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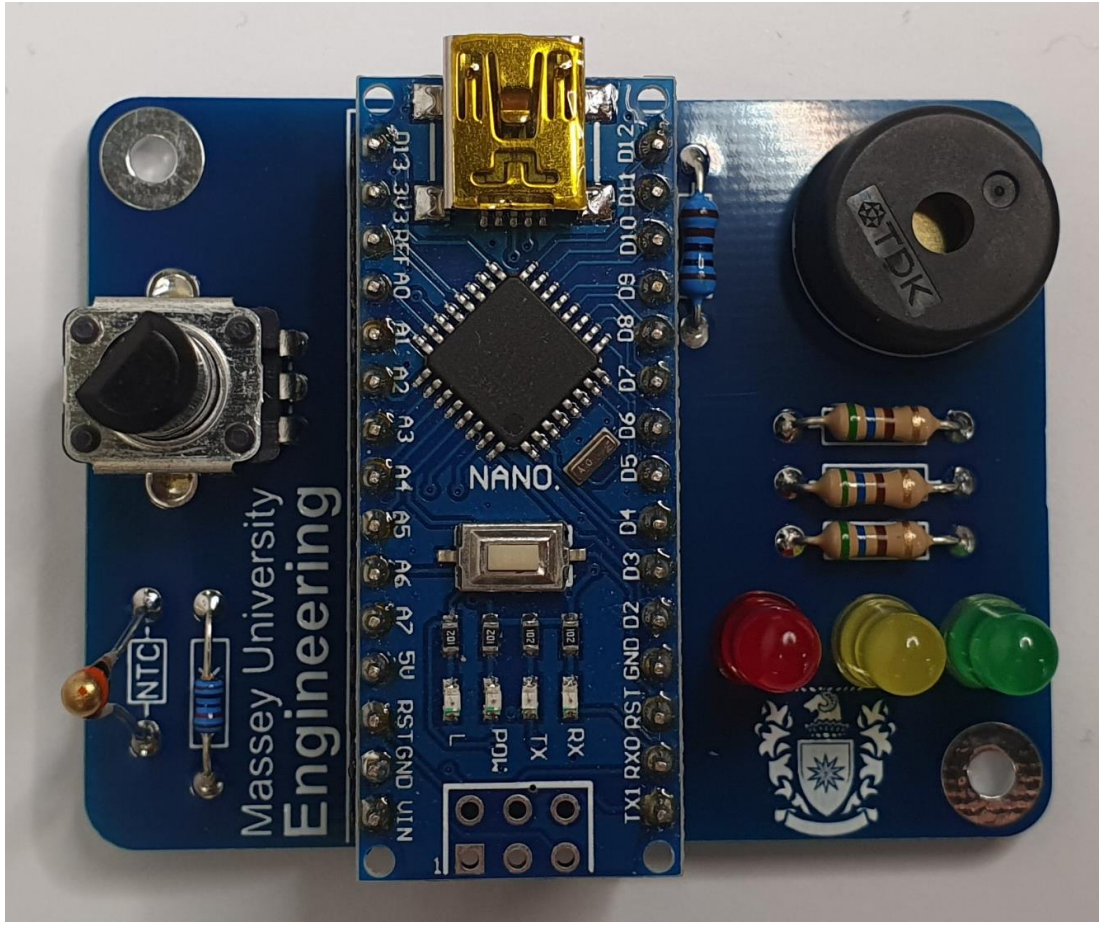
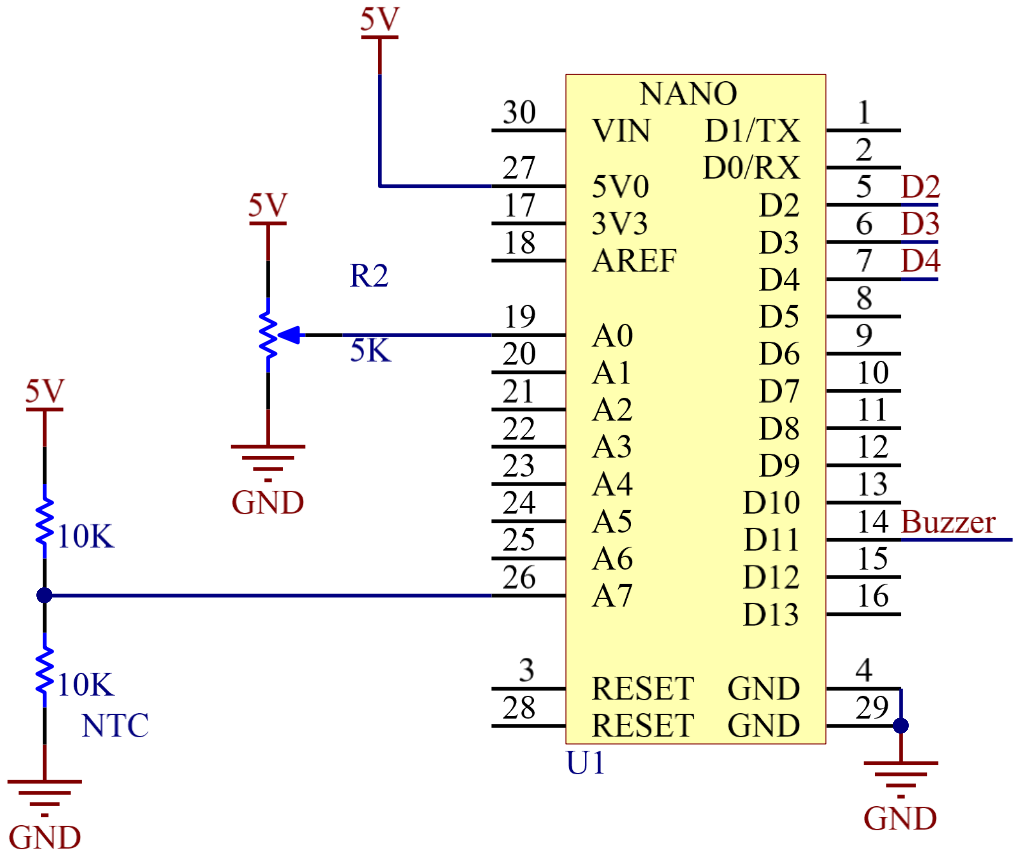
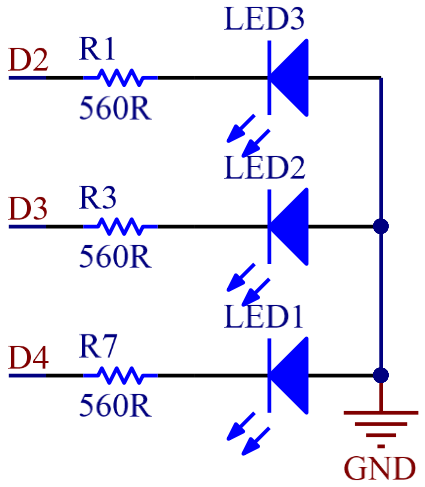
ALBANY SENIOR HIGH SCHOOL

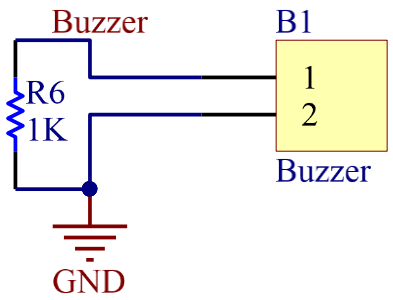
Arduino Temperature Sensor and Buzzer activity



Schematic diagram







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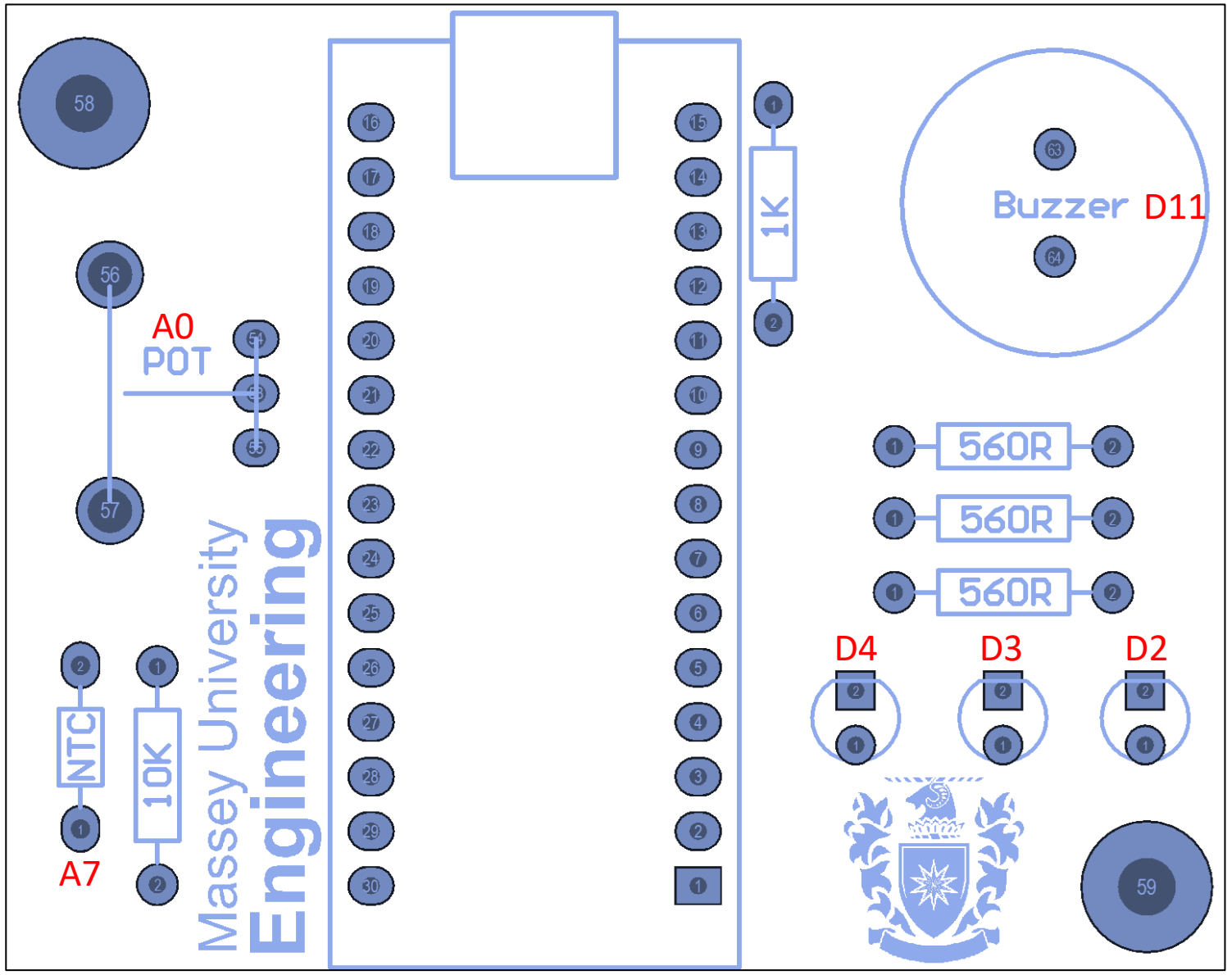
Components and PCB

Part	Quantity
NTC	1
LED - Green	1
LED - Red	1
LED - Yellow	1
Resistor - 560R	3
Resistor - 1K	1
Resistor - 10K	1
Buzzer	1
POT - 10K	1
Arduino nano	1
PCB	1
Female headers	2

Note: Arduino pins are labelled in red for the corresponding peripheral



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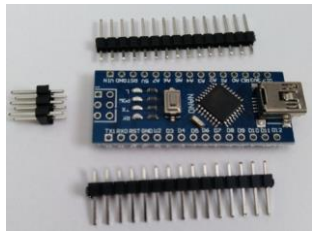
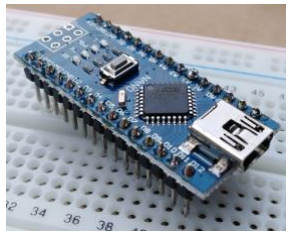
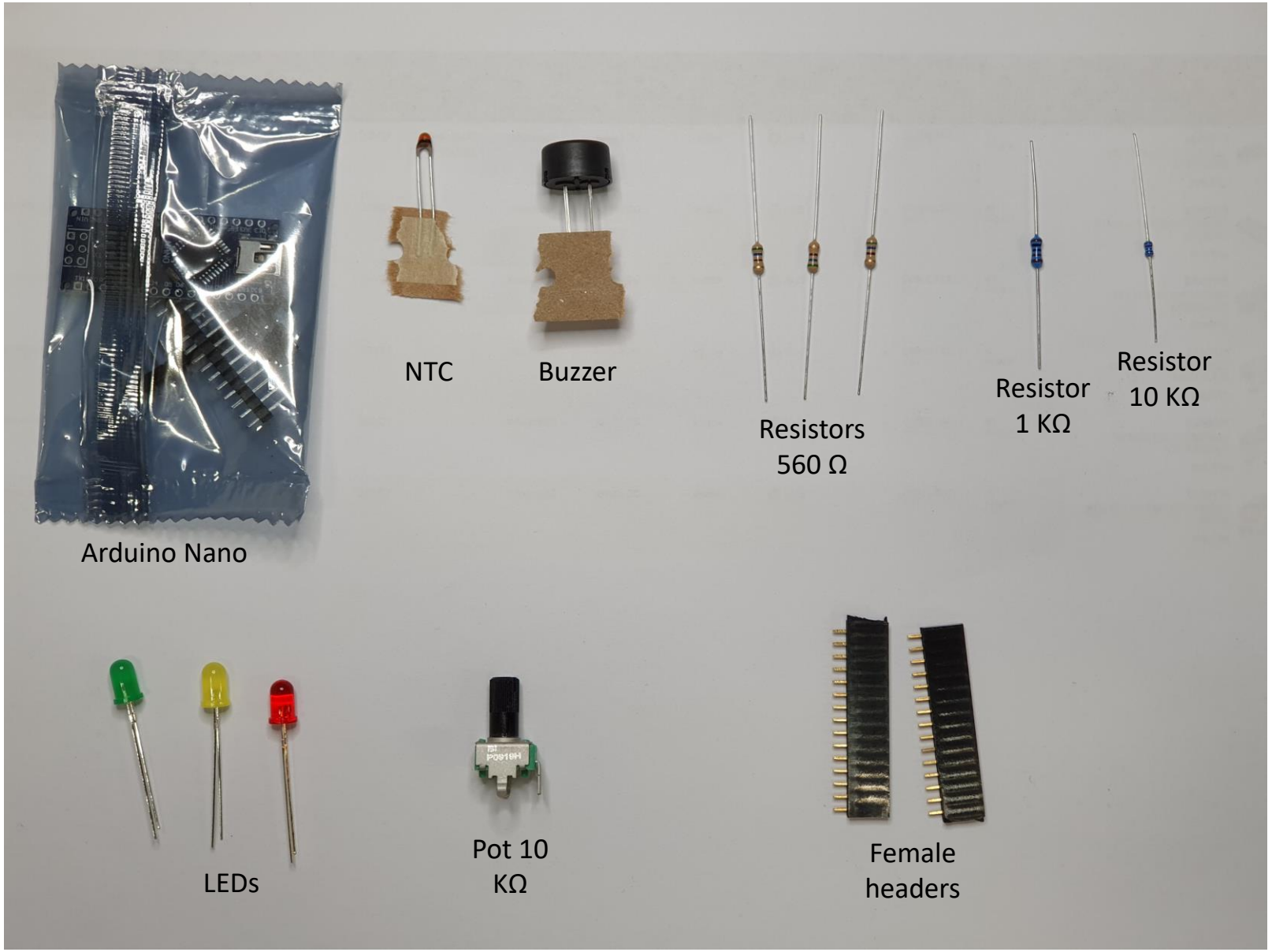
Components

Notes:

- Resistors, NTC and the Buzzer are not polarised and can be soldered on the PCB in any direction.
- The LEDs are polarised. Long leg is positive and short leg is negative, denoted on the PCB by a square pad for positive and round pad for negative. Solder male headers on to Arduino nano as shown in the images below and corresponding female headers get soldered on the PCB.







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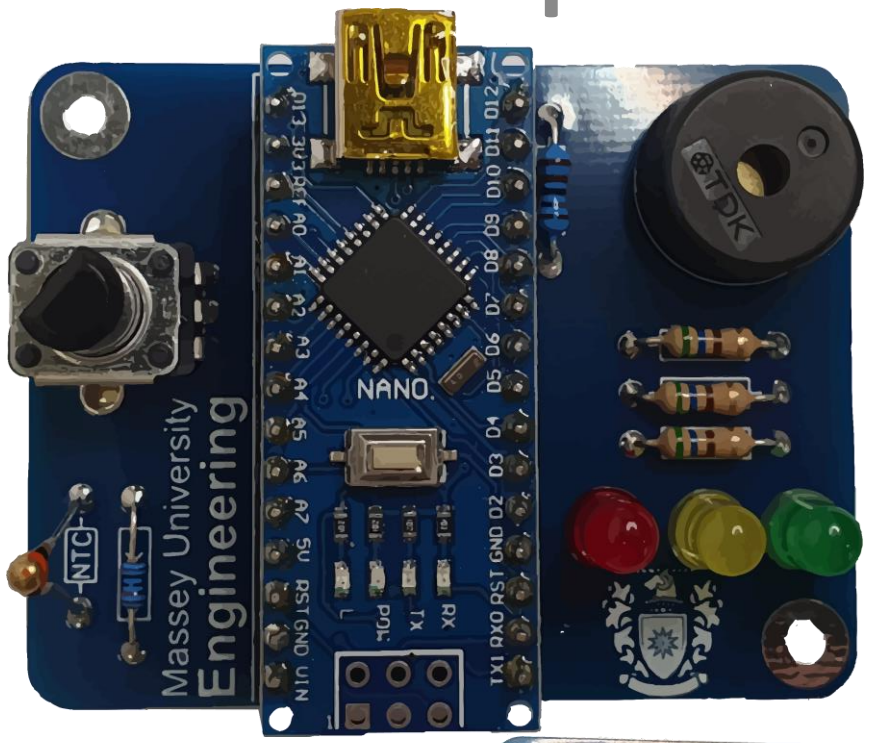
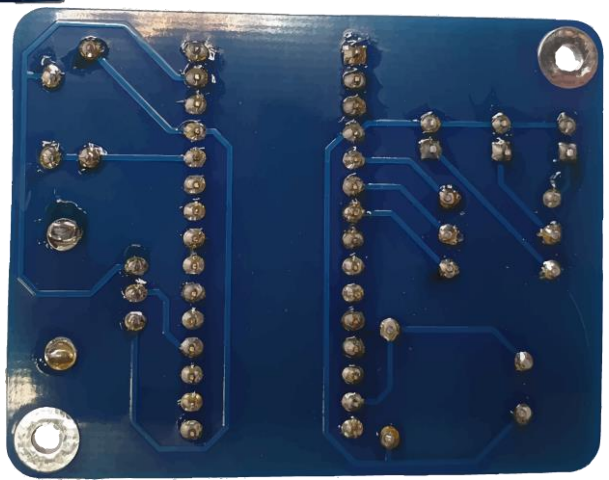
Sample Arduino Code

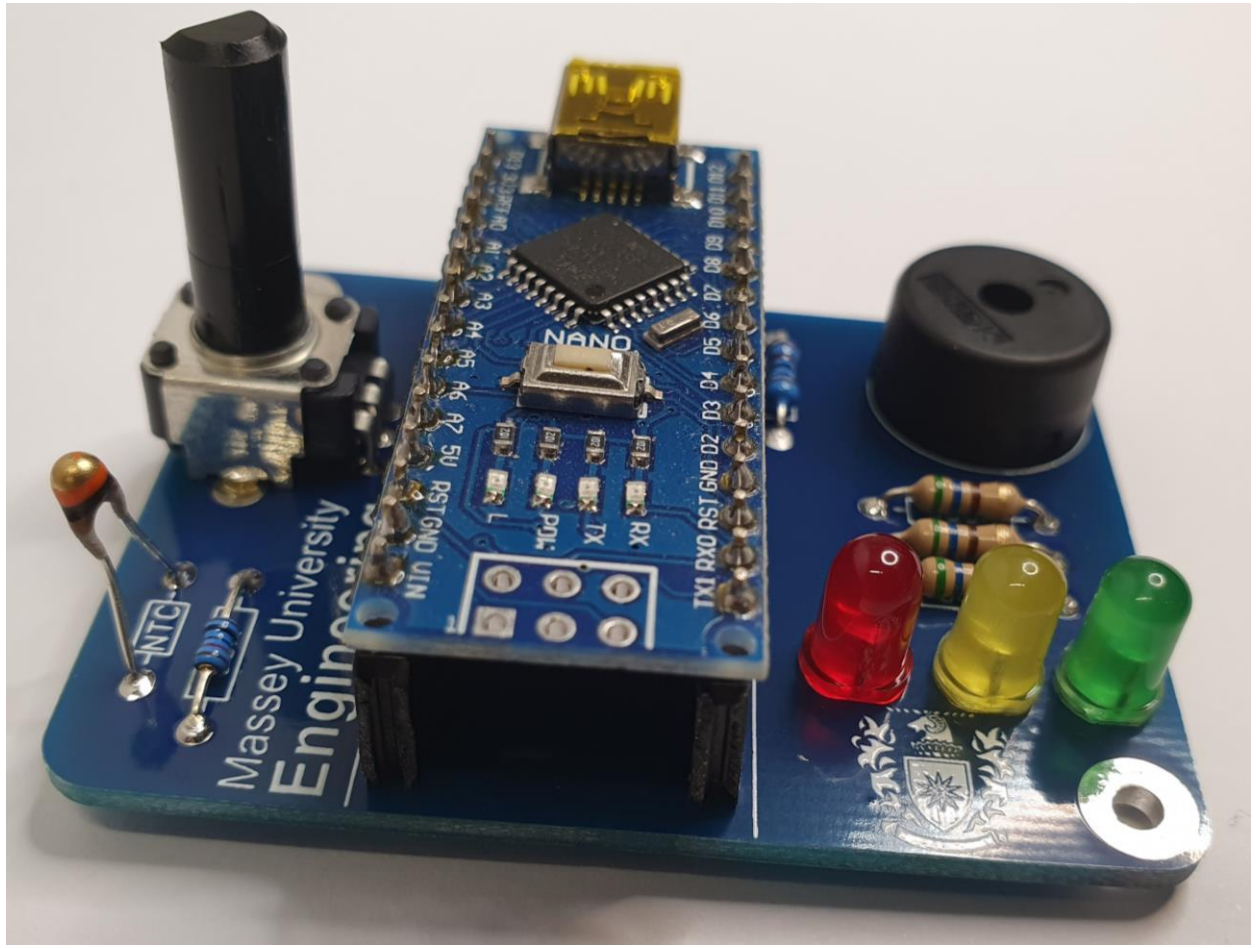
```
#define NTC_PIN A7  // pin to which the NTC voltage divider is connected
#define POT A0
#define BUZZER 11
#define LED_RED 4
#define LED_YELLOW 3
#define LED_GREEN 2
#define ambTemp 22

void setup(void) {
  Serial.begin(115200);  //initialize serial communication at a baud rate of 115200
  pinMode(BUZZER, OUTPUT);
  pinMode(LED_RED, OUTPUT);
  pinMode(LED_YELLOW, OUTPUT);
  pinMode(LED_GREEN, OUTPUT);
}

void loop(void) {
  float T = tempSens();
  Serial.print("Temperature ");
  Serial.print(T);
  Serial.println(" *C");

  if (T <= 22){
    clearLEDs();
  }
  if (T >= ambTemp+2){
    clearLEDs();
    digitalWrite(LED_GREEN, HIGH);
  }
  if (T >= ambTemp+3){
    clearLEDs();
    digitalWrite(LED_YELLOW, HIGH);
    digitalWrite(LED_GREEN, HIGH);
  }
  if (T >= ambTemp+4){
    clearLEDs();
    digitalWrite(LED_RED, HIGH);
    digitalWrite(LED_YELLOW, HIGH);
    digitalWrite(LED_GREEN, HIGH);
  }

  buzzer();
}
```

```
float tempSens (){
  #define NTC_resistance 10000 // Nominal resistance of NTC at room temperature (25ºC)
  #define nominal_temperature 25 + 273.15 // Temperature for nominal resistance (almost
always 25º C)
  #define NTC_beta 3950
  #define samplingRate 5  // Number of samples
  #define Rref 10000 // Value of resistor used for the voltage divider

  uint8_t i;
  float average;
  int samples = 0;

  // take voltage readings from the voltage divider
  for (i = 0; i < samplingRate; i++) {
    samples += analogRead(NTC_PIN);
    // delay(10);
  }
  average = 0;
  average = samples / samplingRate;
  average = 1024 / average - 1;
  average = Rref / average;
  //  temperature;
  float temperature = average/NTC_resistance;
  temperature = log(temperature);  // ln(R/Ro)
  temperature /= NTC_beta;  // 1/B * ln(R/Ro)
  temperature += 1.0 / (nominal_temperature);  // + (1/To), and convert to Kelvin
  temperature = 1.0 / temperature;  // Invert
  temperature -= 273.15;  // convert absolute temp to C

  return temperature;
}

void clearLEDs(){
  digitalWrite(LED_RED, LOW); digitalWrite(LED_YELLOW, LOW); digitalWrite(LED_GREEN, LOW);
}

void buzzer(){
  int val = analogRead(POT);
  val = map(val, 0, 1024, 0, 4500);
  tone(BUZZER, val, 10);
}
```

Finished product







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