IRL #1: Sensor and Motor

Man-Ning Chen (Mandy)

Team G: EXCALIBR

Teammates: Yiqing Cai, Huang-Yang Chang,

Siddharth Raina, Sambuddha Sarkar

Individual Progress

Overview

I was responsible for thermistor and potentiometer. After finishing my tasks, I moved on to support other teammates' works, for example support tuning PID control and GUI coding. In the end, we did integration together.

Thermistor

Thermistor 10K SEN-00250 ROHS is used in our project. Its datasheet can be found online. However, there are more than twenty kinds of part number in the data sheet. Therefore, first of all, I should find out my thermistor belongs to which part number.

Here's my circuit:

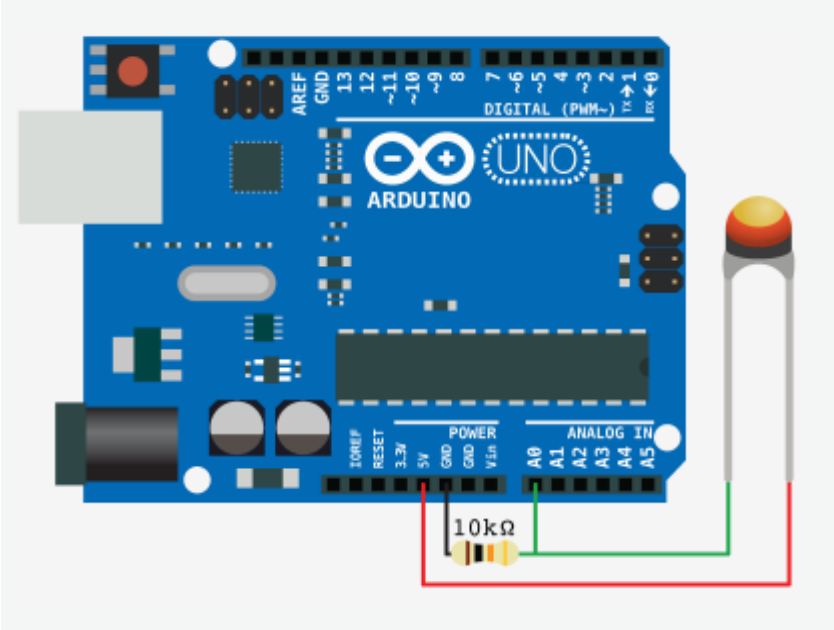


Figure 1

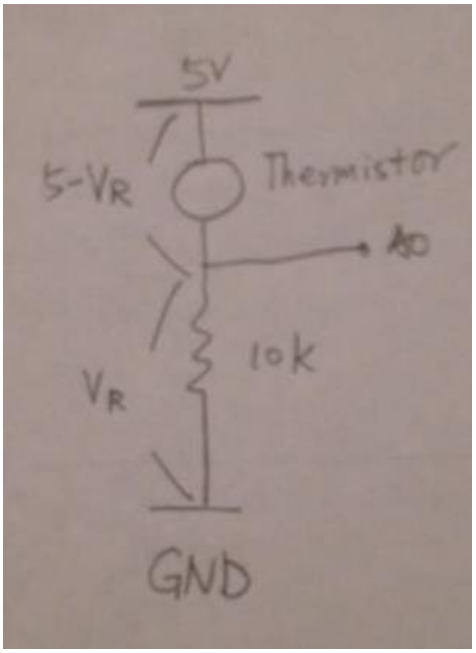


Figure 2

The value read from A0 was about 500.

Since the analog input signal on Arduino maps from 0 to 1023 and the room temperature was known, the resistance of the thermistor can be calculated.

```
double thermometerReading= analogRead(thermometer);
double resistance = 10000.0*(1023.0-thermometerReading)/thermometerReading;
```

The resistance was 10460 ohm. Based on room temperature then, 20-25℃, I found out it is NTCLE100E3103***. See figure 3.

T_{OPER} (°C)	PART NUMBER NTCLE100E3103*** R_T (Ω)		
		50	3605
		55	2989
		60	2490
- 40	332 094	65	2084
- 35	239 900	70	1753
- 30	175 200	75	1481
- 25	129 287	80	1256
- 20	96 358	85	1070
- 15	72 500	90	915.4
- 10	55 046	95	786.0
- 5	42 157	100	677.3
0	32 554	105	585.7
5	25 339	110	508.3
10	19 872	115	442.6
15	15 698	120	386.6
20	12 488	125	338.7
25	10 000	130	297.7
30	8059	135	262.4
35	6535	140	231.9
40	5330	145	205.5
45	4372	150	182.6

Figure 3

The settings for our sensor shown as follows:

temperature < 30℃, GUI shows blue and "Temperature is too low". DC motor does not run.

30℃< temperature < 50℃, GUI shows green and "Safe temperature". DC motor runs at 30 rpm.

temperature < 50℃, GUI shows red and "Temperature is too high". DC motor runs at 60 rpm.

Potentiometer

At first, I used the potentiometer given in the first Arduino assignment and made the same circuit. See Figure 4. Except I made my previous code 4-color illumination changing this time. However, during integration, due to lack of Arduino ports, the led bulb was removed. Instead, we use only GUI to show the light color and illumination changes. In addition, in integration part, the original potentiometer was changed to Figure 5 and its motor control function was added by Sam.

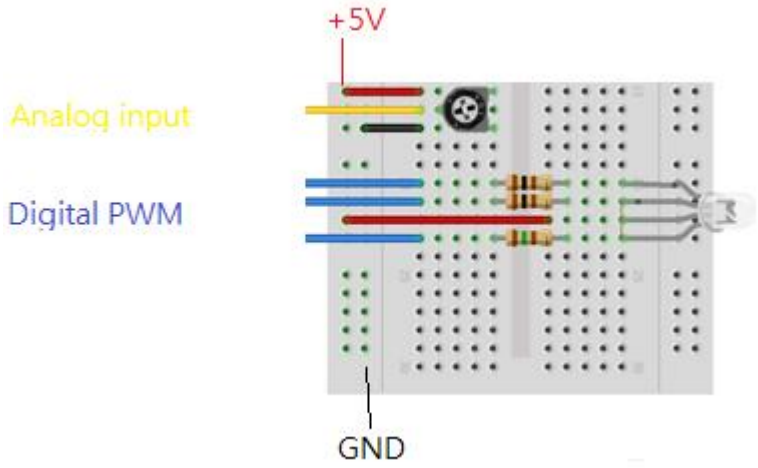


Figure 4

Figure 5

Integration

Because integration is a tough task requires understanding of each components. Our team did the integration together. We discussed which port to which component and managed to organize everything onto the small board.

Circuit:

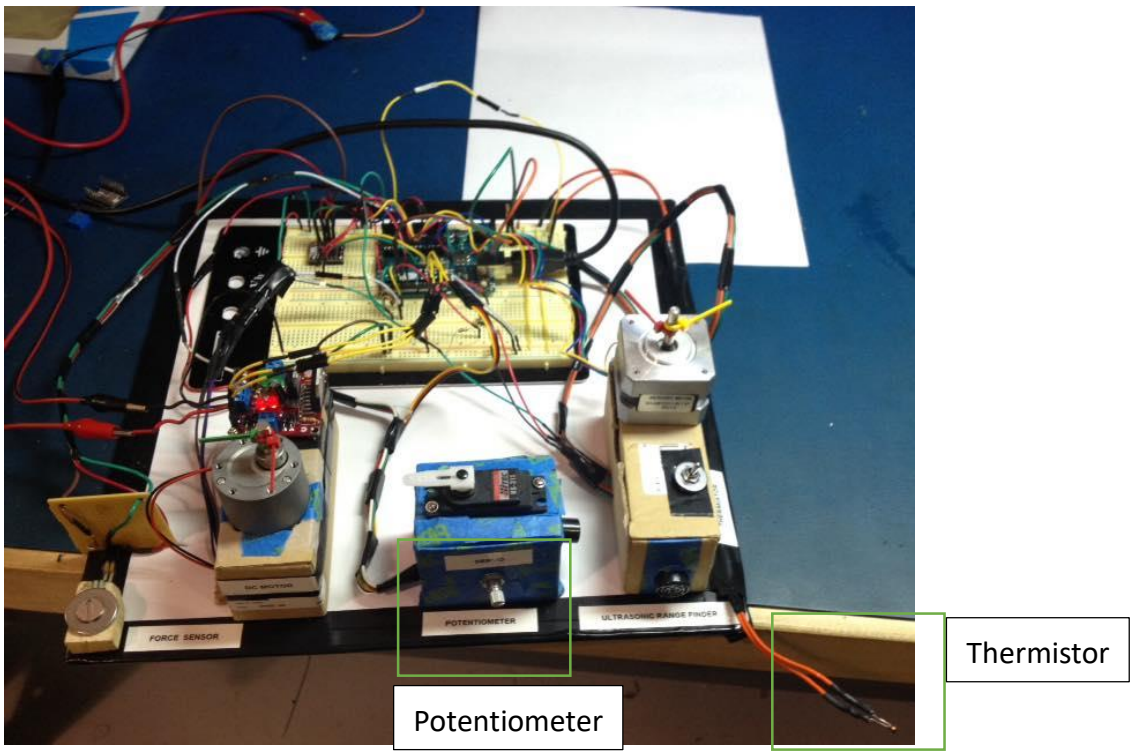
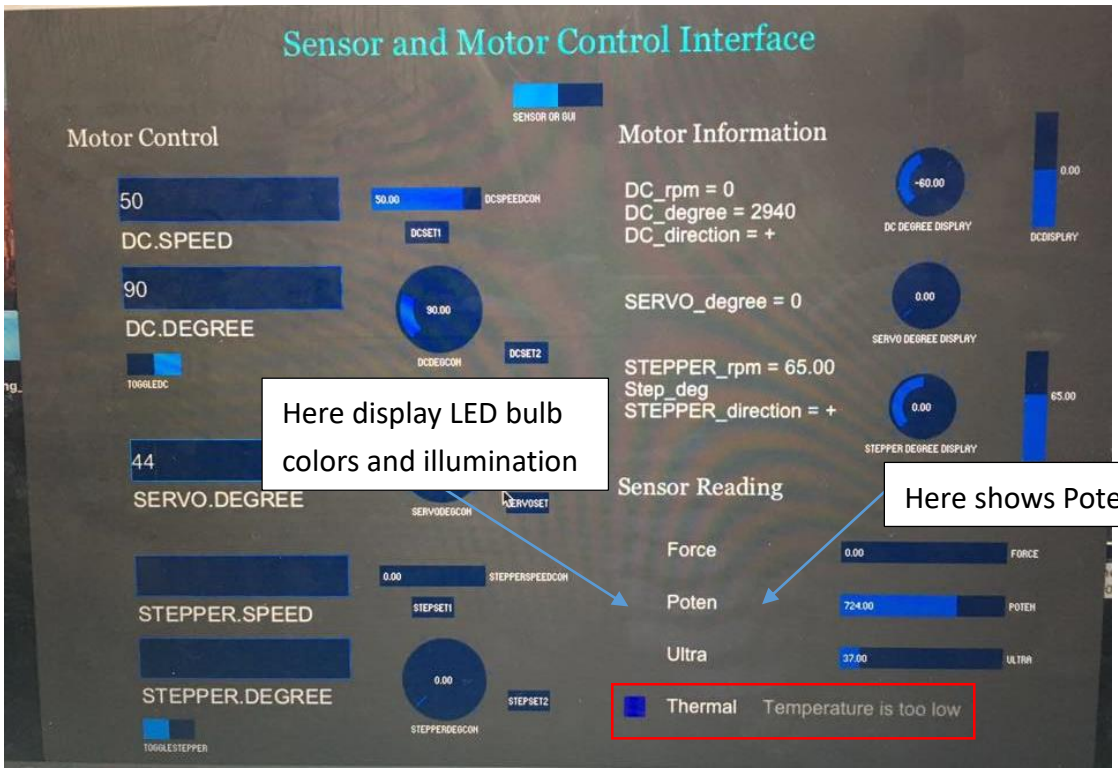


Figure 6

Thermistor is connected to A2. Potentiometer to A0.

GUI:



Figrue 7 shows how my sensor values displayed on GUI

Challenges

1. Arduino has small memory and not so many ports, which made many of our functions couldn't be implemented.
2. Hardware is fragile. Once a hardware is damaged, long hours repair is required. In our project, both DC motor and Stepped motor have been damaged. We had time to start with a new DC motor. However, because the PID coefficients changed, we had to tune the new motor once again. For the stepped motor, since the problem occurs on the presentation day, we couldn't fix it. This led to our failure in stepped motor demonstration.

Teamwork

Overall, our teamwork was great. Each person successfully completed their tasks and did the integration together.

Yiqing Cai	GUI & code integration
Huang-Yang Chang	DC motor & Ultrasonic range finder
Siddharth Raina	Force sensor & sensor graph
Sambuddha Sarkar	Stepped motor, Servo motor, Potentiometer, circuit integration

Future Plan

Our project future plan is shown below,

Calibration

Algorithms. We'll start with the Fixed Pattern Noise (FPN)

a. Read up on the FPN calibration literature
b. Collect some data.
c. Design and implement an algorithm in Matlab

Aerotech Control

Be comfortable with the Aerotech. This includes:

a. Control
b. PSO output
c. Possibly, data logging for the arm positions

References

https://www.sparkfun.com/products/250

Arduino Assignment1

https://hal.archives-ouvertes.fr/hal-00794472/document/