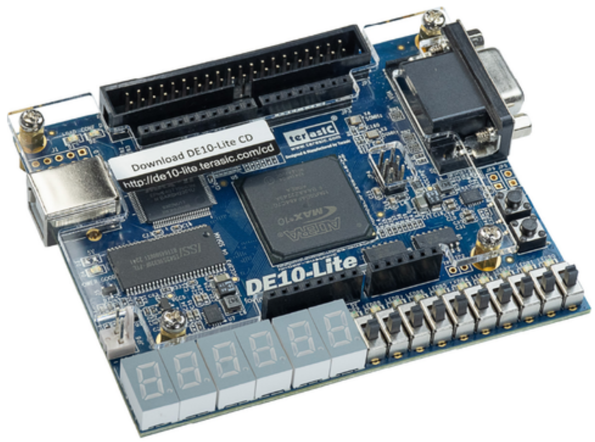
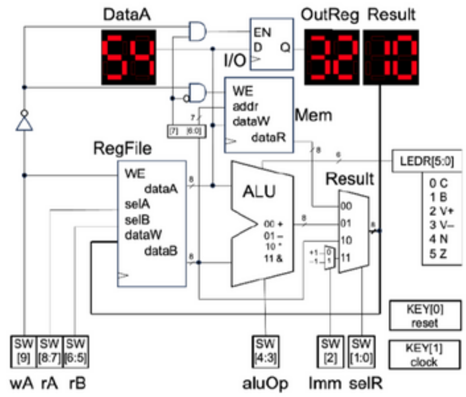
SIMPLE CPU - SYSTEMVERILOG





WHAT?

- Designed and implemented a simplified CPU to execute a custom instruction set, focusing on datapath architecture, control logic, and instruction sequencing.

HOW?

- Built the CPU in SystemVerilog, developing the datapath (register file, ALU, buses) and a finite-state control unit.
- Verified functionality through simulation (Questa) and used the design through a DE10-Lite FPGA board for hardware testing and debugging.

RESULTS

- Successfully executed arithmetic, logic, and control instructions on real hardware, gaining hands-on experience with hardware–software interaction, cycle-level debugging, and translating CPU specifications into a working FPGA implementation.

ELECTRIC GO-KART- WELDING & WIRING

WHAT?

- Designed and built a functional go-kart from the ground up with two teammates using a custom metal chassis and drivetrain.
- Extended the project by converting the completed gas-powered vehicle to an electric drivetrain using an e-bike battery pack with integrated BMS.

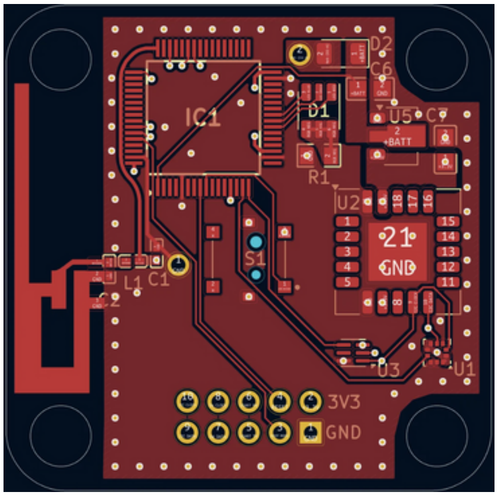
HOW?

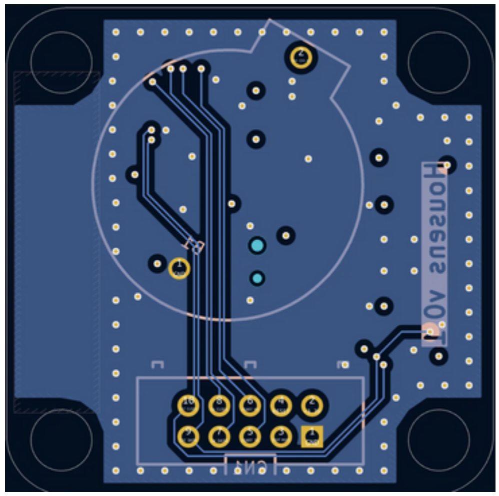
- Determined chassis dimensions and materials by referencing an existing go-kart design.
- MIG-welded the frame using electrical conduit and ensured structural stability.
- Installed a Predator 224 gas engine, rear axle, wheels, steering, and suspension components.
- Converted the system to electric by removing the engine and integrating battery power, wiring, and drivetrain mounting.

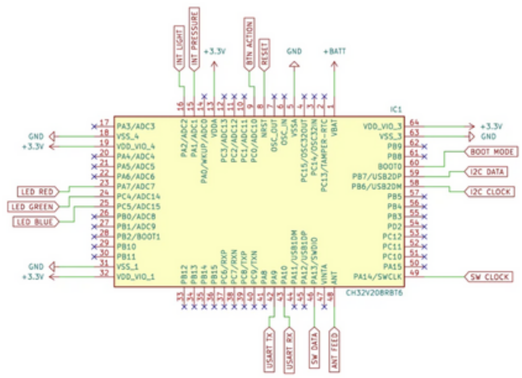
RESULTS

- Achieved reliable starting, acceleration, and steering across test runs.
- Electric conversion produced slightly higher acceleration with reduced top speed.
- Gained hands-on experience in welding, mechanical assembly, electrical wiring, and troubleshooting under real-world constraints.
- Strengthened teamwork, patience, and iterative problem-solving skills through collaborative development.

ENVIRONMENTAL SENSOR BOARD - KICAD







WHAT?

- Designed a Bluetooth Low Energy environmental sensing monitor in a group of three people.
- Reads environmental data using: SCD40 (temperature, humidity), LPS22HB (atmospheric pressure), and APDS-9306 (ambient light) sensors.

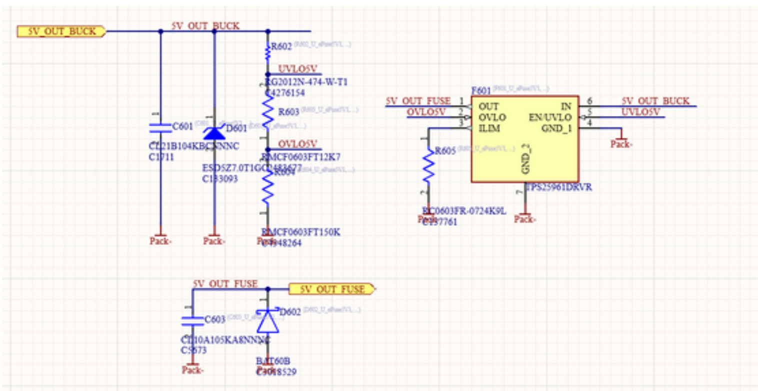
HOW?

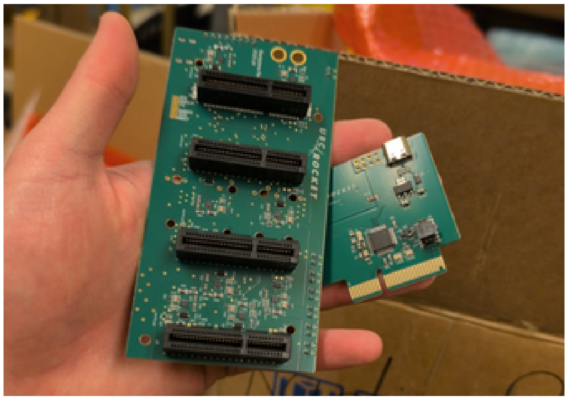
- Created a 4-layer circuit board using KiCad, including power filtering and debug connections. Programmed it to collect sensor data and send it wirelessly over Bluetooth.

RESULTS

- Successfully fabricated and assembled the board.
- The system was able to track temperature and humidity. Bluetooth and battery performance worked as expected.
- Gained hands-on experience with RF layout, multilayer design, and embedded programming.

ROCKET BACKPLANE - ALTIUM & GIT/GITHUB





WHAT?

- Designed an avionics backplane PCB for UBC Rocket that acts like a “hub board,” letting multiple flight electronics boards plug in and share power and key signals.
- Collaborated with teammates using Git and GitHub.

HOW?

- Translated the team's needs into a clear board plan (power rails, connector pinout, where signals go), then built the schematic and PCB layout in Altium, including sensible protection parts (e-fuse, surge protection, filtering).
- Read through datasheets to choose and apply an e-fuse solution for the backplane (power limit + protection behavior), then turned those specs into a working Altium schematic.

RESULTS

- Made the avionics setup cleaner and more reliable by cutting down on loose wiring, adding smarter power protection, and making the board easier to test and debug during integration.
- Built-in power limiting helped prevent “oops” moments (shorts/miswires) from taking down the whole avionics stack. The clearer schematic and test-friendly layout also made troubleshooting faster during bring-up and revisions.