Ezzat Suhaime Project Portfolio

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1. Roamer (Mesh networked sensors)
2. First Robotics Competition
3. BME688 Breakout Module
4. Class D Amplifier
5. Cass AB Amplifier
6. LoRa Breakout Module

Software

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2. Arctail
3. Spade
4. First Robotics Competition
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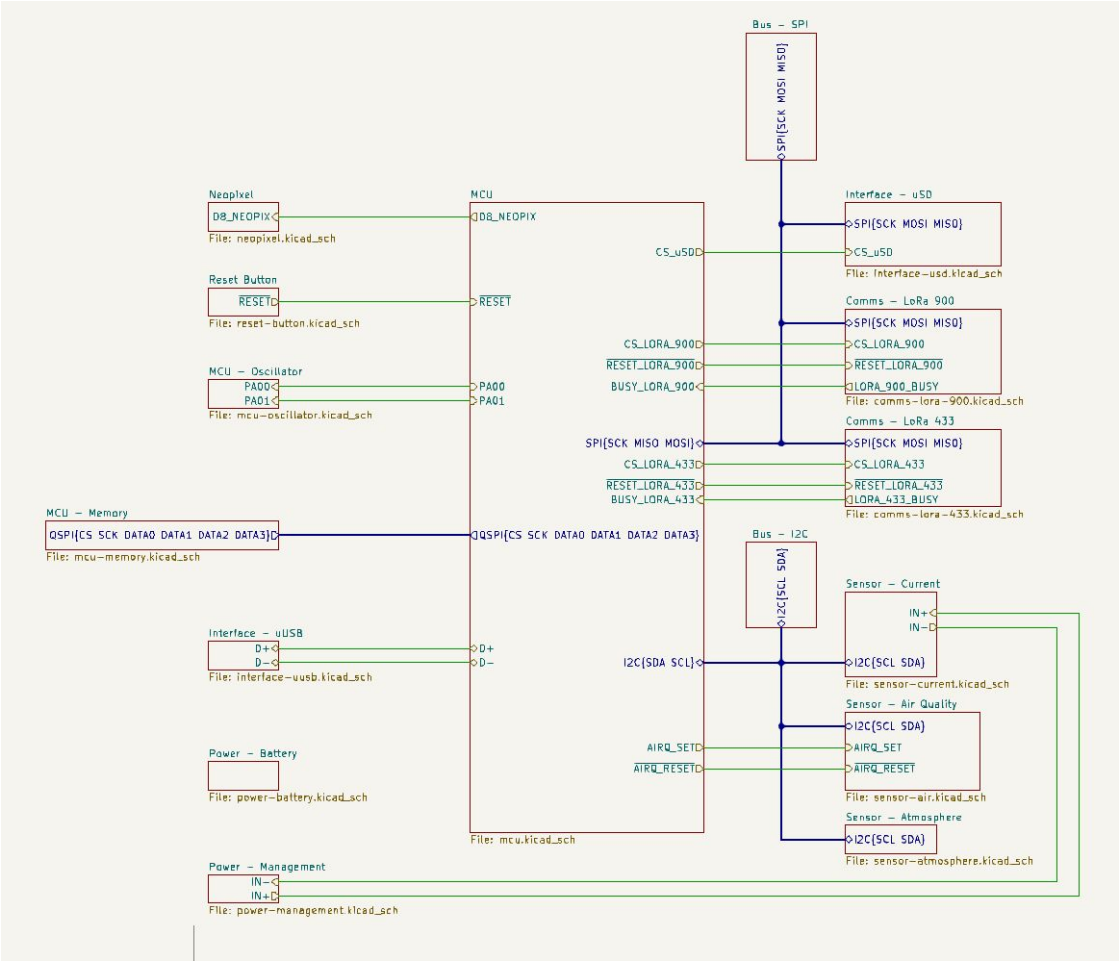
Hardware

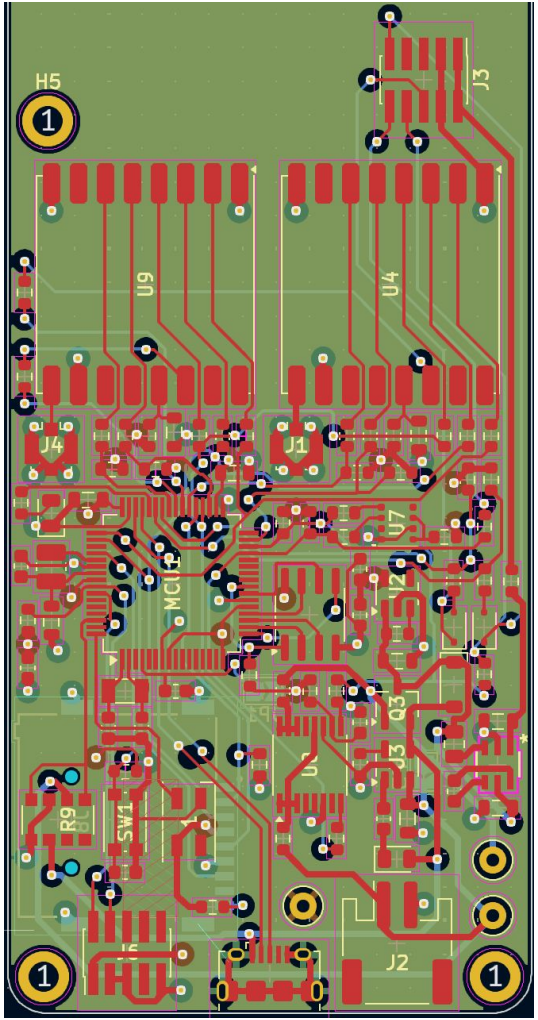
Roamer

Designing a custom PCB with ATSAMD51J19A MCU, integrating LoRa mesh networking, air quality sensor, atmosphere sensor, and power sensor.

Will be used by the Stanford Radio Club for their SNode wildfire meshed sensor project.

Skills: PCB design, microcontroller programming, low-power systems.




H5
J3
U9
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Q3
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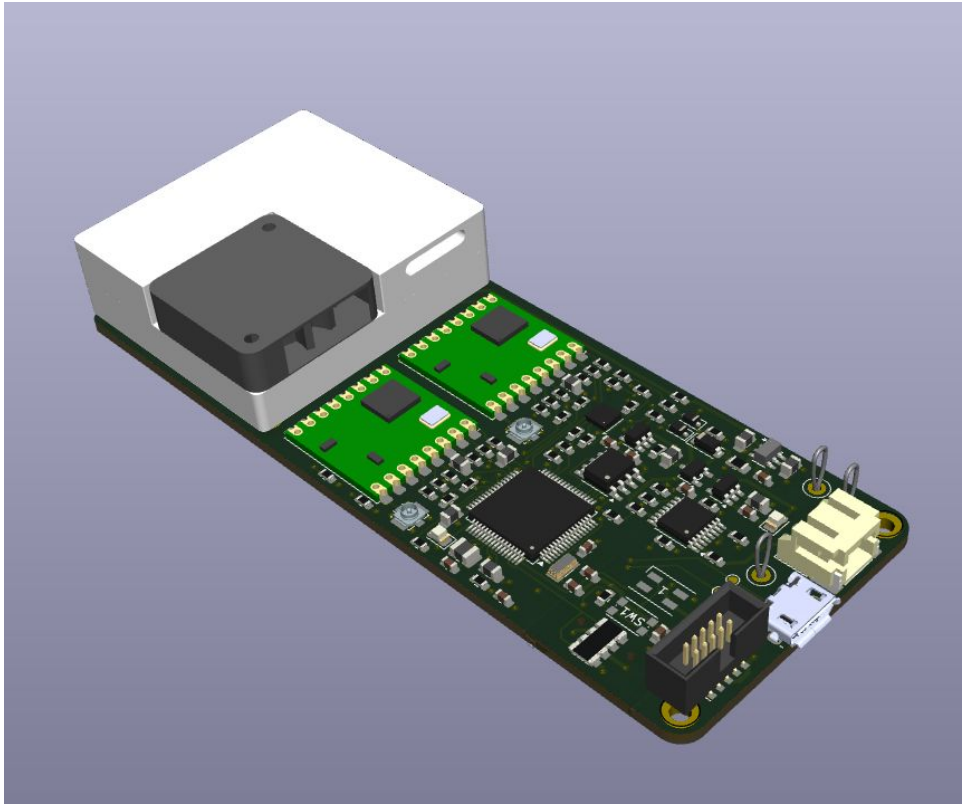
SW1
R9
J5
J2

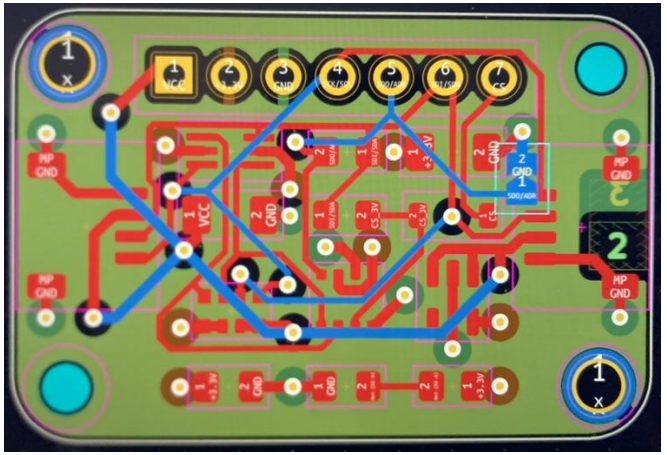

SW1

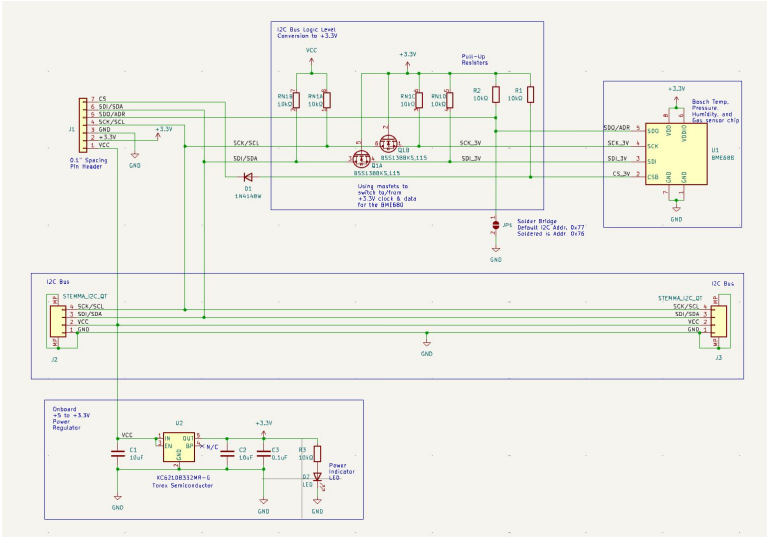
BME688 Breakout

Designed a breakout board for Bosch BME688 sensor, enabling temperature, humidity, pressure, and gas measurements.

Developed in KiCad with I2C/SPI interfaces, logic level shifters, and voltage regulation.

Added address selection and LED indicator for configurable, stable sensor operation.





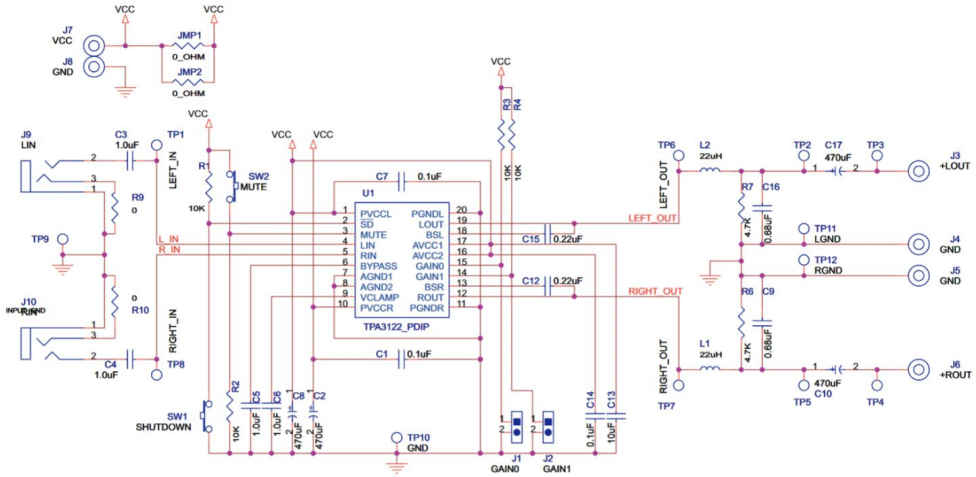
Class D Amplifier

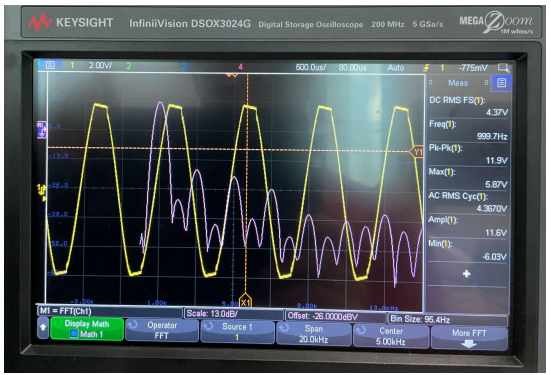
Description: Constructed a Class D audio amplifier based on the TPA3122D2 IC.

Designed an RLC filter for noise reduction and smooth PWM signal conversion to analog.

Optimized for low distortion; validated audio clarity and stability at different power levels.

Skills: Analog circuit design, signal filtering, audio testing.





Still clipping! :(

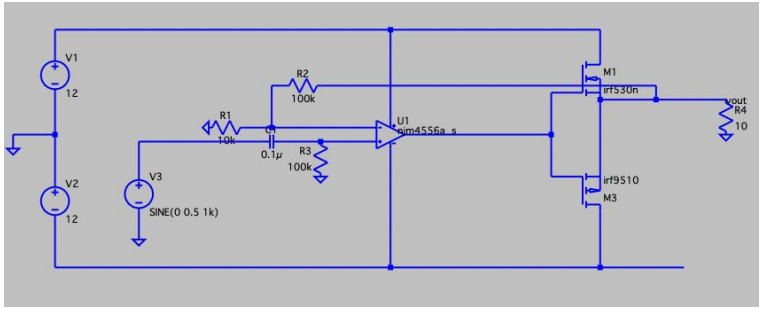
Class AB Driver

Built a Class AB output driver with 4556 operational amplifier and MOSFETs for robust signal handling.

Addressed distortion issues by adding decoupling capacitors at VDD and GND.

Implemented negative feedback for signal stabilization and minimized waveform clipping.

Skills: Signal amplification, MOSFETs, distortion mitigation, feedback systems.



W/o negative feedback

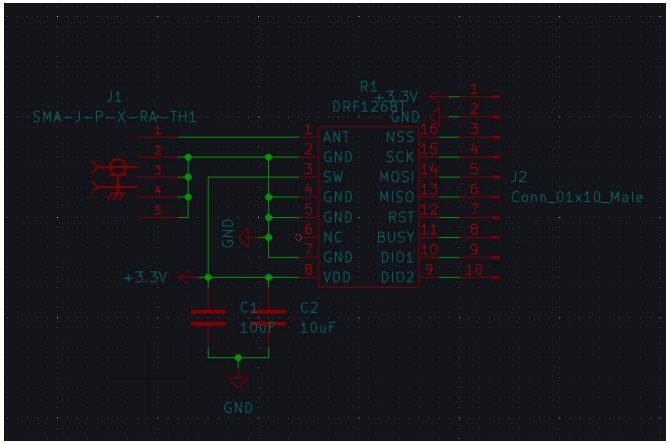
W/ negative feedback!

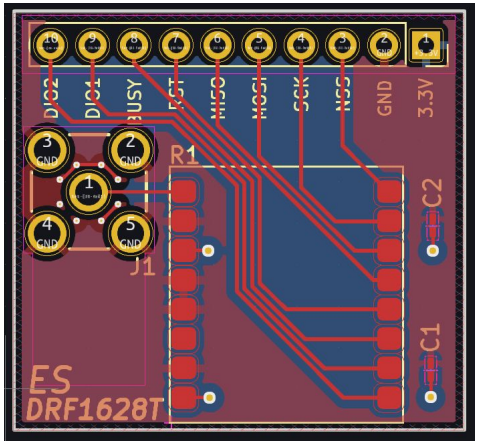
LoRa Breakout

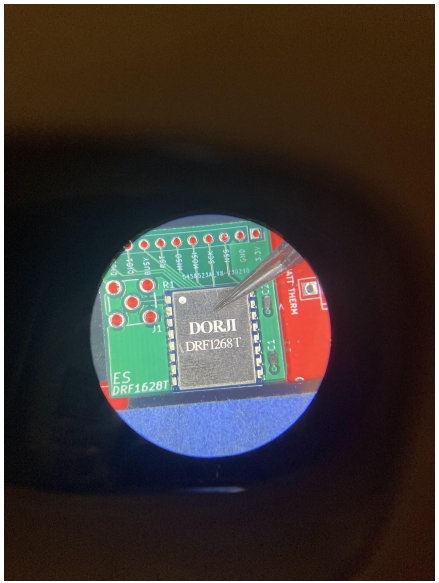
SSI DRF1268T LoRa Breakout Board

Built a LoRa transceiver breakout board with RF considerations for Stanford Student Space Initiative.

Skills: KiCad, RF circuit design, PCB prototyping.







FRC Robot

***Project Overview*:** Led a robotics team in designing and building a competitive robot for the FIRST Robotics Competition, focusing on control systems, autonomous functionality, and CAD-based component design.

***Key Contributions*:**

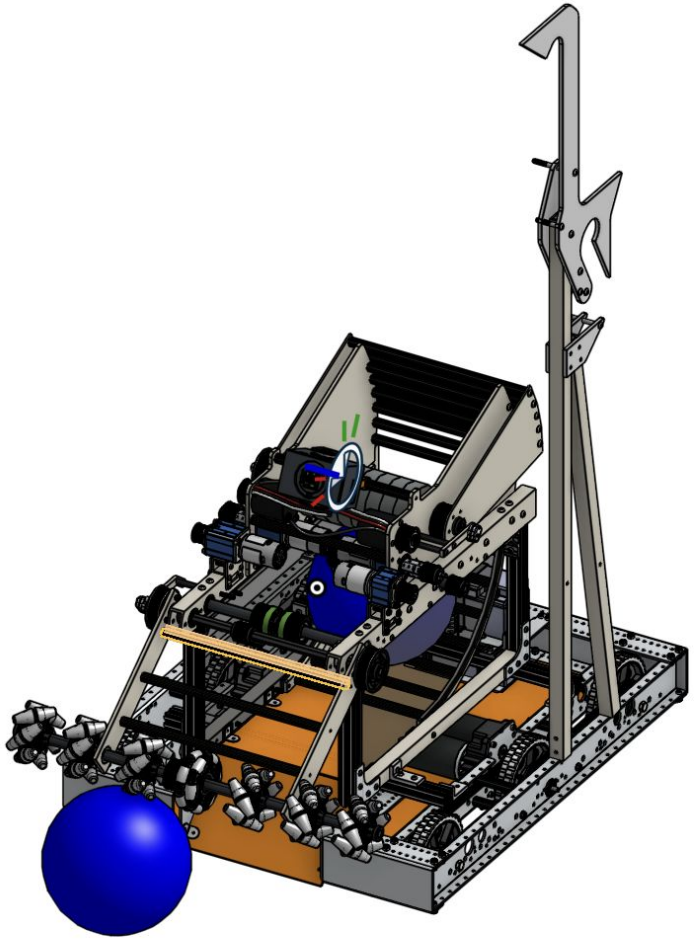
Developed a vision system with Raspberry Pi for real-time game piece tracking and integrated it with NetworkTables for seamless communication with the main robot controller.

Programmed and tuned PID controllers for precise motor control, enabling autonomous movement and optimized targeting.

Transitioned the team to CAD using Onshape for custom part design and coordinated manufacturing using CNC, Bridgeport, and bandsaw.

Established documentation standards and led team training sessions, fostering a collaborative and organized development environment.

Skills: Control systems, computer vision, embedded programming, CAD, team leadership, mechanical fabrication.



Fully modeled robot. The first in team history!

Software

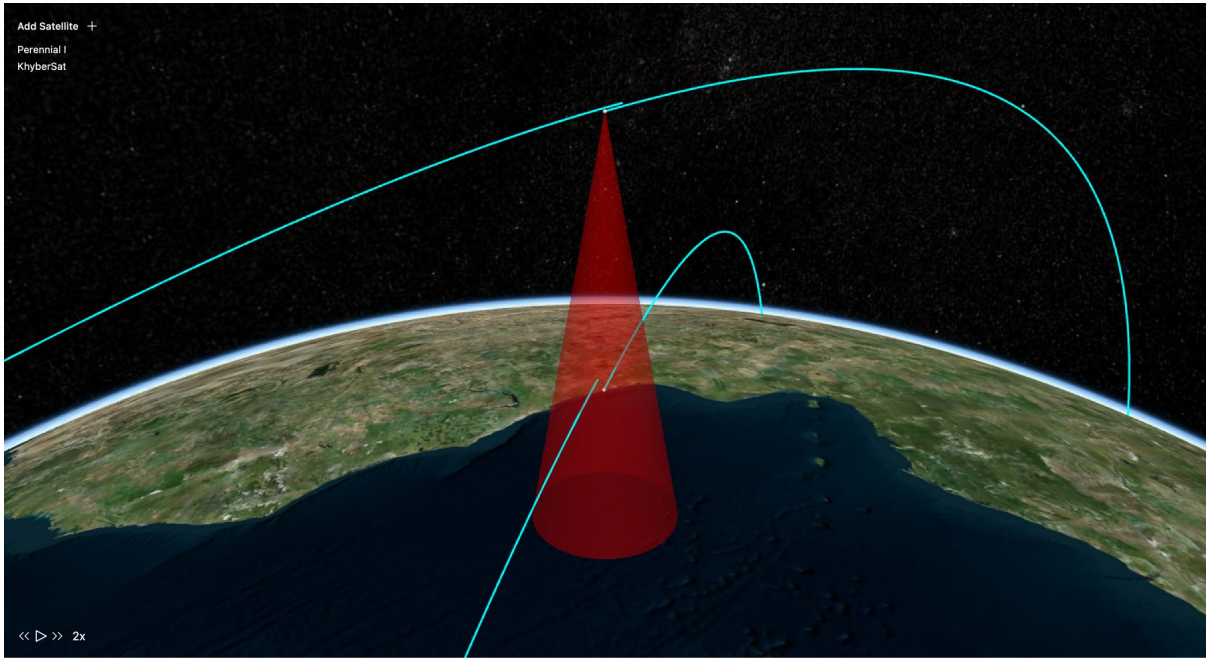
Orbit Propagator

Developed a satellite orbit simulation tool with Cesium visualization, using Runge-Kutta and J2 perturbation methods.

Deployed on AWS. Built a user interface with Cesium.

Skills: Orbital mechanics, AWS deployment, 3D modeling.

Check it out!
commandant.virulentsky.com



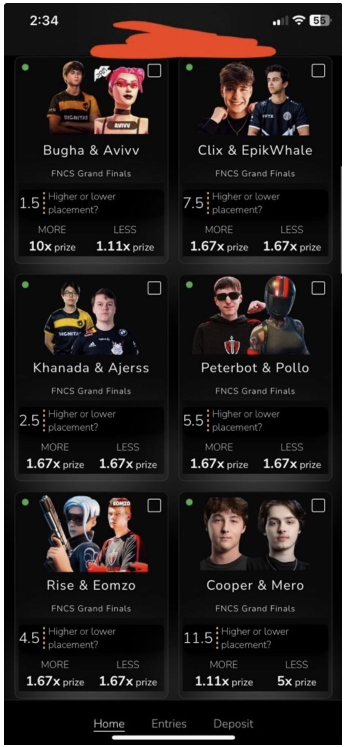
Arctail

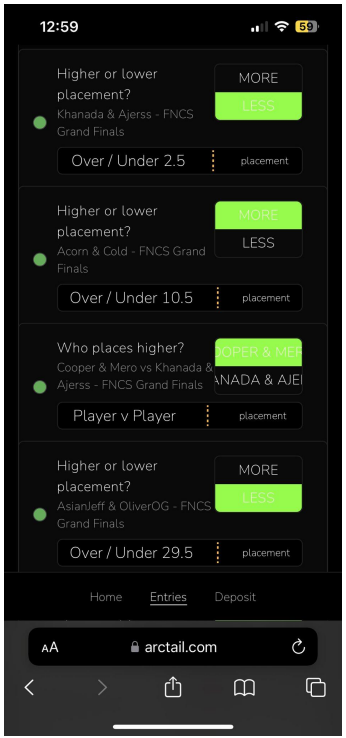
Built a high-traffic Fortnite social sportsbook platform.

Built the entire backend and database functionality to manage users, their parlays, and balances. Integrated Authorize.net payments.

Built many UI components using React.

Skills: Full-stack, payment integration, cloud deployment.





Lots of funny X posts

Spade

Developed web page drawing & annotation extension with 4,000+ users; optimized user writing performance on heavy pages by 50%.

Given a $1000 grant by the 1517 Fund to develop & support cloud costs.

Skills: Chrome extension, AWS deployment, data structures.

Check it out! https://spade.tools/

Autonomous Sailboat Simulation

Description: Developed a Python-based simulation for an autonomous sailboat, integrating a custom PID controller for navigation.

Key Contributions:

Tuned PID parameters to adjust steering and sail position, enhancing stability in varying wind and water conditions.

Expanded the simulation to test scenarios with different environmental variables, creating a realistic model for autonomous behavior.

Skills: PID control, Python, simulation modeling, real-time feedback, autonomous systems.