Aidan Spira

Mechanical Engineering Portfolio

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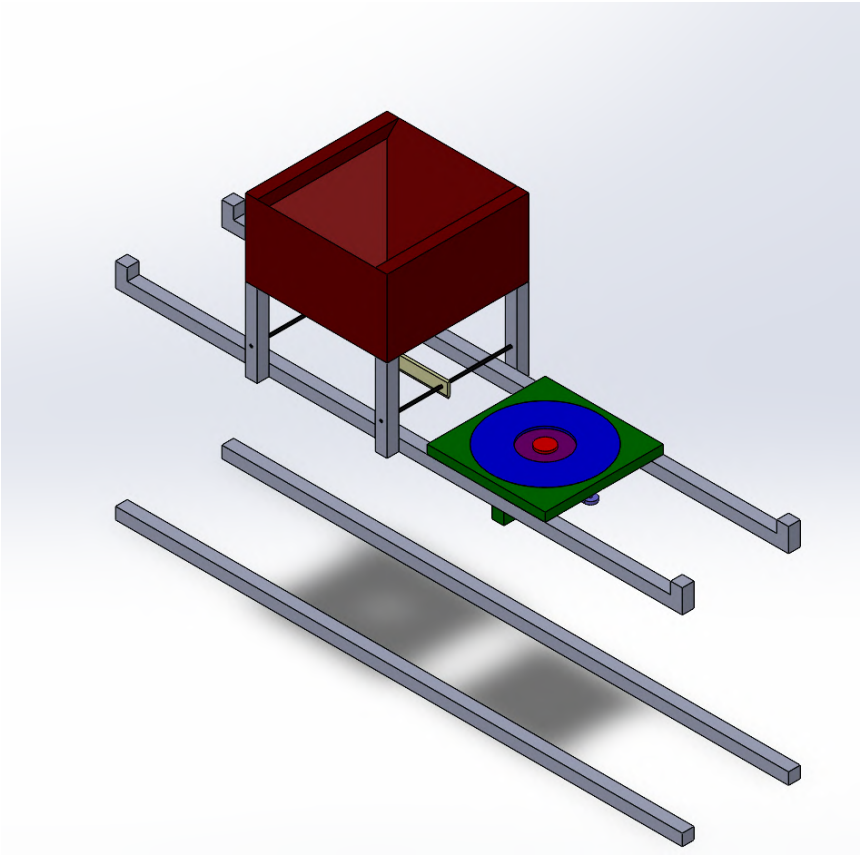
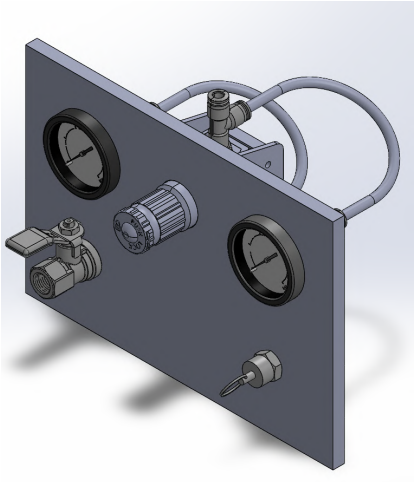
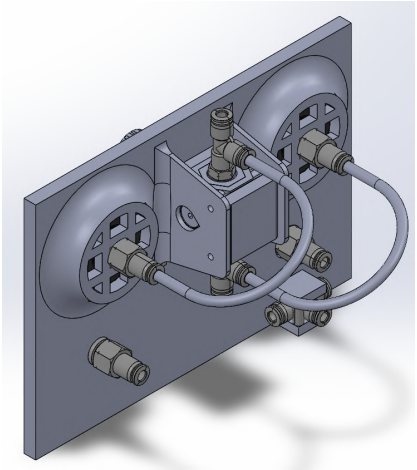
Automated Gasket Manufacturing System

Role: Team Lead | Organization: Aggies Create Sep 2025 – Present

Outcome: Led mechanical system design for an industry-partnered automation project enabling scalable gasket production.







Objective

Develop a mechanically integrated automation system for specialty gasket manufacturing, designed to interface safely with existing industrial equipment.

Leadership & Scope

As team lead, I managed task delegation and system-level integration while contributing directly to critical subsystems, including pneumatics, insert placement, powder distribution, and structural framing. Emphasis was placed on promoting learning while maintaining engineering rigor.

Highlighted Mechanical Contribution

I designed the pneumatic intake and regulation panel, which accepts a high-pressure supply (120 PSI), regulates output pressure, displays both source and regulated pressures, and incorporates safety relief and dump valves to protect downstream components.

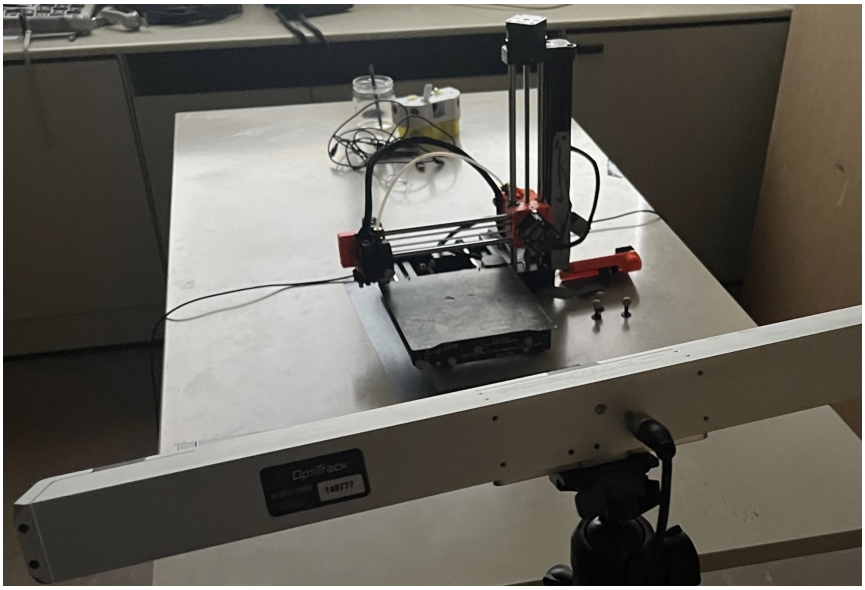
Impact

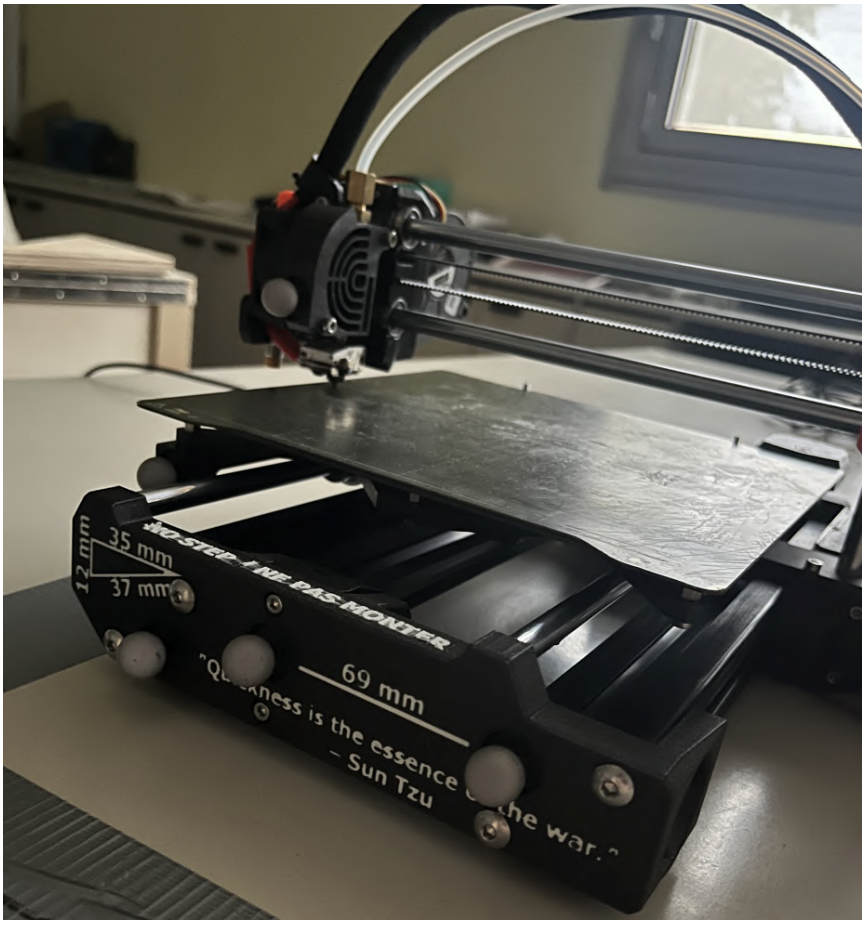
The project earned First Place (“Best in Showcase”) among 40+ teams for feasibility, safety, and practical implementation. Some technical details are omitted due to NDA constraints.

3D Printer Digital Twin & Calibration System

Role: Manufacturing Research Intern May 2025 – Jul 2025

Outcome: Developed a digital twin system to improve 3D printer accuracy, throughput, and reliability.





Objective

Create a digital twin of a 3D printer to measure motion accuracy and enable automated calibration.

Mechanical Contributions

I modified multiple structural components, including the printer front panel, extruder cover, and bed mounting system. Sensor integration required careful consideration of mounting geometry, stiffness, and repeatability.

Key Challenge

Press-fit tracking markers required tight tolerance control, complicated by FDM printer variability. Iterative redesign balanced secure retention with rapid removal.

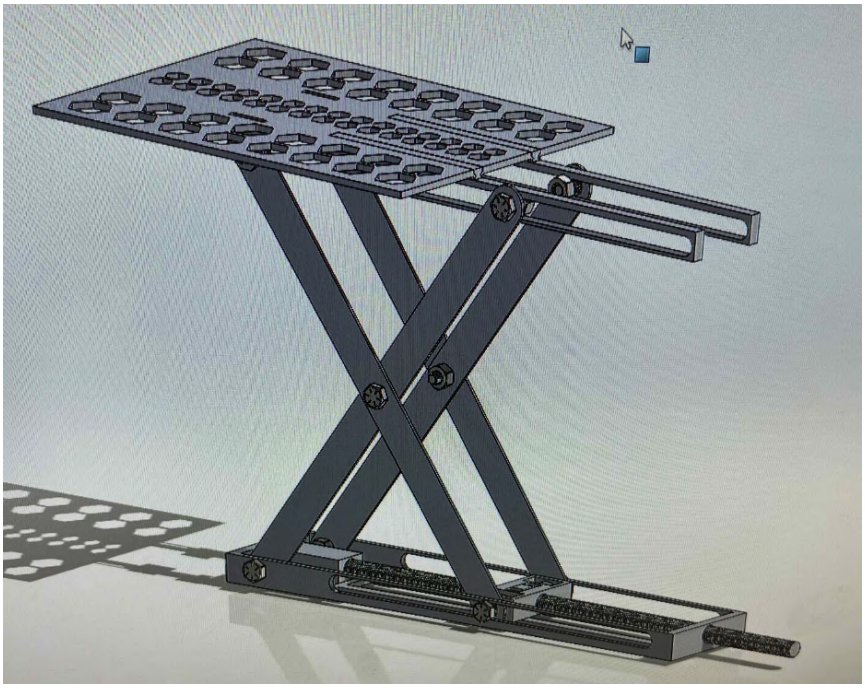
Technical Growth

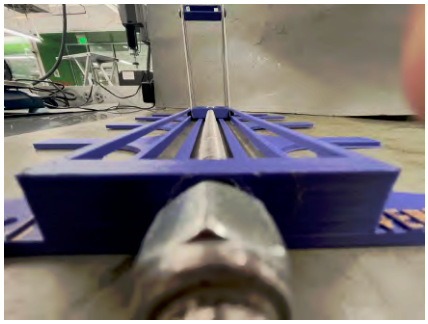
In parallel, I learned PCB design and developed C# calibration software involving nontrivial geometric calculations, enabling automated coordinate transformation and system alignment.

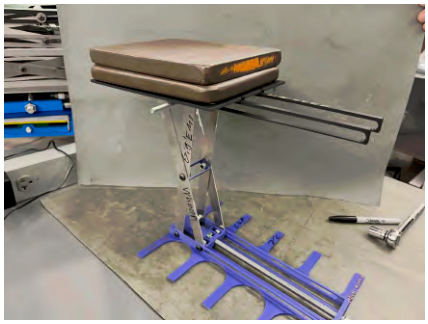
Lightweight Scissor Lift — Structural Optimization

Role: Design Lead | Team: Course Design Team Fall 2025

Outcome: Led the design of a scissor lift system optimized for minimum weight while meeting full load requirements through symmetric load-path design.







Objective

Design a scissor lift capable of supporting the required load while minimizing structural mass and maintaining stability under asymmetric loading.

Design Approach

Rather than using a traditional corner-supported platform, the system was designed to carry load symmetrically through the centerline. This reduced bending moments in the arms and enabled a lighter overall structure without compromising strength.

Engineering Focus

Structural load paths, fastener placement, and joint geometry were iterated in CAD to balance stiffness, manufacturability, and weight. Design decisions were guided by mechanical fundamentals rather than overbuilding.

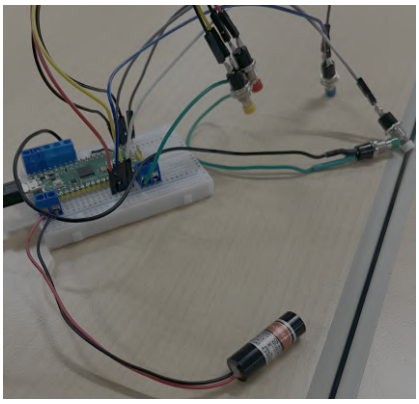
Outcome

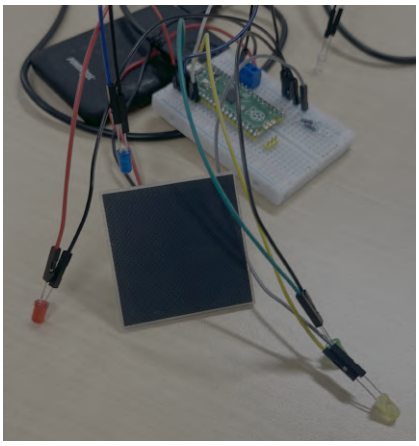
The final design achieved the lowest mass among all teams while still meeting the full load requirement, demonstrating the effectiveness of symmetric load distribution and targeted material use.

Lumicomm: Optical Drone Identification System

Role: Design Lead & Chief Entrepreneur Sep 2024 – May 2025

Outcome: Engineered an optical communication system enabling secure drone identification without RF emissions.





Problem Context

Friendly-fire incidents involving drones remain a critical issue in modern conflicts. This project explored optical signaling as a low-probability-of-intercept alternative to RF-based identification.

Mechanical Design

I designed and fabricated multiple 3D-printed housings to securely mount the laser emitter, solar-panel receiver, and supporting electronics. Mechanical stability and optical alignment were critical, particularly over long distances.

System Performance

The system achieved approximately 500 bps data transfer with 95% reliability at 50 m. LEDs were used as virtual representations of drone response during proof-of-concept testing.

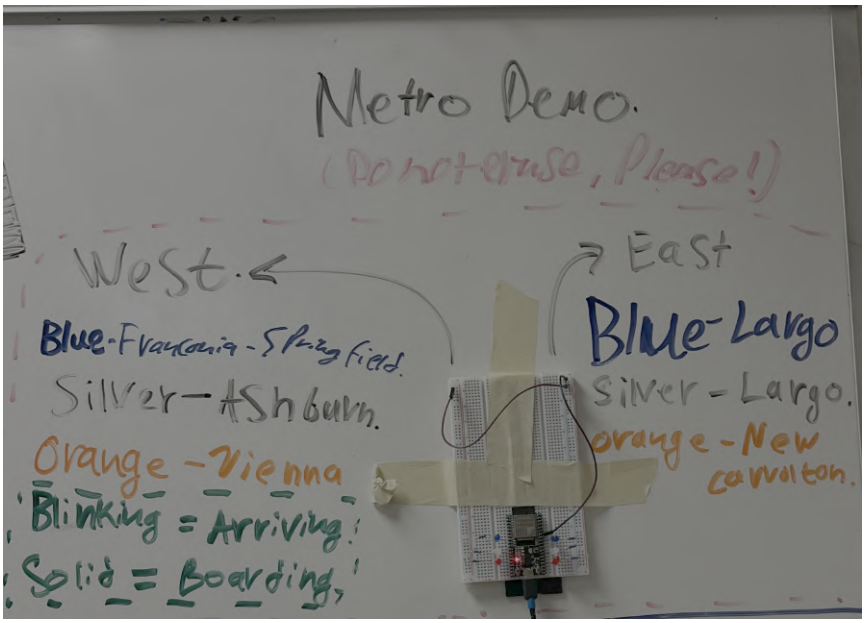
Outcome

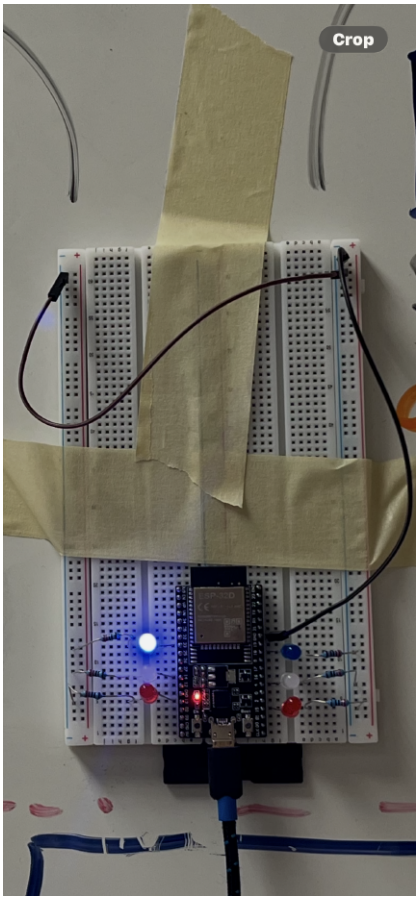
The project won First Place at Aggie Pitch, selected by faculty and industry judges for technical feasibility and defense relevance.

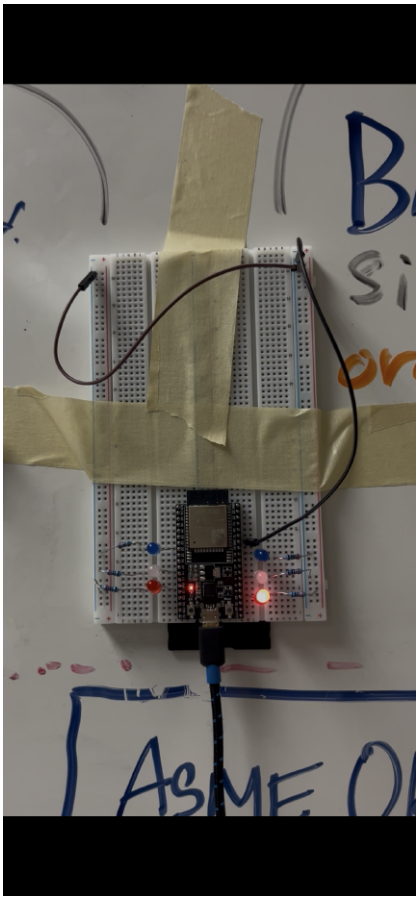
Real-Time Metro Transit Display

Role: Project Lead | Team: Personal Group Project Jan 2026 – Present

Outcome: Designed a modular, physically mounted transit display converting live arrival data into intuitive LED-based visual states.







Objective

Design a physically mounted, real-time transit display that translates live metro arrival data into clear, intuitive visual states using custom electronics and modular mechanical mounting hardware.

Mechanical & System Design

This personal project was initiated to deepen understanding of electronics and circuit design while intentionally planning for future mechanical integration. The system is designed to attach to a pre-fabricated metro sign, requiring custom backing plates and modular mounting hardware.

LED placement was treated as a mechanical problem as much as an electrical one, with early consideration of light reflection, wall bounce, and visibility. These constraints will directly inform final enclosure geometry and PCB layout once the physical sign is obtained and measured.

Current Status

The proof-of-concept successfully mimics real-world metro behavior, with LEDs blinking during train arrival and remaining solid during boarding. The system validates firmware logic, signal routing, and physical layout under a strict budget constraint.

Next Steps

Measure and model the final sign geometry, design modular 3D-printed mounting components, and use physical constraints to drive final LED PCB design.