

AUTONOMOUS FORKLIFT ROBOT

BY:

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PROJECT GOAL

- Use Improved sensors and feedback control
- Create a more efficient forklift system and replace the claw
- Create an efficient/cost effective mechanical design
- Use computer vision with PixyCam to detect boxes and shelves.
 - Color Coded system.

SOLUTION

Robot Detects
a Color
Coded Box

- Robot moves to box
- Pick up designated box

Robot Detects a
Color Coded Shelf

- Robot moves to shelf
- Robot aligns box with shelf and drops off the box.

Robot Searches
for Another Box

MATERIALS

Pixy
CMUCAM5
Camera

Adafruit
VL53L0X
Laser Sensor

Arduino Uno

Adafruit
Stepper/Motor
Shield V2.3

4 DC Motors

Elegoo Smart
Robot Car
Frame

4 AA Battery
Case

Limit Switches

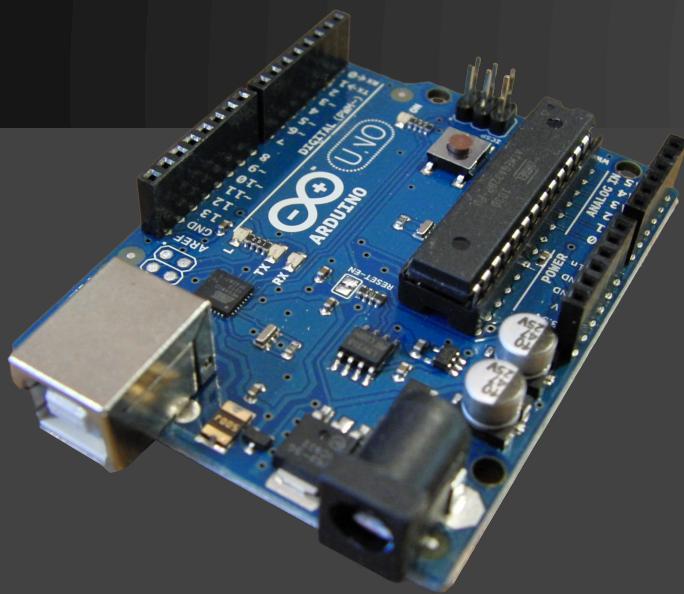
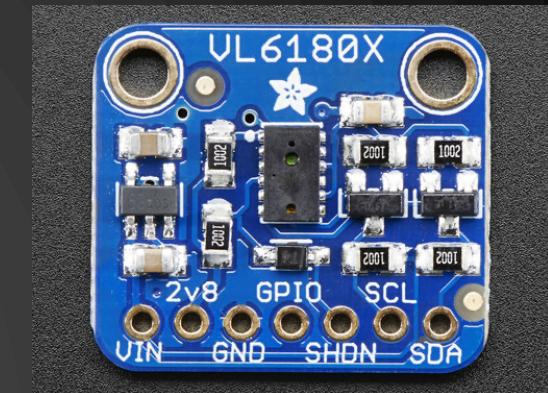
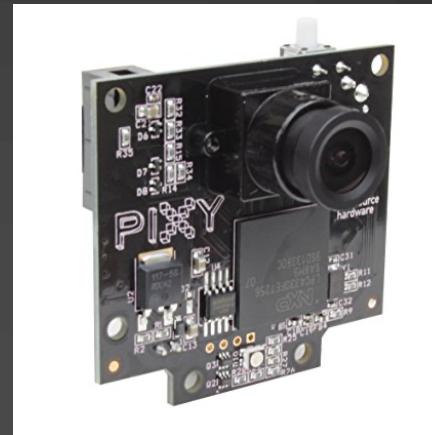
Raspberry Pi 3

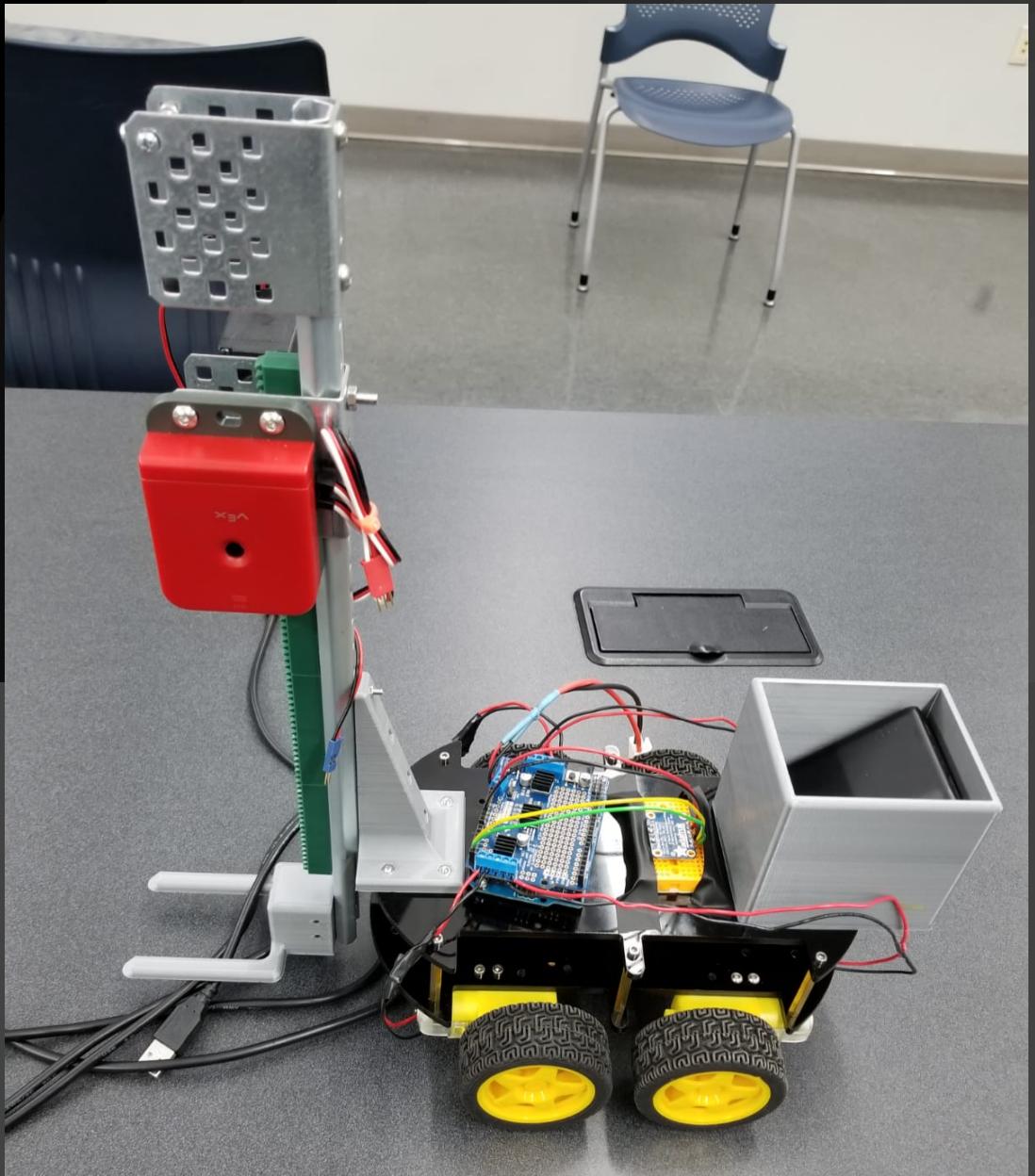
BNO055
IMU

VEX Battery
Packs

Elegoo
18650 Battery

SENSORS And Microcontrollers



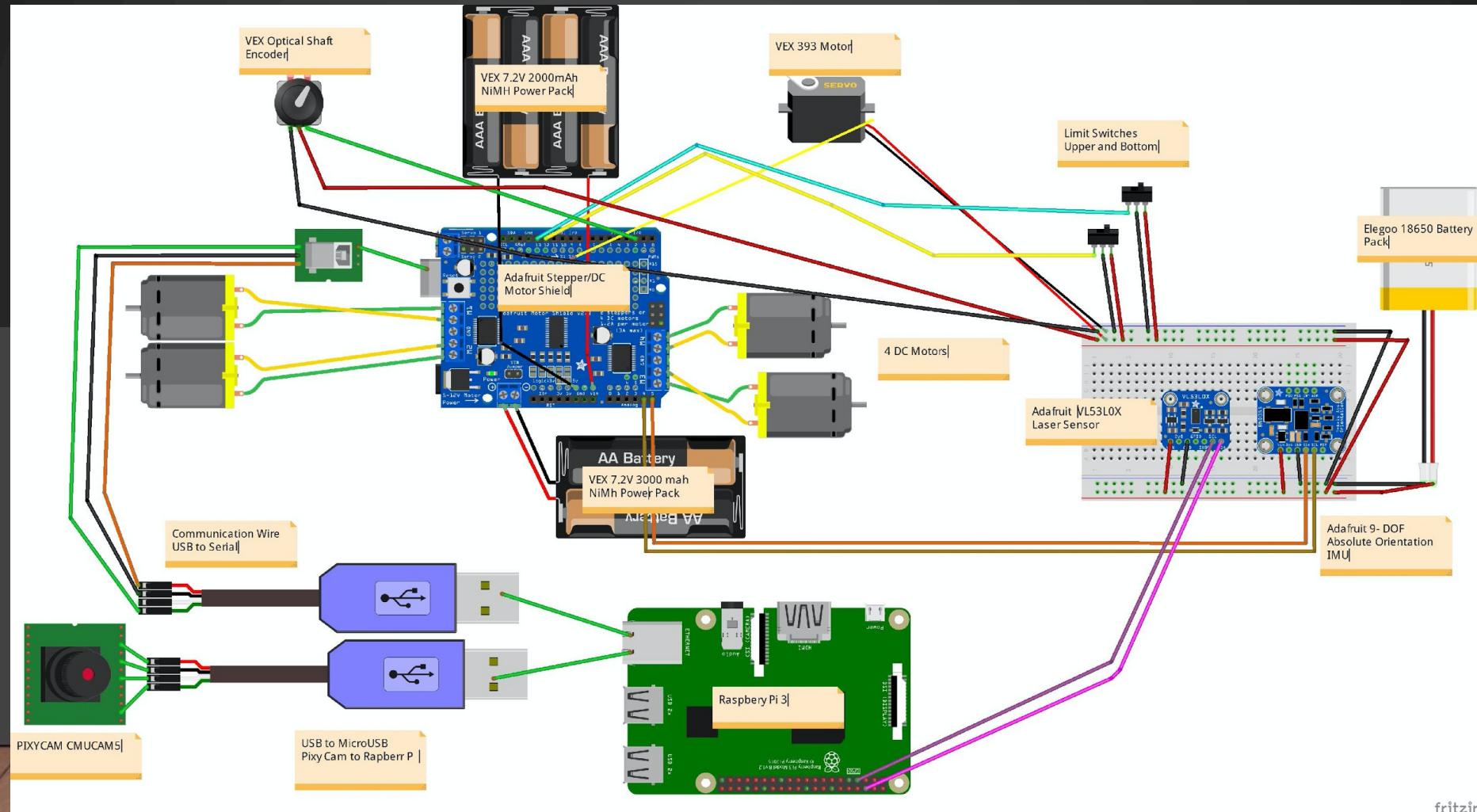


DESIGN



- Color Codes to reduce false positives

WIRING DIAGRAM

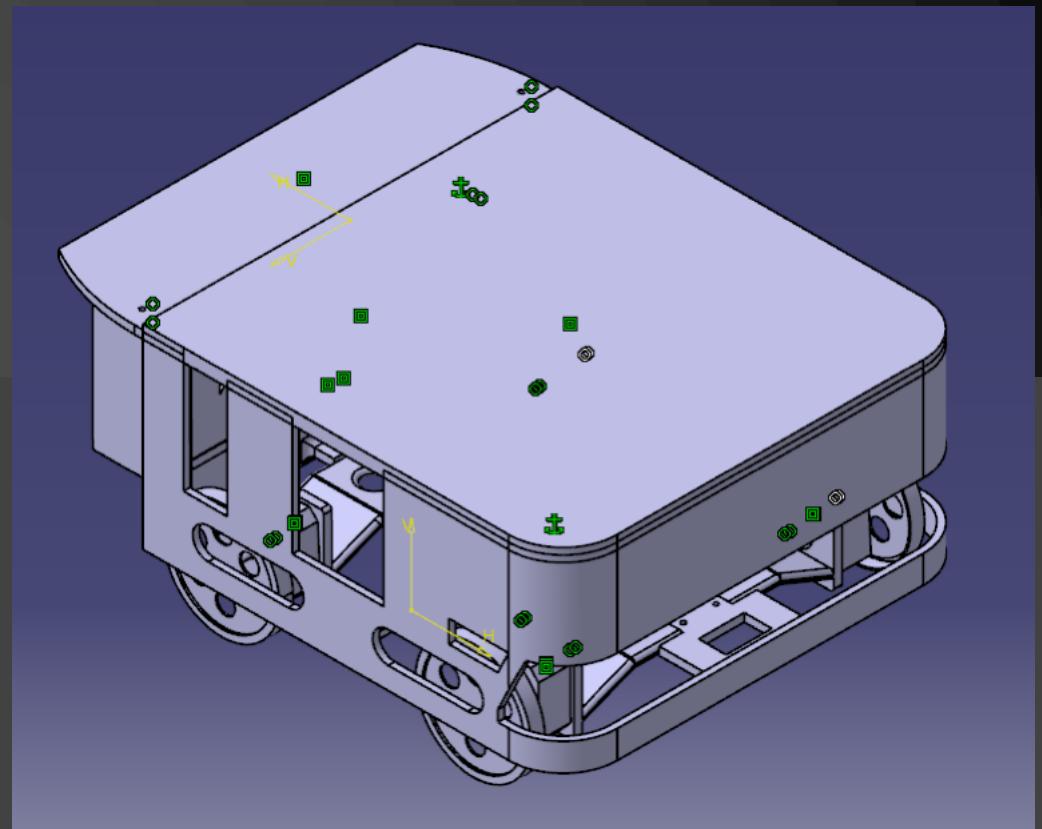


PROGRAM

- The Arduino Uno stores the commands to actuate the motors.
- USB serial communication between controllers
- The Pixycam CMUCAM5 tracks multiple color coded boxes/shelves.
- Laser TOF sensor for distance
- Encoder and limit switches control movement of linear motion system.
 - Forklift limit switch detects if the box is on the forks.
 - Upper limit switch stops box from being lifted too high.
 - Encoder allows choosing different shelf heights
- IMU for precise turns and trajectories

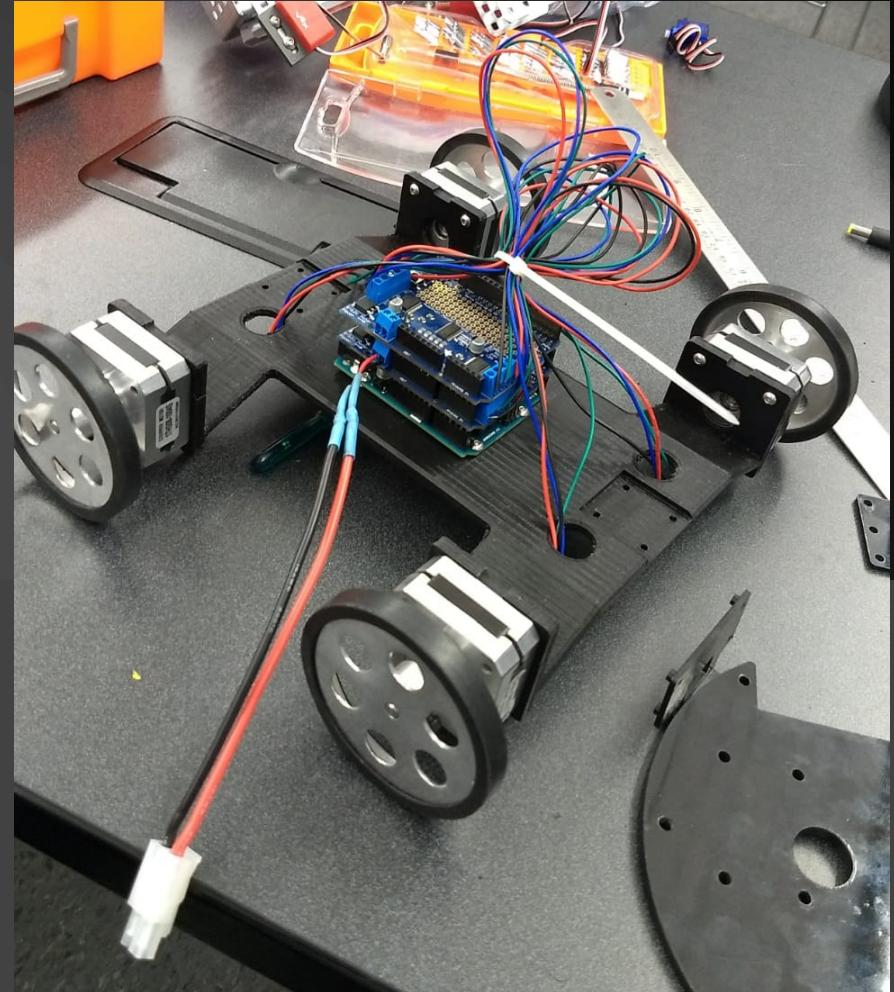
FUTURE PLANS

- Create a larger sized model
 - Enclosed casing around robot to protect electronics.
- Get higher torque motors
- Resolve integration issues.

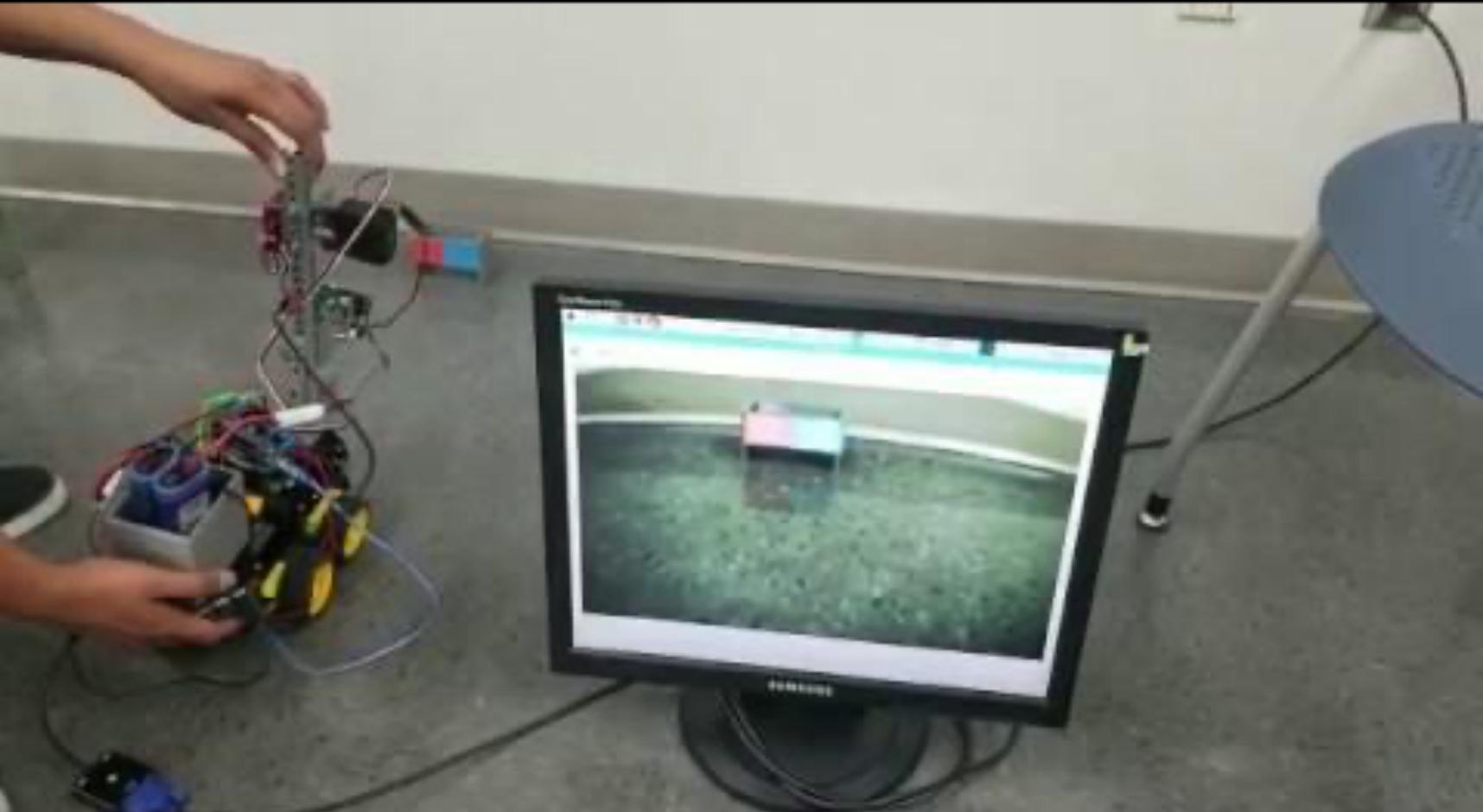


Problems Encountered

- Individual components worked great but full scale integration was glitchy
- Too much overhead, ran out of processing power and PI froze
- C++, Python 2, and Python 3 PI libraries - Had to pass data between all 3
- Precision steering was problematic because of the forklift weight
 - Tried many combinations of stepper motor, dc motors, and control systems
 - Need much higher torque to steer in small increments
 - Caused several complete mechanical redesigns



VIDEO PROOF
**(Full demo very
soon)**



THANK YOU!

