ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 7, July 2015

Design and Implementation of Microcontroller Based Propeller Display

Bajpai K. S.[1], Kadam S. D.[2], Tondare S. M.[3]

U.G. Student, Electronics & Telecommunication Department, STC Faculty of Engineering, Latur, India[1,2]

Assistant Professor, Electronics & Telecommunication Department, STC Faculty of Engineering, Latur, India[3]

Abstract: Here we have presented a project on display numerous information using a special purpose LED display i.e. propeller display. This entire project is based on the mechanism of persistence of vision (illusion effect of human eye i.e. if anything appears in the same spot constantly, the human eye will perceive all of the display is at once and viewer can read the data associated with it. In the construction, we have used a 40 pin microcontroller with a display of 16 bright LEDs to display the message as VIT STC ETC.ENGG. All the synchronizing part is implemented using software(C language and Keil Compiler).

Keywords: Propeller display, LED, Microcontroller, POV.

I. INTRODUCTION

Propeller term is associated with a circular rotating object, the main theme of this project is based on illusion effect of human eyes, prime movers are attached with this and are Propeller [1].From displaying purpose, a set of LEDs have been used and hence this entire project is named as Propeller display .It is a linear array of light emitting diodes, rotating at a high angular velocity to generate a circular screen. Now by synchronizing these light emitting diodes, and keeping in mind the concepts of persistence of vision & limit of resolution, we can display different images, text etc[2]. This phenomenon is related to vision capability of human eye by which an after image is thought to persist for approximately 1/25 of a second. So, if someone is observing the images at a rate of 25 images per second, then they appear to be continuous. The best example of this property is the red circle we observe when we rotate the firecracker orincense stick in circle [3].

The implemented LEDs turn on and off, very rapidly one after other. Naturally the human eye responds slowly and we get an impression that the lights are on all together making the display readable. A few LEDs placed in arrow are attached to a rotating board. They turn on and off at very definite and precise time intervals. All we can see are the lighted dots from the LEDs making a readable display that seems to float. In the project an array of LEDs, microcontroller, and infrared receiver are placed on the board and are rotated by a motor at a very high rpm. Since microcontroller is programmed using certain algorithm so at the same time, the board functions as a display.

Existing systems do employ POV principle, but for displaying each pixel, individual LED is used. This results in a huge number of LEDs even for small sized displays. By using a propeller type display, LED count can be kept to a bare minimum. Even 8 LEDs can perform a task of over 525 LEDs. However in this case we have used a set of 16LEDs with a 40 pin microcontroller IC.

This phenomenon makes one feel fast moving/ changing objects to appear continuous. A television is a common example; in which image is re-scanned every 25 times, there by appear continuous. Further, a glowing objects if rotated in a circle at fast speed, it shows a continuous circle. By modifying this basic idea, 8 LEDs can be rotated in a circle, shoeing 8 concentric circles. But if these LEDs are switched at precise intervals, a steady display pattern can be shown. Applications can find their way into cost effective solutions for large public displays, information systems. It can directly replace Railway station information display, bus stands and many more places [4]. It has the abilities to be mounted on the wall to display messages across the room. It also can be used as a digital or analog clock [5] but these are only a few of the things that are possible on the basic model.

Conventional methods of displaying images to public are using LCD display and dot-matrix LED board. Propeller LED display is a device that project an image or time as if the images are floating in the air. The floating image is received cause of human eye limitation. Actually the floating images emerge by synchronizing LED's blink to occur an image at particular time and rate.

In this project, we made some modifications like the programming of ATMEL AT89C51 is using C language, with kiel compiler. This project consist two main circuit; motor controller circuit and LED circuit. 9VDC will be used to supply the power for LED control circuit. The AC induction motor is used to rotate the LED, synchronization of AC motor speed and LED blink cause the image visible to human eyes. So the desired image such as clock, date or symbol can be programmed.

II. HARDWARE DESCRIPTION

In hardware description we address basic arrangement of the propeller display. It basically consist of set of different blocks as Dc power supply, Microcontroller IC, AC Motor with a set of LED strips as shown in Fig.1.

A. Microcontroller AT89C51

AT89C51 is an 8-bit microcontroller and belongs to Atmel's 8051 family. ATMEL 89C51 has 4KB of flash programmable and erasable read only memory (PEPROM) and 128 bytes of RAM. It can be erased and program to a maximum of 1000 times.

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 7, July 2015

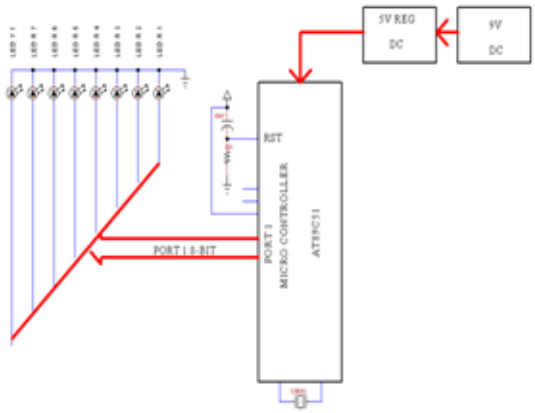

Fig. 1 Block Diagram of Propeller Display

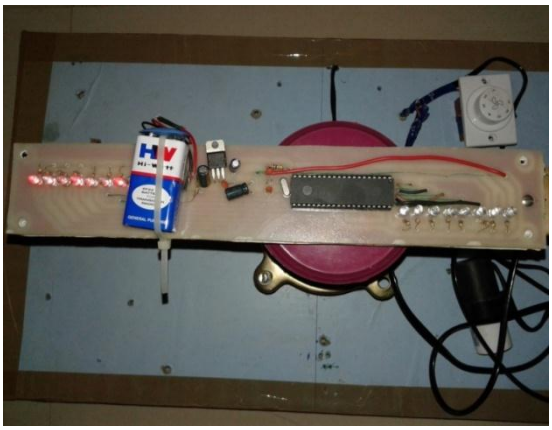

Fig.2. Actual Circuit PCB of Propeller Display

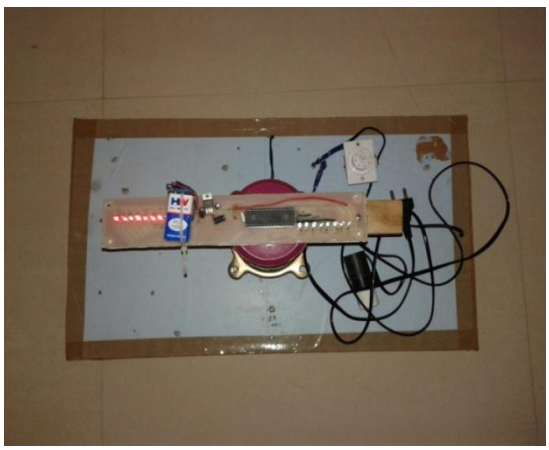

Fig.3 Constructional view of Propeller Display

In 40 pin AT89C51, there are four ports designated as P1,P2, P3 and P0. All these ports are 8- bit bidirectional ports, i.e. they can be used as both input and output ports. Except P0 which needs external pull-ups, rest of the ports have internal pull-ups. When 1s are written to these port pins, they are pulled high by the internal pull-ups and can be used as inputs. These ports are also bit addressable and so their bits can also be accessed individually.

Port P0 and P3 are also used to provide low byte and high byte addresses respectively, when connected to an external memory. Port 3 has multiplexed pins for special functions like serial communication, hardware interrupts, timer inputs and read/write operation from external memory. AT89C51 has an inbuilt UART for serial communication. It can be programmed to at different baud rates. Including two timers & hardware interrupts, it has a total of six interrupts.

B. LED CIRCUIT

Here LED is used in common cathode mode all LEDs common terminal (Cathode) is applied to the ground as we programmed output of microcontroller (port 1) goes high depending on the output respective LEDs will glow. The resistors of 220K to 1K can be used in series of LED, depending upon the LED used in the circuit.

C. AC MOTOR (INDUCTION MOTOR)

Here we used AC induction motor due to its voltage variation, speed also varies. To maintain speed for particular limit, we used here regulator (Dimmer) for motor also it results in reducing the effect of mismatching image visibility.

Here for demo purpose requirement of voltage regulation of AC voltage is necessary hence we used here regulator (dimmer circuit). Using this circuit we can droop the AC voltage within the specified steps of 15-20v (to maintain speed).

The triac is the bidirectional device which controls the AC/DC load depending on the gate current provided to it. As the variable resistor of 100K is at 0 positions the maximum gate current flows and the full 230V provided to load. As resistance of 100K is increased to 15K the gate current is decreased and due to that MT1 to MT2 voltage also decrease and that step is around 15V drop. Again if we increase resistor from 15K to 30K gate current also limit and due to that AC voltage drop paper approximately 30V. For other step it works similarly.

D. DC POWER SUPPLY

Here circuit requires 5V regulated DC supply. We used 9V battery. The output of battery is connected to the regulated of 5V to obtain regulated 5V supply. Capacitor of 10uf is used to reduce small ripples and 0.1uf capacitor is used to reduce the spikes.

III. WORKING PRINCIPLE

Mechanical assembly plays a vital role in proper functioning of this project. The display is scanned each time, by rotating the whole assembly in a circular path. The basic idea we developed is on our own, by implementing and modifying different ways to do this. The following diagram shows the most reliable way, that we finally selected. Here, one major challenge was how to bring +5V supply to the spinning circuit. We tried the same by adopting two three different methods, but finally

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 7, July 2015

we used +9V battery and +5V regulated supply is given and GND is provided by the motor shaft as shown in figure. Most critical objective was to achieve pristine balance and overall good mechanical strength. For weight adjustment, we have provided one long screw, and weight can be attached or removed by adding / removing metallic bolts. If the assembly is balanced perfect, then it can achieve stability and rotate at high RPMs too. This will improve the overall efficiency of this display [6]. Fig.4.a shows schematic of character display in the form of matrices (Row*column) while fig.4.b indicates how "A" character has been displayed.

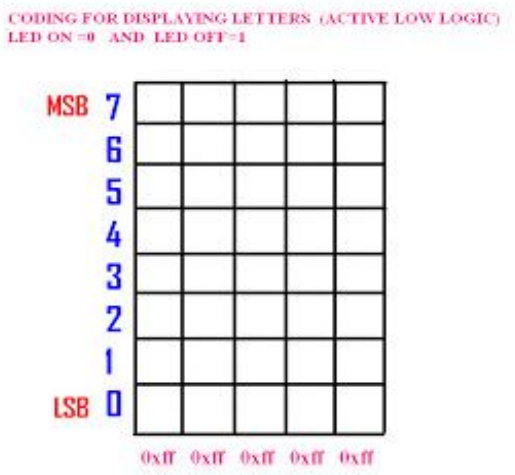

Fig.4.a. Character display schematic

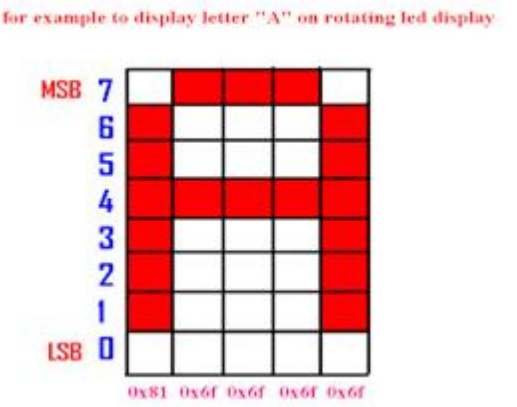

Fig.4.b. A- Character display schematic

A. ALGORITHMIC DESIGN

1. In each revolution as the beam is interrupted, the sensor generates a positive pulse.
2. Microcontroller will execute interrupt routine, when a pulse occurs.
3. Divided it by 120, and stores the result into another timer,
4. Configured in auto-reload mode.
5. Now, the timer overflows after tiny intervals of time.
6. Each time it overflows, next stored value is called from the lookup table, and display.

B. FLOWCHART

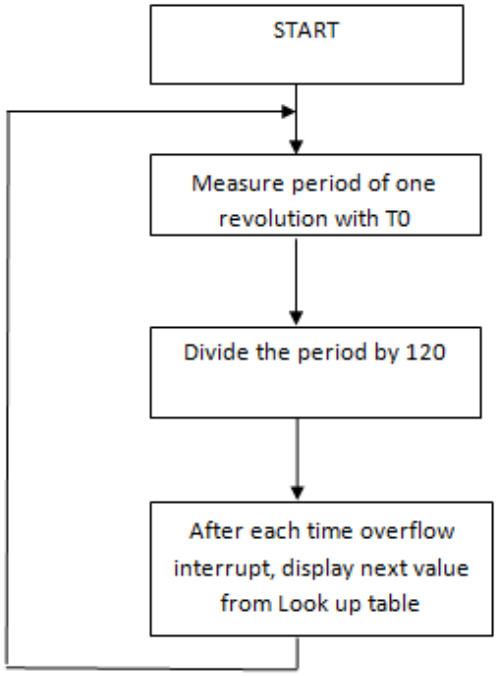

Fig.5. Flowchart- instruction set

IV. RESULTS AND DISCUSSION

Based on the specifications mentioned in earlier sections and using C language [Keil compiler] we have generated code to display various messages. Here we have interpreted as "VIT STC ETC.ENGG" message to display, as shown below

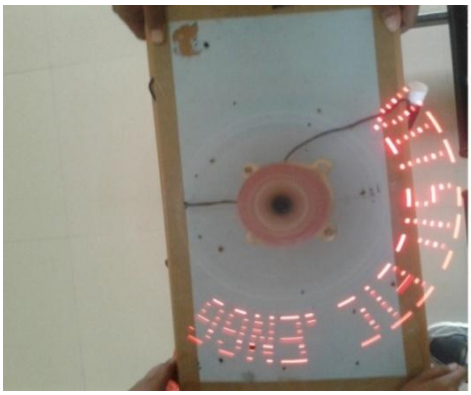

Fig.6. Actual Message display

V. CONCLUSION

Here we have made an attempt to present a project for displaying information which may be beneficial from economical and environmental condition. The future work is to further expand this project to be effective and commercial with reduction in hardware requirement.

ACKNOWLEDGEMENT

Authors are grateful to Principal and Management of S.T.C. Faculty of engineering for their motivational support. Also like to thanks faculties of E&TC dept.

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 7, July 2015

REFERENCES

[1]. Bhanu Pratap, Khushboo Kumari, Ankita Raturi &Abhishek Joshi, "Preparation of Papers for IEEE Journal Of Propeller Clock Mechanically Scanned LED Clock", ISSN (PRINT) : 2320 – 8945, Vol.1, Issue.5, 2013.

[2]. Nayab Suhail Hamirani, Asad Ali Shaikh, Peer Mohammad Memon,Yasir Ali Khatri, "Wireless Dual Purpose Propeller Clock Display" , *International Journal of Engineering and Technology*, Vol.2, No.3, March.2012.

[3]. Sheikh Manihar, Dewangan Komal, Ajay Dansena, "Design and Construction of a low cost Propeller LED Display", *Global Journals Inc.* Vol.12, Issue.4, Version.1, March 2012.

[5]. Kanaujia Singh, Mishra Nilesh, Christie Lionel and Patel Rinkesh , "Intelligent Propagation Display", *International Journal Of Engineering Development And Research* ,Vol. 2, Issue 2014.

[4]. George John P., Togis Thomas, Vishnu Balakrishnan, Vishnu Nair," Design Implementation of Microcontroller Based Propeller Clock", *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, Vol. 3, Issue. 2, February 2014.

[6]. Sheikh Rafik Manihar," The Power Saving Low Cost Rotating 8 LED Information Display", *International Journal of scientific & Engineering Research*, Vol. 3,Issue 5 May 2012.