DIGITAL (LAB)

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First Lab: Introduction About Arduino Kit and Program

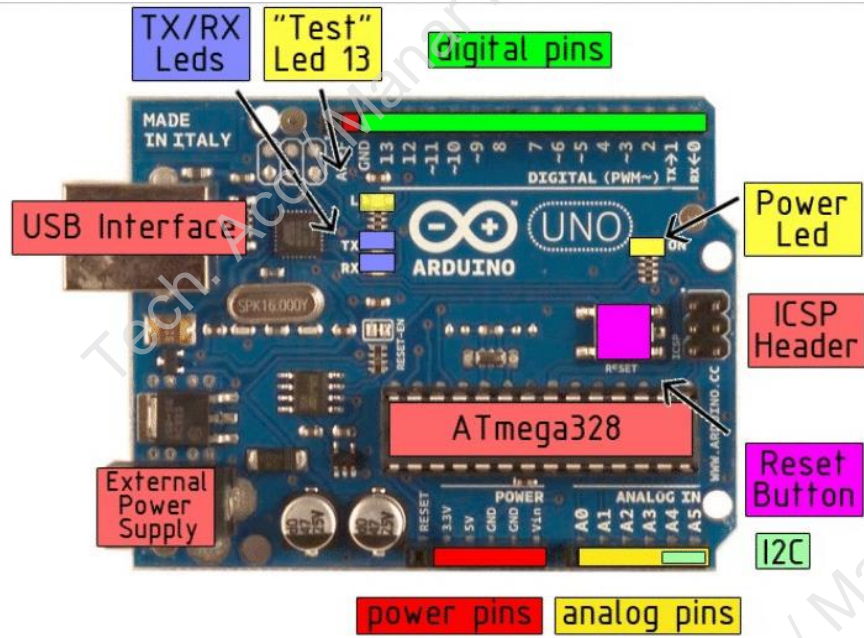## ❖ Material required
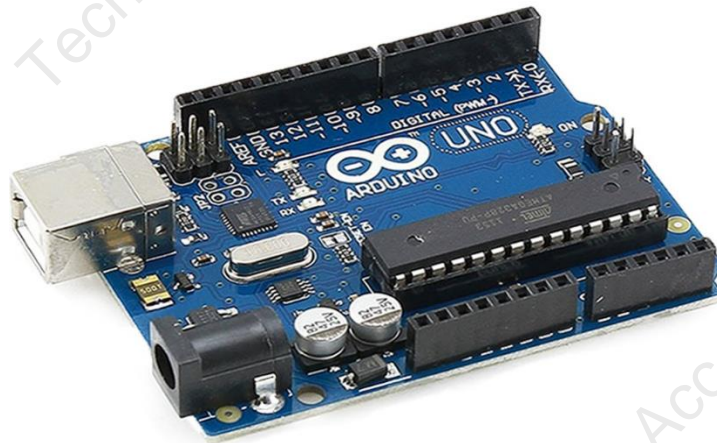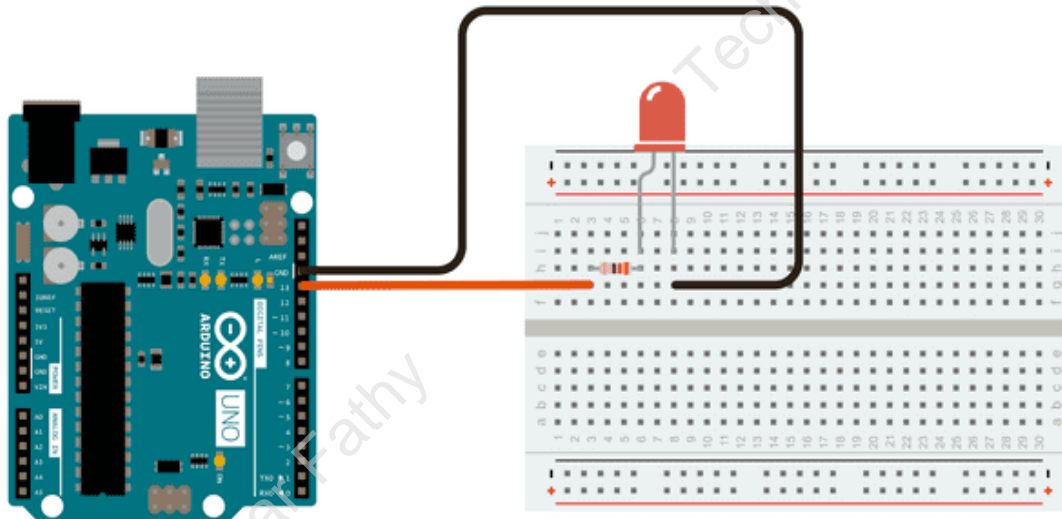
1) Arduino Kit

2) Arduino Software

❖ Objectives:

1) Learn Arduino Kit layout.
2) Learn how to build simply circuit using Arduino Kit.
3) Learn know to make program using Arduino software.

❖ Procedure:

Explore Arduino kit and learn input – output – power -… of it.

Built circuit by Arduino kit.

Explore the software and make examples (blink led, ...)

```
         Upload Using Programmer

 sketch_aug03a
  1  // Turn on LED while button is pressed
  2
  3  const int LED = 13;
  4  const int BUTTON = 7;
  5  int val = 0;
  6
  7  void setup() {
  8    pinMode(LED, OUTPUT);
  9    pinMode(BUTTON, INPUT);
 10  }
 11
 12  void loop(){
 13    val = digitalRead(BUTTON);
 14
 15    if (val == HIGH) {
 16      digitalWrite(LED, HIGH);
 17    } else {
 18      digitalWrite(LED, LOW);
 19    }
 20  }
```
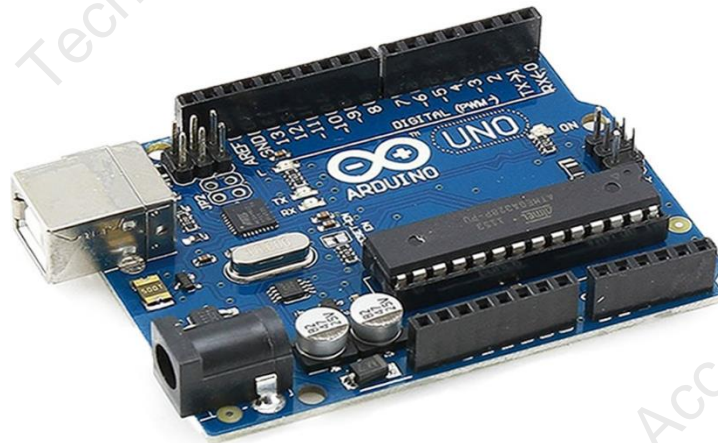
❖ Results:

The student can identify Arduino kit and made circuit using it and program it too.
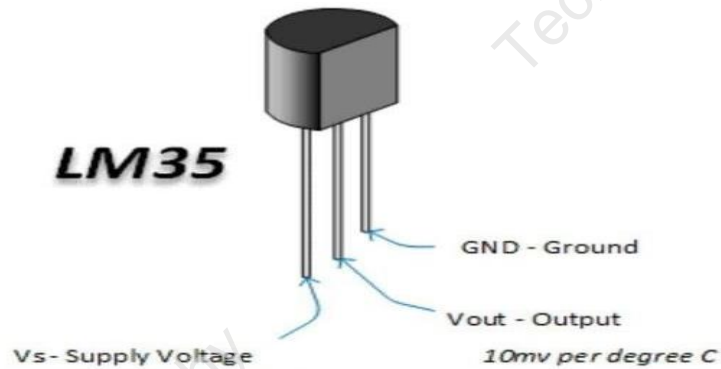
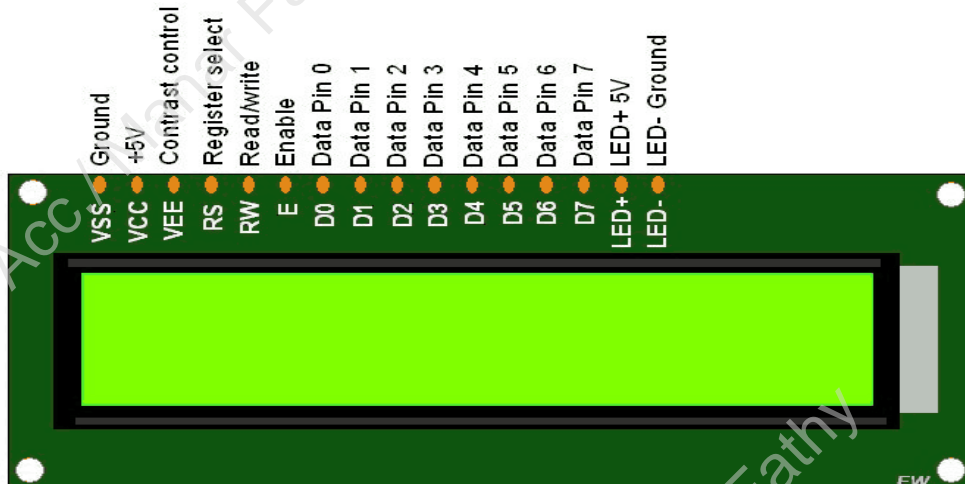# Second Lab: Read Room Temperature Using LM35 Sensor

❖ Material required

1) Arduino Kit

2) LM 35

LM35

GND - Ground

Vout - Output

Vs - Supply Voltage   10mv per degree C

3) LCD 16*two

4) Resistance 220Ω and led

❖ Objectives:

1) Learn types of sensors.
2) Learn how to convert from analog to digital.
3) Learn how to build temperature sensor circuit to Arduino Kit.

❖ Procedure:

LM35 is a temperature sensor that outputs an analog signal which is proportional to the instantaneous temperature. The output voltage can easily interpret to obtain a temperature reading in Celsius. The advantage of lm35 over thermistor is it does not require any external calibration.

LM35 Temperature sensor Features:
- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full −55°C to 150°C Range
- Suitable for Remote Applications
- Operates from 4 V to 30 V
- Less than 60-µA Current Drain
- Low Self-Heating, 0.08°C in Still Air
-Non-Linearity Only ±¼°C Typical
- Low-Impedance Output, 0.1 Ω for 1-mA Load

Steps to calculate temperature using LM35 temperature sensor:

1) Build circuit.

2) Power LM35 to +5-20 volts.

3) Connect sensor output to analog port in Arduino kit.

4) burn the code in Arduino kit.

5) see the temperature in lcd.
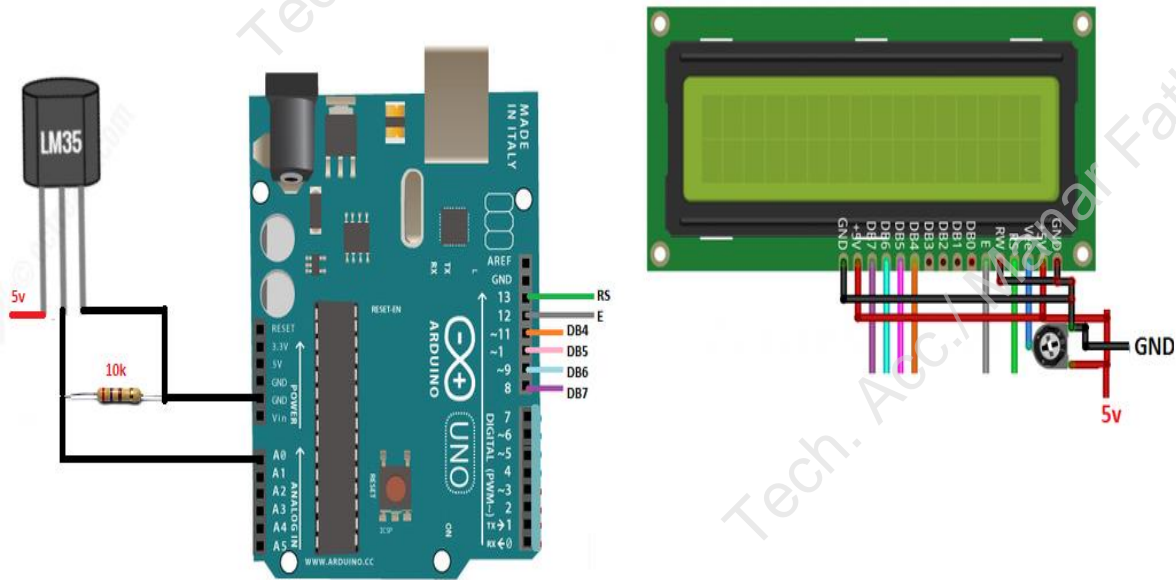
❖ Results:

The student can use analogy port of Arduino kit and convert from analog to digital.

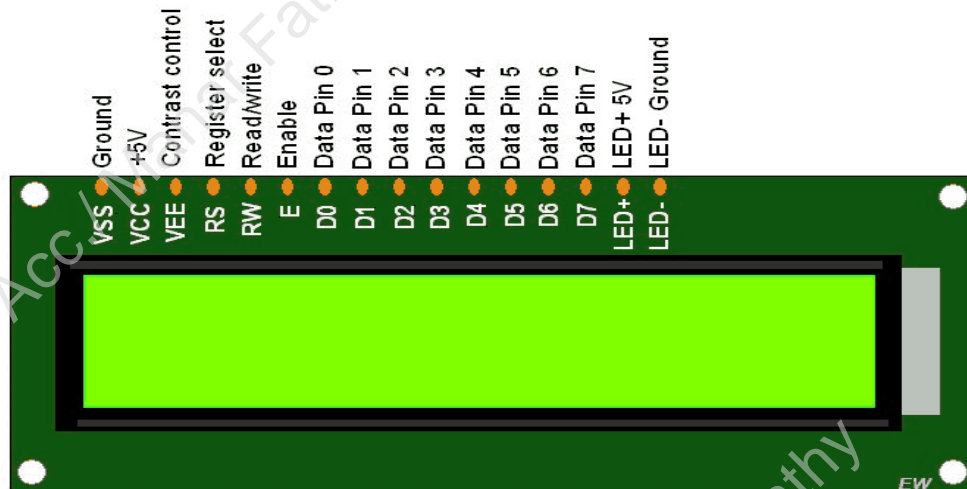# Third Lab: Making simple Incubator

❖ Material required

1) Arduino Kit

2) DHT11 Temperature/Humidity

3) LCD 16*two

4) Resistance 220Ω

❖ Objectives:

1) Learn about digital sensors.
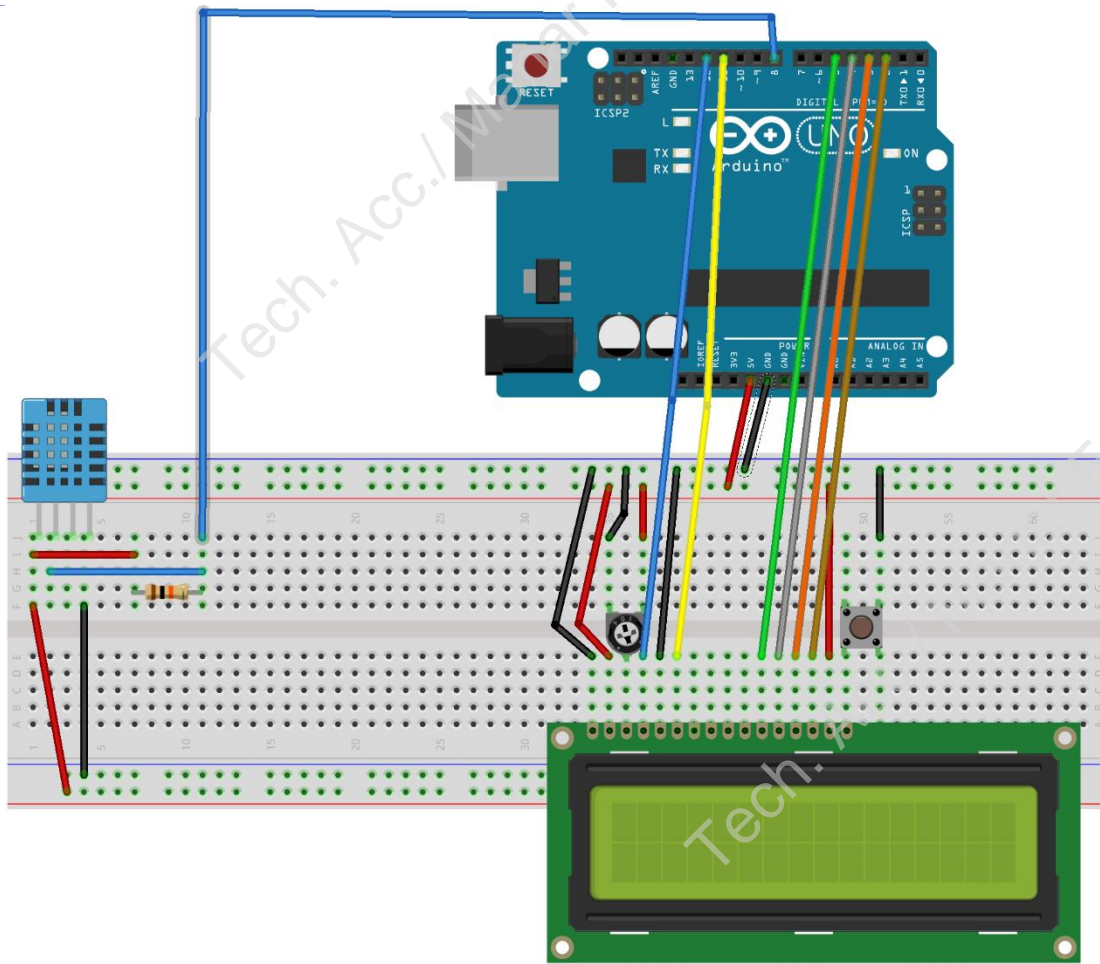2) Learn how to make simple biomedical devices.

❖ Procedure:

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can easily interface with any micro-controller such as Arduino, Raspberry Pi, others to measure humidity and temperature instantaneously.

DHT11 humidity and temperature sensor is available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor.

For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature. To get larger resistance value even for the smallest change in temperature, this sensor usually made up of semiconductor ceramics or polymers.

The temperature range of DHT11 is from 0 to 50 degree Celsius with a 2-degree accuracy. Humidity range of this sensor is from 20 to 80% with 5% accuracy. The sampling rate of this sensor is 1Hz.i.e., it gives one reading for every second. DHT11 is small with operating voltage from 3 to 5 volts. The maximum current used while measuring is 2.5mA

DHT11 sensor has four pins- VCC, GND, Data Pin and a not connected pin. A pull-up resistor of 5k to 10k ohms provided for communication between sensor and micro-controller.

❖ Results:

The student can use digital port of Arduino kit and make simple biomedical devices.

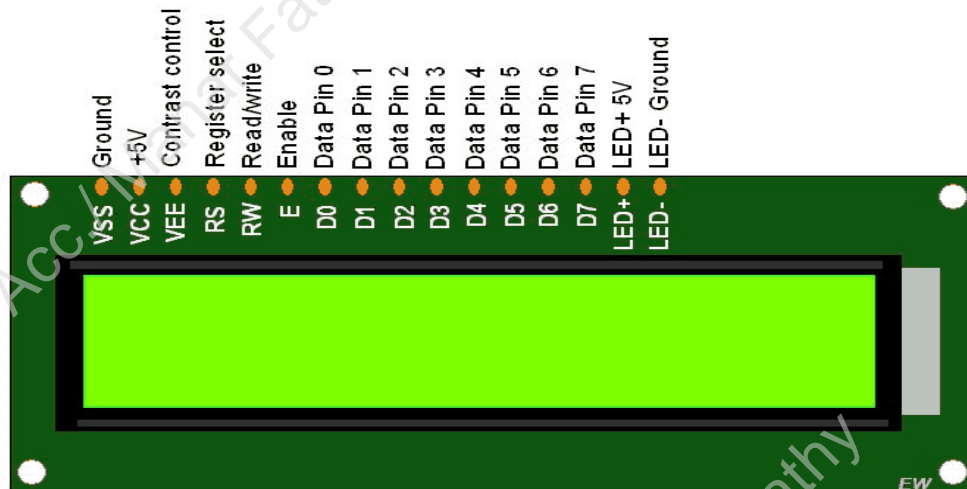# Fourth Lab: Read Pressure Using BMP180 Sensor

❖ Material required

1) Arduino Kit

2) BMP180

3) LCD 16*two

❖ Objectives:
1) Learn about I2C protocol.
2) Learn how to build pressure sensor circuit to Arduino Kit.

❖ Procedure:

The BMP180 is the new digital barometric pressure sensor of Bosch Sensor Tec, with an extremely high performance, which enables applications in advanced mobile devices, such as smart phones, tablet PCs and sports devices.

The BMP180 sensor used to measure atmospheric pressure or biometric pressure. The working principle of the air pressure sensor is amazingly simple; it works based on the weight of air. Because the air around us has a certain weight, and this weight has a specific pressure.
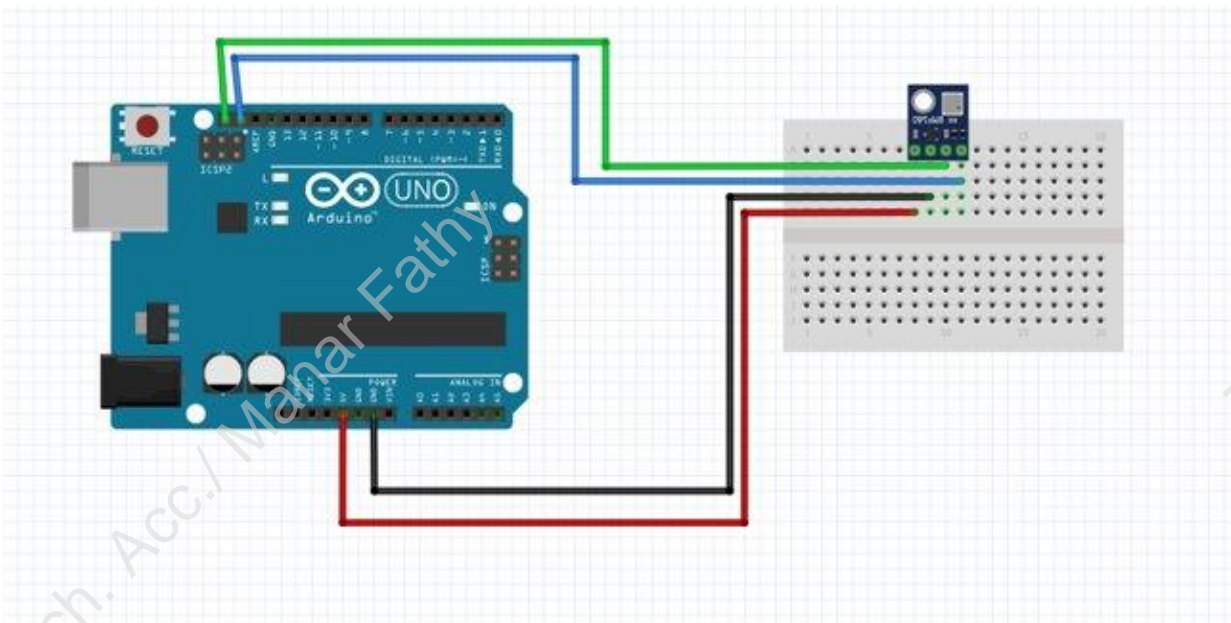
Applications:

Mobile phones

PDA

GPS

Outdoor equipment
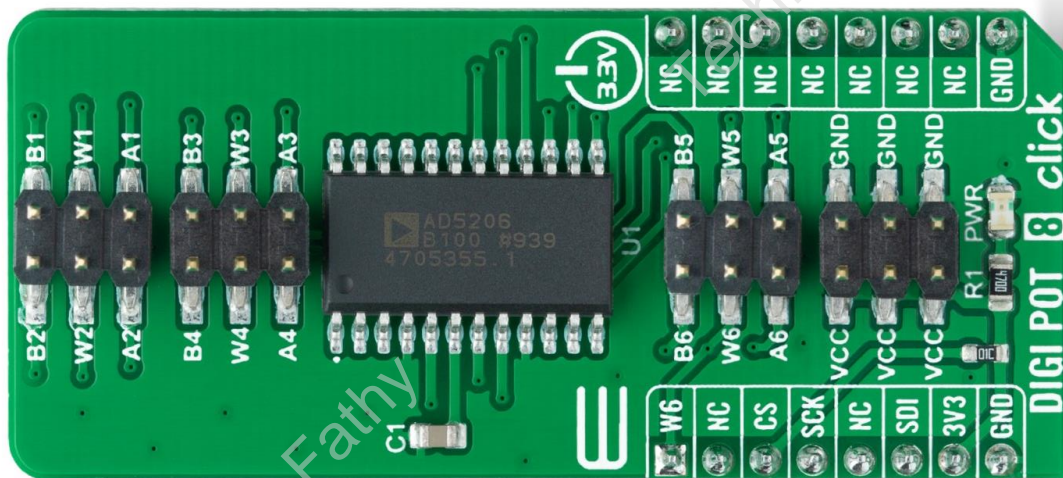

❖ Results:

The student can use pressure sensor.

Fifth Lab: Read Digital Potentiometer
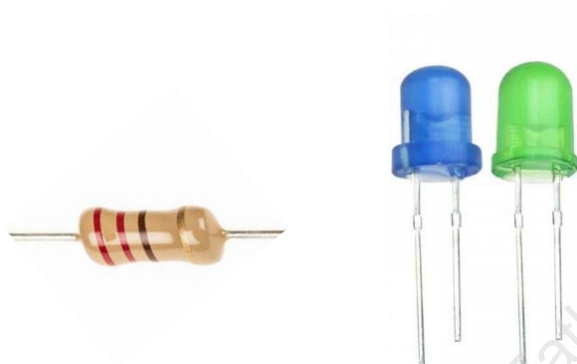
❖ Material required

1) Arduino Kit

2) AD5206

3) Resistances 220Ω and led

❖ Objectives:

1) Learn about SPI Protocol.
2) Learn about digital Potentiometer

❖ Procedure:

The AD5206 is a 6-channel digital potentiometer. This means it has six variable resistors (potentiometers) built in for individual electronic control. There are three pins on the chip for each of the six internal variable resistors, and they can interface with just as you would use a mechanical potentiometer.

FEATURES

256 positions - AD5206 (6-channel)

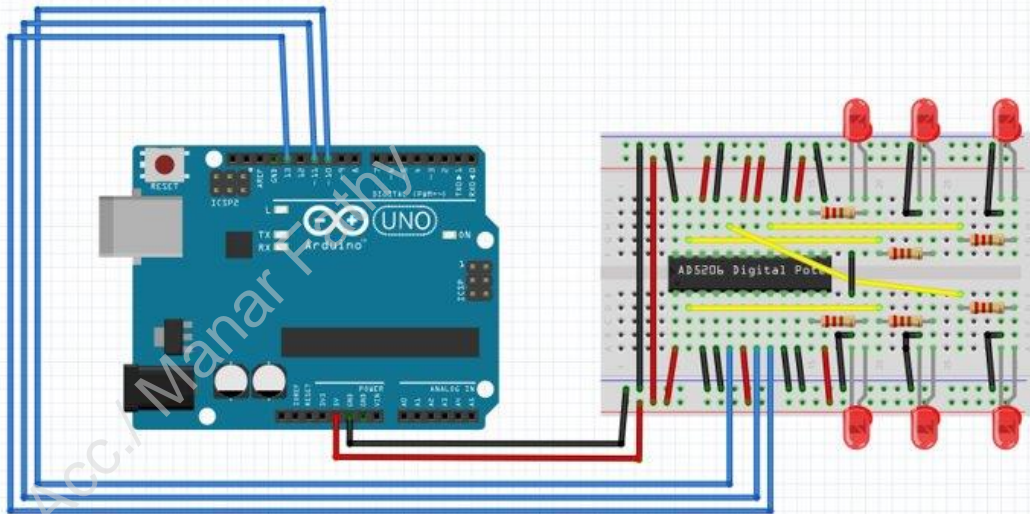Multiple independently programmable channels

Potentiometer replacement

Terminal resistance of 10 KΩ, 50 KΩ, one hundred KΩ

3-wire SPI-compatible serial data input

+2.7 V to +5.5 V single-supply operation; ±2.7 V dual-supply operation

Power-on midscale preset

❖ Results:

The student can use digital potentiometer.