MICROCONTROLLER AND ITS APPLICATION

(ECE 3003)

PROJECT REVIEW-3

DIGITAL THERMOMETER USING 8051

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Aim:

Sometimes people find it difficult to read temperature from analog thermometer because of fluctuations. So here we are going to build a simple Digital thermometer using 8051 microcontroller in which LM35 sensor is used for measuring the temperature.

This project will also serve as a proper interfacing of ADC0804 with 8051 and 16*2 LCD with 8051 microcontroller.

BLOCK DIAGRAM:
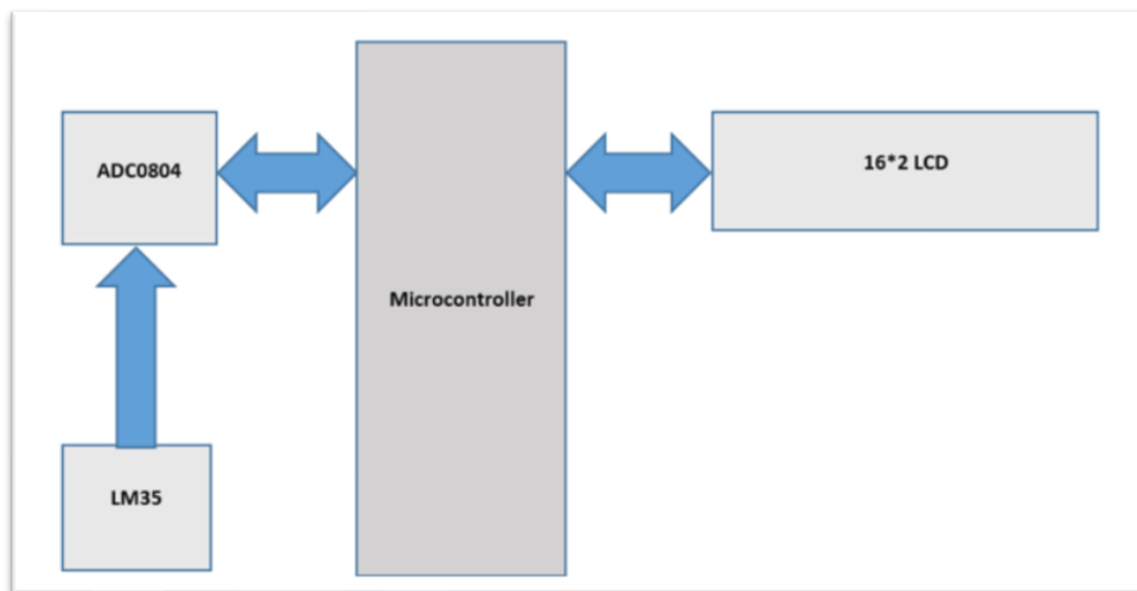
COMPONENTS USED:

- AT 89C51 IC
- ADC0804 board
- 16*2 LCD display
- LM35 sensor
- Potentiometer
- Jumper wires

AT 89C51 IC:

The AT89C51 is an age old 8-bit microcontroller from the Atmel family. It works with the popular 8051 architecture. It is a 40 pin IC package with 4Kb flash memory. It has four ports and all together provide 32 Programmable GPIO pins. It does not have in-built ADC module and supports only USART communication. Although it can be interfaced with external ADC IC like the ADC084 or the ADC0808.

ADC 0804 IC:
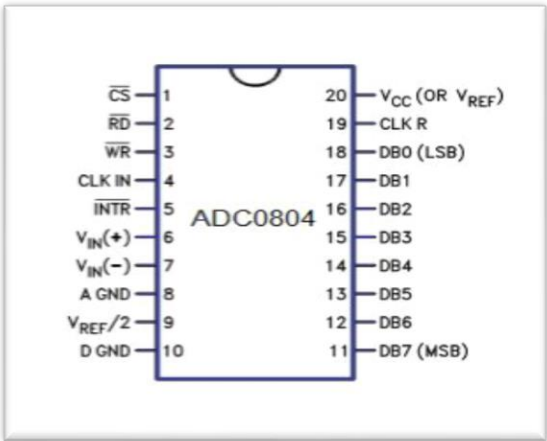
The ADC0804 IC is an 8-bit parallel ADC in the family of the ADC0800 series from National Semiconductor. It works with +5 volts and has a resolution of 8bits. The step size and Vin range varies for different values of Vref/2.

It is a 20-pin Single channel 8-bit ADC module. Meaning it can measure one ADC value from 0V to 5V and the precision when voltage reference (Vref –pin 9) is +5V is 19.53mV (Step size). That is for every increase of 19.53mV on input side there will be an increase of 1 bit at the output side.

LM 35 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
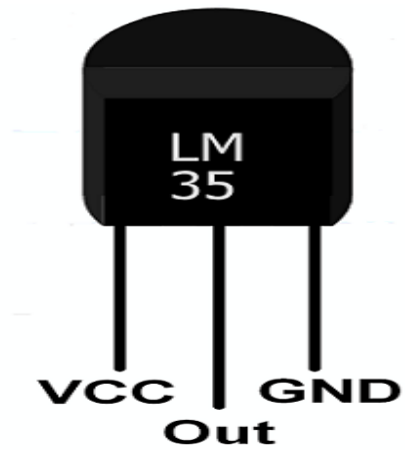
converted into ascii form which is suitable for displaying. This ascii values are fed to 16*2 lcd which displays the temperature on its screen. This process is repeated after specified interval.

16*2 LCD display
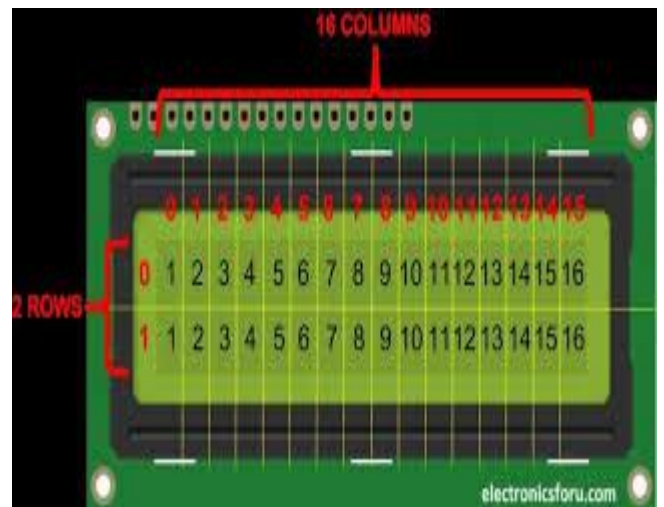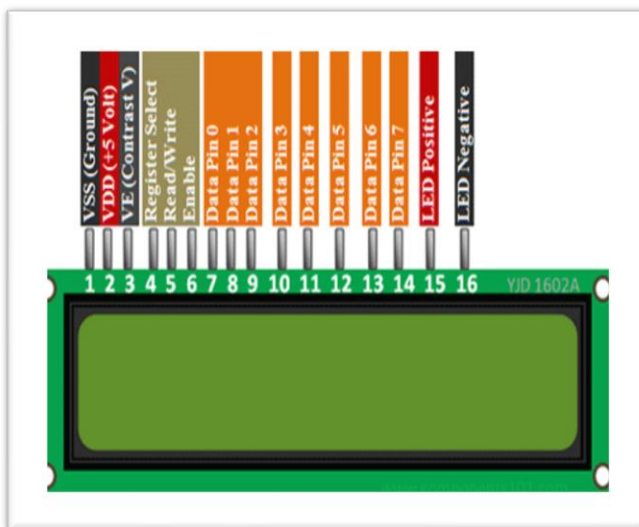
16*2 LCD is a widely used display for embedded applications. Here is the brief explanation about pins and working of 16*2 LCD display. There are two very important registers inside the LCD. They are data register and command register. Command register is used to send commands such as clear display, cursor at home etc., data register is used to send data which is to be displayed on 16*2 LCD.

There is one read and write pin which is low to write to the register and high to read from the register.

Enable pin sends data to data pins when a high to low pulse is given; Extra voltage push is required to execute the instruction and EN(enable) signal is used for this purpose. Usually, we make it en=0 and when we want to execute the instruction we make it high en=1 for some milliseconds. After this we again make it ground that is, en=0.

PIN NO	Symbol	Fuction
1	VSS	GND
2	VDD	+5V
3	V0	Contrast adjustment
4	RS	H/L Register select signal
5	R/W	H/L Read/Write signal
6	E	H/L Enable signal
7	DB0	H/L Data bus line
8	DB1	H/L Data bus line
9	DB2	H/L Data bus line
10	DB3	H/L Data bus line
11	DB4	H/L Data bus line
12	DB5	H/L Data bus line
13	DB6	H/L Data bus line
14	DB7	H/L Data bus line
15	A	+4.2V for LED
16	K	Power supply for BKL(0V)

For software part we are using the Keil µVision 5 Software and to simulate the project we are using proteus software.

PROCEDURE:

1) For 16*2 LCD interfacing with 8051 microcontroller , we have to define pins on which 16*2 lcd is connected to 8051 microcontroller. RS pin of 16*2 lcd is connected to P3.0 , RW pin of 16*2 lcd is connected to P3.1 and E pin of 16*2 lcd is connected to P3.2. Data pins are connected to port 2 of 8051 microcontroller.

2) Similarly, for **ADC0804 interfacing with 8051** microcontroller, we have to define pins on which ADC0804 is connected to 8051 microcontroller. RD pin of ADC0804 is connected to P3.4, WR pin of ADC0804 is connected to P3.3 and INTR pin of ADC0804 is connected to P3.5. Data pins are connected to port 1 of 8051 microcontroller.

3) Next we have to **define some functions** which are used in the program. *Delay* function is used to create specified time delay, c*mdwrt* function is used to send commands to 16*2 lcd display, *datawrt* function is used to send data to 16*2 lcd display and *convert_display* function is used to convert the ADC data into temperature and to display it on 16*2 lcd display.

4) Next we are converting the analog voltage produced by LM35 sensor to digital data and then it is converted to temperature and displayed on 16*2 lcd display. For ADC0804 to start the conversion we have to send a low to high pulse on WR pin of ADC0804, then we have to wait for end of conversion. INTR becomes low at the end of conversion. Once INTR becomes low, RD is made low to copy the digital data to port 0 of 8051 microcontroller. After a specified time delay, next cycle starts. This process is repeated forever.

5) In next part of the code, we are **sending commands to 16*2 lcd**. Commands such as clear display, increment cursor, force the cursor to beginning of 1st line are sent to 16*2 lcd display one by one after some specified time delay.

6) After that, **we are sending data to 16*2 lcd**. Data to be displayed on 16*2 lcd display are sent to display one by one after some specified time delay.

7) In below part of the code , we are sending commands   to 16*2 lcd display. The command is copied to port 0 of 8051 microcontroller.
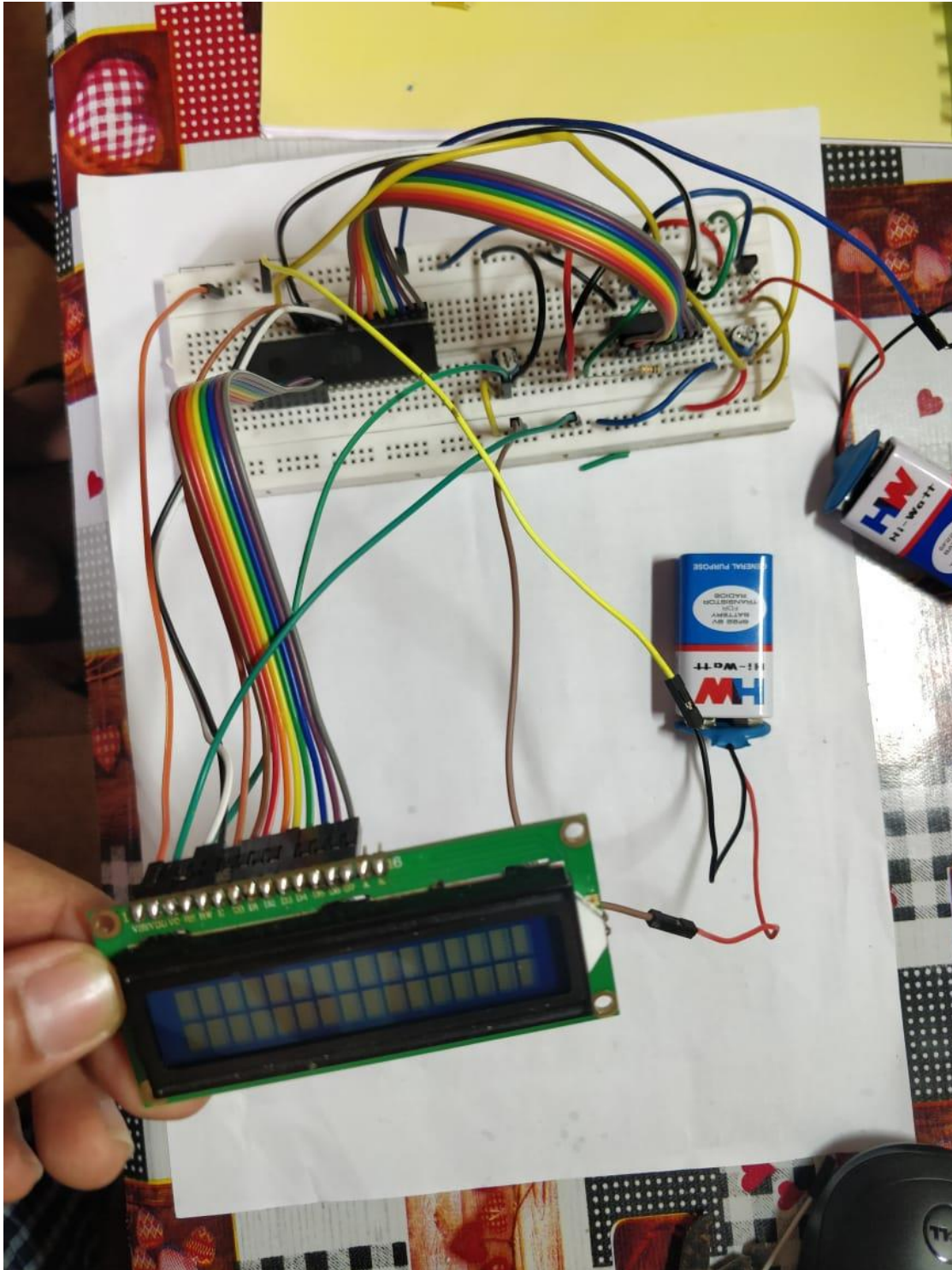
RS is made low for command write. RW is made low for write operation. High to low pulse is applied on enable(E) pin to start command write operation.

8) In the next part of the code, we are sending data to 16*2 lcd display. The data is copied to port 2 of 8051 microcontroller. RS is made high for command write . RW is made low for write operation. High to low pulse is applied on enable(E) pin to start data write operation.

SOFTWARE SIMULATION
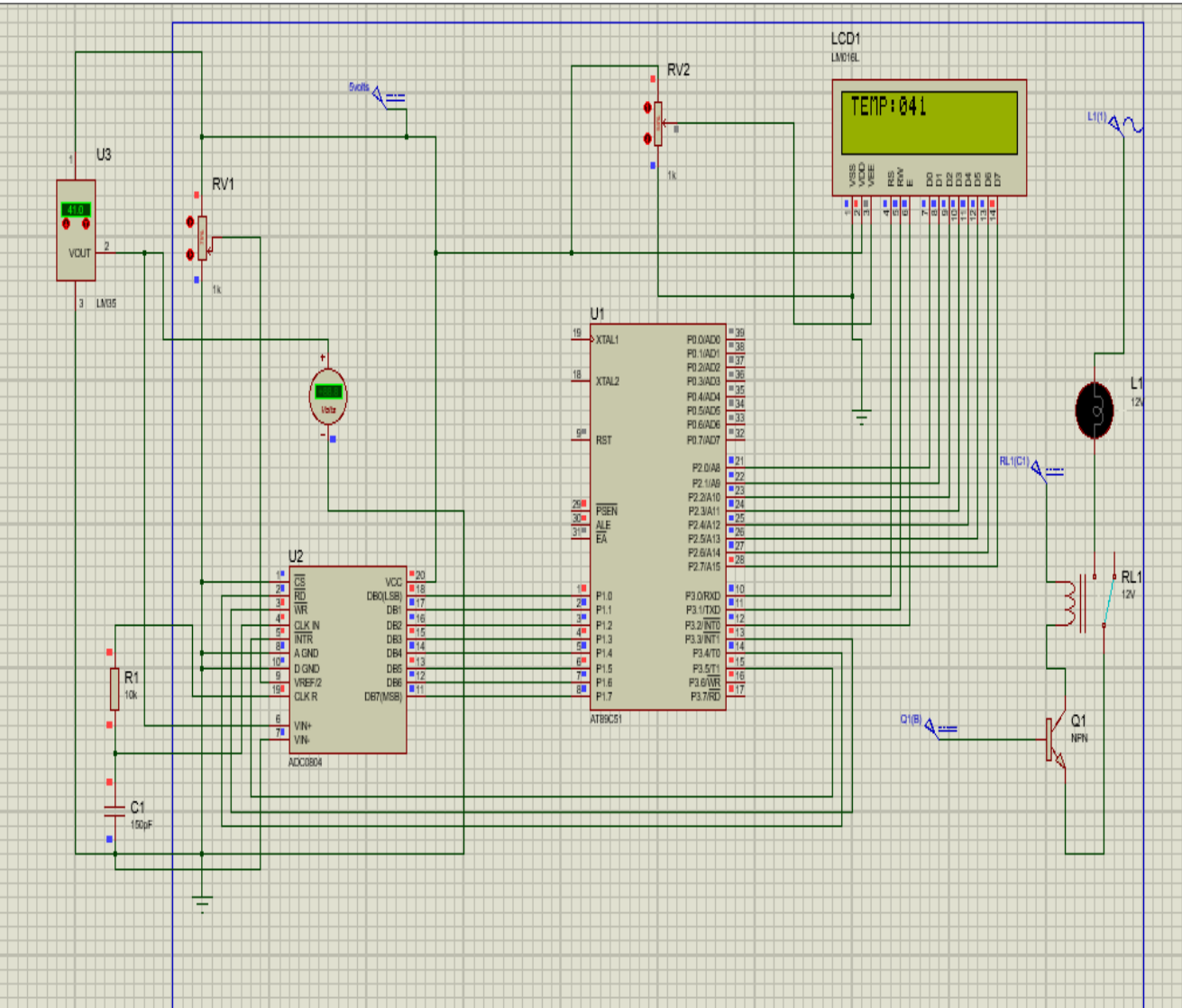
HARDWARE CONNECTION PHOTO

GROUP MEMBERS PHOTO