Tristan Yan-Klassen

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Technical Skills

Embedded: C, C++, Python, ROS, I2C, SPI, CAN, UART, Oscilloscope, Arduino, ESP32, STM32
Manufacturing: PCBA, Soldering, 3D Printing, CNC, Mill, Lathe, Sheet Metal, DFMA, GD&T
Applications: KiCAD, MATLAB, Simulink, SolidWorks (CSWP), VBA, Git

Experience

Jr. Hacksmith – Hacksmith Industries Sept. 2025 – Present

- Created a Fallout Pip-Boy with an AI VATS system, generating 600k YouTube views and $300k in revenue.
- Implemented co-moving position-based tracking, teach and repeat, and teleoperation on a robot arm.
- Developed custom arm inverse kinematics, motion planning, and control loops for stable camera tracking.
- Designed a robot chassis with both manual and autonomous remote control and modular tool mounting.

Engineering Intern – Oxygen8 Solutions Inc. Jan. 2025 – Apr. 2025

- Designed and implemented HVAC unit wire harnesses to cut material cost 30% and assembly time 75%.
- Created global electrical standard for unit wiring and standard templates for SolidWorks Electrical.
- Conducted DFMA analysis of Terra 2.0 to reduce part count by 56% and assembly time by 20%.
- Designed PCB to detect shorts and incorrect wiring, halving rate of defects delivered to production floor.

Controls Simulation Lead – Waterloo Rocketry Sept. 2024 – Present

- Leading development of custom 6-DoF rocket simulation software with support for closed-loop control.
- Conducting airframe load analysis through simulation of aerodynamic, thrust, and recovery forces.
- Developed aerodynamic forcing, atmospheric, and sensor models to support accurate controller tuning.
- Independently conducted aerodynamic analysis and FMEA to determine the viability of unlinked canards.

Physics Olympiad Coach and Volunteer Lead – UBC Physics and Astronomy Jan. 2025 – Present

- Coached Physics Team Canada to an all medalist result at the 2025 International Physics Olympiad.
- Led team of 10 to found the Canadian Junior Physics Olympiad to prepare students for IPhO selection.

Projects

Fallout Pip-Boy

- Integrated Geiger counter, radio, and inputs with a Teensy over serial to a Raspberry Pi to control the device.
- Developed Fallout VATS system with OpenCV segmentation and pose models for reliable game-like behavior.
- Created Pip-OS software to handle display, state changes, and integration with smart glasses HUD.

Inertial Navigation System

- Developing Extended Kalman Filter for real-time fusion of IMU, magnetometer, and barometer data.
- Designed STM32 shield for high-speed IMU interfacing, low-latency sensor fusion and real-time output.

HMI and Motor Control PCB

- Designed and brought up custom PCB powered off USB-C to control a multi-scent diffuser.
- Utilized an ESP32 chip for wireless interfacing, motor control, sensor feedback, and SPI LCD display.
- Developed C++ firmware to handle user inputs, sensor data, device state transitions, and display updates.

Autonomous Robot Chassis

- Integrated omni-directional platform with the ZeroKey positioning system for autonomous navigation.
- Developed feedback-based drive control for trajectory correction and active braking and stabilization.

Education

BASc. Mechatronics Engineering – University of Waterloo, GPA: 4.0 (1st in Class) Sept. 2024 – Present

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DUM-E (Co-bot Arm)

- Developed end effector tracking using the ZeroKey ultrasonic position system.
  - Developed custom inverse kinematics and motion planning to keep camera stable and level throughout all tracking movement.
  - Implemented bounded PID control on joint positions with discretized command paths.
  - Attached ZeroKey to arm base to allow arbitrary arm positioning, with further development toward mounting the arm on a robot chassis for increased usability (see below).
- Integrated teleoperation with custom inverse kinematics.
  - Utilized filtered analog inputs on a Bluetooth gaming controller to allow for both large movements and accurate end effector control for reliable pick and place behavior.
  - Integrating arm with Haply Inverse 3 6-DoF input with scaled velocity control for more intuitive arm manipulation.
- Developed custom “teach and repeat” co-bot behavior to enable easy automation programming.
  - “Teach” mode records arm state continuously as operator moves the arm. Recording is refined in a timeline editor and “repeat” mode replays the movement on demand.
  - Utilizing paired arms to allow for remote training of co-bot for manufacturing environments.
- Interfaced with and controlled the arm over a LAN hosted local server and debugger.

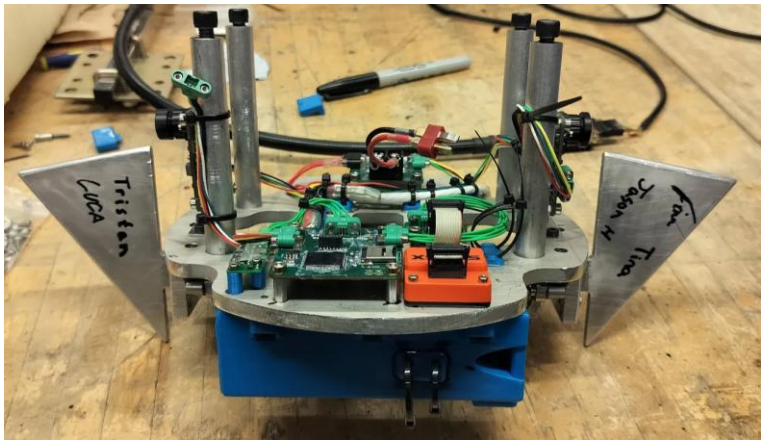
Fallout Pip-Boy (600k+ Views)

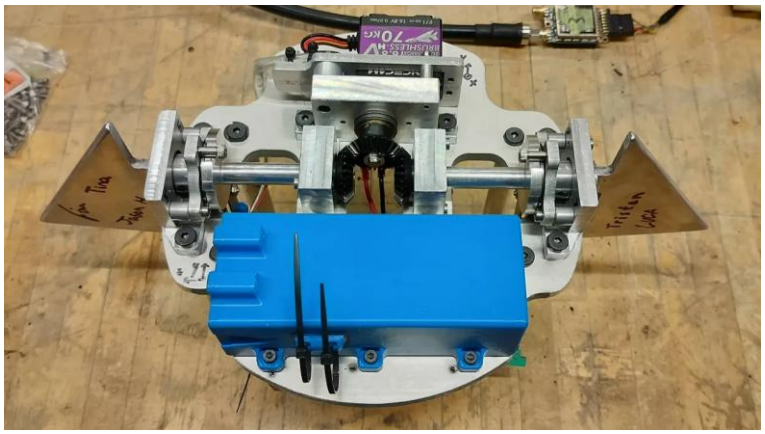
- Created the Pip-Boy from Fallout and hosted a Hacksmith YouTube video with over 600k views, generating over $300k in company revenue.
- Developed VATS targeting system to accurately recreate Fallout experience with OpenCV models.
    - Used pose estimation to identify a target's features and create a region around each.
    - Intersected each region with a segmentation model to allow the user to scroll through each targeting state, assigning hit probabilities using model confidence.
- Developed Pip-OS application on a Raspberry Pi.
    - Created HTML webpage hosted as a kiosk and controlled through keyboard presses.
    - Implemented interactive map and functional holo-tape (removable storage) with Pong game and Hacksmith store variants by reading USB serial numbers.
    - Utilized Discord webhook to send notification updates to the Even Realities smart glasses.
    - Used systemd services to control startup and swap between browser and Python windows.
- Utilized a Teensy microcontroller to handle inputs and external devices.
    - Used I2C to control FM radio and read pulse oximeter, filtering for heart rate.
    - Tapped Geiger counter PCB and filtered signal output to measure counts per second.
    - Relayed inputs as keypresses and Geiger and heart rate over serial to RPi to control Pip-Boy.

Inertial Navigation System

- Developed STM32 shield as a sensor fusion development platform.
- Implementing EKF for accurate position and orientation estimation.
- Connected BMP390 barometer and BNO055 9-DoF IMU over I2C.
- Displayed real-time pose feedback on I2C LCD screen.
- PCB design and code hosted on GitHub.

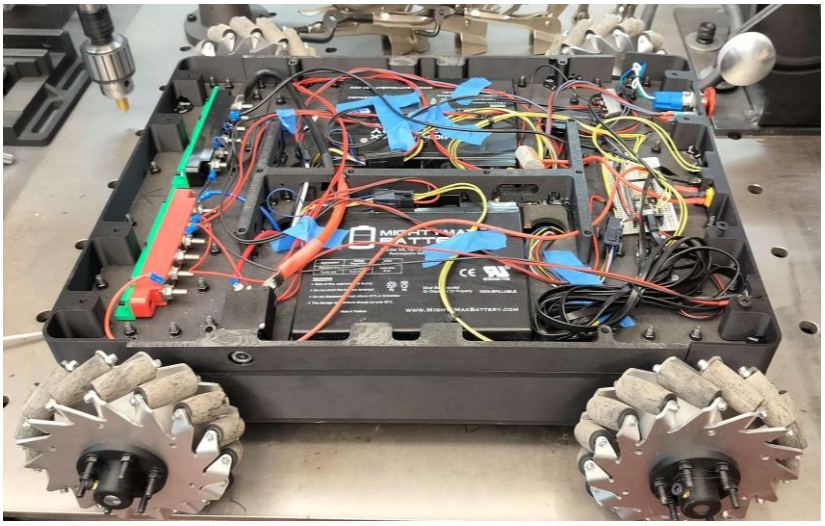
Sounding Rocket Canards





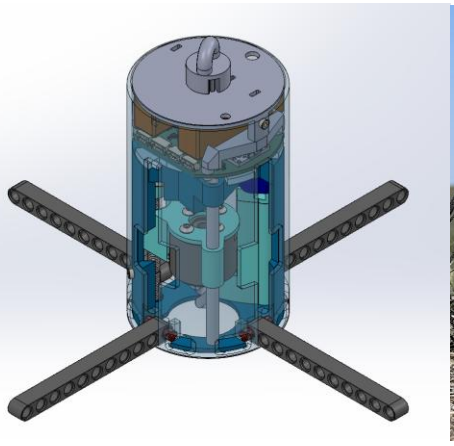
- Leading development of ClosedRocket simulation software in MATLAB Simulink.
    - Leading team of 5 to develop standalone application allowing for closed-loop control, loading analysis, dispersion analysis, and refined transonic/supersonic aerodynamics.
    - Developed aerodynamic forcing, atmosphere, and sensor components of the simulation.
    - Performed HIL testing to validate controller algorithm and verify estimator, controller, and actuator response.
- Conducted aerodynamic analysis of canard behavior and rocket dynamics.
    - Conducted dispersion analysis for failure of unlinked canards, determining non-viability.
    - Developed model for canard flutter, adapting standard models to control surfaces by independently considering aerodynamic forcing and restoring effects.
    - Developed controller testing method for roll reversal (output gain uncertainty) involving randomly selected output gain scaling over airspeed and angle of attack.
    - Sized canards for optimal control authority and determined required servo specs.
- Designed mechanical linkage for canard system.
    - Designed gearbox to ensure canards were locked to affect roll only with minimal backlash.
    - Calibrated canard positions and programmed servo to limit actuation to safe interval.
    - Incorporated layers of mechanical soft and hard stops to ensure safe operation.

Autonomous Robot Chassis



- Built 150 lbs rated omni-directional robot chassis with pegboard modular tool mounting system.
- Wired in overcurrent protection and emergency stop circuit to mitigate potential accidents.
- Controlled by ESP32 microcontroller facilitating Bluetooth teleoperation and control over LAN.
- Integrated with ZeroKey position system for autonomous path following and position direction.
- Utilized encoder feedback for PID controlled active braking and trajectory correction.

Prototype Space Lander (CanSat)

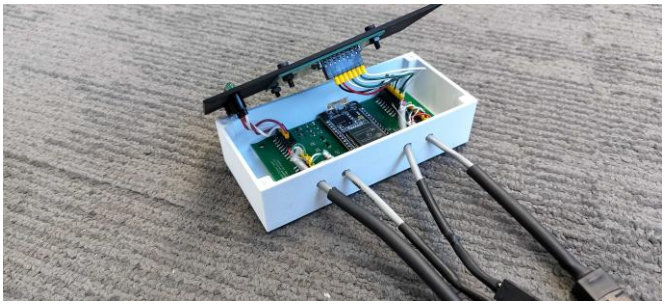


- Designed drilling apparatus composed of landing legs, drill apparatus, and testing chamber.
    - Elastically powered landing legs to upright CanSat upon landing.
    - Custom machined drill bit fastened to motor and deployed via lead screw.
    - Compact testing chamber to test soil sample for presence of amino acids.
    - FPV camera in drill apparatus to remotely operate testing system.
- Designed optimized electrical bay and modelled entire lander to ease integration.
    - Integrated LiPos, radio, recovery, custom PCB, and wire harness into 30mm depth.
- Code, CAD, and more on project page.

HMI and Motor Control PCB

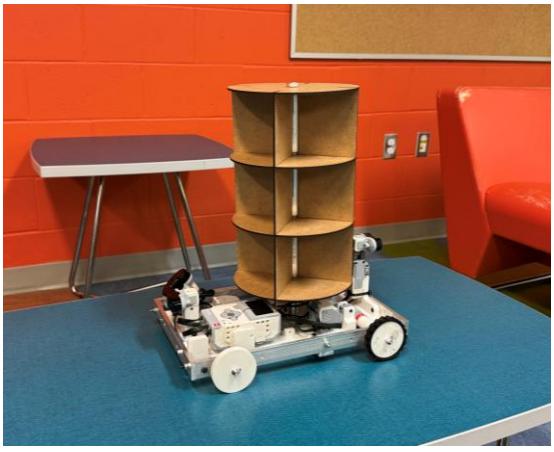
- Control board for multi-scent diffuser device with input via navigation switch and an LCD screen.
- Powered and programmed over USB-C via USB to UART converter for ease of use.
- Code and board design files on GitHub.

Quick Connect Tester



- Designed PCB to detect shorts and incorrect wiring, halving defects delivered to production floor.
- Utilized voltage dividers to detect errors, reported type of error and error rate on SPI LCD display.

Smart Tool Rack



- Designed a smart tool rack to follow an operator around the workshop and keep tools on hand.
- Implemented PID control to smoothly maintain user commanded distance and orientation.
- Developed a collision avoidance system to dynamically restrict movement upon object detection.
- Programmed onboard embedded system in C, using multi-threading to handle concurrent tasks.
- Turned shafts, milled axles, and laser cut shelving to manufacture frame supporting 100 lbs.