

Build Project

Week 9 Final Presentation
Fall '22 PNM Class



“The SRAC is *always* busy”

The Problem

For People New to the Gym

- Intimidated by too many people in gym
- Another excuse to not go to the gym

For People Consistently Going to the Gym

- Too crowded to complete workout in time
- Unable to get all their exercises in
- Have to change workout plan



Solutions

Current Solutions

- Physically go and look in the gym

Potential Solutions

- Specific Machine Availability
 - Button or Weight Sensor
 - Hand Scanner

Our Proposed Solution

- App Showing Live and Past Population
 - IR Sensor in Doorway



Approach

Project

- Goal Project - Minimum Viable Product (MVP)
- Upscaled Project

Teams

User Interface & Experience	Software	Hardware
<ul style="list-style-type: none">• App Mockups	<ul style="list-style-type: none">• Backend• Frontend	<ul style="list-style-type: none">• Electronics• Electronics Casing

Goal Project

UX/UI

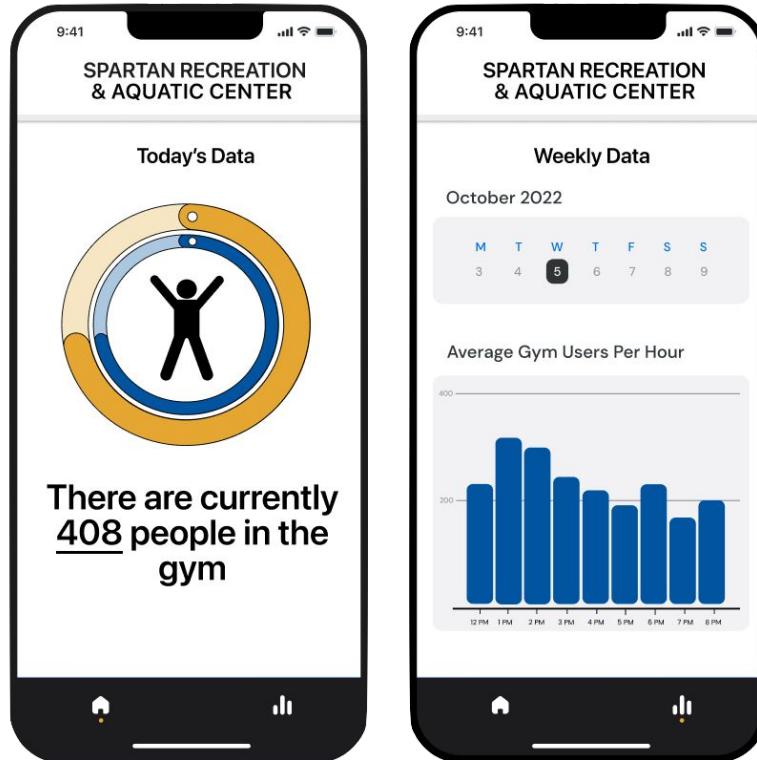
UX/UI - Team Members

Member	Tasks
Kailyn Ramos	Lead Design
Tanya Reuben	Design/SRAC Research
Ryan Tang	Design
Prathyush Jonnalagadda	Software Team Correspondent

UX/UI - Project Breakdown Chart Weeks 3-6

WBS NUMBER	TASK TITLE	TASK OWNER	PCT OF TASK COMPLETE	WEEK 3 (9/26 - 9/30)					WEEK 4 (10/3 - 10/7)					WEEK 5 (10/10 - 10/14)					WEEK 6 (10/17 - 10/21)				
				M	T	W	R	F	M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
2	App UI	Kailyn																					
2.1	App Icon Design	Kailyn, Ryan	100%																				
2.2	Current Data Page	Kailyn, Tanya	100%																				
2.3	Weekly Data Page	Kailyn, Ryan	100%																				
2.4	Mockup Version #1	UX/UI Team	100%																				
2.5	Final Mockup	UX/UI Team	100%																				
2.6	Upscaled Version: Info Page	Ryan, Tanya	100%																				
2.7	Upscaled Version: Current Data Page	UX/UI Team	100%																				
2.8	Upscaled Version: Interactive Map	UX/UI Team	100%																				

UX/UI - Final Mockup



UX/UI - Technology Used & Mockup Elements



SF Pro Semibold
DM Sans Medium

Primary Colors



Blue
R0 G85 B162
#0055A2



Gold
R229 G168 B35
#E5A823



Gray
R147 G149 B151
#939597

Secondary Colors



Light Gray
R210 G210 B210
#D2D2D2



Dark Gray
R102 G102 B102
#666666



Roll-over Blue
R28 G136 B244
#1C88F4

R 142
G 142
B 147

Gray

R 99
G 99
B 102

Gray (2)

R 72
G 72
B 74

Gray (3)

R 58
G 58
B 60

Gray (4)

R 44
G 44
B 46

Gray (5)

R 28
G 28
B 30

Gray (6)

Software

Software - Team Members

Backend (Arduino & Database)	Tasks
Rohith Iyengar	Backend Lead (Firebase/Firestore/Arduino)
Michael Huh	Firestore Database Transfer/Arduino
Gibson Sacramento	Firebase Database Transfer
Ryan Tang	Arduino
Tanya Reuben	Firestore Database Transfer

Software - Team Members

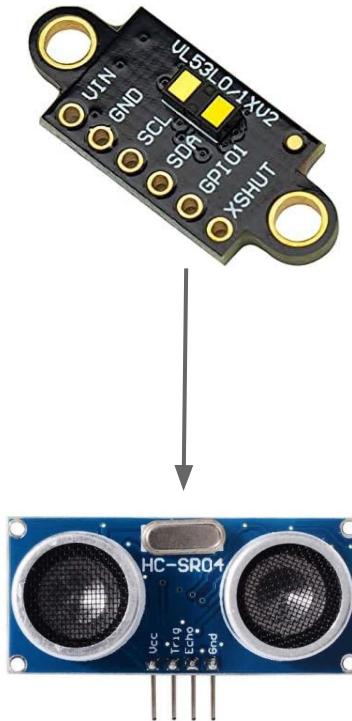
Frontend	Tasks
Bradley Okajima	Frontend Lead
Shreya Raj	Component Creation
Prathyush Jonnalagadda	Component Creation

Software - Project Breakdown Chart Weeks 7-9

WBS NUMBER	TASK TITLE	TASK OWNER	PCT OF TASK COMPLETE	WEEK 7 (10/24 - 10/28)					WEEK 8 (10/31 - 11/4)					WEEK 9 (11/7 - 11/11)				
				M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
3	Software	Bradley																
3.1	Learn Technologies	Software Team	100%															
3.2	Learn Arduino C++ & Libraries	Rohith	100%															
3.3	Sensor (WiFi module) Research	Rohith, Gibson	100%															
3.4	Arduino/Sensor Code	Rohith, Michael, Ryan	100%															
3.5	Arduino to Firebase Database Research	Michael, Gibson	100%															
3.6	Arduino to Firebase Database Setup	Backend Team	100%															
3.7	Arduino to RTDB Subscription & Update	Tanya, Gibson, Rohith	100%															
3.8	API Requests (GET & POST)	Tanya, Rohith	100%															
3.9	Firebase Cloud Function for Update	Tanya, Michael, Rohith	90%															
3.10	Build UI in React Native	Bradley, Shreya, Prath	100%															
3.11	Integration- Firebase to React Native	Bradley, Prath	90%															
3.12	Testing	Software Team	50%															

Software - Complications

- **Week 7:** No values were being obtained by ToF sensor (VL53L0/1XV2)
- New design of two ultrasonic sensors (HC-SR04)
- This is just a temporary solution
 - Upscaled project, would still utilize working ToF sensors



Software - Technologies Used

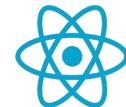


- To convert sensor data to data that can be sent to the firebase database



Firebase

- To store data online and ping frontend of new data updates
- To send data to frontend to be displayed



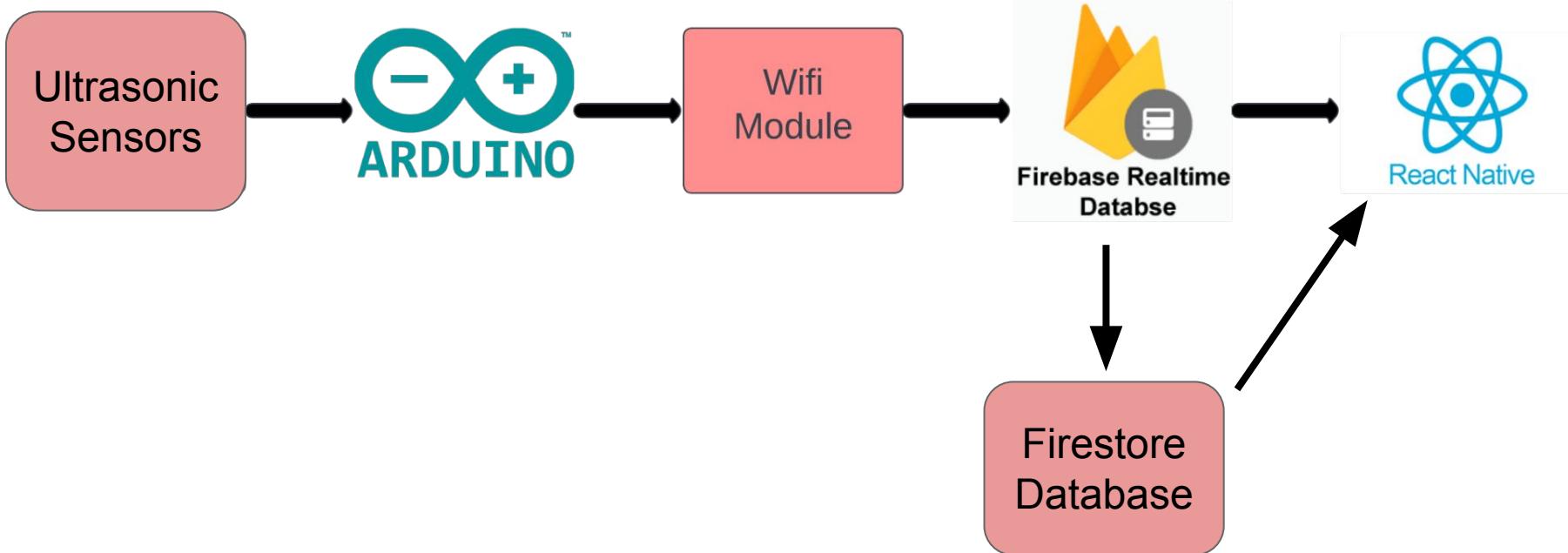
React Native

- To display all data from sensor in gym
- To create interactable ios application
- To create physical version of the user interface



- Platform for building and using APIs
- Used to send JSON structured data to test our Firebase Firestore database

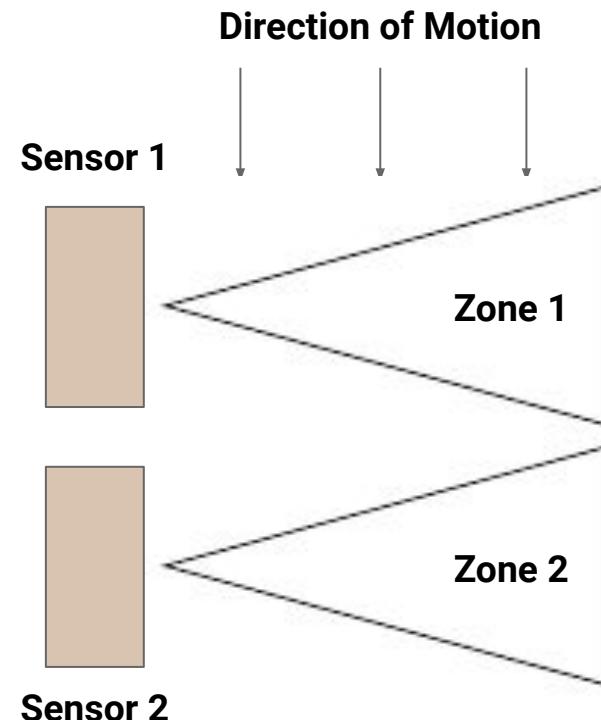
Software - Flow Chart Overview Of Data



Backend

Software – Idea & Implementation

- Utilizes two ultrasonic sensors
- Checks for motion in these zones
- Live count value held locally in our arduino
 - Changed based on entries and exits (+1 / -1)
 - Value sent to Firebase Realtime Database



Software - Demo of Sensor



Software – Firebase Realtime Database

- Utilizing the database URL and the Firebase Admin SDK to connect Arduino WiFi module to the database
- This database will primarily be used to update live count in real time
- Utilizing this count on Firebase Firestore database to determine historical data based on time



Software - Firebase Realtime Database

Realtime Database

Data Rules Backups Usage

Protect your Realtime Database resources from abuse, such as billing fraud or phishing Configure App Check X

https://theta-tau-cd254-default-rtbd.firebaseio.com/

↳ https://theta-tau-cd254-default-rtbd.firebaseio.com/
└ LiveCount: 109

Database location: United States (us-central1)

Software - Firebase Cloud Firestore

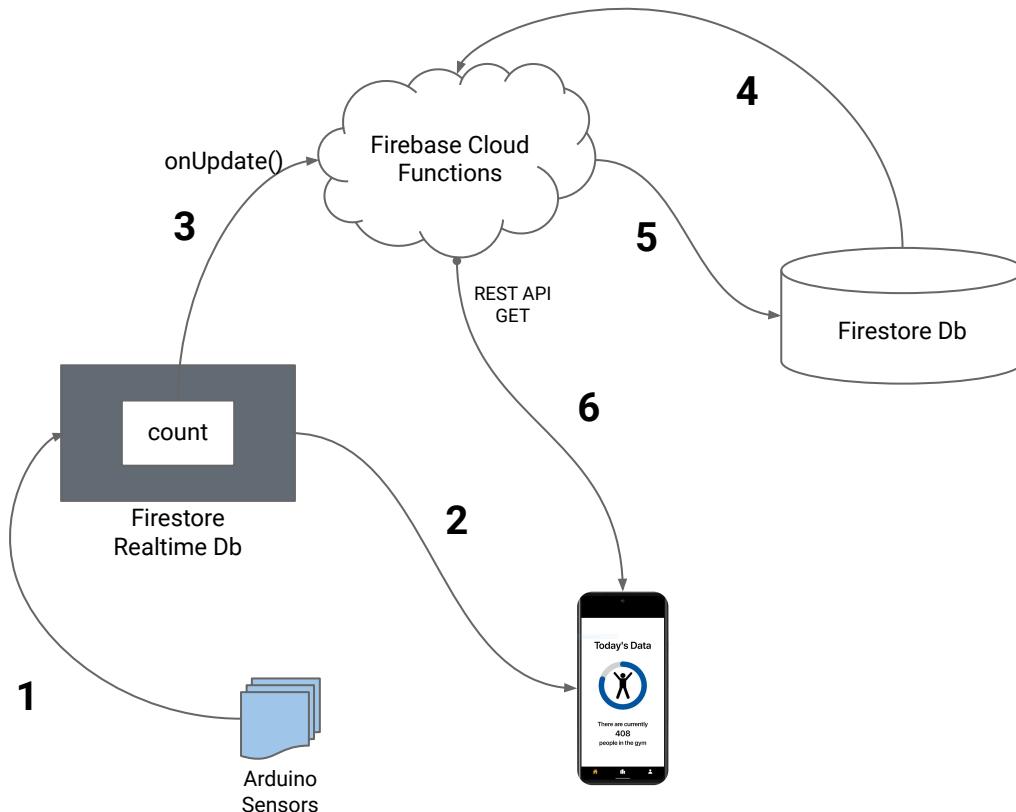
The screenshot shows the Firebase Cloud Firestore interface. At the top, there are tabs for Data, Rules, Indexes, Usage, and Extensions (NEW). Below the tabs, there are two navigation buttons: 'Panel view' and 'Query builder'. The main area displays a hierarchical tree structure under the collection 'days'. The root node 'days' has a child node '11-01-2022' which contains a list of documents for each day from 11-01-2022 to 12-25-2022. Each document contains a single field 'hr' with its value. A 'More in Google Cloud' button is located at the top right of the data grid.

date	hr
11-01-2022	"146"
11-02-2022	"630"
11-03-2022	"573"
11-04-2022	"524"
11-05-2022	"449"
11-06-2022	"386"
11-07-2022	"320"
11-08-2022	"238"
11-09-2022	"130"
11-10-2022	"30"
11-11-2022	"203"
11-12-2022	"314"
12-25-2022	"370"
	"429"
	"452"

Software – Firestore Database

- Utilize Real Time Firestore database to keep the count of people any point in time
- Utilize Firestore database to store historical daily data in a hourly basis
- Every day's data is stored as a Document with the Date as the key
- The Day Document stores the max number of people in the Gym for every hour
- Expose this daily data via REST APIs (http url) using Firebase cloud functions (firebase-url/days?day=11-10-2022)
- The mobile app can call this API with a relevant input (the day for which the data is needed) and the API will return the day's data in JSON format

Updating Realtime Count and Historical Data



- 1 Arduino detects a change in count and sends it to the Realtime Firestore Database.
- 2 The Realtime database notifies the count change to the Mobile app.
- 3 The Realtime db also notifies about old and new Count to the onUpdate() Firebase Cloud function.
- 4 Read the Data Document for that Date from the Db.
Create a new Document if doesn't exist in the Db.
- 5 Change the New count (hourly value) in the Document and save it to the Firestore Db for historic data.
- 6 When the User selects the historic data for a day on the mobile app, the mobile app calls the REST API (url) with the Date as the input, the cloud function reads the historical data (for that date) and sends the data in JSON format back to the mobile app to display the bar graph.

Software - Postman (GET: Get any day)

Getting any day document:

- Query the database to get document based on date
- Receive JSON parsed day object with all hour values

The image shows two side-by-side screenshots. On the left is a screenshot of the Postman application. It displays a GET request to the URL `https://us-central1-theta-tau-cd254.cloudfunctions.net/app/days?day=12-25-2022`. The response status is 200 OK, size is 173 Bytes, and time taken is 2.63 s. The response body is a JSON object representing a day with hour values:

```
1  {
2   "date": {
3     "hr0": "000",
4     "hr1": "1201",
5     "hr10": "201",
6     "hr11": "810",
7     "hr12": "12-25-2022",
8     "hr2": "1300",
9     "hr3": "1300",
10    "hr4": "1301",
11    "hr5": "000",
12    "hr6": "1100",
13    "hr7": "1001",
14    "hr8": "1100"
15  }
16 }
```

On the right is a screenshot of the Google Cloud Firestore console. It shows a collection named 'days' with a document named '12-25-2022'. The document contains the same JSON object as the Postman response, representing a day with hour values.

```
Panel view Query builder
More in Google Cloud ▾
days
12-25-2022
+ Start collection + Add document
days
12-25-2022
+ Start collection + Add field
date: "12-25-2022"
hr1: "810"
hr10: "201"
hr11: "801"
hr12: "1100"
hr2: "1300"
hr3: "1300"
hr4: "1301"
hr5: "000"
hr6: "1100"
hr7: "1110"
hr8: "501"
hr9: "1001"
id: "12-25-2022"
Database location: nam5 (us-central)
```

Frontend

Software - Frontend

React Native

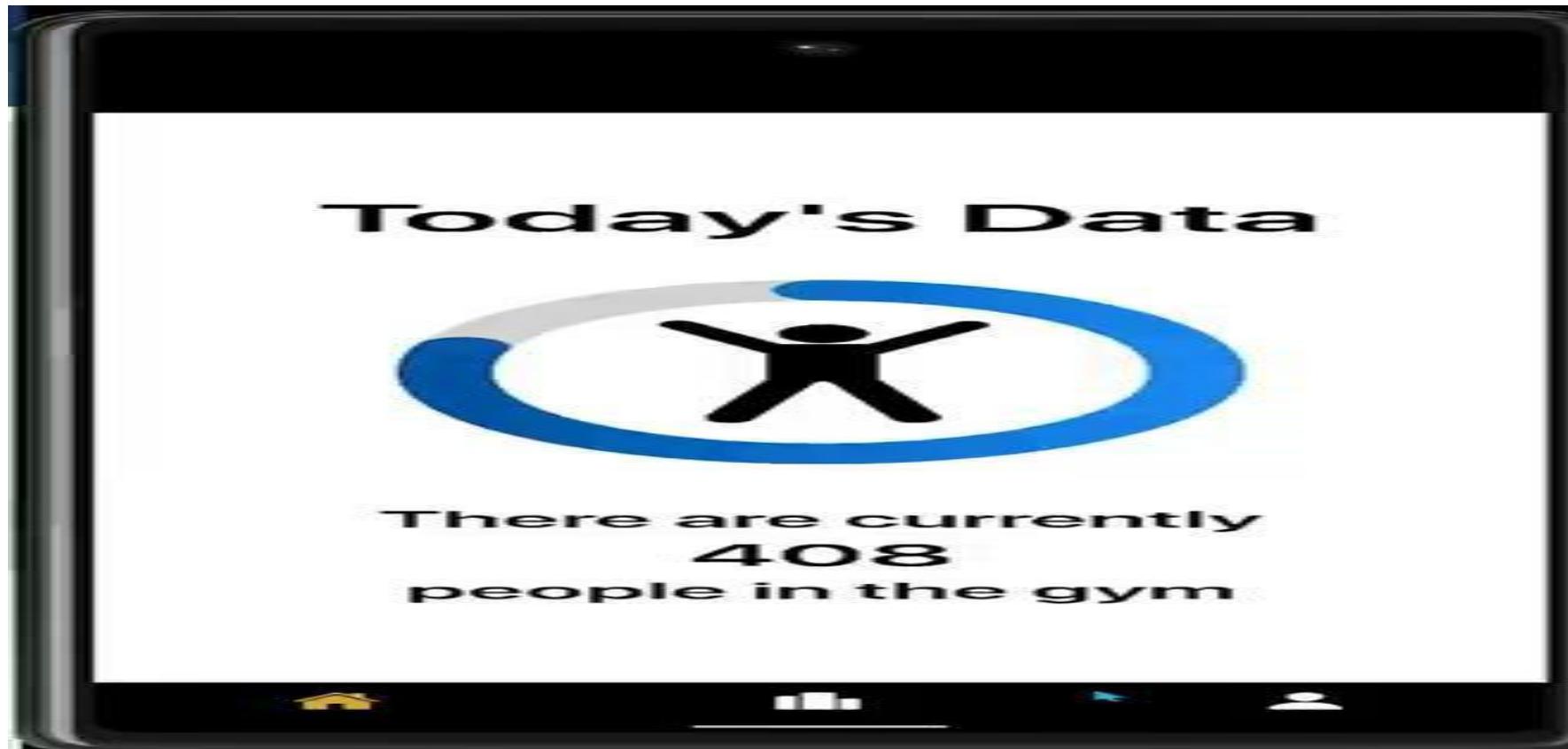
Build React components from UI mockups

- Navigation Bar
- Live Counter
- Hourly Bar Chart

Receive the data from Firebase

- Realtime Database
- Firestore

Software - App Demo

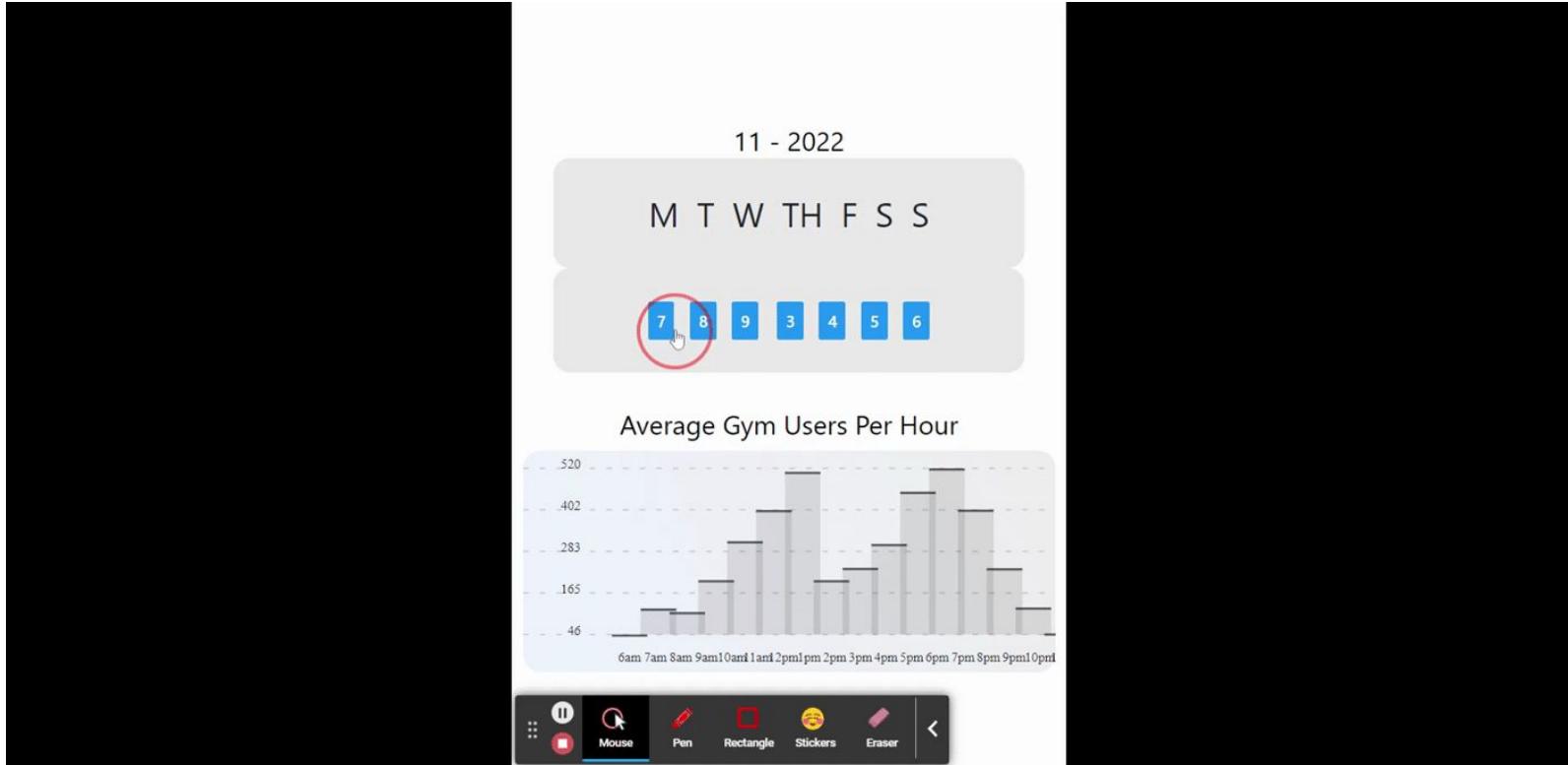


Software - React Component: Live Counter

The image displays three components related to a live counter application:

- Firebase Realtime Database Interface:** On the left, a screenshot of the Firebase console shows the Realtime Database section. It includes a navigation bar with Data, Rules, Backups, and Usage tabs. Below the tabs, there's a URL input field containing `https://theta-tau-cd254-default-rtbd.firebaseio.com/`. A text input field labeled "value" contains the value "250".
- Mobile Phone Screen 1:** In the center, a smartphone screen shows the application's interface. The title "Today's Data" is at the top. Below it is a large circular icon containing a black stick figure with arms raised. Text below the icon states "There are currently 250 people in the gym".
- Mobile Phone Screen 2:** On the right, another smartphone screen shows the same application interface. The title "Today's Data" is at the top. Below it is a large circular icon containing a black stick figure with arms raised. Text below the icon states "There are currently 408 people in the gym".

Software - React Component: Hourly Population



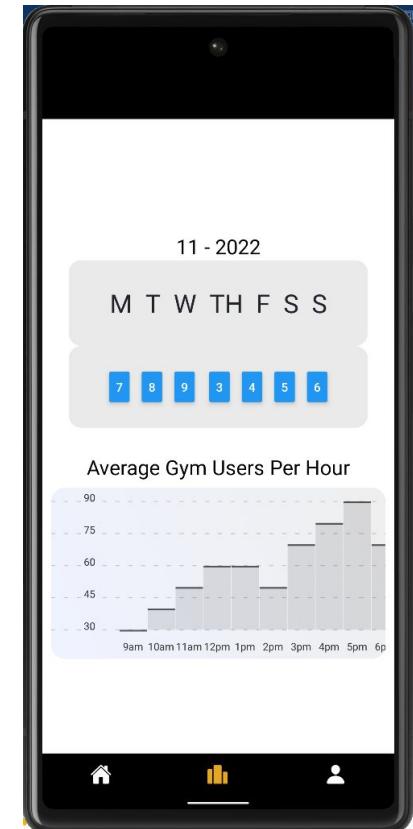
Software - React Component: Hourly Population

Hourly Population - Bar Chart

- firebase/app & firebase/firestore
- react-native-chart-kit
- Sample data for past week
 - Upscaled: Query specific data points from firestore

Weekly Calendar Display

- JavaScript Date Object



Hardware

Hardware – Team Members

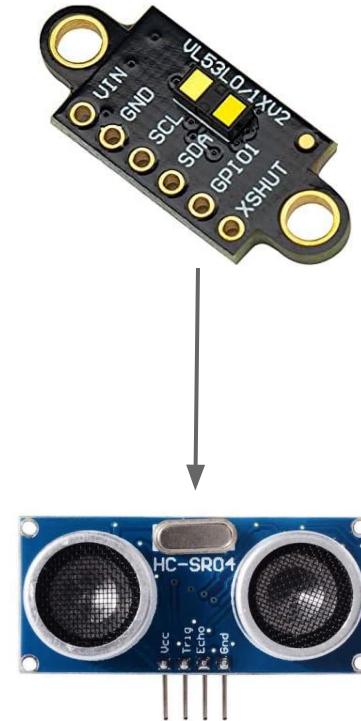
Members	Task
Rishi Jammy	Circuit Design
Rohith Iyengar	Circuit Design
Cecily Sagiao	Circuit Design & CAD Design
Edwin Garcia	CAD Design
Kailyn Ramos	CAD Design

Hardware – Project Breakdown Chart Weeks 7-9

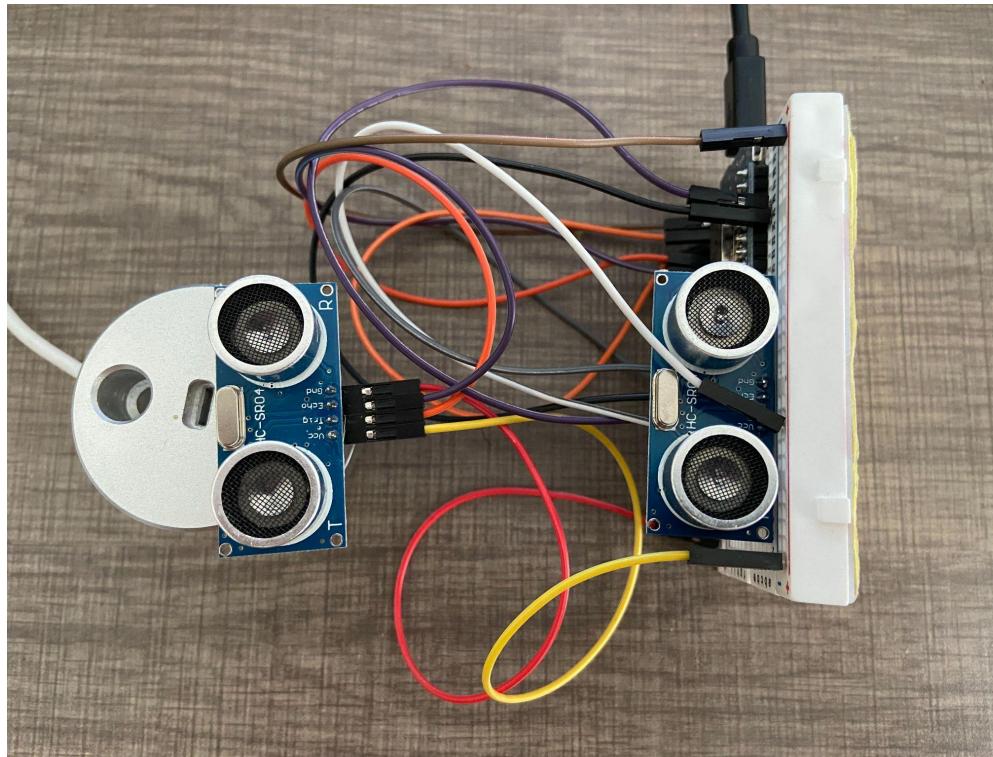
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				M	T	W	R	F	M	T	W	R	F	M	T	W	R	F
4	Hardware	Rishi																
4.1	Learn Technologies	Hardware Team	100%															
4.2	Equipment Research	Hardware Team	100%															
4.3	Equipment Order	Hardware Team	100%															
4.4	Circuit Design	Rohith, Rishi, Cecily	100%															
4.5	CAD Mockups	Edwin, Cecily	100%															
4.6	CAD Mockups Stress Test	Edwin, Kailyn	100%															
4.9	3D Design Printing	Edwin	100%															
4.10	3D Part Assembly	Edwin	100%															

Hardware – Complications

- ToF sensor no longer able to produce values
- Try different sensors
 - Switch to Ultrasonic Sensor (for MVP)
 - Two ultrasonic sensors together to determine direction of movement
- Added a battery component after first print
 - Change dimensions and reprint
 - Stress test again
 - Added battery wiring



Hardware – Ultrasonic Sensor Design



Hardware – Bill of Materials

Item	Description	Cost
LampVPath 2 AA Battery Holder	Battery Holder with Leads	\$6.48
11mm 90° Pin Headers Male	Headers	\$3.99
Yotache Weather Stripping	Weatherproof Seal	\$7.77
Aoicrie Jumper Wire Kit	Jumper Wires	\$8.99
AA Duracell Battery Holder	Battery Holder	\$5.34
NodeMCU ESP8266	Microcontroller	\$14.98
Polulu 400-point	Solderless Breadboard	\$2.95
VL53L1X-V2	IR Sensor	\$17.88
HC-SR04	Ultrasonic Sensor	\$10.93
	Total	\$79.31

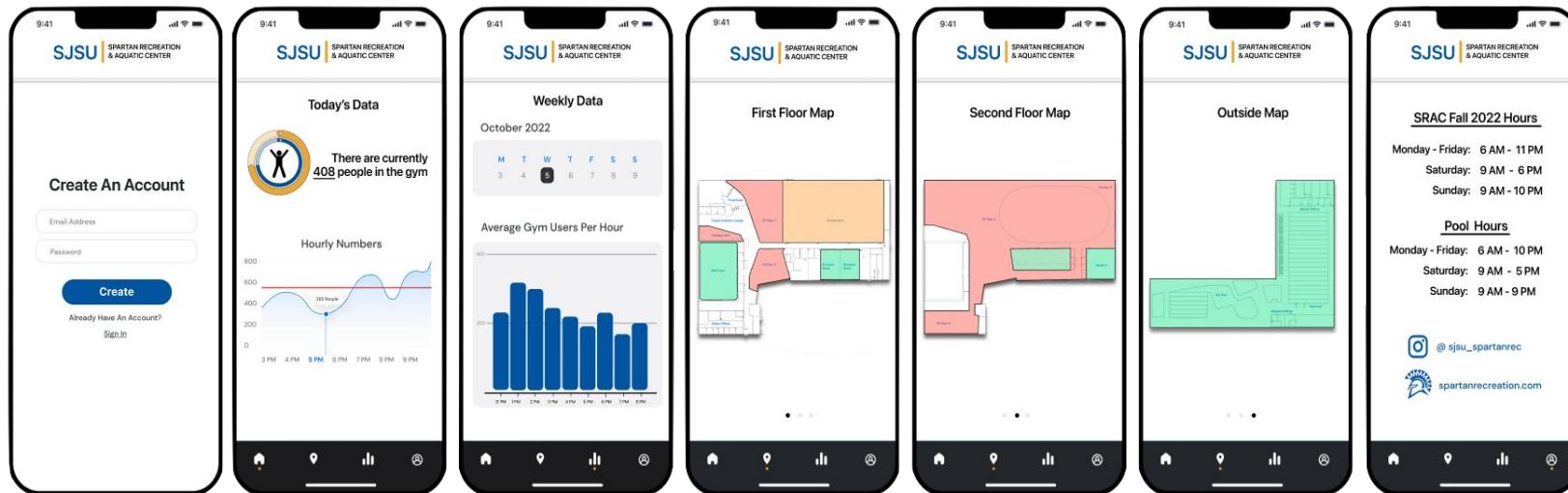
Hardware – Summary

- Sensors
 - Switch from IR sensor to Ultrasonic for MVP
- Power
 - Used two AA batteries for power
 - 2 AA batteries in series (3.1V)
 - Connected positive lead to 5V Vin on microprocessor
- Casing
 - Redesign to bigger casing

Upscaled Project

UX/UI & Frontend

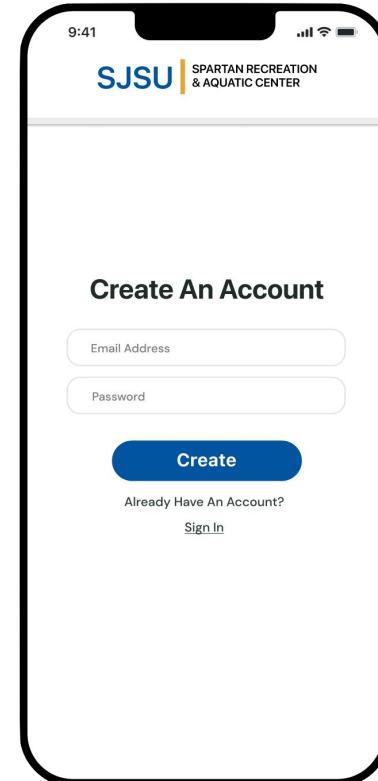
UX/UI & Frontend - Upscaled Mockup



UX/UI & Frontend - Upscaled Mockup

Firebase Authentication/Security

- Sign Up/Sign In
 - Email/Username
 - Password
- Record users in Firebase console

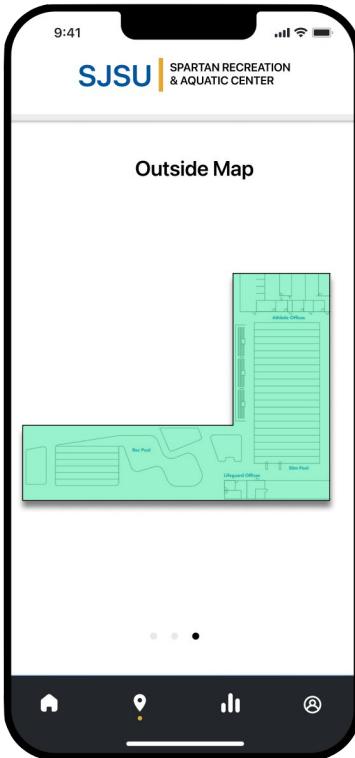
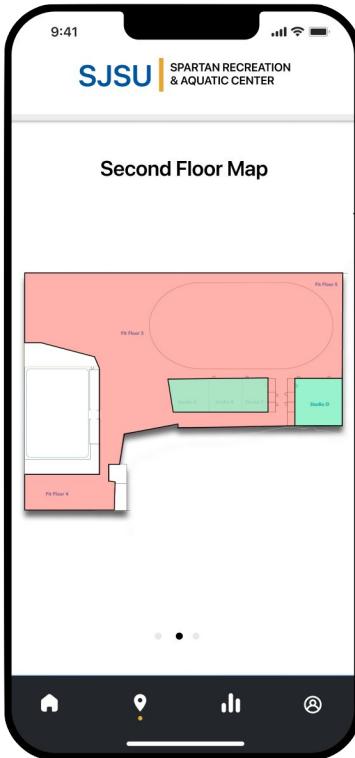


UX/UI & Frontend - Upscaled Mockup

The image displays three iPhone mockups side-by-side, each showing a different screen of the SJSU Spartan Recreation & Aquatic Center mobile application.

- Left Screen: Today's Data**
 - Header:** SJSU | SPARTAN RECREATION & AQUATIC CENTER
 - Section Title:** Today's Data
 - Icon:** A circular icon featuring a stylized orange and yellow design with a figure inside.
 - Text:** There are currently 408 people in the gym
 - Section Title:** Hourly Numbers
 - Chart:** A line graph showing the number of users per hour from 3 PM to 9 PM. A blue line fluctuates between 200 and 600, with a red horizontal line at 600. A point on the curve at 5 PM is labeled "265 People".
- Middle Screen: Weekly Data**
 - Header:** SJSU | SPARTAN RECREATION & AQUATIC CENTER
 - Section Title:** Weekly Data
 - Text:** October 2022
 - Calendar:** A weekly calendar showing the days of the week (M, T, W, T, F, S, S) and dates (3, 4, 5, 6, 7, 8, 9).
 - Section Title:** Average Gym Users Per Hour
 - Chart:** A bar chart showing average gym users per hour from 12 PM to 8 PM. The y-axis ranges from 0 to 400. The bars show peaks around 1 PM and 2 PM, and a smaller peak around 6 PM.
- Right Screen: SRAC Fall 2022 Hours**
 - Header:** SJSU | SPARTAN RECREATION & AQUATIC CENTER
 - Section Title:** SRAC Fall 2022 Hours
 - Text:** Monday - Friday: 6 AM - 11 PM
Saturday: 9 AM - 6 PM
Sunday: 9 AM - 10 PM
 - Section Title:** Pool Hours
 - Text:** Monday - Friday: 6 AM - 10 PM
Saturday: 9 AM - 5 PM
Sunday: 9 AM - 9 PM
 - Social Media:** Instagram icon with handle @sjsu_spartanrec
 - Website:** spartanrecreation.com

UX/UI & Frontend - Upscaled Mockup



Backend

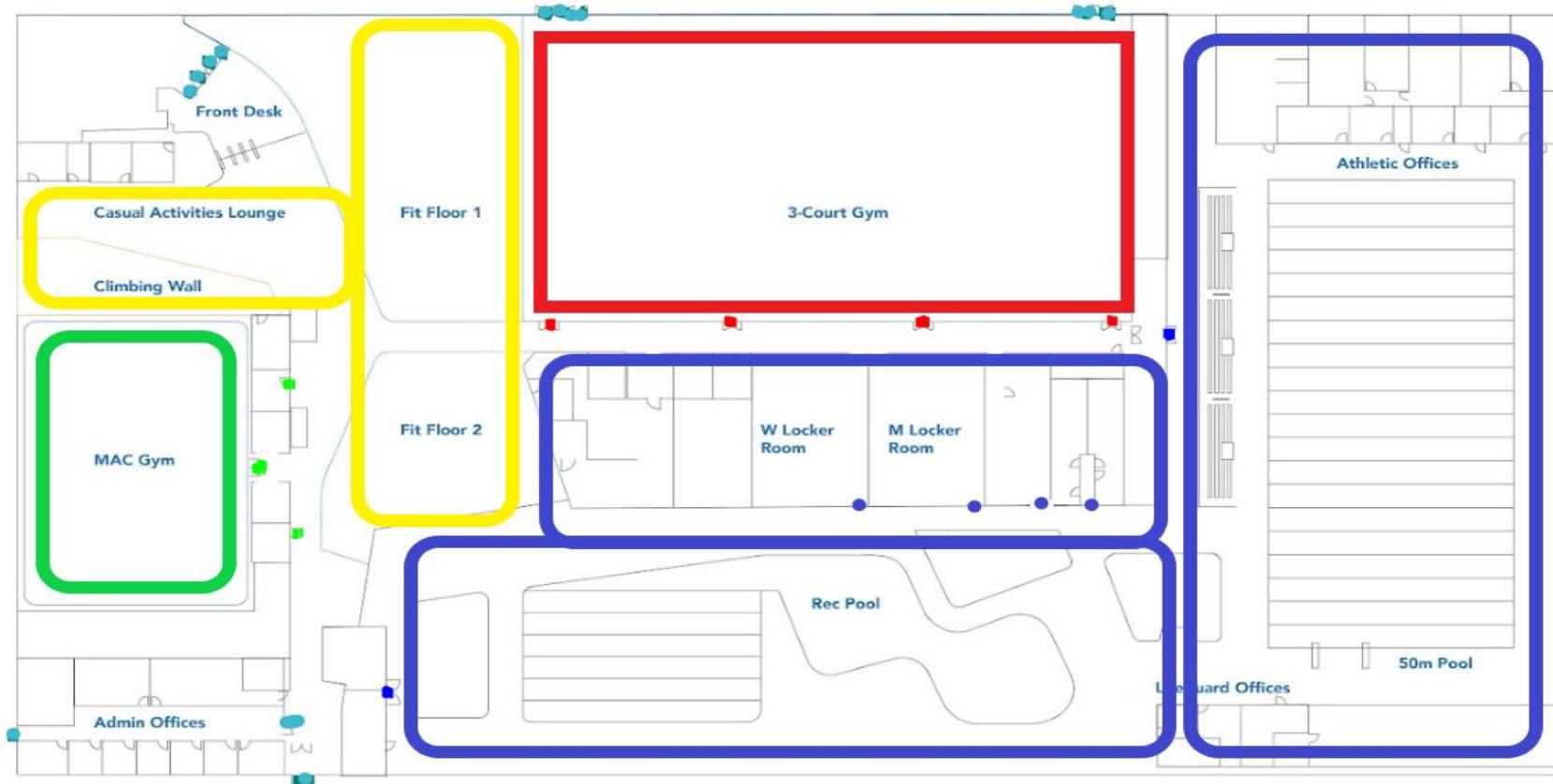
Software – Backend

- Utilize the ToF sensor instead of two ultrasonic sensors
- Find a way to recognize quicker sensor passes
- Create a network of arduinos. Utilize a server to add and subtract 1 from multiple sensors simultaneously
- More analytic information to display on the app (database and backend):
 - Data of previous weeks (more than one week)
 - More accurate live count of population by time

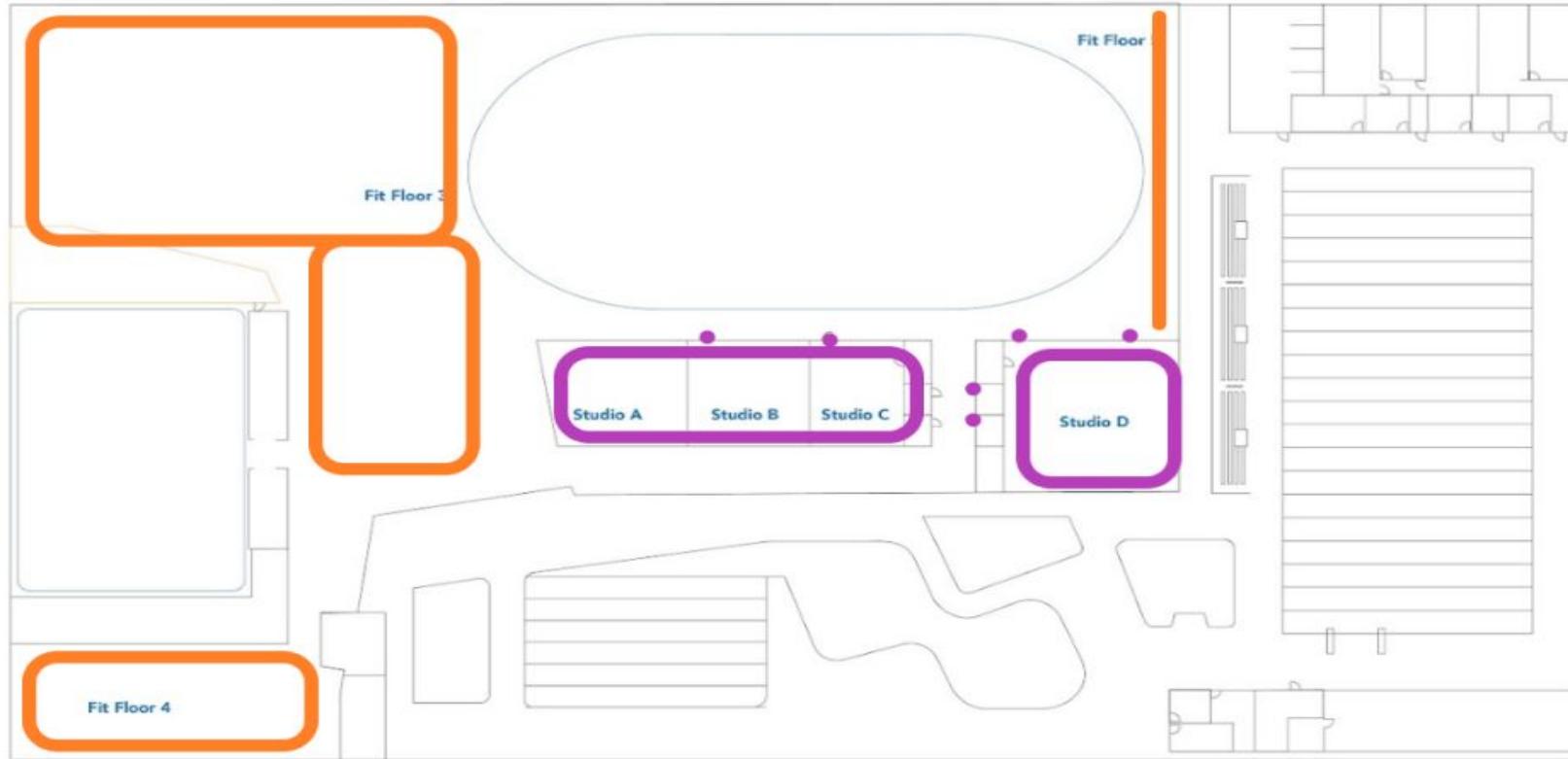


Hardware

First Floor



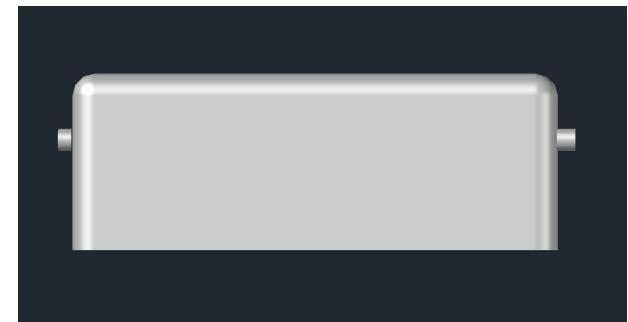
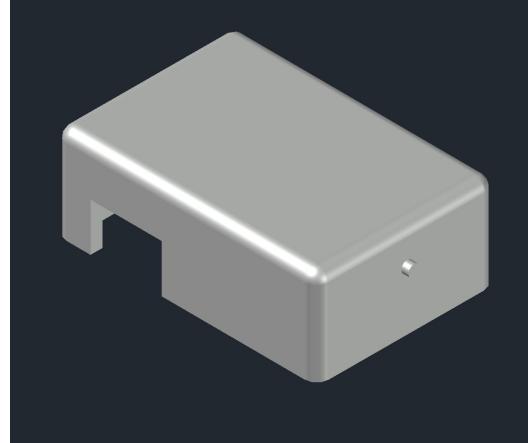
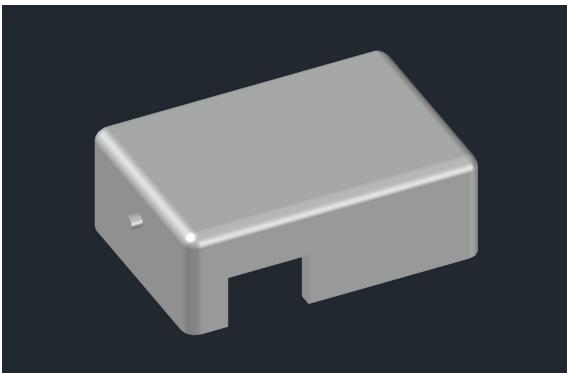
Second Floor



Hardware – Case Design

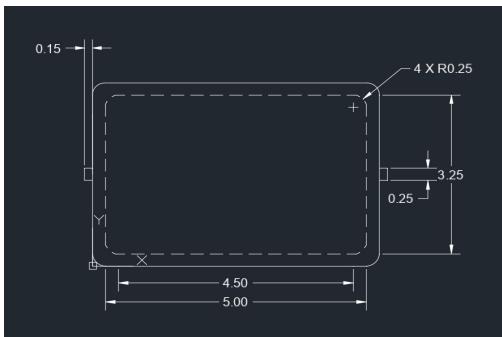
Dimensions: 5.5" x 3.75" x 2"

Thickness: 0.25"

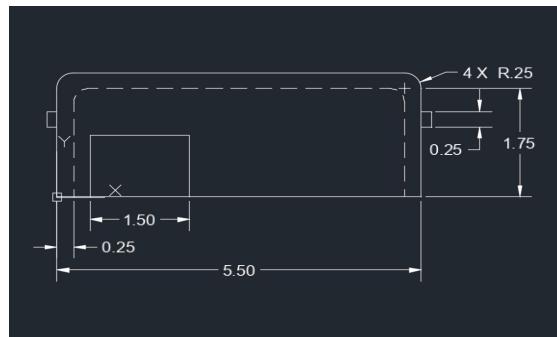


Hardware – Case Orthogonal Projection

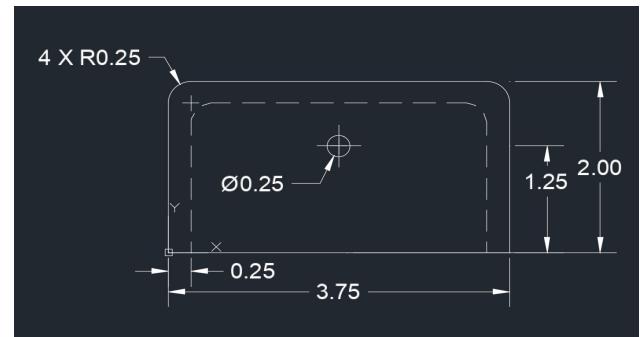
Front View



Top View



Right View

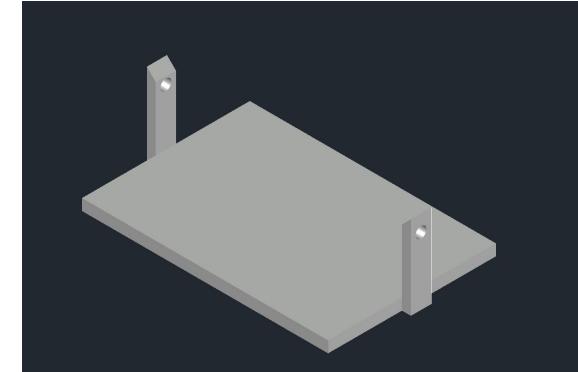
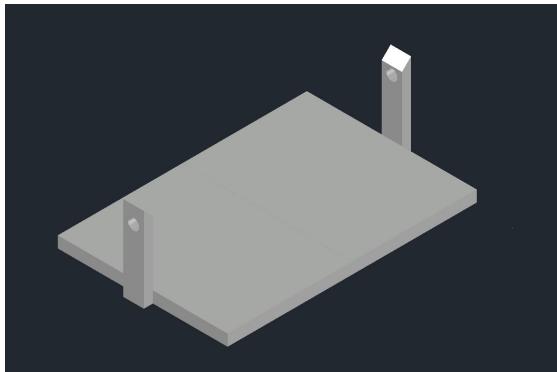


*Dimensions in inches

Hardware – Base Design

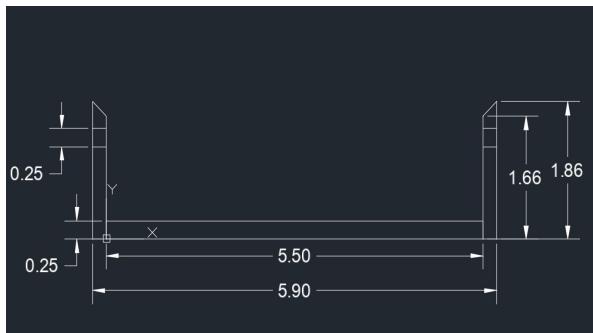
Dimensions: 5.9" x 3.37" x 1.75"

Thickness: 0.25"

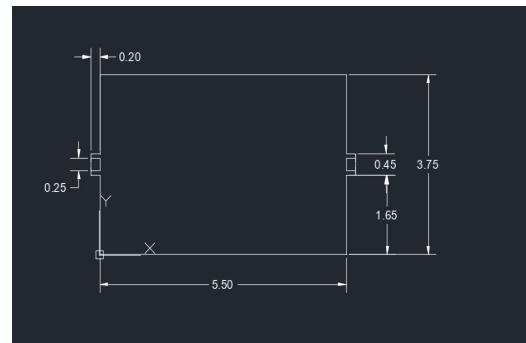


Hardware – Base Orthogonal Projection

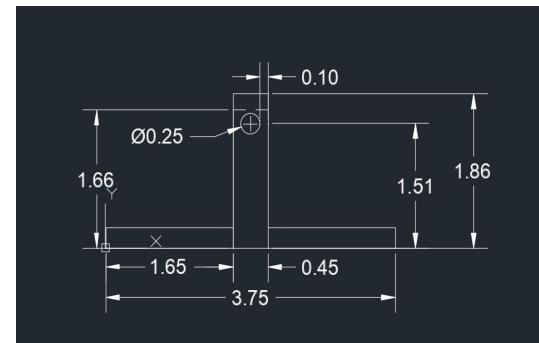
Front View



Top View

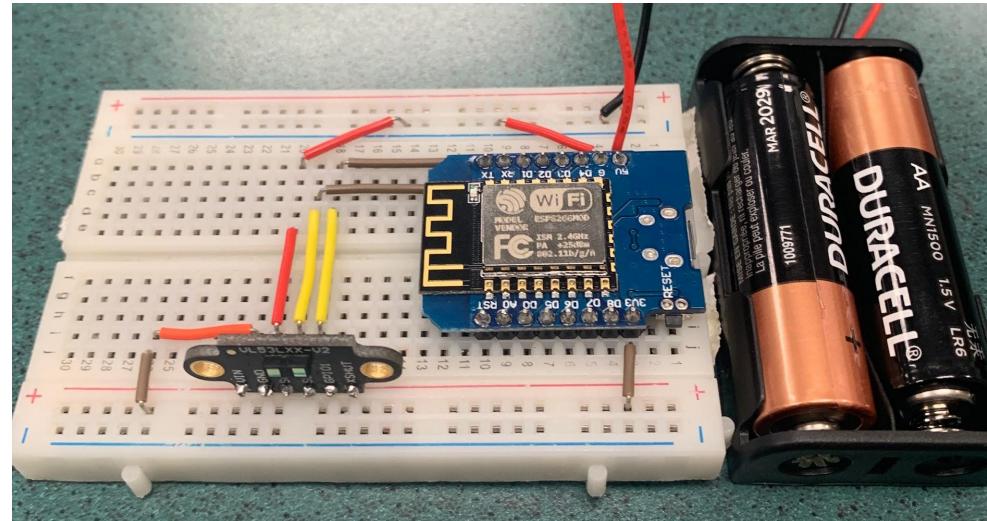
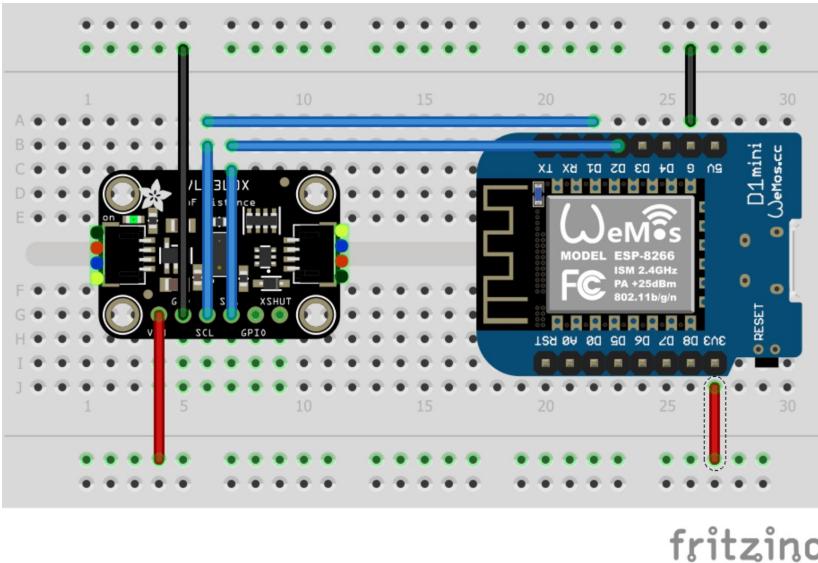


Right View

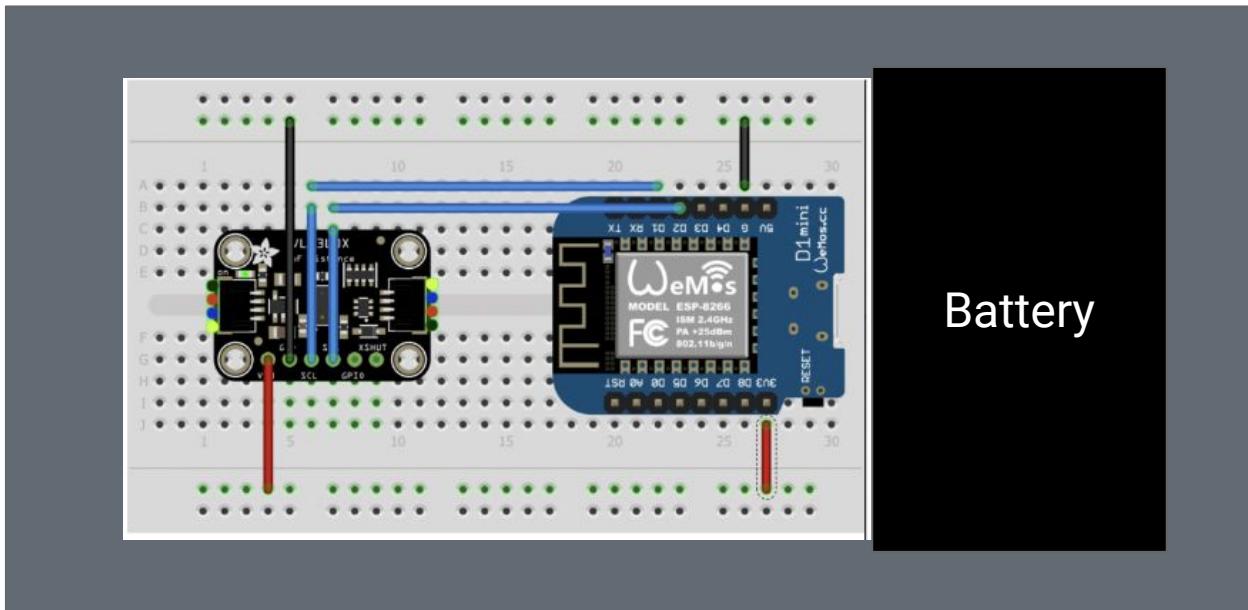


*Dimensions in inches

Hardware - Final Circuit Design



Hardware – Final Casing Layout



Battery

Hardware – Summary

- Sensor
 - IR Sensor
 - We only have to use one sensor
 - Uses the FOV cones to split into zones and determine direction
- CAD design
 - Slimmer design
 - 3D print

Final Thoughts

Things that went well:

- Individually learned a lot about new technologies, languages, and tools
- We learned how to work together and help each other to resolve issues
- We were able to resolve complications that arose
 - ToF → ultrasonic sensor

Things to improve:

- Researching more thoroughly beforehand to make sure designate tasks more efficiently
- Staying on schedule
- Communication between all teams
- Designate more time to test our product

Thank You!

Questions?