Project Report

TOPIC - "TEMPERATURE SENSOR"

SUBJECT–Microcontroller 8051

E.C.E, SECTION -2

SUBMITTED BY-

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INTRODUCTION

The LM35 is a temperature sensor whose output voltage is linearly proportional to Celsius temperature. It requires no external calibration as it is already calibrated. It outputs 10mV for each degree of Celsius temperature. The sensor produces voltage corresponding to the temperature. This voltage is converted to digital by ADC0804 and it is fed to 8051 microcontroller.8051 microcontroller converts this digital value into temperature in degree Celsius. Then this temperature is converted into ASCII form which is suitable for displaying. This ASCII values are fed to LCD which displays the temperature on its screen.

LIST OF COMPONENTS

1. LM35 Temperature sensor
2. AT89C51 (8051 Microcontroller)
3. ADC0848 (Analog to Digital converter)
4. LM016L (LCD)
5. Resistor
6. Capacitor
7. Potentiometer
8. Crystal oscillator

WORKING OF COMPONENTS

1. LM35 TEMPERATURE SENSOR

The LM35 is a temperature sensor whose output voltage is linearly proportional to Celsius temperature. The LM35 comes already calibrated hence requires no external calibration. It outputs 10mV for each degree of Celsius temperature.

LM35 sensor produces voltage corresponding to temperature. This voltage is converted to digital (0 to 256) by ADC0804 and it is fed to 8051 microcontroller. 8051 microcontroller converts this digital value into temperature in degree Celsius. Then this temperature is converted into ASCII form which is suitable for displaying. This ASCII values are fed to 16*2 LCD which displays the temperature on its screen. This process is repeated after specified interval.

2. AT89C51

AT89C51 is an 8-bit microcontroller and belongs to Atmel's 8051 family. **ATMEL 89C51** has 4KB of Flash programmable and erasable read only memory (PEROM) and 128 bytes of RAM. It can be erased and program to a maximum of 1000 times. In 40 pin AT89C51, there are four ports designated as P_1, P_2, P_3 and P_0. All these ports are 8-bit bi-directional ports, *i.e.*, they can be used as both input and output ports. Except P_0 which needs external pull-ups, rest of the ports have internal pull-ups. When 1s are written to these port pins, they are pulled high by the internal pull-ups and can be used as inputs. These ports are also bit addressable and so their bits can also be accessed individually. Port P_0 and P_2 are also used to provide low byte and high byte addresses, respectively, when connected to an external memory. Port 3 has multiplexed pins for special functions like serial communication, hardware interrupts, timer inputs and read/write operation from external memory. AT89C51 has an inbuilt UART for serial communication. It can be programmed to operate at different baud rates. Including two timers & hardware interrupts, it has a total of six interrupts.

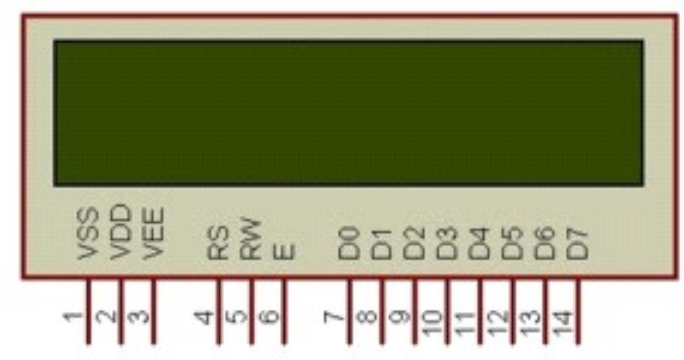
3. ADC0848

The **ADC0848 IC** is an 8-bit parallel ADC in the family of the ADC0800 series from National Semiconductor. It works with +5 volts and has a resolution of 8bits. The step size and VIN range varies for different values of V ref/2. Following formula is used to calculate output voltage: **`D out = VIN / step size`** Where D out is digital data output in decimal, VIN = analog input voltage and step size (resolution) is the smallest change.

4. LM016L

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.
The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

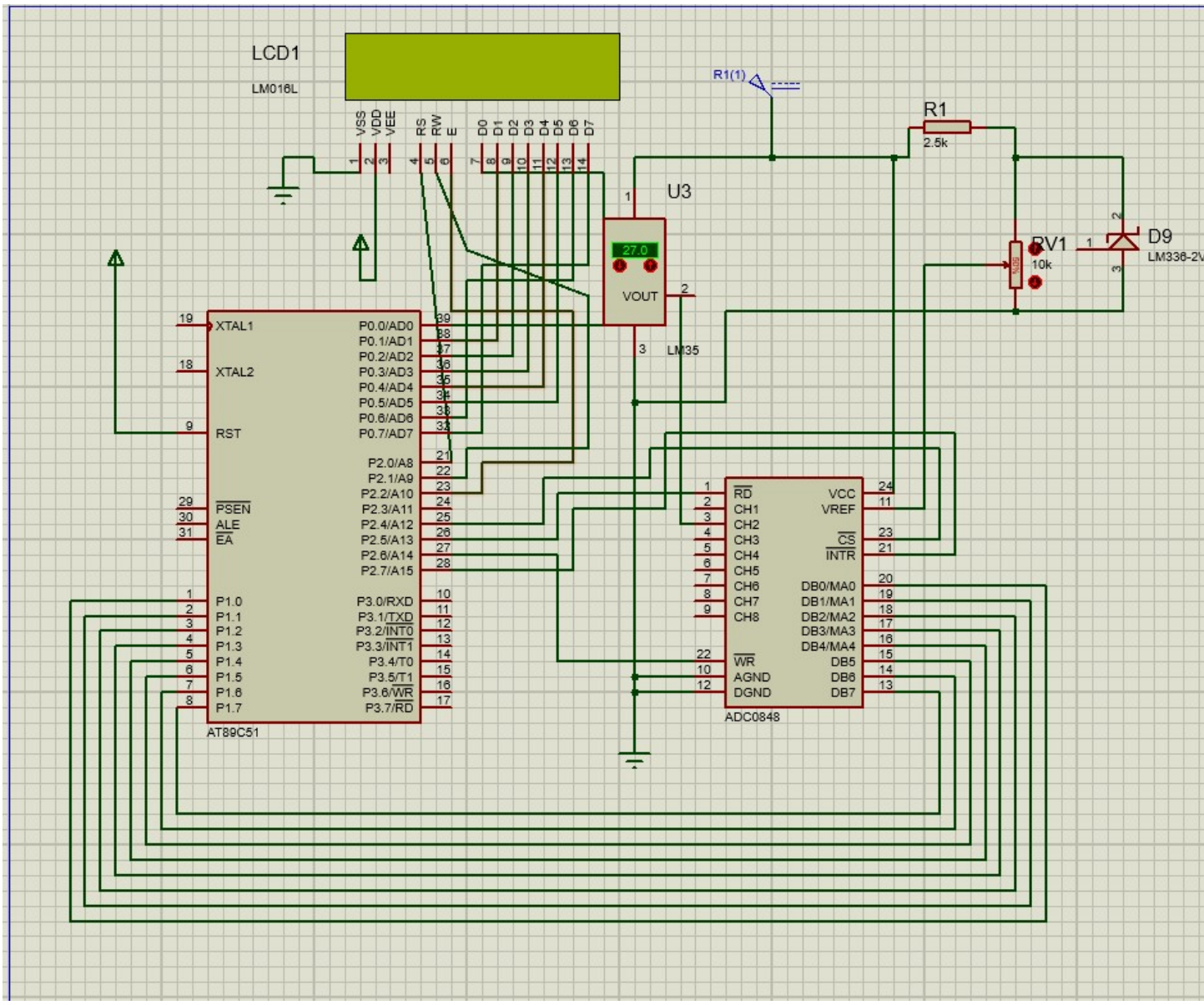
Pin description is shown in the table below.



Pin No.	Name	Description
Pin no. 1	**VSS**	Power supply (GND)
Pin no. 2	**VCC**	Power supply (+5V)
Pin no. 3	**VEE**	Contrast adjust
Pin no. 4	**RS**	0 = Instruction input

		1 = Data input
Pin no. 5	**R/W**	0 = Write to LCD Module 1 = Read from LCD module
Pin no. 6	**EN**	Enable signal
Pin no. 7	**D0**	Data bus line 0 (LSB)
Pin no. 8	**D1**	Data bus line 1
Pin no. 9	**D2**	Data bus line 2
Pin no. 10	**D3**	Data bus line 3
Pin no. 11	**D4**	Data bus line 4
Pin no. 12	**D5**	Data bus line 5
Pin no. 13	**D6**	Data bus line 6
Pin no. 14	**D7**	Data bus line 7 (MSB)

BLOCK DIAGRAM


LCD1
LM016L
VSS
VDD
VEE
RS
RW
E
D0
D1
D2
D3
D4
D5
D6
D7
R1(1)
R1
2.5k
U3
27.0
VOUT
LM35
RV1
10k
D9
LM336-2V
XTAL1
XTAL2
RST
PSEN
ALE
EA
P0.0/AD0
P0.1/AD1
P0.2/AD2
P0.3/AD3
P0.4/AD4
P0.5/AD5
P0.6/AD6
P0.7/AD7
P2.0/A8
P2.1/A9
P2.2/A10
P2.3/A11
P2.4/A12
P2.5/A13
P2.6/A14
P2.7/A15
P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
P3.0/RXD
P3.1/TXD
P3.2/INT0
P3.3/INT1
P3.4/T0
P3.5/T1
P3.6/WR
P3.7/RD
AT89C51
RD
CH1
CH2
CH3
CH4
CH5
CH6
CH7
CH8
WR
AGND
DGND
VCC
VREF
CS
INTR
DB0/MA0
DB1/MA1
DB2/MA2
DB3/MA3
DB4/MA4
DB5
DB6
DB7
ADC0848

PROGRAM

```
ORG 0H
SJMP MAIN
ORG 300H
DB 38H, 0EH ,01H ,80H,0
ORG 55H
MAIN:
MOV DPTR,#300H
REPEAT: CLR A
MOVC A, @A+DPTR
JZ DATANEW
ACALL COMMANDWRITE
ACALL DELAY
INC DPTR
SJMP REPEAT
DATANEW: SETB P2.7
SETB P2.4
SETB P2.5
SETB P2.6
BACK:
MOV P1,#0AH
NOP
CLR P2.4
CLR P2.6
NOP
NOP
SETB P2.6
SETB P2.4
MOV P1,#0FFH
HERE: JB P2.7,HERE
CLR P2.4
CLR P2.5
NOP
NOP
SETB P2.5
SETB P2.5
SETB P2.4
ACALL CONVERT
SJMP BACK
CONVERT:
CLR A
MOV A,P1
MOV B,#0AH
DIV AB
MOV P0,B
ACALL DATAWRITE
MOV B,#0AH
DIV AB
MOV P0,B
ACALL DATAWRITE
MOV P0,A
ACALL DATAWRITE
ACALL DELAY
RET
COMMANDWRITE:
MOV P0,A
CLR P2.0
CLR P2.1
SETB P2.2
ACALL DELAY
ACALL DELAY
CLR P2.2
RET
DATAWRITE:
SETB P2.0
CLR P2.1
SETB P2.2
ACALL DELAY
ACALL DELAY
```

```
67 ACALL DELAY
68 CLR P2.2
69 RET
70 DELAY:
71 MOV R3,#0FFH
72 MOV R4,#0FFH
73 AGAIN: DJNZ R4,AGAIN
74 AGAIN1: DJNZ R3,AGAIN1
75 RET
76 END
```

WORKING OF PROJECT

After making all the connections and burning the code onto the 8051 Microcontroller, turn ON the power supply. The LM35 Temperature Sensor provides the Analog Temperature Data to ADC0848, which it converts into Digital Values and sends to 8051.

Upon receiving the digital values, the 8051 Microcontroller performs a small calculation and then displays the temperature on the LCD.

The circuit is based on LM35 analog temperature sensor and microcontroller. For example, if the temperature is 38°C, the output voltage will be 38 x 10mV = 380mV. MICROCONTROLLER has an inbuilt ADC that is used to is used to convert the analog output voltage of the LM35 to a proportional 10 bit digital value suitable for the microcontroller. The microcontroller accepts the output of ADC, performs necessary manipulations on it and displays it numerically on an LCD display.

The LM35 can be connected easily in the same way as other integrated circuit temperature sensors. It can be stuck or established to a surface and its temperature will be within around the range of 0.01˚C of the surface temperature.

This presumes that the ambient air temperature is just about the same as the surface temperature; if the air temperature were much higher or lower than the surface temperature, the actual temperature of the LM35 die would be at an intermediate temperature between the surface temperature and the air temperature.

The temperature sensors have well known applications in environmental and process control and also in test, measurement and communications. A digital temperature is a sensor, which provides 9-bit temperature readings. Digital temperature sensors offer excellent precise accuracy, these are designed to read from 0°C to 70°C and it is possible to achieve ±0.5°C accuracy. These sensors completely aligned with digital temperature readings in degree Celsius.

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CONCLSION

Temperature monitoring and controlling is done with the help of a microcontroller and LM35 is the temperature sensor. The temperature is displayed on the LCD screen and the desired value of temperature is also set. The entire decision making is done with the help of a microcontroller . This type of system can be installed in any place where we need to maintain temperature approximately constant. Also, by applying more sensors like light intensity sensor, barometer, humidity sensor etc, more parameters like light, atmospheric pressure and humidity etc can be monitored and controlled which are vital for any industrial process. The system has various advantages over other similar systems such as cost-effectiveness, smaller size, on- device display, less complexity and greater portability. This project can be used in industries to measure the temperature and control the temperature as per requirement. It can be used in tea factories to continuously monitor and control the temperature required for processing the tea leaves. It can also be used in confectioneries for preservation of the sweets. The system can be used in green houses to control the temperature for the proper growth of plants. Temperature monitoring and controlling action can be used in home or various halls like conference room, seminar hall to control the temperature of room.

FUTURE SCOPE

- **USED AS FIRE ALARM SYSTEM**
- **DATA CAN BE RECORDED AND CAN BE USED AS PREDICTION OF WEATHER(AI METHOD)**
- **CAN BE USED AUTOMATIC REGULATION OF COOLING DEVICE**

REFERENCE

- https://circuitdigest.com/microcontroller-projects/digital-thermometer-using-lm35-8051
- YOUTUBE
- QUORA
- https://www.elprocus.com/temperature-sensors-types-working-operation/