Embedded System Lab: Session First - Microcontroller

LAB – 2: Interfacing 7-Segment LED Display with 8051/8052 Micro-controller

Objectives

To enable us to write assembly language code for the 8051/8052 micro-controller capable of:

- Displaying non-multiplexed and multiplexed output on 7-segment LED units
- Displaying static and scrolling output on 7-segment LED units

Equipment Required

- Hardware: 8051 or 8052 micro-controller development board, Jumper cables
- Simulation Software: KEIL, Vision-Embedded development tool, Proteus Design Suite – Professional PCB layout, circuit design and simulation tool
- In-System Programming (ISP) Software: ProgISP – An in-system-programmable tool to load HEX files in to micro-controller
- Device Drivers: LibUSB – Application controlling data transfer to/from USB devices

Circuit Description

The circuit diagram, consisting of micro-controller AT89C52 and four common cathode 7 segment display, used for simulation for this lab is shown below:
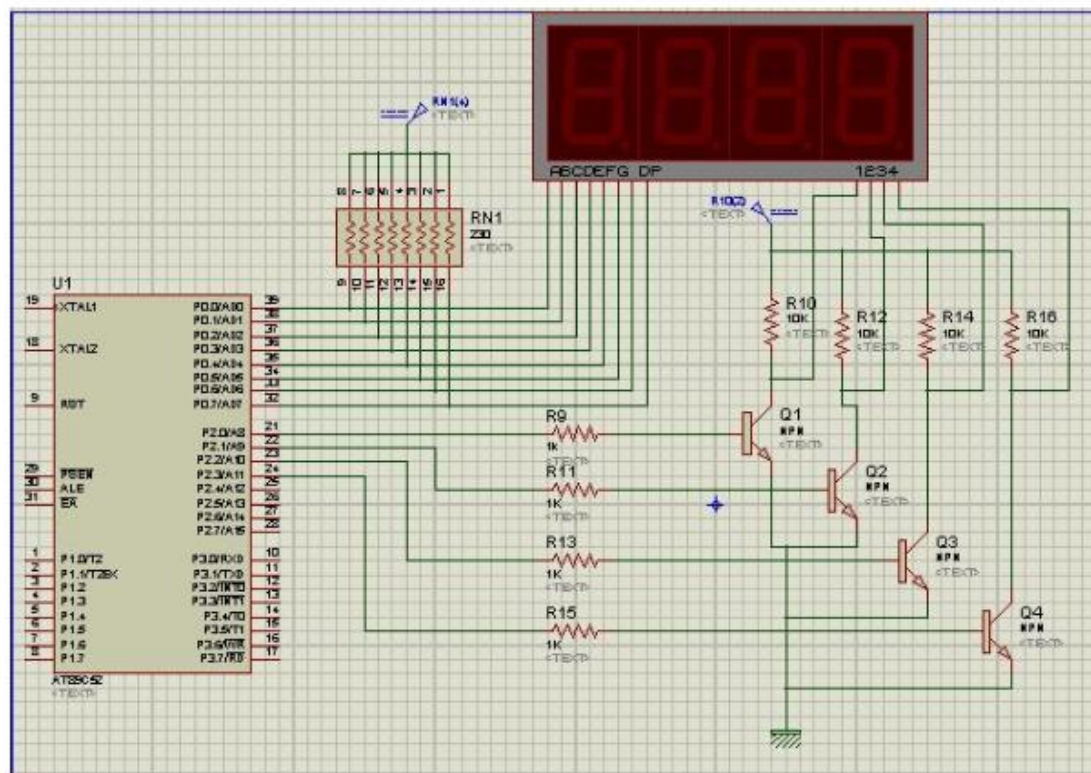
Figure shows that the common data lines, from the array of four seven segment display, are connected to the PORT 0 of microcontroller with array of 8 pull-up resistor. Here data line A is connected to P0.0 (LSB) whereas DP is connected to P0.7 (MSB). The control pins 1, 2, 3 and 4 are indirectly connected to P2.0, P2.1, P2.2 and P2.3 respectively. Since logic low should be applied to control pin to trigger corresponding segment, here transistor is used to invert the logic. It means in order to trigger a certain segment, let's say 1, logic high is applied to the connected pin, here P2.0, so that there will be logic low across the transistor where the control pin 1 is connected.

Now in order to display digits on more than one segment then illusion technique most be used. It means we have to give an illusion that multiple values are displayed at once on multiple 7-segment LED units using shared data lines. This illusion is created due to the persistence of vision as we know that human brain cannot differentiate between the two events occurring at a time difference of less than 40 milliseconds. Hence the data must be passed to the common data lines at a rate of about 60 to 100 times per second in order to avoid flickering. At the same time corresponding 7-segment units need to be turned ON or OFF.

Problems

1. Write a code to design a single digit decimal counter that counts up from 0 to 9 and back to 0. This process should repeat indefinitely.
2. Write a code to design a double digit decimal counter that counts up from 00 to 20 and back to 00 indefinitely.
3. Write a code to display the first (N) numbers of the Fibonacci sequence, where the number (N) must be stored in a memory location and can be any integer from 1 to 10. The sequence should repeat indefinitely.
4. Write a code to generate the multiplication table of a number (N) stored in a memory location which can be any integer from 1 to 10. Repeat the sequence indefinitely.
5. Write a code to display the roll numbers of your lab group members one by one in static format. Each student roll number should be of four characters. Display of student roll numbers should repeat indefinitely.
6. Write a code to display the roll numbers of your lab group members in scrolling format, separated by using decimal point. Roll numbers should be scrolled towards the left and is repeated indefinitely.