Volume 5, Issue 3, March 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Propeller LED Message Display based on Persistence of Vision

Karthik Krishnamurthi, Saikat Mukherjee, Mikhil Mohanan, Rishana Johny
Department of Computer Science, Christ University,
Bangalore, India

Abstract— The human eye is one of the five specialized ways using which the mind forms a picture. Every time we blink our eyes, an optical phenomena called the persistence of vision works in the background to reproduce a sequence of visual images in a motion picture. Whenever light from an image strikes the retina, the eye retains the impression of that light for a particular fraction of seconds depending on the brightness of the image even after the image has been removed from the human sight. This principle is used in this paper to display messages in a propelling display of light emitting diodes (LED). Most of the existing LED grids consists of large number of LEDs and hence consume a lot of energy. In the present work, virtual grids are used in order to reduce the number of LEDs. Virtual grids are formed by placing eight LEDs serially on a propeller. The propeller is subject to rotation at 600 revolutions per minute to create virtual grids.

Keywords— Persistence of vision, propeller display, virtual grids, LED display, Rotating LED display.

I. INTRODUCTION

The use of LEDs in display systems is a common phenomena in the present day. In situations where a large number of LEDs are needed to display just a single message, the system is costly, consumes lot of energy and becomes complex. The cost further increase in case of LED hoardings, advertisement banners, notifications in railway stations/airports etc. Such cost can be cut down to a huge extent by using the system suggested in the present work where only eight LEDs are used to display any message. This work also plays a major role in reducing the consumption of electricity. Energy crisis is the main issue now days, as the major source of electrical power is still thermal power. The only solution to reduce the use of electricity is to use LEDs with less power or to make use of less number of LEDs.

This paper contributes in the following directions:

1) The rotating display reduces the number of LEDs from a few hundreds to just 8 LEDs thus making it portable and reducing the complexity of the system.
2) It makes use of a virtual grid thus making the device light unlike the present devices which are huge and heavy.
3) The usage of limited LEDs leads in less power consumption regardless of the length of the message that has to be displayed.
4) Since energy consumption is a major crisis in India, using this system can reduce power consumption.

The rest of the paper is as follows. Section II presents the principle that has been implemented in this paper i.e. persistence of vision. Section III discusses the various components and the methodology. Section IV discusses about the previous related work. Section V talks about the various experiments held and the different kind of output obtained for each. Section VI concludes the paper.

II. PERSISTENCE OF VISION

The human eye can retain an image for about $1/30^{th}$ seconds after the image has been removed from the sight [3]. The amount of time varies depending on the brightness of the image. This property of retaining the image for a while is known as persistence of vision. When a series of images are shown to the human eye and then removed from the sight quickly, the human eye presumes it to be a motion of pictures. This is caused due to the inability of the human brain to differentiate between the images in the short span of time. Basing on this principle, we can display messages by making use of only eight LEDs.

III. METHODOLOGY

The various components used in the present work are described in the following.

AT89S53

It's a low power, high performance CMOS microcomputer with 12Kbytes download-able flash programmable and erasable read only memory. It has got three-level program memory lock, 256 x 8 bit internal RAM, 32 programmable I/O lines, three 16 bit timer/counters, nine interrupt sources, programmable UART serial channel, SPI serial interface, low power idle and power down modes, interrupt recovery from power down and power off flag.

IR Sensor

These sensors work by using a specific light sensor to detect a selected light wavelength in the Infra- Red spectrum. The intensity of the received light can be obtained by using LED's that produces light at the same wavelength as what the sensor is looking for. When an object is close to the sensor, the light, from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity which can be detected by using a threshold.

LM7805

This is basically a voltage converter. They are used with external objects to obtain the desired voltage or current levels. In this project the voltage needed by the 0PCB is 5V, since we are using a 9V battery LM7805 is needed to convert the 9V to 5V.

0PCB

It's a simple board on which manually a circuit can be created.

DC Motor

Repeated scanning of the display is must for continuous vision. This task is achieved using circular rotation of the whole circuit assembly [2].

The present work uses an AT89S53 micro-controller for displaying messages by using the concept of persistence of vision. Fig. 1 shows an AT89S53 mounted on a PCB. The AT89S53 is a low-power, high-performance CMOS 8-bit microcomputer with 12K bytes of download-able flash programmable and erasable read only memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin-out. The on chips download-able flash allows the program memory to be reprogrammed in-system through an SPI serial interface or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with download-able flash on a monolithic chip, the Atmel AT89S53 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications [5].

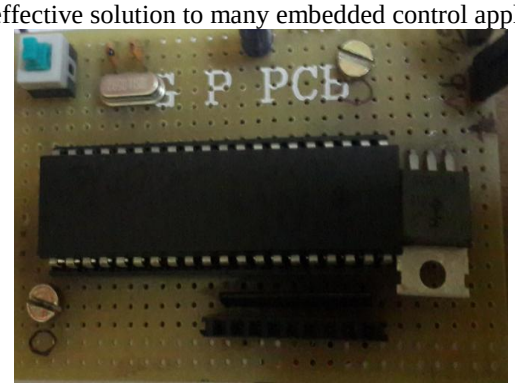

Fig. 1: AT89S53 micro-controller mounted on a PCB

This work uses only eight LEDs when compared to the other message display devices that use hundreds of LEDs. An LED array of 8 red LEDs, 2 blue LED's, AT89S53 micro-controller, 0PCB, IR sensor, KA7805 voltage converter, 12v DC motor, 9v battery, 10k register, 33k register, 330E register, 220 register, 1k register, 10uF capacitor, 12v adapter and switch are used in the circuit diagram illustrated in Fig. 2.

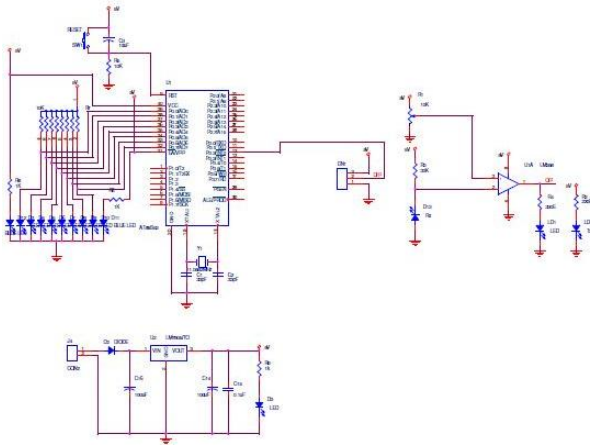

Fig. 2: Circuit diagram

Propeller LED Message Display is basically a set of 8 LEDs placed in a single column shown in Fig. 3 which is rotated in such a way that its blinking at a certain interval would display the message that has been burned into the micro-controller. Its main motive is to display the message by creating virtual grid instead of the presence of real LEDs in large number which would actually decrease the amount of power usage.

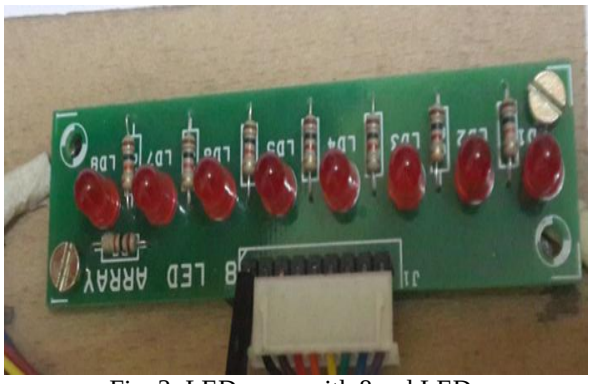

Fig. 3: LED array with 8 red LEDs

The system contains an 8 LED array port, an arm containing the micro-controller circuit, a DC motor to rotate the arm at approximately 600 RPM. The micro-controller is mounted on a 0PCB with a power supply through a 9v battery shown in Fig. 4 which is being converted to a 5v using a KA7805 voltage converter. The micro-controller has to be removed from the 0PCB and then must be connected to a programmer every time a new message has to be passed.

Fig. 4: 9v battery

The LED's are connected to the 0PCB with separate wires through the circuit to different ports of the micro-controller. The principle of persistence of vision functions as follows. At first the micro-controller is programmed using the software C51V953 and flash studio. Then it is mounted on the 0PCB which is connected to the LEDs. Eventually a continuous power supply is given to both the 0PCB and IR sensor shown in Fig. 5.

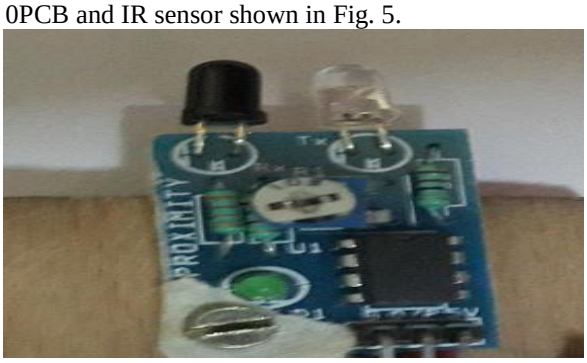

Fig. 5: IR sensor

The IR sensor is connected to the 0PCB. The IR sensor basically returns a interrupt which helps to reset the message every time a single rotation is completed. The DC motor is connected to a 12v adapter to direct power supply. The motor is rotated at 600 RPM and the LEDs start blinking at certain intervals which in coordination with the rotation of the circuit displays the desired message. The entire connections of the system is shown in Fig. 6.

Fig. 6: The entire circuit connection

IV. RELATED WORK

There are various previous similar tasks related to our work. One such work is the rotating display [1]. In this paper the authors have displayed the clock by making use of the chip PCF8583 and the concept of persistence of vision. The method that they have followed in this paper is different from the propeller clock because of the presence of the chip PCF8583. Their concept of persistence of vision is same as what has been applied in the present work. PCF8583 is known as the real time clock (RTC) that keeps track of the current time. Its normally used in mobile phones but its also used in electronic gadgets which requires keeping track of accurate time. 89C52 microcontroller has been used to input the current time from the RTC and selectively turns the LED on and off to display the text. When the motor is made to rotate, the 16 LEDs glow in a particular pattern which is determined by the program written in the 89C52 microcontroller and the full text is displayed when it receives the interrupt from the infrared LED fitted between the rotating parts. Whenever the phototransistor receives the beam from the IR LED, it sends the series of data in sequences glow all the LEDs, one column at a time. But the human eye, due to Persistence Of Vision (POV) cannot determine such fast change and so the entire display is visible. Here the characters are also displayed by using the combination of 8 LED's. In this paper they have displayed only the clock.

Another similar previous work is [2]. To develop the model the authors have also made use of the concept of POV. In this work they have used only 7 LED's thus reducing the number of LED's from 16 as that in [1]. They have also made use of microcontroller, LED module, DC motor and interrupter module. The entire circuit is made to rotate in circular paths. One supply is given through the motors shaft. Other terminals are connected by arranging a friction disc-brush arrangement. This brush would always be in contact with the disk so that there would be proper supply of current. A fixed voltage power supply producing +5V consists of a step down transformer, a bridge rectifier, filter capacitor C1 and 3 terminal regulator IC LM7805. A step down transformer that produces 9V at the input is selected. The capacitor C2 connected between the output terminal and ground cancels out any inductive effect due to long distribution leads. The input capacitor C1 is used to improve transient response of the regulator IC. An algorithm is written and burned into the microcontroller and thus the message is displayed on the screen.

V. EXPERIMENTAL RESULTS

In this paper three experiments are being shown. Firstly the propeller is rotated at 300 RPM, secondly at 600 RPM and finally at 1000 RPM. At 600 RPM the message is being displayed properly and the desired result is obtained as shown in Fig. 7. When the propeller is being rotated at 300 RPM the message being displayed is vague or in other words it's being overlapped. And when the propeller is being rotated at 1000 RPM the message gets rotated with the propeller and hence its not stable.

Fig. 7: Persistence of Vision at 600 RPM

VI. CONCLUSIONS AND FUTURE WORK

Propeller LED message display serves multi purposes like saving energy and helping in viewing the message in 360 degree. The size in which the message has to be displayed can be varied by using motors of different speed. The message to be displayed can be varied by burning the desired message onto the microcontroller. Thus this work serves the whole purpose of conserving energy. The rotating device is very useful in various places like railway stations, etc. where the message can be displayed along with a timer, or to display the train number of the next train which is yet to arrive. This display can be viewed from all the angles thus making it easier and efficient to view the message unlike the present ones.

This work can be further extended by using CO2 laser lights instead of LEDs since CO2 laser lights have variable light emitting lengths which will help in creating 3D effects. Bluetooth model can also be implemented to pass real time messages through bluetooth enabled devices such as mobile, PC etc.

REFERENCES

[1] Debopam Ghosh, Jyotimoy Guha and Anirban Mukherjee, "Rotating Display", *Proceedings of National Student Paper and Circuit Design Contest*, 2012.

[2] Sheikh Rafik Manihar, Komal Prasad Dewangan and Ajay Kumar Dansena, "The Design and Construction of a low cost Propeller Led Display", *Global Journal of Research in Electrical and Electronics Engineering*, 2012.

[3] http://en.wikipedia.org/wiki/Persistence_of_vision

[4] http://en.wikipedia.org/wiki/Electricity_sector_in_IndiaThermal_power

[5] http://www.atmel.com/images/doc0787.pdf

[6] http://www.foundationsmag.com/persistence_of_vision.html

