MICHIGAN STATE UNIVERSITY

Project Plan

Using Sensors to Study Human Behavior

The Capstone Experience

Team Michigan State University CSE

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From Students…
…to Professionals

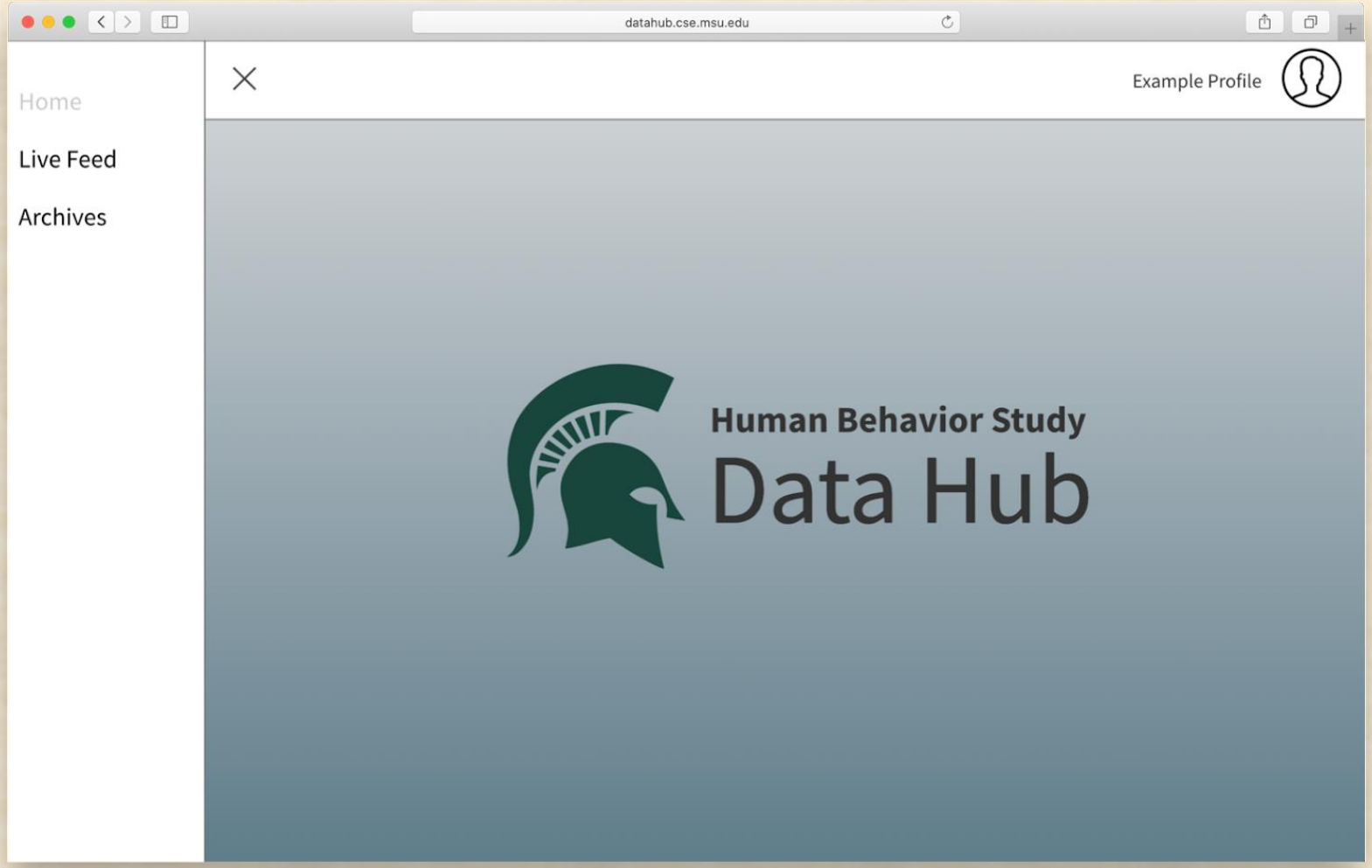
Functional Specifications

- Sensor data will be streamed to a server and displayed in a convenient web platform for researchers to analyze
- Data can be viewed in both real-time and from archives
- Trigger actions can be defined to alert researchers whenever sensor data reaches a specified threshold

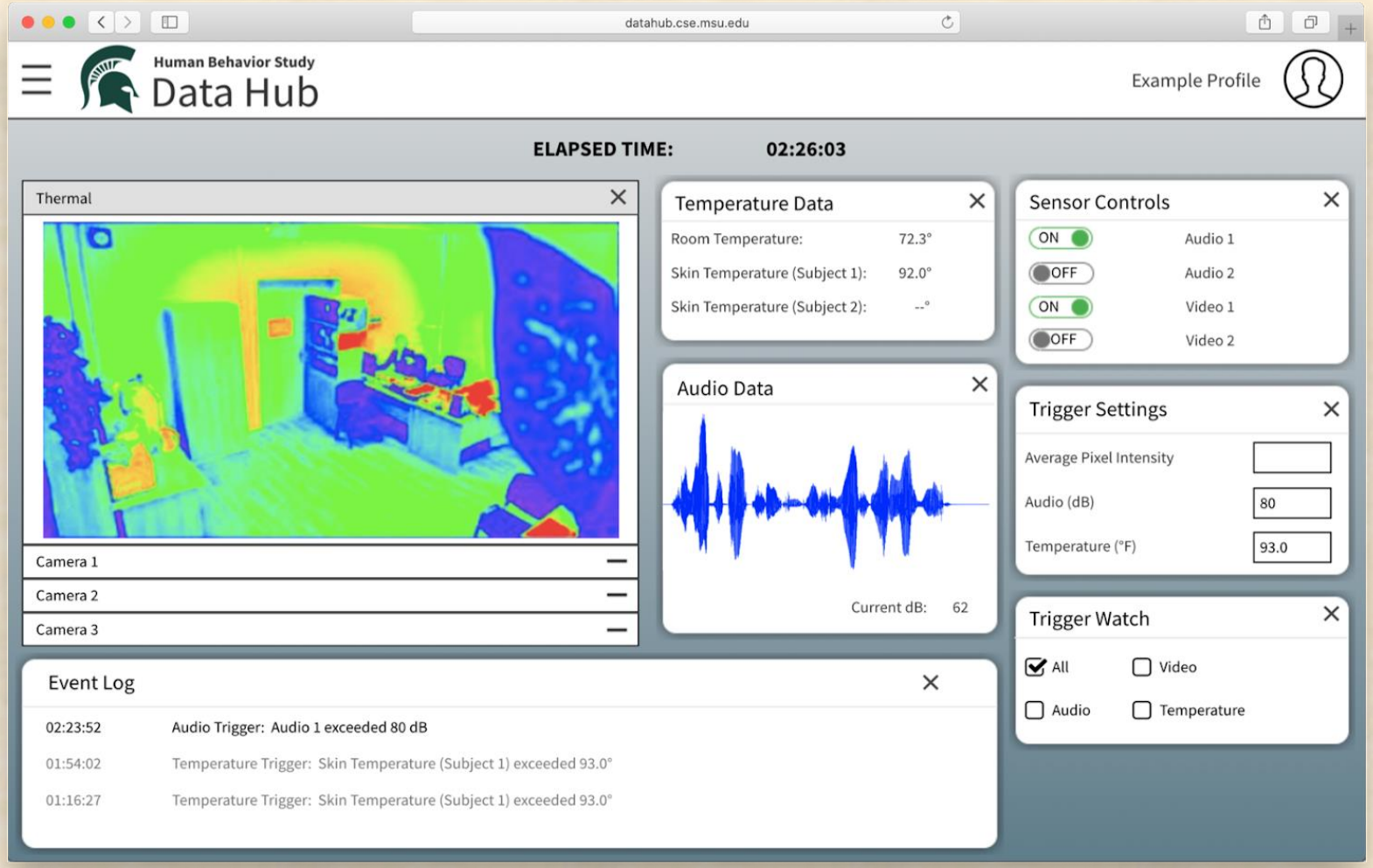
Design Specifications

- Home Page
  - Displays a collapsible menu to allow users to navigate to other parts of the website
- Live Feed
  - Displays real-time visual, audio and temperature data
  - Displays trigger settings
  - Displays an event log of past trigger events with the ability to filter based on a selected sensor medium
  - Displays sensor controls to turn sensors on and off
- Trigger Alert
  - A pop-up window is displayed to alert researchers when a trigger event has occurred
- Archive
  - Displays recorded video, audio and temperature data from a selected session

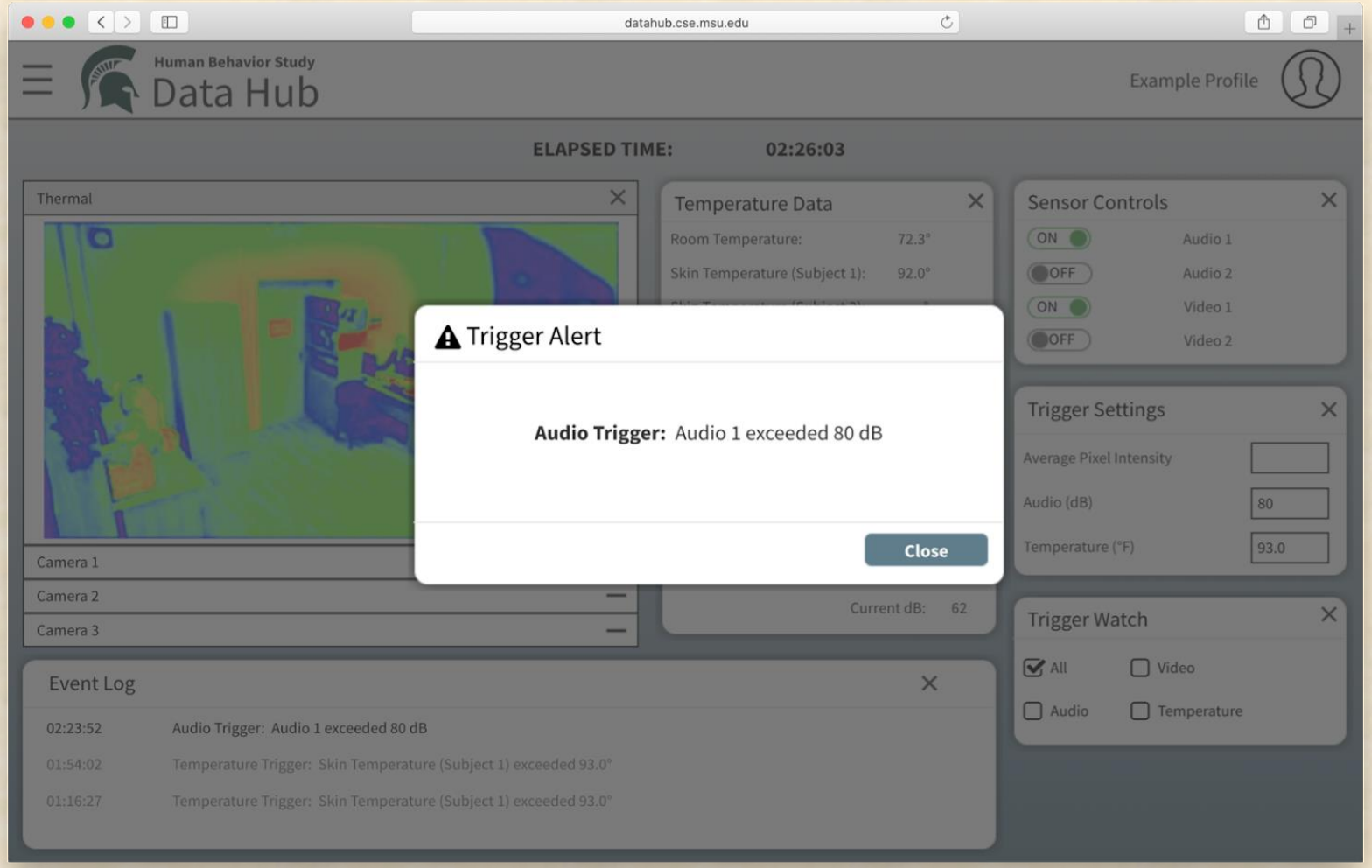
Screen Mockup: Home Page



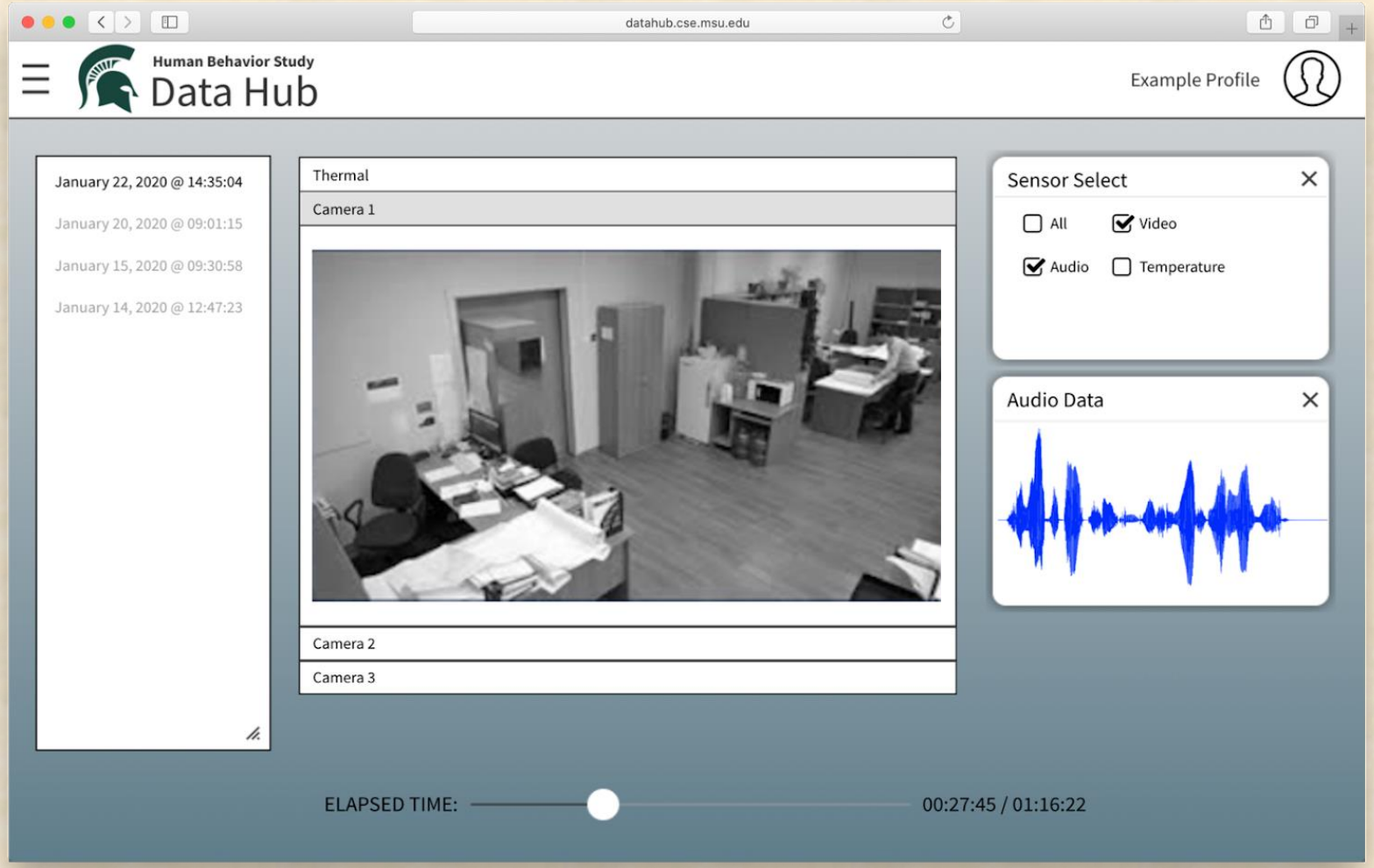
Screen Mockup: Live Feed



Screen Mockup: Trigger Alert



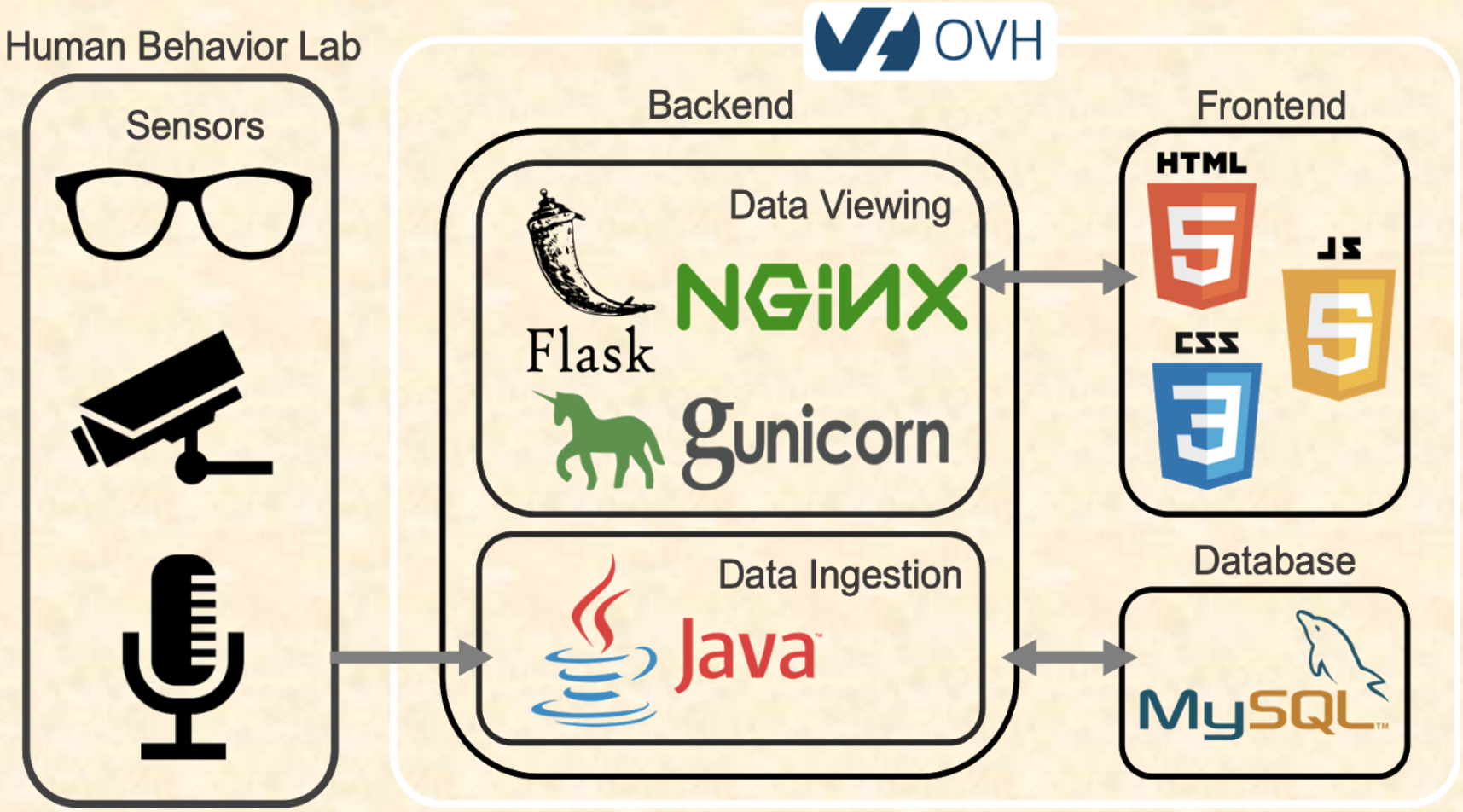
Screen Mockup: Archives



Technical Specifications

- Data Collecting and Streaming
  - Raspberry Pi will collect data through connected sensors and stream data to a Data Ingestion and Analysis Engine
- Data Storage and Analysis
  - A Java engine on a server will manage data streams and provide a framework for analysis
- Data Viewing and Interaction
  - A web application will be used for visualizing sensor data, sensor controls, trigger settings and viewing an archive of previous recordings

System Architecture



System Components

- Hardware Platforms
  - Raspberry Pi
  - Sensors: Samson Go Mic USB Microphone, Arducam Stereo USB Camera, Raspberry Pi Camera V2 and Sense HAT
- Software Platforms / Technologies
  - Java
  - Flask Web Framework with Python 3.6
  - Ubuntu 18.04 and Nginx
  - MySQL
  - Raspbian Lite

Risks

- Risk 1
  - Handling mass amounts of raw sensor data will take up a large amount of RAM and Disk space on the production server
  - Mitigation: Upgrade the production server RAM and disk space
- Risk 2
  - Concurrent reads and writes to and from the database will likely occur and may cause errors
  - Mitigation: Research and designing the web application to minimize read and write conflicts
- Risk 3
  - Compatibility issues when connecting third party hardware to our developed computational infrastructure
  - Mitigation: Create the Data Ingestion Engine to be as general as possible to facilitate the connection of various third party sensors
- Risk 4
  - Multiple data streams will need to be handled concurrently on the server
  - Mitigation: The Data Ingestion Engine will need to implement multithreading
- Risk 5
  - Collecting data from sensors connected to a Raspberry Pi and streaming the data to a server has not been done by anyone in our team prior to this project
  - Mitigation: Select sensors that have open source examples of streaming data from a Raspberry Pi to a server

Questions?