

# Project Portfolio

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CALEB BARNES

# Accurate Object Measurement from Smartphone Images

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*This project is ongoing, and specific details have been left out to respect client confidentiality.*

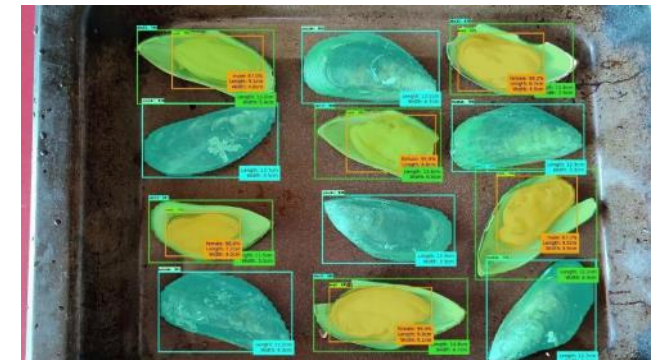
We are building a platform that predicts shellfish meat yield from a smartphone image.

Accurate harvest assessments can significantly increase yield, resulting in economic gains without increasing the environmental footprint of the industry.

The objective is to create a computer vision and machine learning algorithm that can take images from any smartphone (this would be the deckhand's phone for example) and calculate the maturity of a sub-set of mussels that represent the rest of the long-line.

Learning Objectives/Outcomes:

- Intrinsic and extrinsic camera calibration
- Client/Customer interaction
- User-friendly backend development
- Computer Vision algorithms
- Machine Learning algorithms
- Profitable solutions
- Project Management



# Autonomous Search and Collect Robot

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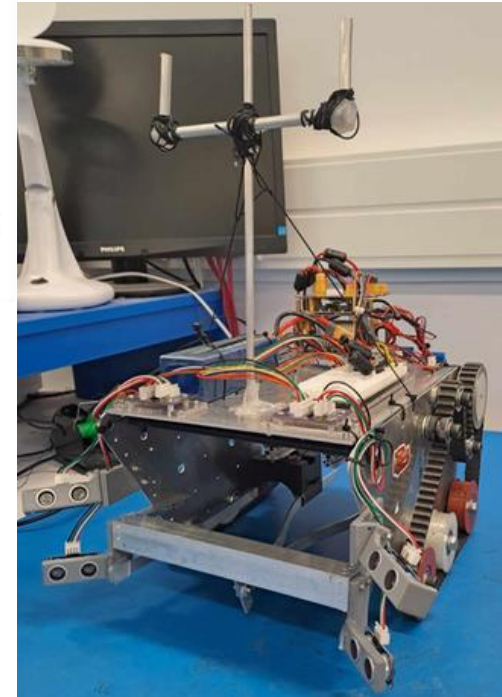
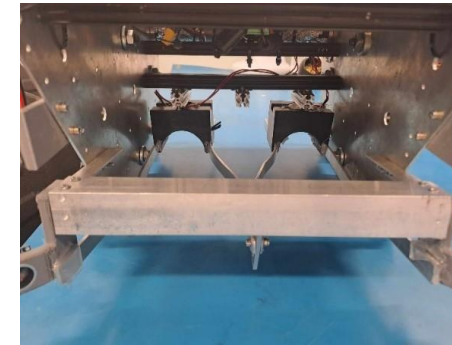
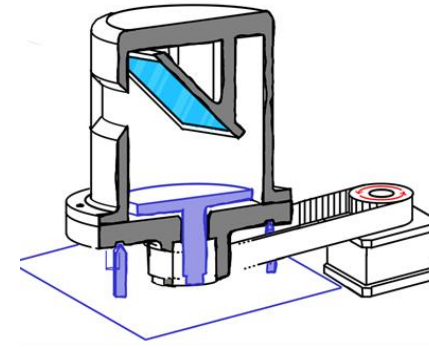
This project was the first completely autonomous robot that I undertook. The robot was made to compete in the university's 2023 RoboCup challenge.

The objective of this competition was to autonomously navigate an area and collect more of the target weights than the opposing robot. We achieved this by utilising an array of ultrasonic sensors, time of flight sensors, and a hall-effect metal detecting circuit that I made myself.

Our robot performed well and collected every weight it navigated to with 100% accuracy. The weight retrieval system was designed to be simple, static, and reliable. This system is what put our robot above our competitors which used overly-complex systems

## Learning Objectives/Outcomes:

- Team leadership
- System design tools
  - Modelling
  - Reliability and hazard analysis
  - Version control (Git)
- Signal processing/filtering
- Project management
- Utilisation of various sensors



# Line Following Robot

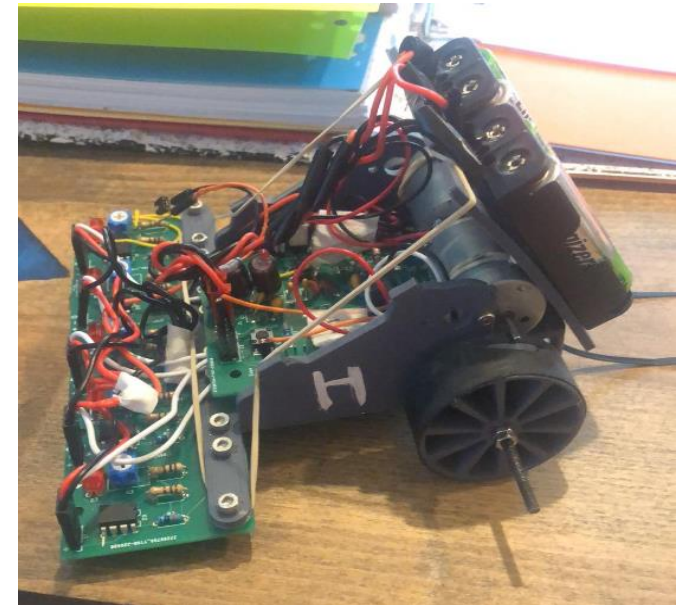
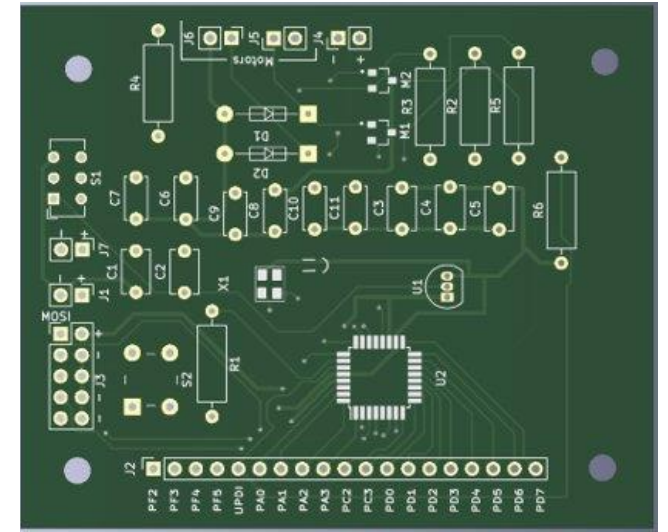
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The line following robot was the first semi-autonomous robot that I constructed. The objective of this project was to take a complete mechatronic design from inception to completion. This involved designing electrical circuits to accommodate IR sensors and a micro-controller. Taking these circuits to create to a PCB layout which subsequently got manufactured. The chassis then had to be designed and printed, finally the micro-controller was programmed in C to create a functional robot.

My robot placed 9th of the 64 competing robots.

## Learning Objectives/Outcomes:

- Usage of Git Repositories
- C/C+ programming
- Mechatronic design
- PCB/Design
- Circuit simulation
- CAE
- Algorithm design
- Realtime embedded software
- Altium Design CAE software



# Infrared Communications and Computer Architecture

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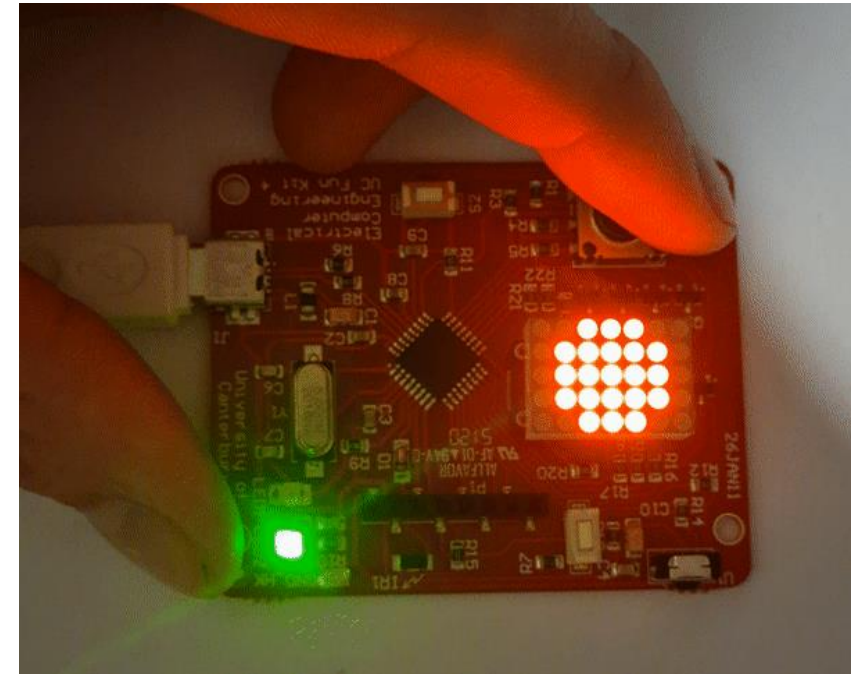
Early into my degree we were tasked with creating a programme that utilised infrared communications to interface two boards together to play "Paper, Scissors, Rock."

This was our first introduction to an embedded system and subsequently C/C+ programming.

The board provided intentionally was not able to perform all the tasks that we required. This created an interesting challenge wherein the architecture of the chip had to be considered and effectively used to achieve our desired outcome

Learning Objectives/Outcomes:

- Usage of Git Repositories
- C/C+ programming
- Effective utilisation of computer architecture
- Time management
- Collaborative programming
- Algorithm design
- Realtime embedded software implementation





# CNC Soldering Machine

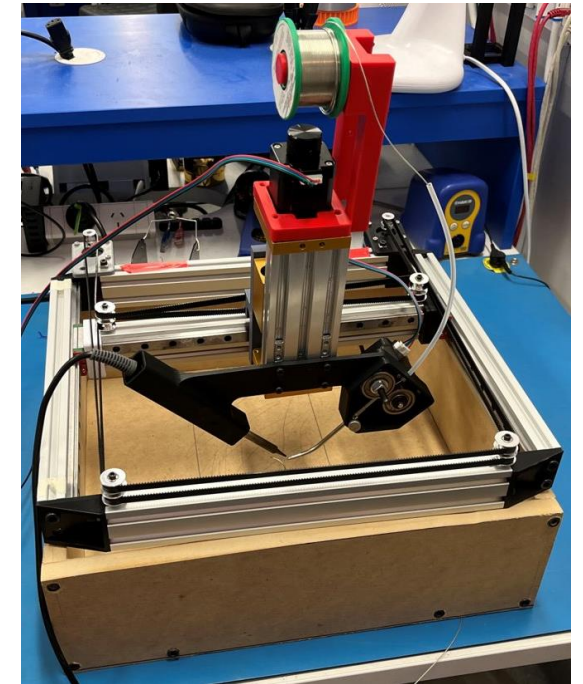
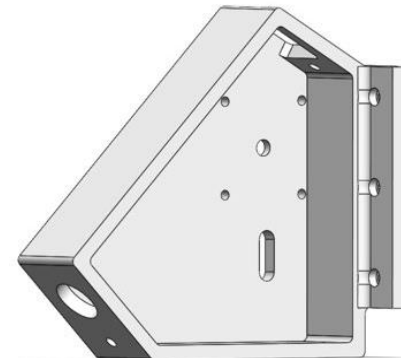
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The first project assigned to us was designing and building a CNC machine. My team specifically built a CNC soldering machine.

This introduced us to designing for specific manufacturing techniques. It also taught us how to refine our designs as well as how to analyse the possible point of failures.

Learning Objectives/Outcomes:

- CAD Modelling
- Rapid Prototyping
- Topology studies
- 3D Printing
- DfAM/DfSM
- Fault tree analysis
- Teamwork



# Practical Projects

I have always been practically minded and therefore strive to find the simplest solution to any challenge.

Because I enjoy working with my hands (and partly out of necessity) I have developed skills that often come in handy. A few examples of this are designing and building a lightweight stern anchor to partially rebuilding an engine and replacing its head gaskets.

There are countless more examples that go undocumented, I work hard to simplify every process in my life.

## Learning Objectives/Outcomes:

- Low-cost solutions
- MIG/TIG/Stick welding
- Metalwork
- Machining (lathe and mill)
- Project management
- Self-driven learning
- Task identification and breaking complex systems to their root

