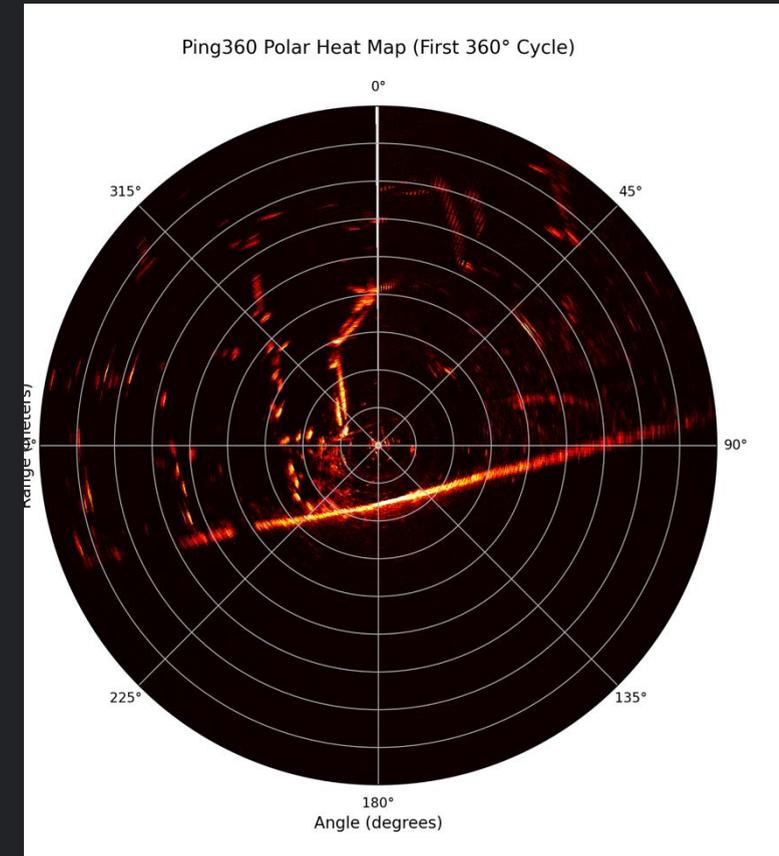
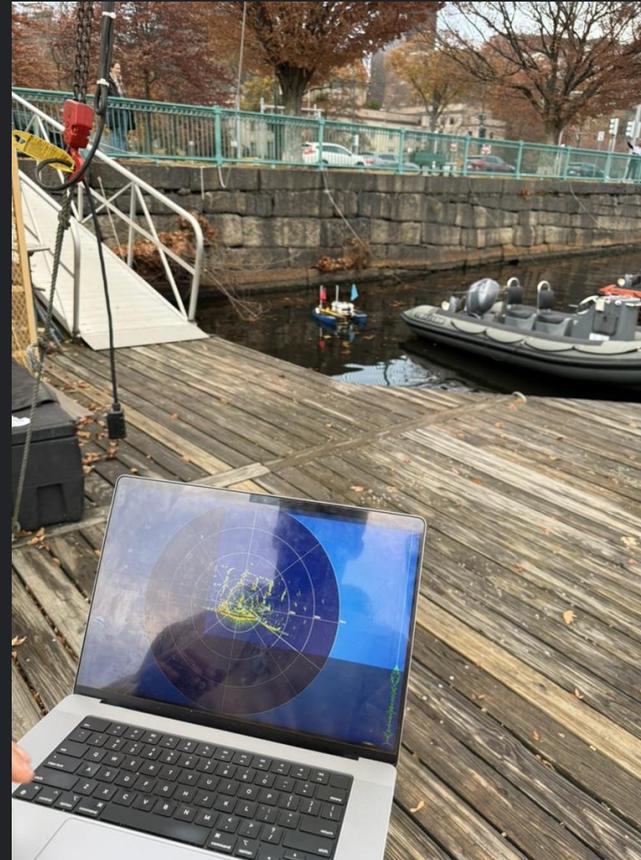


Seth Robles: Mechanical Engineering & Robotics Portfolio

See more at my website <https://sethrobles.github.io>



Marine Autonomy Lab: Ping360 Integration



C++ Library

Wrote code for a c++ library to interact with Ping360 firmware communication protocol

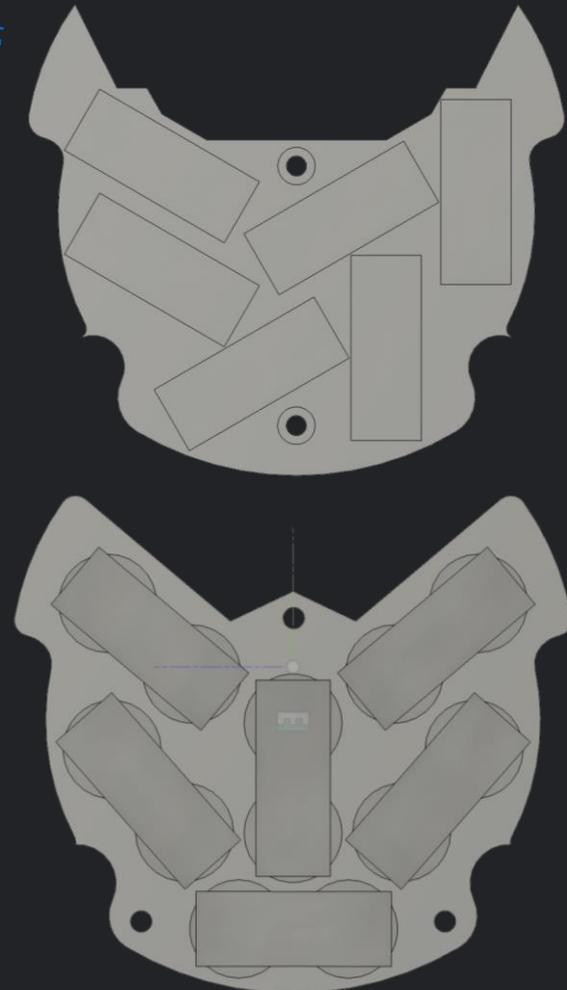
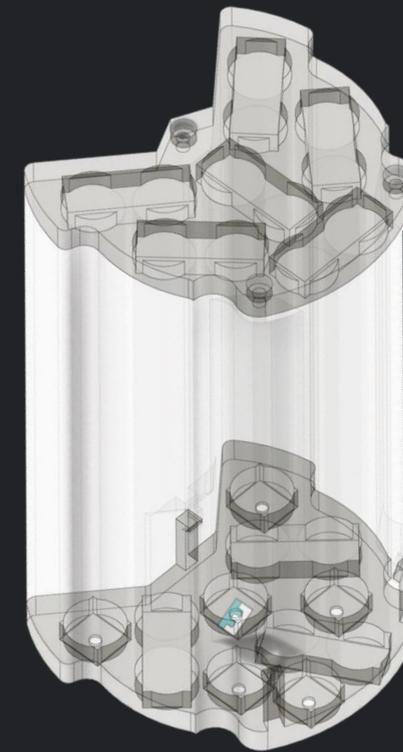
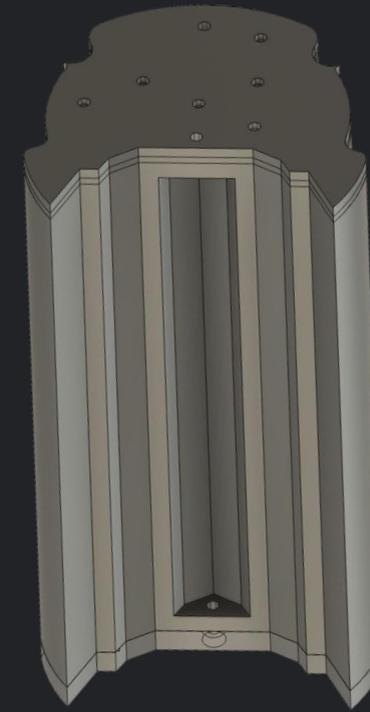
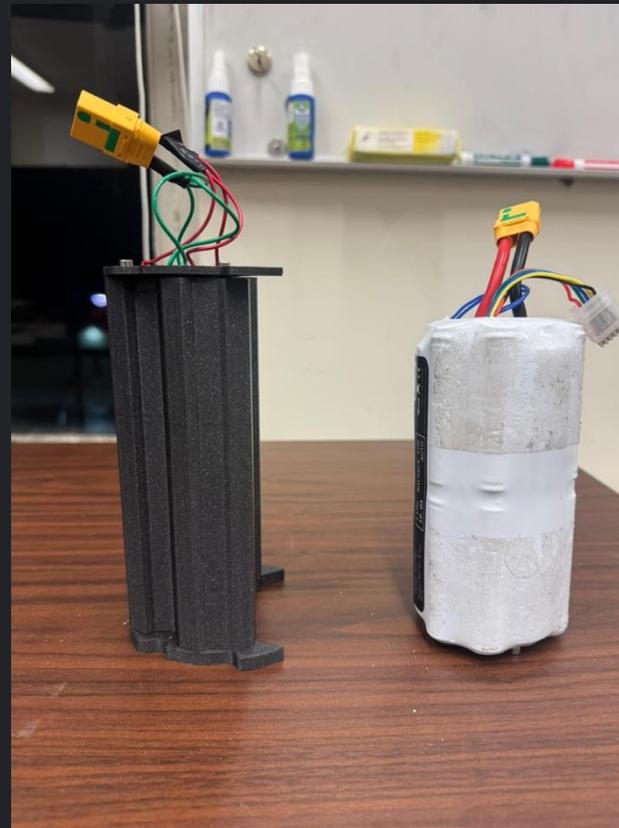
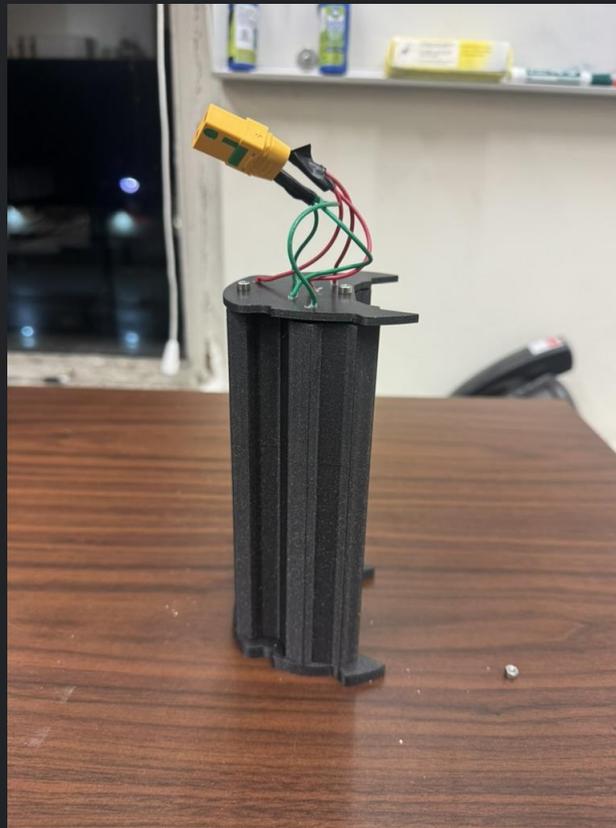
MOOS-IvP Integration

Used developed c++ library alongside MOOS-IvP to create a Ping360 app for logging sonar data

Future Goals

Develop mapping and SLAM tools to work for object avoidance and mapping of the Charles River

Marine Autonomy Lab: AA Battery Pack



AA Battery Pack

Designed a 12s3p AA battery pack for low resource and high-risk environment

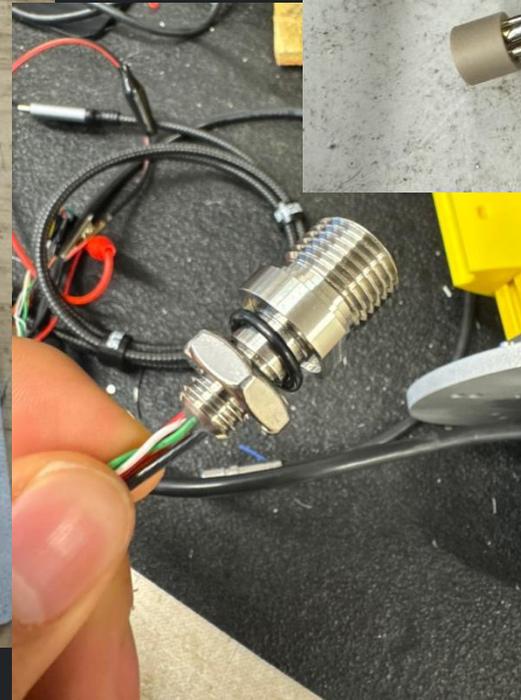
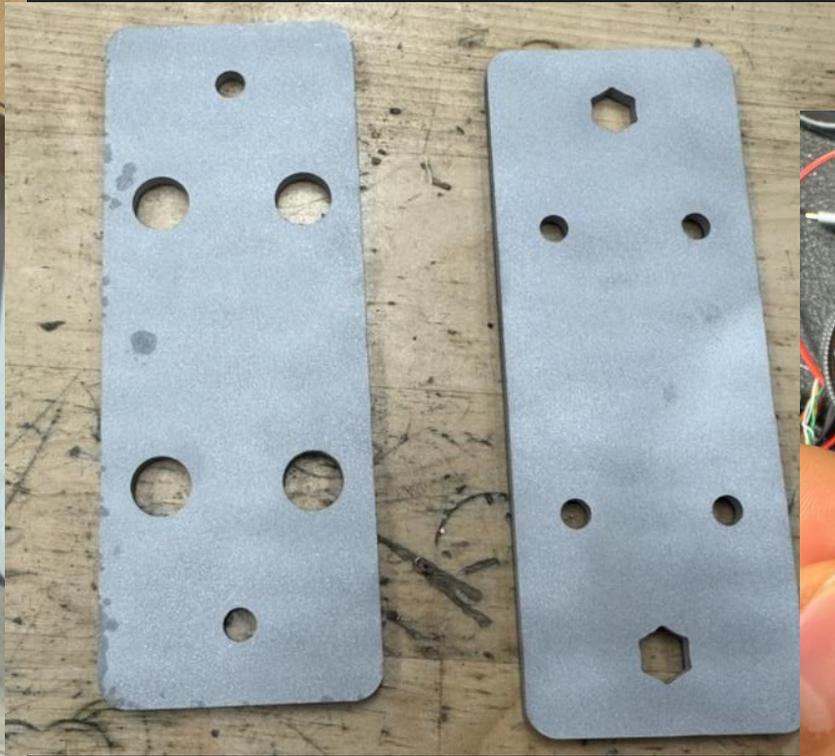
Spurdog AUVs

Designed to fit in a 16-cm space, giving only 1 cm of clearance for design

Skills Used

Fusion 360 (Lab Standard), soldering, FDM Printing

Marine Autonomy Lab: Additional Hardware



Mounts

Waterjetted and CNCed mounts for Ping360 and BlueBoat radios

Ping360 Cable Termination

Converted and potted a Ping360 cable to work with BlueBoats Blue Trail termination kits

Skills Used

Waterjetting, potting cables, CNC milling, tapping

FIDL: Suction Tank Track Robot



Suction Tank

A self-contained 3D printed suction tank developed to work with suction cup arrays



Frame Iterations

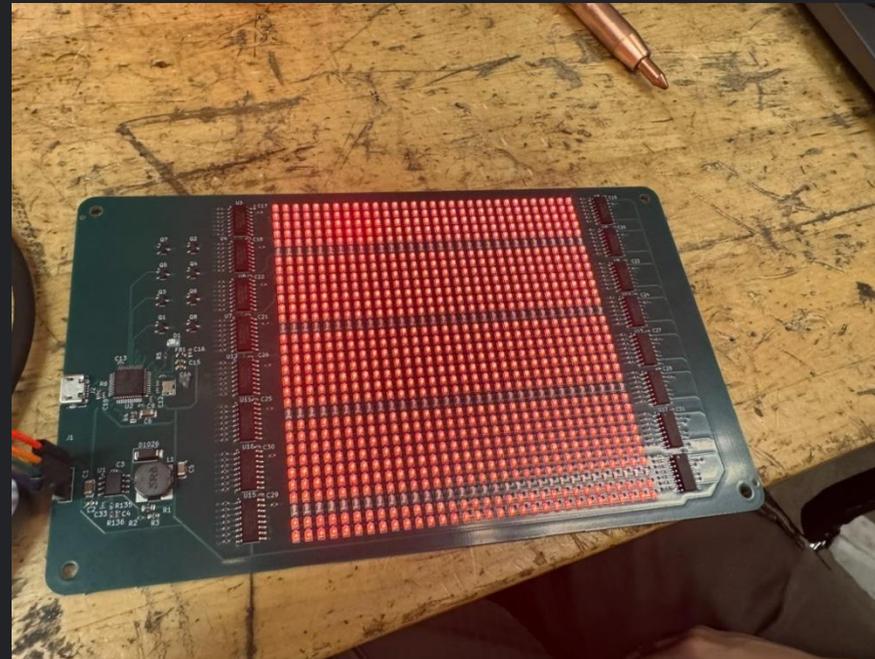
This project involved a lot of iterations for designing the frame to improve track movement



Gear System

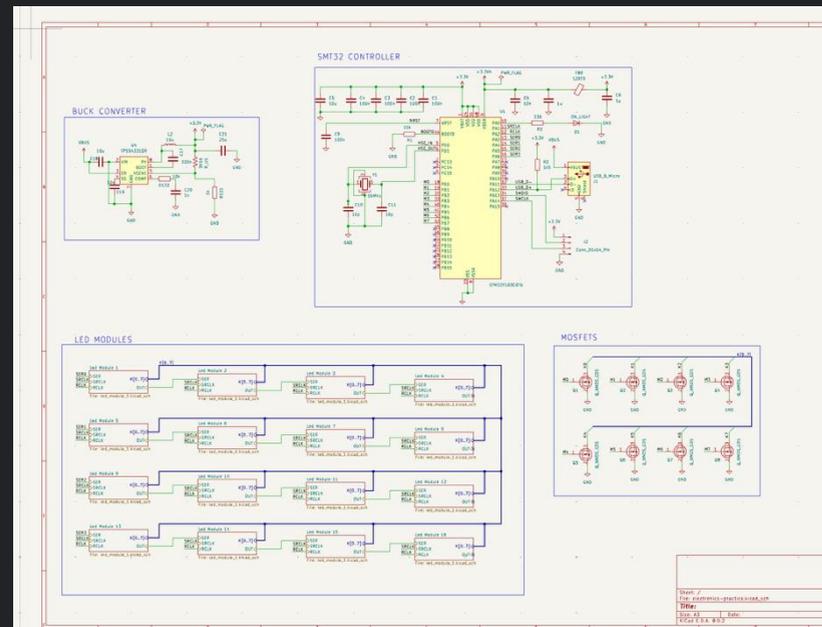
The gears were consistently refined to mesh better with the track and limit alignment issues

Personal: LED Array PCB



LED Array PCB

A 4-layer PCB developed in KiCAD as a gift flashed with an ST-Link as a gift for my girlfriend that flashes icons



KiCAD Design

My first design in KiCAD, this design used hierarchical designs alongside many LEDs, NFETs, and a buck regulator



Firmware Programming

The PCB was flashed with an ST-Link with firmware written in STM32CubeIDE

2.00 Library Tracker



Project Description

Analog system requested by librarian to keep track of students' activities in class

User Requirements

Required to be robust, built from wood, 'aesthetically pleasing' and intuitive

Skills Used

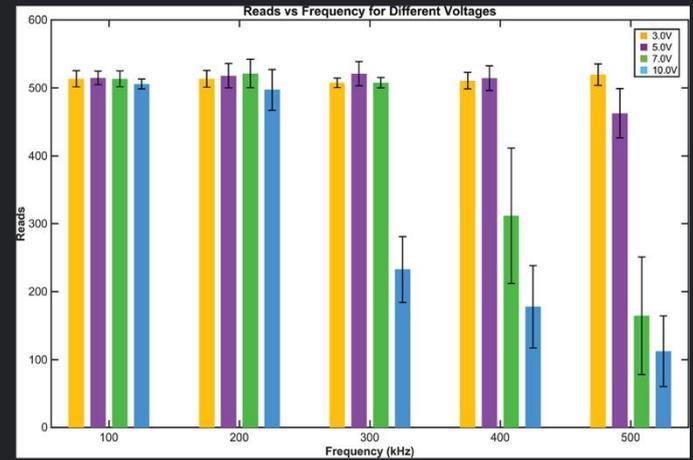
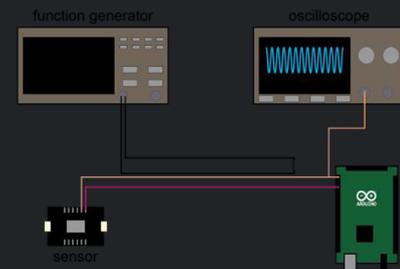
Onshape, Arduino, C++, Soldering, lasercutting

2.671: EMI Investigation

EMI STRUGGLES



EXPERIMENTAL SETUP



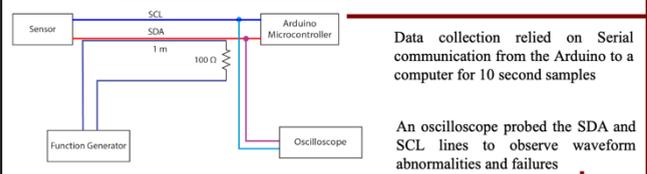
Abstract

Modern robotics oftentimes requires packing of electronics, making digital communication lines increasingly vulnerable to electromagnetic interference (EMI) from nearby components. This project investigated how EMI disrupts I2C communication between a microcontroller and a sensor. This microcontroller and sensor were laid near a cable loop driven by a function generator, which resulted in **coupled sinusoidal noise** of varying frequencies and amplitudes onto the I2C data line. The communication rate fell from a **nominal 50 Hz baseline** in standard conditions to a minimally observed 10 Hz at high disruption voltage and frequency. There is a significant drop in performance, with higher voltages having a drop in communication integrity.

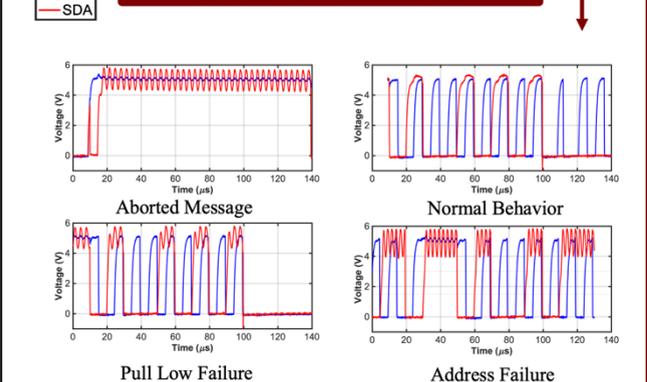
Basics of Serial Communication and I2C

I2C is communication bus protocol used frequently in robotics between microcontrollers and peripherals. It uses a shared (SCL) and data line (SDA) with open-drain drivers and pull-up resistors, so devices pull the lines low and the resistors restore them high. Communication is organized into messages by START and STOP conditions, followed by 8-bit data bytes and an ACK or NACK bit from the receiver.

Experimental Method

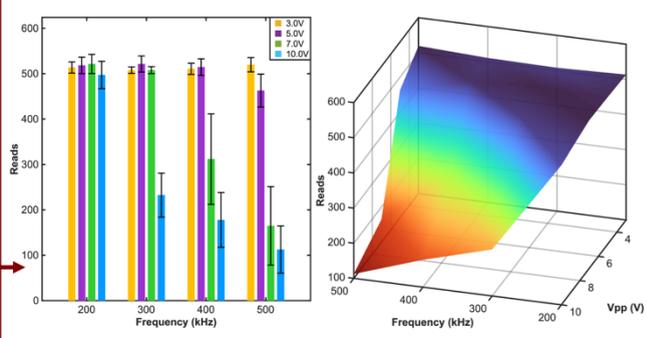


I2C Observed Waveform Behaviors



Results

Arduino Reads within 10-second Time Frame



Conclusions

- From the waveform data, **3 modes of I2C failure** were observed, which corresponded with literature understanding of I2C communication failures due to EMI coupling
- At higher voltages and frequencies, **communication reaches a catastrophic shutdown**, with no back-and-forth communication between the IMU and microcontroller and requires constant rebooting
- At low voltages (3 and 5 Vpp), there was no significant change in communication integrity over a 10 second time frame
- Further work may involve a more rigorous characterization of failure modes, especially relating to the restart issues observed at catastrophic levels of interference

Acknowledgements

Thank you to Dr. Hughey, Dr. Hover, Dr. Halm, Dr. Chin, and Mr. Banzaert for guidance and feedback essential to the project

References

[1] Image: "Microcontroller Icon". Flaticon (licensed under Free License with Attribution). Available at https://www.flaticon.com/free-icon/microcontroller_2752877.

Project Description

Analyzed the impact that wire cross-talk could have on I2C communication reliability

Experimental Analysis

Observed both waveform level data and computer reads to interpret I2C communication failures

Technical Communication

A poster and paper were written as part of the requirements of the cover

2.12 UR5 Pick & Place Robot



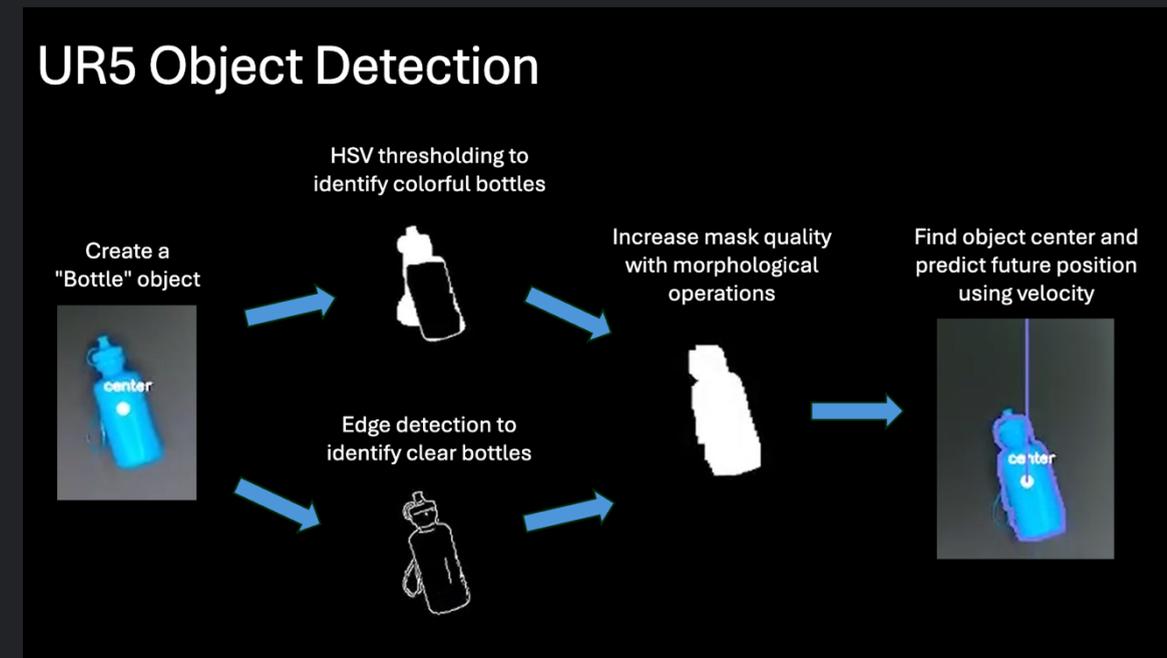
Project Description

I was a project lead for 5 upperclassmen designing a pick-and-place robot with a UR5



User Requirements

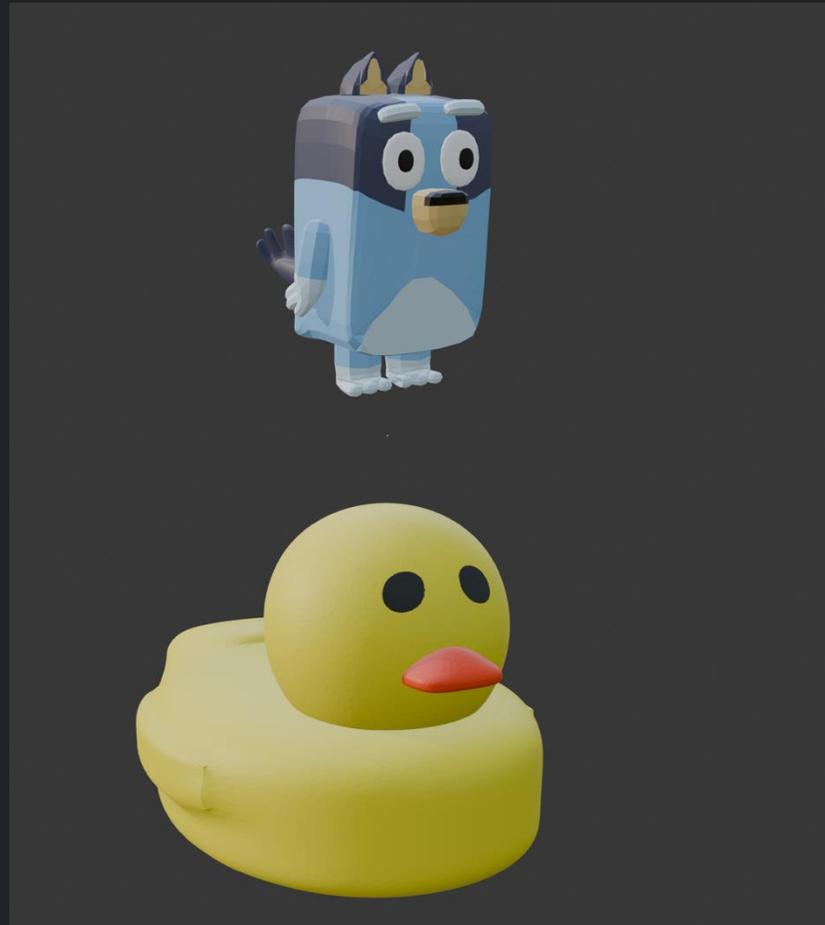
Managed team members, ordering components, and distributing workload



Contributions

Worked on autonomy and object detection, as well as the vacuum gripper –simple but consistent

Miscellaneous



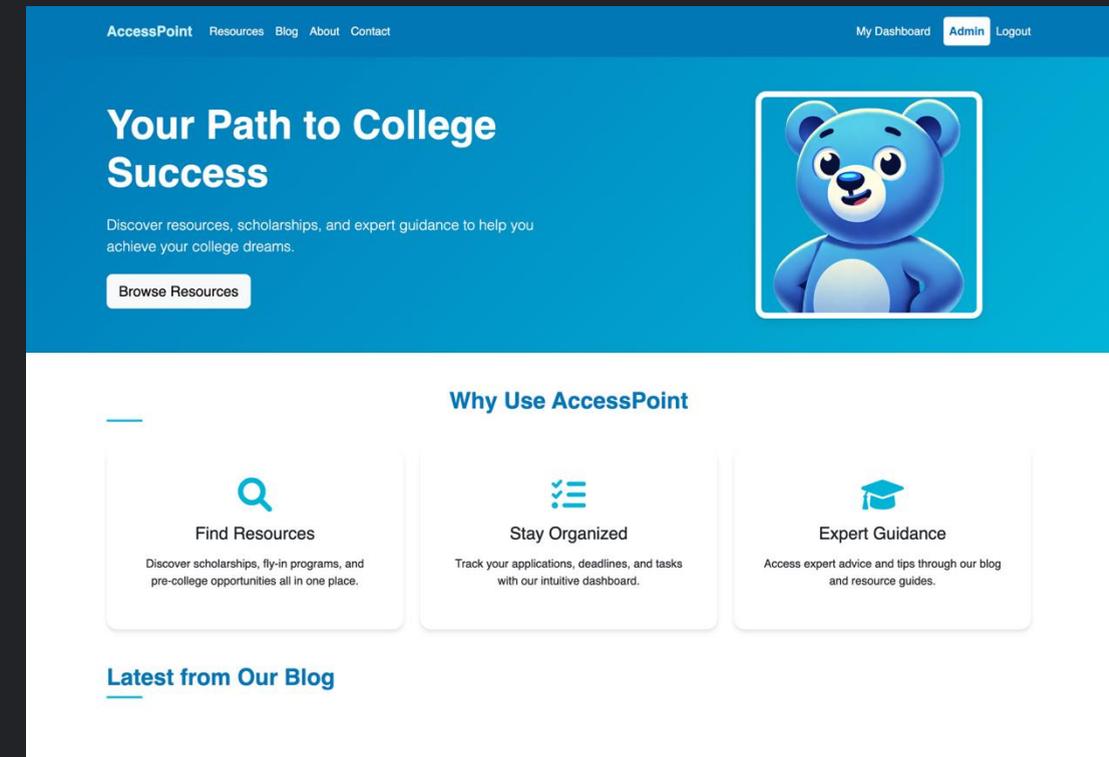
Blender Development

I recently got into making figures in Blender that I intend to print as gifts for friends or making animations



LED Acrylic Sign

A gift for friends currently in progress (a lot of soldering is required), this sign will be a lit up blue for residents of Burton 1 who call themselves B1ners



AccessPoint

A flask website made by a friend and I (now taken down) to help first generation students apply to colleges