International Journal of Engineering Research and Development (IJERD) ISSN: 2278-067X
Recent trends in Electrical and Electronics & Communication Engineering (Page 10-14)
(RTEECE 08th – 09th April 2016)

Propeller LED Display

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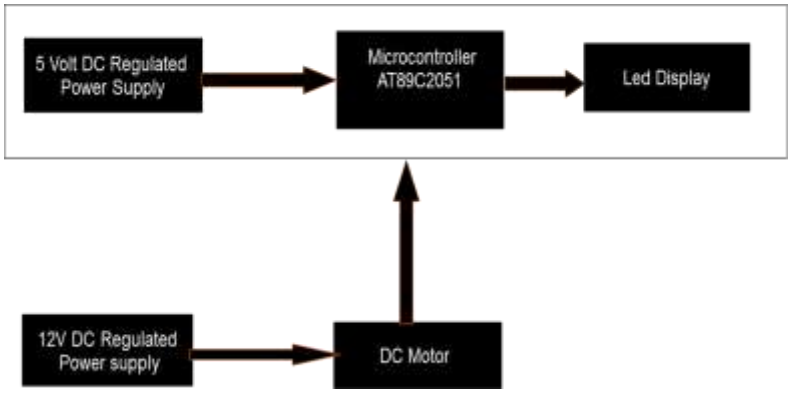
ABSTRACT: *As a part of an Electrical Engineering program, it is important to understand the practical application of all those things and concepts that have been taught theoretically, this project report is a summary of practical things learnt by us during the period of our project execution. Propeller 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. This propeller display is mechanically scanned and displays in digital format. 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, that Anyone having a little electronics knowledge can take care of this. All the synchronizing can be implemented through software. The software part of clock works using interrupts and timers.*

I. INTRODUCTION

In deciding on a project I looked for a challenge that would have a good mix of hardware and software problems. I ended up primarily concentrating on looking at unusual display technologies and decided that a persistence of vision (POV) display would be a good balance of hardware and software. A POV display is a display created by rotating an array of LEDs rapidly. Due to the fact that human eyes can only render about 10 images per second, the fast spinning LEDS seem like a solid display.

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.

II. BLOCK DIAGRAM



In this section we will emphasize on detailed overview of each of the block shown in previous 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 AT89C2051: This project is based around the microcontroller AT89C2051, which is a derivative of 8051 family. This is a 14 pin IC packaged in DIP package. 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 Display: 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 220 ohm.

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.

DC Power Supply: For microcontroller, as well as the DC motor, a regulated DC power supply is required. We have to provide +5V to the microcontroller, while +12V to the motor.

III. CIRCUIT DIAGRAM

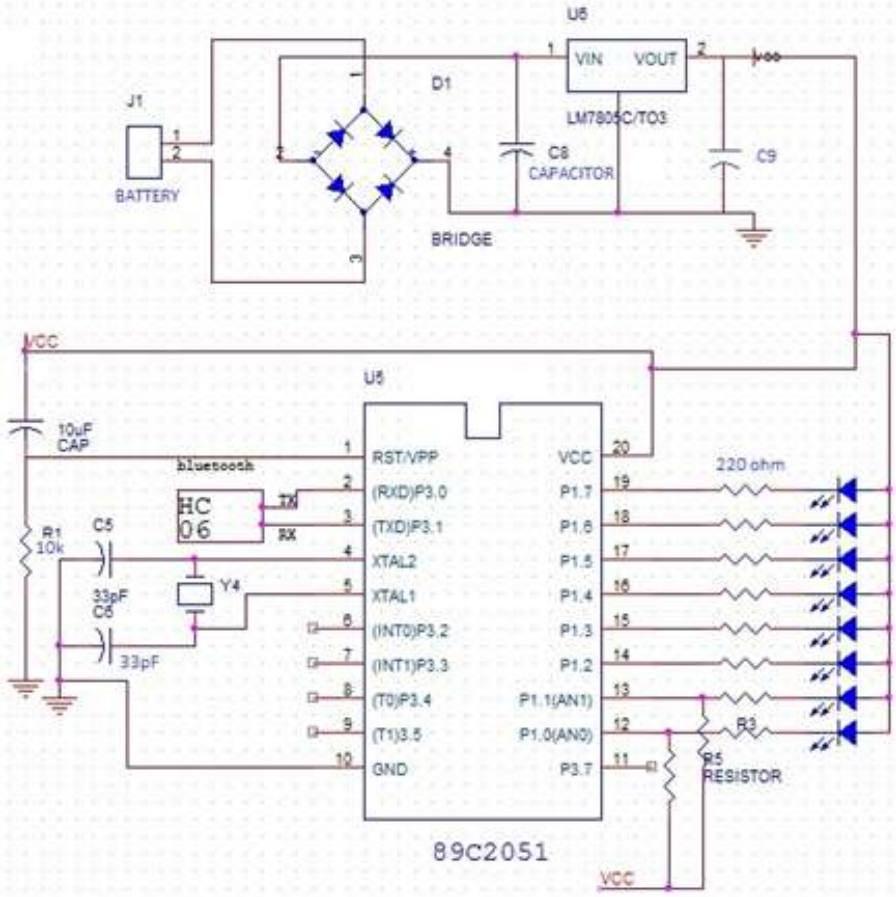


Fig. 1: Circuit Diagram with AT89C2051

Table I: Component Description

COMPONENT	
LEDs	8
CAPACITOR	2(33 pF),1(0.1µF,10µF)
BATTERY	1 (9 V)
VOLTAGE REGULATOR	1 (7805)
RESISTOR	8(220Ω)
MICROCONTROLER	AT89C2051
CRYSTAL	1(11.0952 MHz)
DC MOTOR	1(1000 rpm)

IV. PARTS INVOLVED

The Hardware of Propeller LED Display Involves Two Parts.
1 Motor driven part
2 Propeller display part

1 Motor with Supporting Wheel:

Fig. 2: Caption of motor with wheel

In a motor-driver part, the power from the AC mains is stepped down to a motor-operating range by a step down transformer. Because it is a DC motor, the AC voltage is converted into DC using a bridge-rectifier circuit, and then it is regulated to a motor voltage. For this purpose we have used an adaptor.

2 Propeller Display Part:

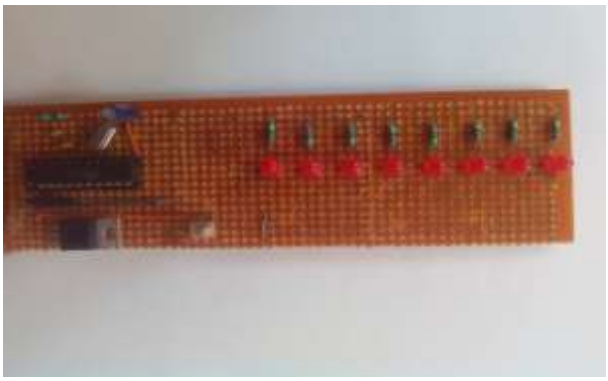


Fig. 3: Caption of bread board with LEDs

DC power supply is given to the microcontroller, which is programmed, and then the message will be displayed on the rotating object by using a set of LEDs. DC supply given to controller is taken from DC battery. By this way, the LEDs display the message with the help of a motor driver in a rotating fashion.

V. DELAY CALCULATION

Length of PCB (Radius) == 15 cm
Perimeter== 2¶ * 15 == 94.24 cm
Total numbers of letters==17
Total number of column ==17*6== 102
Width of led column == 0.923 cm
Length for a letter == 6 * 0.923 == 5.54 cm
Motor speed == 1000 RPM
Time for one rotation == 60 ms
Time for a letter == 60\17 ==3.52 ms
Column for each letter == 6

Time for a column==3.52/6=0.588 ms==588µs

VI. MAKING

The biggest problem was the making of the hardware setup as the whole system had to be a light weight, evenly balanced and yet a strong one. Even slight variation of centre of mass from the axle resulted in large scale wobbling of the system.

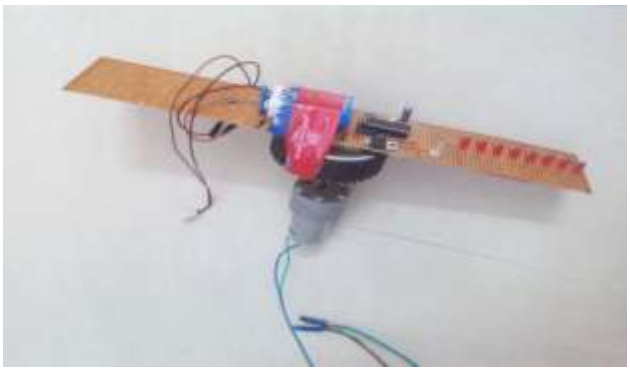


Fig. 4: Caption of actual hardware

Fig. 5: Caption of actual hardware

Programming the microcontroller was not simple either. A lot of experiments were done to get proper display of characters.
We had some soldering practice when we made model of our project.

VII. BLUETOOTH MODULE-HC06

Bluetooth Basics: How it works?

Network Topology

Any Bluetooth device can be a master or a slave, depending on the application scenario. Bluetooth employs frequency hopping spread spectrum (FHSS) to communicate. So in order for multiple Bluetooth devices to communicate, they must all synchronize to the same hopping sequence. The master sets the hopping sequence, and the slaves synchronize to the Master.

A piconet is formed by a master and up to seven active slaves. The slaves in a piconet only communicate with the master.

A scatter net can be formed by linking two or more piconets. When a device is present in more than one piconet, it must time-share and synchronize to the master of the piconet with which it is currently communicating.

While the topology and hierarchical structure of WLAN networks are relatively simple, Bluetooth networks are far more diverse and dynamic.

They are constantly being formed, modified, and dissolved, as Bluetooth devices move in and out of range of one another. And because different Bluetooth devices can represent many different usage profiles, there are many different ways in which Bluetooth devices can interact.

Service Discovery

The concept of service discovery is utilized to determine what kind of Bluetooth devices are present and what services they desire or offer. When a Bluetooth device requires a service, it begins a discovery process

by sending out a query for other Bluetooth devices and the information needed to establish a connection with them. Once other Bluetooth devices are found and communication is established, the Service Discovery Protocol (SDP) is utilized to determine what services are supported and what kinds of connections should be made.

In order for the above to happen, devices willing to connect must be located. Some devices may be set up so that they are invisible. In this case, they can scan for other Bluetooth devices, but will not respond if they are likewise queried. Applications determine whether a device is connectable or discoverable, and thus applications determine the topologies of networks and their internal hierarchies.

VIII. APPLICATIONS

Applications can find their way into cost effective solutions for

- Film system
- Computer monitors
- Printed media
- For the 3d appearance applications.
- Large public displays, information systems.
- It can directly replace Railway station information displays, bus stands, hospitals, schools, industries and many more places.
- This can be used as industrial, commercial and domestic purpose.

IX. ADVANTAGES

- Digital scrolling LED display can be replaced by propeller display which has very less number of LEDs used compare to scrolling message system even though it covers same area of display.
- Requires less space.
- Having low weight, easy to handle.
- Attractive display used for advertisement.
- Instantaneous change in display by Bluetooth
- Low cost compare to scrolling display

X. FUTURE SCOPE

- It can be made possible to Display the clock RTC on the Display.
- It can be made to have a cylindrical or spherical display as well.
- It can be integrated with android phone via Bluetooth.
- Display content can be instantly changed by using phone, so the stock market, jewellery showrooms, etc can have reliable displays.

XI. CONCLUSION

Since our display is designed to work without any predetermined spin speed, upgrading our motor and display module would allow us to improve the display with minimal changes.

On the design side, we independently developed all our hardware and software. We also made sure that our project would not cause ethical concerns. While there is a slight chance of injury from the spinning board, we keep the speed low enough to prevent the chance of injury.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to my project guide **Dr. Hiren Shah** for his guidance and support during all the stage of my project. Without his encouragement and enthusiasm this project would have not been completed. I am evincing great pleasure in expressing my thanks and heartiest gratitude to those entire people who have helped us during the development of this project.
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