PROPELLER LED DISPLAY FOR IMAGES

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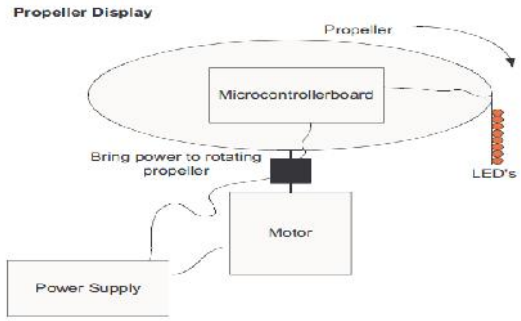
ABSTRACT:

Propeller display is a special kind of circular LED display. It is making use of POV, Persistence of Vision, which means that if something appears in the same spot consistently, at least 50-60 times per second, our brains think that it's permanently there when it is not. 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 because of human eye limitation.The floating images emerge by synchronizing LED'S blink to form an image at particular time and rate.This propeller display is mechanically scanned and displays in digital format .Made from scrap it can be used anywhere and everywhere and the interesting fact is that its crystal clear display. Maintenance and repairing of the display is so easy.All the synchronizing can be implemented through software.

SUBJECT:

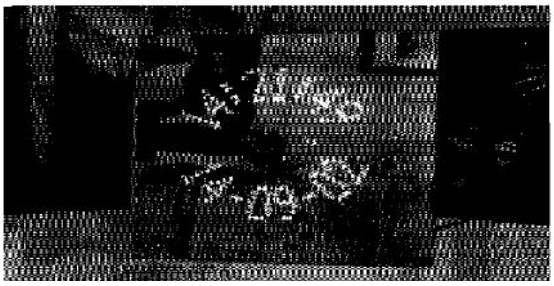
Idea to implement the propeller LED display to solve time delay issue and to reduce the complexity.



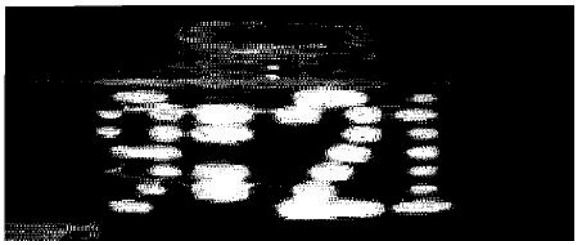
1.INTRODUCTION:

Propeller is a term associated with a circular rotating object. As this project needs to rotate the whole circuit assembly, there must be some prime mover attached to it. So, the term 'Propeller'. This project using bright light emitting diodes for displaying the characters and symbols on its assembly.This is the phenomenon which is related to vision capability of human eye by which an afterimage 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. This project was started with a simple principle which is frequently encountered in our everyday life, which is Persistence of Vision. This phenomenon makes one feel fast moving/changing objects to appear continuous. A television is a commonexample; in which image is re-scanned every 25 times, thus making it continuous. A glowing objects if rotated in a circle at fast speed, it shows a continuous circle. 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. It can directly replace Railway station information displays, bus stands, public information display systems and many more places.

HENK'S PROPELLER DISPLAY:

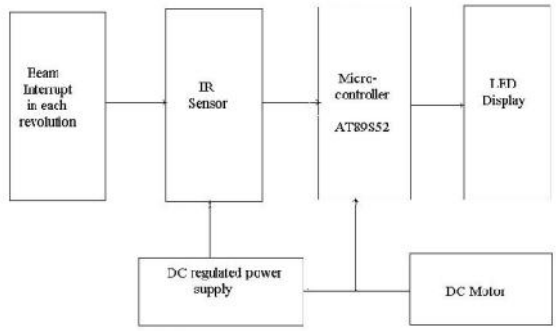


BOB'S PROPELLER DISPLAY:

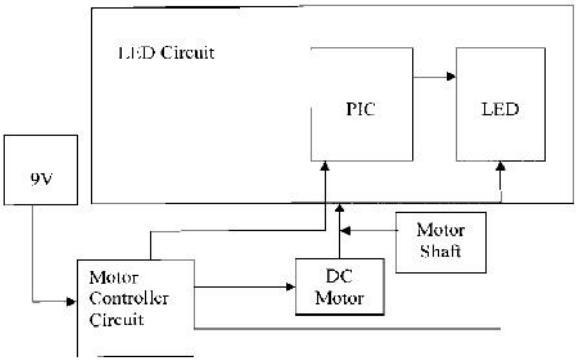


2.DESCRIPTION:

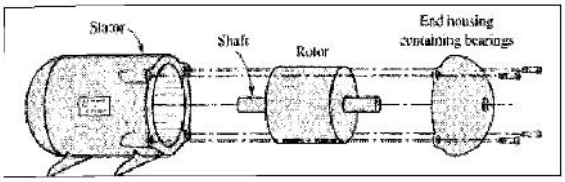
The Main Part of the propeller display is Microcontroller AT89S52.We can also use the others like ATMega32A, 8051, PIC microcontrollers but here I am using this because of its low cost. The IR LED, which is stationary, is fixed on the base of rotating assembly. When the IR rays sent by the IR LED falls on the photo diode, which is placed on the rotating PCB,it will generate a low pulse on the interrupt pin of microcontroller which results in the generation of desired pattern. We are making use of internal program execution EA(external access) pin has to be made high with the help of VCC.A reset circuit is provided for the reset of microcontroller. The anodes of LEDs are joined together and connected to 5v supply. Logic 0 level at the output of port0 will result in illumination of LED.



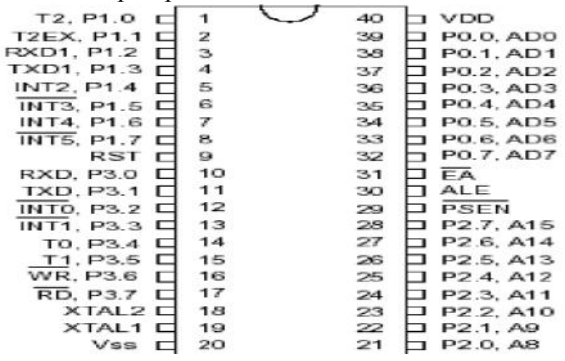
Circuit with PIC Controller:



DC Motor:DC motors, apply a voltage to both terminals, and it will spins. DC motors are non-polarized which means that it can reverse voltage so the motor will rotate in two directions, forward and backward. Typical DC motors are rated from about 6V-12V. The larger ones are often 24V or more but for the purpose of this project, it is necessary to use 6V-12V range motor. Voltage is directly related to motor torque. The more voltage supplied, the higher the torque will be produce.Specifications of most DC motors show high revolutions per minute (rpm) and low torque. The DC motor is popular in a number of drive applications due to its simple operation and control. In figure it has 2 main parts which is rotor and stator. Stator is the part where the permanent magnet situated and used to generate the magnetic field and it is static. Rotor is the rotary part in the motor and contains block of core and wire loops. It also called the armature.



Microcontroller: In this project AT89S52 micro-controller is used which consists of 40pins that are dedicated to various functions. Out of the 40 pins, a total of 32 pins are set aside for four ports P0, P1, P2, and P3 where each port takes 8 pins. The rest of the pins are designated as GND, Vcc, XTAL1, XTAL2, RST, EA, and PSEN. The micro-controller (AT89S52) has an on-chip oscillator but requires and external clock to run it. Often a quartz oscillator is connected to inputs XTAL1 (pin 19) and XTAL2 (pin 18).We can also use the crystal oscillator The quartz oscillator connected to XTAL1and XTAL2 also needs two capacitors 33pF.The RST pin (9th pin) is an input and is active high. Upon applying a high pulse to this pin, the micro-controller will reset and terminate all activities. This is often referred to as a power-on reset. Vcc is used to power up the entire micro-controller, which is pin 40 and GND is pin 20. Here port P1 is used as output port to which LEDs are connected.

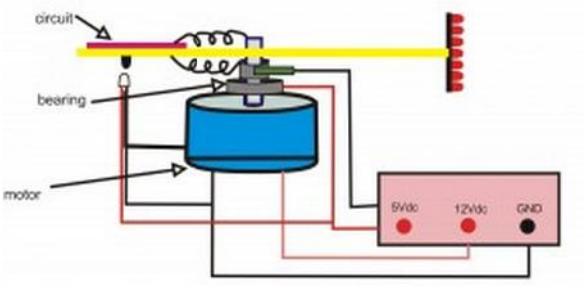


Led Module:LED module consisting of bright red color LEDs and it is fixed in corner of the arm of the

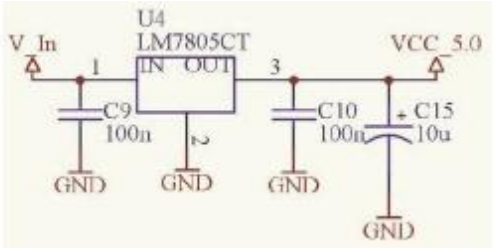
propeller. LED module is used to displaying the characters and symbols. TheseLEDs are connected with each pins of the port A and two pins of the port B of microcontroller with a series current limiting resistorof470 ohm.

Interrupter Module: Interrupter module is our sensor module, consisting of the IR interrupt sensor from Motorola. This sensor was selected from a variety of other alternatives, because of its small size, precise interrupt sensing, and study casing. One great advantage of using this module is, interfacing it with the microcontroller is just a matter of two resistors and a general purpose transistor. MOC7811 is the sensing part of the interrupter module, while rest of the circuitry works as signal conditioning circuit, wires emerge out from the module, respectively Vcc, Signal and Ground. Output of the module is LOW, if interrupt
occurs, otherwise it remains HIGH. It consists of IR LED and Photodiode mounted facing each other enclosed in plastic body. When light emitted by the IR LED is blocked because of some completely opaque object, logic level of the photodiode changes. This change in the logic level can be sensed by the microcontroller or by discrete hardware.

Mechanical Assembly: Mechanical assembly plays a vital role in properfunctioning of this project. The display is scannedeachtime, by rotating the whole assembly in acircular path.The basic idea developed isown, byimplementing and modifying different ways.The display is displays the time by rotating the whole assembly in a circular path. Following diagram shows the most reliableway.



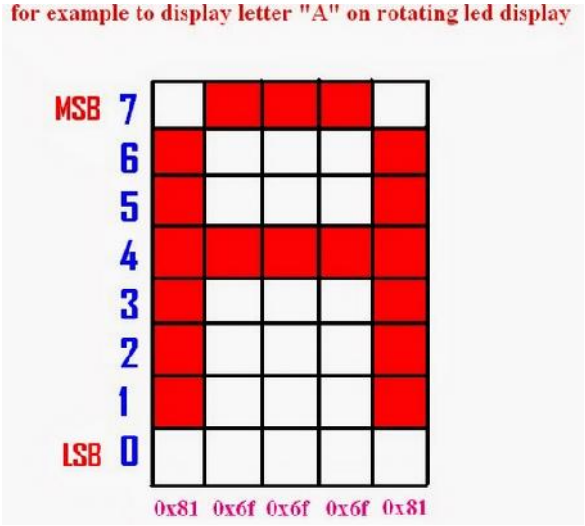
DC Power Supply: A fixed voltage power supply producing constant +5V consists of a bridge rectifier, filter capacitors and 3 terminal regulator IC LM7805. The 12v ac is obtained from the output of a step down transformer. This power supply is capable of supplying +5v and load current up to 500mA. Input capacitor is used to improve transient response of the regulator IC, i.e. response of regulator to sudden changes in load. It is also helpful in reducing the noise present in the output. Dropout voltage (Vin-Vout) needs to be at least 2V under all operating conditions for proper operation of regulator. For microcontroller and led we are giving the supply by connecting the output of IC LM7805 which is inputted by the 12v battery.



LCDInterface:

Designator	*Description*
V_{SS}	Ground
V_{DD}	5V Supply
V_{LCD}	Supply for the LCD-Driver 0-5V (Contrast)
RS	Register Select
R/W	Read (1) or Write (0)
E	Enable
DB_0 *	Databit 0 (I/O)
DB_1 *	Databit 1 (I/O)
DB_2 *	Databit 2 (I/O)
DB_3 *	Databit 3 (I/O)
DB_4	Databit 4 (I/O)
DB_5	Databit 5 (I/O)
DB_6	Databit 6 (I/O)
DB_7	Databit 7 (I/O)
E2	Enable for 2nd controller (only on large displays)

3. DISPLAY METHOD:



Code for this Display:

if your motor is rotating in clock wise direction then the corresponding code will be as follows. Leds are connected to PORT0 of AT89S52 so the logic will be

```
P0=0x81; delay( );
P0=0x6f; delay( );
P0=0x6f; delay( );
P0=0x6f; delay( );
P0=0x81; delay( );
P0=0xff; delay( );
```

if it is anti-clock wise thensame code in the reverse order in this example in using the letter "A" which is symmetrical for other letters you need to follow from down to top of the code algorithm discussed above

```
P0=0xff;  delay( );
P0=0x81; delay( );
P0=0x6f; delay( );
P0=0x6f; delay ( );
P0=0x6f;  delay( );
P0=0x81;  delay( );
```

Similarly for active high the following notation must be followed

4.CALCULATIONS:

Voltage and Current Limitations

5 V DC voltage is provided using 5 V regulator circuit. Mother board will provide the input voltage to Daughter board. 500 mA current supply provided to mother board to get all components to a perfect working condition.9 V DC voltage provided to Mother board using 9 V regulator circuit. User can plug a 9Vdc-24Vdc range DC power supply as the power source of Motor. Minimum 500mA and Maximum 1000 mA current supply must provide to Motor to get a proper rotation speed.

ATmega32A microcontroller

Input voltage = +2.7 V to +5.5 V; Current = 200 mA

DC Motor

Input voltage = 3 V to 9 V; Current = 1000 mA (max)

Speed of LEDs (Frame Rate):

The rotational speed of the LEDs is directly affects to the frames per second. If there is a more frame rate, it cause to the less flickering of the picture. It is not easy to achieve high frame rates in this project because of the propeller display displayed the picture mechanically. The propeller has to be very well balanced to reduce vibrations and keep proper speed of the rotating LEDs. Here is a calculation for calculate the rotation speed of the LEDs when a picture is displayed with a frame rate of 25Hz.

f = 25Hz (Frame rate)

r = 7cm (Radius from center of rotation to the LED's)

$c = 2 * r * 3.141 = 2 * 0.07m * 3.141 = 0.43974m$

$v = f * c * 3600 = 25 * 0.43974m * 3600 = 39576.6 m/h$

Delay Calculations for 8051:

motor speed===1000 RPM
time for one rotation===60 milli seconds
radius =30cm
parameter=2*3.414*30=204.84~205
width of led column=0.5cm (this indicated the duration of led glow in terms of length of display)
total num of columns(leds)=205/0.5=410
410 leds=60 milli seconds
columns for each letter=6
time for a letter=6*146=876 micro seconds
length for letter=6*0.5=3
total letters=205/3=68

THE CALCULATIONS VARIES ACCORDING TO THE GLOW TIME OF LED AND RADIUS OF THE ROTATING ARM

motor speed===1000 RPM
time for one rotation===60 milli seconds
radius =30cm
parameter=2*3.414*30=204.84~205
width of led column=1cm(this indicated the duration of led glow in terms of length of display)
total num of columns(leds)=205
205 leds=60 milli seconds
columns for each letter=6
time for a letter=6*292=1752 micro seconds
length for letter=6
total letters=205/6=34

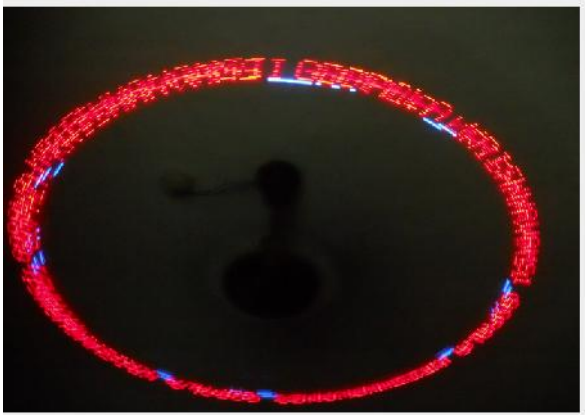
5.SOFTWARE DESCRIPTION:KEIL C51

The Keil C51 C Compiler for the 8051 microcontroller is the most popular 8051 C compiler in the world. It provides more features than any other 8051 C compiler available today. The C51 Compiler allows you to write 8051microcontroller 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 8051.The C51 Compiler translates C source files into relocatable object modules which contain full symbolic information for debugging with the µVision Debugger or an in-circuit emulator. In addition to the object file, the compiler generates a listing file which may optionally include symbol table and cross reference information. We used the Keil compiler to write the program code. The code is written in c language for the word "GRIET".

CODING IN KEIL C51 :

```
#include<reg51.h>
```

```
delay()
{ inti,j;
for (i=0; i<51;i++)
for (j=0;j<4;j++);
}
delay1 ()
{ int i, j;
for (i=0;i<25;i++)
for(j=0;j<1;j++);
}
void main ()
{
While (1)
{
P1=0x01; delay1 ();
P1=0x01; delay1 ();
P1=0x01; delay1 ();
P1=0xFF; delay1 ();
P1=0xFF; delay1 ();
P1=0x01; delay1 ();
P1=0x01; delay1 ();
P1=0x01; delay1 ();
P1=0x00; delay ();
//E
P1=0x49; delay1 ();
P1=0x49; delay1 ();
P1=0x49; delay1 ();
P1=0x49; delay1 ();
P1=0x49; delay1 ();
P1=0x49; delay1 ();
P1=0x49; delay1 ();
P1=0x7F; delay1 ();
P1=0x00; delay ();
delay ();
//I
P1=0x81; delay1 ();
P1=0x81; delay1 ();
P1=0x81; delay1 ();
P1=0xFF; delay1 ();
P1=0xFF; delay1 ();
P1=0x81; delay1();
P1=0x81; delay1 ();
P1=0x81; delay1 ();
P1=0x00; delay ();
delay ();
//R
P1=0x86; delay1 ();
P1=0xC5; delay1 ();
P1=0x49; delay1 ();
P1=0x29; delay1 ();
P1=0x29; delay1 ();
P1=0x19; delay1 ();
P1=0x10; delay1 ();
P1=0xFF; delay1 ();
P1=0x00; delay ();
delay ();
//G
P1=0xE1; delay1 ();
P1=0x21; delay1 ();
P1=0x61; delay1 ();
P1=0x61; delay1 ();
P1=0x41; delay1 ();
P1=0x41; delay1 ();
P1=0x41; delay1 ();
P1=0x7F; delay1 ();
P1=0x00; delay ();
} }
```



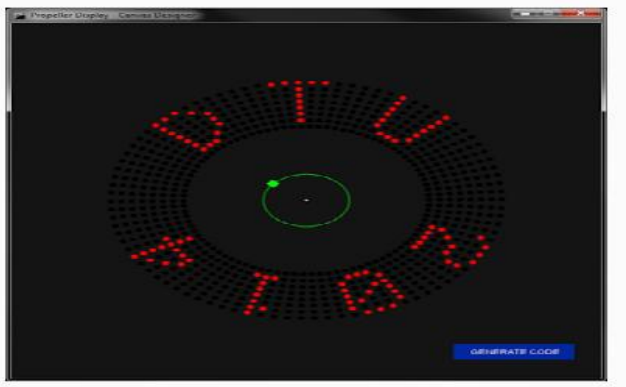
This is due to improper delay between the letters.

CODING IN AVR:

```
#include<avr/io.h>
#define F_CPU 8000000
#include<util/delay.h>
 DDRD=0xff;
unsigned int del=50;
_delay_us( );
void delay(void)
{
 _delay_us(del);
 _delay_us(del);
 _delay_us(del);
 _delay_us(del);
}
void display(unsigned char car);
void main()
{
 while(1)
{
 display(' ');
//try to change the del value as per your motor until
you get a perfect
//display once you got it then write your code for
remaining letters
//once you did this it will be very easy you can do
your own fonts
//like "smily" ,"heart" etc
//but the main logic is to achieve perfect "delay".once
if you refer to the
 //delay calculations you will get it
//direction of rotation is also one important
thing(clock wise or anti clock)
```

```
// this "A" is simetrical so works on both directions.
}}
void display(car)
{switch(car)
  case 'A' : // letter A
{ led=0x81;  delay( );
    led=0x6f;  delay( );
    led=0x6f;  delay( );
    led=0x6f;  delay( );
    led=0x81;  delay( );
    led=0xff;  delay( );
   }
    break;
   case ' '  : // space
 { led=0xff;  delay( );
    led=0xff;  delay( );
    led=0xff;  delay( );
    led=0xff;  delay( );
    led=0xff;  delay( );
    led=0xff;  delay( );
    led=0xff;  delay( );
   } break;
 default: led=0xfe;
 }
```

Image in Canvas Designer:



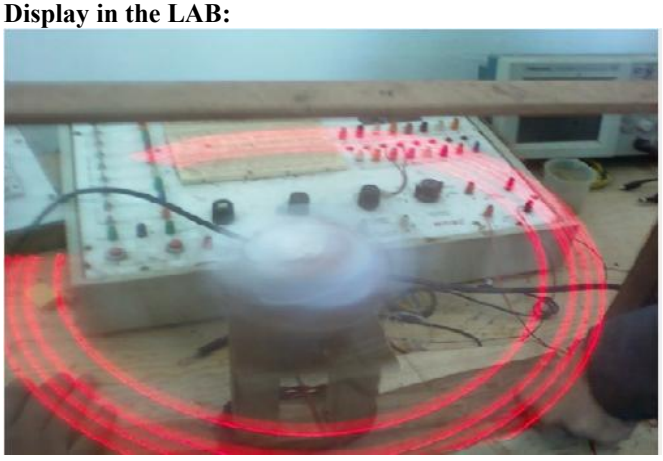
6.RESULTS

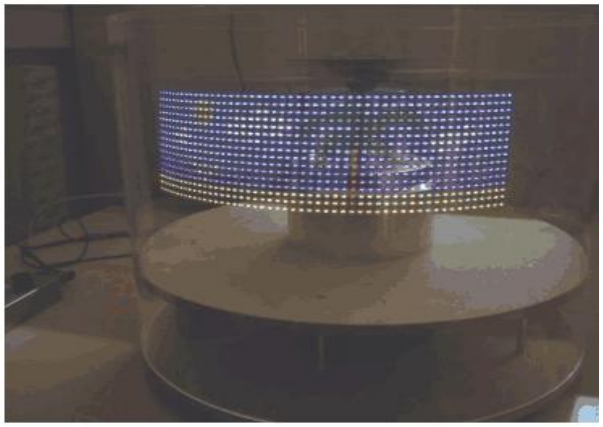
The System was able to display the time with digital type on the rotated LED display and system can display seconds, minutes and hours separated.

Time Display:

Lightening scars(irregular) Display:

Display in the LAB:





7. CONCLUSION

The propeller should build as lighter and more stable. It matters to a faster rotation of propeller. And if the assembly is balanced perfect with having good mechanical strength, then it can achieve stability, and rotate at high RPM. More clear display can get using bright light LED s. An IR transmitter receiver pair should be used to get a 'home' point for the propeller clock. It is used to detect the completion of one revolution.This will improve the overall efficiency of this display and this gives a clear picture without flicker.

Limitations:

This device is a cylindrical type display with only having capable of displaying text and digits. To display analog clock, we must create disk shaped propeller display.

8.FUTURE SCOPE FOR THE DEVICE

- This device displays only the time. Therefore we can modify this devise for display date besides time.
- User only can do the time adjustment when propeller is at the rest of condition. Therefore a remote system can be used to set time and date.
- This device can be modifying as a computer based display board. A wireless system can be used to communicate between the PC and the device. This would let the user to display any massage easily on propeller display.
- LED patterns can be display using this devise. We have to modify the program for LED patterns.
- We can use an external Real Time Clock (RTC) module as the clock. It gives time and date with 100% accuracy.

9. REFERENCES:

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