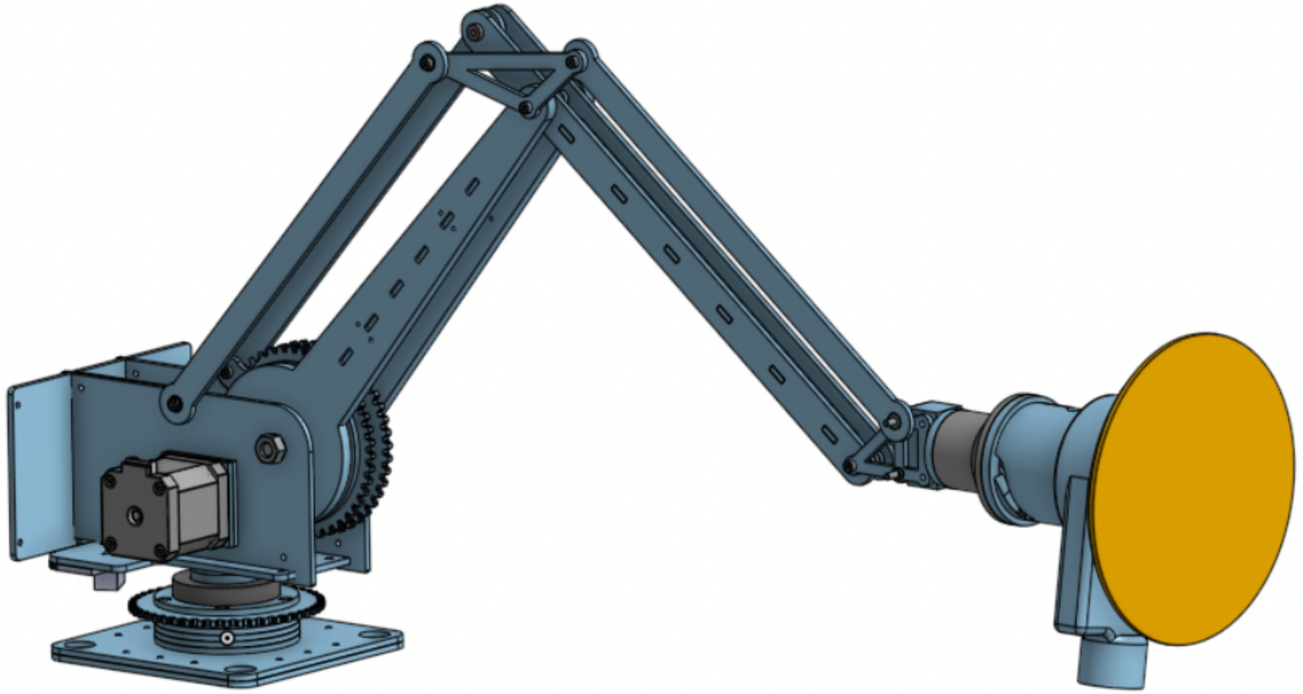
ROBOSANDY



LOGAN JONES
OLUWATAMILORE ILUPEJU
SHEHRYAR ALI MEMON
SAHEEL MOHAMMED

MARCH 31 2022 / DND CANADA

1

There exists a need for a lightweight cost-effective 3D printable robotic arm to scan, scrape and repaint over corroded areas of the Halifax class frigate, operated using a simple GUI

INVERSE KINEMATICS SOLVER

SHEHRYAR ALI MEMON

MARCH 31 2022 / DND CANADA

OUR

CODE

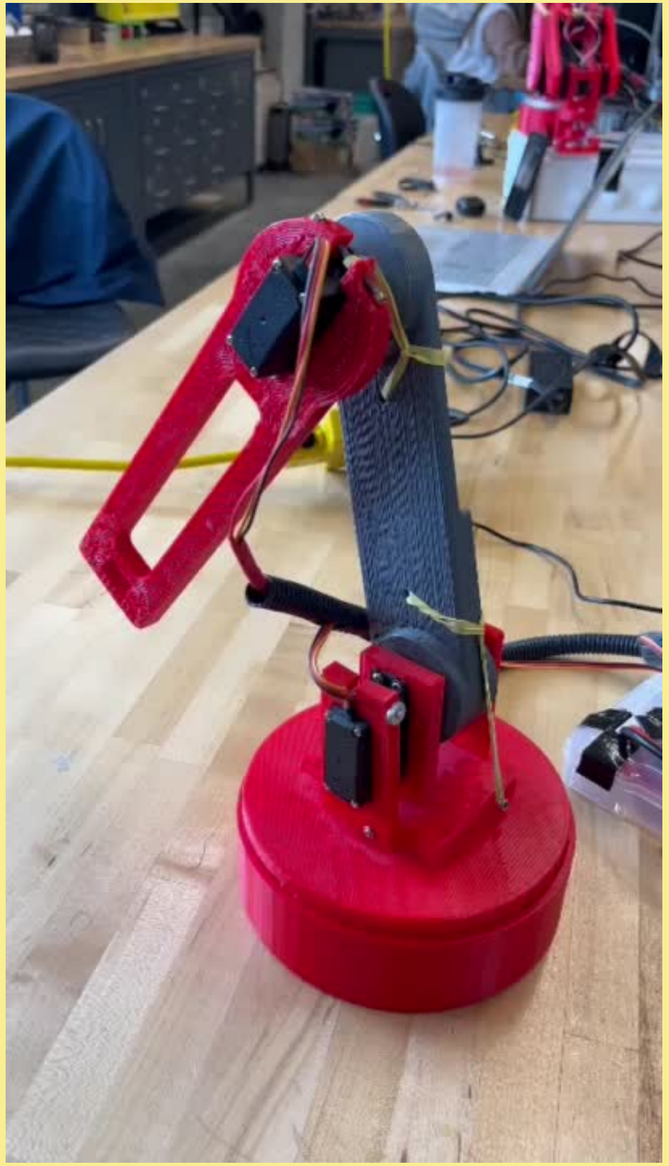
INVERSE KINEMATICS {SOLVER}

```
/*
  ESP32 PCA9685 Servo Control
   esp32-pca9685.ino
  Driving multiple servo motors with ESP32 and PCA9685 PWM module
  Use I2C Bus

  DroneBot Workshop 2020
   https://dronebotworkshop.com
*/

// Include Wire Library for I2C
#include <Wire.h>
#include  <InverseK.h>
// Include Adafruit PCA9685 Servo Library
#include  <Adafruit_PWMServoDriver.h>

volatile float L1;
volatile float L2;
// end effector

volatile float pi = 3.14159265359;
// Creat object to represent PCA9685 at default I2C address
Adafruit_PWMServoDriver pca9685 = Adafruit_PWMServoDriver(0x40);

// Define maximum and minimum number of "ticks" for the servo motors
// Range from 0 to 4095
// This determines the pulse width

#define SERVOMIN  80  // Minimum value
#define SERVOMAX  600  // Maximum value

// Define servo motor connections (expand as required)
#define SER0  0    //Servo Motor 0 on connector 0
#define SER1  1   //Servo Motor 1 on connector 12
#define SER2  2

// Variables for Servo Motor positions (expand as required)
int pwm0;
int pwm1;
int pwm2;
float x=1;
float y=1;
float z=1;
int i;
float angle1;
float angle2;
float angle3;
double rad_angle1;
float rad_angle2;
float rad_angle3;
float preangle1=90;
float preangle2=90;
float preangle3=90;
void setup() {

  // Serial monitor setup
   Serial.begin(115200);

  // Print to monitor
   Serial.println("PCA9685 Servo Test");

  // Initialize PCA9685
   pca9685.begin();

  // Set PWM Frequency to 50Hz
   pca9685.setPWMFreq(50);
 Serial.println("Enter the length of first arm ");
  while(Serial.available()==0){}
  //L1=Serial.parseFloat();
  L1=6.5;
 Serial.println("Enter the length of second arm ");
  while(Serial.available()==0){}
  //L2=Serial.parseFloat();
  L2=8;
}

void loop() {
inverseKinematics();
}
void  inverseKinematics(){

    Serial.println("Enter the value x ");
        while(Serial.available()==0){}
        //x=Serial.parseFloat();

        Serial.println("Enter the value y ");
        while(Serial.available()==0){}
        //y=Serial.parseFloat();

        Serial.println("Enter the value z ");
        while(Serial.available()==0){}
        //z=Serial.parseFloat();

        rad_angle2 = acos((sq(z)+ sq(y) - sq(L1) - sq(L2)) / (2*L1*L2));
        rad_angle3 = acos((sq(L1) + sq(L2) - sq(y)- sq(z)) / (2*L1*L2));
        rad_angle1= (atan2(y , x) - atan2(L2*sin(rad_angle2),
L1*sin(rad_angle3)))/(L1*cos(rad_angle3)+L2*cos(rad_angle2));
        delay(1000);
        angle1= (rad_angle1*180)/pi;
        angle2= (rad_angle2*180)/pi;
        angle3= (rad_angle3*180)/pi;

Serial.print("x is ");
 Serial.println(x);
Serial.print("y is ");
 Serial.println(y);
Serial.print("z is ");
 Serial.println(z);
Serial.print("angle1 is   ");
 Serial.println(angle1);
Serial.print("angle2 is ");
 Serial.println(angle2);
Serial.print("angle3 is ");
 Serial.println(angle3);

 if(preangle1>angle1){
      angle1++;
       pwm0 = map(angle1, 0, 180, SERVOMIN, SERVOMAX);
       pca9685.setPWM(SER0, 0, pwm0);
       preangle1=angle1;
}

 else if(preangle1<angle1){
    angle1--;
     pwm0 = map(angle1, 0, 180, SERVOMIN, SERVOMAX);
     pca9685.setPWM(SER0, 0, pwm0);
     preangle1=angle1;

}

 if(preangle2>angle2){
 angle2++;
 pwm1 = map(angle2, 0, 180, SERVOMIN, SERVOMAX);
 pca9685.setPWM(SER1, 0, pwm1);
 preangle2=angle2;
}

 else if(preangle2<angle2){
 angle2--;
 pwm1 = map(angle2, 0, 180, SERVOMIN, SERVOMAX);
 pca9685.setPWM(SER1, 0, pwm1);
 preangle2=angle2;
}

 if(preangle3>angle3){
 angle3++;
```

MARCH 2022

DEMO

INVERSE KINEMATICS {SOLVER}



SAFTY SOLUTIONS

OLUWATAMILORE ILUPEJU

MARCH 31ST 2022 /DND CANADA

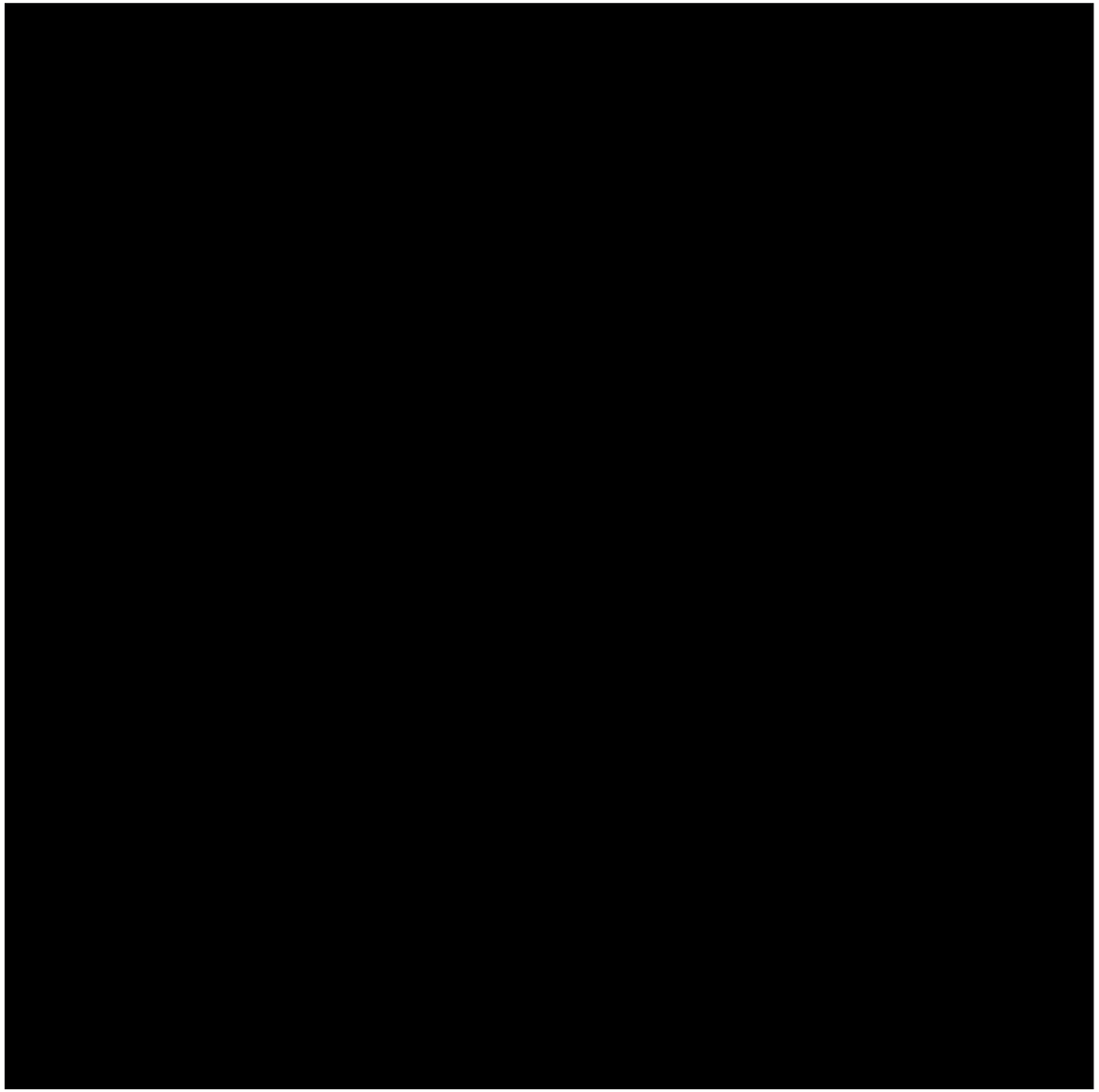
MANUAL FORCE-STOP BUTTON

This would be placed on the arm itself as a last resort to top the arm

IR SENSOR MOUNTED AT THE BASE OF THE ARM

Placed at the base of the arm, constantly monitoring for obstructions

OBSTRUCTION DETECTION



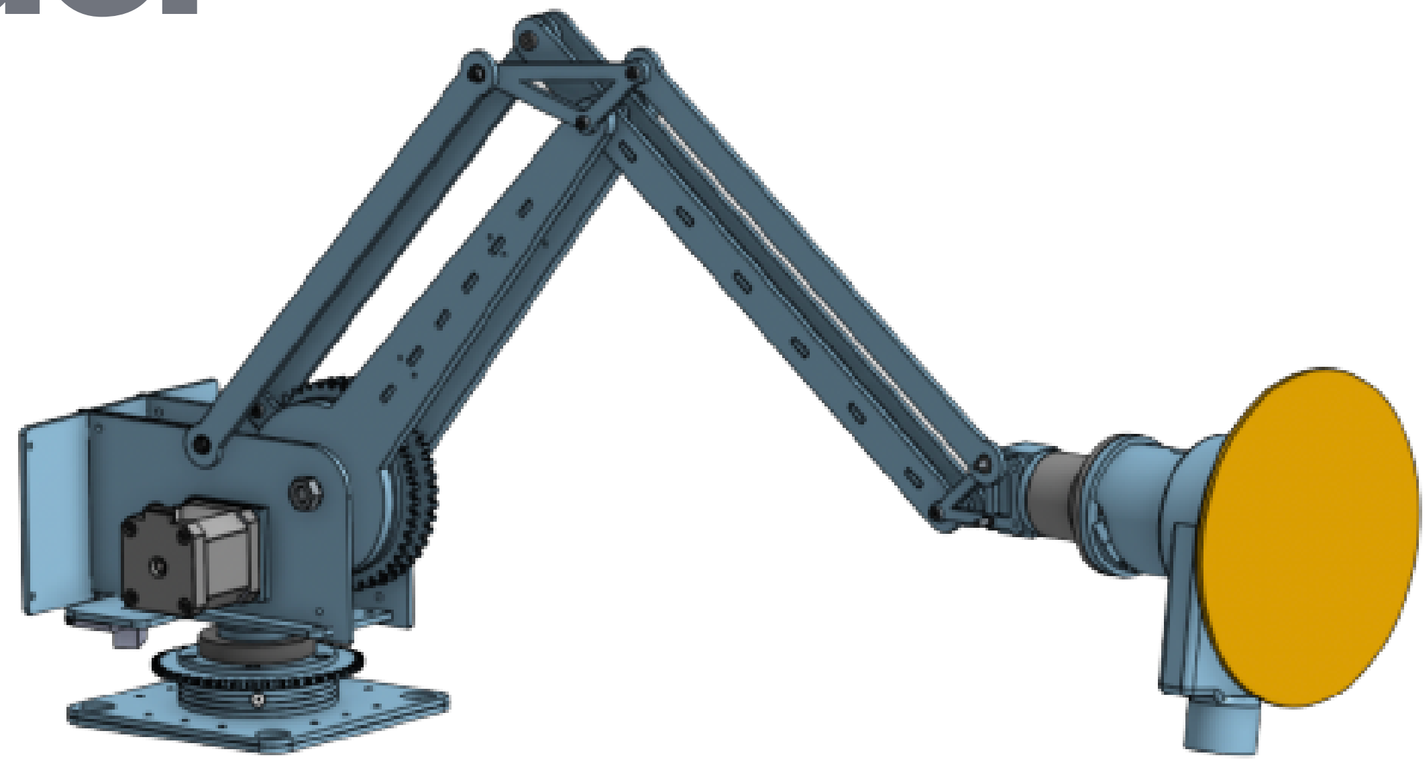
```
int analogInPin = A0; //analog pin potentiometer is attached to
int led = 10;
int sensorValue = 0; //value read from the pot

void setup() {
  //initialize serial communications at 9600 bps:
  Serial.begin(9600);
  pinMode(led, OUTPUT);
}
void loop() {
   // read the analog in value:
   sensorValue = analogRead(analogInPin);
   Serial.print("sensor = ");
   Serial.println(sensorValue);
   delay(200);
   if(sensorValue<80) {
      digitalWrite(led,HIGH);
    }
    else {
    digitalWrite(led,LOW);
    }
```

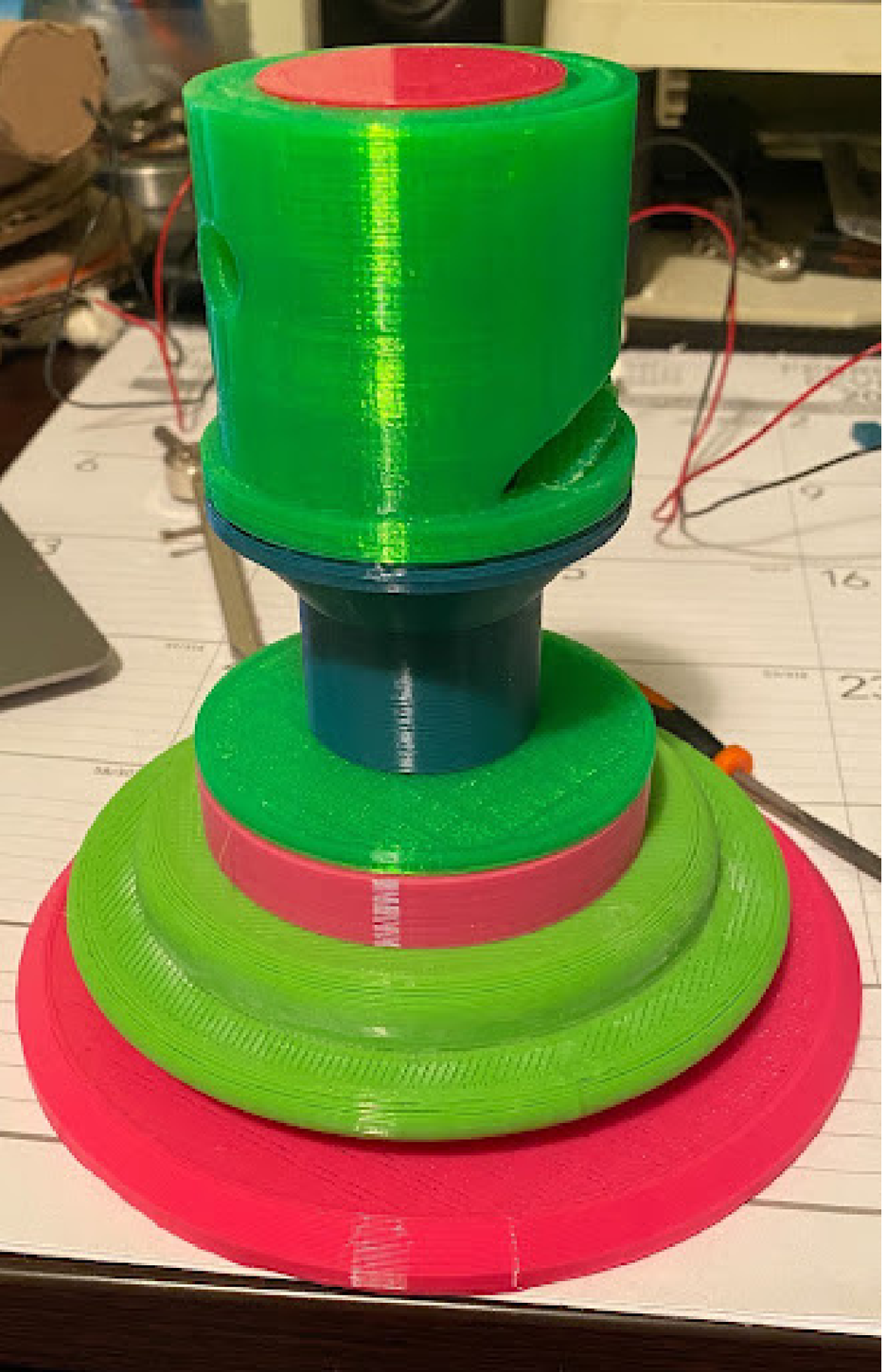
MODELS

LOGAN JONES

MARCH 31 2022 /DND CANADA

Sander





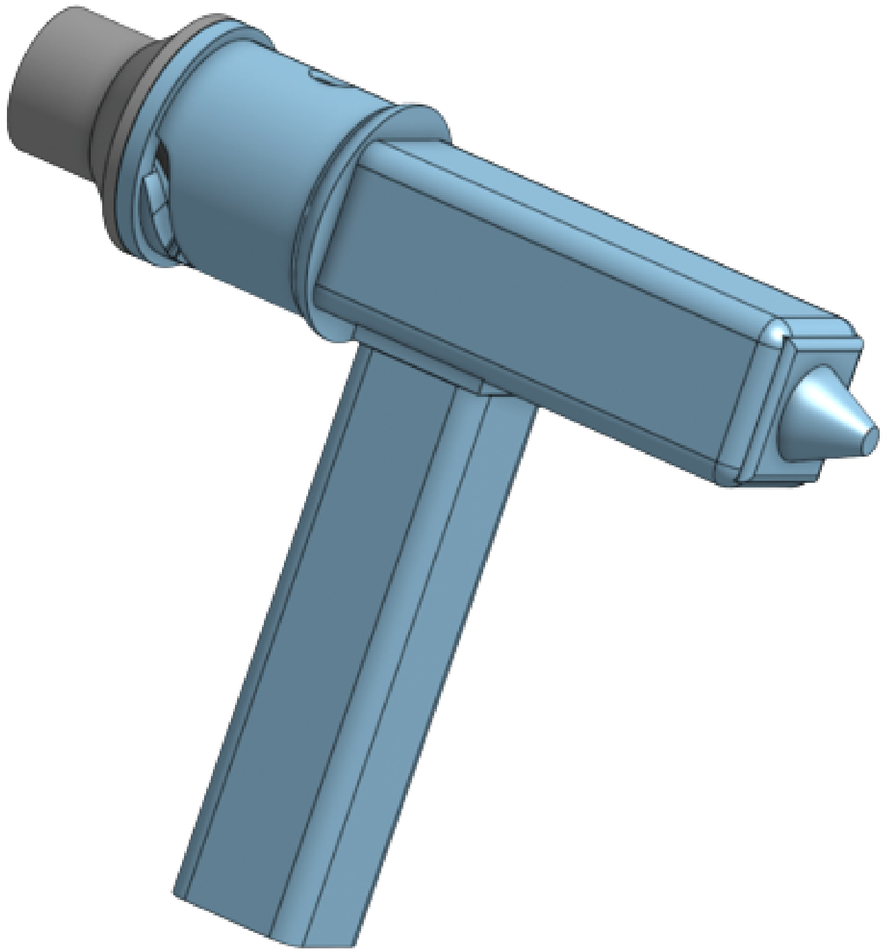
SANDER

MARCH 2022

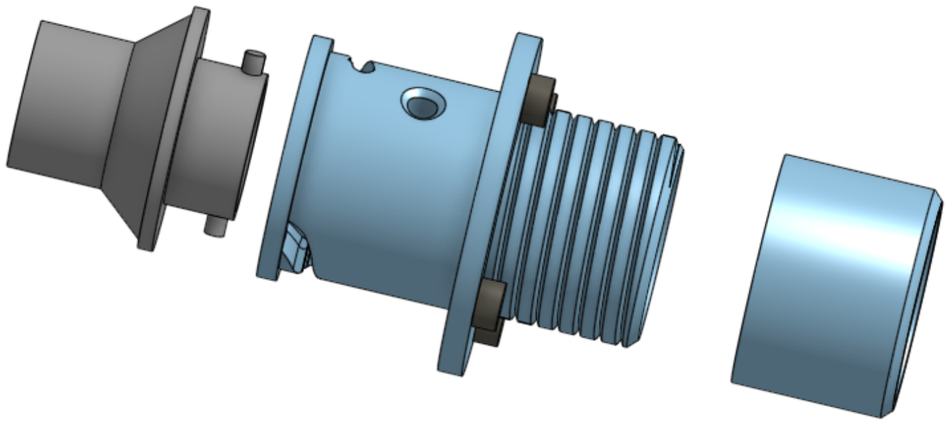
DEMO

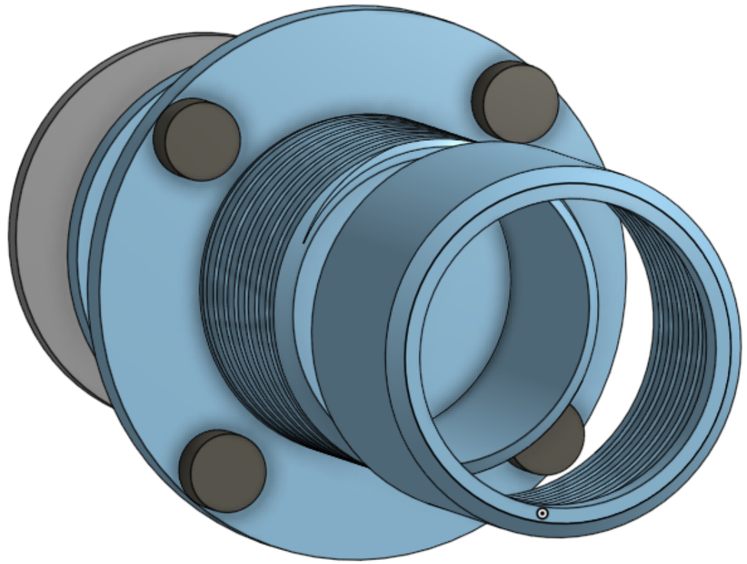
SANDER

Painter



Camera Case





GRAPHICAL USER INTERFACE

SAHEEL MOHAMED/SHEHRYAR A. MEMON

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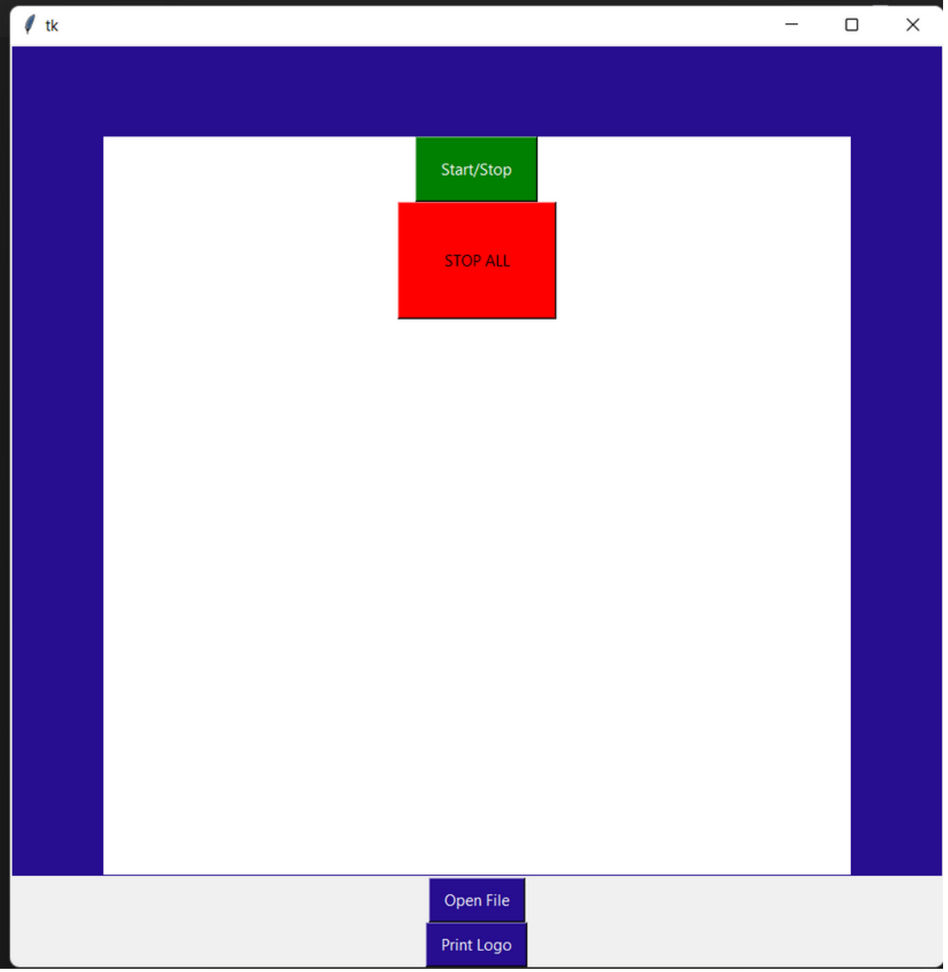
Snippet of Code

File Edit Selection View Go Run Terminal Help — PyGUI.py - GUI - Visual Studio Code

PyGUI.py

PythonApplication1 > PythonApplication1 > PyGUI.py > ...

```python
#source code taken from developedbyed.com-DevEd Youtube

import tkinter as GUI
from tkinter import filedialog, Text
import os

root=GUI.Tk()
apps=[]

if os.path.isfile('save.txt'):
    with open('save.txt', 'r') as f:
        tempApps = f.read()
        tempApps = tempApps.split(',')
        print(tempApps)
        apps = [x for x in tempApps if x.strip()]

def addApp():

    for widget in frame.winfo_children():
        widget.destroy()

    filename= filedialog.askopenfilename(initialdir="/", title="Select Picture to Paint",
        filetypes=(("Pictures","*.png"),("All files", "*.*")))
    apps.append(filename)
    print(filename)
    for app in apps:
        label = GUI.Label(frame, text=app, bg="gray")
        label.pack()

def runApps():
    for app in apps:
        os.startfile(app)

canvas= GUI.Canvas(root, height=800, width=1000, bg="#270D90")
canvas.pack()

frame = GUI.Frame(root, bg="white")
```



Future Plans

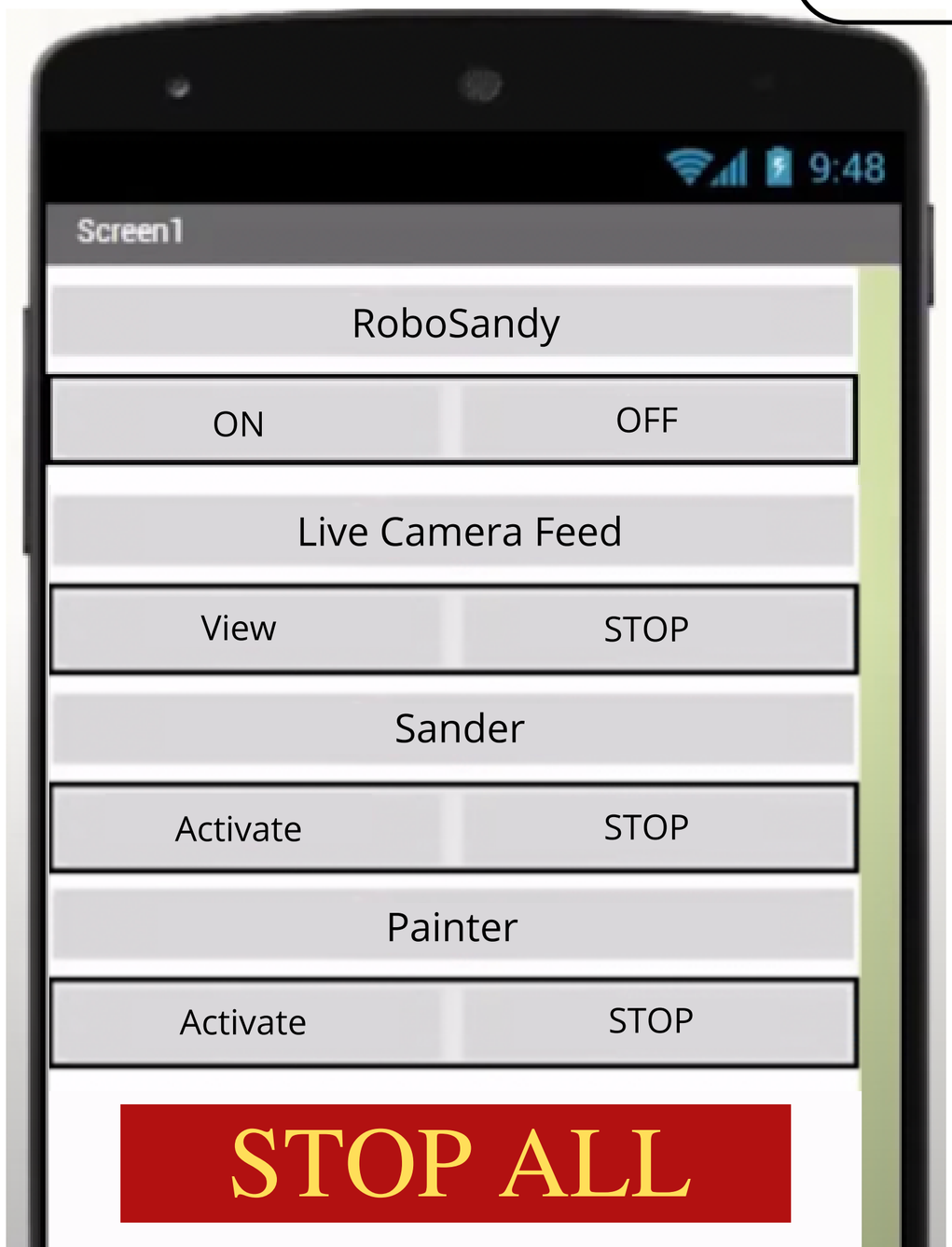
ULTRASOUND SENSOR

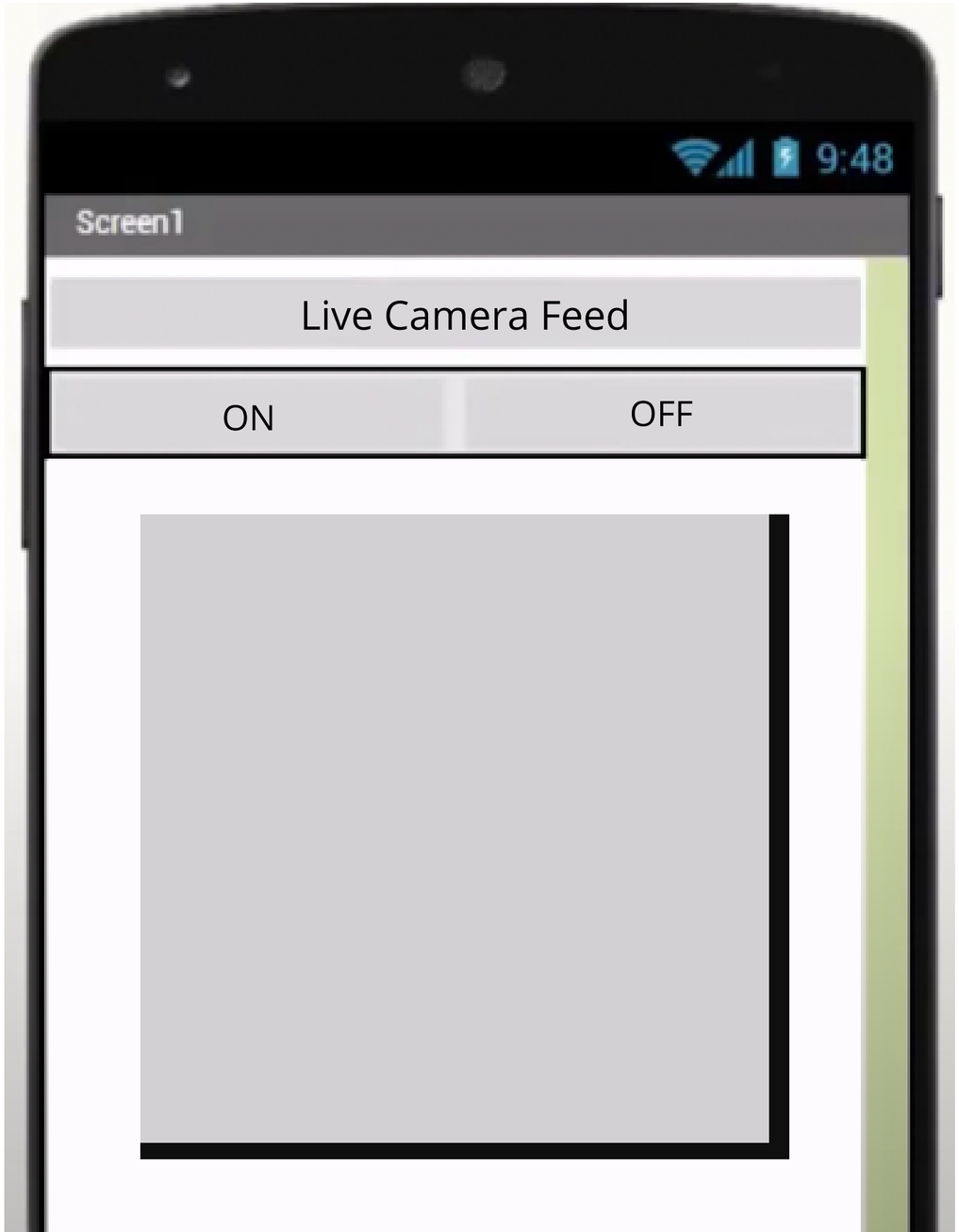
Placed on our end-effector to assist the IR sensor in detecting distance and depth

BLUETOOTH APP FOR MOBILE DEVICE

We are aiming to integrate Bluetooth/mobile connectivity to this model, here is a sneak-peek of the expected GUI

SAHEEL MOHAMED





Thank You!

Any Questions?