**KIIT, Deemed to be University**
**School of Computer Engineering**
**Sensors And Automation [EC28005]**

# EXPERIMENT -6

## Aim:

The aim of this experiment is to interface an analog sensor, specifically the LM35, to accurately measure temperature, convert its analog output to digital format, and enable data acquisition for precise and reliable temperature monitoring and control.

## Component/Software Used:

| Component/Software | Specification |
|---|---|
| Arduino Uno | - |
| Bread Board, Cables, Connecting Wires, Laptop/Computer,7 Segment Display,Analog Sensor (LM35) | - |
| Software(s) Used | Arduino IDE 2.2.1 |

## Theory:

### 1. LM35 Analog Sensor Overview:

- The LM35 is a precision integrated-circuit temperature sensor that provides an analog output voltage proportional to the ambient temperature. It has a linear scale factor of 10 mV/°C, making it ideal for accurate temperature measurements.

2. **Analog-to-Digital Conversion:**
   - To interface the analog output of the LM35 sensor with digital systems like microcontrollers, an analog-to-digital converter (ADC) is required. The ADC converts the continuous analog output voltage from the LM35 into discrete digital values that can be processed by digital systems.

3. **Data Acquisition:**
   - The process involves reading the digital temperature values from the ADC at regular intervals to acquire temperature data. This data can be used for real-time monitoring, logging, control systems, or further analysis.

4. **Calibration and Accuracy:**
   - Calibrating the LM35 sensor setup is crucial to ensure accuracy. Factors such as sensor placement, ambient conditions, and voltage references need to be considered to achieve precise and reliable temperature measurements.

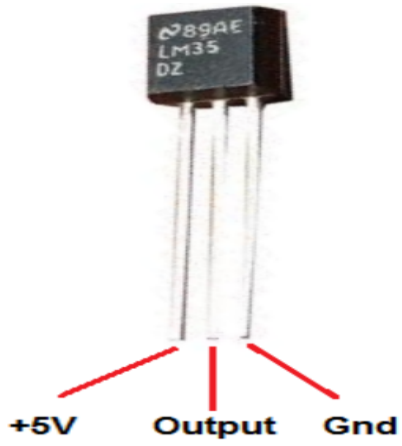
5. **Interfacing with Microcontrollers:**
   - Utilizing appropriate communication protocols and coding, the interfacing of the LM35 sensor with microcontrollers allows for temperature data processing and integration into various applications like IoT devices, temperature control systems, or data logging applications.

6. **Temperature Monitoring and Control:**
   - Once the LM35 sensor is successfully interfaced and calibrated, temperature monitoring and control functions can be implemented. This enables automated responses based on the temperature readings obtained, enhancing efficiency and accuracy in various applications.

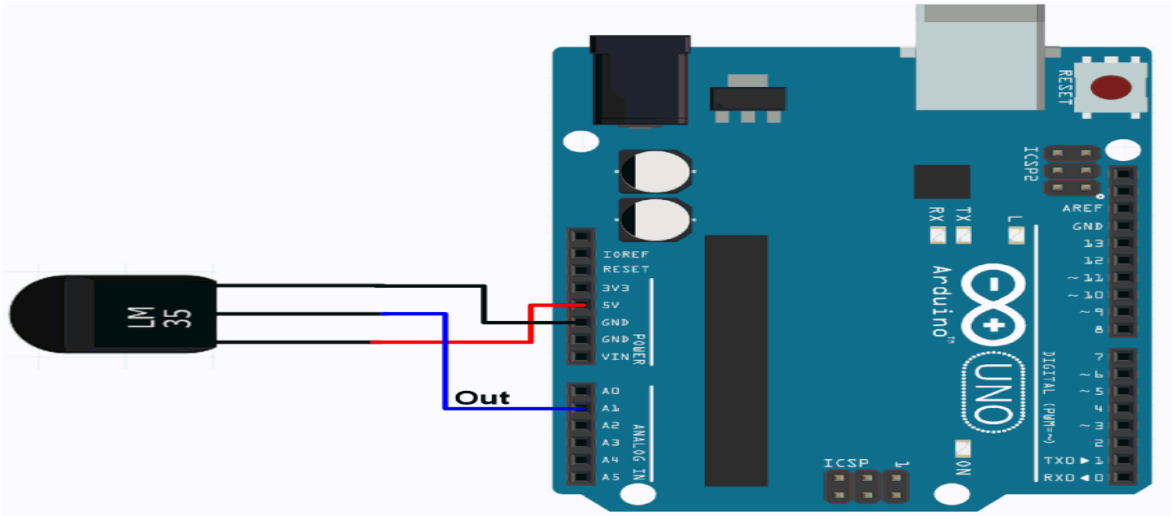
## Principle of Working:

The LM35 analog sensor operates on the principle of generating a linearly proportional output voltage based on surrounding temperature. When interfaced with a microcontroller, the analog output is converted to digital values through an analog-to-digital converter (ADC). These digital values are then acquired and processed for temperature monitoring and control, ensuring accurate and reliable measurements.

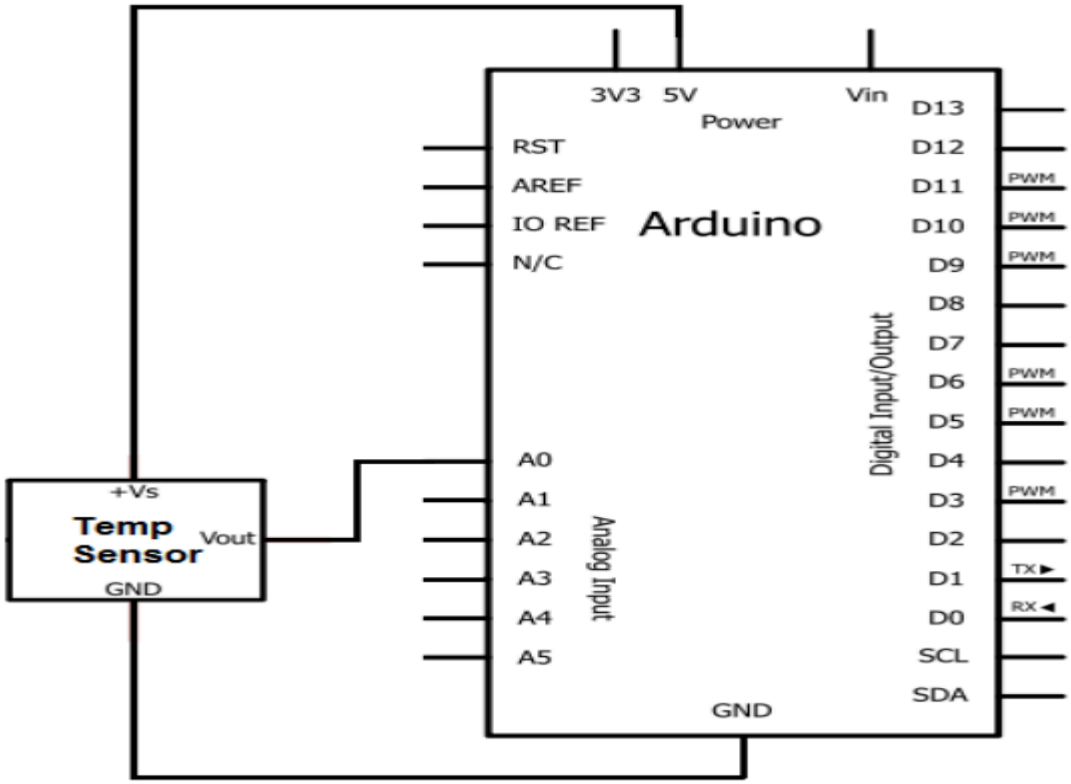
## LM35 Temperature Sensor:




## Circuit:



## Schematic:

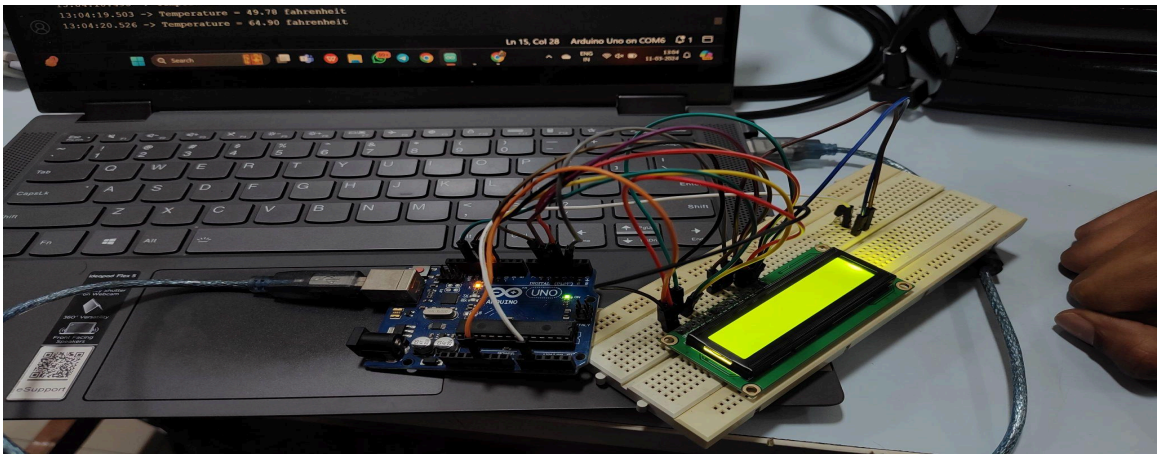


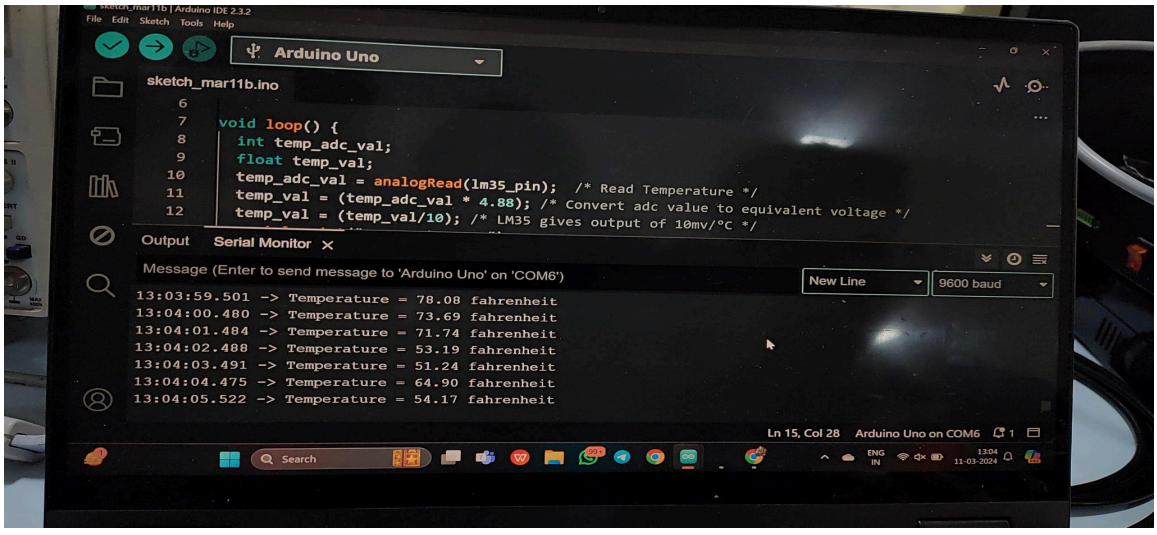

## Program:

```
const int lm35_pin = A1;  /* LM35 O/P pin */


void setup() {
  Serial.begin(9600);
}


void loop() {
  int temp_adc_val;
  float temp_val;
  temp_adc_val = analogRead(lm35_pin);  /* Read Temperature */
```

```
  temp_val = (temp_adc_val * 4.88);  /* Convert adc value to equivalent
      voltage */
  temp_val = (temp_val/10);  /* LM35 gives output of 10mv/°C */
  Serial.print("Temperature = ");
  Serial.print(temp_val);
  Serial.print(" fahrenheit \n");
  delay(1000);
}
```

## Result picture:



**Conclusion:**

The successful interfacing of the LM35 analog sensor with a microcontroller enables accurate and reliable temperature measurements. The conversion of the analog output to digital values, along with data acquisition and processing, demonstrates the feasibility of utilizing the LM35 sensor for temperature monitoring and control applications. The experiment provides valuable insights into the practical implementation of analog sensors for precise environmental measurements and highlights the potential for integrating such sensors into various smart systems and data logging applications. Overall, the experiment underscores the significance of effective sensor interfacing for real-time monitoring and control of environmental parameters.

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