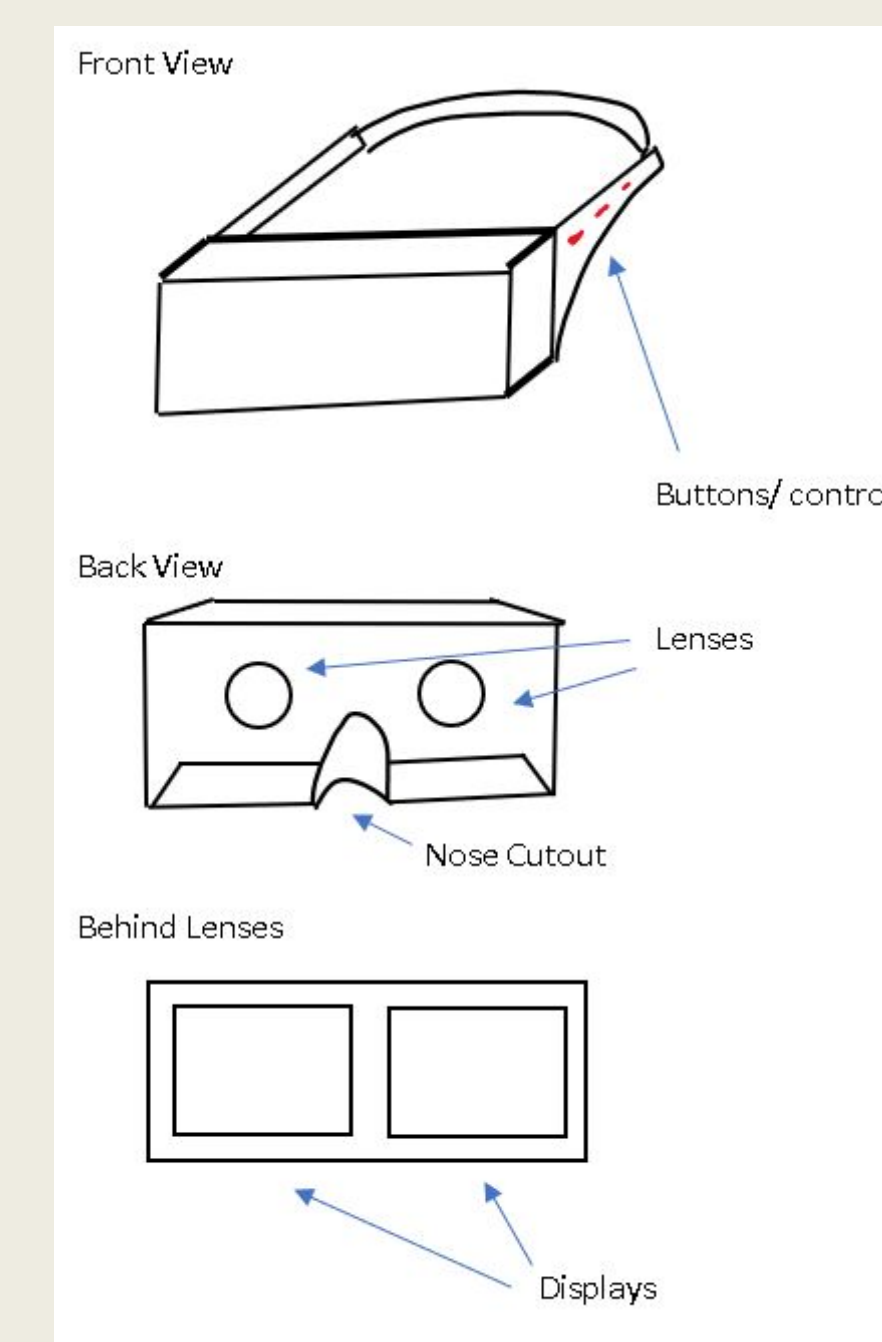
- **Unit Testing**
 - Tests of individual software components on the Raspberry Pi
- **Interface Testing**
 - Tests of communication between different hardware and software modules
- **Acceptance Testing**
 - Use case testing to determine if the product meets project requirements
- **Results**
 - Test could not be loaded from the headset due to slow performance
 - Need to use a more powerful Raspberry Pi
 - Some aspects of the user interface were not comfortable
 - Network configuration page color scheme is somewhat abrasive
 - Network configuration graphical keyboard is too small when viewed on the headset

Results



Landing Page

- Functional Prototype
 - Serve as a platform for additional sensors
- Software interface
 - Sign-in for network
 - Landing page to go off to testing platforms
 - Prevents user from accessing anything else
- Hardware too slow for practical use
 - Upgraded hardware (Raspberry Pi 3+)
- Price came in around \$200
 - Development costs: \$191.05
 - Estimated cost: \$116.86



Headset Opened Up



Headset Being Worn