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Interfacing two-Digit 7-Segment with 8051 Microcontroller

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ABSTRACT -This article is about how to interface multiple seven segment LED display to an 8051 microcontroller. 7 segment LED display is very popular and essential to display any type of information/messages. The main problem comes here that we can't attach more than 4 seven-segment display to 8051 microcontrollers, so we have overcome this problem by multiplexing method. In this paper, we have given a brief overview on the Interfacing of 8051 and discusses of its method for n-number

KEYWORDS: Microcontroller; 7-segment interfacing; Multiplexing; Research Methodology

I. INTRODUCTION

A Microcontroller (MC) is a small and low-cost microcomputer, which is designed to perform the specific tasks of embedded systems like displaying microwave's information, receiving remote signals, etc. All general Microcontroller consists of the processor, the memory (RAM, ROM, EPROM), Serial ports, peripherals (timers, counters), etc. which are used to interact with things connected to the chip. 8051 Microcontrollers are designed by Intel in 1981. It is an 8-bit microcontroller. It is built with 40 pins DIP (dual inline package),4kb of ROM storage and 128 bytes of RAM storage, Tow 16-bit timer/counters. It consists of are four parallel 8- bit ports, which are programmable as well as per the requirement. An on-chip crystal oscillator is integrated in the microcontroller having crystal frequency of 12 MHz [1]. It consists of Full duplex serial port, 6-source/5-vector interrupt structure with two priority level, Extensive Boolean processing (single-bit logic) capabilities and 32 bidirectional and individually addressable I/O lines. 8051 microcontrollers have 4 I/O ports each of 8-bit, which can be configured as input or output. Hence, total 32 input/output pins allow the microcontroller to be connected with the peripheral devices
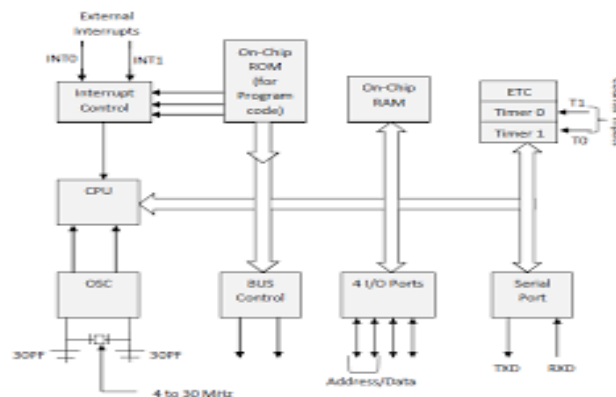
II. ARCHITECTURE OF 8051

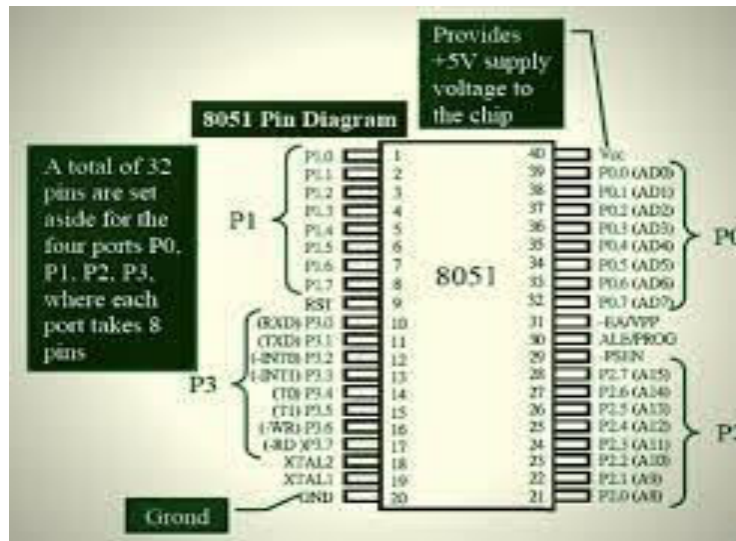**Fig -1:** ARCHITECTURE OF 8051 MICROCONTROLLER

Fig -2: PIN CONFIGURATION OF 8051 AND FUNCTION OF THEIR PINS

III. INTERFACING 7-SEGMENTS DISPLAY WITH8051 MICROCONTROLLER

Interfacing is the method of connecting/linking one device with another, especially a computer or micro-controller with another allowing us to design or adapt the output and input configurations of the two electronic devices so that they can work together.

3.1 7-SEGHMENT DISPLAY

A 7-segment display module is an electronic device used to display numbers and some alphabet. It is made up of seven led segments. Because of the small size of the led, it is really easy for a number of them to be connected together to make a unit like 7-segment display . Each led segment has one of its pins brought out of the rectangular package. Other pins are connected together to a common terminal. 7-segment display are used to indicate numerical information. 7-segments display can display digits from 0 to 9 and even we can display few characters like A, B, C, D, E, F, G, H, etc. They are more popular and have many more applications.

Fig -3: 7-SEGMENT DISPLAY

3.2 TYPE OF SEVEN SEGMENT

There are two types of 7-segment display • Common cathode terminal (CC) • Common anode terminal (CA) A.
A.COMMON CATHODE(CC)

As the name indicates, its cathode is connected to a common terminal. Below is the schematic diagram to indicate its common cathode structure. It should be connected to the ground while operating the display. If a high voltage is given to the anode, then it will turn on the corresponding segment
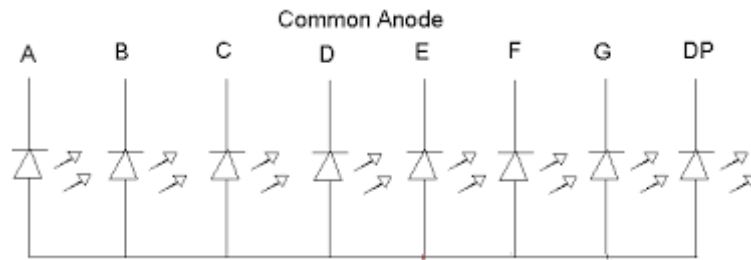
Fig -4: COMMON CATHODE CONNECTION

B.COMMON ANODE (CA)

In this type, the anode is common. It should be connected to a high voltage (to the supply through a resistor to limit current). In order to turn on a particular segment, a ground level voltage is given to the corresponding pin. Since logic circuits can sink more current than they can source, common anode connection is used most widely.
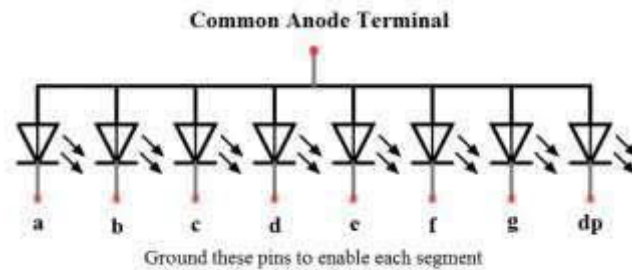

Fig -5: COMMON ANODE CONNECTION

IV. DIGIT DRIVE PATTERN

To display the digits on 7 segments, we need to glow different logic combinations of segments. For example, if you want to display the digit 3 on seven segment then you need to glow the segments a, b, c, d and g. The below table show you the Hex decimal values what we need to send from PORT2/PORT-1 to Display the digits from 0 to 9

Numbers	Common Cathode		Common Anode	
	(DPGFEDCBA)	HEX Code	(DPGFEDCBA)	HEX Code
0	00111111	0x3F	11000000	0xC0
1	00000110	0x06	11111001	0xF9
2	01011011	0x5B	10100100	0xA4
3	01001111	0x4F	10110000	0xB0
4	01100110	0x66	10011001	0x99
5	01101101	0x6D	10010010	0x92
6	011111101	0x7D	10000010	0x82
7	00000111	0x07	11111000	0xF8
8	01111111	0x7F	10000000	0x80
9	01101111	0x6F	10010000	0x90

Fig -6: DIGIT DRIVE PATTERN FOR 8051

V. MULTIPLEXED 7-SEGMENT DISPLAY

If two or more seven segment displays have to be used and the microcontroller unit does not have enough I/O ports to accommodate all the input pins of the seven segment display units. The best method to be adopted in such cases would be to use a multiplexer. By multiplexing, the number of seven segment units multiplexed would be using only the seven output ports and enable pins equal to the number of display units to display the output. Now, how it is made possible to use only seven output ports to display output of the number of seven segment display units at a single time? The principle behind this is the persistence of vision. Only one unit is working at a single time and the switching between the seven segment display units are made faster so that the onlooker is not able to recognize the switching The 7-segment are connected in parallel as shown in figure-7.
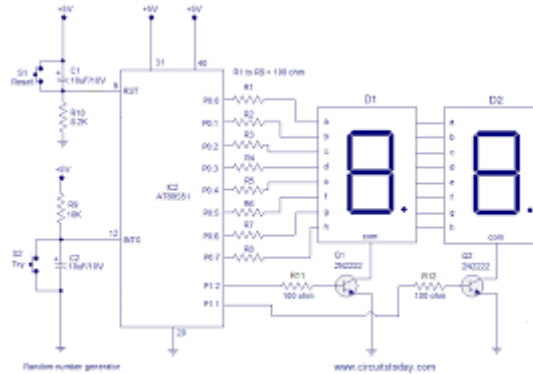
VI. CIRCUIT DIAGRAM

Fig -7: CIRCUIT DIAGRAM OF INTERFACING TWO 7- SEGMENT DISPLAY

VII. HOW TO OPERATE?

• Initially run the program to the microcontroller.

• Give the connections as per the circuit diagram.

• Make sure that a to g pins of 7 segment are connected to the P2.0 to P2.6 respectively in the first circuit and to PORT-0 pins in the second circuit

. • Switch on the supply, you can observe that digits 0 to 9 will display continuously with some delay in the first circuit and digits from 0 to 99 will display on 4- digit 7-segment display in the second circuit.

• Switch of the supply.

VIII. APPLICATIONS

• Seven segments are widely used in digital clocks to display the time

. • These are used in electronic meters for displaying the numerical information.

• Used in Instrument panels.

• Used in digital readout displays

IX. LIMITATIONS

• The complexity is increased to display large information

. • It is not possible to display the symbols on seven segment.

X. CONCLUSION

Suppose you need a three-digit display connected to the 8051. Each 7-segment display have 8 pins and so a total amount of 24 pins are to the connected to the microcontroller and there will be only 8 pins left with the microcontroller for other input output applications. Also, the maximum number of displays that can be connected to the 8051 is limited to 4 because 8051 has only 4 ports. More over three 3 displays will be ON always and this consumes a considerable amount of power. All these problems associated with the straight forward method can be solved by multiplexing in multiplexing all displays are connected in parallel to one port and only one display is allowed to turn ON at a time, for a short period. This cycle is repeated for at a fast rate and due to the persistence of vision of human eye, all digits seems to glow. The main advantages of this method are:

> Fewer number of port pins are required.

> Consumes less power.

> More number of display units can be interfaced (maximum 24).

This is way that how it interfaces with the 8051 microcontrollers.

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