Low Cost Propeller LED Display

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ABSTRACT

This paper explains the project which is a special kind of circular LED display. With the help some mechanical assembly, LED count, hardware requirement, and hence overall cost is cut to very affordable price. Also, maintenance and repairing of the display is so easy, that anyone having a little electronics knowledge can take care of this. All the synchronizing can be implemented through software. This project use the principle of Persistence of vision. The propeller display is mechanically scanned and displays the characters and symbols. It can be used anywhere and everywhere and the most amazing fact about this display is its crystal clear display. This display consists of just 8 bright LEDs which are rotated to show the display. For building this project, requirement is just a microcontroller, dc motor, interrupter module and LEDs. This display can show the messages, which are usually displayed by around 525 LEDs. So hardware and cost minimization is achieved.

Keywords: Microcontroller, Propeller, Persistence of vision, LEDs

1. INTRODUCTION

Propeller is a term associated with a circular rotating object. As this project needs to rotate whole circuit assembly, there must be some prime mover attached to it, for rotation. So, the term ‘Propeller’ is used. This project uses bright light emitting diodes for displaying the characters and symbols on it assembly. That’s why this project is named as ‘PROPELLER LED DISPLAY’. The propeller Display is a linear array of light emitting diodes, rotating at a high angular velocity to generate a circular screen. The basic principle behind propeller LED display is “persistence of vision”. This is the phenomenon which is related to vision capability of human eye by which an after image is thought persist for approximately 1/25'th of a second. So if someone is observing the image at a rate of 25 images per second then they appear to be continuous. Cinema and films also based on this principle. The propeller display is a linear array of light emitting diodes, rotating at a high angular velocity to generate a circular screen. A television is a common example; in which image is re-scanned every 25 times, thereby 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, showing 8 concentric circles. But if these LEDs are switched at precise intervals, a steady display pattern can be shown. 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. Applications can find their way into cost effective solutions for large public displays, information systems. It can directly replace Railway station information displays, bus stands and many more places.

2. LITERATURE SURVEY

With this scheme ‘MANVI’ is displayed and that only with the help of 8 LEDs by forming 8*5 matrix of LEDs. In actual Displaying of the same near about 100 LEDs will be used. Clarity of the message can be improved by adjusting the delay by Hit and trial method.

3. METHODOLOGY

3.1 Block Diagram

In this section we will emphasize on detailed overview of each of the block shown in above block diagram. In every description of the block respective schematics and working is explained. The propeller display consists of following blocks, as shown in the block diagram.

- Microcontroller(AT89S51)

This project is based around the microcontroller AT89S51. The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In-System Programmable Flash memory. This small sized IC is used, mainly because of its reduced weight. This improves the performance of the display, because reduced weight gives advantage of increased RPM.
• Led Module
LED module consisting of 8 bright LED is fixed in another side of the arm of our project. These LEDs are connected with each of the port pin of microcontroller, with a series current limiting resistor of 330 ohm. LED module is used to displaying the characters and symbols.

• DC Motor
Repeated scanning of the display is must for continuous vision. This task is achieved using circular rotation of the whole circuit assembly. So, we used a DC motor as the prime mover.

• Interrupter Module
Interrupter module is our sensor module, consisting of the IR LED and a phototransistor. In order to know when the system should restart displaying the current image or message on the propeller clock, we need a known reference point called home point. A phototransistor and an IR LED are used to determine that reference point. The IR LED, which is stationary, is fixed on the base of rotating assembly. When the IR rays sent by the IR LED falls on the photo diode, it will generate a low pulse on the interrupt pin of microcontroller which results in the generation of desired pattern.

3.2 Circuit Diagram
The figure shows the complete circuit diagram of the project. We have used 12 volt, 2400 rpm dc motor, but we are giving 5 volt supply to it to reduce the speed of dc motor to stabilize the circuit. Current limiting resistors of 330 ohm are used in series with LEDs. Interrupter Module used to determine the reference point is connected to the 12th interrupt pin of the microcontroller.
3.3 Mechanical Assembly

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 was developed by implementing and modifying different ways to do this. Following diagram shows the most reliable way, that we finally selected.

![Figure 3 Complete circuit diagram of Propeller Display](image)

Figure 4 Arrangement of Components    Figure 5 Blinking LEDs

DC Motor was attached below this black cover and when this display was rotated than characters appears above this black cover. In the project, the LEDs are not illuminated constantly. The LED s turn on and off at precise intervals, one after another, extremely rapidly while being rotated with several thousands of rounds per minute (RPM).

3.4 Software Description

Basically the microcontroller is a device that cannot act on its own. It is a device that can be tailored to perform a specific function. Timing of LEDs turning on and off is controlled by microcontroller through program written in assembly language.

KEIL : The software is written in “ASSEMBLY” language and compiled using KEIL(micro vision). The source program is converted into hex code by the compiler.Burn this hex code into AT89S51 microcontroller.

EAGLE SCHEMATIC : Eagle (Easily Applicable Graphical Layout Editor) PCB design software to design an electronic schematic and lay out a printed circuit board (PCB).Eagle is a PCB design software package consisting of a schematics editor, a PCB editor andan autorouter module.

4. Results

This Project Propeller LED Display is first tested and then successfully implemented. The programming of microcontroller AT89S51 used in the project is done in Assembly language which is coverted to HEX Code by KEIL software.Interrupter Circuit is used in this project to stabilize the image. All the passive elements are tested by multimeter.And all other circuits are first analysed on breadboard and than implemented on PCB.
4.1 Interrupter module testing
This Interrupter module testing is required for detecting exact position of wheel on which whole circuit assembly is mounted.

Output voltage obtained at Pin.No.12 of AT89S51 without interrupt = 5 Volt
Output voltage obtained at Pin.No.12 of AT89S51 with interrupt = 0 Volt

4.2 Calculation of time for one rotation
1 minute = 1500 rotations and 1 second=(1500÷60) = 25 rotations
Therefore 1 rotation= (1÷16.67) = 40 milli seconds
So persistence of vision can be achieved.

4.3 DC Motor RPM Testing
DC Motor used in this project is 12 V dc motor which is tested by using digital contact-less tachometer. Arrangement was made so that the sensing circuit gives high to low pulse for each completion of revolution. By measuring the time difference between two successive pulses RPS can be calculated which further provide RPM value, as shown below:

Power supply given to DC Motor = 5V

Time interval between two successive pulses as seen onCRO = 41.46ms

RPS = 1 / (41.46ms) = 24.11 and RPM= 24x60=1440

4.4 Display Generated Pattern

With this scheme ‘MANVI’ is displayed and that only with the help of 8 LEDs by forming 8*5 matrix of LEDs. In actual Displaying of the same near about 100 LEDs will be used. Clarity of the message can be improved by adjusting the delay by Hit and trial method.

References


