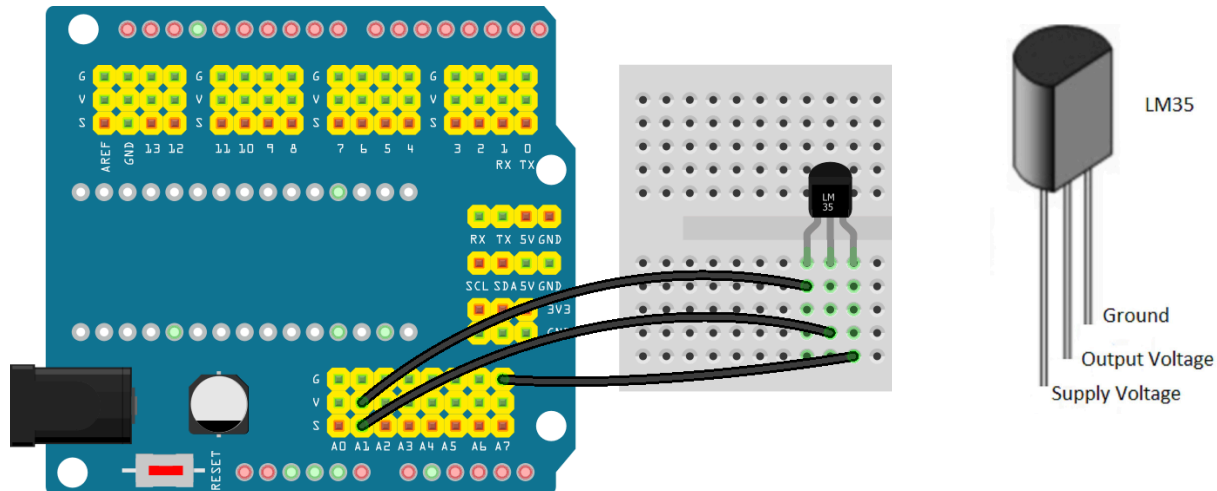


Task 1. Build a digital thermometer.

Connect the following circuit:



The LM35 is a linear temperature sensor that outputs a voltage proportional to the ambient temperature value.

Code example:

```
#define BAUDRATE 115200
#define LM35_PIN A1
int analogvalue;

void setup() {
    Serial.begin(BAUDRATE); }

void loop() {
    analogvalue = analogRead(LM35_PIN);
    Serial.println(analogvalue);
    delay(250); }
```

Exercise no 3: Analog inputs

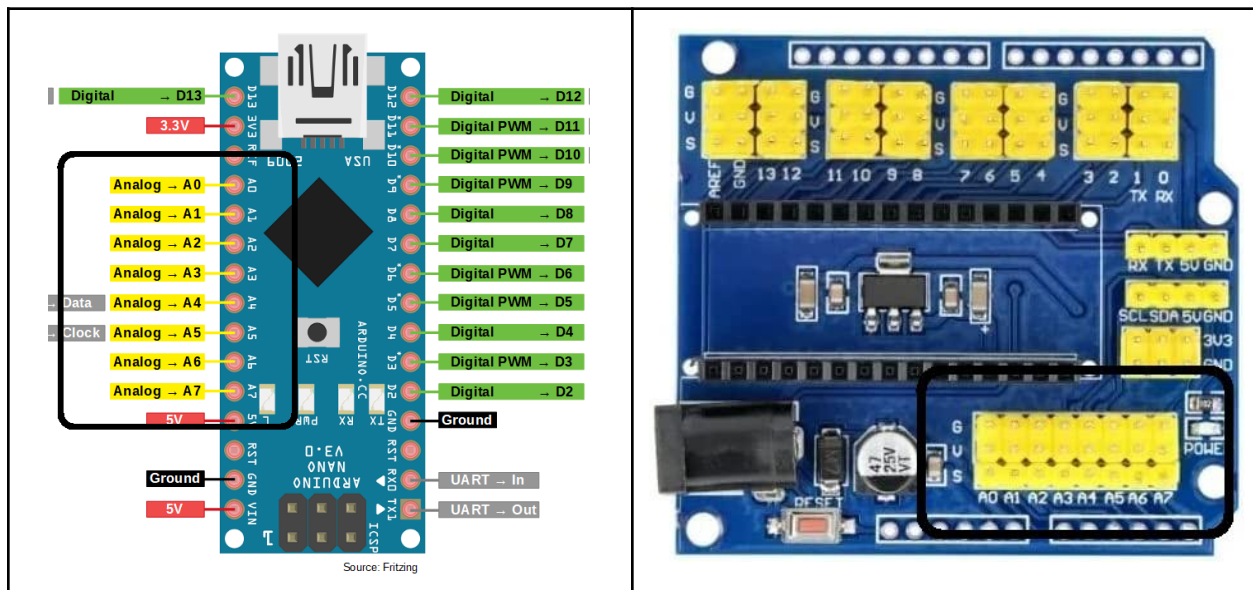
What's new:

analogRead function

Reference:

www.arduino.cc/en/Reference/AnalogRead

Arduino boards contain a multichannel, 10-bit analog-to-digital converter. It will map input voltages between 0 and the operating voltage (5V or 3.3V) into integer values between 0 and 1023.



7.3.1 LM35 Transfer Function

The accuracy specifications of the LM35 are given with respect to a simple linear transfer function:

$$V_{OUT} = 10 \text{ mV/}^{\circ}\text{C} \times T$$

where

- V_{OUT} is the LM35 output voltage
- T is the temperature in $^{\circ}\text{C}$

```
#define BAUDRATE 115200
```

```
#define LM35_PIN A1
```

Exercise no 3: Analog inputs

```
double analogvalue;

void setup() {
    Serial.begin(BAUDRATE); }

void loop() {
    analogvalue = analogRead(LM35_PIN);
    Serial.println(analogvalue*5/1023.0*100);
    delay(250); }
```

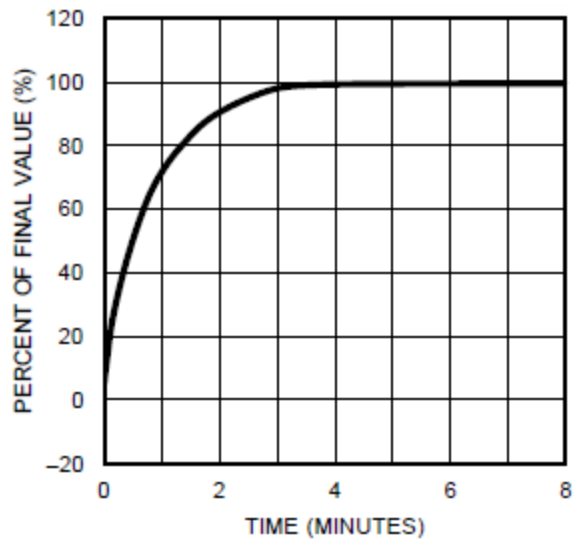
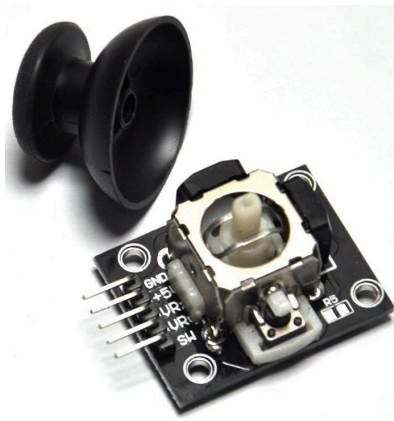
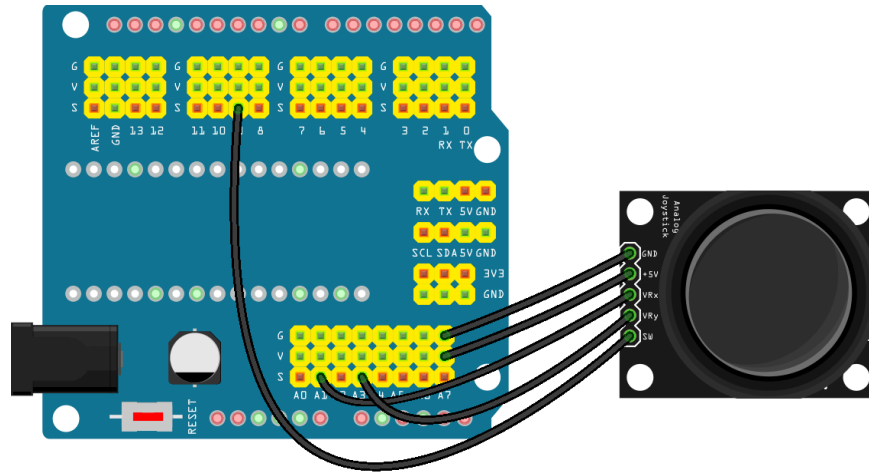


Figure 3. Thermal Response In Still Air

Exercise no 3: Analog inputs

Task 2. Connect the following circuit. Create a code to send the values corresponding to the stick inclination in the X and Y axes to the computer.



Arduino board	Joystick board
Gnd	Gnd
+5V	+5V
A1	VRx
A3	VRy
9	SW

```
#define BAUDRATE 115200
#define VRX A1
#define VRY A3

int Vrx, Vry;

void setup() {
    Serial.begin(BAUDRATE); }

void loop() {
    Vrx = analogRead(VRX);
```

Exercise no 3: Analog inputs

```
Vry = analogRead(VRY);  
Serial.print("Vrx = "); Serial.print(Vrx);  
Serial.print(" Vry = "); Serial.println(Vry);  
delay(250); }
```

Task 3. Using the previous example, write a program that will send information about the stick inclination encoded with cardinal directions: N, S, W, and E and intermediate directions: NW, NE, SW, and SE to the computer.

Prompt:

- expression `if(x < 100 && x > 0)` allows you to check whether the value of variable x is in the range of values from 0 to 100;
- expression `if(x > 100 || x < 0)` allows you to check whether the value of variable x is outside the range of values from 0 to 100.

```
#define BAUDRATE 115200  
#define VRX A1  
#define VRY A3  
  
int Vrx, Vry;  
String dir = "";  
  
void setup() {  
  Serial.begin(BAUDRATE);  
}  
  
void loop() {  
  Vrx = analogRead(VRX);  
  Vry = analogRead(VRY);  
  
  if(Vry < 100) dir += "N";
```

Exercise no 3: Analog inputs

```
else if(Vry > 900) dir += "S";

if(Vrx < 100) dir += "E";
else if(Vrx > 900) dir += "W";

if(dir.length() != 0) {
    Serial.println(dir);
    dir="";
}
delay(250); }
```

What's new:

String variable, ***String.length()*** expression

Task 4. Temperature detector. Create a solution to detect if the temperature is within the pre-defined range.

For those interested:

1. Analog input pins tutorial:

www.arduino.cc/en/Tutorial/AnalogInputPins

2. HowToMechatronics tutorial:

howtomechatronics.com/tutorials/arduino/analog-inputs/

3. Guide for LM35, LM335 and LM34 Temperature Sensors with Arduino:

randomnerdtutorials.com/arduino-lm35-lm335-lm34-temperature-sensor/