

Asad Warind

MECHANICAL ENGINEERING AT UNIVERSITY OF WATERLOO

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About me

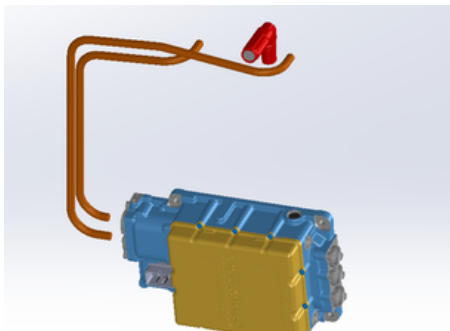


I'm Asad Warind, and I'm studying Mechanical Engineering at the University of Waterloo. I initially explored engineering as a medium to allow me to question how things work. Since then, that curiosity has broadened into an interest in automotive systems, embedded systems, robotics, electromechanical design, and more.

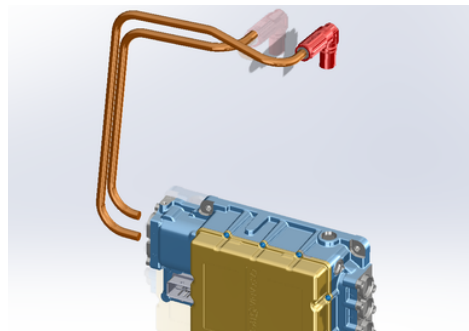
I've tried to explore that interest as much as possible through personal projects, Formula SAE (FSAE), class projects, and by learning from the people around me. Most of the work I enjoy involves some combination of mechanical, electrical, and software systems.

The projects below encapsulate some of the work I've done in the pursuit of learning as much as I can.

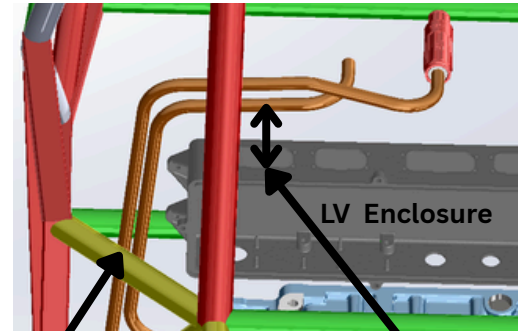
HV Cable Routing Optimization - FSAE



Before



After



Close to chassis for easy mounting HV-LV clearance

Idea

- Redesign the high-voltage DC cable routing between the ~590 V accumulator and inverter
- Create a physically implementable routing path while improving HV-LV separation, minimizing cable length, and meeting packaging constraints

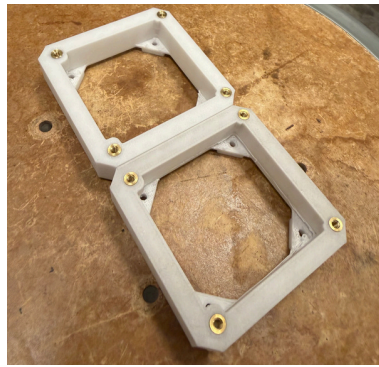
How

- Modeled HV DC cable paths in SolidWorks using 3D sketching
- Evaluated three potential routing paths based on chassis integration, nearby wiring congestion, motor interference risk, cable length and HV-LV clearance
- Validated bend radius requirements against cable datasheet specifications

Result

- Increased HV-LV clearance by 6 mm (~20%) compared to the previous routing configuration
- Developed a routing solution aligned with real-world assembly constraints rather than purely CAD-based geometry
- Implemented routing was used during competition

Accumulator Fan Mounts & Fan-hole Marking Jig — FSAE



Idea

- Design and 3D printed fan mounts for accumulator segments that fit within tight HV accumulator packaging constraints
- Create a marking jig to accurately locate screw holes for fan installation, improving repeatability and reducing the risk of misaligned mounting holes during accumulator assembly

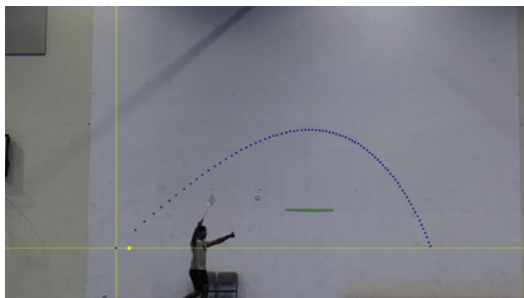
How

- Modeled fan mounts in SolidWorks around real fan geometry, accumulator segment spacing, mounting points, airflow direction, wire routing, and nearby component clearances
- Mated the fan mounts into the accumulator CAD assembly to verify packaging, ease of assembly
- Designed a fan-hole jig using the fan mounting pattern and segment geometry. Used to guide fan mounting-hole placement

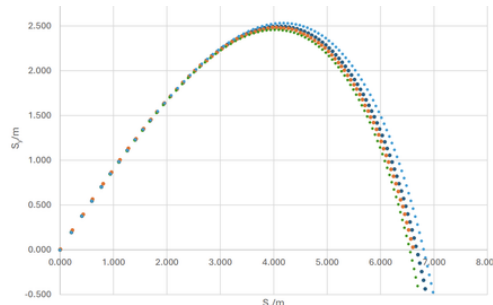
Result

- Produced accumulator fan mounts without requiring accumulator layout changes
- Created a 3D printed marking jig that improved repeatability when locating fan screw holes
- Reduced assembly risk by converting fan-hole placement to a CAD-derived physical jig
- Gained hands-on experience with accumulator packaging, SolidWorks assembly design, DFM/DFA, and jig design

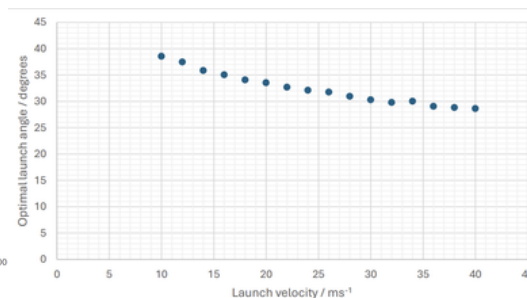
Experimental R&D, Testing & Modeling: Shuttlecock Aerodynamics



Data collection for trajectory validation



Comparing model with experimental data



Optimal launch angle vs speed

Idea

- Investigated how air drag changes the optimal launch angle for range of shuttlecock
- Rather than assuming ideal projectile motion, the project aimed to experimentally estimate the drag coefficient, build a physics-based trajectory model, and use that model to quantify how launch speed affects the optimal angle

How

- Designed terminal-velocity drop tests and used Logger Pro position tracking to estimate the shuttlecock's drag constant
- Built an iterative Excel flight model with 0.0167 s time steps, updating drag, velocity, and displacement in both axes
- Validated the model by comparing upper/lower drag-bound trajectories against experimental shuttlecock flight paths from video analysis

Result

- Processed five drop-test videos to estimate a terminal velocity of 6.9–7.0 m/s and drag constant of $0.00173 \pm 0.00005 \text{ m}^2$
- Predicted the optimal launch angle to decrease from 38.52° at 10 m/s to 28.61° at 40 m/s
- At 40 m/s, the optimal angle was approximately 16° below the idealized no-drag result
- Validated the model against experimental flight data within identified experimental limitations

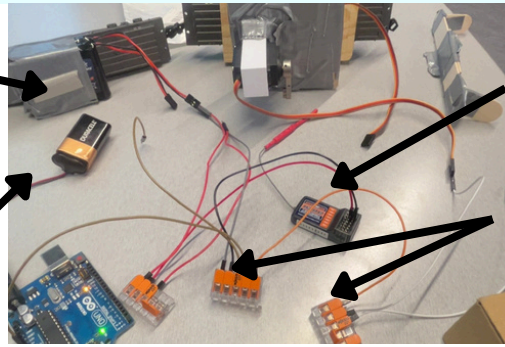
RC Controlled Water Gun System Toy Prototype - Course Project



Battery pack selected

NiMH battery to power servos

Arduino power supply



RC receiver

Shared LV ground



Design group

Idea

- Developed an Arduino-controlled pan/tilt water gun system as part of a course prototype
- Goal was to create a remotely controlled aiming and firing mechanism while meeting budget, weight, runtime, and control smoothness constraints

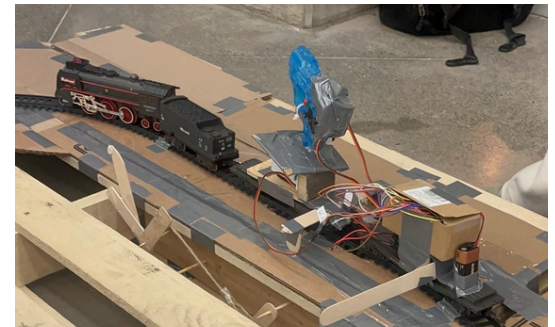
Result

- Successfully developed a fully functional RC-controlled aiming and firing mechanism with pan, tilt, and trigger control
- Achieved an estimated worst-case runtime of ~48 minutes (100+ hours using nominal calculations) while exceeding the project's 30-minute runtime requirement through hand calculations
- Gained hands-on experience with embedded control systems, actuator selection, power budgeting, RC communication, and electromechanical integration

How

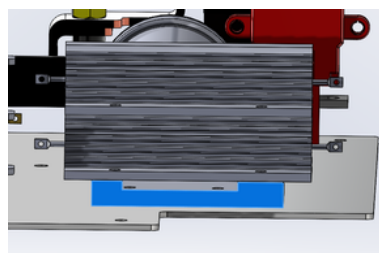
- Designed and programmed the full aiming and firing system, including servo control, joystick mapping, PWM control, smoothing logic, and RC receiver integration with Arduino
- Used three MG995 servos for pan, tilt, and trigger actuation, with servo selection based on torque calculations of trigger
- Calculated battery requirements from servo current draw and selected dual 6 V NiMH battery packs in parallel to increase available current capacity and runtime
- Implemented software limits and smoothing logic to improve aiming stability and reduce servo jitter during operation

Testing

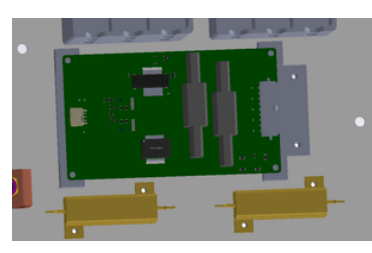
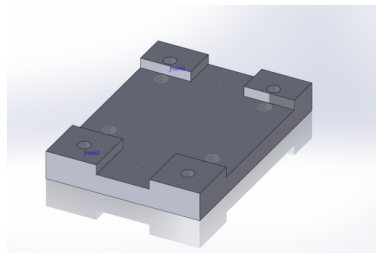


Integrated onto train

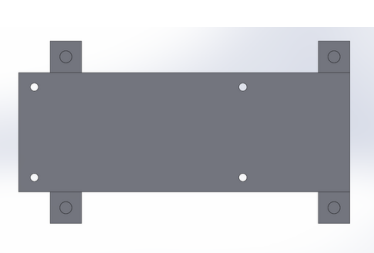
Electrical Components Adapter Mounts - FSAE



Pre-Charge DC circuit (PCDC) resistors + mount



Precharge circuit unit (PCU) + mount



Idea

- Designed adapter mounts for updated HV electrical components (PCDC & PCU) whose mounting patterns no longer matched the existing electronics shelf
- Needed to preserve the original polycarbonate electronic shelf and avoid adding new holes to the UL94-rated structure

How

- Modeled custom adapter mounts in SolidWorks to interface between the old and new mounting patterns
- Designed around uneven hole offsets and optimized geometry for PETG V0 3D printing
- Integrated heat-set inserts into both the mounts and e-shelf to simplify fastening and assembly

Result

- Successfully integrated updated HV electrical components without modifying the original electronic shelf
- Manufactured and installed the mounts onto the vehicle