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Propeller LED Display

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Abstract: Conventional methods of displaying images are by using LCD display or LED board. Propeller display is a special type of circular display that project an image as if the images are floating in the air. This project was started with a simple principle which is frequently happening in our day today life, which is Persistence of Vision (POV). Whenever the light from an image strikes on the retina, the eye retains the impression of that light for a particular fraction of seconds ($1/16^{th}$) depending on the brightness of the image even after the image has been removed from the human sight. Most of the existing LED displays consumes large amount of energy due to more number of LEDs used. In the present work virtual displays are used in order to reduce the number of LEDs. The propeller is subjected to rotate above 1000rpm to obtain virtual display.

Keywords: Propeller, persistence of vision, LED**,** Arduino.

1. INTRODUCTION

Propeller is a term associated with circular rotating objects. Conventional methods of displaying images are mainly using LCD display and dot-matrix where a huge number of LED's and power processors are used to create the display. The main idea of this project is to use minimum number of LED's and components to create a virtual display with minimum power consumption. For the purpose of displaying a set of LED's have been used, hence the name Propeller LED display. The main advantage of propeller display as compared to the LED matrix board is its lower power consumption. The first propeller clock was created by Bob Blick, where a single array of LED's was used to produce the display. Propeller clock uses extremely small LED's for displaying the typescript and symbols on its assembly in an appropriate way.

The main mechanism behind virtual display is the phenomenon of Persistence of vision (POV). The phenomenon is related to vision capability of human eye by which an after image is thought to persist for approximately 1/25th of a second. So, if someone is observing the images at a rate of 25 images per second, then they appear to be continuous. Existing systems do employ POV principle, but for displaying each pixel, individual LED is used [1].

This results in a huge number of LEDs even for small sized displays. By using a propeller type display, LED count can be kept minimum. The LED's 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 LED's making a readable display that seems to float [2]. In the project an array of LED's, microcontroller and infrared receiver are placed on the board and are rotated by a motor at a very high rpm. The prototyping board itself is used as the propeller to minimize the weight and parts used for the propeller LED display. 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. METHODOLOGY

The main objective of this project is to create a non-existing display of low power consumption with bare minimum components and at minimum cost. It consists mainly of a set of LEDs, a micro-controller to synchronize the switching on and off of the LEDs at precise time intervals and a motor that will spin the LEDs at a high speed.

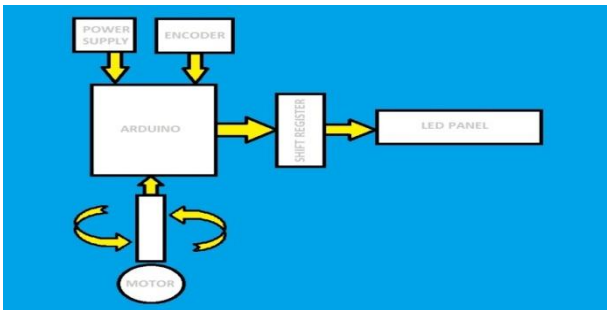

Figure 1: Block diagram

A.HARDWARE DESCRIPTION

The system consists of the following components:

- Shift Register
- LED Module
- DC Motor
- Arduino
- DC power supply

74HC595 shift register: The 74HC595 shift register has an 8 bit storage register and an 8 bit shift register. Data is written to the shift register serially, then latched onto the storage register. The storage register then controls 8 output lines.

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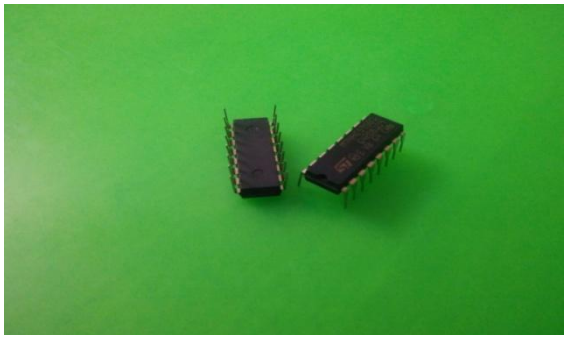

Figure 2: Shift Registers

LED Module: LED module consisting of 7 bright LED is fixed on one side of the PCB board. These LEDs are connected with each of the port pin of micro-controller, with a series current limiting resistor of 470 ohm. The LEDs are powered by an on board battery which is placed on one side of the board

Figure 3: LEDs

Interrupter module: LM358 is used as the interrupter module. These devices consist of two independent, high-gain frequency-compensated operational amplifiers designed to operate from a single supply or split supply over a wide range of voltages.

DC motor: A brushed DC motor is used to spin the whole circuit assembly which is required for the continuous vision. The speed should be in the range of 1000rpm to 3000rpm to have a good quality display.

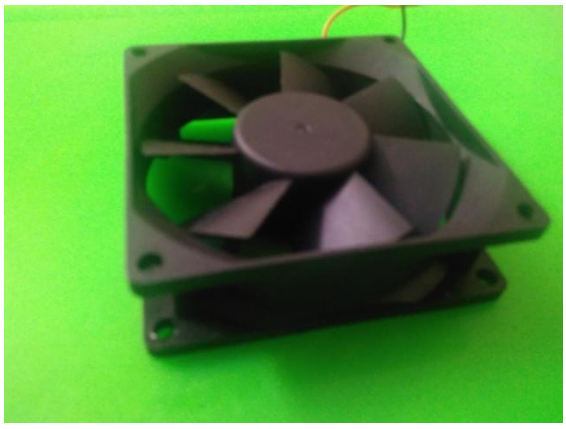

Figure 4: DC Motor

Arduino ATmega 328: The At-mega 328 is a single chip 8 bit microcontroller which is having five software selectable power saving modes. It operates between 1.8-5.5 volts. ATmega328 is chosen mainly because of its reduced weight which helps in reducing the overall weight of the board. Its small size, low powered and low cost makes it more appropriate.

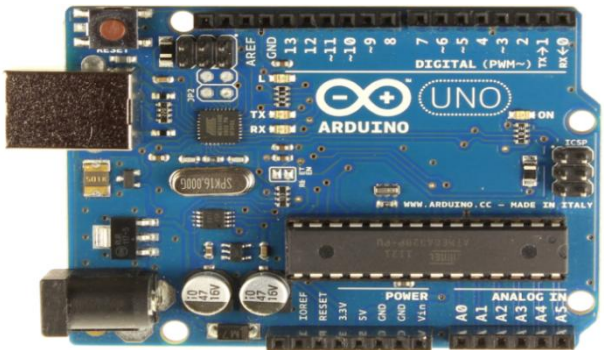

Figure 5: Arduino ATmega 328

DC power supply: For the components like Arduino, shift registers, VCC required is 5V DC. But the power supply available is 230V AC. To convert this 230V AC to 5V DC we use the combination of bridge rectifier, filter capacitor, and three terminal regulator. This circuit combination to produce the power supply is called DC power supply.

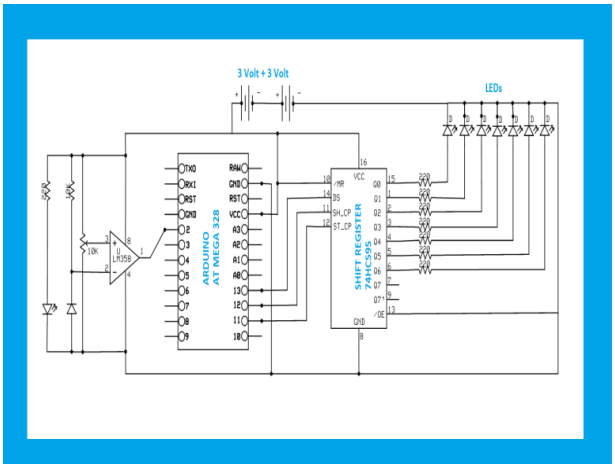

Figure 6: Circuit Diagram

B. WORKING

In mechanical assembly, on one side of the PCB board the LEDs are connected and the micro-controller on the other side. Using a DC motor the whole circuit assembly is rotated and on each rotation the display is scanned. An on board battery is placed on one side of the propeller to power the LEDs and this can also use as a counter balance. The micro-controller is mainly responsible for the fast switching of LEDs. For good visibility the character height must be a minimum of 30mm height. The characters will appear as dots and an appropriate font must be used to display the characters. By allocating a 7×5 matrix for each character, the similar font used on LCD character displays can be obtained. A blank column is added to create space between characters. Thus all characters will be based on a 7 x 6 matrix which serves as the building blocks for the display algorithm.

The LEDs are mechanically scanned from left to right and each column is lit up according to the matrix being displayed. To display the letter 'A', its corresponding matrix is passed into the display algorithm function. The value of each row is assigned to each element of the LED array after each column.

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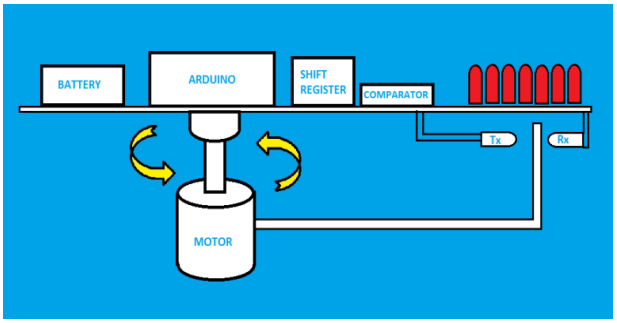

Figure 7: mechanical assembly

Using the 7x6 matrices symbols can be easily created. The average current consumption is 10mA per LED and 200mA for the propeller motor. This gives a total of 270mA for the display as compared to an average of 8820mA for the conventional LED display with the same pixel count (126x7) [5].

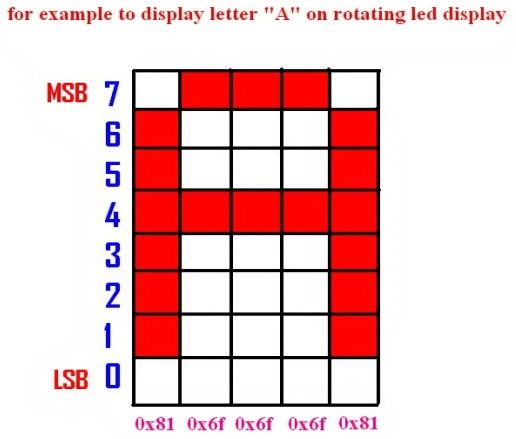

Figure 7: LED Pattern for letter A

Figure 8: Output of Propeller LED Display

4. CONCLUSION

The Propeller LED display is used to create virtual display. It gives clear display by using bright light LEDs. Many aspects in terms of cost, power requirement, hardware requirements, ease of use, maintenance were considered. Even seven LEDs can perform a task of over 525 LEDs. Application 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. By efficient coding we can make the display to show 3D images, digital and analogue time also.

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