

Joe Hughes

Project Portfolio

Rowing NZ – Computer Vision

Feb 2024 - Present

I have been developing a system using OpenCV and TouchDesigner to create enhanced graphics for Rowing NZ's live broadcasts. Rowing NZ are undertaking a long term project to create compelling live-streamed content of major regattas to improve the viewing experience for in venue spectators, family and friends at home as well as generate advertising revenue from increased viewership.

I have been a part of this program for two years as a general technical hand, but after identifying a potential value addition related to object tracking, I put together a proposal which was accepted and I was then paid for my further efforts.

The system aims to replicate the style of motion graphics used in sailing such as the America's Cup or Sail GP. A live camera feed is provided from the video switcher (a low angle drone shot is most effective). The python script then identifies the location of each skiff using a custom trained pytorch model. The image coordinates are passed to TouchDesigner, a live video application that handles signal filtering, data binding, control and animations. Speed data is collected from a GPS unit on a follow boat.

I am currently working on a system to place advertisements so that they appear within the “real world”, taking inspiration from digital paint systems used in rugby and cricket broadcasts.

This project has given me great practise in persevering through difficult challenges, self-teaching difficult tasks and utilising my existing knowledge to solve new problems in creative ways.





Monstavision – Truck Mounted LED Screens

Dec 2024 – Jan 2025

I spent the 2024-25 summer at Monstavision, a supplier of LED screens for live music, sports and permanent advertising. One of the core business assets is the fleet of flat-deck trailers with large screens mounted on them. They are driven around the country partially assembled and then construction is finished in place. The designs vary as each has been custom built to suit different needs as the business grew and developed.

Two of these trailer screens live at the South Island workshop in Christchurch and were both due for a total LED panel replacement this summer. The existing panels were approaching end of life and were becoming so unreliable that the screens were almost unusable.

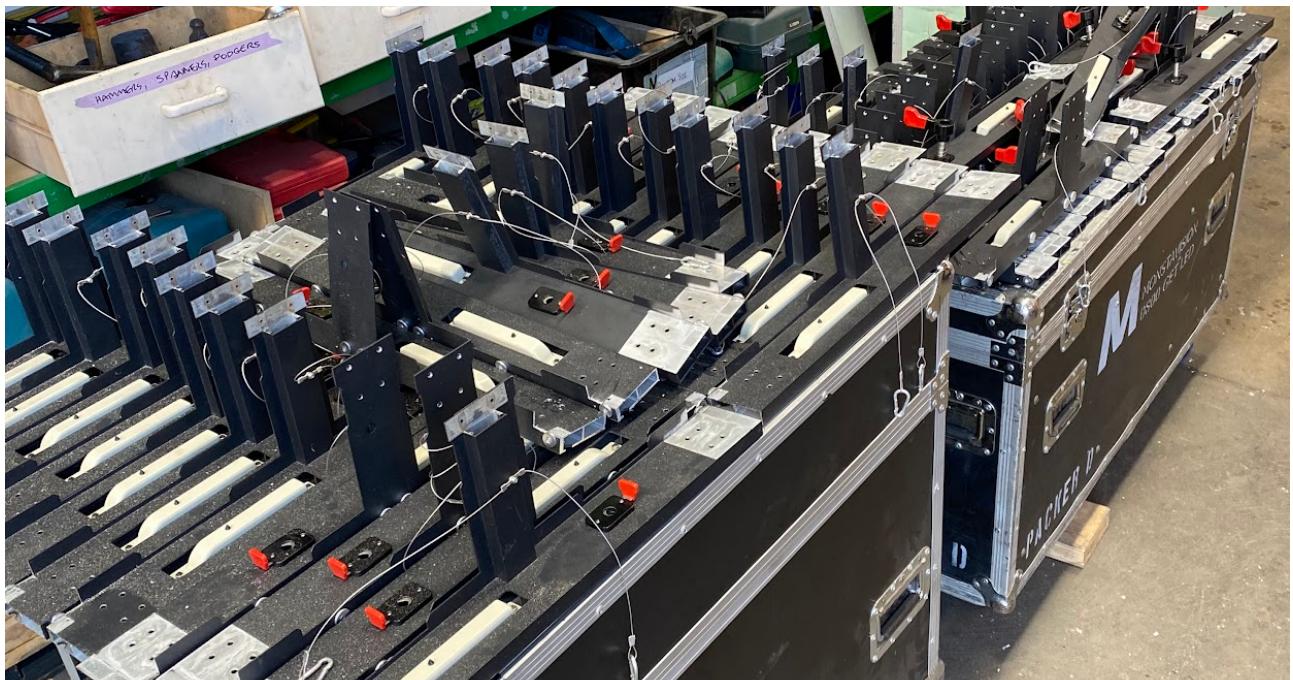
There are no commercially available panels that meet the weather resistance, size, mounting and strength requirements of the project. We instead purchased the most water-resistant panel available on the market and adapted them to meet the other requirements.

After my boss, a coworker and myself had come up with a comprehensive plan and design, myself and a small team disassembled hundreds of thousands of dollars' worth of panels, cut them down to size, drilled and tapped new holes and reassembled them as required to fit the new design. This included full reassembly of electrical distribution cabinets, including the addition of new power and data connections to better suit the new layout of the panels.

The old panels were removed from the steel subframe which required extensive cleaning and rust treatment. New mounting holes were drilled in the subframe to allow the mounting of aluminium crossbars, which we designed and made in-house. The rows of panel then mounted to the crossbars, ensuring maximum rigidity as well as providing space for power and data cables to run between the panels and subframe.

This project gave me experience creating precise parts and assemblies with imprecise tools. It also gave me opportunities to make mistakes and recover. I gained confidence working with my hands and power tools as well as an understanding of how materials behave when

worked. It highlighted the importance of prototyping to understand deficiencies or oversights in a plan or design.



Partially disassembled panel frames



Finished frames before electrical and LED re-installation



First outing with new screens – Nelson Opera in the Park

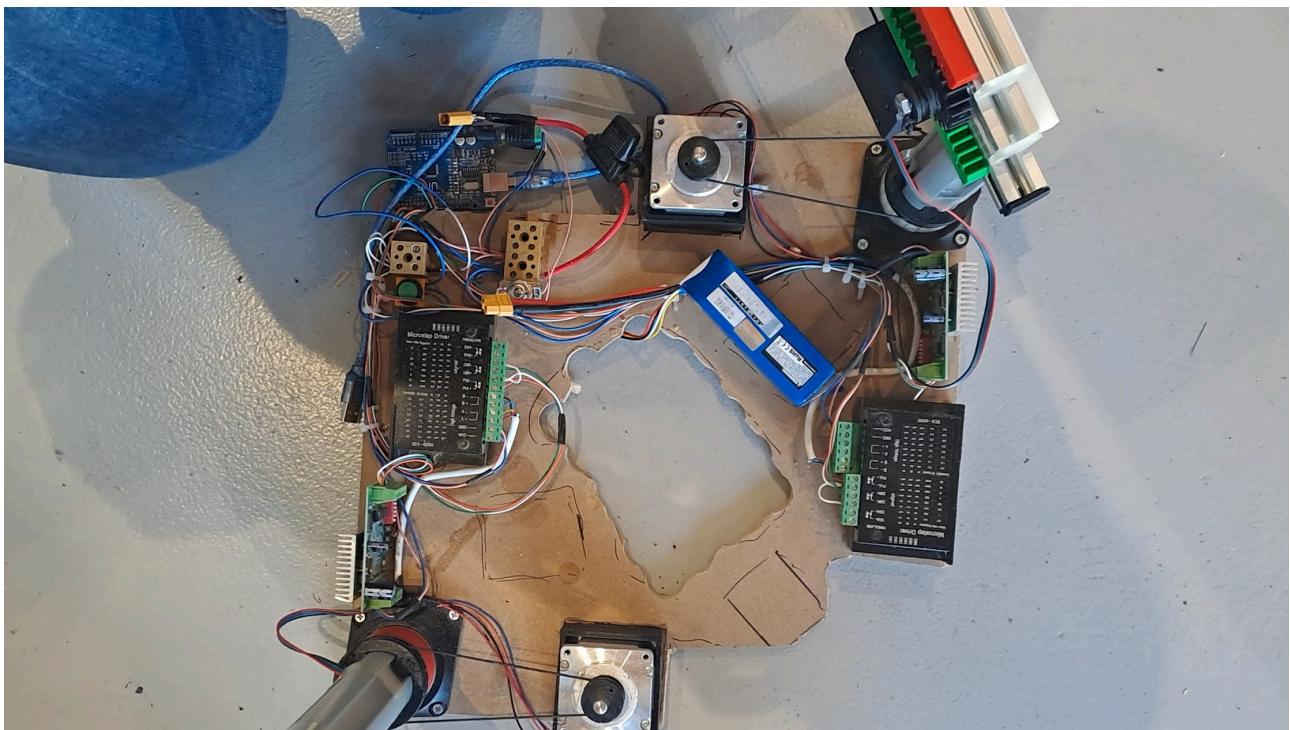
University of Canterbury – WARMAN Robotics Competition

Apr - Sep 2024

The WARMAN robotics competition is an annual event in which all 2nd year Mechanical Engineering students at UC compete. We had to design a device that was capable of achieving a given task (collecting a series of tennis balls and depositing them in a hole) while staying within size and weight constraints. Our team was keen to minimise personal spending on the project, so we sourced scrap/free materials and components as much as possible. The final cost of the device was under \$100.

This was mainly a teamwork challenge, requiring co-operation in all stages of the project. This was challenging at times, as some group members lacked enthusiasm and buy-in. I made it my personal mission to get everyone involved and excited about the project, and by the end we were all deeply committed to the success of the team. In fact, the group member who showed the least amount of interest in the early stages ended up being the only one to voluntarily pull an all-nighter to get his part of the design finished.

This project also taught me how critical it is to fail cheaply and early, so that deeply rooted issues don't creep into a later design where fixing them becomes more difficult. We found and eliminated many issues early on in the project, but neglected to keep track of the weight constraint. Nearing the end of the build, we realised we were going to be overweight. In the effort to reduce weight, we had to sacrifice a lot of stiffness which resulted in the device becoming much less reliable. This was preferable over failing the entire assessment due to an overweight device, but had we realised earlier, it could have been addressed in less detrimental ways.



Prototype / layout testing

2. GD&T AS PER ISO1101-2004.

1	Single Holder (Side)	Nathan Roberts	3D Print	1	FREE
2	Extension Gear	Self	3D Print	6	FREE
3	Aluminium V-Slot Extrusion	Self	ALEXCO	6	\$6.00
4	Alignment Slide	Self	3D Print	8	FREE
5	M6 Threaded Rod	Self	Bunnings	1	\$2.50
6	Single Holder (End)	Nathan Roberts	3D Print	1	FREE
7	Motor Holder	Toby Blain	3D Print	2	FREE
8	Motor Pulley	Self	3D Print	2	FREE
9	NEMA23	3dcontentcentral.com	Zac Persson	2	LOAN
10	Crane Pulley	Self	3D Print	2	FREE
11	Battery	3dcontentcentral.com	Zac Persson	1	LOAN
12	Arduino Uno	3dcontentcentral.com	Zac Persson	1	LOAN
13	Bearing	Self	Bunnings	2	\$6.50
14	Aluminium Bar Extrusion	Self	Scraps Bin	2	FOUND
15	NEMA17	3dcontentcentral.com	Zac Persson	2	LOAN
16	Double Holder	Nathan Roberts	3D Print	2	FREE
17	M6 Bolt	Toolbox	Workshop	2	FREE
APPROX TOTAL COST					\$60

CAD Model



Final Device