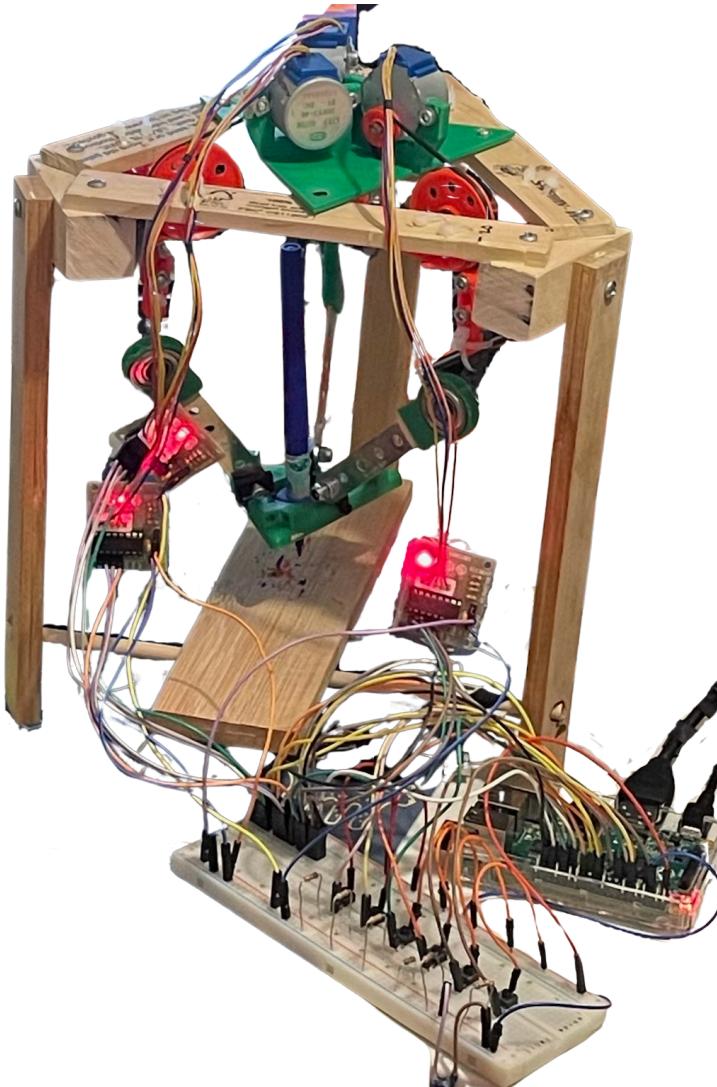


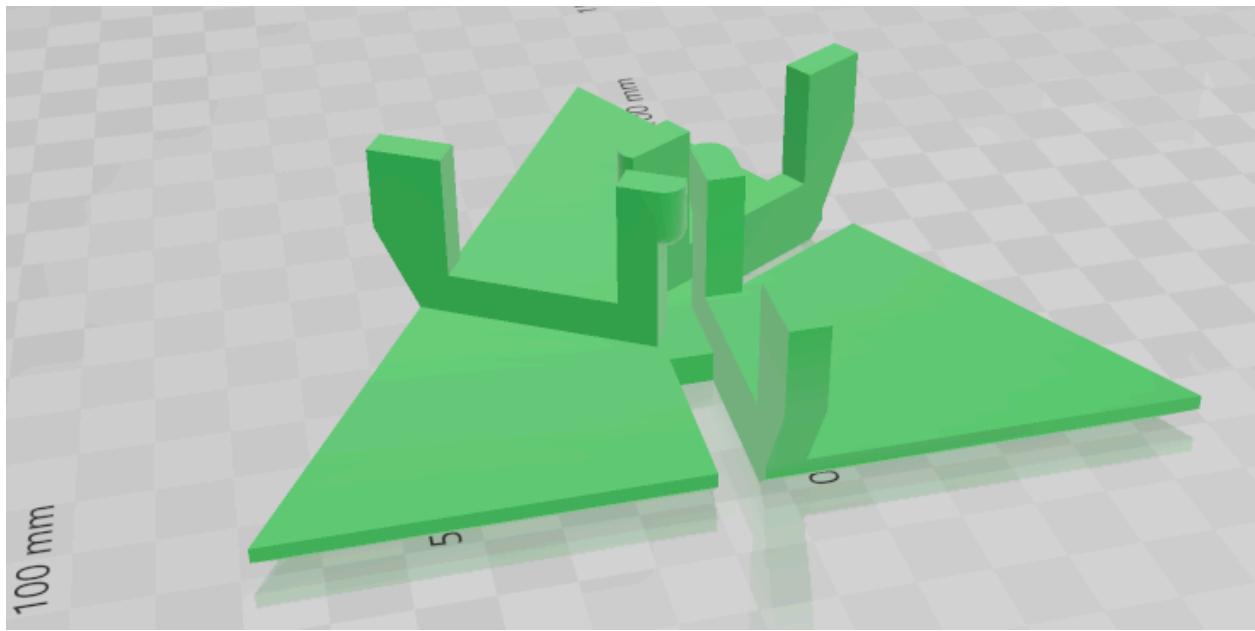
Select Projects

Autonomous Tic-Tac-Toe-Playing Robot

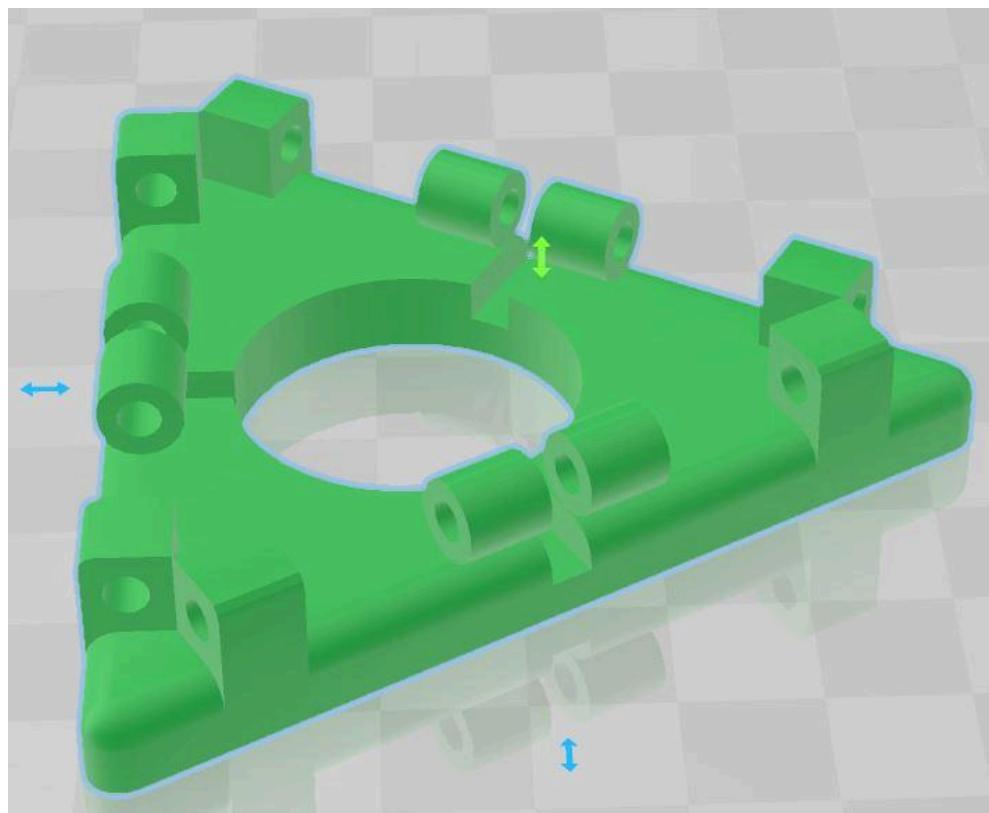
- A robot that can play Tic Tac Toe against a human.
- *Raspberry Pi, Python, stepper motors, mechanical design and assembly, OpenCV, integration and functional testing, iterative design*



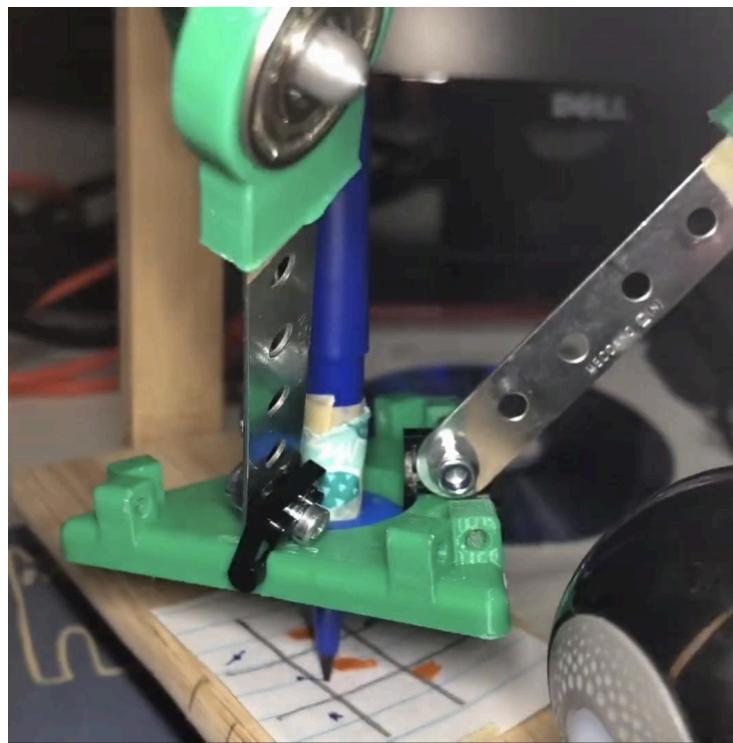
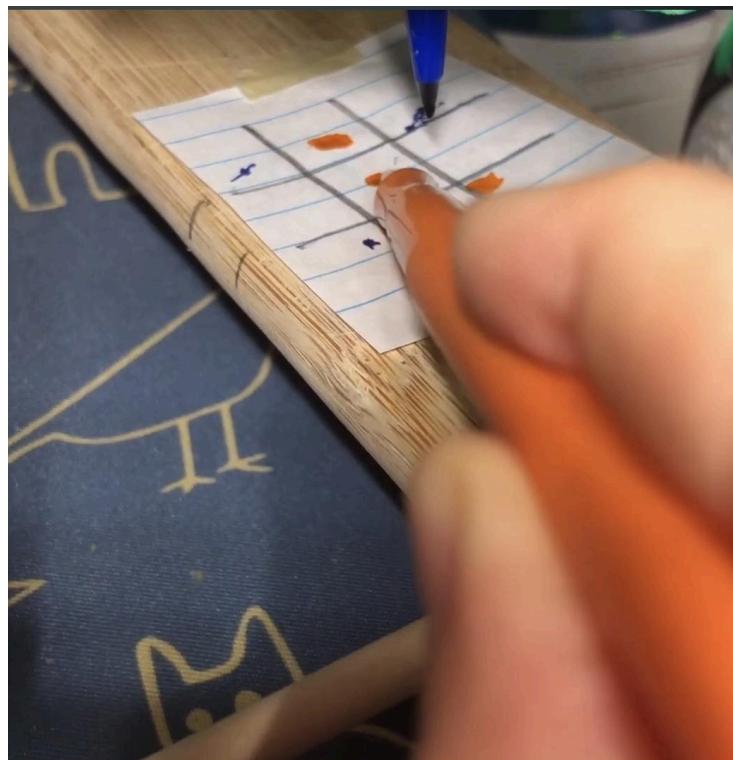
A Delta mechanism was chosen for the robot design. Since this complicated the kinematics, a good shortcut solution was used to overcome this and draw moves in the appropriate grid locations. A blue pen is attached to the robot's end effector.



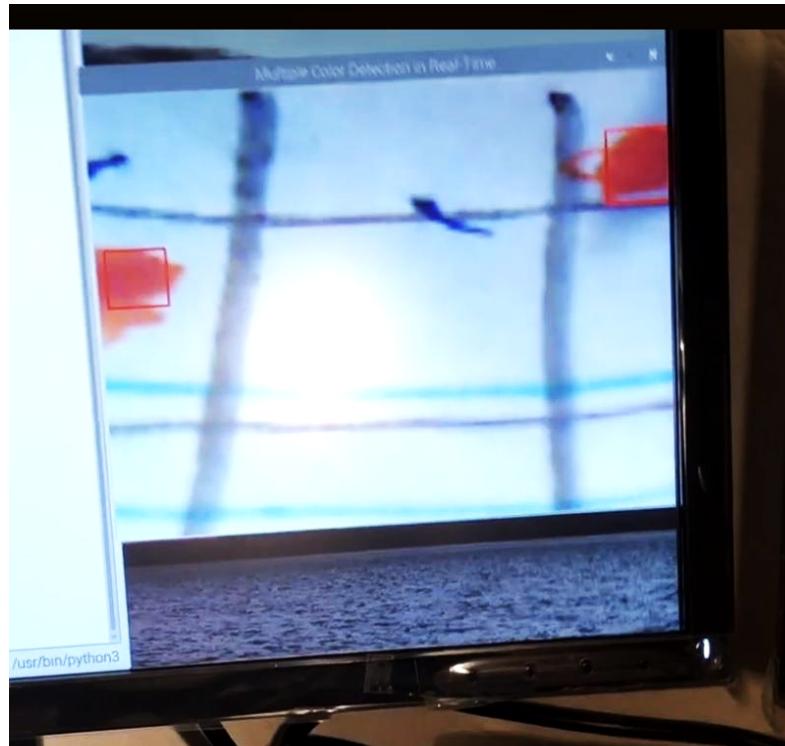
A 3D model was designed and then printed for the motor mount, located at the top of the robot.



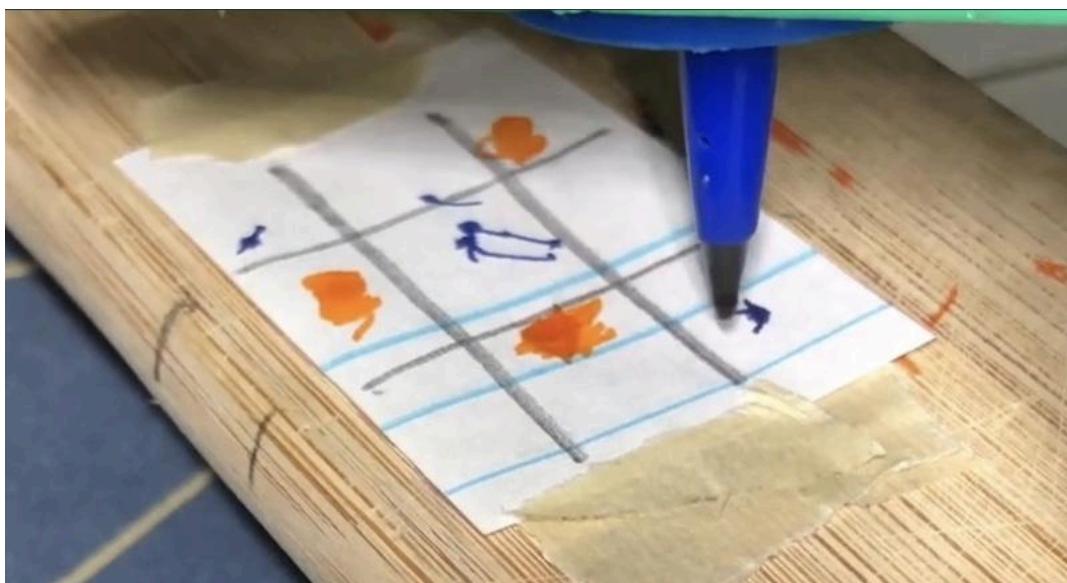
3D model for the end effector platform, located at the bottom of the robot.



A camera is pointed toward the game grid to determine in which grid locations the human opponent plays their move.



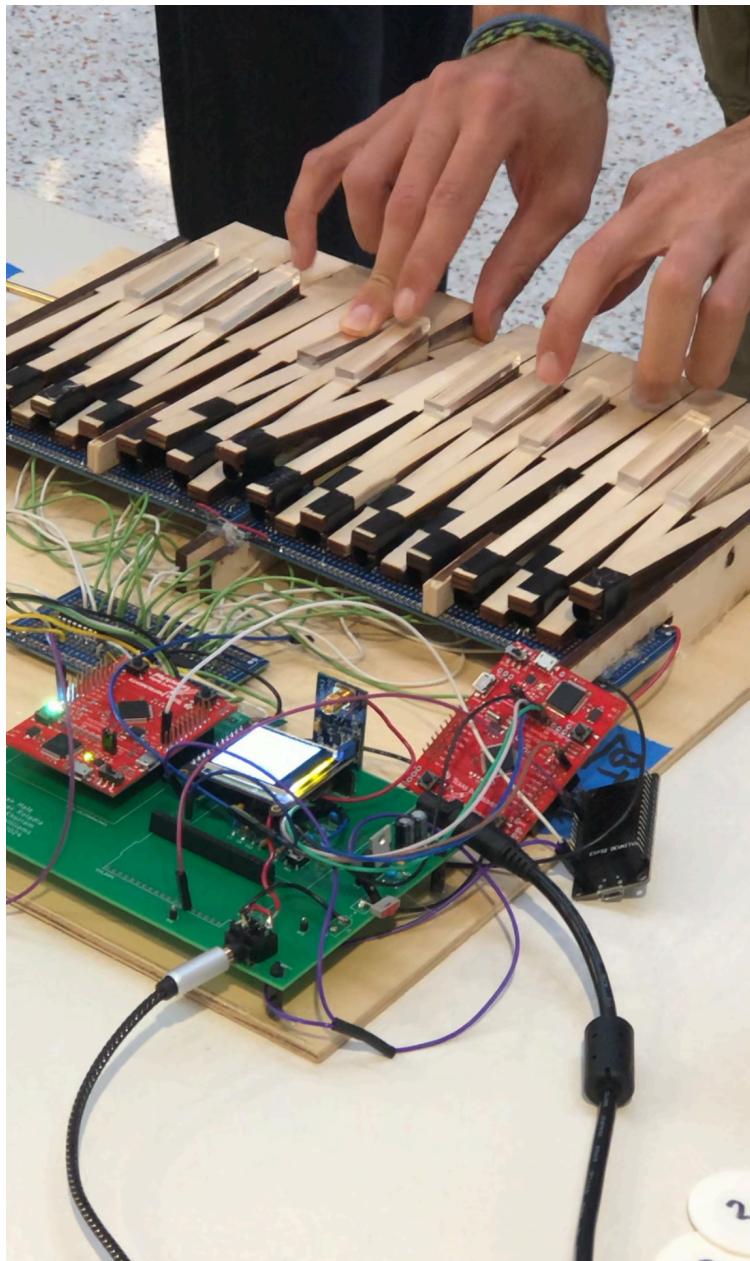
Desktop monitor displays red boxes where opponent moves are detected using OpenCV color detection.



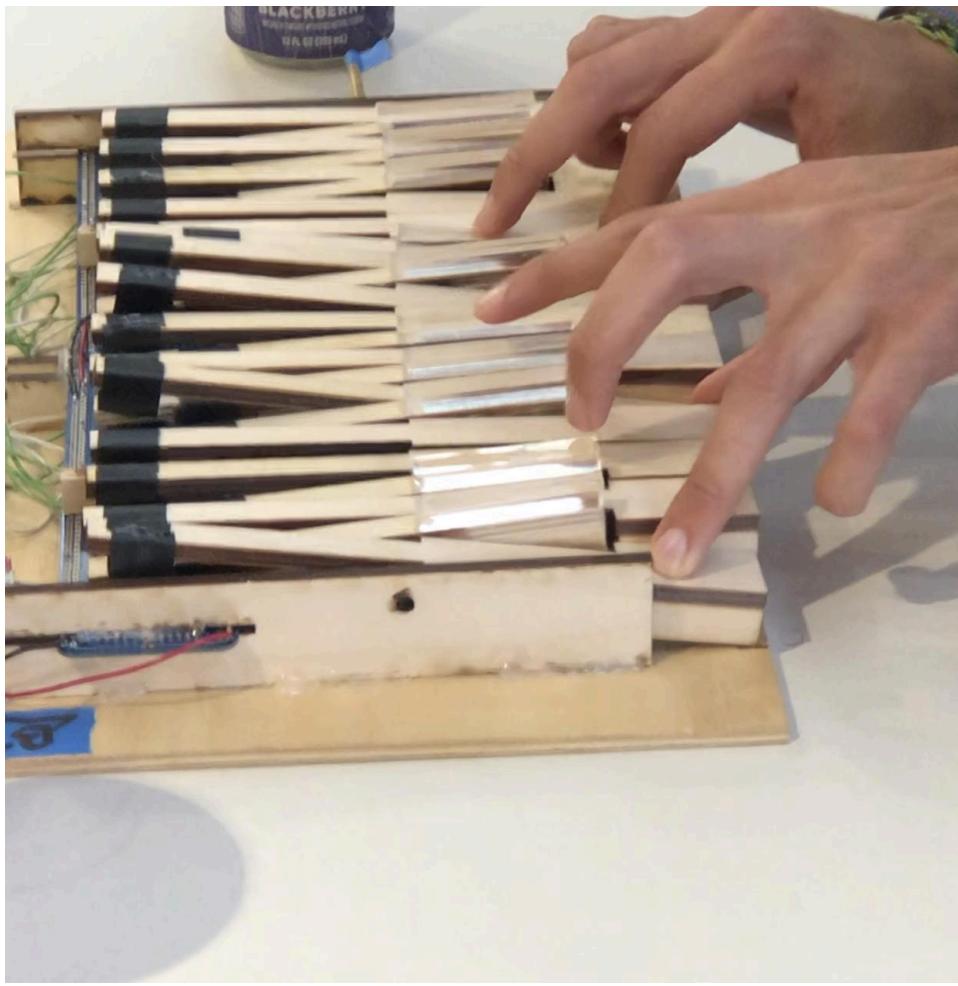
Minimax algorithm was used to decide the best move for the robot. The robot has won in this game.

Bluetooth Piano Keyboard

- A custom-made 24-key piano keyboard featuring the option for wireless sound output and varying instruments.
- *ADC, DAC, Hall Effect sensors, C, sampling, audio, SPI, UART, mechanical design, laser-cutting, soldering, functional testing, modular design, reports/documentation, performance metrics*



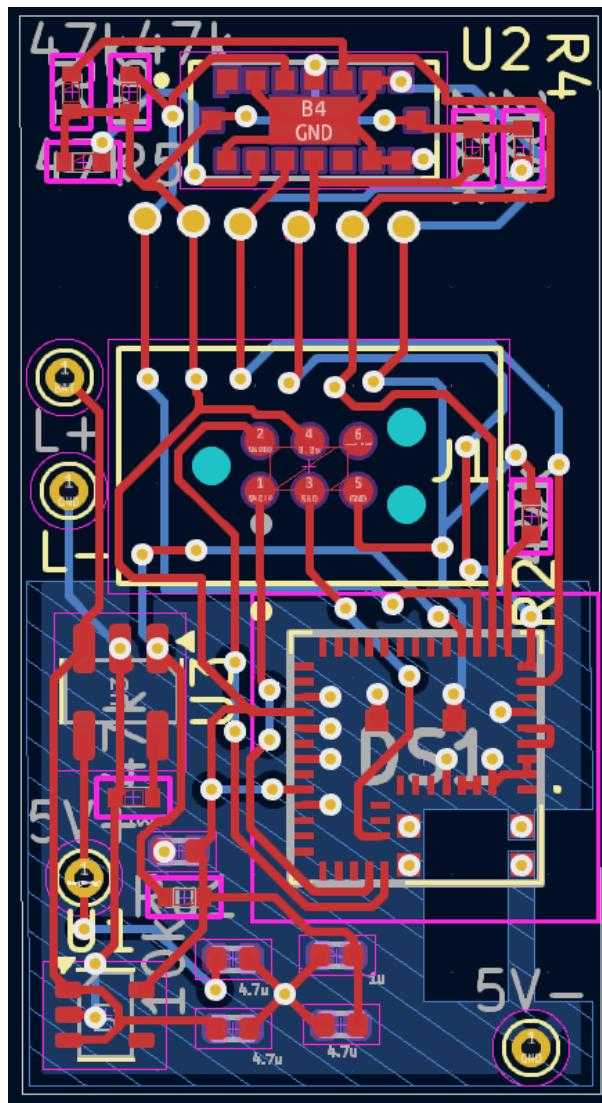
A PCB was created for the piano system. For wired sound output, an audio jack and DAC is included. For wireless sound output, an ESP32 microcontroller sends the note amplitudes to a speaker over Bluetooth.



Pressing a key causes a magnet on the opposite end to raise. A Hall Effect sensor placed under each magnet detects the variation in distance over time to obtain the key-press velocity.

Smart Necklace for Meal Tracking- in progress

- A wearable device that tracks eating patterns throughout the day.
- *BLE, hardware component selection, PCB schematic and layout, product design*



PCB design of the prototype- featuring BLE chip, distance sensor, power regulator, battery charger, and programmer port.