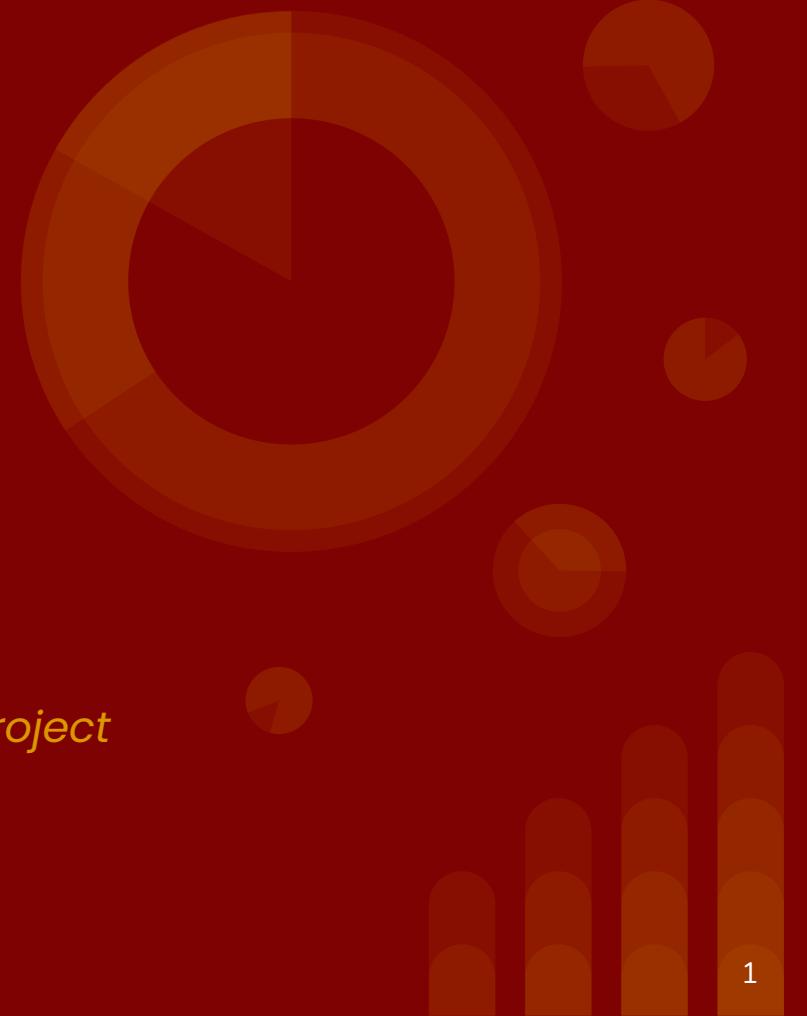


Project Presentation: **Spacepark**



Spring 2022 Class Potential New Member Project

4/21/2022

1. Overview



Problem

- Parking in San Jose State University has one problem
 - Too many cars but not enough available spots
- Issues
 - People are late to events
 - People get frustrated with finding a spot
 - People waste fuel and time



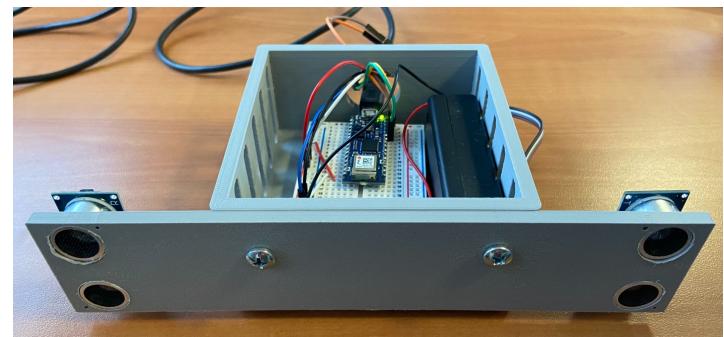
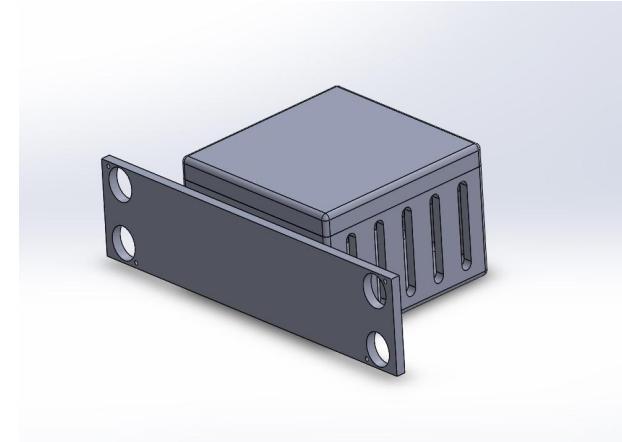
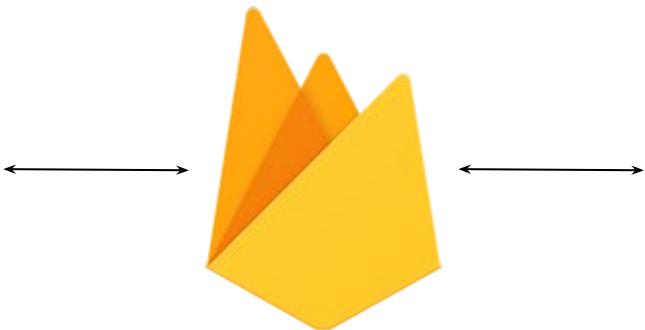
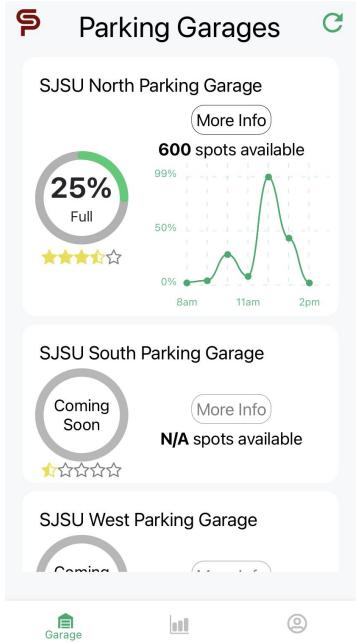
Solution: Domain & Service

- Spacepark
 - A device that tracks the occupancy of the cars in a garage
 - An application that allows users to see:
 - Current Occupancy
 - Capacity Frequency
 - Garage Reviews
 - Garage Information





Solution: High Level





Execution Strategy

Project Director: Aneesh Pothuru

<u>Frontend</u>	<u>Backend</u>	<u>Hardware</u>
1. Yuki Saito	1. Chloe Dang	1. Juggie Ray Heerey
2. Anusri Chavali	2. Aneesh Pothuru	2. Calvin Anderson
3. Erica Xue	3. Anushka Chokshi	3. Dylan Subijano
4. Ji Soo Kim	4. Daanyaal Qureshi	4. Nathan Lee
5. Neha Washikar	5. Nancy Diaz	5. Phillip Pham

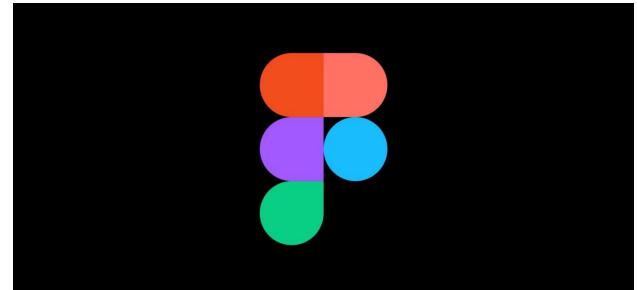
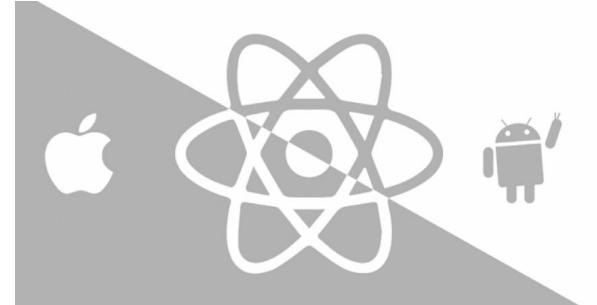
2. Software

2.1 Frontend



Technologies

- Languages
 - JavaScript and CSS
- Framework
 - React Native
- Tools
 - Figma
 - React Native Libraries
 - Expo



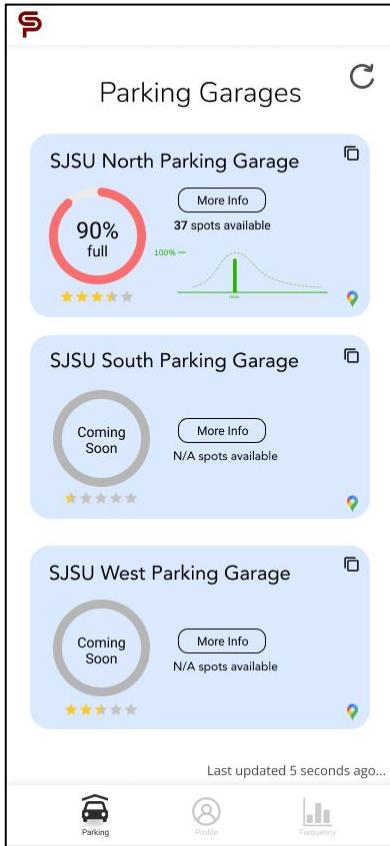


Development Process

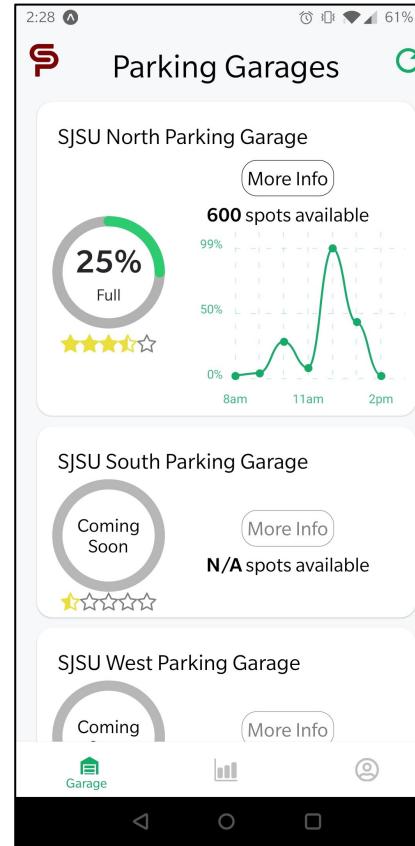
- Paired Programming
- Template Code
- Supervising, Reviewing, Teaching
- Meetings

UI Mockup Comparison (Part 1)

Proposed

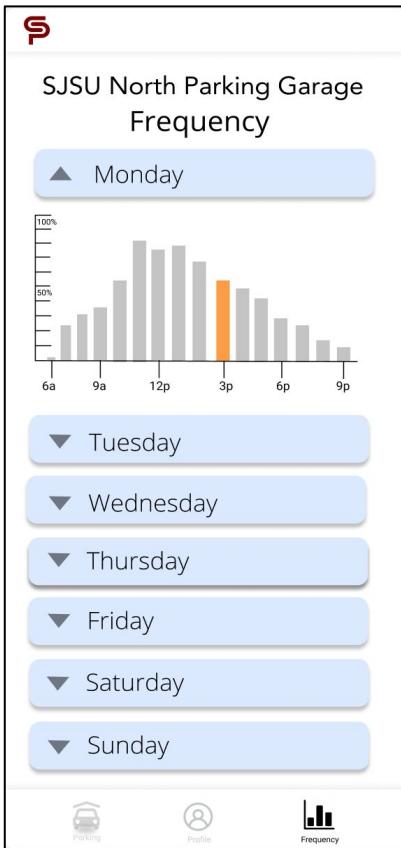


Actual

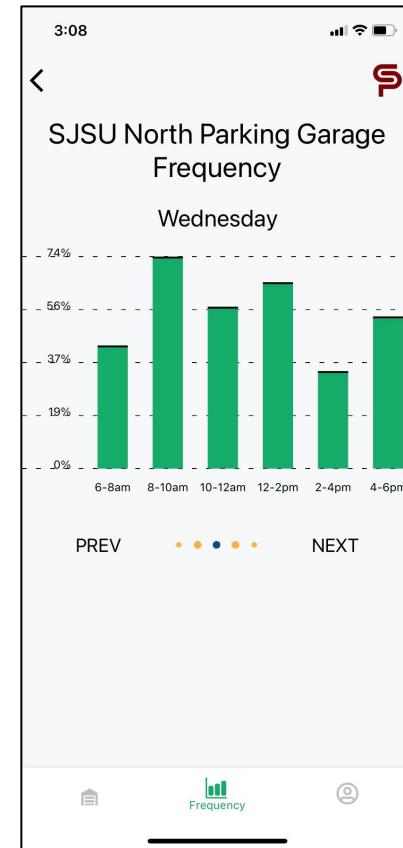
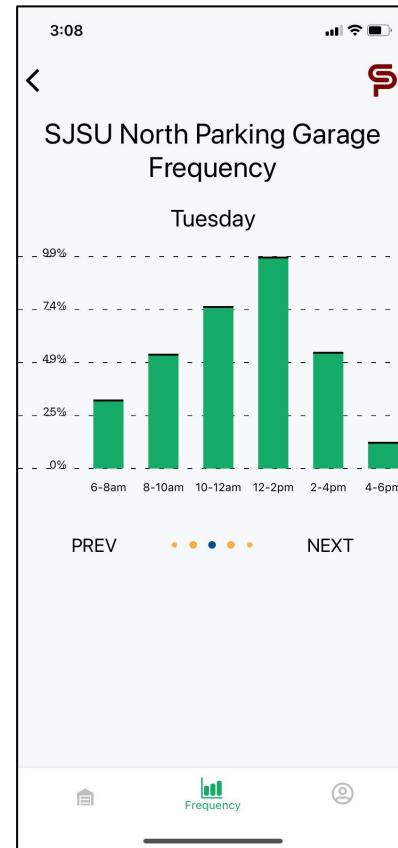


UI Mockup Comparison (Part 2)

Proposed

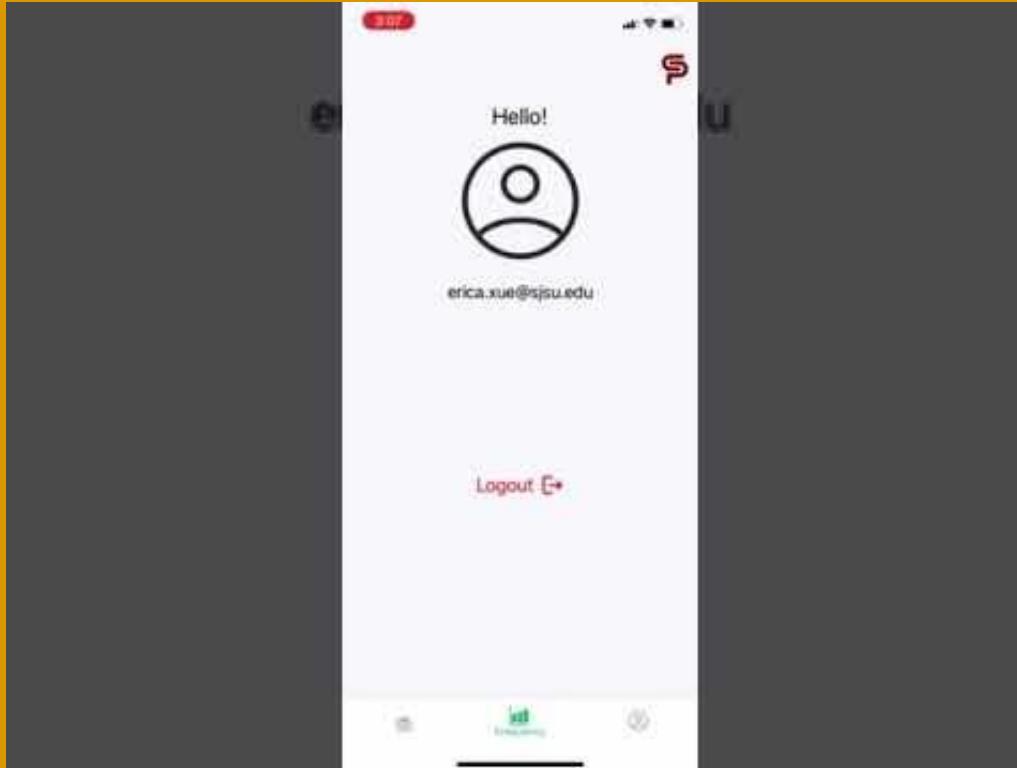


Actual





Demo/Overview



Overview

SJSU North Parking Garage

Total parking spots

General -----	1,445
Disabled -----	8
Employee -----	335
R-Permit -----	7
30-Min Time Zone -----	22

Pricing

Mon - Fri

30 Mins -----	\$1.00
24 Hours -----	\$8.00
After 5:30 PM -----	\$5.00

Sat - Sun

24 Hours -----	\$5.00
----------------	--------

No Change & Refund

Hours

Mon - Fri

Open 6:00 Am - 1:00 AM
'E', 'R', 'H', Carpool, Overnight

Garage

Reviews

Write your review here!

Johnny Doe

>Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Jane Doe

Ut enim ad minim veniam, quis nostrud exercitation ullamco

Jim Doe

Excepteur sint occaecat cupidatat non proident

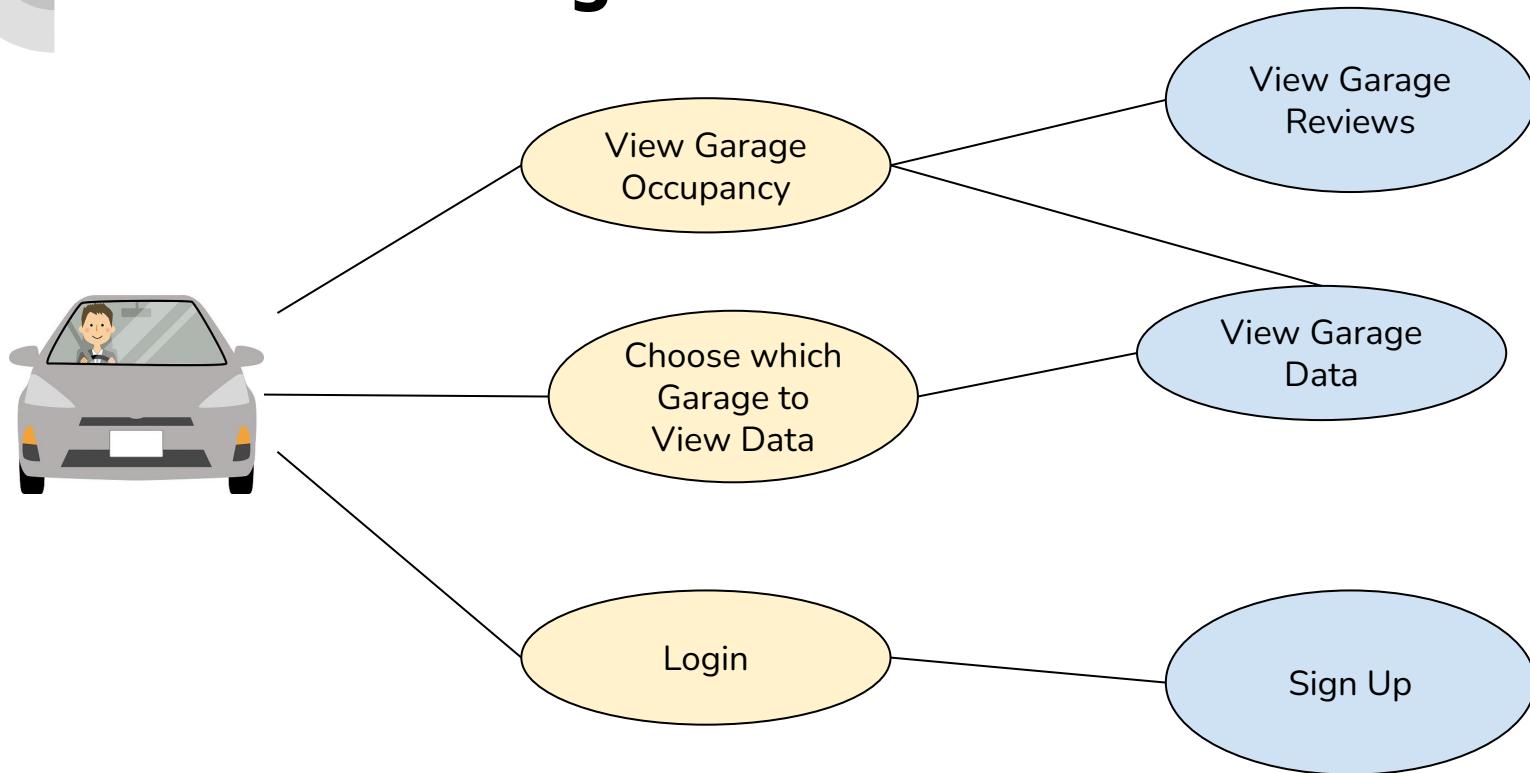
John Doe

Lorem ipsum dolor sit amet

Jane Doe



Use Case Diagram





Quality Testing Report

- User Acceptance Testing
 - Ensured 100% UI availability
- Unit Testing

```
Test Suites: 5 passed, 5 total
Tests:       15 passed, 15 total
Snapshots:   0 total
Time:        3.374 s, estimated 14 s
Ran all test suites.
(base) Aneeshs-MacBook-Pro:Spacepark aneeshporthuru$
```



Deliverables Met

- All Intended Pages Included
 - Frequency, Garage Data, Profile/Account, Review System
- Works on IOS & Android

Future Improvements

- South & West Garage
- Adding Support for Different Languages

Deliverable Status

WBS NUMBER	TASK TITLE	TASK OWNER	PCT OF TASK COMPLETE
2	Frontend	Yuki	
2.1	Learn Technologies	All	100%
2.2	Setup Structure	Yuki	100%
2.3	Finalize Mockups	All	100%
2.4	Static Pages : Login, Signup, Profile	Ji Soo, Erica	100%
2.5	Static Pages: Garage View, Frequency	Neha, Anusri	100%
2.6	Static Pages: More Info	Ji Soo, Neha	100%
2.7	Static Pages: Review	Erica, Anusri	100%
2.8	Code Review	Yuki	100%
2.9	API Requests	All	100%
2.10	Integration	Leads	50%



Core Learning Outcomes

Technical

- Figma mockups
- Javascript/CSS Styling
- React Native/Expo
 - Importing libraries
- Git

Non-Technical

- Collaboration
- Problem-Solving
- Communication

2.2 Backend



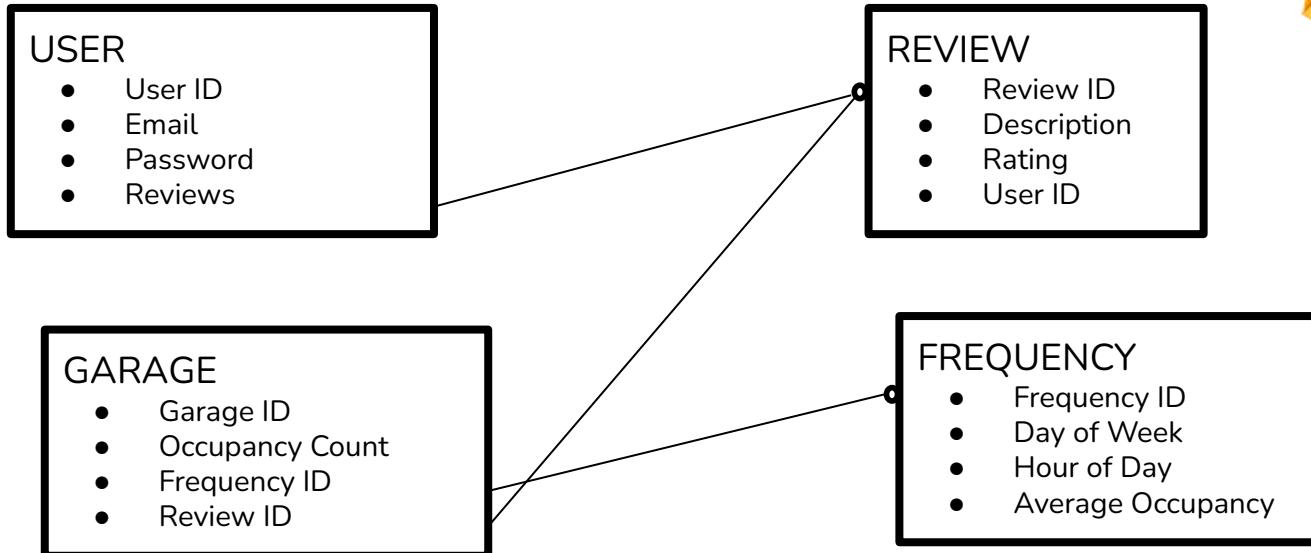
Technologies

- Languages
 - Javascript
- Tools
 - Google's Firebase Cloud Firestore Database



Database Structure

Google's Firebase Cloud Firestore Database





User Authentication

Firebase Authentication SDK

- Email and Password Based

Key Functions

- GET: User Profile
- GET: Auth Token
- POST: Create User
- POST: Update User Information

The screenshot shows the Firebase Realtime Database interface. At the top, there's a navigation bar with a home icon, followed by 'user' and a specific document ID 'C4ziJ5fLlyTmX...'. Below this is a table structure.

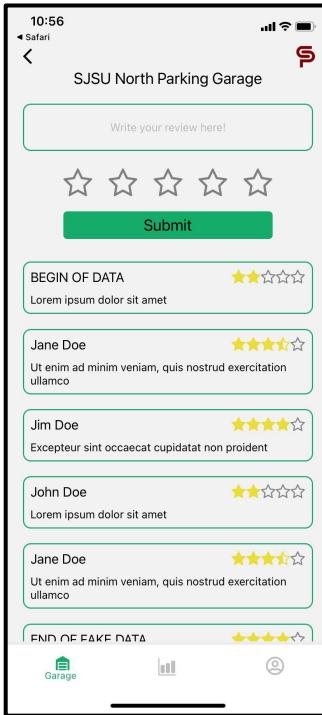
spacepark-8c822	user	C4ziJ5fLlyTmXB3HLaPhJpS9yVm1
+ Start collection	+ Add document	+ Start collection
frequency	8o8rB6h2xJYx6r3SbivqMC1IVun2	+ Add field
garage	AQjmmjm3K4tTgFnz0qYP0lNriyfw2	createdAt: April 19, 2022 at 8:56:18 PM UTC-7
reviews	C4ziJ5fLlyTmXB3HLaPhJpS9yVm1 >	email: "calvin@gmail.com"
user >	OdInQz0qBrE23x5kWf6B	Providers
	QpTH1dEHzfSj6f9CWwqZ7sAtRIn2	username: "Calvin Anderson"



User Reviews

Firebase

- Reviews
 - By User
 - By Garage



The screenshot displays two document snapshots in the Firestore database:

- reviews** collection:
 - Document ID: gw8JhAYQrsEWzhbVh1p0 (highlighted with a red box)
 - description: "I have parked my car at this location numerous times and I have never experienced a break-in or damages to my car. There is some difficulty finding parking on the lower levels, so I would suggest parking on the 4th or 5th floors!"
 - garageId: "5kDinR7sN82hRH4JTrMV"
 - rating: 3
 - userId: "OdInQzOqBrE23x5kWf6B" (highlighted with an orange box)
- user** collection:
 - Document ID: OdInQzOqBrE23x5kWf6B (highlighted with an orange box)
 - createdAt: April 10, 2022 at 11:15:14 AM UTC-7
 - email: "itsnxncy@gmail.com"
 - reviews (sub-collection):
 - Document ID: gw8JhAYQrsEWzhbVh1p0 (highlighted with a red box)
 - username: "Nancy Diaz"

Key Functions

- GET: User Reviews
- GET: Garage Reviews
- GET: Garage Rating
- POST: User Review
- POST: Garage Review



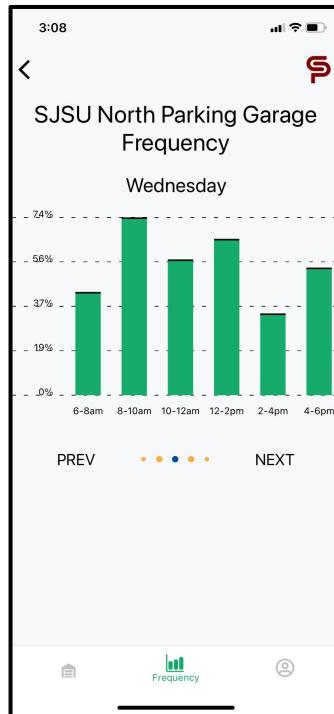
Occupancy and Frequency

Firebase

- Garage Status
 - Occupancy
 - Frequency

Key Functions

- GET: Garage Occupancy
- GET: Garage Frequency
- POST: Garage Occupancy
- POST: Garage Frequency



frequency	garage
+ Add document	+ Add document
cigkoe62rk7h3rbqdplh	5kDinR7sN82hRH4JTrMV
+ Start collection	+ Start collection
+ Add field	+ Add field
monday	frequencyId: "cigkoe62rk7h3rbqdplh"
0 140	name: "North"
1 643	occupancy: 340
2 723	
3 756	
	reviews
	0 "gw8JhAYQrsEWzhbVh1p0"
	1 "CNCJDfzuSHUFciWE1lu"



Quality Testing Report

- Database & API Testing
 - Data Integrity
- Unit Testing

```
Test Suites: 5 passed, 5 total
Tests:       15 passed, 15 total
Snapshots:   0 total
Time:        3.374 s, estimated 14 s
Ran all test suites.
(base) Aneeshs-MacBook-Pro:Spacepark aneeshporthuru$
```

Deliverable Status

WBS NUMBER	TASK TITLE	TASK OWNER	PCT OF TASK COMPLETE
3	Backend	Chloe	
3.1	Learn Technologies	All	100%
3.2	Setup Structure	Chloe	100%
3.3	Connect Firebase to React Native	Aneesh, Chloe	100%
3.4	Google Firebase Database Setup	Daanyaal, Nancy	100%
3.5	Database: Occupancy and Frequency Storage	Anushka	100%
3.6	Database: User Accounts & Authentication	Nancy	100%
3.7	Database: User Reviews	Anushka	100%
3.8	Code Review	Chloe	100%
3.9	API Requests	All	100%
3.10	Integration	Leads	50%



Core Learning Outcomes

Technical

- Javascript
- noSQL Database
- Application Architecture
- API Calls
- Git

Non-Technical

- Collaboration
- Problem-Solving
- Communication

3. Hardware

3.1 Fundraising



Fundraiser

- Two Day Brownie Bake Sale
- Tabled on 7th Street
- Successfully Sold Out in 1.5 Hours both Days





Fundraiser

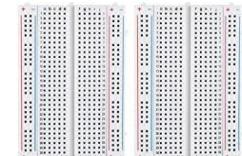
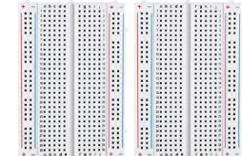
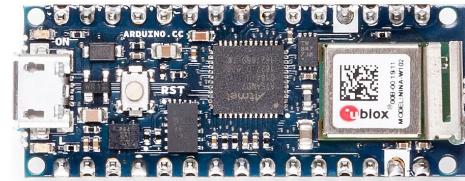
- Cost of Hardware estimate = \$85
- Cost of Brownie materials day 1 = \$13.75
- Cost of Brownie materials day 2 = \$9
- Cost of Cookies (store bought) day 1 = \$9
- Made \$169 dollars total - \$52.25 profit
 - Sold regular brownies \$1, marshmallow and m&m \$2, cookies \$1



Equipment



Arduino	\$25
Sensors	\$20
Bread Board	\$13
Batteries	\$12
Battery Holders	\$10
3D Printing	\$5
Total Cost	\$85



3.2 Electronics



Demo

Google Firebase Integration



Occupancy calculator

```
2.604 -> data
2.604 -> 0.00
2.604 -> 0.00
2.604 -> number of cars= 0
52.651 ->
52.651 -> distances
52.651 -> 1.79
52.651 -> 0.08
52.651 -> data
52.651 -> 1.78
52.651 -> 0.18
52.651 -> number of cars= 1
52.651 ->
52.651 -> distances
52.651 -> 1.55
52.651 -> 0.07
52.651 -> data
52.651 -> 0.00
52.651 -> 0.00
52.651 -> number of cars= 1
52.651 ->
52.651 -> distances
52.651 -> 1.81
```

Overview

- Hardware Integration
 - Connecting the hardware components
 - Arduino Nano 33 IoT, Ultrasonic Distance Sensor
- Ping/Send data to our API
 - ESP32 Module and WiFi
 - Google Cloud Firebase
- Prototype Integration
 - Hardware and enclosure development
 - Ensure safety for our components/housing
 - Portable device





Technologies

- Environments
 - Arduino IDE 
 - VSCode
 - PlatformIO extension 
- SolidWorks
 - FEA Simulations 
- CAD
 - Dimensions 
- Google Firebase API 
- GitHub
 - Version control and collaboration 



Development Process

- Ensured each member had a specific task to complete
 - Electronics
 - Physical Device
- Set up the Arduino IoT and environments for project development
 - Become familiar with C and C++ syntax
 - Git / GitHub



Development Process cont.

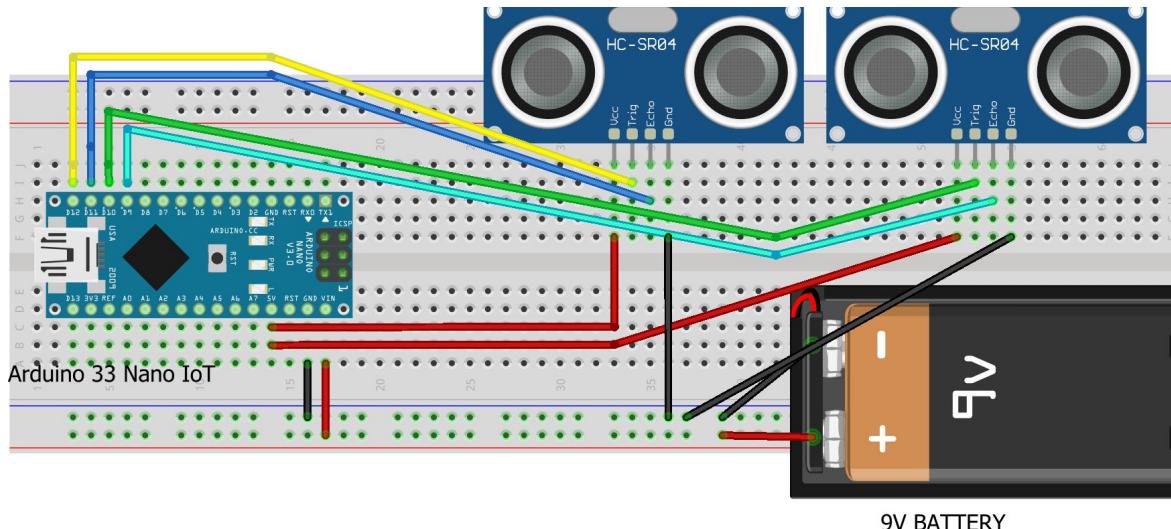
- Illustrated different breadboard configurations
 - Assembled the electronics altogether
- Discussed prototypes and housing to enclose the hardware
 - Assembled our prototype
 - FEA Testing
- Arduino Integration to Google Firebase
 - Ensure connectivity to the Realtime Database





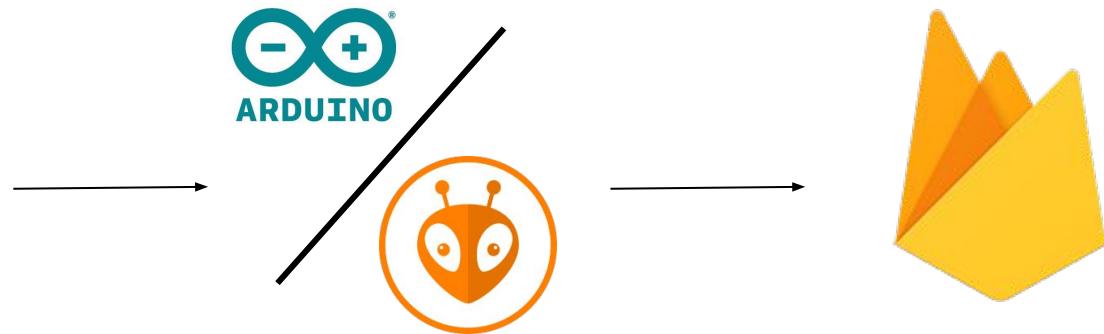
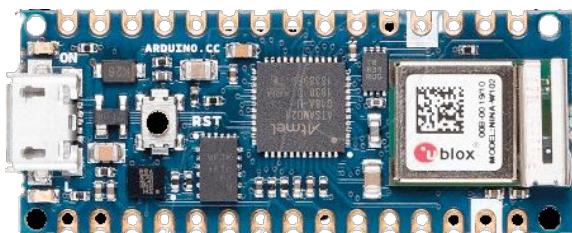
Schematics and Pin-Out

- Sensor 1 Trigger Pins and Echo pins Assigned to Pins 12 and 11
- Sensor 2 Trigger Pins and Echo pins Assigned to Pins 10 and 9
- All Ground connected through Negative Rail
- Sensor powered by Arduino +5V pin
- Arduino Powered by 9V Battery pin Vin





Software



Wifi and hardware integration

*Identification and occupancy
calculator*

*Data transfer with json file
and structure*



Deliverables Met

- Arduino schematic with ultrasonic distance sensors
 - Ultrasonic sensor and power supply routed onto arduino
 - Appropriate pin-outs for UD Sensors and Arduino
 - Installed and created changes in Arduino Development
- ESP32 Module communication with Google Cloud Firestore
 - Displayed output via Realtime Database
- Working ultrasonic distance sensor
 - Person or vehicle passing through
 - Moving forward counts as 1 car, backwards as -1



Deliverables Not Met

- Portable device
 - Using a 9V battery and stable WiFi connection
- Version Control using Git
- Working video demonstration and live demo of device

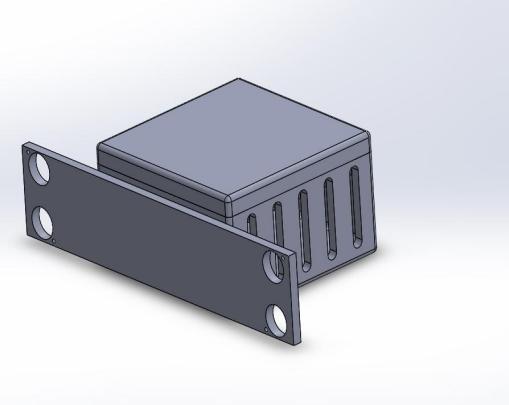
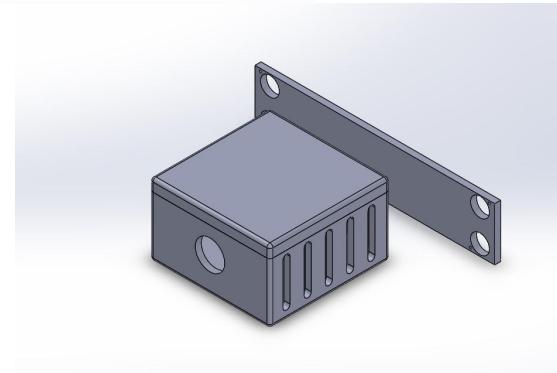
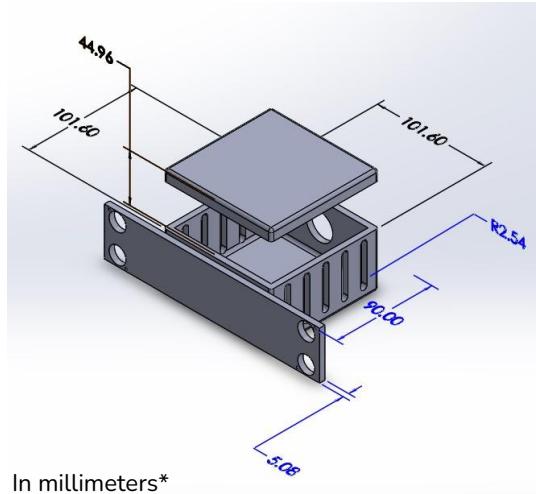


3.3 Physical Device

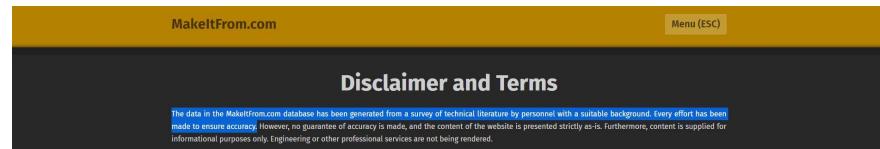
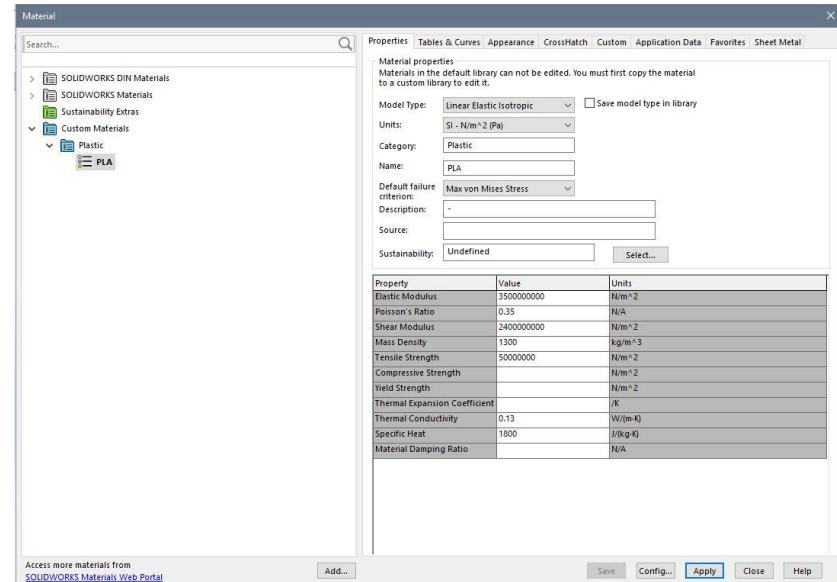
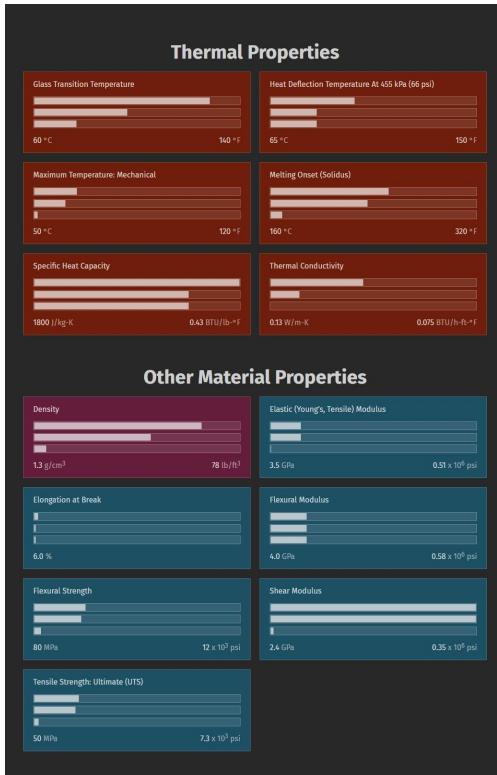


SolidWorks

- Created and drew a 3D design of the product using Solidworks.
- Designed specialized components that would better fit the hardware.

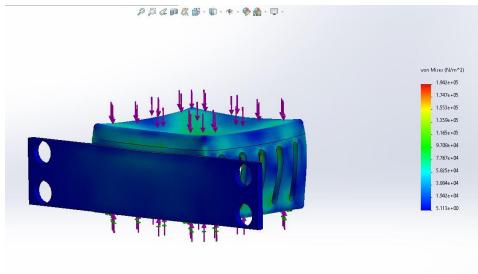


SolidWorks (FEA Testing)

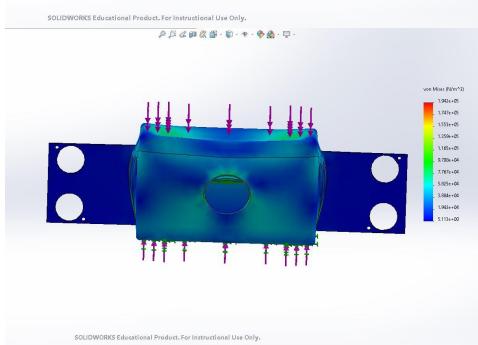




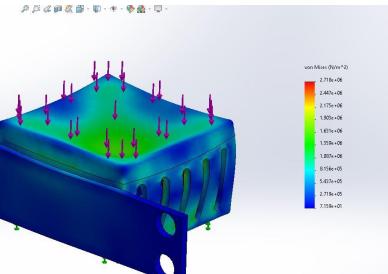
SolidWorks (FEA Testing)



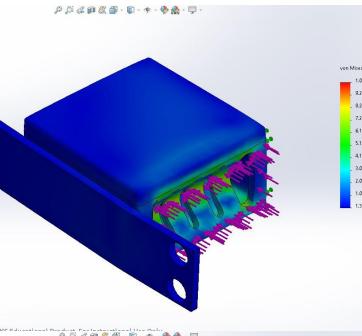
SOLIDWORKS Educational Product. For Instructional Use Only.



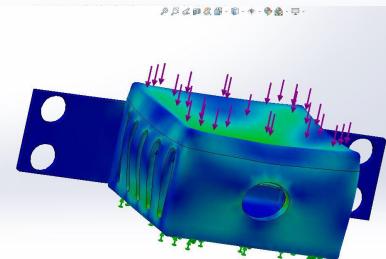
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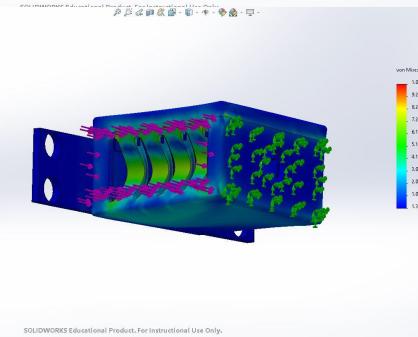
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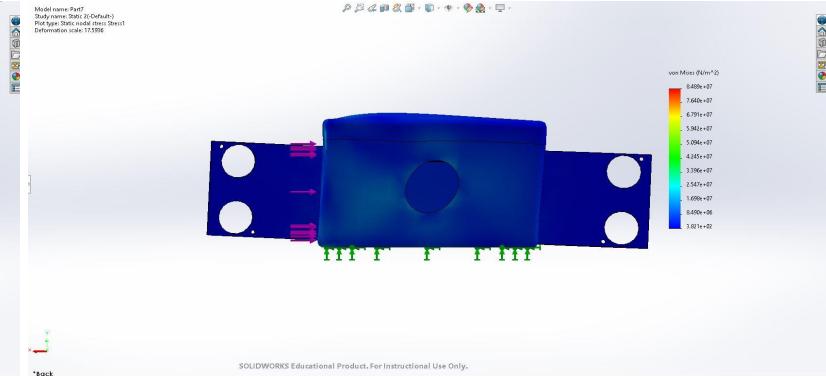
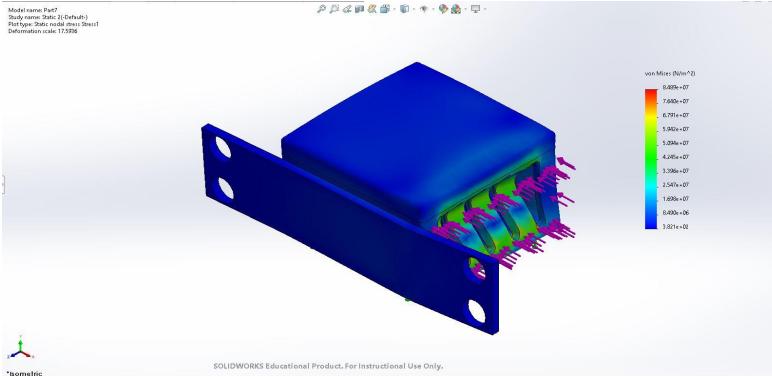
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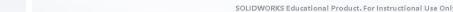
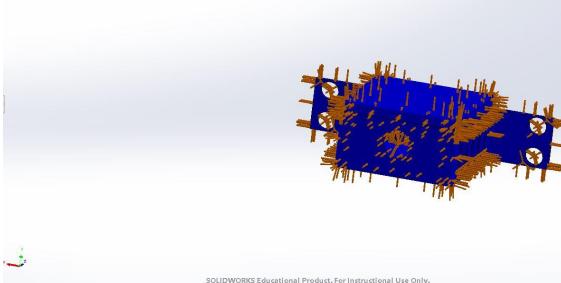
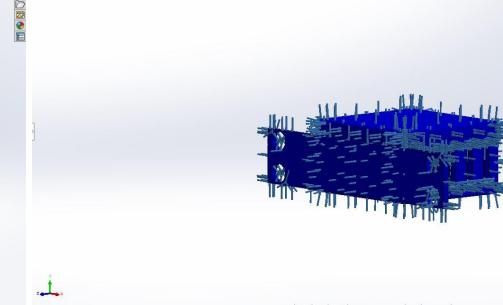
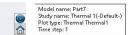
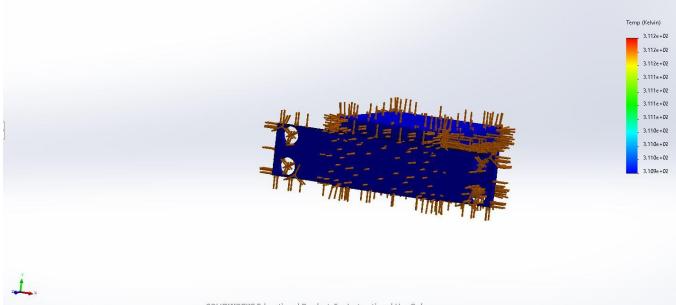


SolidWorks (FEA Testing)





SolidWorks (FEA Testing)





Drop Test

- Test conducted from a height for mounting the device
- Tested on carpet
- Testing on concrete
- Done to see if anything would happen to the hardware casing itself





Deliverables Met

- Created an initial design through AutoCAD, used drawings to create final SolidWorks 3D Model.
- Successfully 3D printed the SolidWorks model.
 - 3D Printing done in the SCE club room.
- Conducted FEA testing.
- Conducted Physical Testing.
- Overall designed, developed, and manufactured a viable hardware casing for the electronic equipment.





Deliverables Not Met

- 3D print a tripod to hold the device for portability
- Placeholder for the breadboard to avoid movement inside the box
- Design a hinge system in SolidWorks
- 3D print both the box and sensor-arm together

Deliverable Status

WBS NUMBER	TASK TITLE	TASK OWNER	PCT OF TASK COMPLETE
	Hardware	Juggie	
4.1	Learn Technologies	All	100%
4.2	Obtain Equipment	All	100%
4.3	Cad Design	Phillip, Dylan	100%
4.4	Implement Arduino IDE and Wifi Chip Set	Juggie, Nathan, Calvin	100%
4.5	FEA Testing	Phillip, Dylan	100%
4.6	Equipment Functionality Test	Juggie, Nathan, Calvin	100%
4.7	Print 3D Design	Phillip, Dylan	100%
4.8	Assembling Hardware into 3D printed Design	Juggie, Nathan, Calvin	100%
4.9	Organizing Electronic Hardware	Calvin	100%
4.10	Ultrasonic Sensor Coding Logic / Integration	Juggie, Nathan, Calvin	100%
4.11	Final Design Accuracy Testing	Leads	0%



Core Learning Outcomes

- Hardware to backend connections
- 3D diagrams and design
- Testing hardware components
- Collaboration and planning





Challenges

- Parts Cost
- Connection to FireBase
- Defective batch of sensors
- Spare backup plan
- Portability
- Sufficient voltage or current



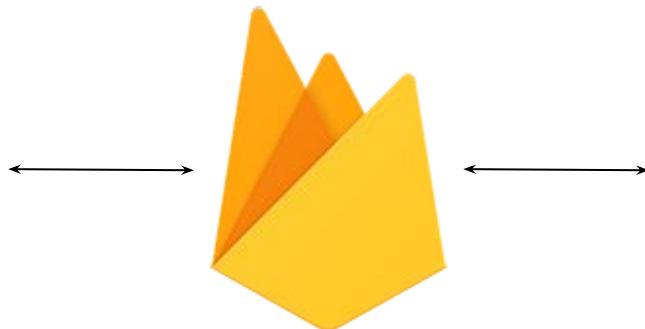
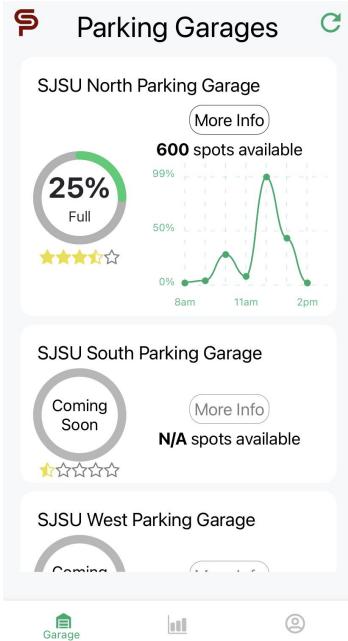
Future Improvements

- Decreasing the sizes the ventilation slits both back and side
- 3D print a bigger size to protect the sensor circuits
- Creating a manual power switch for the batteries
- Recreating the holes for a better wiring.
- Latch locking system
- Incorporating Voltage/Current Safety Device (Fuse)

4. Conclusion

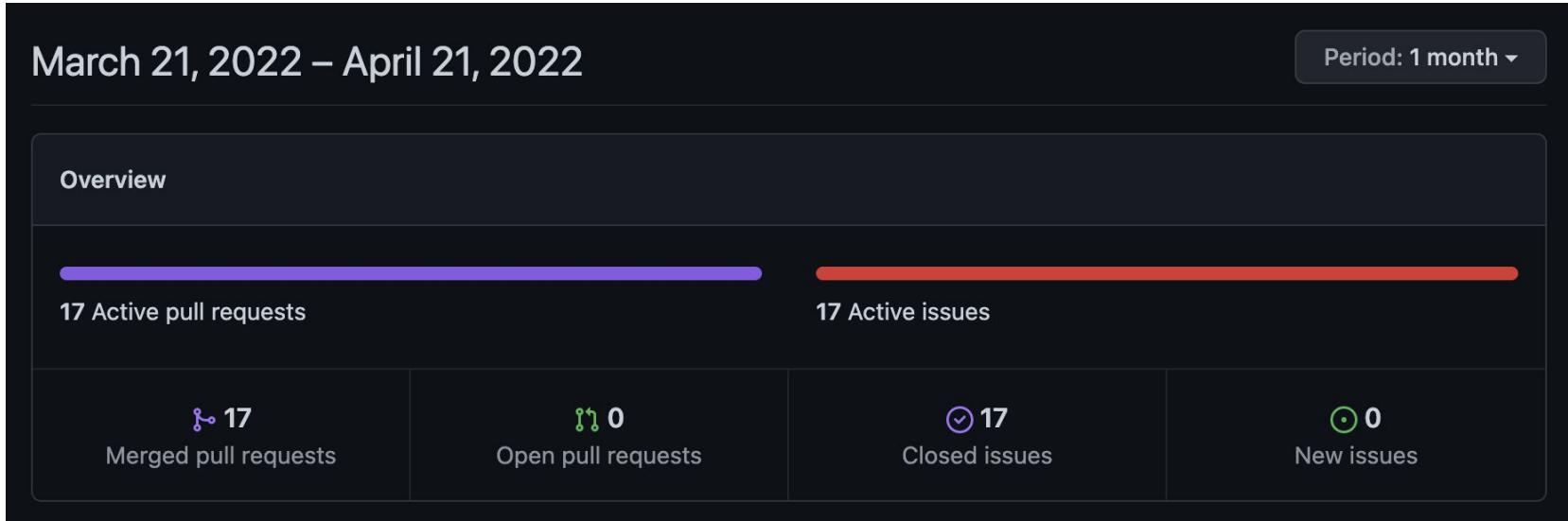


Summary: Final Product

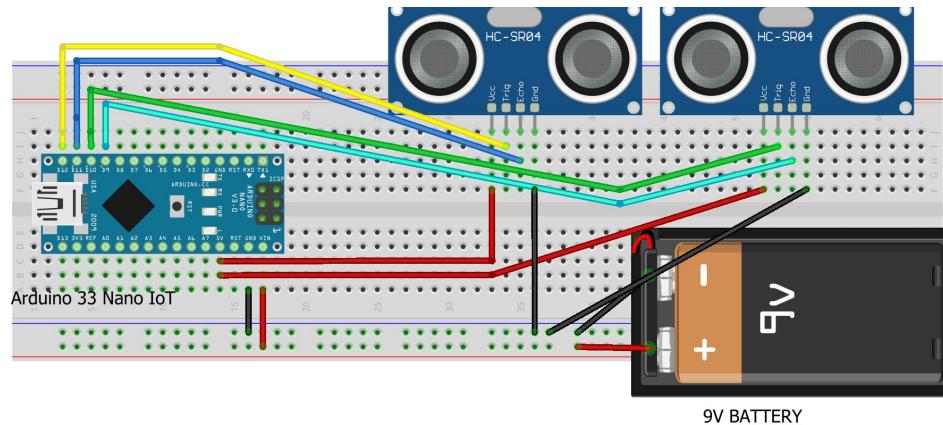
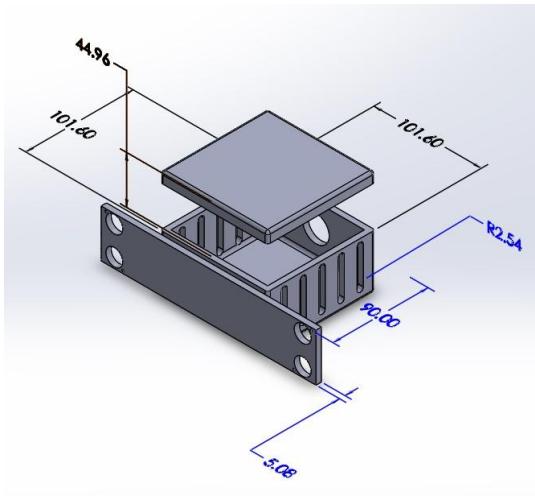




Contributions: Software



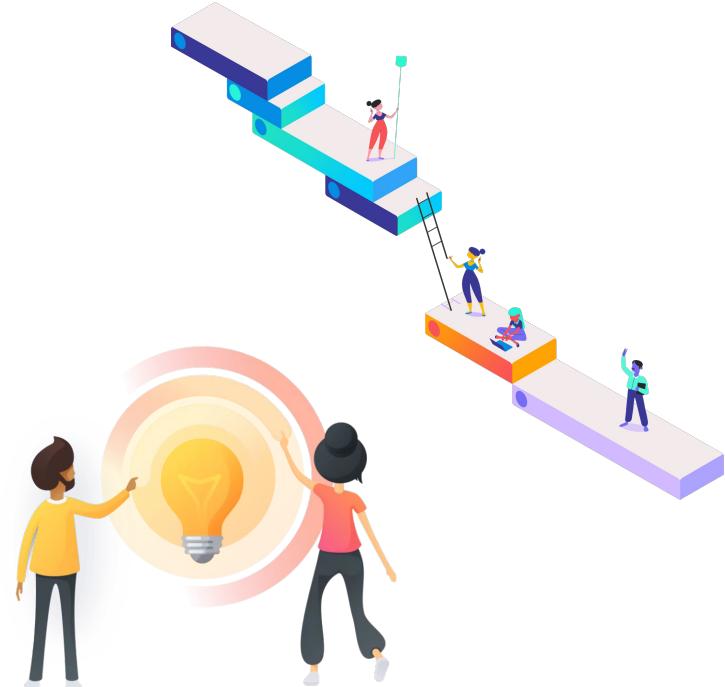
Contributions: Hardware





Challenges

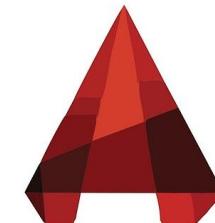
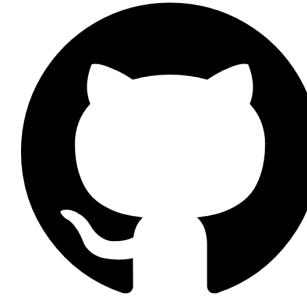
- Optimistic Timeline
- Dependencies
- Replanning





Core Learning Outcomes

- Communication
- Project Development Lifecycle
- Technical Skills



Thank you!