Shane Blinkman's Engineering Portfolio

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Stanford
ENGINEERING

ABOUT ME

I am a mechatronics/mechanical engineer (M.S. ’25, B.S. ‘23, Stanford) who loves building things that move, think, and interact with the world. My path has been guided by curiosity: first leading me towards medicine, then towards devices that heal, and finally to the integrated world of mechatronics where hardware and software meet.

I’ve been fortunate to explore this passion from multiple angles. In medical device internships at Cirtec Medical and Artio Medical, I gained professional exposure to the rigors of medical device R&D. A few memorable experiences were developing and performing diagnostic test procedures at a swine animal study in Sacramento; rapidly designing and deploying a key stabilization part for a heart pump controller just days before human trials began in Uruguay; and working with a skilled technician to help redesign a manufacturing assembly to aid him in more accurately and efficiently producing tapered catheter tips.

At Stanford, I collaborated with and learned from many inspirational peers and professors on a range of hands-on projects—from autonomous robots to rehabilitative wearable. From my first mathematics course to my last advance dynamics course, and from my first anatomy course to my final mechatronics course, I learned to thrive in process of taking ideas and making reality. These experiences solidified my love for prototyping and problem solving, especially at the intersection of disciplines.

Currently, I am seeking to bring my skills in mechanical design and embedded systems to a fast-paced, innovative, multidisciplinary team working on novel technology.

Apart from engineering, my life has been defined by the pool, where I began swimming competitively at the age of seven and continued through college as a student-athlete, representing Stanford at the NCAA D1 Championships and Olympic Trials. Since I hung up my goggles for the last time in 2023, I enjoy staying active with friends and find happiness in the everyday effort of conquering new athletic challenges. Additionly, I love to get lost in the speculative worlds of science fiction or the tactical plots of clandestine and war novels.

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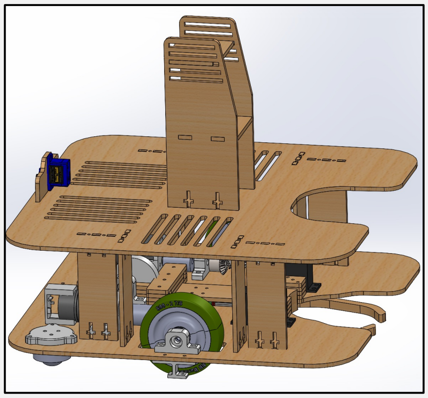
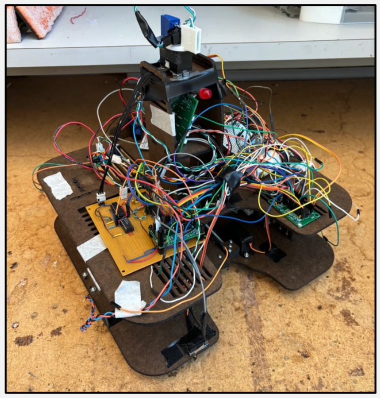
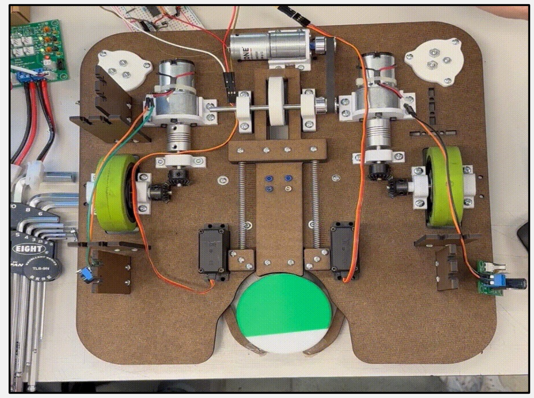
Autonomous Robot for Competitive Retrieving and Launching

Team | Stanford – Smart Product Design Applications | March 2024

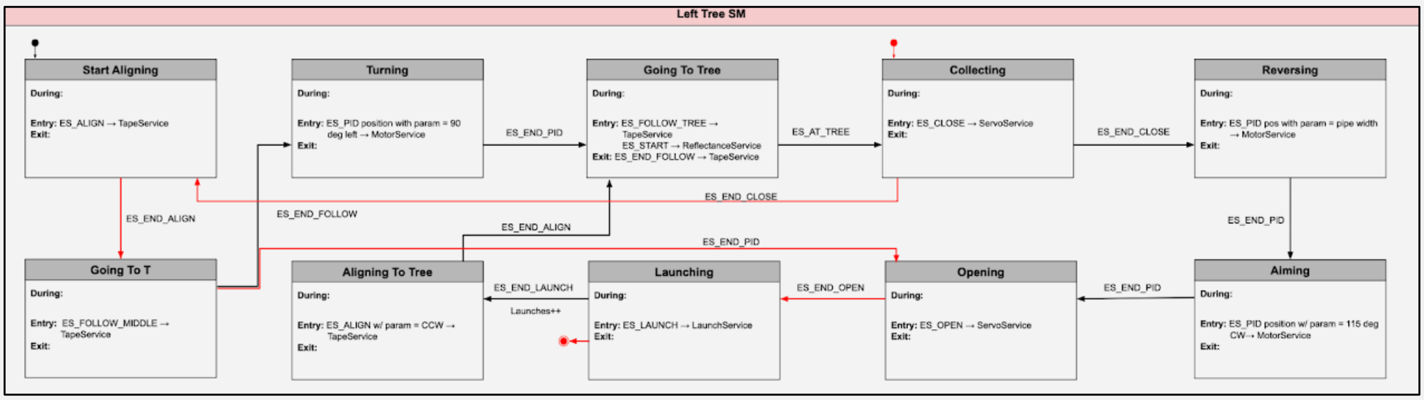




CAD assembly of the robot structure (left) and the finished prototype assembly of the robot (right).



Robot's drive train, object collection, and launching mechanisms.



Detailed state diagrams of hierarchical state machine's (HSM) third level, outlining the events and services responsible for the autonomous retrieval and launching capabilities of objects on the playing field.

Overview: Developed an autonomous robot capable of navigating a game field to retrieve and launch objects to target area. I was responsible for architecting the software and designing the object collection and launching mechanisms.

Results:

- Implemented a hierarchical state machine (HSM) in embedded C to manage concurrent autonomous behaviors and inter-processor communication via SPI.
- Designed a spring-loaded snail-cam launching mechanism that stored and instantaneously released potential energy for powerful projectile launch.
- Achieved reliable navigation through a combination of PID-controlled tape following, IR signal processing, and bumper switch obstacle detection.
- Successfully troubleshot and resolved signal interference complications during field testing, demonstrating adaptive problem-solving and debugging skills.

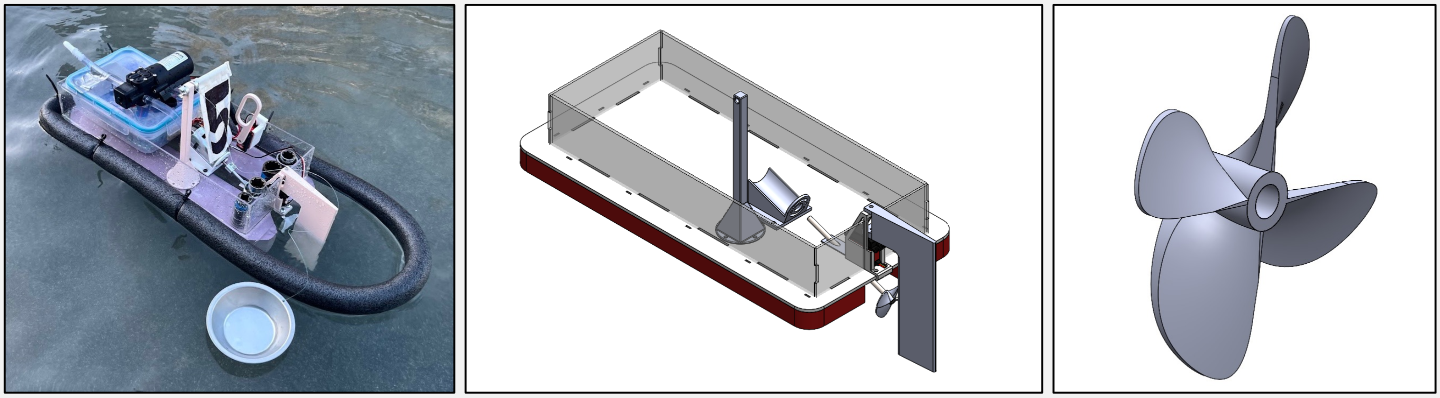
Primary Skills and Tools:

Embedded C, State Machine Design, Communication Protocols, Mechanical System Design, Debugging, CAD, Laser Cutting, 3D Printing, Circuit Design and Analysis, Logic Analyzers, DMMs

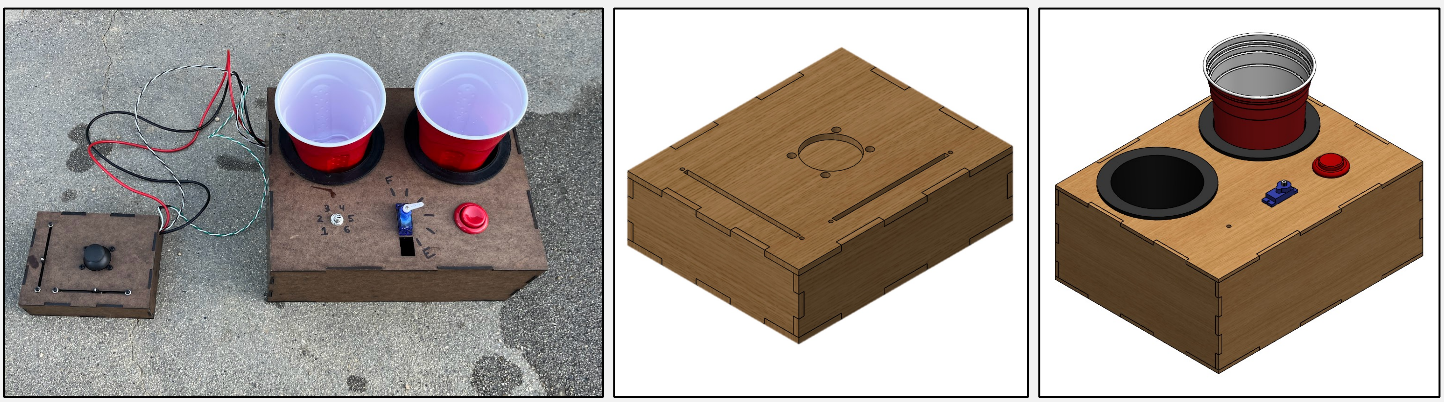
Full Report ↗

Combative Remote-Controlled Watercraft

Team | Stanford – Smart Product Design Practice (ME218c) | May 2024



Prototype of the boat (left) and the associated CAD assembly (middle). Propulsion and steering systems were 3D printed by myself, including the propeller (right) to assemble with a scavenged propeller shaft.



Prototype of the controller (left) and the associated CAD models (middle and right). Constructed entirely of laser-cut Duron hardwood board and assembled with press-fit box (finger) joints and glued.

Outcome: Led the mechanical design of a remote-controlled boat and companion controller for a survivor-themed combat game, delivering a functional prototype capable of engaging in competitive "naval" battles.

Headline Results:

- Designed and integrated custom components for buoyancy, propulsion, steering, and user interaction, resulting in an agile watercraft.
- Engineered the controller housing for ease of use, ensuring reliable radio communication and system coordination during operation.
- Conducted iterative in-water testing to diagnose and resolve propulsion and steering inefficiencies, significantly improving performance and handling by final iteration.
- Identified and fixed a critical design flaw—a potentiometer short due to overtightened bolts—demonstrating rigorous root-cause analysis and rapid prototyping skills under pressure.

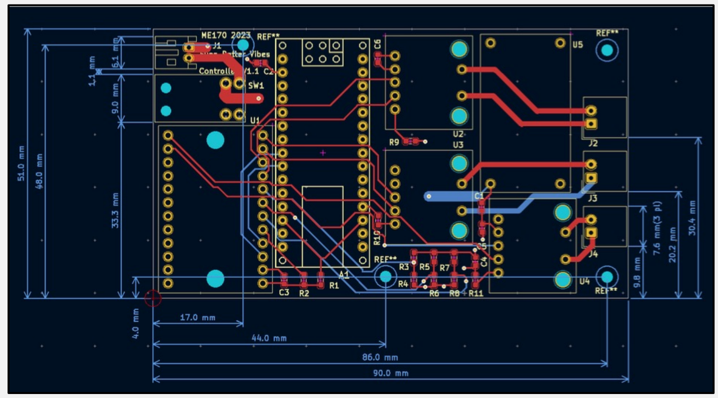
Main Skills and Tools:
Mechanical Design, CAD, System Integration, Rapid Prototyping (3D Printing, Laser Cutting), Embedded C, Circuit Design & Analysis, Iterative Testing & Debugging

Full Report ↗

Wearable Gait Therapy Device for Cerebral Palsy

Independent | Stanford – Mechanical Engineering Capstone | September 2022 – March 2023

Decreased the weight and size of the prototype by 44% and 48% respectively from initial (left) to final (right).



Laying out a PCB was the primary process for reducing the size and weight of the prototype.

Designed and 3D printed a PLA housing to protect the PCB from damage. Additionally, designed and sewed a neoprene brace to comfortable secure the electronics in position on the user's leg. Both designs were verified through rigorous testing to assure compliance to established user requirements.

Outcome: Improved upon and existing prototype of a wearable clinical device to aid in clinical studies on gait therapy for youths with spastic cerebral palsy, successfully implementing a user-centered design with a PCB, sensors, and firmware.

Headline Results:

- Engineered a PCB from an existing prototype, reducing the weight and size by 44% and 48% respectively.
- Developed a wearable brace, including a durable 3D-printed case and neoprene brace, designed for secure fit, comfort, and alignment of vibration motors on the targeted soleus muscle.
- Validated user requirements through FMEA analysis and stress/comfort testing, proactively identifying and mitigating risks.
- Championed ethical design principles—including accessibility, cost-efficiency, and discretion—to ensure the technology supports user dignity and broad clinical adoption.

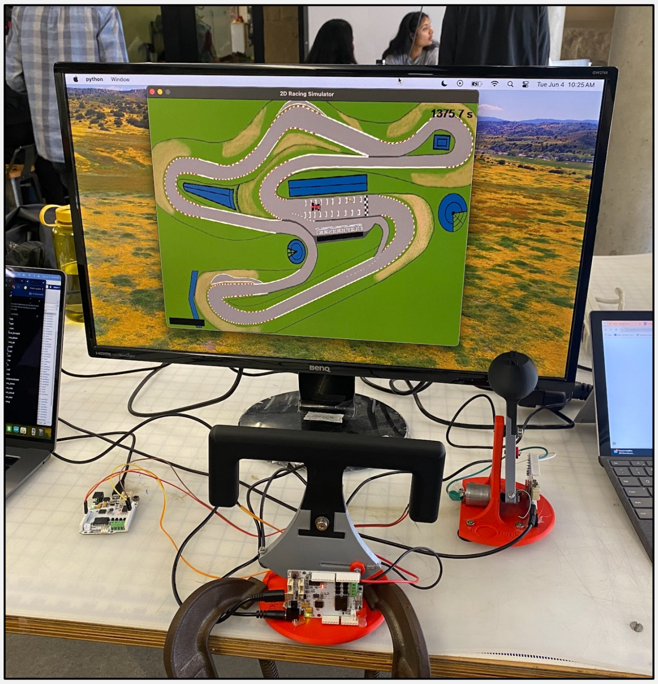
Main Skills and Tools:

Medical Device Design, PCB Design & Fabrication, Sensor Integration (Gyroscope), Machine Learning, 3D Printing, FMEA, SolidWorks, User-Centered Design

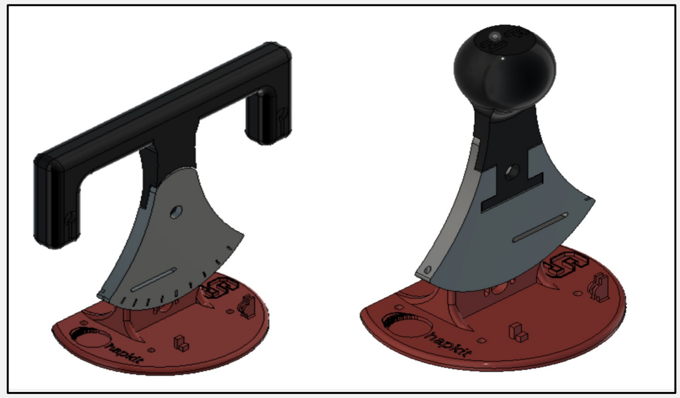
Full Report ↗

Haptic Feedback Racing Simulator

Team | Stanford – Design and Control of Haptic Systems | May 2024



Racing simulator on presentation day. The track was masked with on/off road elements, which informed the feedback model. Haptic feedback was so strong it required the steering wheel to be clamped to the table.



CAD models of the steering wheel (left) and "hand pedal" (right).

Teammate and I tuning control values to maximize the realism of haptic feedback and track dynamics.

Outcome: Designed and programmed a haptic racing simulator featuring force feedback and embedded vibration motors, coupled with a realistic 2D vehicle dynamics model. I owned the CAD design and 3D printing, as well as Arduino code for haptic motor control.

Headline Results:

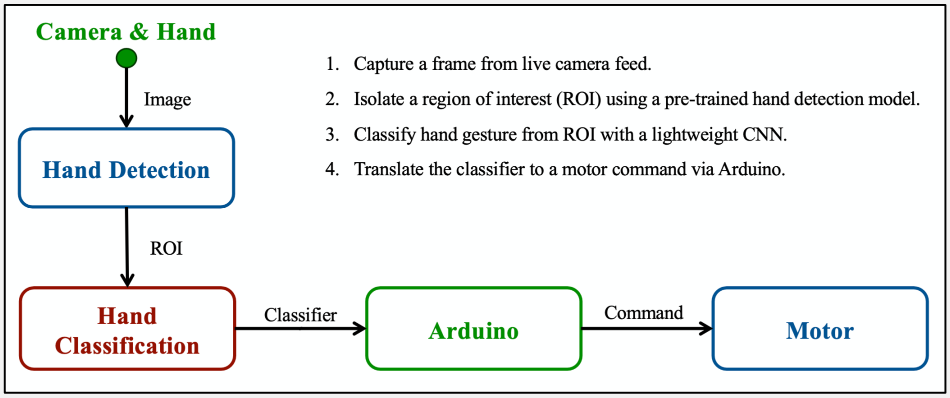
- Developed a 3D printed steering wheel and "hand pedal" with integrated vibration motors and torque feedback to simulate road texture and vehicle forces.
- Assisted in implementing 2D vehicle dynamics model in Python that calculated real-time force feedback based on user inputs (speed and turning) and track conditions.
- Conducted user testing that validated the system's vibration and torque feedback realism.
- Identified hardware limitations during aggressive testing, providing valuable insights for future iterations in haptic system design.

Main Skills and Tools:
CAD, Python, Mechatronic Prototyping, User Testing & Validation, Control Systems, Data Analysis, Arduino

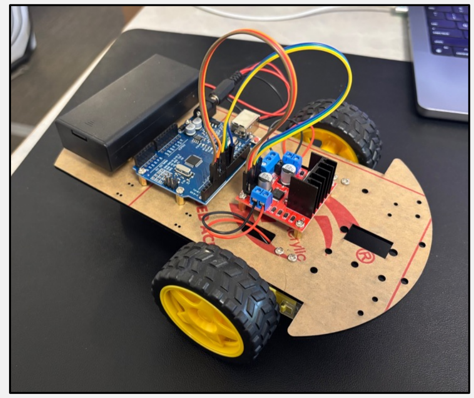
[Full Report ↗]

Real-Time Gesture Detection Model for Robot Control

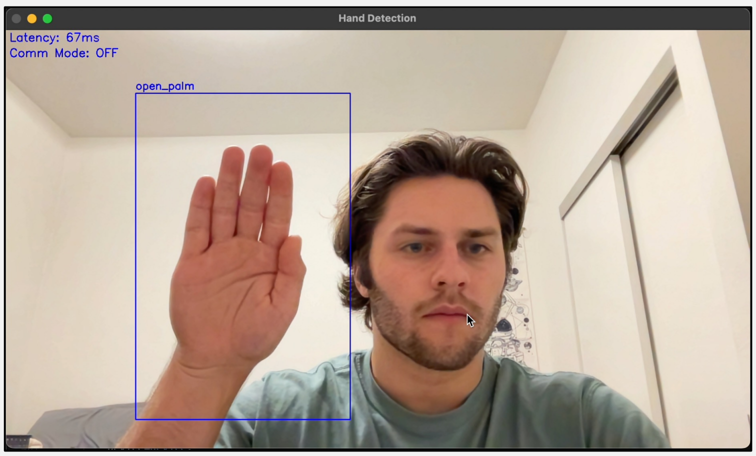
Independent | Stanford – Introduction to Computer Vision | March 2025



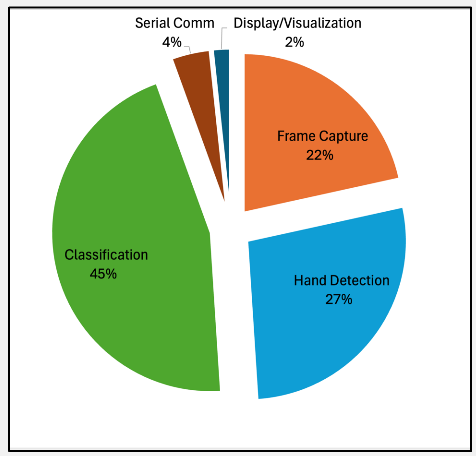
Pipeline applied for the project, informing program inputs and returns.



Mobile robot manipulated for the purpose of successful demonstration.



Capture and cropping process showing the bounding box returned from the hand detection model and inputted to the classification model. Classifier displayed on the top left corner.



Pie graph showing the time utilization of each program in the detection and classification pipeline.

Outcome: Designed and implemented a real-time pipeline that utilized a hand detection model and custom trained Convolutional Neural Network (CNN) to classify and translate hand gestures into motion commands for a robot, demonstrating a robust interface between computer vision and physical hardware.

Headline Results:

- Developed a real-time hand detection pipeline using a computer webcam and Google's MediaPipe library to generate stable bounding boxes and cropping around the user's hand.
- Architected and trained a lightweight CNN to classify four distinct hand gestures, achieving greater than 98% accuracy and a mean latency of 57ms, enabling seamless real-time classification at 17 FPS.
- Transmitted classification results to an Arduino-controlled robot, triggering movement commands when confidence score exceeded 35%.
- Validated the integrated system, proving the efficacy of lightweight CNNs for responsive control in mechatronic applications.

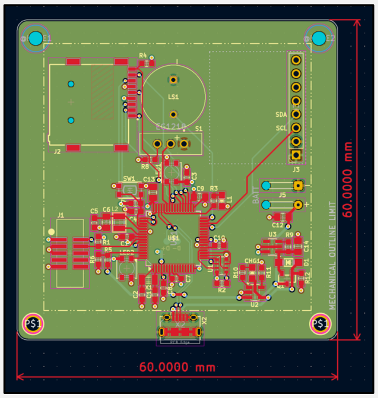
Main Skills and Tools:

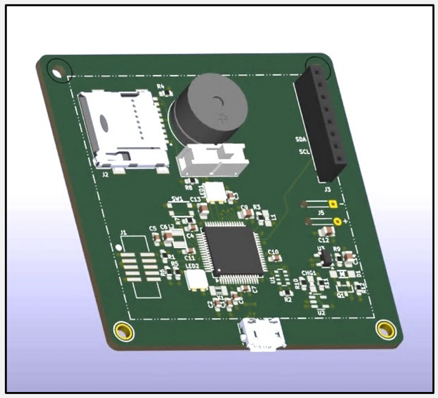
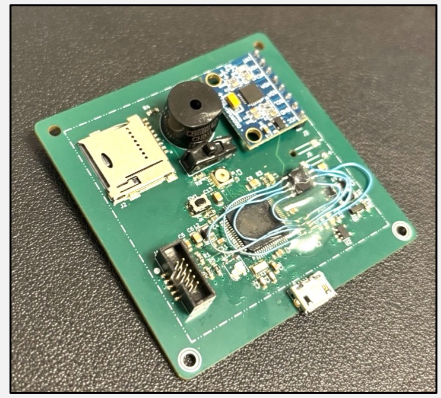
Python, Computer Vision, PyTorch/TensorFlow, Arduino, Communication Protocols, Embedded Systems

[Full Report ↗]

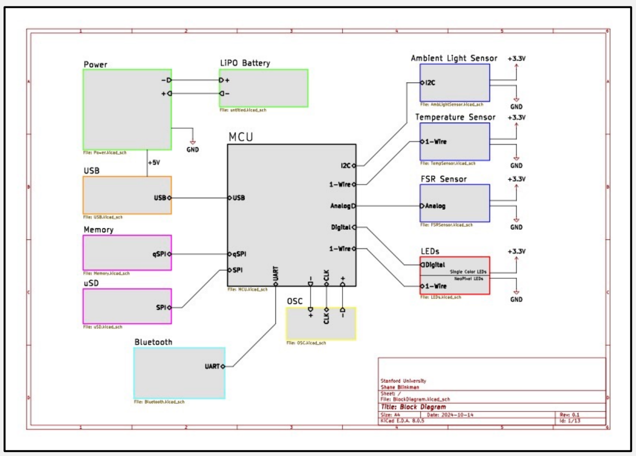
PCB Design of a Desktop Pomodoro Timer

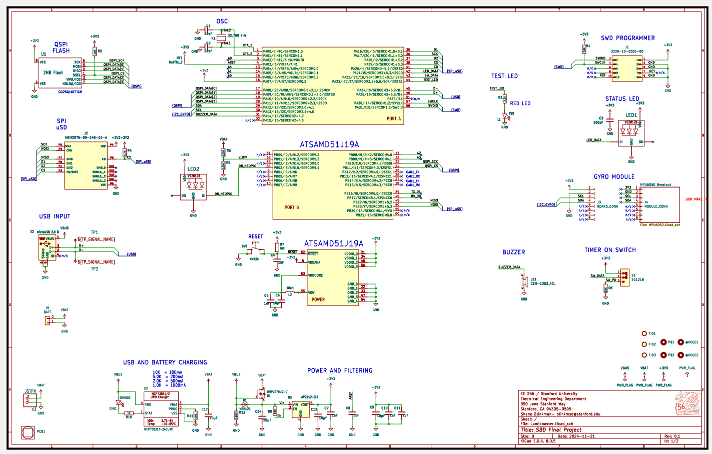
Independent | Stanford – Board Level Design | November – December 2024



Progression of board bring up from board layout (left), 3D rendering (middle) physical board after programming and testing (right).





Block diagram overview (left) outlining system interactions and communications used to inform the development of the electrical schematic overview (right).

Outcome: Executed the full PCB development cycle—from schematic design to board bring-up—delivering a functional pomodoro desktop timer, while practicing industry-standard design tools and debugging techniques.

Headline Results:

- Designed an electrical schematic and multi-layer PCB layout in KiCAD, employing best practices for power/ground planes, trace routing, and component placement.
- Managed the fabrication pipeline, from electrical component selection, BOM and ordering management, and board assembly, soldering, and reflow.
- Successfully salvaged a board-level error (mismatched flash memory footprint) by implementing a bodge-wire solution, demonstrating debugging skills under real-world constraints.
- Validated board functionality through systematic bring-up procedures using oscilloscopes and DMMs, verifying power integrity and communication protocols.
- Created a detailed requirements document and utilized Python for rapid firmware prototyping, ensuring a structured development process.

Main Skills and Tools:

PCB Design (KiCAD), Circuit Design & Analysis, Board Layout, Soldering/Reflow, Oscilloscopes, DMM, Board Bring-Up, Debugging, System Verification, Python

[Full Report ↗]

Summary of Skills

Core Engineering Disciplines
Mechatronics Engineering • Mechanical Design • Embedded Systems
Software Engineering • Electrical Engineering • Control Systems

Programming & Software
- **Languages:** C, C++, Embedded C, Python, MATLAB, Simulink
- **Embedded Systems:** PIC32, ESP32, STM32, AVR (Arduino), Raspberry Pi
- **Computer Vision:** OpenCV, Google MediaPipe, Convolutional Neural Networks
- **Version Control:** Git
- **Front End:** HTML, CSS, JavaScript (all familiarity)

Hardware & Electronics
- **PCB Design:** KiCad, LTSpice
- **Circuit Design & Analysis:** Power Management, Voltage Regulation
- **Sensor Integration:** IMU, Encoders, Load Cells, Pressure/Temperature, Proximity, IR, etc.
- **Actuator Control:** DC Motors (Brushed/Brushless), Servo, Stepper, Solenoids, Linear Actuators, etc.
- **Communication Protocols:** SPI, I2C, UART/Serial, Bluetooth/BLE, WiFi
- **Test & Measurement:** Oscilloscopes, Logic Analyzers, DMM, Signal Conditioning, Data Acquisition

Mechanical Design & Fabrication
- **CAD & Modeling:** SolidWorks, Fusion 360
- **Analysis & Simulation:** Stress Analysis (FEA), SolidWorks Simulation, COMSOL, Kinematics & Dynamics, Fluid Dynamics, Thermodynamics
- **Rapid Prototyping:** 3D Printing, Laser Cutting, Waterjet Cutting, Traditional Machining
- **Manufacturing:** DFM, DFA, Material Selection, Sheet Metal Fabrication
- **Assembly & Finishing:** Soldering, PCB Rework, Wiring & Harnessing, Post-Processing

Systems & Control
- **Control Theory:** PID Control, State-Space Control, Digital Control Systems, Feedback Systems
- **System Architecture:** Hierarchical State Machines, System Modeling & Simulation, Dynamic System Modeling
- **Robotics & Automation:** Robotics, Machine Vision, Signal Processing
- **Medical Device Specific:** Catheter Design, Biocompatibility, Sterilization Methods

Testing, Validation & Quality
- **Test Development:** Test Plan & Procedure Development, Verification & Validation
- **Risk Management:** Risk Management, Human Factors Engineering

Professional Competencies
- **Project Management:** Agile Methodology, Gantt Charts, Technical Leadership
- **Medical Device Lifecycle:** Regulatory Submissions, Clinical Trial Support
- **Collaboration & Communication:** Cross-Functional Collaboration, Technical Communication, Client/Stakeholder Interaction
- **Problem-Solving:** Critical Thinking, Adaptability, Mentoring & Tutoring