

# Digital Thermometer Using 8051 and ADC0808

## Introduction

This project outlines the design and implementation of a digital thermometer using the 8051 microcontroller and the ADC0808 analog-to-digital converter. It uses an LM35 temperature sensor to measure temperature and displays the result on a 16x2 LCD.



## Components Used

1. 8051 Microcontroller
2. ADC0808 (Analog-to-Digital Converter)
3. LM35 Temperature Sensor
4. 16x2 LCD Display
5. Miscellaneous components: Resistors, Capacitors, Connecting wires, Power supply

# Connections

## LM35 Temperature Sensor

- **VCC:** Connected to 5V supply.
- **GND:** Connected to ground.
- **VOUT:** Connected to the IN0 channel of ADC0808.

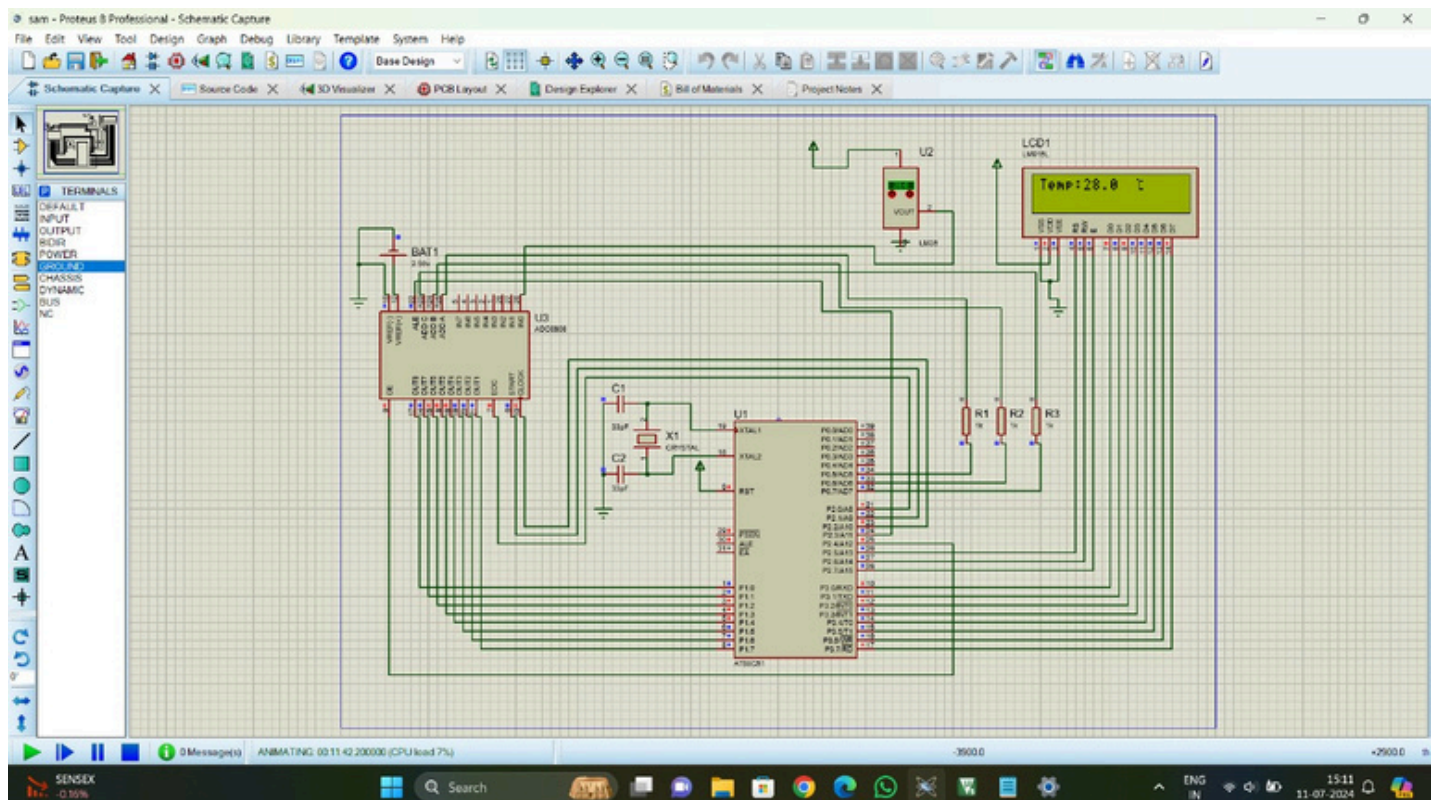
## ADC0808

- **VCC:** Connect to +5V supply.
- **GND:** Connect to ground.
- **VREF(+/-):** Connect to 2.56V and ground respectively.
- **IN0-IN7:** Analog input channels (e.g., IN0 connected to sensor output).
- **ALE, START, EOC, OE:** Connected to respective pins of 8051.
- **ADDR A-C:** Address pins for channel selection.
- **Data Outputs (D0-D7):** Connected to any port of 8051 (e.g., P1.0-P1.7).

## LCD Display

- **RS, RW, EN:** Connected to P2.5, P2.6, and P2.7 respectively.
- **Data pins (D0 to D7):** Connected to P3.0 to P3.7.

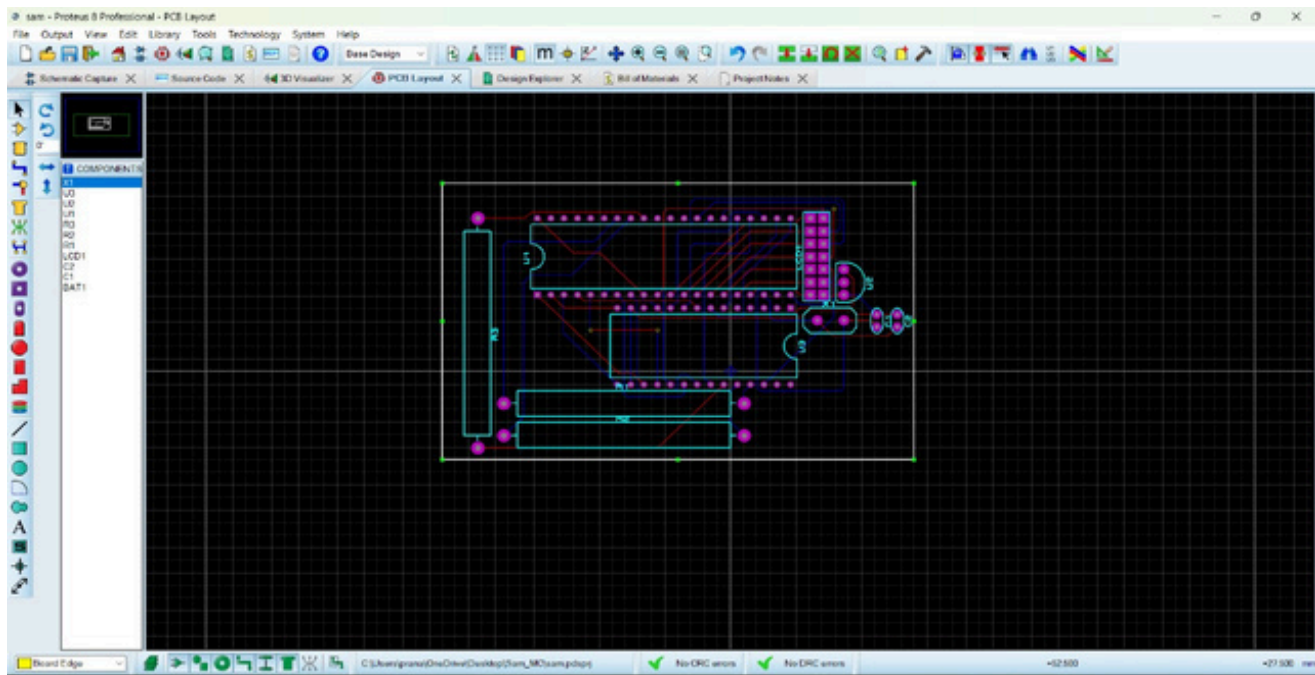
# Circuit Schematics



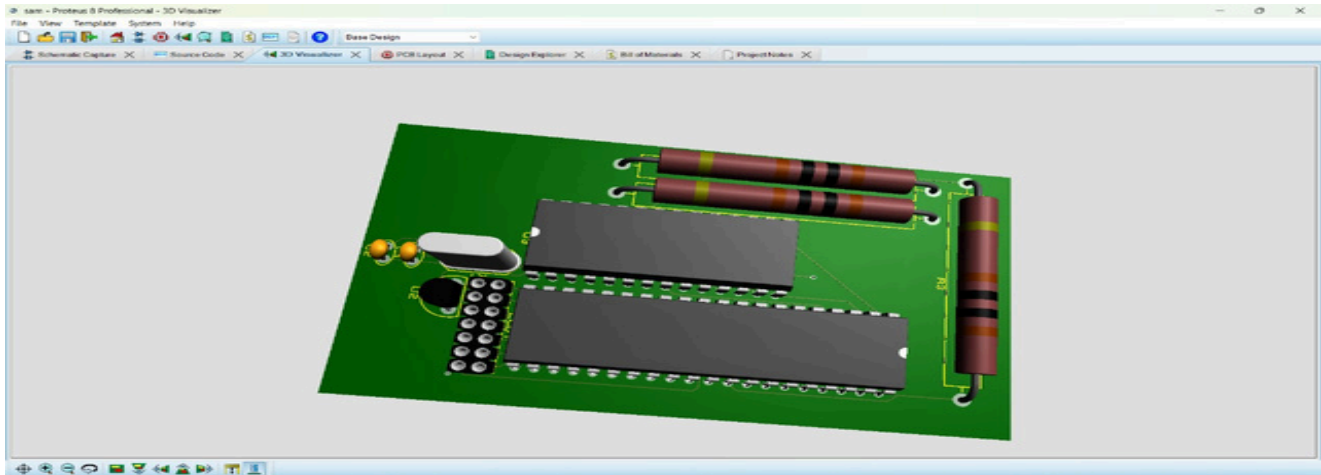
## Working Principle

1. **Temperature Sensing:** The LM35 sensor measures ambient temperature and converts it to an analog voltage.
2. **Analog to Digital Conversion:** The ADC0808 converts this analog voltage to an 8-bit digital value.
3. **Data Processing and Display:** The 8051 microcontroller reads the digital value, processes it to calculate the temperature, and displays it on the 16x2 LCD.

## PCB Mapping and Layout Design



## Realization



## Software Used

- **Development Environment:** Program written in C, compiled using Keil MicroVision 4.
- **Simulation:** Circuit simulated using Proteus 8.0.

## Circuit & Program explanation

- **LCD Initialization and Commands** : The LCD is initialized in 8-bit mode, display is turned on, and the cursor is set to the home position.
- **ADC Initialization and Reading** : The ADC is initialized and started. The read\_adc() function waits for the end-of-conversion signal and then reads the digital value.
- **Temperature Calculation and Display** : The digital value from the ADC is converted to temperature and displayed on the LCD.

## Program Code (C).

```
#include<reg51.h>
```

```
#include<string.h>
```

```
sbit RS = P2^5;
```

```
sbit RW = P2^6;
```

```
sbit EN = P2^7;
```

```
sbit ale = P2^3;
```

```
sbit oe = P2^4;  
sbit start = P2^1;  
sbit eoc = P2^0;  
sbit clk = P2^2;  
sbit chc = P0^7;  
sbit chb = P0^6;  
sbit cha = P0^5;
```

```
void delay(int t);  
void lcd_init(void);  
void lcd_command(char c);  
void lcd_data(char d);  
void str(char a[]);  
void print(long float p);
```

```
long float k;  
unsigned long int q, r, x, y, z;
```

```
void timer0() interrupt 1 // TIMER 0 interrupt ISR  
{  
    clk = ~clk;  
}
```

```
void main() // MAIN PROGRAM  
{  
    lcd_init(); // lcd initialization  
    str("!!welcome!!");  
    lcd_command(0x01); // clear display  
    str("Temp:");  
    lcd_command(96); //custom character (°c) display
```

```
lcd_data(0x10);
lcd_data(0x07);
lcd_data(0x08);
lcd_data(0x08);
lcd_data(0x08);
lcd_data(0x08);
lcd_data(0x07);
lcd_command(0x8b);
lcd_data(4);
eoc = 1; // make eoc an input
ale = 0;
oe = 0;
start = 0;
TMOD = 0x02; // timer 0 in mode 2
TH0 = 0xc2; // 15khz
IE = 0x82; // set timer 0 interrupt
TR0 = 1; // start timer 0

while(1)
{
    chc = 0; // select channel 0
    chb = 0;
    cha = 0;
    ale = 1; // send high to low pulse on start and ale pin
    start = 1;
    delay(1);
    ale = 0;
    start = 0;
    while(eoc == 1); // wait for conversion
    while(eoc == 0);
```

```

    oe = 1;

    k = P1;

    lcd_command(0x85);

    print(k); // send the digital data to lcd

    oe = 0;

}

}

void str(char a[]) // lcd function to display string
{
    int j;
    for(j = 0; a[j] != '\0'; j++)
    {
        lcd_data(a[j]);
    }
}

```

## **Conclusion**

This project successfully demonstrates the interfacing of an 8051 microcontroller with an ADC0808 to create a digital thermometer. The system accurately measures and displays temperature using an LM35 sensor and a 16x2 LCD. Future enhancements could include data logging and temperature alerts.