Experiment-04

Aim : Study of different types of sensors and interfacing of sensors to Arduino uno nano board.

Objective: To study different sensors and their working.

Theory:

There is a wide selection of temperature sensors that are used for different applications.

RTD Temperature Sensor-

RTD stands for Resistance Temperature Detector, these are more accurate and stable than other temperature sensors. As temperature changes, the resistance of any metal changes as well. This difference in resistance is what RTD temperature sensors are based on. An RTD is a resistor with well-defined resistance vs. temperature characteristics. Platinum is the most common and accurate material used to make RTDs.

Thermistors:

Thermistors are similar to RTDs in that temperature changes cause measurable resistance changes. Thermistors are usually made from a polymer or ceramic material. In most cases, thermistors are cheaper but are also less accurate than RTDs.

Thermocouples:

Thermocouples are the most commonly used type of temperature sensor. They are used in industrial, automotive, and consumer applications. Thermocouples are self-powered, require no excitation, can operate over a wide temperature range, and have quick response times. There are several types of thermocouples that are made from a variety of different materials, which allows for different temperature ranges and different sensitivities.

Semiconductor based ICs:

Semiconductor based temperature sensor ICs come in two different types: local temperature sensor and remote digital temperature sensor. Local temperature sensors are ICs that measure their own die temperature by using the physical properties of a transistor. Remote digital temperature sensors measure the temperature of an external transistor. Local temperature sensors can use either analog or digital outputs. Semiconductor based temperature sensor ICs come in two different types: local temperature sensor and remote digital temperature sensor. Local temperature sensors are ICs that measure their own die temperature by using the physical properties of a transistor. Remote digital temperature sensors measure the temperature of an external transistor.
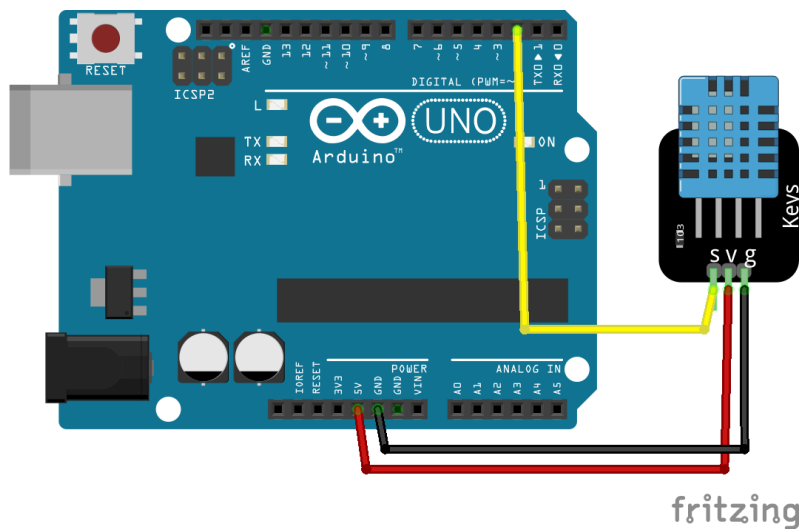
DHT11 Sensor:

The **DHT11** is a commonly used **Temperature and humidity sensor that** comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

DHT11 Specifications

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%

Circuit Diagram:

Code:

```
#include "dht.h"
#define dht_apin A0
```

```
dht DHT;

void setup(){

  Serial.begin(9600);
  delay(500);
  Serial.println("DHT11 Humidity & temperature Sensor\n\n");
  delay(1000);

}

void loop(){


        DHT.read11(dht_apin);

        Serial.print("Current humidity = ");
        Serial.print(DHT.humidity);
        Serial.print("%  ");
        Serial.print("temperature = ");
        Serial.print(DHT.temperature);
        Serial.println("C  ");

        delay(100);//Wait 5 seconds before accessing sensor again.


}
```

Output:

/dev/ttyACM0

Send

```
DHT11 Humidity & temperature Sensor

Current humidity = 66.00%  temperature = 33.00C
Current humidity = 66.00%  temperature = 33.00C
Current humidity = 66.00%  temperature = 33.00C
Current humidity = 66.00%  temperature = 33.00C
Current humidity = 66.00%  temperature = 33.00C
Current humidity = 66.00%  temperature = 33.00C
Current humidity = 69.00%  temperature = 33.00C
Current humidity = 72.00%  temperature = 33.00C
Current humidity = 74.00%  temperature = 34.00C
Current humidity = 76.00%  temperature = 34.00C
Current humidity = 77.00%  temperature = 34.00C
Current humidity = 74.00%  temperature = 34.00C
Current humidity = 69.00%  temperature = 34.00C
Current humidity = 69.00%  temperature = 34.00C
Current humidity = 69.00%  temperature = 34.00C
Current humidity = 67.00%  temperature = 34.00C
Current humidity = 65.00%  temperature = 34.00C
Current humidity = 65.00%  temperature = 34.00C
Current humidity = 64.00%  temperature = 34.00C
Current humidity = 64.00%  temperature = 34.00C
Current humidity = 63.00%  temperature = 34.00C
Current humidity = 63.00%  temperature = 34.00C
```

☑ Autoscroll   No line ending ▾   9600 baud ▾

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sketch_aug02b

```cpp
#include "dht.h"
#define dht_apin A0 // Analog Pin sensor is connected to

dht DHT;

void setup(){

  Serial.begin(9600);
  delay(500);//Delay to let system boot
  Serial.println("DHT11 Humidity & temperature Sensor\n\n");
  delay(1000);//Wait before accessing Sensor

}//end "setup()"

void loop(){
  //Start of Program

    DHT.read11(dht_apin);

    Serial.print("Current humidity = ");
    Serial.print(DHT.humidity);
    Serial.print("%  ");
    Serial.print("temperature = ");
    Serial.print(DHT.temperature);
    Serial.println("C  ");

    delay(5000);//Wait 5 seconds before accessing sensor again.

    //Fastest should be once every two seconds.

}// end loop()
```

/dev/ttyACM0

Send

```
Current humidity = 76.00%  temperature = 34.00C
Current humidity = 77.00%  temperature = 35.00C
Current humidity = 78.00%  temperature = 35.00C
Current humidity = 78.00%  temperature = 35.00C
Current humidity = 79.00%  temperature = 35.00C
Current humidity = 79.00%  temperature = 35.00C
Current humidity = 79.00%  temperature = 35.00C
Current humidity = 79.00%  temperature = 35.00C
Current humidity = 80.00%  temperature = 36.00C
Current humidity = 73.00%  temperature = 35.00C
Current humidity = 68.00%  temperature = 35.00C
Current humidity = 65.00%  temperature = 35.00C
Current humidity = 65.00%  temperature = 35.00C
Current humidity = 64.00%  temperature = 35.00C
Current humidity = 64.00%  temperature = 35.00C
```

☑ Autoscroll   No line ending ▾   9600 baud ▾

Done uploading.

Binary sketch size: 5,020 bytes (of a 32,256 byte maximum)

31   Arduino Uno on /dev/ttyACM0