

8051 Project Report

INTERFACING 8051 WITH 16*2 LCD

A report submitted in part fulfilment Microprocessor Lab
Course

3rd Year (5th Semester) in ECE

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Chapter 1: Introduction

Majority of embedded projects needs to display information. Here come the LCD modules which help in displaying the information. Various application includes calculators, laptops, mobiles etc. 16*2 is basic module which can display 2 rows of 16 characters. Each character can be displayed with 5*7 or 5*8-pixel matrix. Two registers are present on LCD namely command and data registers to process the commands or data for the LCD. A Built in-controller is mounted on the backside of LCD to get the commands and data from the MCU and process them to display meaningful information onto LCD Screen. This LCD can work in 8-bit or 4-bit mode depending upon the pins available with microcontroller.

This is simple project which shows how to interface the 16*2 LCD with 8051. For this project JHD162A module is used. Hitachi HD47780 IC is mounted on the backside of LCD. 8-pins are used to transmit the data from microcontroller.

Custom characters can also be generated in this LCD. CGRAM is main component in generating the custom characters. This project does not deal with custom character generation.

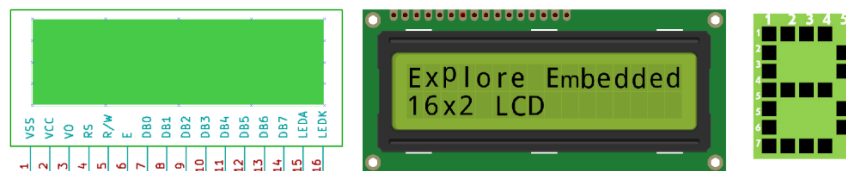


Figure 1 LCD Pin Diagram and Pixel Matrix

Chapter 2: Schematic

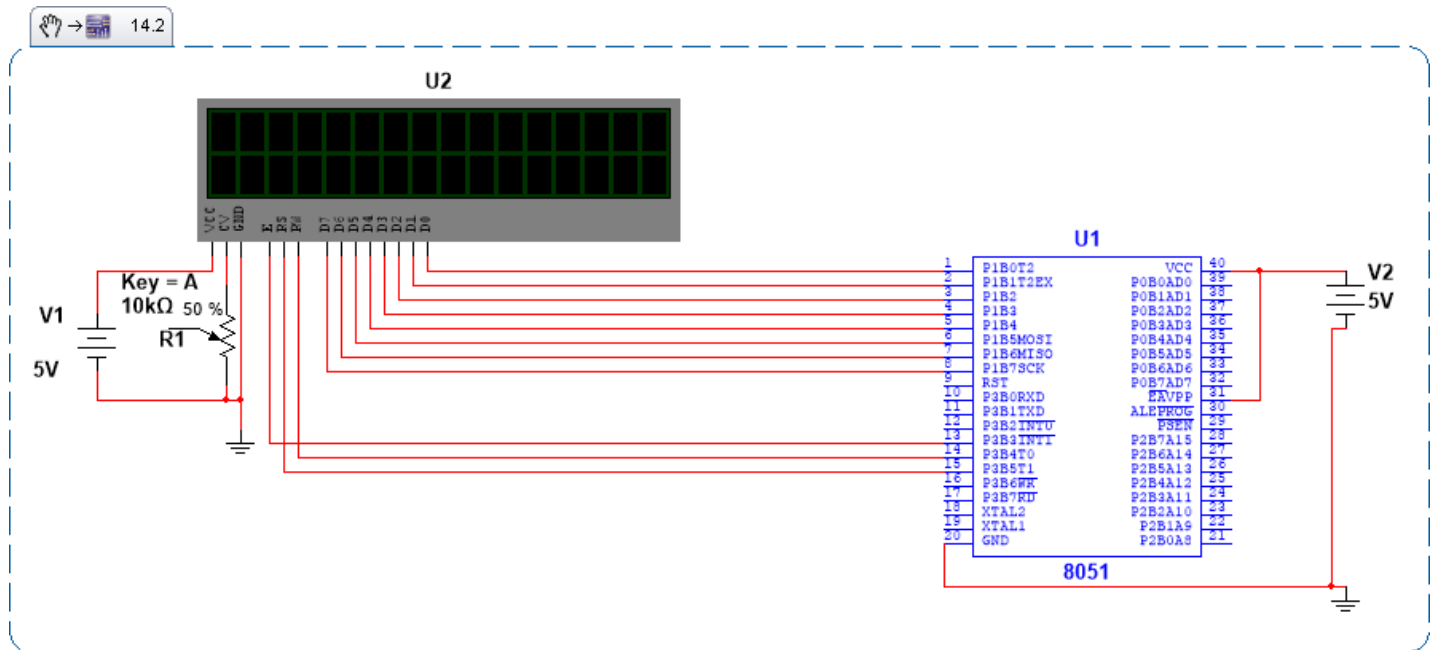


Figure 2: Schematic for LCD interfacing with 8051

Chapter 3: Working Procedure

Connection overview:

- Port 1 is connected with the data lines D0-D7 of LCD modules for the transfer of data/commands.
- PIN 3.3 is connected with Enable pin of LCD module which acknowledges data on high to low pulse.
- PIN 3.4 is connected to R/W pin of LCD. 0 = write on LCD, 1 = read from LCD
- PIN 3.5 is connected to RS pin of LCD. 0 = command register, 1 = data register
- PIN 3 of LCD connected with potentiometer to decide the contrast.

Step 1: 5 Different commands passed to accumulator to set the LCD in required condition and after every command 'CMND' loop is called.

Step 2: CMND loop is used to execute every command. Working of CMND is as follows: -

- Command data copied to Port 1 from accumulator.
- Command register is selected by making pin 3.5 equals to 0
- Write operation is selected by making pin 3.4 equals to 0 to write on LCD.
- Pin 3.3 set and then reset to make enable pin work
- Approx. 40uS needed to execute most of the commands so 60uS delay is given for the successful execution of the command. This eliminate the need to check the Busy Flag.

Step 3: Look-up table is used to store the contents at 300H and 30AH. DPTR is used to point at these locations. Loop1 follow these steps:

- Data is copied to accumulator one-by-one
- DISP loop is called to display the character on the LCD
- DPTR increments by one to access all characters
- Accumulator is cleared to delete the previous data
- R0 is used as counter to get out of loop
- So loop1 executes "CREATED BY" in line 1 starting from position 0
- Same process is followed by loop2 to execute "GOPAL AGARWAL" in line 2 starting from position 0.

Step 4: Working of DISP loop is as follows: -

- Data copied to Port 1 from accumulator.
- Data register is selected by making pin 3.5 equals to 1
- Write operation is selected by making pin 3.4 equals to 0 to write on LCD.
- Pin 3.3 set and then reset to make enable pin work
- Approx. 40uS needed to execute most of the commands so 60uS delay is given for the successful execution of the command. This eliminate the need to check the Busy Flag.

Chapter 4: Assembly Code

Label	Opcode	Comments
HERE:	ORG 0000H	STARTING FROM 0000H
	MOV A, #38H	8-BIT MODE, USE 2 ROWS, 5*7 PIXEL DOTS
	ACALL CMND	38H TRANSFERRED TO LCD
	MOV A, #0FH	LCD ON, CURSOR ON, BLINKING ON
	ACALL CMND	0FH TRANSFERRED TO LCD
	MOV A, #06H	INCREMENT CURSOR
	ACALL CMND	06H TRANSFERRED TO LCD
	MOV A, #01H	CLEAR DISPLAY, RETURN CURSOR TO HOME
	ACALL CMND	01H TRANSFERRED TO LCD
	MOV A, #80H	CURSOR AT LINE 1, POSITION 0
	ACALL CMND	80H TRANSFERRED TO LCD
	CLR A	ACC SET TO 0
	MOV R0, #0AH	USING R0 AS COUNTER
	MOV R1, #0DH	USING R1 AS COUNTER
	MOV DPTR, #300H	DPTR POINTS TO 300H AT 300H ASCII VALUES ARE STORED
LOOP1:	MOVC A, @A+DPTR	ACCESSING ASCII VALUES ONE BY ONE AND STORING TO ACC
	ACALL DISP	ASCII VALUES ARE TRANSFERRED TO LCD
	INC DPTR	INCREASING DPTR TO ACCESS ALL REQUIRED LOCATION

Label	Opcode	Comments
	CLR A	ACC SET TO 0
	DJNZ R0, LOOP1	IF COUNTER=0 GET OUT OF LOOP1
	MOV A, #0C0H	CURSOR LINE 2, POSITION 0
	ACALL CMND	C0H TRANSFERRED TO LCD
	CLR A	ACC SET TO 0
	MOV DPTR, #30AH	DPTR POINTS TO 30AH AT 30AH ASCII VALUES ARE STORED
LOOP2:	MOVC A, @A+DPTR	ACCESSING ASCII VALUES ONE BY ONE AND STORING TO ACC
	ACALL DISP	ASCII VALUES ARE TRANSFERRED TO LCD
	INC DPTR	INCREASING DPTR TO ACCESS ALL REQUIRED LOCATION
	CLR A	ACC SET TO 0
	DJNZ R1, LOOP2	IF COUNTER=0 GET OUT OF LOOP2
	SJMP HERE	REPEAT THE SAME PROCESS AGAIN AND AGAIN
	ORG 300H	
	TABEL1: DB 43H,52H,45H,41H,54H,45H,44H,20H,42H,59H	ASCII VALUES FOR “CREATED BY”
	ORG 30AH	
	TABEL2: DB 47H,4FH,50H,41H,4CH,20H,41H,47H,41H,52H,57H,41H,4CH	ASCII VALUES FOR “GOPAL AGARWAL”
CMND:	MOV P1,A	P1 <= A
	CLR P3.5	COMMAND REGISTER ACTIVATED

Label	Opcode	Comments
	CLR P3.4	WRITE COMMAND ON LCD ACTIVATED
	SETB P3.3	LCD ENABLE SET TO 1
	CLR P3.3	LCD ENABLE SET TO 0
	ACALL DELAY	TIME DELAY TO LET PRESENT TASK TO BE EXECUTED, ELIMINATE THE NEED TO CHECK BUSY FLAG (BF)
	RET	RETURN
DISP:	MOV P1, A	P1 <= A
	SETB P3.5	DATA REGISTER ACTIVATED
	CLR P3.4	WRITE COMMAND ON LCD ACTIVATED
	SETB P3.3	LCD ENABLE SET TO 1
	CLR P3.3	LCD ENABLE SET TO 0
	ACALL DELAY	TIME DELAY TO LET PRESENT TASK TO BE EXECUTED, ELIMINATE THE NEED TO CHECK BUSY FLAG (BF)
	RET	RETURN
DELAY:	MOV R2, #08H	DELAY SUBROUTINE FOR 60 MICRO SECOND
DEL:	DJNZ R2, DEL	
	RET	
	END	

Chapter 6: Result

8051 is Successfully interfaced with 16*2 LCD module and a message is display “CREATED BY GOPAL AGARWAL”.

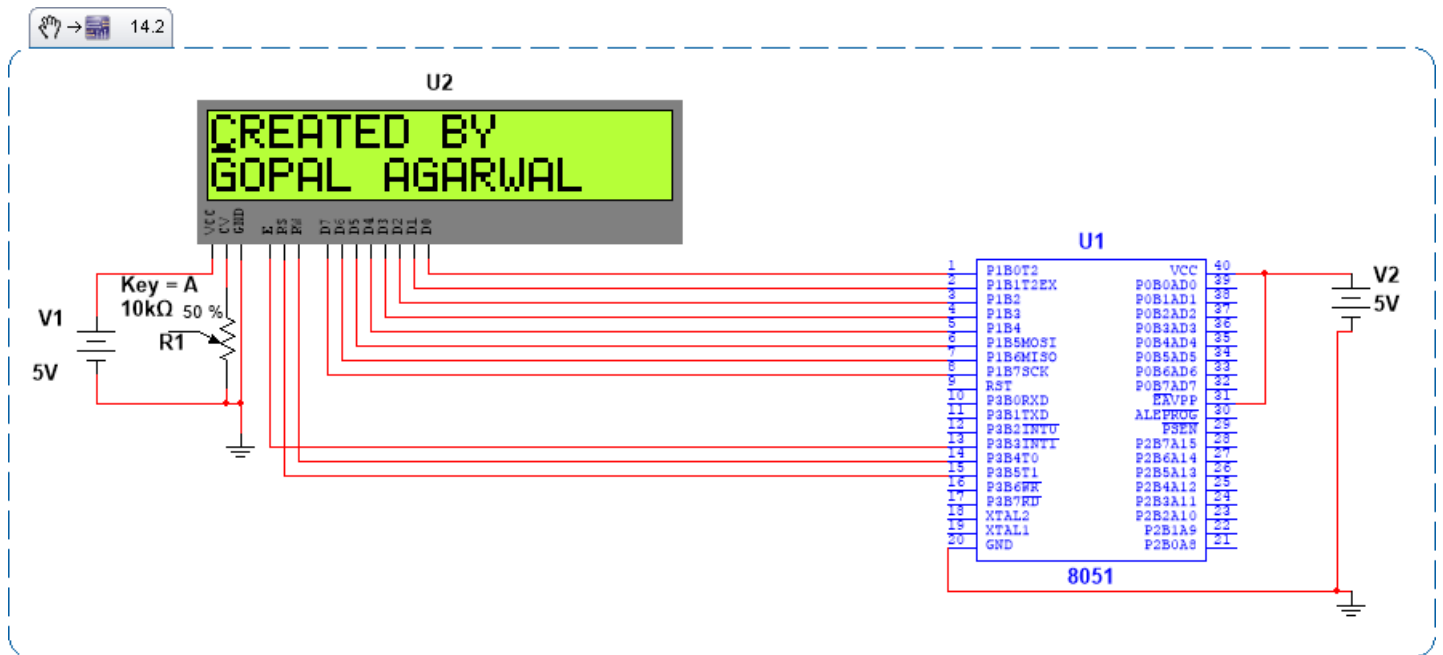


Figure 3 Result

Chapter 7: Future Goals

This circuit can be integrated with any embedded projects which needs an LCD to display the required information.

Chapter 7: References

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