Team 16 Final Project:
THE TRASH CAR

ECE/MAE 148

Members**:**
Preston Gomersall, Steven Garcia, Kamran Mapar,
Jacob Rossi, Yelane Tara Chermak

What's the Trash Car?

Must haves:

- Autonomous Vehicle

- Picks up Trash and brings it to a designed location

- Can recognize different types of trash to recycle correctly

Nice to have:

- Can avoid fix and moving obstacles

- Can map its environment to clean an area efficiently

- Vacuum to suck cigarette butts

Team 16

UC San Diego
JACOBS SCHOOL OF ENGINEERING

Why a Trash Car?

Large amounts of trash on Campus

It takes a lot of effort to pick up trash

Hence the Trash Car

UC San Diego

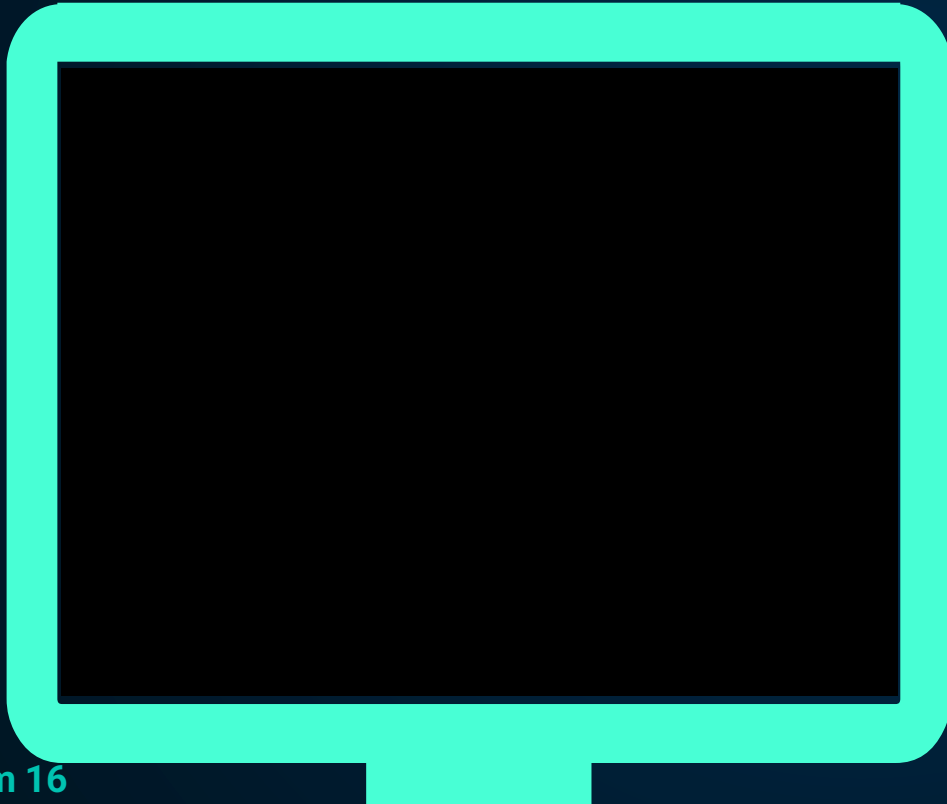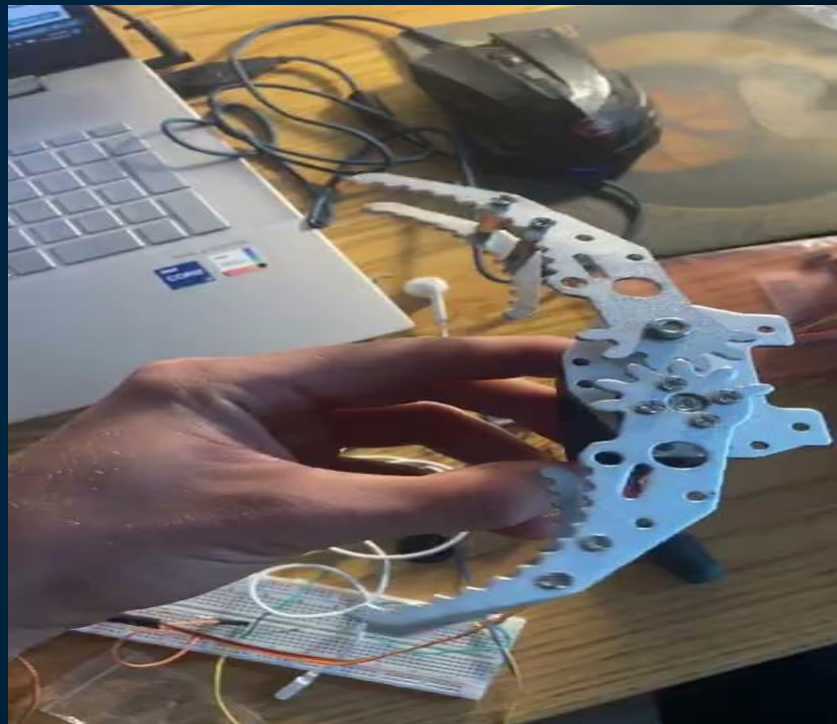JACOBS SCHOOL OF ENGINEERING

Creation Process

UC San Diego
JACOBS SCHOOL OF ENGINEERING

Implementing the Camera Mount

Camera mount created in Fusion 360, and then Laser cut in EnVision Lab

UC San Diego

JACOBS SCHOOL OF ENGINEERING

Constructing the Claw
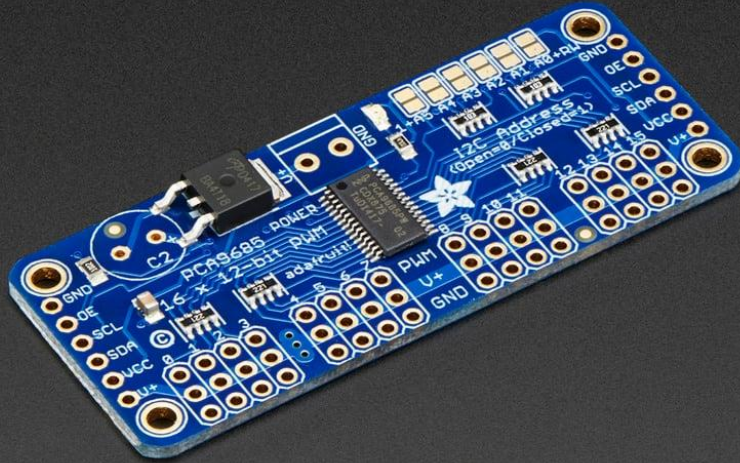
Team 16

UC San Diego
JACOBS SCHOOL OF ENGINEERING

AdaFruit PWM Servo Driver add On

Our team implemented the AdaFruit PWM Servo Driver to control multiple servos at once. The VESC was giving us trouble, so the Adafruit made it much easier to control the robotic claw separately.
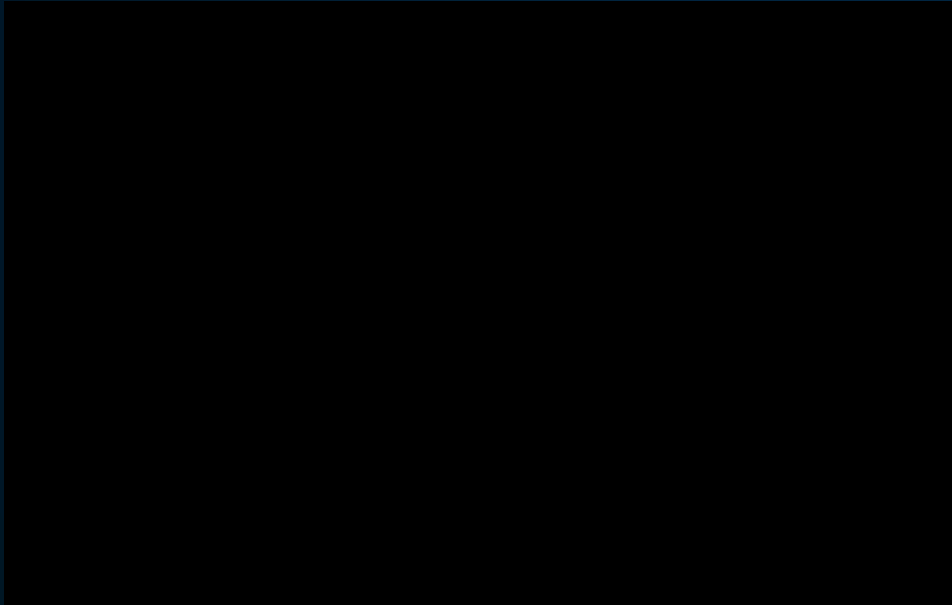
Team 16

UC San Diego

JACOBS SCHOOL OF ENGINEERING

UC San Diego
JACOBS SCHOOL OF ENGINEERING

Depth AI with OAK-D

Pre-trained Model used to detect objects of interest

Used Stereo Cameras on OAK-D Lite for Depth Perception

Depth Perception and Object detection used to get coordinates of objects relative to the camera.

UC San Diego

JACOBS SCHOOL OF ENGINEERING

Servo and Robot Arm Code

```python
def turn(dist):
    angle = 70
    if dist < 0.3:
        angle = 20
    elif dist >= 0.3 and dist < 0.5:
        angle = 50
    elif dist >= 0.3 and dist < 0.5:
        angle = 90
    elif dist > 0.7:
        angle = 120

    return angle

def action(state, dist):
    if state == 0:
        # We don't see anything so go forward
        myvesc.run(70,50,0.18)
    elif state == 1:
        # It saw something
        # Turn
        angle = turn(dist)
        myvesc.run(angle,90,0.15)
    elif state == 2:
        # We grab
        myvesc.run(70,90,0.0)
        time.sleep(3)
        myvesc.run(70,90,0.2)
        time.sleep(0.3)
        myvesc.run(70,30,0.0)
        time.sleep(2)
        myvesc.run(70,30,-0.2)
        time.sleep(5)
        myvesc.run(70,30,0)
        time.sleep(15)
        state = 0

    print(state)
```

```python
if str(label) == 'cup': # and z = int(detection.spatialCoordinates.z:
    # If close
    if int(detection.spatialCoordinates.z) <= 400 and int(detection.spatialCoordinates.z) > 0:
        # Grab
        state = 2
    # If far:
    elif int(detection.spatialCoordinates.z) > 400 and state != 2:
        state = 1

    # 0.5 == center
    print(detection.xmin + (detection.xmax-detection.xmin)/2)
    dist = detection.xmin + (detection.xmax-detection.xmin)/2
```
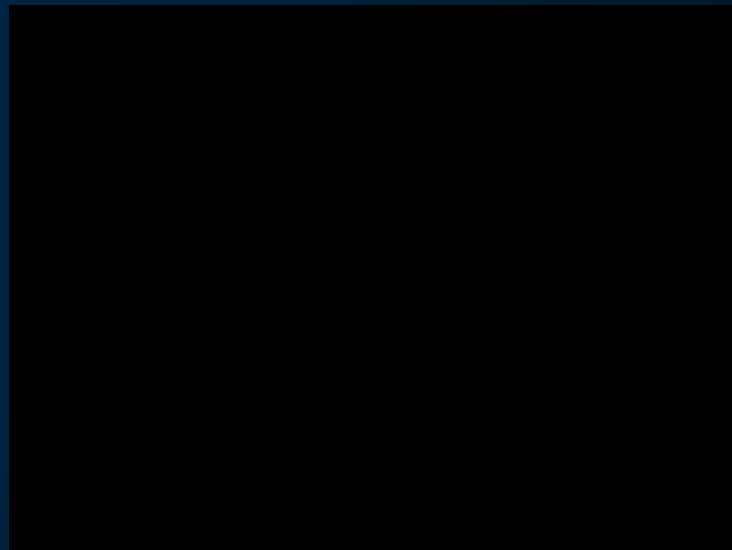
Video Presentation

UC San Diego
JACOBS SCHOOL OF ENGINEERING

Our Result

What worked:

- Recognizing trash

- Moving towards the item (with servo and throttle)

- Grabbing the item to bring it somewhere else

What did not work:

- Avoid fix and moving obstacles

UC San Diego

JACOBS SCHOOL OF ENGINEERING

Problems encountered

Parts:

- Battery
- VESC
- Buck converter
- Jetson Nano
- GPS

Other:

- Motor
- Code

Team 16

UC San Diego

JACOBS SCHOOL OF ENGINEERING

If we had another week ?

- Drop off Location using GPS
- Roaming an Area to detect trash
- Detection of more objects

- Avoiding obstacles
- An extra servo to lift trash off the ground
- Try the Lidar
- added vacuum

Team 16

UC San Diego
JACOBS SCHOOL OF ENGINEERING

The End

Special thank you to Professor Silberman and the TA's :)

Team 16