

# Digital Thermometer using Arduino, LCD, and TMP36

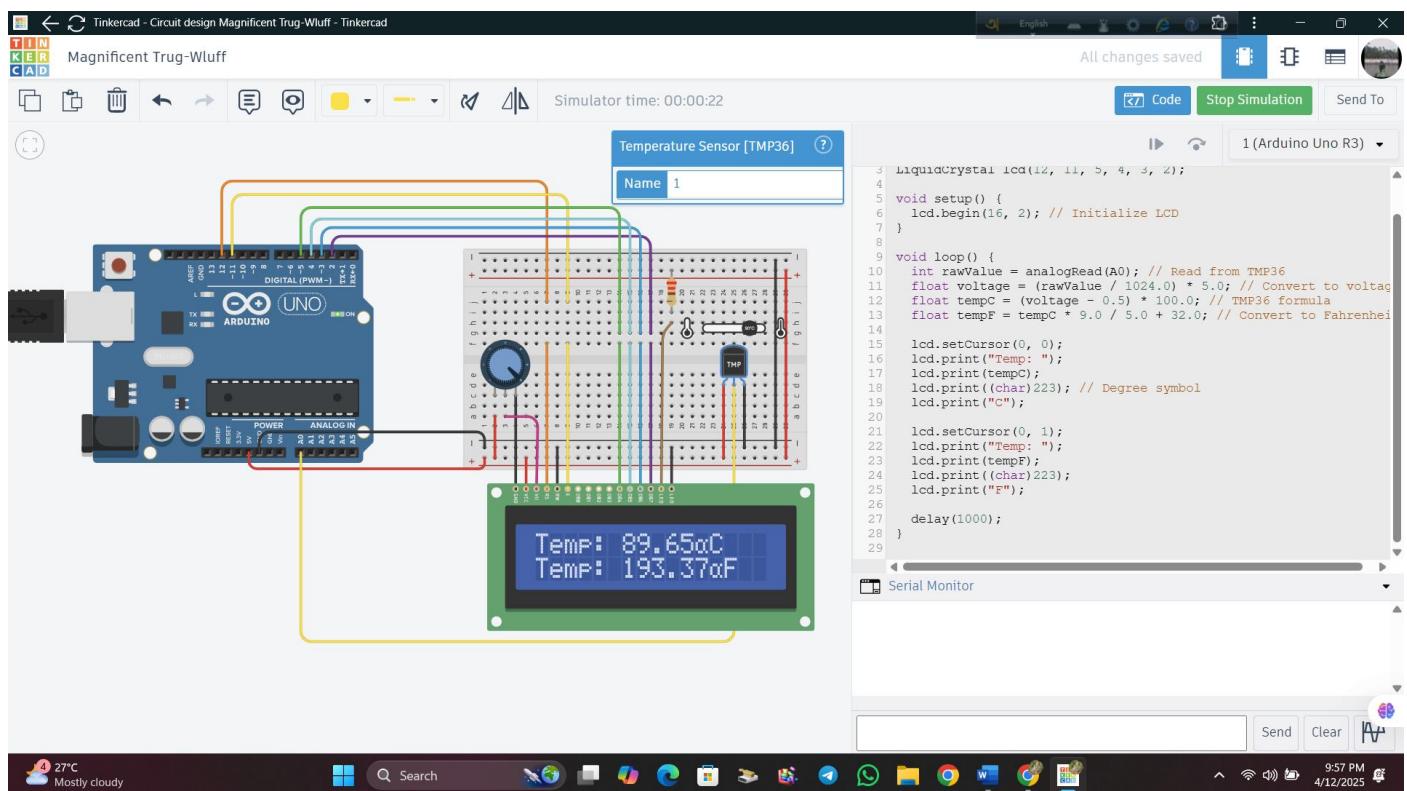
## Key Components:

1. **Arduino Uno** – The microcontroller that reads temperature data and displays it.
2. **TMP36 Temperature Sensor** – An analog sensor that outputs voltage proportional to temperature.
3. **16x2 LCD Display** – Used to show the current temperature in Celsius and Fahrenheit.
4. **220Ω Resistor** – Current limiting resistor for the LCD backlight.
5. **Jumper Wires & Breadboard** – For circuit connections.

## Working Principle:

- The **TMP36 sensor** outputs an analog voltage corresponding to the temperature.
- The **Arduino reads this analog signal** using the analog pin (A0).
- The voltage is **converted into temperature** in both **Celsius and Fahrenheit**.
- The temperature is then **displayed on a 16x2 LCD display** using the LiquidCrystal library.

## Circuit Overview:



- **TMP36:**
  - VCC → 5V (Arduino)
  - GND → GND
  - Vout → A0 (Arduino analog pin)
- **LCD (16x2):**
  - VSS → GND

- VDD → 5V
- VO → Potentiometer (for contrast)
- RS → Pin 12
- E → Pin 11
- D4 → Pin 5
- D5 → Pin 4
- D6 → Pin 3
- D7 → Pin 2
- A (LED+) → 5V through 220Ω
- K (LED-) → GND

### **Arduino Code Logic (Summarized):**

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup() {
    lcd.begin(16, 2); // Initialize LCD
}

void loop() {
    int rawValue = analogRead(A0); // Read from TMP36
    float voltage = (rawValue / 1024.0) * 5.0; // Convert to voltage
    float tempC = (voltage - 0.5) * 100.0; // TMP36 formula
    float tempF = tempC * 9.0 / 5.0 + 32.0; // Convert to Fahrenheit
    lcd.setCursor(0, 0);
    lcd.print("Temp: ");
    lcd.print(tempC);
    lcd.print((char)223); // Degree symbol
    lcd.print("C");
    lcd.setCursor(0, 1);
    lcd.print("Temp: ");
    lcd.print(tempF);
    lcd.print((char)223);
    lcd.print("F");
    delay(1000);
}
```

### **Code Explanation:**

- **Analog Value Conversion:** analogRead(A0) reads values between 0-1023. This is converted into a voltage between 0–5V.
- **Temperature Calculation:** TMP36 outputs 750 mV at 25°C. So, formula used:  
$$\text{Temp}(\text{°C}) = (\text{Vout in volts} - 0.5) \times 100$$
- **Fahrenheit Conversion:** Standard formula:  $F = C \times 9/5 + 32$
- **Typecasting:** Ensures floating point division and accurate temperature results.

### **Conclusion:**

- This project provides a **simple and accurate method** to measure ambient temperature using an **analog temperature sensor (TMP36)** and **display the results on an LCD screen**.
- It demonstrates usage of **analog-to-digital conversion**, **basic electronics**, and **LCD interfacing with Arduino**.