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LASA Science Olympiad

Detector Building Design Log

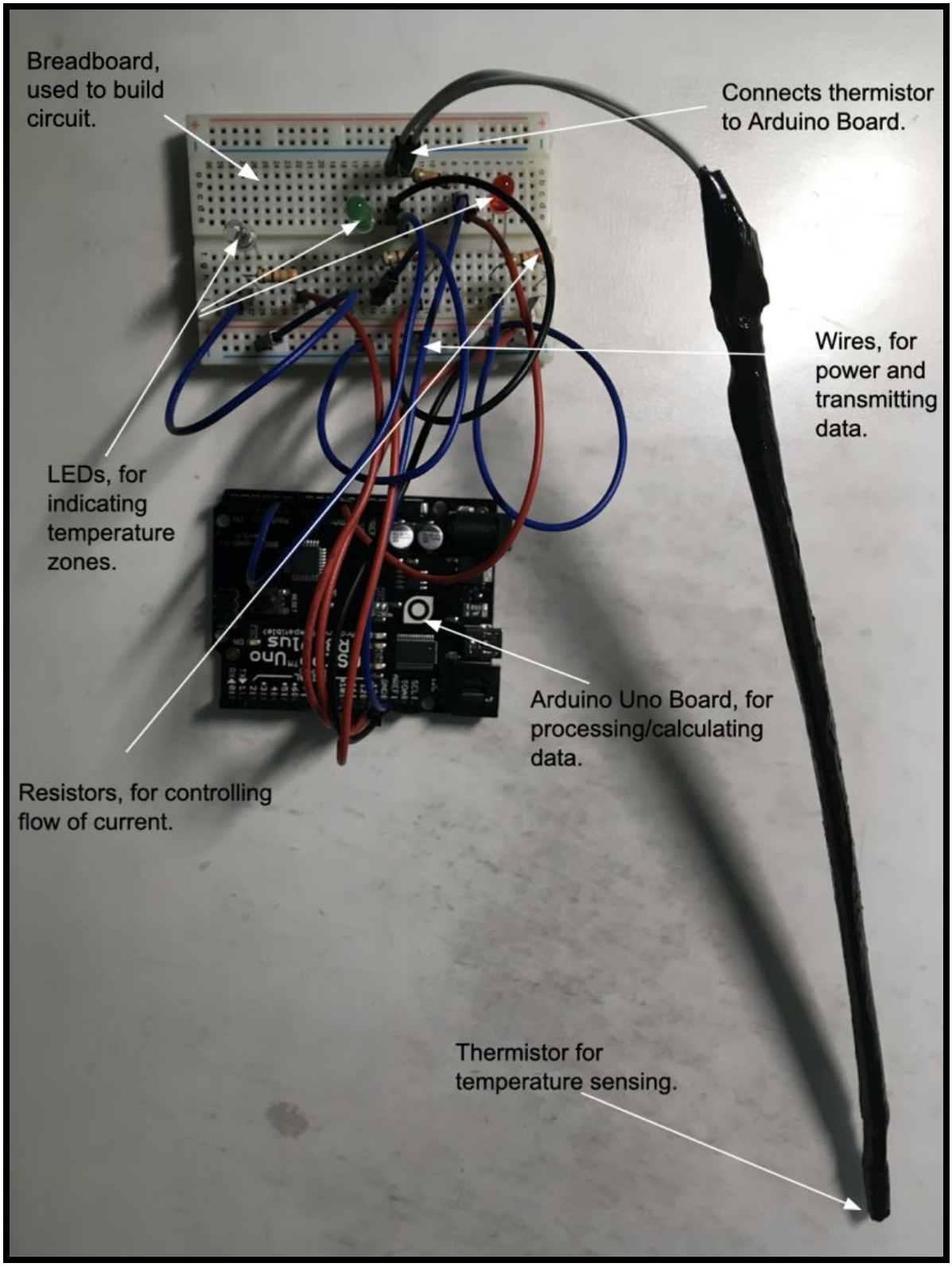
6 March 2020

Detector Building Design Log: Nathan Elias

Introduction:

For the purpose of this experiment, I calculated the temperature from the resistance. The resistance was calculated using the same *analogRead()* function used for calculating voltage. Essentially, I calculated resistance from voltage, and ended up using the resistance to calculate the actual temperature in degrees celsius of the water samples. For that reason, I have made my scatterplot and function graph using resistance vs temperature. In summary, the temperature was calculated from resistance, which was derived from the voltage, thereby using both voltage and resistance to calculate the actual temperature in degrees celsius of the water samples.

Summary of Device:



First, I soldered the the wire to the thermistors, and soldered it to another one.

Second, I covered the soldered joint of the thermistor and wire with liquid electrical tape.

Third, I covered the soldered joint between one wire and the other with liquid electrical tape.

This is liquid electrical tape. It is essentially a water-proof rubber sealant.

Fourth, I covered the soldered joint of the thermistor and wire with heat shrink.

Fifth, I covered the soldered joint of the wire and the other with heat shrink.

Sixth, I covered the entire unit with a large piece of heat shrink.

Seventh, I covered the end of the unit with the thermistor using actual electric tape.

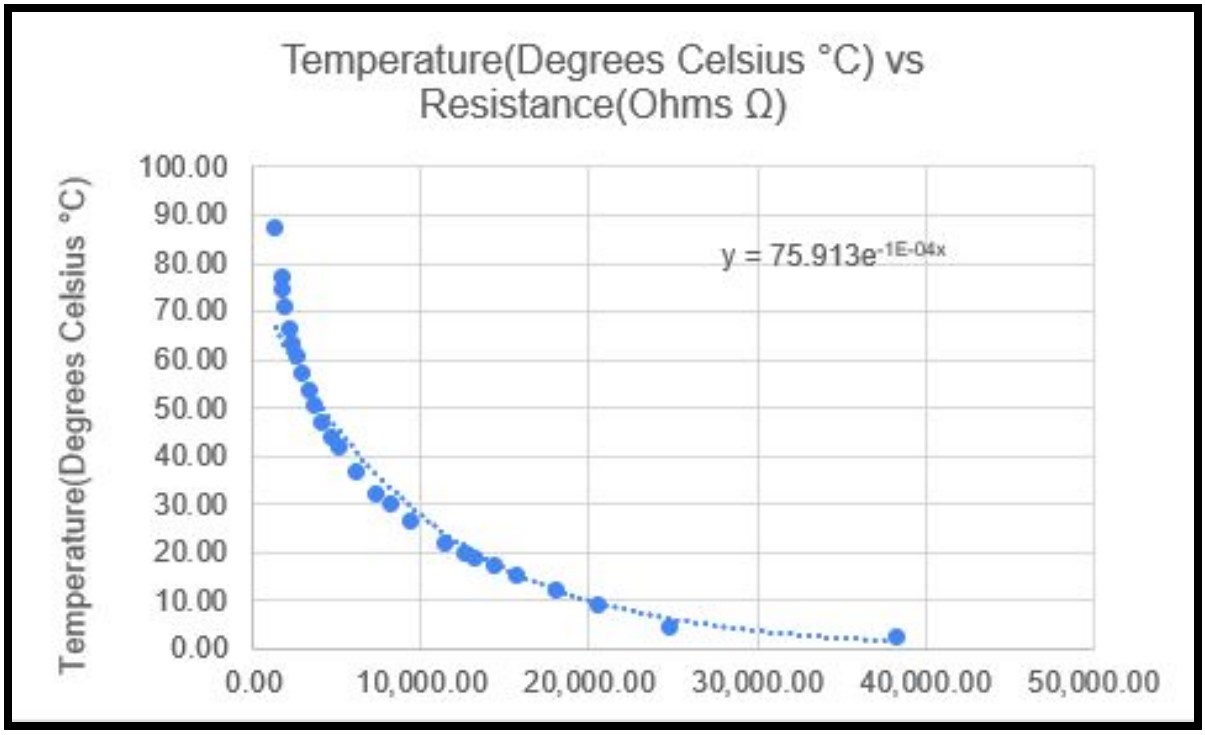
Lastly, I coated the heat shrink with liquid electrical tape.

By coating the tip of the temperature probe and actual thermistor with liquid electrical tape, I have prevented water from getting into the wires and shorting the probe. The liquid electrical tape will act as a sealant, thereby preventing any water from getting into/shorting the probe.

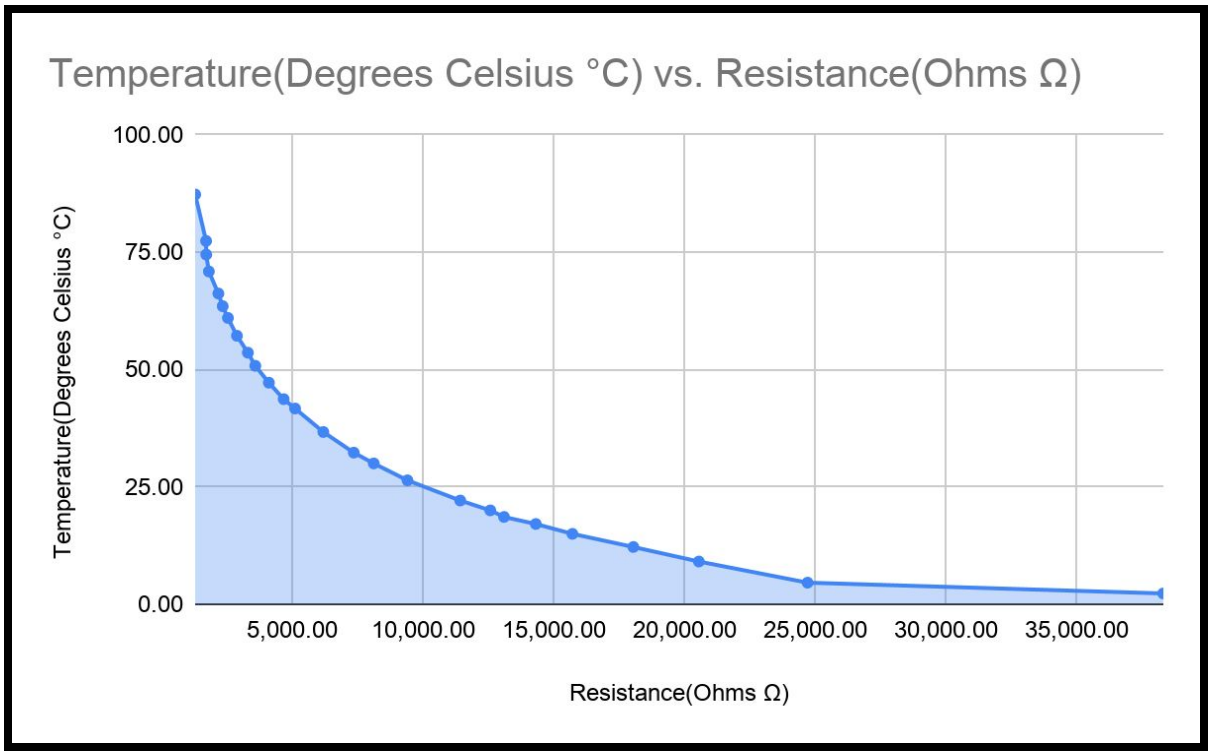
Data Table:

Resistance(Ohms Ω)	Temperature(Degrees Celsius °C)
1,291.00	87.30
1,708.00	77.40
1,714.00	74.50
1,814.00	70.90
2,178.00	66.20
2,343.00	63.50
2,543.00	61.00
2,887.00	57.20
3,306.00	53.60
3,590.00	50.80
4,109.00	47.20
4,676.00	43.70
5,111.00	41.70
6,191.00	36.70
7,355.00	32.30
8,120.00	30.00
9,408.00	26.40
11,426.00	22.10
12,575.00	20.00
13,100.00	18.60
14,316.00	17.10
15,716.00	15.00
18,046.00	12.20
20,551.00	9.10
24,707.00	4.60
38,307.00	2.30

Scatter-Plot of Data:



Function Graph of Data:



KEY:

Yellow = Mathematical Conversion Equation

Blue = LEDs Illumination Code

Conversion Equation:

$$Degrees\ Celsius(°C) = 75.913 * e^{(-1*10^{-4})x},\ where\ x\ is\ resistance(\Omega)$$

Program:

```
/*
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  Detector Building
*/

//Assigning LEDS
int red = 13;
int green = 12;
int blue = 11;

int thermistor = A0; //Declares thermistor pin
float voltage = 0; //Declares voltage

#define SAMPLES 20 //Number of loops
int samples[SAMPLES]; //Declares array of size numSamples

//Defining values for temperature calculation
float resistor = 10000;

//Set up function, starts things up
void setup() {
  pinMode(red, OUTPUT);
  pinMode(green, OUTPUT);
  pinMode(blue, OUTPUT);
  analogReference(EXTERNAL); //Declares reference voltage
  Serial.begin(9600); //Begins serial monitor
}

//Loop function, "main" function
void loop() {

  //For temperature
  int i;
```

```
  float resistance = 0;

  for (i = 0; i< SAMPLES; i++) { //Reads thermistor value numSamples times
    samples[i] = analogRead(thermistor);
    resistance += samples[i];
  }

  resistance /= SAMPLES; //Calculates average

  //Formula to calculate resistance
  resistance = 1023 / resistance - 1;
  resistance = resistor / resistance;

  Serial.print("Resistance: ");
  Serial.print(resistance);
  Serial.print("\t");

  //For voltage
  voltage = 3.3 * (resistance / (10000 + resistance));//Voltage divider
equation

  Serial.print("Voltage: ");
  Serial.print(voltage);
  Serial.print("\t");

  //Conversion formula to calculate temperature(degrees celsius) from
resistance, which is calculated from voltage
  float temperature = 75.913*(pow (M_E, -1*(pow(10, -4))*resistance ));

  Serial.print("Temperature : ");
  Serial.print(temperature);
  Serial.print(" *C\n");

  if(temperature > && temperature <){
    digitalWrite(red,);
    digitalWrite(blue,);
    digitalWrite(green,);
  }
  else if(temperature > && temperature <){
    digitalWrite(green,);
    digitalWrite(blue,);
    digitalWrite(red,);
  }
  else if(temperature >){
    digitalWrite(blue,);
    digitalWrite(green,);
    digitalWrite(red,);
  }
  else{
    digitalWrite(green,);
    digitalWrite(blue,);
    digitalWrite(red,);
  }

  delay(800);
}
```