

*robotics*  
*electronics*  
*control systems*  
*mechatronics*  
*computer science*

**gabriel thien's**  
**portfolio**  
*a recollection of passions and experiences*

last updated:  
31st August 2023

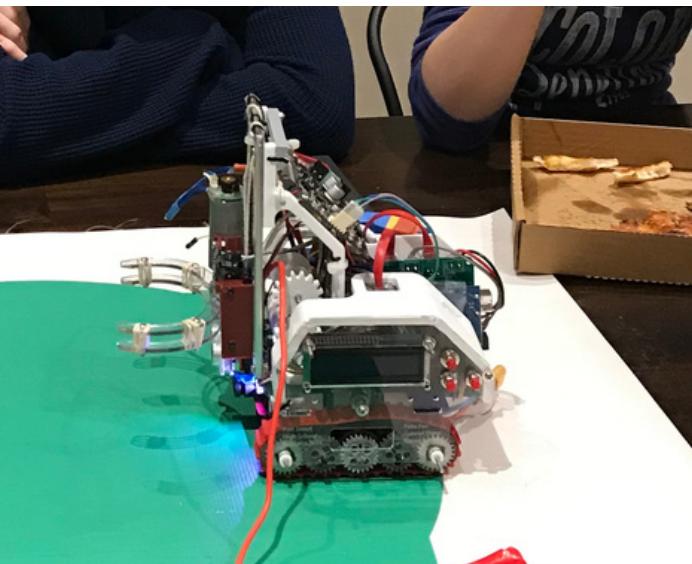
## Competitive Autonomous Rescue Vehicle

- Designed and developed static & dynamic mechanisms
- Features custom designed PCB for hosting controllers and supporting electronics
- Incorporates a suite of awareness sensors such as ultrasonic, time-of-flight, camera, colour sensors, current and voltage sensors
- Sensor communication: I2C, Serial
- Software developed with Arduino framework, OpenCV & OpenMV

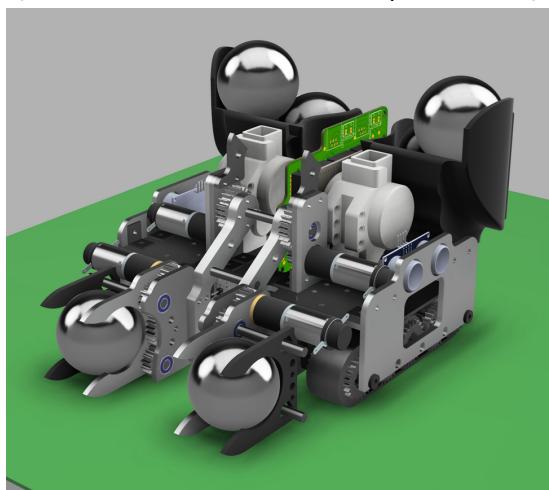


(2019 Iteration 2 – RoboCup State & Nationals)

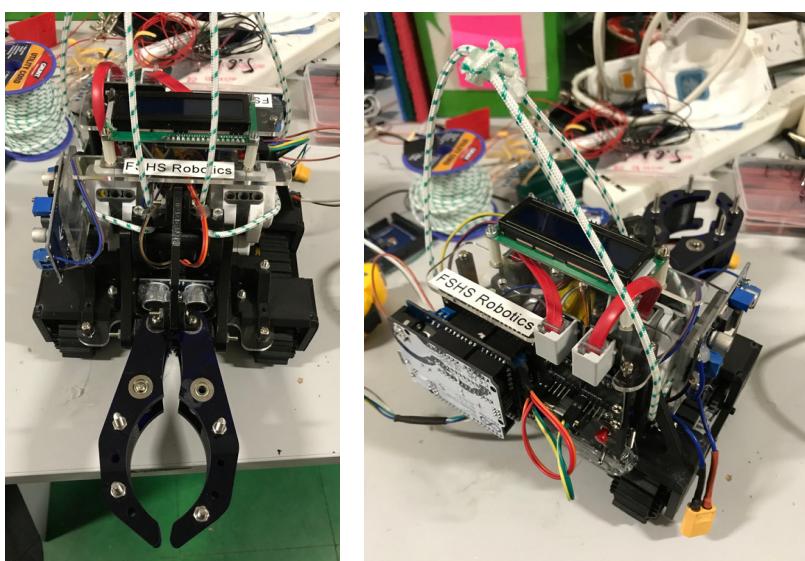
- Features simple UI with LCD screen, buttons for program and mode selection
- Involved 3D printing, laser cutting, aluminium machining, electronics assembly
- Required mechanical prototyping, electrical debugging, software testing & calibration
- High focus on team communication, presentation skills to interviewers, judges and industry representatives



(2019 International RoboCup Iteration)



(2018 Iteration 1 – RoboCup State & Nationals)



## 2019 International Iteration

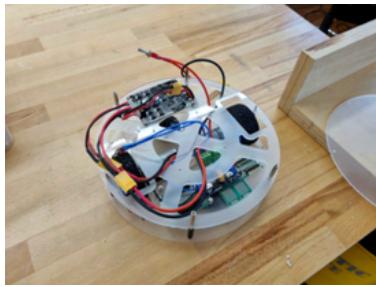
- New grabber mechanism designed for self-centering with picking up steel balls
- Geared linear actuators for claw movement
- Ball backpack (2 max per side) with back chute release into capture area
- 80% of components were metallic for further strength and durability

## 2018 Iteration

- Unreliable grabber & lifting mechanisms
- More fragile, simpler chassis components, less sophisticated power management, sensor systems compared to 2019 version
- Components were less durable & required frequent debugging

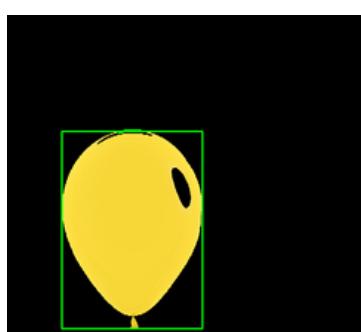
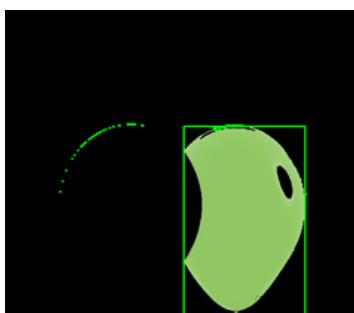
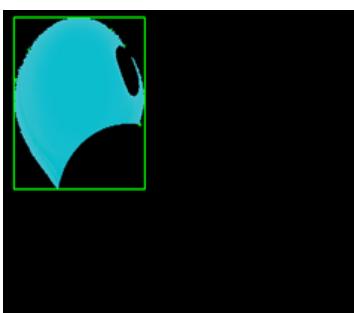
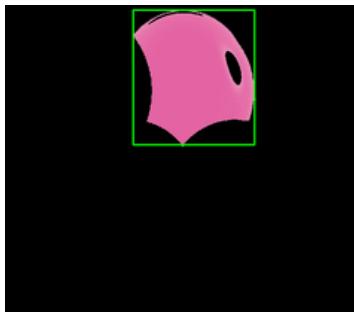
## Competitive Autonomous Droid Racing

- Involved timed navigation around a track using computer vision based decision making (bang bang alg.)
- Involved integrating electronics, software and basic hardware chassis
- Debugging logic level conversion & serial communication between camera & controller
- Developed with Arduino, OpenMV, MicroPython
- Won Best Overall Team, 2nd Place in time, competed at QUT Brisbane



## Computer Vision: Image Colour Segmentation

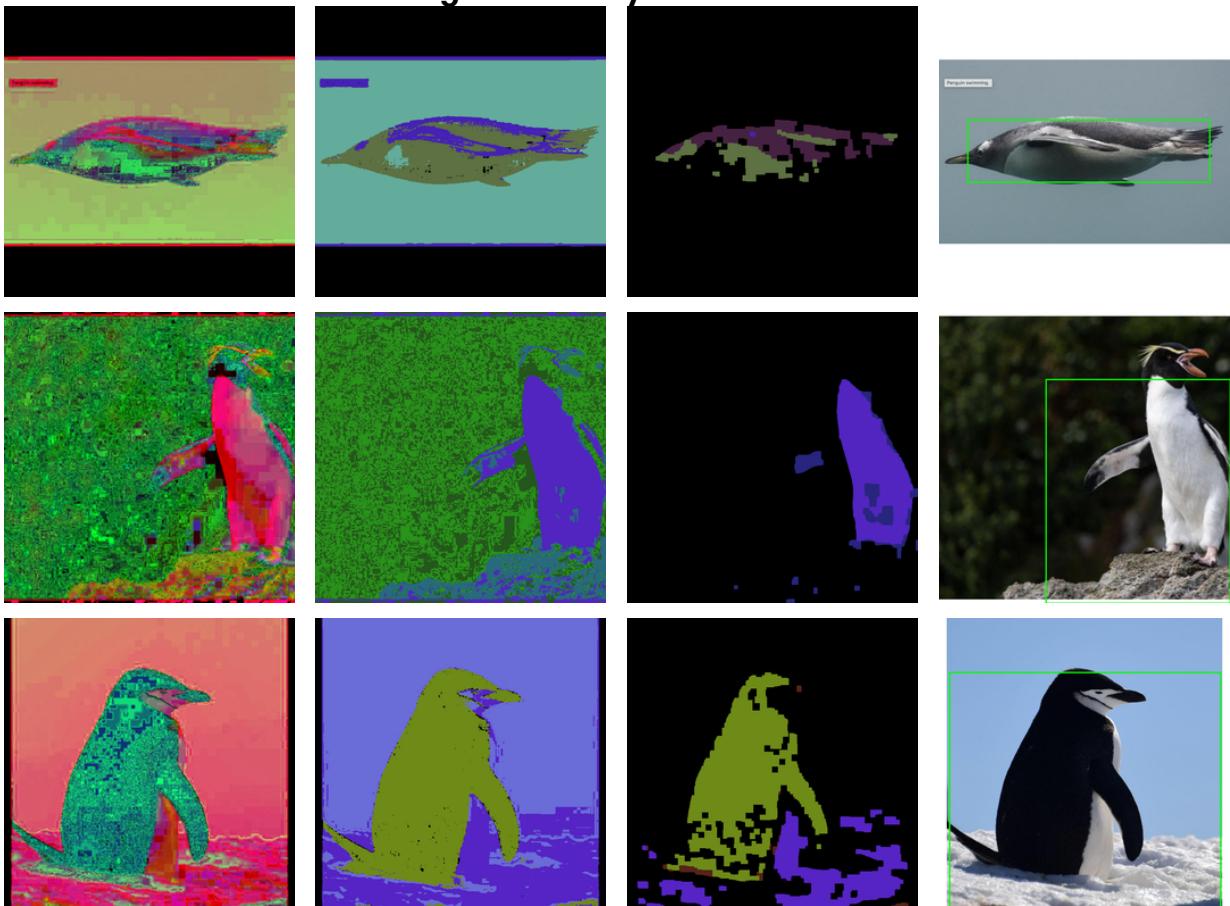
- Used OpenCV to detect & determine distinct objects in an image by colour segmentation
- Involved image pre-processing techniques and image masking



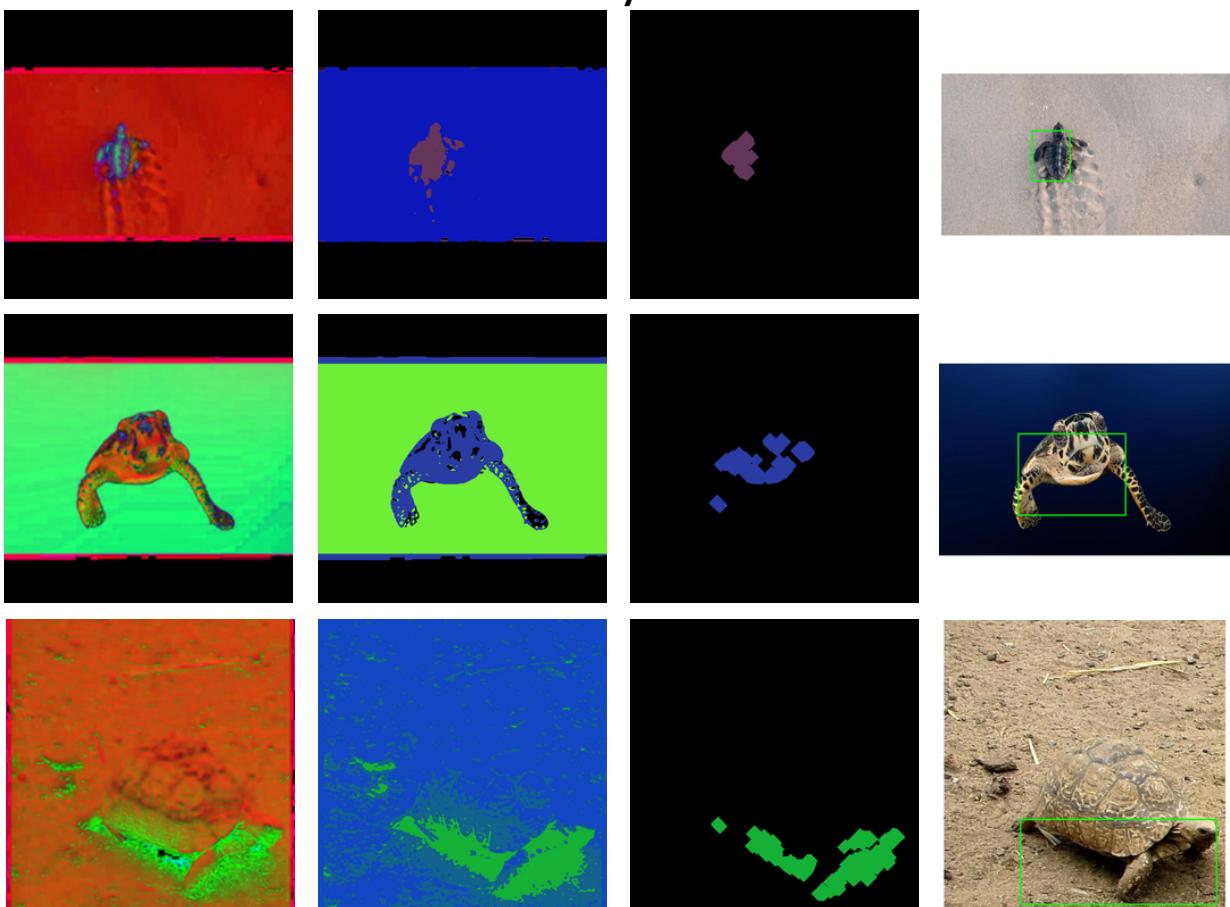
## Computer Vision: Traditional Subject Detector

- Used OpenCV to detect the subject of interest in a range of environments
- Combines multiple methods of image pre-processing techniques and image masking
- Involves colour segmentation, colour frequency histograms, morphological operations

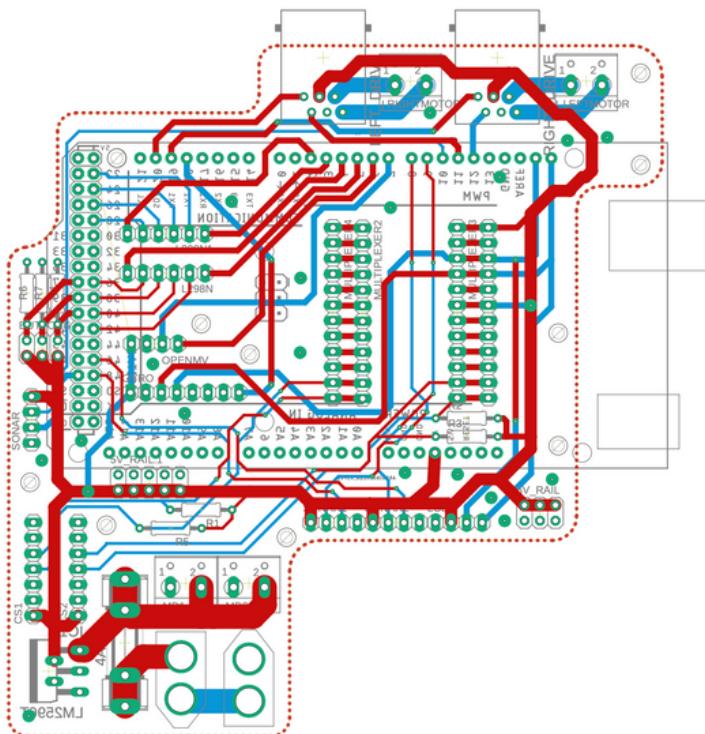
**"High Sensitivity" Parameters**



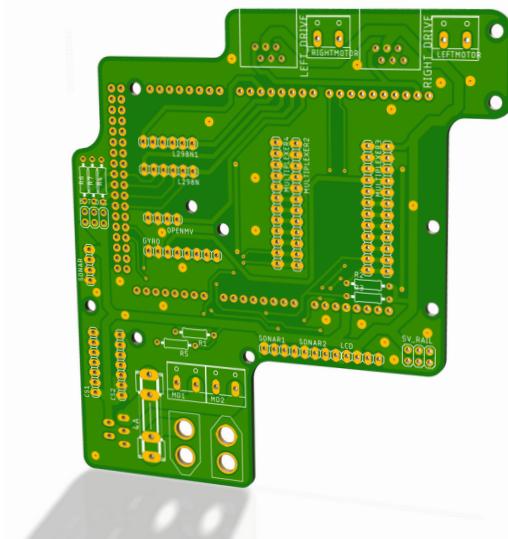
**"Low Sensitivity" Parameters**



## Competitive Robotics Control PCB

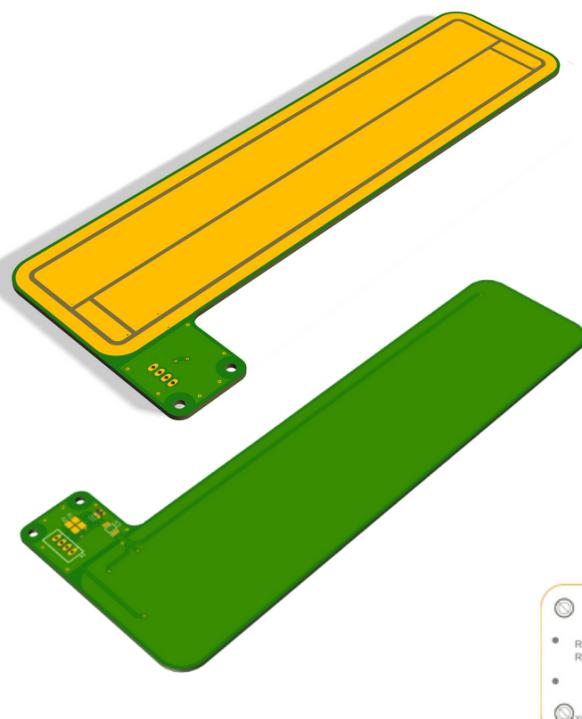
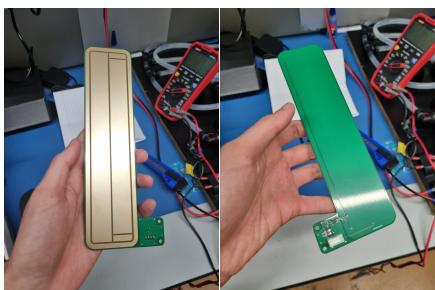


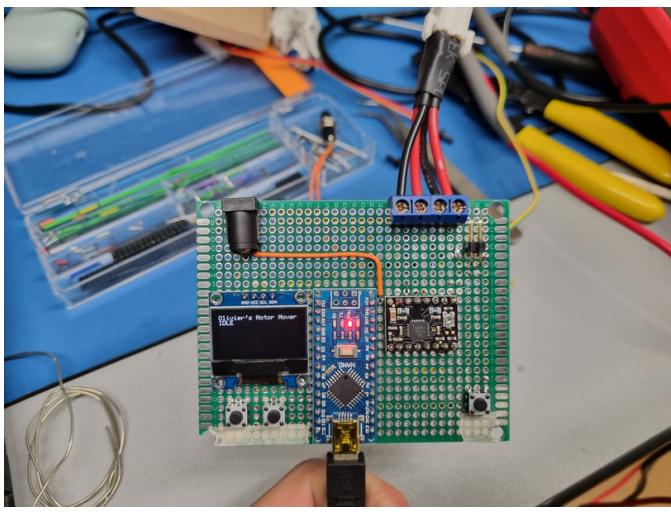
- PCB design for competitive autonomous robot (2019 International Robocup)
- Hosts stacked components such as Arduino Mega, motor shield, I2C multiplexer
- Handles I2C lines for sensor communication & pin passthrough
- Hosts high & low power voltage lines



## Capacitive Non-Contact Liquid Level Sensor (Asiga)

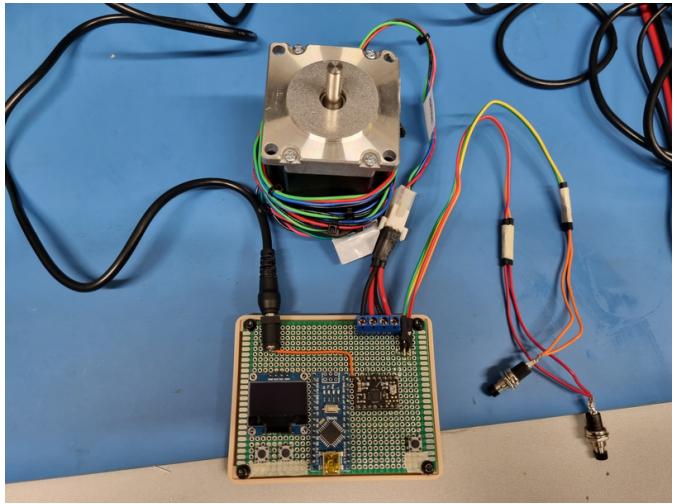
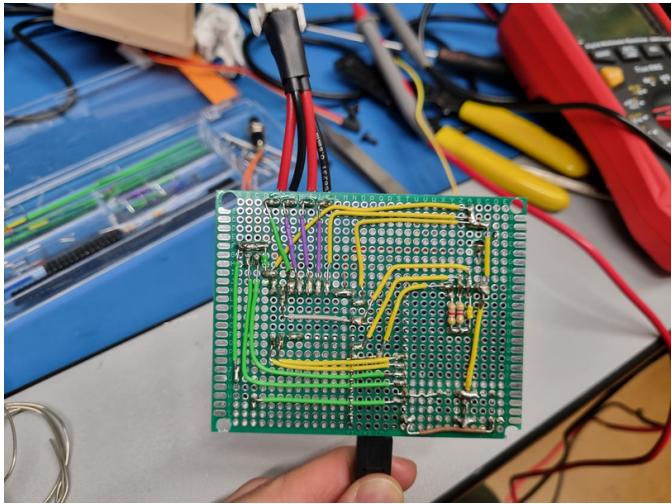
- Developed a proof-of-concept capacitive sensor for accurately tracking the level of liquids of different properties and contaminants
- Based on the Texas Instruments FDC1004 IC
- Involved PCB design, rapid prototyping and testing
- Wrote driver code & libraries for Arduino, ESP32, STM32 microcontroller frameworks
- Developed with Altium Designer & PlatformIO IDE
- Driver code @ GitHub <https://github.com/losgab/fdc1004-lls-drivers>





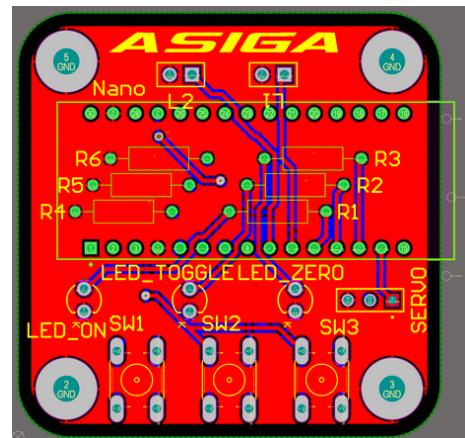
## Stepper Motor driver & testing platform (Asiga)

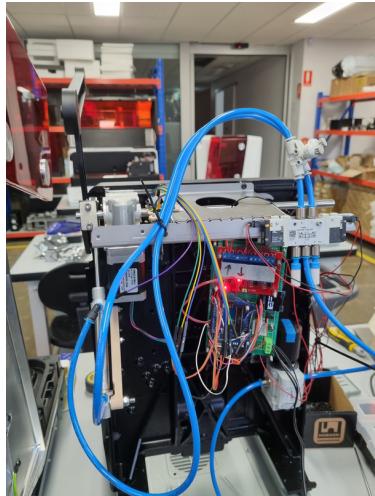
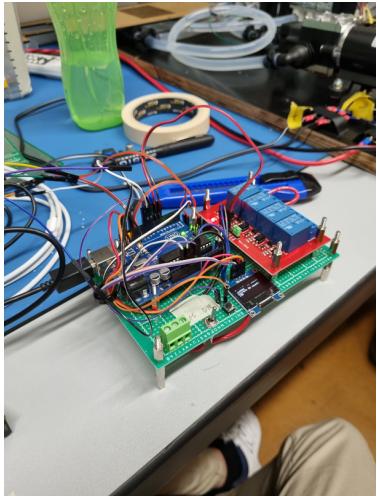
- Developed a multi-purpose driver & testing platform for 4-pin bipolar stepper motors
- Includes support for limit switches & stopping
- Includes stress testing auto & manual control mode
- Used as internal tool for prototyping unreleased products
- Used as internal tool for testing & product repair
- Built on Arduino framework



## Laser Filter Alignment Assembly Tool (Asiga)

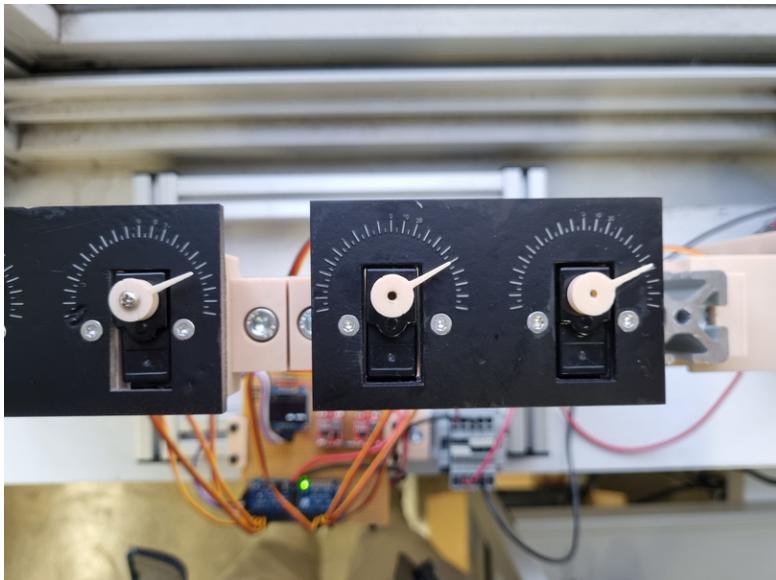
- Developed an alignment & calibration tool for assembling laser filter + servo in a resin laser-curing system
- Used for guiding adjustment of filter holder mounting on servo
- Includes line laser diodes for verifying servo position
- Includes un-seizing operation for new servos, position toggle and line laser diode toggle
- Programmed with Arduino framework, designed in Altium Designer





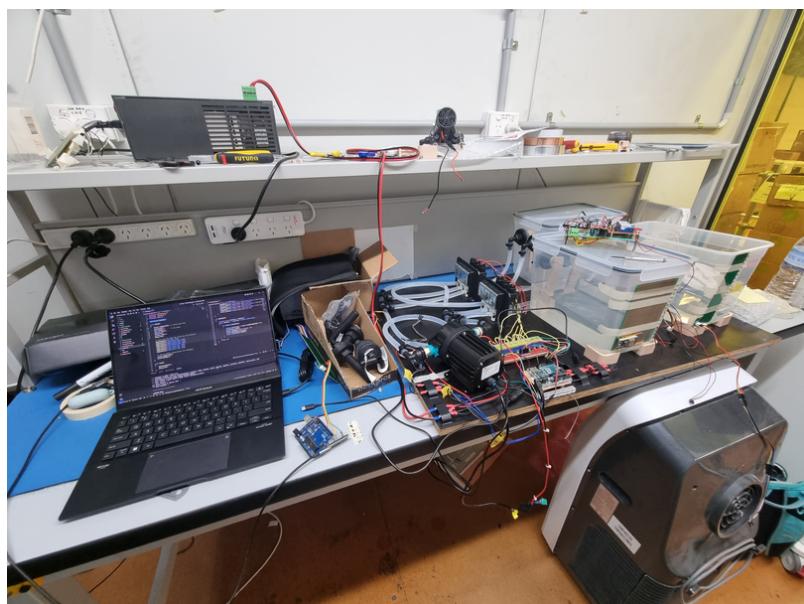
### Valve control testbed (Asiga)

- Developed a 4-relay control testbed platform for switching high power circuits
- Includes support for limit switches & stopping
- Includes auto mode for counting cycles
- Built on Arduino framework



### Servo Precision & Life Cycle Testing (Asiga)

- Developed a control platform for lifecycling servos, measuring precision & drift over time
- Built using ESP32, PWM controller, program control for modes and centering



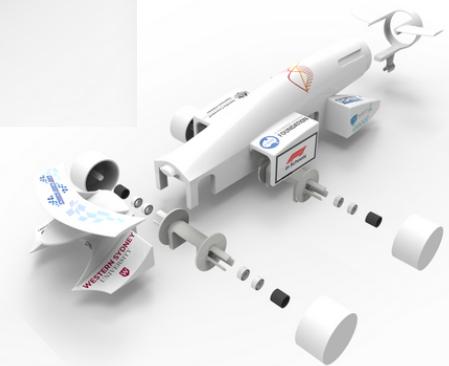
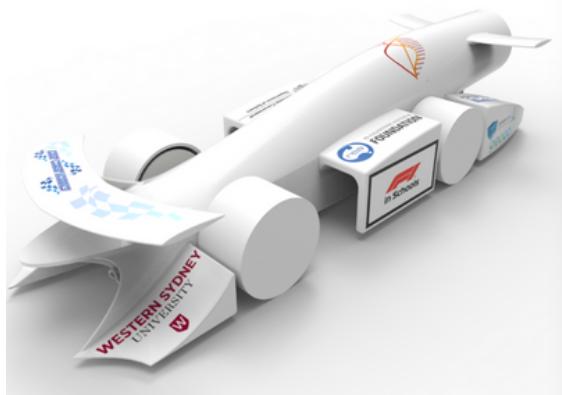
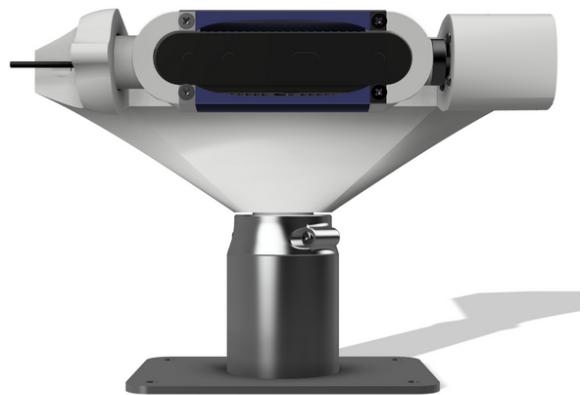
### Product Prototyping (Asiga)

- Developed prototype control software for controlling tank flow through valves
- Includes expandability for testing various sensors
- Built using relays, solenoids, pumps, Arduino framework, I2C protocols for sensors



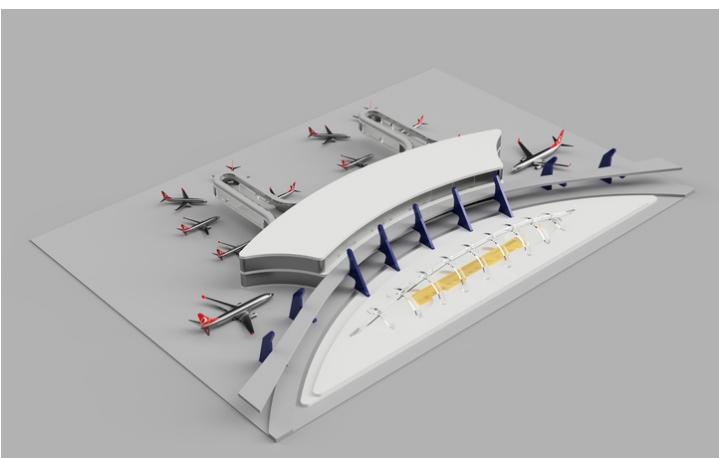
## Motorised Camera Mount System

- Designed a camera housing solution for use for rover development challenge
- Internal stepper motors allow for global camera FOV control
- Cobra-style for a primarily near field & horizon view
- Designed for Intel D450 camera



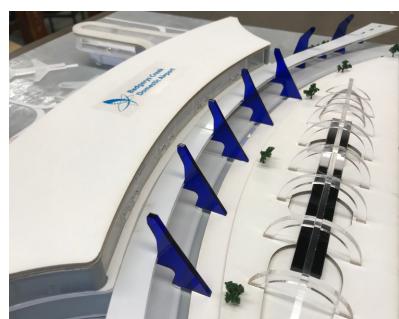
## Model F1 Racing Cars

- Designed & manufactured model F1 racing cars for gas-propelled straight track competition
- Designed in Fusion 360 using wireframe modelling technique
- Involved 4-axis CNC machining, 3D sintering & printing, mechanical assembly and finishing techniques



## Model Airport Concept

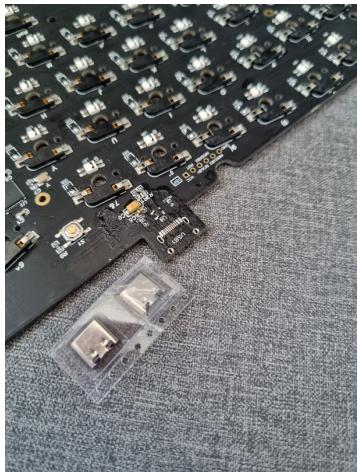
- Designed & made demo model of a modern airport terminal and train station



# bits & pieces

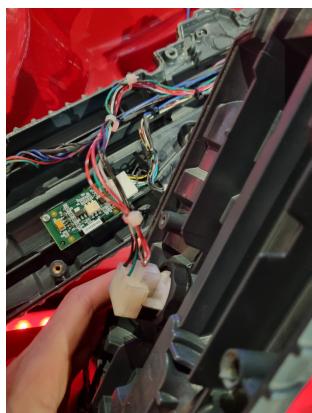
## Mechanical Keyboards

- SMD soldering & replacement USB-C port
- Built custom mechanical keyboards, modding for sound and feel with foam, lubricant and film



## Custom PC builds

- Side-hustle building custom PCs for clients
- Procured parts, optimised pricing based on market knowledge
- Handled budgeting, procurement, build process & repackaging for client



## Arcade General Technician

- involved fault diagnosis of machines and general IT systems in venue
- Involved ordering parts, disassembly, repair and maintenance
- Debugged electronics, legacy systems and mechanical issues
- Arcades are a scam. They trick you