A
Real Time/Societal Research Project Report
On

"PROPELLER LED DISPLAY"

Submitted in Partial Fulfillment of the
Academic Requirement for the Award
of Degree of

BACHELOR OF TECHNOLOGY

in

Electronics and Communication Engineering

Submitted by

A. MANEESHA	**(22R01A0466)**
CH. SANTHOSH	**(22R01A0478)**
CH. SANJAY	**(21R01A0473)**
S. CHANDU	**(21R01A04B4)**

Under the esteemed guidance of

Mr.K.Haripal Reddy
(Assistant Professor)

Department of Electronics and Communication Engineering

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Kandlakoya(V),Medchal Dist-501401
www.cmrithyderabad.edu.in

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CERTIFICATE

This is to certify that a Real Time Project entitled with "**PROPELLER LED DISPLAY**" is being submitted by:

A. MANEESHA	**(22R01A0466)**
CH. SANTHOSH	**(22R01A0478)**
CH. SANJAY	**(21R01A0473)**
S. CHANDU	**(21R01A04B4)**

To JNTUH, Hyderabad, in partial fulfillment of the requirement for award of the degree of B.Tech in Electronics &Communication Engineering and is a record of a bonafide work carried out under our guidance and supervision. The results in this project have been verified and are found to be satisfactory. The results embodied in this work have not been submitted to have any other University forward of another degree or diploma.

Project Supervisor

(Mr. K. Haripal Reddy)

(Assistant Professor)

Signature of HOD

(Dr. K. Niranjan Reddy)

(Head of the Department ECE)

EXTERNAL EXAMINER

ACKNOWLEDGEMENT

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We will be failing in duty if we do not acknowledge with grateful thanks to the authors of their references and other literatures referred in this Project.

We express our thanks to all staff members and friends for all the help and coordination extended in bringing out this Project successfully in time.

Finally, we are very much thankful to our parents and relatives who guided directly or in directly for every step towards success.

A.MANEESHA **(22R01A0466)**

CH.SANTHOSH **(22R01A0478)**

CH.SANJAY **(21R01A0473)**

S.CHANDU **(21R01A04B4)**

DECLARATION

We **A. MANEESHA (22R01A0466), CH. SANTHOSH (22R01A0478), C H . SANJAY (21R01A0473),S. CHANDU(21R01A04B4)** of the Real Time Project entitled as **"PROPELLER LED DISPLAY"** hereby declared that the matter embodied in this project is the genuine work done by us only and has not been submitted either to the university or to any university/institute for the fulfillment of the requirement of any course of study.

A.MANEESHA	**(22R01A0466)**
CH.SANTHOSH	**(22R01A0478)**
CH.SANJAY	**(21R01A0473)**
S.CHANDU	**(21R01A04B4)**

ABSTRACT

This paper mainly emphasizes on the POV (Persistence of Vision) technology with the help some mechanical arrangement, LED, equipment required, and consequently general cost is sliced to extremely moderate cost. Additionally, support and repairing of the display is easy to the point for anybody having a little electronics education can deal with this. All the synchronizing can be executed through programming. It is made utilizing ATmega328 microcontroller, this project utilize the rule of Space Multiplexing and persistence of vision. This propeller display will be mechanically examined and shows the characters in advanced arrangement and data to be shown can be either fed by assembly level program or by an android application using Bluetooth. Produced using scrap it can be utilized anyplace and all over and the most astounding certainty about this propeller display is its perfectly clear. This propeller comprises of only 8 RGB LEDs which are arranged on to demonstrate the display. For building this project, necessity is only an Arduino board, a position encoder, and LEDs. This display can demonstrate the messages, which will require 665 LEDs. So equipment and cost minimization is accomplished.

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1.CHAPTER

1.1 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. That’s why this project is named as ‘PROPELLER LED DISPLAY‘. 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. The best example of this property is the red circle we observe when we rotate the firecracker or incense stick in circle. 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 common example; in which image is re-scanned every 25 times, thus making it continuous. Further, a glowing objects if rotated in a circle at fast speed, it shows a continuouscircle. By modifying this basic idea, 7 LEDs can be rotated in a circle, showing 7 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 numberof LEDs even for small sized displays. By using a propeller type display, LED count can be kept to a bare minimum. Even 7 LEDs can perform a task of over 525 LEDs.Applications can find theirway into cost effective solutions for large publicdisplays, information systems. It can directly replaceRailway station information displays, bus stands andmany more places.

2. CHAPTER

DESIGN OF HARDWARE

- Arduino Microcontroller.
- LED’s.
- Power Supply.
- DC Motor
- Genaral purpose PCB boards
- Connecting wires.

2.1 Arduino microcontroller

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (basedon Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reacheda wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of

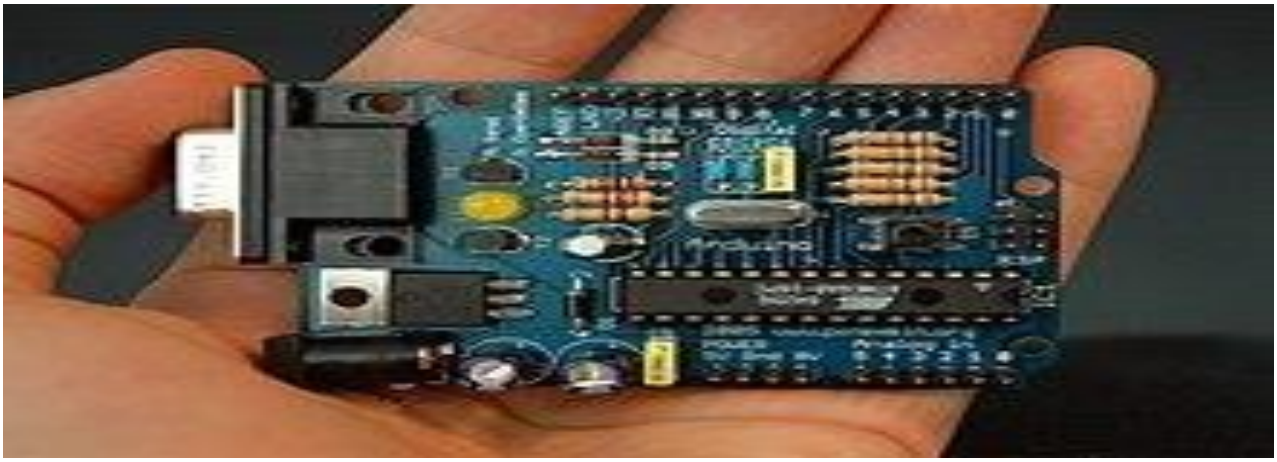


Fig2.1:Aurdino microcontroller

working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- **Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than \$50

- **Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

- **Simple, clear programming environment** - The Arduino Software (IDE) is easy-to- use for beginners, yet flexible enough for advanced users to take advantage of as well.For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.

- **Open source and extensible software** - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

- **Open source and extensible hardware** - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can

make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

Software:

A program for Arduino hardware may be written in any programming language with compilers that produce binary machine code for the target processor. Atmel provides a development environment for their 8-bit AVR and 32-bit ARM Cortex-M based microcontrollers: AVR Studio (older) and Atmel Studio

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting thesketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. Traditionally, Arduino IDE was used to program Arduino's official boards based on Atmel AVR Microcontrollers, but over time, once the popularity of Arduino grew and the availability of open-source compilers existed, many more platforms from PIC, STM32, TI MSP430, ESP32 can be coded using Arduino IDE.[64]

An initial alpha preview of a new Arduino IDE was released on October 18, 2019, as the Arduino Pro IDE. The beta preview was released on March 1, 2021, renamed IDE 2.0. On September 14, 2022, the Arduino IDE 2.0 was officially released as stable.

The system still uses Arduino CLI (Command Line Interface), but improvements include a more professional development environment and autocompletion support. The application frontend is based on the Eclipse Theia Open Source IDE. Its main new features are:

- Modern, fully featured development environment
- New Board Manager
- New Library Manager
- Board List
- Basic Auto-Completion
- Serial Monitor

Pin configuration:

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board.

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pins of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.

SPI Pins: This is the Serial Peripheral Interface pin, it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. **SS**: Pin number 10 is used as a Slave Select
2. **MOSI**: Pin number 11 is used as a Master Out Slave In
3. **MISO**: Pin number 12 is used as a Master In Slave Out
4. **SCK**: Pin number 13 is used as a Serial Clock

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

2.2 Power supply

Power supply is an electronic circuit designed to provide various ac and dc voltages for equipment operation.Proper operation of electronic equipment requires a number of source voltages. Low dc voltages are needed to operate ICs and transistors. High voltages are needed to operate CRTs and other devices. **Batteries** can provide all of these voltages.

A **power supply** is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power.

Power Supply Functions

The complete power supply circuit can perform these functions:

Step voltages up or step voltages down, by transformer action, to the required AC line voltage.

- Provide some method of voltage division to meet equipment needs.
- Change AC voltage to pulsating dc voltage by either half-wave or full-wave rectification.
- Filter pulsating dc voltage to a pure dc steady voltage for equipment use.
- Regulate power supply output in proportion to the applied load.

Power Supply Components

A block diagram illustrating these functions is shown in Figure 1. Note that certain functions are not found in every power supply. See Figure 2 for typical commercial power supply components

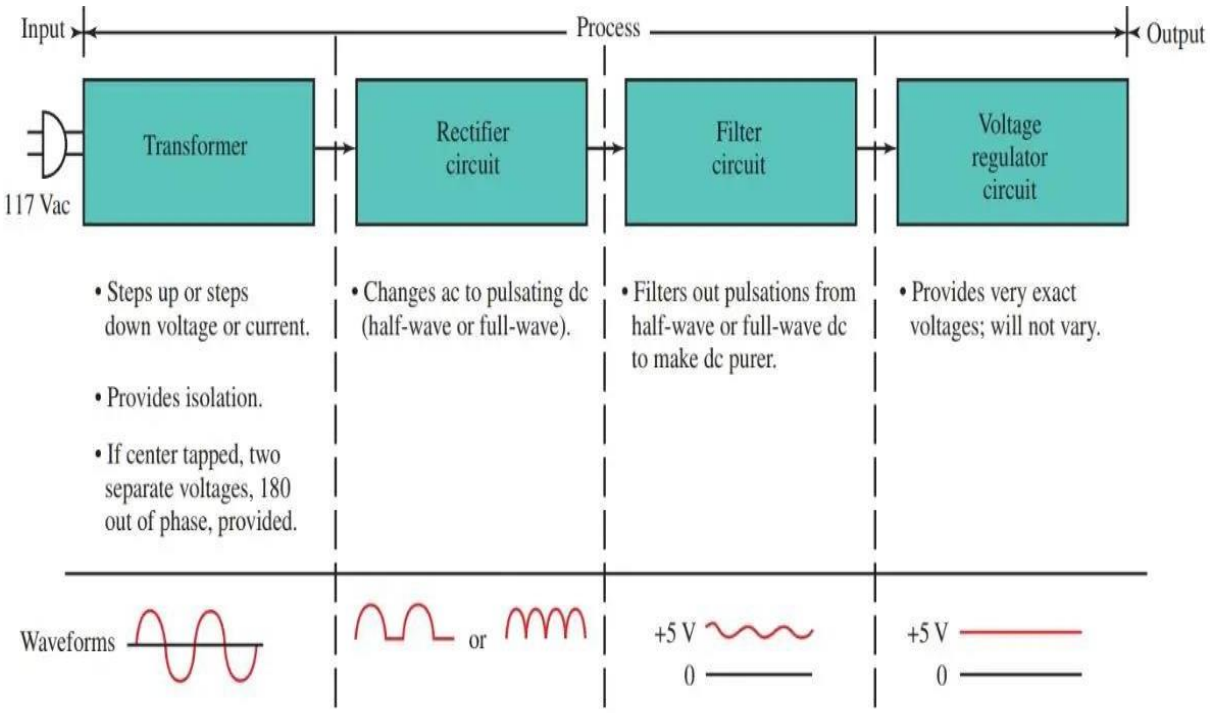


Fig.2.2. Block diagram for power supply components.

2.3 Led:

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction.

Light-emitting diodes are heavily doped p-n junctions. Based on the semiconductor material used and the amount of doping, an LED will emit coloured light at a particular spectral wavelength when forward biased. As shown in the figure, an LED is encapsulated with a transparent cover so that emitted light can come out.

LED Symbol:

The LED symbol is the standard symbol for a diode, with the addition of two small arrowsdenoting the emission of light.

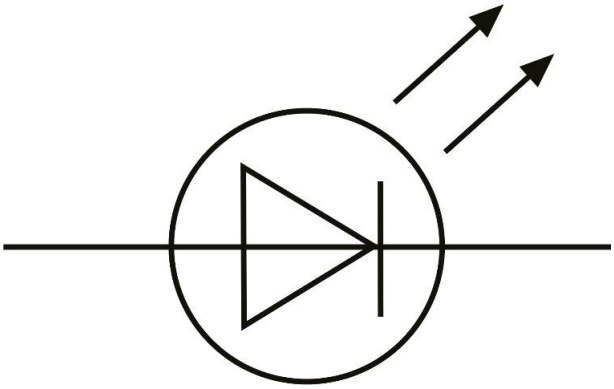


Fig.2.3(a).LED symbol

Simple LED Circuit:

The figure below shows a simple LED circuit.

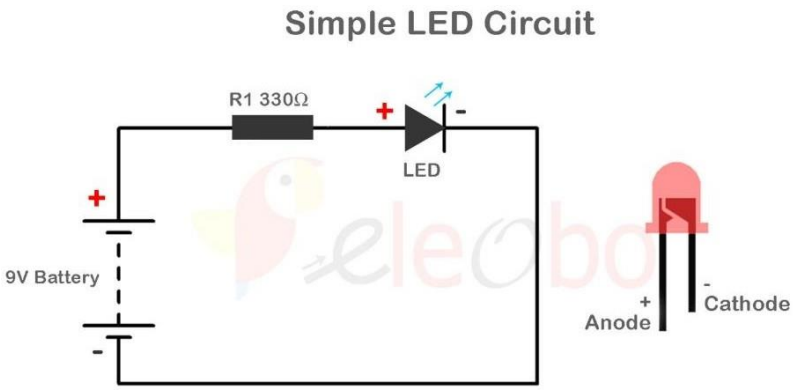


Fig.2.3(b).LED circuit

The circuit consists of an LED, a voltage supply and a resistor to regulate the current and voltage.

Properties of Laser Light

Laser light is monochromatic, directional and coherent.

Laser Light is Monochromatic

Unlike white light, which is made of seven colours, laser light is made of a single colour.

Laser Light is Directional

Laser light is highly directional.

Laser Light is Coherent

Laser light is coherent because the wavelengths of the laser light are in phase in space and time.

Uses of LED:

LEDs find applications in various fields, including optical communication, alarm and security systems, remote-controlled operations, robotics, etc. It finds usage in many areas because of its long-lasting capability, low power requirements, swift response time, and fast switching capabilities. Below are a few standards LED uses:

- Used for TV back-lighting
- Used in displays
- Used in Automotives
- LEDs used in the dimming of lights

2.4. DC Power supply:

A DC/DC power supply, known as DC/DC Converter, is a power supply that uses DC voltage as input instead of AC voltage. The main purpose of DC/DC power supplies is to produce a regulated voltage output for electronic and electric devices. Unlike AC voltage, DC voltage cannot be stepped up or stepped down using a transformer.

A DC power supply has two major power inputs:

AC Input: An AC input can be rectified and filtered to produce a DC voltage, which is then applied to a regulator circuit, generating a constant DC output voltage. The output can range from less than a volt to >1000 volts.

DC Input:

A DC voltage with typical values, 5V, 12V, 24V, or 48V, can also be accepted by a DC power supply as an input. The output voltage can also be generated; this ranges from less than a volt to
>1000 volts DC. A battery or harvested energy (solar cells, fuel cells, etc.), which derive their electrical power from other energy sources, can also be used as power inputs for a DC power management subsystem.

Battery Input:

The DC power management subsystem is normally integrated with the electronic system of portable equipment. An AC adapter, a power unit that is plugged into the AC line outlet and gives a DC output voltage, is usually included in portable equipment that powers the unit. If there is a system battery, an AC adapter can also be used to recharge it.

Ultralow Voltage Input:

Small amounts of energy from solar power, thermal energy, wind energy, or kinetic energy can be harvested by a power converter that can operate with ultralow voltage inputs. Once harvested,this energy is accumulated and stored for future use as a power source.

fig.2.3:Battery supply

2.5. DC Motor:

A **DC motor** is an electrical motor that uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

DC motors were the first form of motors widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor, a lightweight brushed motor used for portable power tools and appliances can operate on direct current and alternating current. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

Fig.2.5. DC Motor

2.6. Crystal oscillator:

Crystal oscillators operate on the principle of inverse piezoelectric effect in which an alternating voltage applied across the crystal surfaces causes it to vibrate at its natural frequency. It is these vibrations which eventually get converted into oscillations.

These oscillators are usually made of Quartz crystal, eventhough other substances like Rochelle salt and Tourmaline exhibit the piezoelectric effect because, quartz is inexpensive, naturally-available and mechanically-strong when compared to others.

Crystal oscillators can be designed by connecting the crystal into the circuit such that it offers low impedance when operated in series-resonant mode (Figure 2a) and high impedance in fig2.

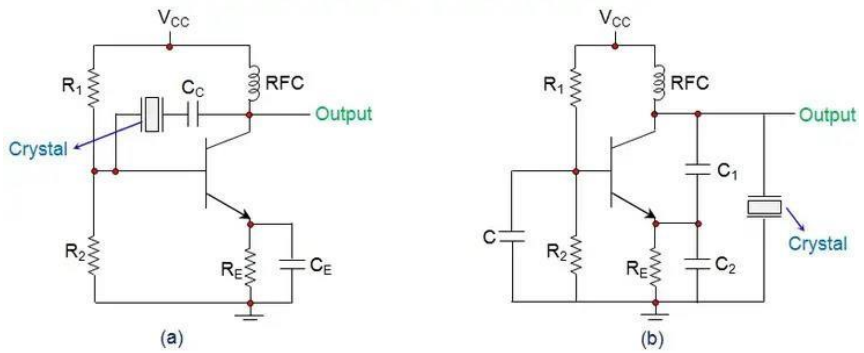


Figure 2 Crystal Oscillator Operating in (a) Series Resonance (b) Parallel Resonance

Crystal oscillators are compact in size and are of low cost due to which they are extensively used in electronic warfare systems, communication systems, guidance systems, microprocessors, microcontrollers, space tracking systems, measuringinstruments, medical devices, computers, digital systems, instrumentation, phase-locked loop systems, modems, sensors, disk drives, marine systems, telecommunications, engine control systems, clocks, Global Positioning Systems (GPS), cable television systems, video cameras, toys, video games, radio systems, cellular phones, timers, etc

2.7. 8*1 LED Display:

LED displays are the captivating screens that command our attention with their vibrant colors and eye-catching visuals. Picture the massive screens at concerts that make you feel like you're part of the show, or the sleek digital billboards that bring city streets to life. These displays are the modern-day storytellers, using countless tiny light-emitting diodes (LEDs) to create images and videos that jump off the screen. Think of them as digital artists, painting with light to craft immersive scenes that draw you in. From sharing important messages in busy city centers to transforming sports events into unforgettable spectacles, LED displays have become the go-to choice for making an impact. In simple terms, **LED displays are dynamic screens that use light-emitting diodes to produce stunning visuals that capture our imagination andspark our curiosity.**

LED dot matrix displays can be considered as the next logical step up from 16-segment alphanumeric arrangements. In a typical dot matrix LED display, the clustering of individual diodes is dense, while the dots (LEDs) are typically arranged in a rectangular grid that is wider than it is tall.

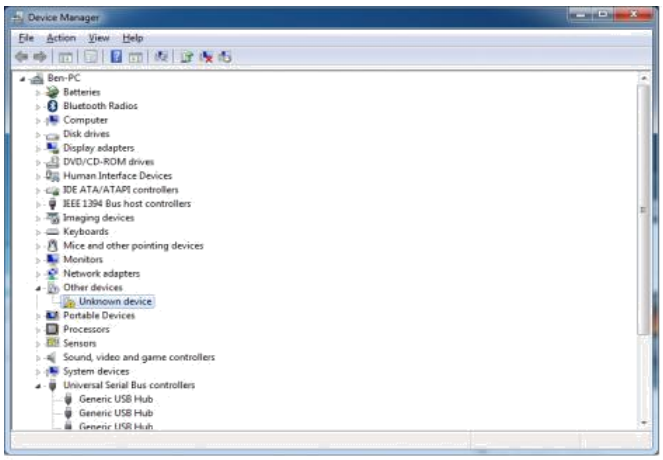
Fig.2.7.LED Display

3.CHAPTER

SOFTWARE DESCRIPTION

3.1 Arduino software:

The Arduino is a family of microcontroller boards to simplify electronic design, prototyping



and experimenting for artists, hackers, hobbyists, but also many professionals. People use it abrains for their robots, to build new digital music instruments, or to build a system that lets y

our house plants tweet you when they're dry. Arduinos (we use the standard Arduino Uno) are built around an ATmega microcontroller — essentially a complete computer with CPU, RAM, Flash memory, and input/output

What you will need:

- A computer (Windows, Mac, or Linux)
- An Arduino-compatible microcontroller (anything from this guide should work)
- A USB A-to-B cable, or another appropriate way to connect your Arduino-compatible microcontroller to your computer (check out this USB buying guide if you're not sure which cable to get).
- An Arduino Uno
- Windows 7, Vista, and XP
- Installing the Drivers for the Arduino Uno (from Arduino.cc)

- Plug in your board and wait for Windows to begin it's driver installation process After a few moments, the process will fail, despite its best efforts

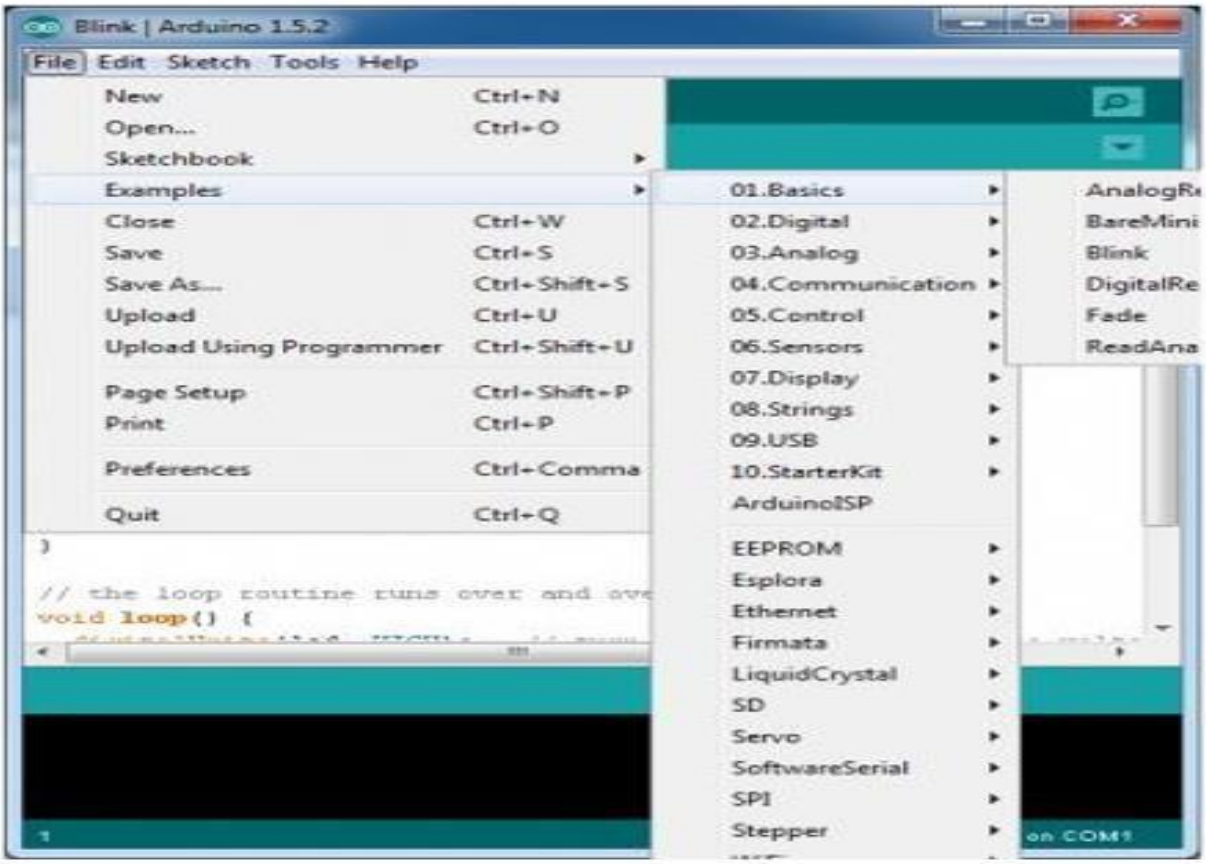
- Click on the Start Menu, and open up the Control Panel
- While in the Control Panel, navigate to System and Security. Next, click on System Once the System window is up, open the Device Manager
- Look under Ports (COM & LPT). You should see an open port named "Arduino UNO (COM xx)".
- If there is no COM & LPT section, look under 'Other Devices' for 'Unknown Device'
- Right click on the "Arduino UNO (COM xx)" or "Unknown Device" port and choose the "Update Driver Software" opt next, choose the "Browse my computer for Driver software" option

Finally, navigate to and select the Uno's driver file, named "ArduinoUNO.inf", located in the "Drivers" folder of the Arduino Software download (not the "FTDI USB Drivers" sub-directory). If you cannot see the .inf file, it is probably just hidden. You can select the 'drivers' folder with the 'search sub-folders' option selected instead. Windows will finish up the driver installation

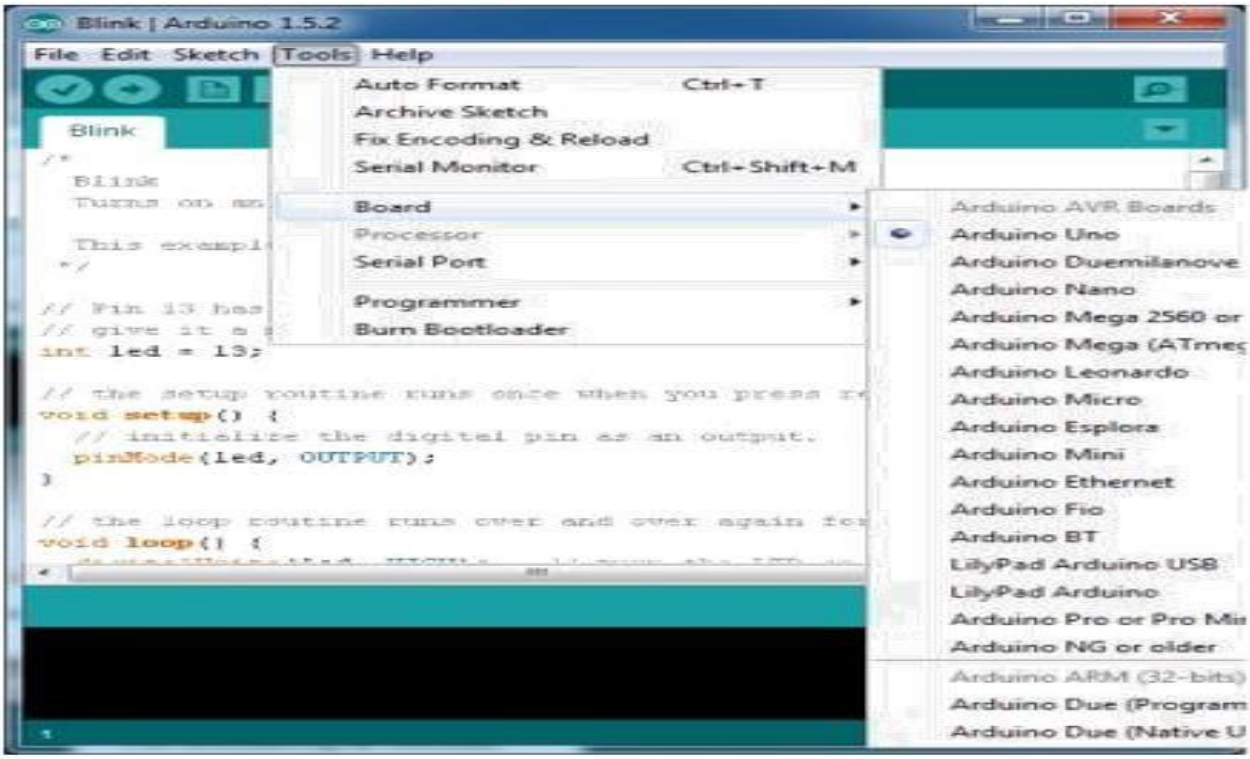
Launch and blink !

After following the appropriate steps for your software install, we are now ready to testyour first program with your Arduino board!

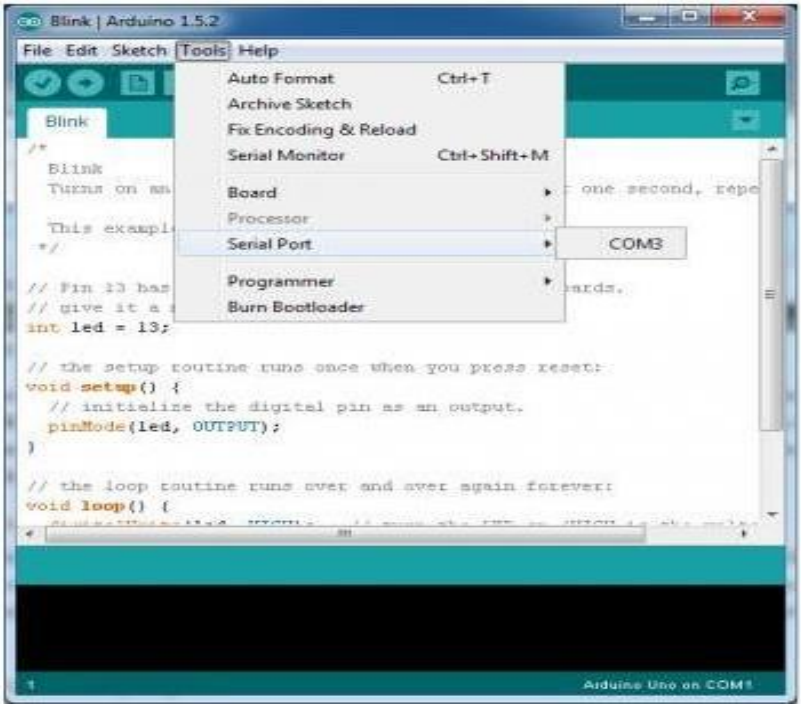
- Launch the Arduino application
- If you disconnected your board, plug it back in
- Open the Blink example sketch by going to: File > Examples > 1. Basics > Blink

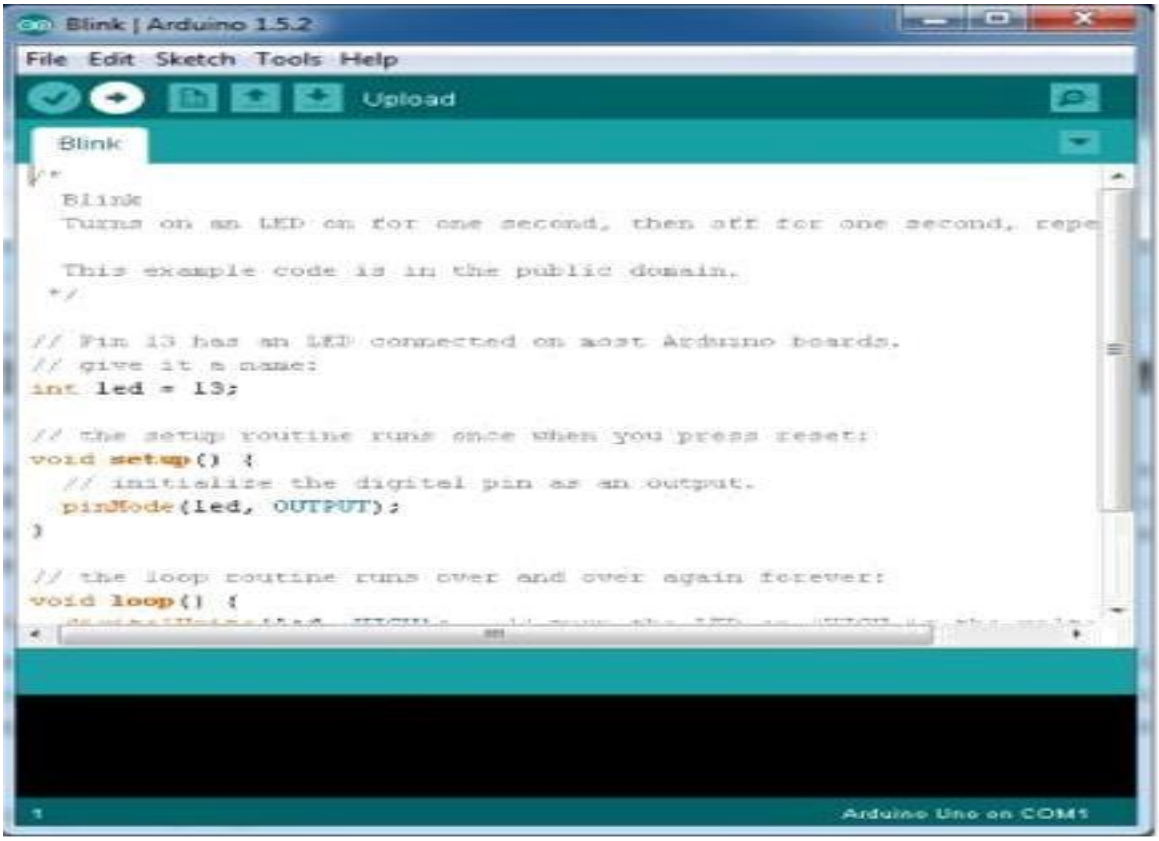


- Select the type of Arduino board you're using: Tools > Board > your board type



- Select the serial/COM port that your Arduino is attached to: Tools > Port > COM x





If you're not sure which serial device is your Arduino, take a look at the available ports, thenunplug your Arduino and look again. The one that disappeared is your Arduino.

With your Arduino board connected, and the Blink sketch open, press the 'Upload' button

After a second, you should see some LEDs flashing on your Arduino, followed by the message 'Done Uploading' in the status bar of the Blink sketch.

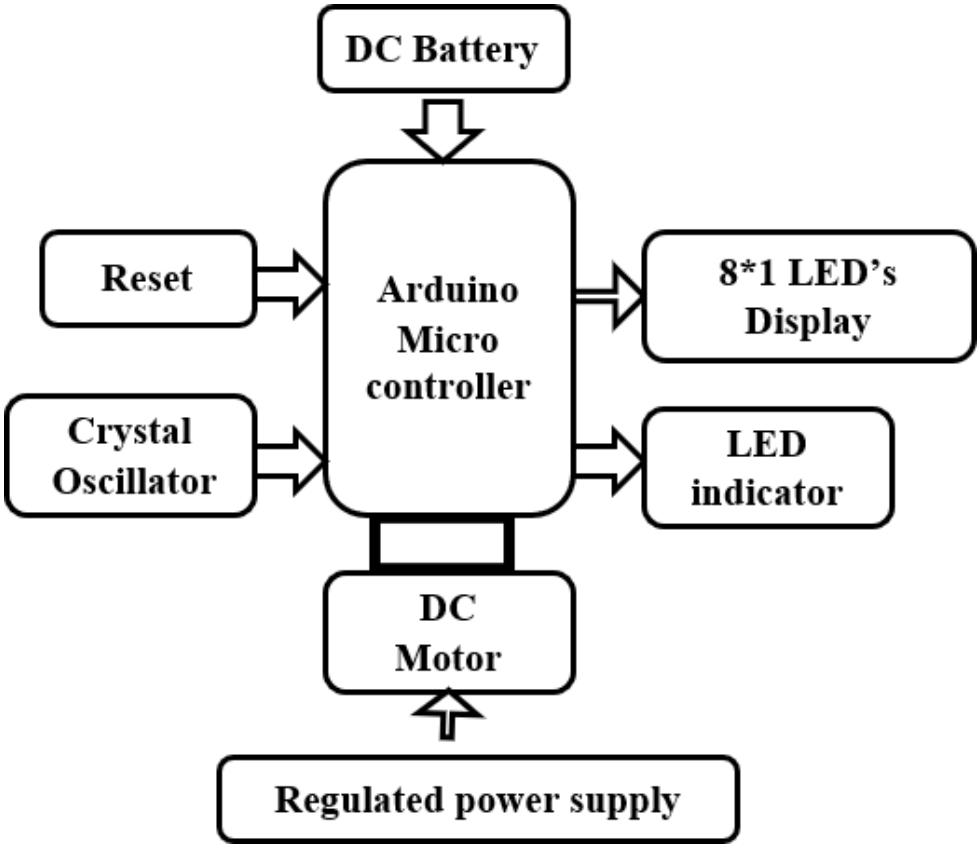
If everything worked, the onboard LED on your Arduino should now be blinking! You just programmed your first Arduino!

4.CHAPTER

Project description:

Propeller is a term connected with a rotating object: motor or pump, and is used in this project. Propeller rotates a set of light emitting diode for displaying numbers, characters and symbols in a rotating manner that's the reason why it is termed as a Propeller LED display

4.1. Block diagram:



4.2. Software requirements:

- Embedded c language
- Arduino Nano

4.3. Hardware requirements:

- Arduino Microcontroller.
- LED's.
- Power Supply.
- DC Motor
- Genaral purpose PCB boards
- Connecting wires.

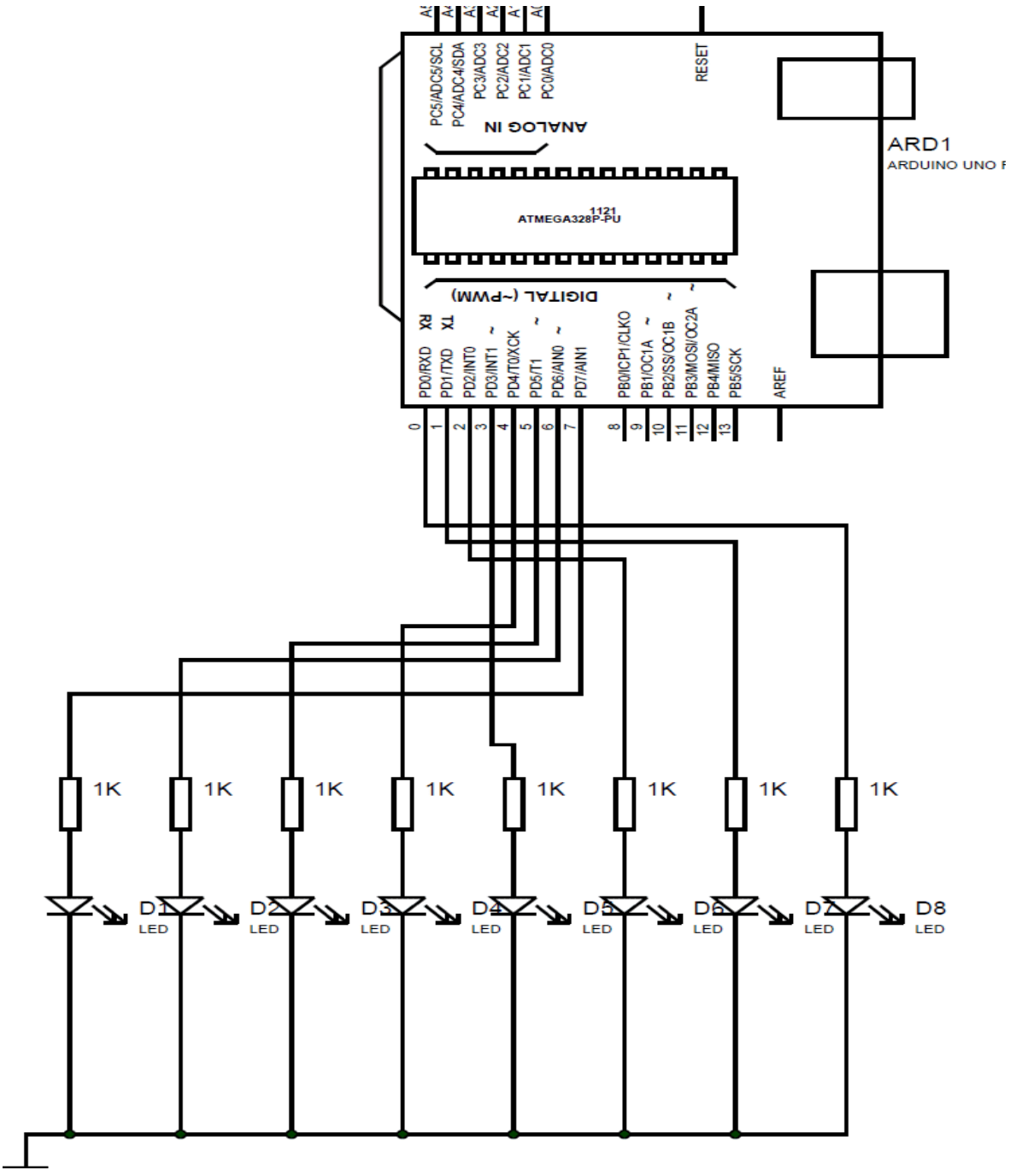
4.4. Working:

Propeller is a term connected with a rotating object: motor or pump, and is used in this project. Propeller rotates a set of light-emitting diodes for displaying numbers, characters and symbols in a rotating manner that's the reason why it is termed as a Propeller LED Display. Some of the features of Propeller LED Display include displaying messages in a typical manner; displaying numbers in analog and digital clocks, self cooling systems, and so on. Propeller runs on a single battery with wall adapter facility. The rotating LED displays can be cylindrical ordisc shaped. The cylindrical displays are capable of displaying texts and digits, and the disc- shaped displays are capable of displaying analog clock. A Propeller display is a mechanically- scanned device that displays its characters in a digital format. A propeller clock is a linear array of light emitting diodes rotating at a high angular velocity to generate a circular screen.

This project uses two decoders for turning each segment of seven-segment display. As we are using 16-characters display, for better utilization of microcontroller pins, these decoders play a key role. This 3 to 8 demultiplexer or decoder uses three pins from the microcontroller, and based on its high and low values, the output of the decoder varies. The system uses a power supply of 5V DC drawn from a voltage regulator, which is fed to the microcontroller and to the remaining of the circuit.

5.CHAPTER

5.1.Layout diagram:



6.CHAPTER

6.1.Coding:

```
int NUMBER9[]={1,1,1,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,1,1,1,1,1,1,1};
 int NUMBER8[]={0,1,1,0,1,1,1,0, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 0,1,1,0,1,1,1,0};
 int NUMBER7[]={1,0,0,0,0,0,0,0, 1,0,0,0,1,0,0,0, 1,0,0,0,1,0,0,0, 1,0,0,1,1,1,1,1, 1,1,1,0,1,0,0,0};
 int NUMBER6[]={1,1,1,1,1,1,1,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,1,1,1};
 int NUMBER5[]={1,1,1,1,1,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,1,1,1};
 int NUMBER4[]={1,1,1,1,0,0,0,0, 0,0,0,1,0,0,0,0, 0,0,0,1,0,0,0,0, 0,0,0,1,0,0,0,0, 1,1,1,1,1,1,1,1};
 int NUMBER3[]={1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,1,1,1,1,1,1,1};
 int NUMBER2[]={1,0,0,0,0,0,1,1, 1,0,0,0,0,1,0,1, 1,0,0,0,1,0,0,1, 1,0,0,1,0,0,0,1, 0,1,1,0,0,0,0,1};
 int NUMBER1[]={0,0,1,0,0,0,0,0, 0,1,0,0,0,0,0,0, 1,1,1,1,1,1,1,1, 0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0};
 int NUMBER0[]={1,1,1,1,1,1,1,1, 1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1, 1,1,1,1,1,1,1,1};

 int _[] = {0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0, 0,0,0,0,0,0,0,0};
 int A[] = {1,1,1,1,1,1,1,1, 1,0,0,1,0,0,0,0, 1,0,0,1,0,0,0,0, 1,0,0,1,0,0,0,0, 1,1,1,1,1,1,1,1};
 int B[] = {1,1,1,1,1,1,1,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 0,1,1,0,1,1,1,0};
 int C[] = {0,0,1,1,1,1,0,0, 0,1,0,0,0,0,1,0, 1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1};
 int D[] = {1,1,1,1,1,1,1,1, 1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1, 0,1,0,0,0,0,1,0, 0,0,1,1,1,1,0,0};
 int E[] = {1,1,1,1,1,1,1,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1, 1,0,0,1,0,0,0,1};
 int F[] = {1,1,1,1,1,1,1,1, 1,0,0,1,0,0,0,0, 1,0,0,1,0,0,0,0, 1,0,0,1,0,0,0,0, 1,0,0,1,0,0,0,0};
 int G[] = {0,1,1,1,1,1,1,1, 1,0,0,0,0,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,1,1,0};
 int H[] = {1,1,1,1,1,1,1,1, 0,0,0,0,1,0,0,0, 0,0,0,0,1,0,0,0, 0,0,0,0,1,0,0,0, 1,1,1,1,1,1,1,1};
 int I[] = {1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1, 1,1,1,1,1,1,1,1, 1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1};
 int J[] = {0,0,0,0,0,1,1,0, 0,0,0,0,1,0,0,1, 0,0,0,0,0,0,0,1, 0,0,0,0,0,0,0,1, 1,1,1,1,1,1,1,0};
 int K[] = {1,1,1,1,1,1,1,1, 0,0,0,1,1,0,0,0, 0,0,1,0,0,1,0,0, 0,1,0,0,0,0,1,0, 1,0,0,0,0,0,0,1};
 int L[] = {1,1,1,1,1,1,1,1, 0,0,0,0,0,0,0,1, 0,0,0,0,0,0,0,1, 0,0,0,0,0,0,0,1, 0,0,0,0,0,0,0,1};
 int M[] = {1,1,1,1,1,1,1,1, 0,1,0,0,0,0,0,0, 0,0,1,0,0,0,0,0, 0,1,0,0,0,0,0,0, 1,1,1,1,1,1,1,1};
 int N[] = {1,1,1,1,1,1,1,1, 0,0,1,0,0,0,0,0, 0,0,0,1,1,0,0,0, 0,0,0,0,0,1,0,0, 1,1,1,1,1,1,1,1};
 int O[] = {0,1,1,1,1,1,1,0, 1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1, 1,0,0,0,0,0,0,1, 0,1,1,1,1,1,1,0};
 int P[] = {1,1,1,1,1,1,1,1, 1,0,0,1,0,0,0,0, 1,0,0,1,0,0,0,0, 1,0,0,1,0,0,0,0, 0,1,1,0,0,0,0,0};
```

```
  int Q[] = {0,1,1,1,1,1,1,0, 1,0,0,0,0,0,0,1, 1,0,0,0,0,1,0,1, 0,1,1,1,1,1,1,0, 0,0,0,0,0,0,0,1};
  int R[] = {1,1,1,1,1,1,1,1, 1,0,0,1,1,0,0,0, 1,0,0,1,0,1,0,0, 1,0,0,1,0,0,1,0, 0,1,1,0,0,0,0,1};
  int S[] = {0,1,1,1,0,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,0,0,1, 1,0,0,0,1,1,1,0};
  int T[] = {1,0,0,0,0,0,0,0, 1,0,0,0,0,0,0,0, 1,1,1,1,1,1,1,1, 1,0,0,0,0,0,0,0, 1,0,0,0,0,0,0,0};
  int U[] = {1,1,1,1,1,1,1,0, 0,0,0,0,0,0,0,1, 0,0,0,0,0,0,0,1, 0,0,0,0,0,0,0,1, 1,1,1,1,1,1,1,0};
  int V[] = {1,1,1,1,1,1,0,0, 0,0,0,0,0,0,1,0, 0,0,0,0,0,0,0,1, 0,0,0,0,0,0,1,0, 1,1,1,1,1,1,0,0};
  int W[] = {1,1,1,1,1,1,1,1, 0,0,0,0,0,0,1,0, 0,0,0,0,0,1,0,0, 0,0,0,0,0,0,1,0, 1,1,1,1,1,1,1,1};
  int X[] = {1,1,0,0,0,0,1,1, 0,0,1,0,0,1,0,0, 0,0,0,1,1,0,0,0, 0,0,1,0,0,1,0,0, 1,1,0,0,0,0,1,1};
  int Y[] = {1,1,0,0,0,0,0,0, 0,0,1,0,0,0,0,0, 0,0,0,1,1,1,1,1, 0,0,1,0,0,0,0,0, 1,1,0,0,0,0,0,0};
  int Z[] = {1,0,0,0,0,1,1,1, 1,0,0,0,1,0,0,1, 1,0,0,1,0,0,0,1, 1,0,1,0,0,0,0,1, 1,1,0,0,0,0,0,1};
  int* alpha[]= {A,B,C,D,E,F,G,H,I,J,K,L,M,N};//,T,U,V,W,X,Y,Z};
  int letterSpace;


int dotTime;
void setup()
  { Serial.begin(9600);
 // setting the ports of the leds to OUTPUT(SExperiments)
  for( int i = 2; i<10 ;i++ )
  { pinMode(i, OUTPUT);
  }

 // defining the space between the letters (ms)
  letterSpace = 6;
  // defining the time dots appear (ms)
  dotTime =1;
 }
  void printLetter(int letter[])
  {
  int y;
 // printing the first y row of the letter
  for (y=0; y<8; y++)
  {
```

```
 digitalWrite(y+2, letter[y]);
 }
 delay(dotTime);
// printing the second y row of the letter
 for (y=0; y<8; y++)
 {
 digitalWrite(y+2, letter[y+8]);
 }
 delay(dotTime);
// printing the third y row of the letter
//(SExperiments)
 for (y=0; y<8; y++)
 {
 digitalWrite(y+2, letter[y+16]);
 }
 delay(dotTime);
 for(y = 0; y<8; y++) {
 digitalWrite(y+2, letter[y+24]);
 }
 delay(dotTime);
for(y = 0; y<8; y++) {
 digitalWrite(y+2, letter[y+32]);
 }
 delay(dotTime);
 // printing the sspace between the letters
```

```
//(SExperiments) for
(y=0; y<8; y++)
  {
  digitalWrite(y+2, 0);
  }
  delay(letterSpace);
  }
  void loop()//write here =)
  {
  printLetter (C);
  printLetter (M);
  printLetter (R);
  printLetter (I);
  printLetter (T);
  printLetter (_);
  printLetter (_);
  printLetter (_);
  printLetter (_);
 }
```

7.CHAPTER

7.1 Conclusion:

Propeller displays offer a visually striking means of presenting information through the clever manipulation of light and motion. By rapidly spinning an array of LEDs or other light sources, they create the illusion of static images or text, exploiting the phenomenon of persistence of vision. This technology has found applications in various fields, from advertising and marketing to art installations and interactive displays. However, despite their captivating visual effects, propeller displays come with their own set of limitations that must be considered. These include issues related to resolution, viewing angle, power consumption, and complexity. While propeller displays may not be suitable for every scenario due to these limitations, they stillhold value in specific contexts where their unique capabilities can be leveraged effectively .

8.CHAPTER

8.1 Future scope:

In the future, propeller displays may see a surge in applications driven by advancements in technology. One potential area of growth lies in the integration of propeller displays with augmented reality (AR) and virtual reality (VR) systems. By synchronizing with AR/VR platforms, propeller displays could enhance immersive experiences by overlaying virtual content onto the physical world in real-time. This could revolutionize fields such as gaming, education, and training simulations, providing users with a more dynamic and engaging environment. Additionally, advancements in materials science and miniaturization could lead to the development of smaller, more lightweight propeller display modules, making them suitable for a wider range of applications, including wearable devices and smart accessories. Moreover, as renewable energy sources become more prevalent, there could be a shift towards eco-friendly propeller displays powered by solar or kinetic energy, reducing their environmental impact. Overall, the future of propeller displays appears promising, with ample opportunities for innovation and expansion into new domains.

9.CHAPTER

9.1 Reference:

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