



Autonomous Coffee Delivery Capstone

By Nathanael Martin

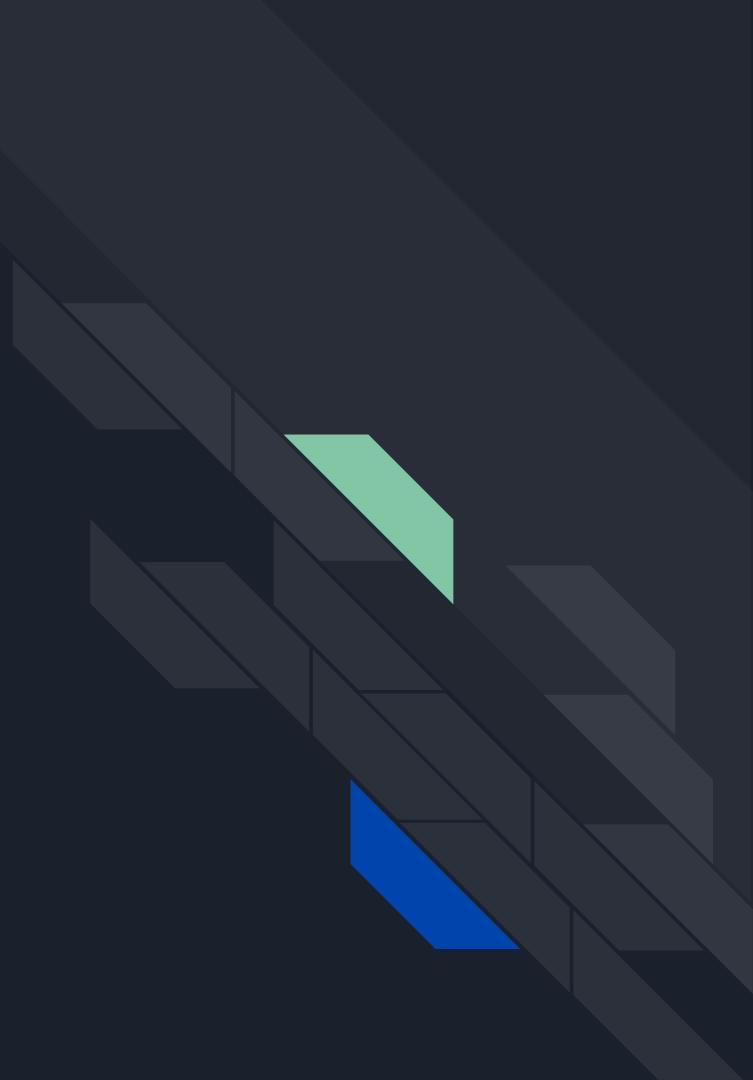
The Plan

How It Started

Materials

Assemblies

Programming





The Beginning

The Autonomous Coffee Delivery Capstone was started by Rachel Divine

It was inspired by the food delivery services that use robots on college campuses





The Problem

These college campus delivery robots are highly expensive, and for good reason

- They must travel outdoors
- They have to be able to integrate with various restaurants
- They have to be weather resistant



POSTMATES





Differences with our situation

01

Our robot will function entirely indoors, meaning that it will not have to be made to ride on multiple different surfaces. This will limit the ways its autonomous navigation may work in however.

02

We will not have to make the robot work with such a variety of restaurants, which will make it able to be more customized. However this will require a large amount of programming solutions to integrate with the school's tech ecosystem.

03

Because we do not need to be weather resistant we can lower the cost of parts; However, due to it being inside a school it still needs good mechanical resistance to impacts from students.



Where I'm Starting

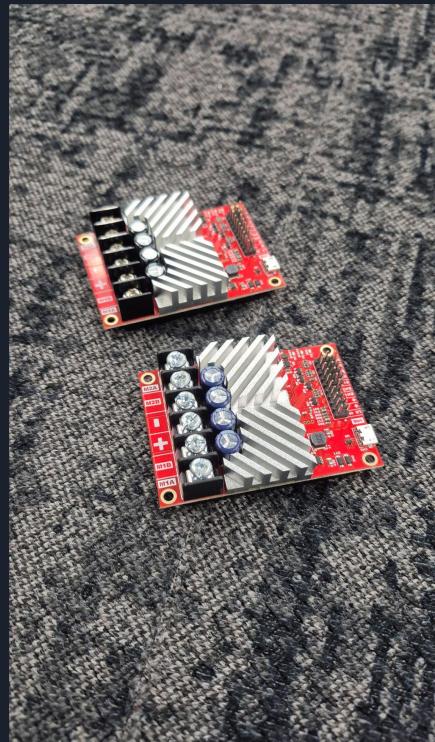


Rachel Divine during her Capstone year did fundraising and purchased some of the parts for the robot.

I arrived expecting a physical robot to be built, and for my responsibility to be adding automation and programming.

This has required me to go outside of my area of expertise to focus on hardware, rather than the software side.

Ordered Parts





Part Choice



For all parts inside this build I am going over the necessary specs to increase durability and lifespan of the project

I want this to be something that I make, and can survive multiple years without getting maintained by anyone - in case there is no one in the high school without the skills, and because I don't want to burden someone with it





Wheels

Hi-Grip Endura Wheels

For the wheels, Hi-Grip wheel where chosen from andymark due to them having a max holding capacity of 80 pounds and offering a great grip on the highly slippery concrete floor of the OIC.





Chassis Beams

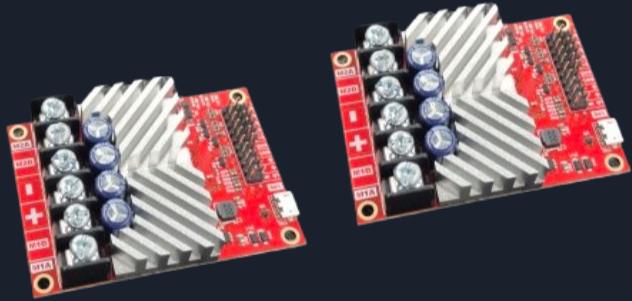
Aluminium Extruders

Aluminium Extrude where chosen to be highly durable, replaceable, and they were able to be gotten for free from a previous years competitive robotics arena setup



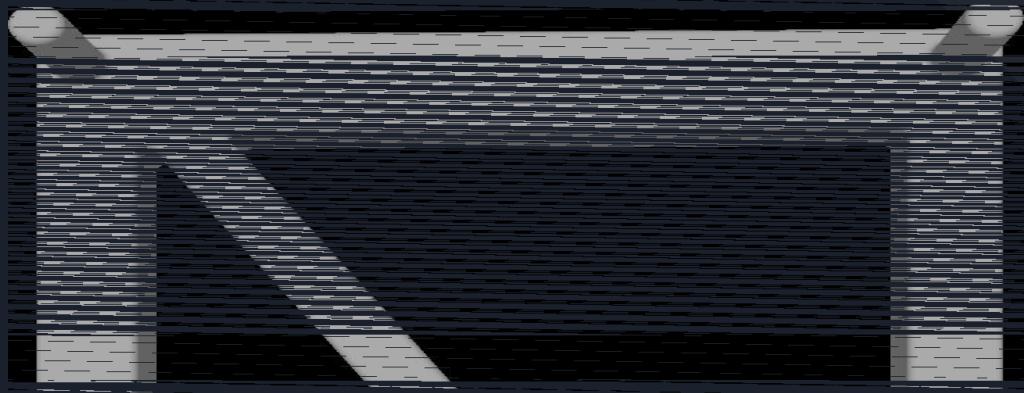
Motor Setup

Encoders, Motors, and Controllers



For the motors planetary gearboxes where chose to be able to increase the torque to be able to make it through the OIC, while also decreasing the maximum speed to a safer level. Each motor is using hall-effect magnetic encoders to keep an accurate track on position for higher accuracy localization, and the motor control boards also support breaking for rapid deceleration

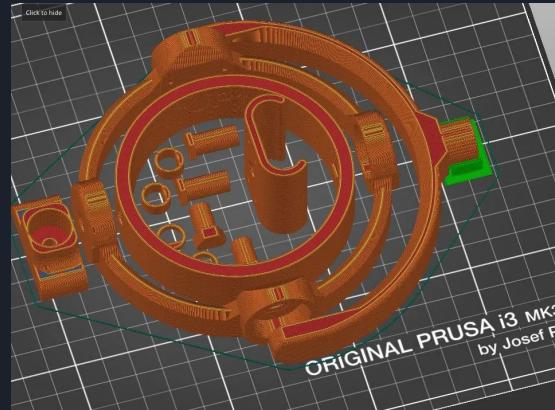
Historically groups have forgotten to get ones that support breaking which can lead to dangerous overheating and even explosions



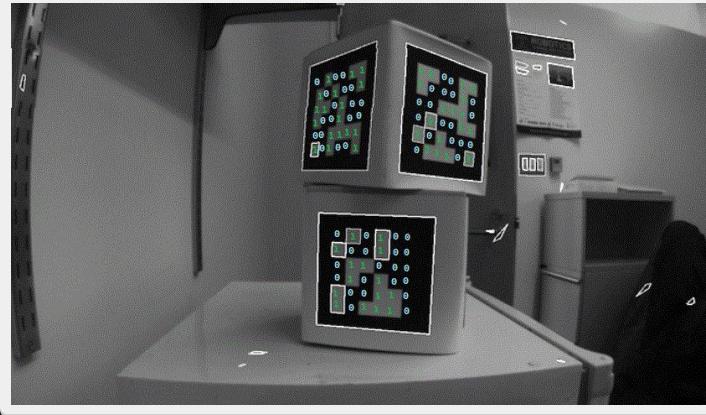
Assemblies

The goal for the robot is to have three main assemblies

- The chassis and mobility system
- The on board processing unit and coffee holder
- The external processing server



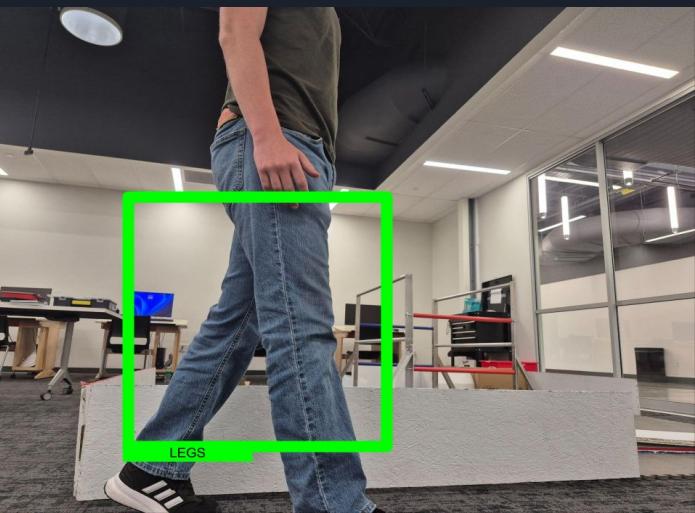
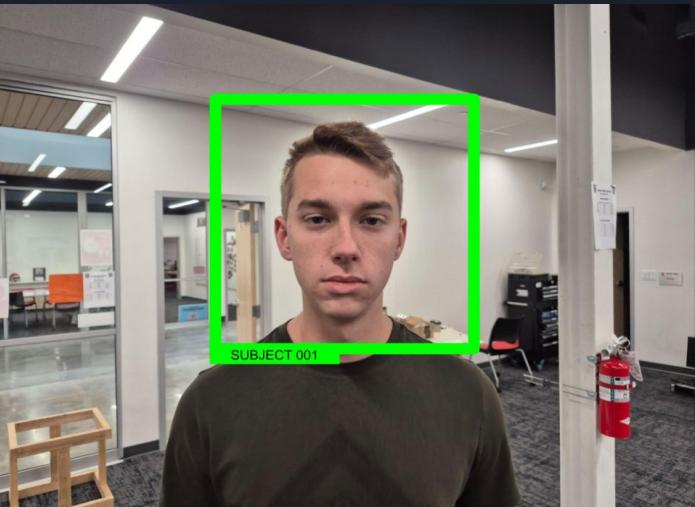
April Tag Detection



April tags are effectively miniature versions of QR codes, in which a camera, upon knowing its size, can detect where the camera is because of the how it is misaligned, and the size that it appears on computer



AI IMAGE RECOGNITION



For the robot to work effectively it needs to be able to avoid colliding with objects, and to be able to unlock upon delivering coffee to the correct person

Without using highly expensive Lidar sensors, artificial intelligence image recognition is the key

Potential Alternative

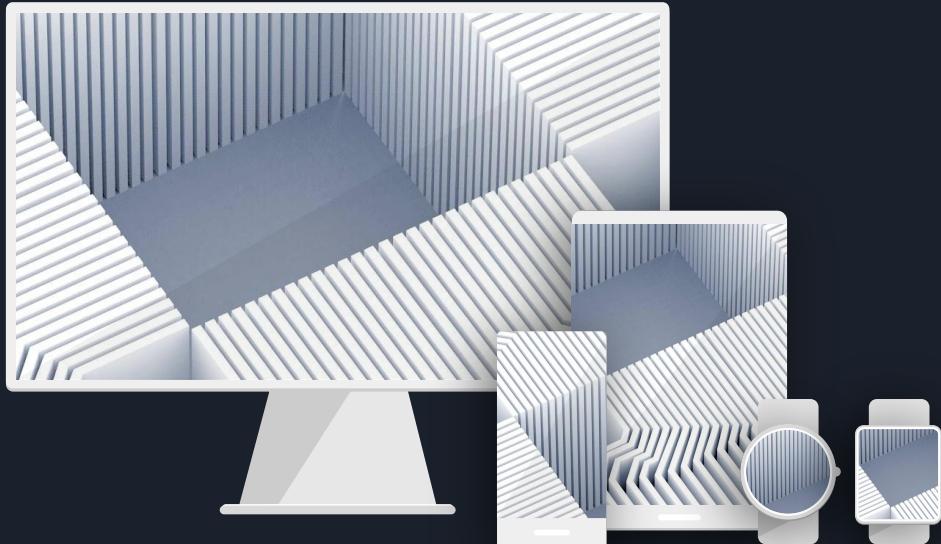
Using a pivoting distance sensor we could determine if there are any objects in the course - and we could use a keypad where people enter in there passwords

Likely this will be what happens at the start, with image recognition being something someone could add in later



Questions?

Any questions?



Thank you

