

CIS-033-53082 Robotics and Embedded System

Lab 5

Joystick

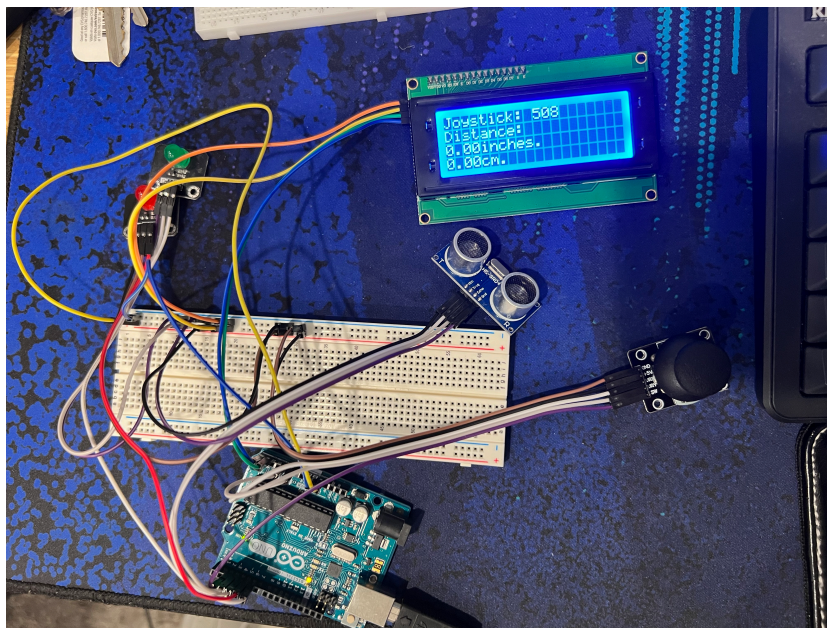
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Task 1. Design a system to have a joystick, LCD, Ultrasound sensor and two LEDs. The program should continuously display the value of the joystick to the serial monitor and the distance both in inches and centimeter to the LCD. When the joystick is at the normal position, both LEDs should be off. When joystick is moved upward the first LED must blink (but the blink time should be a function of how far the joystick is up. In other words, when joystick is all the way up, the LED must blink the fastest. The second LED must do the same function as first except for downward position. In this lab, the joystick and ultrasound are not related together. But in future, when you move the joystick, the distance would change accordingly. When the object gets close to the ultrasound, both LEDs must become ON and do not blink at all.

Arduino Setup:



Code can also be found here: https://github.com/YizheWill/arduino_course/blob/main/joystick/joystick.ino

Video can be found here:



Code Part 1:

```
1  #include <LiquidCrystal_I2C.h>
2  #include <NewPing.h>
3
4  #define JOY_X A0      // Joystick X-axis analog pin
5  #define JOY_Y A1      // Joystick Y-axis analog pin
6  #define JOY_SW 2      // Joystick switch pin
7  #define TRIG_PIN 3    // Ultrasound sensor trigger pin
8  #define ECHO_PIN 4    // Ultrasound sensor echo pin
9  #define LED_UP 5      // First LED pin
10 #define LED_DOWN 6    // Second LED pin
11 #define MAX_DISTANCE 200 // Sonar sensor max distance
12
13 LiquidCrystal_I2C lcd(0x27, 20, 4);
14 NewPing sonar(TRIG_PIN, ECHO_PIN, MAX_DISTANCE);
15
16 int interation = 5;
17 float distance_cm, distance_in, duration;
18 int joystickY;
19
20 void setup()
21 {
22     Serial.begin(9600);
23     pinMode(JOY_SW, INPUT_PULLUP);
24     pinMode(LED_UP, OUTPUT);
25     pinMode(LED_DOWN, OUTPUT);
26     pinMode(TRIG_PIN, OUTPUT);
27     pinMode(ECHO_PIN, INPUT);
28     digitalWrite(LED_UP, LOW);
29     digitalWrite(LED_DOWN, LOW);
30
31     lcd.init();
32     lcd.backlight();
33     lcd.begin(20, 4);
34     lcd.setCursor(0, 0);
35     lcd.print("Joystick: ");
36     lcd.print(joystickY);
37     lcd.print("    ");
38 }
```

Code Part 2:

```
40 void loop()
41 {
42     int joystickY = analogRead(JOY_Y);
43     bool joystickSW = digitalRead(JOY_SW);
44     digitalWrite(TRIG_PIN, LOW);
45     delayMicroseconds(2);
46     digitalWrite(TRIG_PIN, HIGH);
47     delayMicroseconds(10);
48     digitalWrite(TRIG_PIN, LOW);
49     duration = sonar.ping_median(iteration);
50     distance_cm = (duration / 2) * 0.0343;
51     distance_in = distance_cm / 2.54;
52     lcd.setCursor(0, 1);
53     lcd.print("Distance:");
54     lcd.setCursor(0, 2);
55     lcd.print(distance_in);
56     lcd.print("inches. ");
57     lcd.setCursor(0, 3);
58     lcd.print(distance_cm);
59     lcd.print("cm. ");
60     if (distance_cm > 0 && distance_cm < 20)
61     {
62         digitalWrite(LED_UP, HIGH);
63         digitalWrite(LED_DOWN, HIGH);
64         delay(100);
65     }
66     else
67     {
68         digitalWrite(LED_DOWN, LOW);
69         digitalWrite(LED_UP, LOW);
70         lcd.setCursor(0, 0);
71         lcd.print("Joystick: ");
72         lcd.print(joystickY);
73         lcd.print(" ");
74         // since the joystick is not very accurate, the "middle position"
75         // can range from 490 - 520 on my device, so I set it up as if the
76         // value is between 490 and 520, then it shall be recognized as "middle position".
77         if (joystickY > 520)
78         {
79             blinkLed(LED_UP, joystickY);
80         }
81         else if (joystickY < 490)
82         {
83             blinkLed(LED_DOWN, joystickY);
84         }
85     }
86 }
```

Code Part 3:

```
87 void blinkLed(int pin, int level)
88 {
89     int delay_time;
90     int val;
91     val = level > 512 ? level - 512 : 512 - level;
92     delay_time = map(val, 0, 512, 1000, 0);
93     digitalWrite(pin, HIGH);
94     delay(delay_time);
95     digitalWrite(pin, LOW);
96     delay(delay_time);
97 }
```