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APEKSHA SARODE
Dept of Computer Engineering, K.C College of Engineering, Thane, India, apeksha.sarode@gmail.com

DEEPALI MADHUKAR SALUNKE
Dept of Computer Engineering, K.C College of Engineering, Thane, India, deepali_salunke25@yahoo.com

AKSHAYDUTTA LAXMIDUTTA SHUKLA
Dept of Computer Engineering, K.C College of Engineering, Thane, India, akshayshukla1991@gmail.com

MANVI MUKESH SONAWADEKAR
Dept of Computer Engineering, K.C College of Engineering, Thane, India, manvi18j@gmail.com

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SPINNING LED DISPLAYUSING RADIO FREQUENCY

APEKSHA SARODE, DEEPALI MADHUKAR SALUNKE, AKSHAYDUTTA LAXMIDUTTA SHUKLA & MANVI MUKESH SONAWADEKAR

Dept of Computer Engineering, K.C College of Engineering, Thane, India
Email: apeksha.sarode@gmail.com, deepali_salunke25@yahoo.com, akshayshukla1991@gmail.com manvi18j@gmail.com

Abstract- The project consists of Spinning LED display using RF which displays the messages send by the user at the handheld device. if there are no inputs from the user for the system, the message that is programmed in the microcontroller will be displayed continuously. The circuit needs to be mounted on a mechanical structure that rotates at high speed. The display consists of 7 LEDs only in a vertical row. By moving them fast enough, message can be displayed which appears to be generated by a 7*n matrix of LEDs and not a single column of LEDs, where n is the no. of columns of the display matrix. This illusion is based on inertia of human eye or in other terms PERSISTANCE OF VISION. It consists of motor and seven LEDs that are arranged in a vertical line. The motor spins at a constant rate such that the LEDs rotate around a centre pivot point. As the LEDs spin around they light up sequentially such that they will display the message. The motor spinning fast enough that the human eye will perceive all of the display is on at once, and the viewer will be able to read the message completely. If LED formed message will periodically and frequently enough flash, they will appear solid and steady. A microcontroller is used to keep the message and blink the LEDs in an appropriate pattern. It has to be programmed so that it will both keep message and also send the appropriate signals to the LEDs to light them in the correct sequence.

Keywords*-360 degree; LED; Color display; Radio frequency ; dynamic message display ; microcontroller 89S52*

I INTRODUCTION

The Spinning LED display has been a project that has evolved from a simple design on paper to a complex functional prototype. The basic concepts of the project were to:

a) Design and build a wireless communications system.
b) Allow user input of text messages on a PC.
c) Display those text messages on a LCD screen controlled by a microcontroller.
d) Transmit the messages to a remote device using wireless communication.
e) The microcontroller also controls multiple LEDs to display messages and/or patterns.

The messages and commands can then be transmitted to a remote device that is capable of displaying messages or patterns using 7 light emitting diodes (LED).

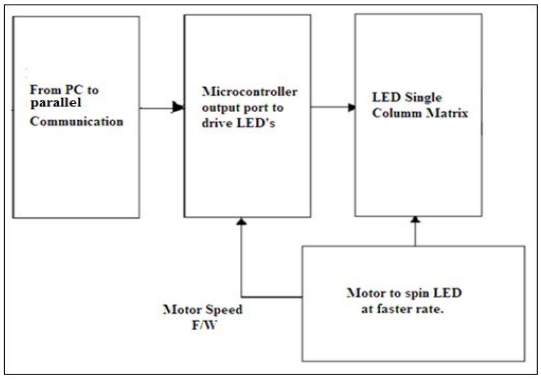

Fig.1 Block diagram of module

The above fig.1 shows the block diagram of the circuit, whose explanation is as under:

a) PC- from PC we are sending the message we want to display through Serial communication to microcontroller serial port. PC will convert the message in appropriate form and give signal to Microcontroller to display the signal on LED's.

b) MICROCONTROLLER- Microcontroller will drive the LED's and motor according to sequence generated by the PC.

c) LED- Ultra bright RGB LED is used for the better message display.

d) MOTOR- DC motor will be using to spin the LED at faster rate to perceive continuous message on the principal of persistence of vision. [1]

II BASIC WORKING

We have all seen a train or a car whizzing past us, we see that its lights appear as horizontal lines instead of moving dots. This is due to a characteristic of our eyes known as Persistence of Vision. A quickly moving light appears to be in many places at once. If it's on continuously, we see a solid line. If it is flashing, we see a line of dots. This phenomenon can be thought of as the brain having a limited "frame of vision". Movies "work" only because of this limitation. We only think we are seeing fluid motion around us because the brain is very good at piecing bits of data into continuous images and stories. This is the basic principle of our Project named as 'Spinning LED Display'. The project is a rotating LED display message display

system which displays messages Programmed in microcontroller IC89S52 or Wireless communication (Radio frequency) using parallel port is the transfer of information over a distance without the use of electrical conductors or "wires". In RF there is user input for the system. We display the message using 7 LED's .This is done by building 2 different parts first is mechanical part (use for rotating whole circuit) and second is Electrical part (deals with microcontroller and other electronics). In this the different messages will scroll, with respective intervals or delay by the microcontroller itself which is already programmed by the user. The code is written using software visual basic. This circuit needs to be mounted on the mechanical structure (rotating disc) where it displays the messages .The disc is rotating using DC motor with the speed of 1500rpm , the motor speed is kept constant .There are sensor and obstacle attached at the base of the disk and the base stand respectively that will help to detect one complete rotation of 360°.The message can be changed as per user needs by rewriting the microcontroller in built memory or through RF via sending wireless data through pc. The complete display system circuit is battery- run on 9v, Dc motor works on 9v and current of 3 miliampere. This unique way of displaying messages is a very eye catching, for it is use in many fields like advertising, toys etc. the figure 2 shows the diagrammatic side view of the proposed module.[2]

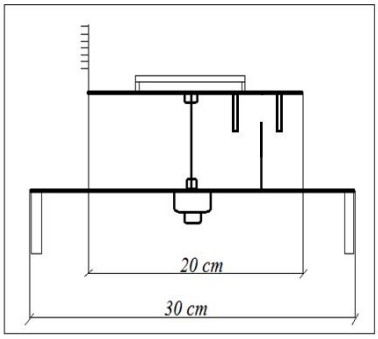

Fig.2 Side view of proposed module

III. MODULES OF PROJECT

A. Power Supply

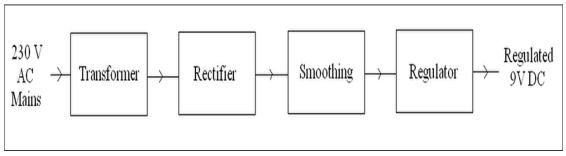

Fig.3 power supply circuit

The above fig.3shows the power supply circuit that converts high AC voltage to 9V DC voltage. Function of each block:

a) Transformer - steps down high voltage AC mains to low voltage AC.
b) Rectifier - converts AC to DC, but the DC output is varying.
c) Smoothing - smoothes the DC from varying greatly to a small ripple.
d) Regulator - eliminates ripple by setting DC output to a fixed voltage.[3]

B. Transmitter

A transmitter or a radio transmitter is an electronic device which, with the aid of the antenna, produces a radio wave. The transmitter itself generates a radio frequency alternating current which is applied to the antenna. When exited by this alternating current, the antenna radiates radio wave [4]

The transmitter circuit we will be using in our project is as shown in fig.4.

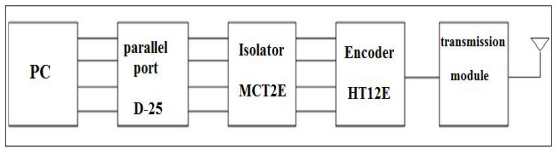

Fig.4 transmitter circuit

The detailed explanation of transmitter module is as follows.

a) *PC :*

It is used for sending the message that we want to display. It will convert the message in appropriate form. Give signal to Microcontroller to display the signal on LED's.

b) *Parallel Port D-25 :*

Parallel port is an interfacing cable between PC and PCB, found at the back of the CPU cabinet. Male part of parallel port is connected to pc and female part is connected to PCB via PCB mount 25-pin D-type Female connector.

c) *Isolator :*

It mainly used to isolate PC from circuit side. i.e protect PC from any reverse leakage current . It is used to minimize the loading effect which will take place on the motherboard of computer and might damage it.

d) *Encoder IC HT12E(18pin):*

This encoder which is manufactured by Holtek, consists of 8 address lines and 4 data lines. It is mainly used to convert incoming 4-bit parallel data into its equivalent serial form which is used by transmitter module.

e) *Transmitter Module :*

This module is used to transmit the data using antenna. It also consists of the DIP switch. It is an 8-

way DIP switch is used for Addressing. For proper communication the address lines at transmitter and receiver side should be same. 2^8 = 256 different combination of address can be generated by DIP switch, that is 256 different user can use the same frequency at the same time at the same place.

C. Receiver

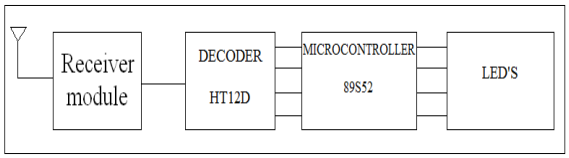

Fig.5 receiver module

The receiver module in fig.5 receives the signals transmitted by the transmitter module. The detailed information of individual components is as follows:

a) Decoder HT12D:

The receiver module after receiving the signal verifies its address and passes to decoder. The decoder manufactured by Holtek consists of 8 address lines and 4 data lines. After decoding, data is passed to microcontroller 89S52.

b) Microcontroller 89S52 :

The 89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using high-density non-volatile memory technique. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the 89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

c) LED:

There are 8 Tri-color LEDs, which when rotates at high enough speed with the help of DC motor, such that it gives us the illusion of a screen being created.

D. Software Designing

The software for this project is split into two sections. The first section is the displaying of the message. This is done in a timer compare match ISR in order to keep the LEDs blinking at a constant rate and prevent distortion of the display. The code in the ISR simply checks for which colour the letter is to be displayed in and it outputs each byte from the array for the corresponding letter, where each bit corresponds to a specific LED. The rest of the ISR just increments the variables keeping track of which letter it is displaying and which byte it is displaying (and the variable keeping track of letter colour if the user sets the display to display each letter in a different colour), the variables are incremented or decremented to allow the software to cycle through the entire message over and over for persistence of vision. The timing for the ISR was done on the guess and checks method and remains constant.

The second part of the software is the keypad reading and the creation of the array of the letters to be displayed. The denounce state machine is used to make sure a button is just read as a single push and not several pushes. A set of nested if statements is used to determine what to do. [5][6]

E. Visual basic

The BASIC language, as the name implies was a very simple language that used line numbers and little explicit structure – it's up to the complier/interpreter to work out the details. By placing a few restrictions on the language, it became a very good language for students new to programming to learn and hone their skills on. We have used visual basic to create the basic graphic user interface (GUI) which is as shown.

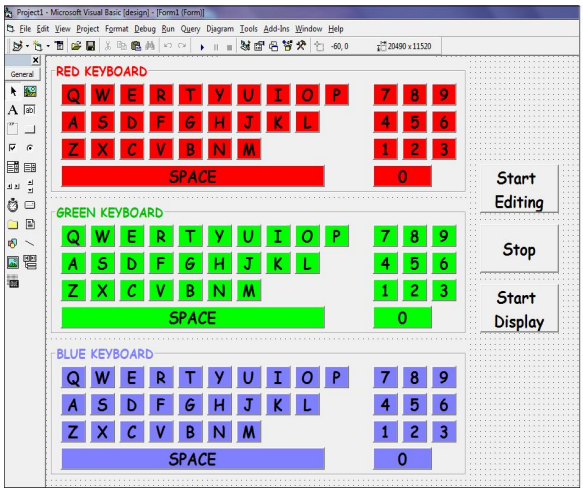

Fig.6 Graphic user interface

The fig.6 shows that there are seperate keyboards for the characters of all three colors red ,green ,blue.After pressing the "start editing" button,the user can press different characters in different colors as required,and can end the editing use the "stop" button.The user can begin to display the edited content after pressing the "start display" button.[7] [8]

F. KEIL

KEIL provides a broad range of development tools like ANSI compiler, macro assemblers, debuggers and simulators, linkers, real-time operating systems and evaluation boards for 8051 microcontroller family which also include the 89s52 microcontroller which we are using in our project. [9] The C51 Compiler allows us to write 81S52 microcontroller applications in C that, once compiled, have the efficiency and speed of assembly language. Language extensions in the C51 Compiler give you full access to all resources of the 89S52. It has nine basic data types, including 32-bit IEEE floating point,

interrupt functions can be written in C and it makes full use of the register banks. It provides complete information regarding source level debugging and contains several instruction sets for the 8051 microcontroller family.

IV. TIMING CALCULATIONS

We will be using a DC motor of 1500rpm.thus there will be 25 rotations in 1 sec. It thus takes 0.04 sec to complete one rotation or 360°. So, for 1°, it takes $1.1*10^{-4}$ sec. In this time, we display the 1st column of 5x8 arrays that is used to display one single character. Thus, it takes 6°, 5° to display one character and 1° to distinguish between two characters.

V. ADVANTAGES

This project helps us to display the information in attractive multiple colors in 360° view. The total power utilization is about 3mW.Also, less number of LED's is required to display the message. The available memory is 8kb, which is higher than other microcontrollers like 89C51; 89C52.The troubleshooting part is much simpler and prompt. We can also utilize the Global System for Mobile communication (GSM).

VI. CONCLUSION

This energy saving display system employee a single column of multi-color LED's, rotating a high enough speed to be indistinguishable for human eye. Hence the display appears to be constantly illuminated and brilliant color image can be seen from any angle of view. After completing the process of implementation of both hardware and software, followed by a rigorous testing phase, we can conclude that the spinning LED display appropriately displayed a visible message without blurs, flickering, or delays once the motor reached desired speed. Further it also confirmed that the keypad also worked as expected, allowing a programmable message and the ability to designate color .Thus we can say that spinning LED display system using radio frequency as mode of communication will have an efficient and satisfying display quality compared to tradition dot matrix LED scrolling text systems.

VII. FUTURE MODIFICATION

This spinning LED display can be accessed by using the other wireless technologies such as GSM and Bluetooth via mobile phone device. [10] Using AC motor will get the smoother and clearer display while increasing the number and size of LEDs will produce the better quality and can facilitate the display of images. A larger memory space can be provided according to the scope of the display to store the bigger messages. This project is confined to the usual alphabets and numbers but the special characters such as #, @, &, $ etc. can also be programmed into the microcontroller for the wide range of message to get displayed.

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