

# **Design, Simulation and Implementation of PIC based Scrolling Message Display Board**

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**ABSTRACT** The aim of the paper is to describe a cheap and easy design and implementation of microcontroller based scrolling message display using a series of eight numbers of LED matrices with each LED matrix having 5 rows and 7 columns. A PIC18F452 is chosen as the microcontroller because of its high memory space which is required to save data in the memory for all the alphanumeric characters and symbols. The message can be sent by the computer through a software to the microcontroller using a serial port. This message is displayed on the board. The design was first simulated using Proteus v8.0 and then implemented in the hardware. The program was compiled in mikroC and fed into the microcontroller using a programmer for PIC 8-bit microcontrollers. Such scrolling display boards can be installed as notice boards, for advertising and displaying important information in public places.

**KEYWORDS:** PIC microcontroller, scrolling display, LED matrix

## **I. INTRODUCTION**

With the ever increasing demand for display with low power consumption at low costs, LED technology for display has gained momentum due to its several inherent advantages. LEDs have the potential of lighting for several hours continuously. They dissipate negligible amount of energy as heat compared to conventional sources of light. They produce brighter light while consuming lower energy. As a result, LEDs reduce the wastage of energy. LEDs are readily available in the market in various colours, thereby, serving as an ideal source for colourful display. One of the primary reasons for the dominance of LED technology in the market is its declining cost making it extremely affordable. As a result, LED technology is being continuously being explored for new prospects in the world of display. Recently, organic light emitting diodes (OLED), which use organic compounds as display materials have become popular for flexible displays [1]. OLEDs are promising because of their cheap, flexible nature, very light weight and improved brightness.

In this article, a practical and constructive application of LED technology has been demonstrated. A cheap and simple design has been illustrated for scrolling display using eight mono-colour 5X7 LED displays arranged in series. Thus, the total display consists of 7 rows and 40 columns. The heart of the circuit is the PIC18F452 microcontroller which receives message from a computer, sends it to the circuit and displays on the LED matrix with the help of five 74HC595 shift registers. All the components are easily available in the market and they are quite cheap. The whole assembly can thus be available at a very low cost. Before the hardware implementation, the software is simulated in software, Proteus v8.0. This Scrolling Message Display Board can be used as notice boards in educational institutes, for advertisement and display of prices of different products, to display information in public spaces like railway terminals, airports and bus depots etc.

The paper first describes the theory of LED dot matrix followed by the description of circuit design and software description. Subsequently, the simulation of the circuit in Proteus design software has been described. Then, the hardware implementation of the circuit has been discussed. Finally, the conclusion is presented.

**II. THEORY OF LED DOT MATRIX**

In an LED matrix display a number of LEDs are arranged in rows and columns. In this way, the number of pins that are required to address and drive the LEDs are reduced. For example a 5x7 matrix of LEDs shown below has 7 rows and 5 columns. Each led has an anode and a cathode. So, a total of 70=5x7x2 connections are needed. Such numerous connections would make the circuit cumbersome. Instead, if the anodes of all the LEDs in a row are tied together, thereby making 7 rows and the cathodes of all the LEDs in a column are tied together making 5 columns, then only 12 =5+7 pins are enough to control all the led pixels individually. A particular led can be illuminated by addressing the led with the row and column number. For example, if we want to turn on the led in third row and fourth column r3 is pulled high and c4 is pulled low.

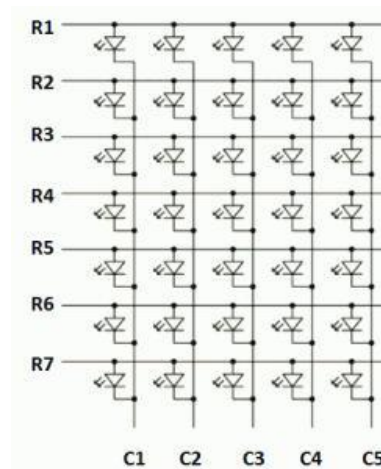


Fig. 1 Structure of a 5X7 LED dot matrix display

There are two methods to display a character, namely row scanning and column scanning. In case of row scanning method, one row is pulled high at a time and rest of the rows remain low. Consecutive rows are pulled high at a fast speed while the data required for display of a particular character may be supplied to the columns. One row gets illuminated at a time. But, the character can be seen due to persistence of vision. The data is provided by the microcontroller. In order to make a 7X40 LED matrix display, eight 5X7 matrices are connected in series where similar row pins in each matrix are connected together.

**III. CIRCUIT DESIGN AND SOFTWARE DESCRIPTION**

The block diagram of the circuit is shown in Fig. 2.

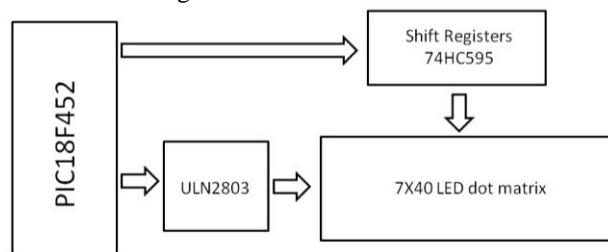


Fig. 2 Block Diagram of the circuit

Eight 5x7 square LED dot matrix are connected in a linear fashion to construct a 7-row X 40-column display matrix.. The similar row pins of all eight dot matrices are connected together and are fed to the output sinks of an ULN2803 IC, which consists of 8 Darlington arrays. Now the output pins of ULN2803 can be used as a sink for current in the LEDs. The current per LED is limited to ~12.5 mA.

The positive terminals of LEDs are accessible through column pins. A row scanning technique is applied for display of characters. A 40-bit serial-in-parallel-out system is constructed by five 74HC595 ICs which are in turn connected in cascading fashion. Each column is connected to the output of the 74HC595 ICs. The 74HC595 device is an 8-bit serial-input shift register which has both the features of parallel and serial output. The serial output feature allows the connection of multiple 74HC595 devices in cascading fashion. The LED pins were connected to the shift registers through a resistance of 330 ohms.

PIC18F452 has been selected from the mid-range 8-bit PIC family. The ground path for the columns through ULN2803 is provided by one of the 8-bit ports of the microcontroller. The data and clocks for the shift registers are also provided by the microcontroller. PIC18F452 has a default pin for UART communication. A serial terminal program has to be installed in the computer which helps in sending character data to the microcontroller through the UART port. The microcontroller saves the information into its inbuilt EEPROM.

The program for controlling the output pins of the microcontroller and receiving the message to be displayed from the PC was done in C language and compiled using mikroC. The program was fed into the microcontroller using a programmer for PIC microcontrollers.

#### IV. CIRCUIT DESIGN SIMULATION

The circuit was simulated in the software Proteus v8.0 before hardware implementation. In this software, all the components of the circuit required were selected from the device library and connections were done by wire. The program was compiled using mikroC. The hex file of the program was loaded into the PIC microcontroller. Finally, the simulation was done. The circuit used for simulation of a 7X40 LED circuit is given in Fig. 3. The connection to the microcontroller is not shown in the circuit. The data bit and shift register clocks were connected to RA2, RA1 and RA0 pins of the microcontroller whereas the inputs for the seven rows were connected to the ULN2803 by RB0 through RB6.

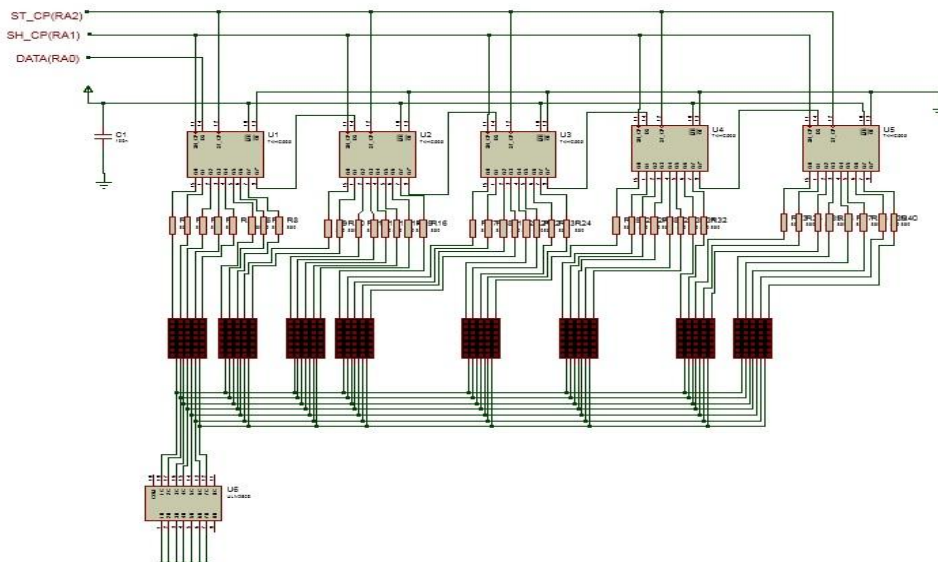


Fig. 3 Circuit Design For 7 X 40 LED dot matrix

#### V. HARDWARE IMPLEMENTATION

Since, a number of electrical components including 8 LED dot matrices, 5 shift registers, 40 resistors, 1 ULN2308 and 1 PIC microcontrollers were used, it was difficult to assemble the circuit into a single vero board. Three vero boards were joined together to adjust the LED dot matrices and enable a continuous display. IC bases were used for the

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components so that they can be changed in case of any damage or for reuse. Fig. 4 shows the hardware implementation of the circuit.

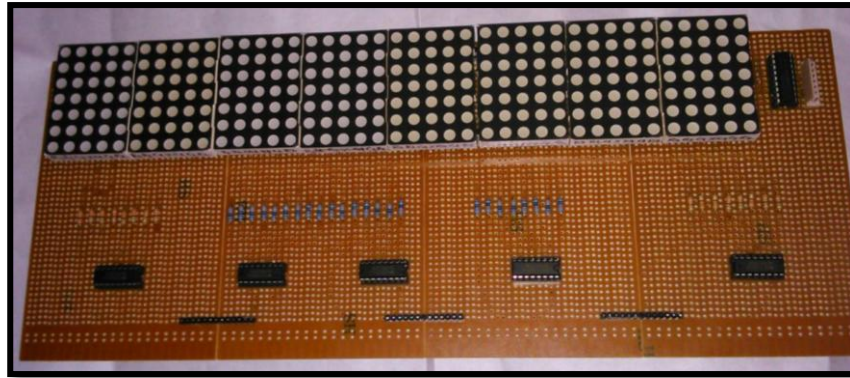


Fig. 4 Hardware Implementation of Circuit

### VI.CONCLUSION

We have designed, simulated and implemented a cheap, simple and straightforward LED scrolling display board. Our program successfully displays and scrolls the message that is fed by the user. This paper explains the working of a single LED dot matrix and then using them for a display board using components readily available in the market. The circuit has been simulated in software before hardware implementation. GSM modules and speech to text technology can be added as special features for improvement of this system.

### REFERENCES

- [1] K.T. Kamtekar, A.P. Monkman, M.R. Bryce, "Recent Advances in White Organic Light Emitting Materials and Devices (WOLEDs)", *Advanced Materials*, vol 22, No. 5, 572, 2010
- [2] R. Gaonkar, *Fundamentals of Microcontrollers and Applications in Embedded Systems*, Penram International Publishing (India) Pvt. Ltd., 2010.
- [3] J. Axelson, *Serial Port Complete*, Penram International Publishing (India) Pvt. Ltd, 1998
- [4] S. K. Mandal, *Microprocessors and Microcontrollers*, Tata McGraw Hill Education, 2011
- [5] Sedra and Smith, *Microelectronic Circuits*, Fourth edition, Oxford University Press, 1998
- [6] R.S. Sedha, *A Text Book of Applied Electronics*, S. Chand and Company Ltd., 2002
- [7] [www.alldatasheet.com](http://www.alldatasheet.com)
- [8] [www.mikroe.com](http://www.mikroe.com) (Programming in C by PIC microcontroller)