OPTICAL ILLUSION LED DISPLAY USING ARDUINO

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[1]B.E.Student,[2]B.E.Student[3]B.E.Student, [4]B.E.Student [5]Project Guide
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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. 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, that anyone having a little electronics knowledge can take care of this. All the synchronizing can be implemented through software .The software part of display works using interrupts and timers.*

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. First of its kind, made using the 40-pin 8051 series microcontroller, this project use the principle of Space Multiplexing. This propeller display is mechanically scanned and displays the characters in digital format. Made from scrap 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 7 bright LEDs which are rotated to show the display. For building this project, requirement is just a small 40 pin microcontroller, a position encoder, and LEDs.

This display can show the messages, which will require a whopping 525 LEDs. So hardware and cost minimization is achieved.

Keyword-*persistence of vision display, Microcontroller, DC motor, Voltage converter, LED Display,9V Battery*.

I. INTRODUCTION

Optical illusion refers to the persistence of vision whereby multiple discrete images blend into a single image in the human mind. Our eyes offer one of the five specialized means by which our mind is able to form a picture of the world. The eye is a remarkable instrument, having certain characteristics to help us process the light we see in such a way that our mind can create meaning from it. Take the motion picture, the scanning of an image for television, and the quential reproduction of the flickering visual images they produce. These work in part because of an optical phenomenon that has been called "optical illusion." and its psychological partner, the phenomenon, the mental bridge that the mind forms to conceptually complete the gaps between the frames or characters. Propeller is a term associated with circular rotating objects. Conventional methods of displaying images are mainly using LCD display and dot-matrix where the number of LED's and power processors are used to create the display.[5] 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 [6]..

II. LITERATURE REVIEW

This project was started with a simple principle which is frequently encountered in our everyday life, which is optical illusion. 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, thereby appear continuous.

Further, a glowing object 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. The design and construction of a low cost propeller LED display by Sheik Rafik Manihar, Komal Prasad Dewangan, and Ajay Kumar Dansena used principle of space multiplexing and the propeller display is mechanically scanned and displays the characters in digital format, propeller display based on persistence of vision using RF transceivers uses a wireless transmission technology and is a real time project. Wireless dual purpose propeller clock display by Peer Mohammad Memom and it is used a infrared remote control for time selecting like switching from analog to digital mode,(propeller display based on persistence of vision using RF transceivers uses a wireless transmission technology, line no 12 page no 10, circuits book) and is a real time project. Design and implementation of microcontroller based propeller clock by George John P, Togs Thomas, Vishnu Balakrishnam, and Vishnu N Nair used principal of persistence of vision and was implemented using a microcontroller. Propeller display based on persistence of vision using RF transceivers uses a wireless transmission technology and is a real time project (A wireless system was designed wherein the display board need not be reprogrammed to display a new message, LED current technology, line no 44, page no 89, LED circuit). This paper was aimed to develop a mobile sign board which makes the user to change the scrolling message using SMS service instantaneously. The user can update it even from a remote distant. Once read, the SMS is deleted making entry for next incoming SMS

LED scrolling message display system using Android application was designed. This system used Bluetooth technology to communicate from Android phone to LED display board3.
This system can display 8 alphanumeric characters in one time whereby the arrangement of LEDs is using matrix display with less connection needed. Multiplexing and matrix addressing method is applied to control the turn on and off of LED in that particular time4.
(In a system to display the message received by the cell or a modem was proposed. Microcontroller controls the system using authentication and attention (AT) commands. This system is easy, robust to use in normal life by any-one at any place, Kamboj R, Abrol P. Design and development of GSM based multiple LED display boards, line no 56, and page no 87).
A LED display control system can also be designed using advanced reduced instruction set computer machines and field programmable gate array 8. According to module structure characteristics of the Red, Green, Blue (RGB) three colors LED display and the dynamic scanning display of the LED display. This system supports texts and pictures to display with full colors LED screen and a remote data transmission. A microcontroller based display system with the size of six 32×32 dot matrix Chinese characters by a dynamic scan mode is discussed in 9. The system can be divided into two small display screens which can display 24 Chinese characters. The display contents and scrolling speed can be adjusted according to user requirements. LED display notice board is an economical solution for displaying messages with various changing effects and can be applicable in shops, restaurants, pharmacies, etc. These boards can be large LED panels or LED dot matrix displays which could be in mono, bi, and multicolor.

The power consumption of these boards is less. This can display static and dynamic messages10.A radio frequency system was designed, that consists of spinning LED to display the messages send by the user at the handheld device. If there are no inputs from the user for the system, the message that is programmed in the microcontroller will be displayed continuously..

III. PROPOSED SYSTEM

1. If a row of LEDs is moved sideways while the LEDs intensity is changed, an image will shortly visualize in the air where the LEDS are moved.
2. If this is done several times, for example if the LEDs are mounted on the end of a bar mounted on a motor as in figure on the right, the same area in the air could be scanned several times showing the same image each time.
3. A plastic scale is mounted on the shaft of the DC Motor. The 9V battery is fixed to the scale with a cable tie. The Arduino is also fitted to the scale with the help of nuts and cable tie. A plastic casing is attached perpendicular to the scale.
4. The vero board with the 5 LEDs soldered is fixed to the plastic casing with the help of nuts and bolts. The 9V battery is used to power up the Arduino UNO . The 12V source is used to run the DC Motor.

5. When a person sees an object, its image remains in the retina of the eye for a time interval of 1/16th of a second. This phenomenon is known as persistence of vision. This phenomenon is used in the LED POV Display to form images.

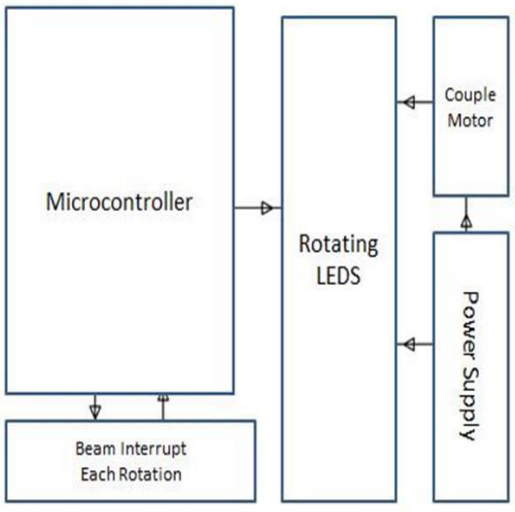


Fig.Proposed Architecture Diagram of the System

6. We turn the LEDs on and off in such a way that the different images overlap each other forming letters and characters. Let's take an example of the letter E (in the above figure) to be displayed on the POV Display.

7. Done at high speed it would generate a quite good virtual display hanging in air thanks to persistence of vision effect of the brain. In this project the micro- controller and the LEDs are soldered on a general purpose PCB and this PCB is attached to the propeller of a ceiling fan to provide rotating motion.

8. This way we can visually see the letter H formed by the LEDs but the time interval would be very small in milliseconds. Due to the short time intervals and the ability of the LEDs to turn ON and OFF very quickly we can see the letter H as all the 3 images merge.

9. This process is also applicable for displaying any texts.

10. As the motor is spinning and time passes, each LED moves from one position to the next, so all these images merge together.

IV. FLOW CHART

V. METHODOLOGY

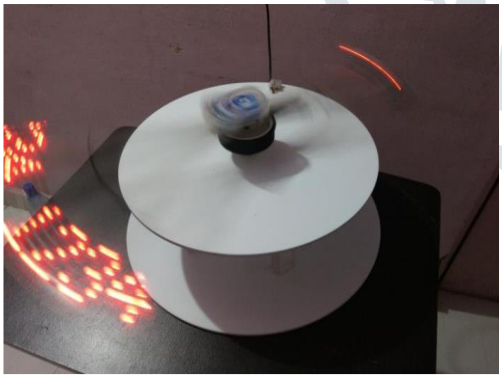
Optical illusions have interesting visual effects, which attract viewer eyes and hold their attention during information transfer; thus, they are widely used in advertising design, artistic drawing, fashion and environmental spaces. Previous design education discussed optical illusion design, which mostly expounded various optical illusion theories related to visual perception, Gestalt laws and figure/ground from the perspective of the psychology of vision (Lauer and Pentak, 2007;Di, 2002; Wallschlaeger and Busic-Snyder, 1992). However ,for the practical creation of optical illusion design, in addition background knowledge of academic theories and the presentation of picture examples, a design method should be provided for students to follow. Therefore, this study proposed the operational definition of optical illusion design in order to establish design rules.

VI. RESULT

When we are start the power supply, as per the program, the motor is start spinning. We are use a 300RPM motor. As the motor spins, the pattern of LED is generated by the program that is feed in the Arduino microcontroller. The input is come from a PC in the form of binary numbers. The PC and the unit are be connected via Bluetooth.

The rotational speed of the LEDs will directly affecting to the frames per second. If there is a more frame rate, it adds to the lesser 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.

Finally we are see the text on rotating screen.



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VII. IMPLEMENTATION

Microcontroller

It's a low power, high performance CMOS microcomputer with 12Kbytes download flash programmable and erasable read only memory. It has got three-level program memory lock, 256 x 8 bit internal RAM, 32 programmable I/O lines, three 16 bit

timer/counters, nine interrupt sources, programmable UART serial channel, SPI serial interface, low power idle and power down modes, interrupt recovery from power down and power off flag.

Arduino is an open-source electronics platform based on easy to use hardware and software arduino boards are able to read inputs-light on sensor, a finger on button or a twitter message and turn into an output activating a motor turning on led publishing something online.

You can tell your board what to do by sending set of instruction to the microcontroller on the board.to do so you use the arduino programming language (based on wiring),and the arduino software(IDE),based on processing.

An arduino board historically consist of an Atmel 8, 16- or 32bits AVR microcontroller (‘although since 2015 other markers’ microcontroller have been used) with a complementary component that facilitated programming and in cooperation into other circuits.

The arduino projects provides the arduino integrated development environment (IDE), which is a cross platform application written in a programming language JAVA. It is originated from the IDE for the language processing and wiring.it is designate to introduce programming to artist and other newcomers unfamiliar with software development.it includes a code editor with a features such as syntax highlighting, brace matching automatic and provide simple one click mechanism to compile and load program to an arduino board. A program written with IDE for arduino is called as “sketch”.

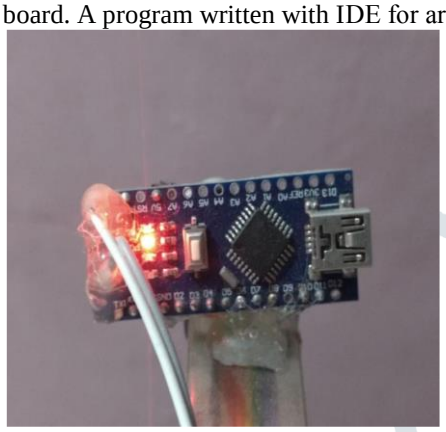


Fig. Microcontroller

IR Sensor

These sensors work by using a specific light sensor to detect a selected light wavelength in the Infra- Red spectrum. The intensity of the received light can be obtained by using LED’s that produces light at the same wavelength as what the sensor is looking for. When an object is close to the sensor, the light, from the LED

bounces off the object and into the light sensor. This results in a large jump in the intensity which can be detected by using a threshold. Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave regions. The infrared waves typically have wavelengths between 0.75 and 1000µm. The infrared spectrum can be split into near IR, mid IR and far IR. The wavelength region from 0.75 to 3µm is known as the near infrared region. The region between 3 and 6µm is known as the mid-infrared region, and infrared radiation which has a wavelength greater higher than 6µm is known as far infrared.

The basic concept of an Infrared Sensor which is used as Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver.Infrared sensors can be passive or active. Passive infrared sensors are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detects energy emitted by obstacles in the field of view.

They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat and are independent of wavelength. Thermocouples, piezoelectric detectors and bolometers are the common types of thermal infrared detectors.

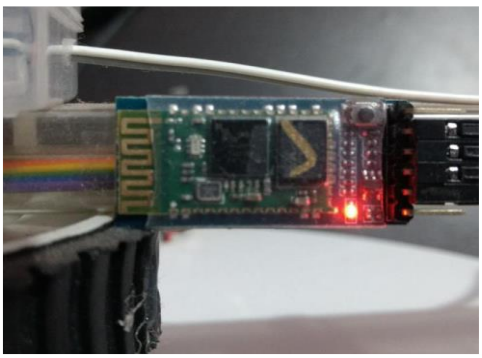


FIG. IR SENSOR

Dc motor

Repeated scanning of the display is must for continuous vision. This task is achieved using circular rotation of the whole circuit assembly. The present work uses an AT89S53 micro-controller for displaying messages by using the concept of persistence of vision. The microcontroller is a low-power, high-performance CMOS 8-bit microcomputer with 12K bytes of download-able flash programmable and erasable read only memory.

The device is manufactured using Atmel’s high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin-out. The on chips download-able flash allows the program memory to be reprogrammed in-

system through an SPI serial interface or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with download-able flash on a monolithic chip, the microcontroller is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

A motor converts supplied electrical energy into mechanical energy. Various types of motors are in common use. Among these, brushless DC motors (BLDC) feature high efficiency and excellent controllability, and are widely used in many applications. The BLDC motor has power-saving advantages relative to other motor types.

In this type of motor, electrical current is passed through coils that are arranged within a fixed magnetic field. The current generates magnetic fields in the coils; this causes the coil assembly to rotate, as each coil is pushed away from the like pole and pulled toward the unlike pole of the fixed field.

To maintain rotation, it is necessary to continually reverse the current—so that coil polarities will continually flip, causing the coils to continue "chasing" the unlike fixed poles. Power to the coils is supplied through fixed conductive brushes that make contact with a rotating commutator; it is the rotation of the commutator that causes the reversal of the current through the coils.

Fig. DC motor

The commutator and brushes are the key components distinguishing the brushed DC motor from other motor types. Figure 1 illustrates the general principle of the brushed motor.

With the brushed motor, rotation is achieved by controlling the magnetic fields generated by the coils on the rotor, while the magnetic field generated by the stationary magnets remains fixed. To change the rotation speed, you change the voltage for the coils.

With a BLDC motor, it is the permanent magnet that rotates; rotation is achieved by changing the direction of the magnetic fields generated by the surrounding stationary coils. To control the rotation, you adjust the magnitude and direction of the current into these coils.

Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses. Maintenance involves regularly replacing the carbon brushes and springs which carry the electric current, as well as cleaning or replacing the commentator. These components are necessary for transferring electrical power from outside the motor to the spinning wire windings of the rotor inside the motor.

Brushes are usually made of graphite or carbon, sometimes with added dispersed copper to improve conductivity. In use, the soft brush material wears to fit the diameter of the commutator, and continues to wear. A brush holder has a spring to maintain pressure on the brush as it shortens. For brushes intended to carry more than an ampere or two, a flying lead will be molded into the brush and connected to the motor terminals. Very small brushes may rely on sliding contact with a metal brush holder to carry current into the brush, or may rely on a contact spring pressing on the end of the brush. The brushes in very small, short-lived motors, such as are used in toys, may be made of a folded strip of metal that contacts the commutator.

If external mechanical power is applied to a DC motor it acts as a DC generator, a dynamo. This feature is used to slow down and recharge batteries on hybrid car and electric cars or to return electricity back to the electric grid used on a street car or electric powered train line when they slow down. This process is called regenerative braking on hybrid and electric cars. In diesel electric locomotives they also use their DC motors as generators to slow down but dissipate the energy in resistor stacks. Newer designs are adding large battery packs to recapture some of this energy.

LM7805

This is basically a voltage converter. They are used with external objects to obtain the desired voltage or current levels. In this project the voltage needed by the 0PCB is 5V, since we are using a 9V battery LM7805 is needed to convert the 9V to 5V.

The LM78S40 from Fairchild is not part of the 78xx family and does not use the same design. It is a component in switching regulator designs and is not a linear regulator like other 78xx devices. The 7803SR from Date is a full module (designed as a drop-in replacement for 78xx chips), and not a linear regulator like the 78xx ICs. LM78XX series of voltage regulators is the last two digits of the number. A LM7805 ends with "05"; thus, it outputs 5 volts. The "78" part is just the convention that the chip makers use to denote the series of regulators that output positive voltage. The other series of regulators, the LM79XX, is the series that outputs negative voltage.

LM78XX: Voltage regulators that output positive voltage, "XX"=voltage output.

LM79XX: Voltage regulators that output negative voltage, "XX"=voltage output

The LM7805, like most other regulators, is a three-pin IC.

Pin 1 (Input Pin): The Input pin is the pin that accepts the incoming DC voltage, which the voltage regulator will eventually regulate down to 5 volts.

Pin 2 (Ground): Ground pin establishes the ground for the regulator.

Pin 3 (Output Pin): The Output pin is the regulated 5 volts DC.

It is recommended to limit the voltage to 2-3 volts higher than the output regulated voltage. For a 5-volt regulator, no more than 8 volts should be applied as the input voltage. The difference between the input and output voltage appears as heat. The greater the difference between the input and output voltage, the more heat is generated.

If too much heat is generated, through high input voltage, the regulator can overheat. If the regulator does not have a heat sink to dissipate this heat, it can be destroyed and malfunction. So the two options are, design your circuit so that the input voltage going into the regulator is limited to 2-3 volts above the output regulated voltage or place a heat sink in your circuit to dissipate the created heat.

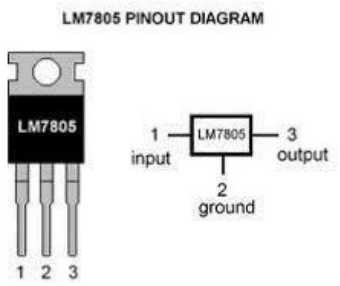


FIG.VOLTAGE CONVERTER

LED DISPLAY

The LED Display /screen is a flat panel/screen/cabinet, composed of little LED modules which display text signals Grayscale, and other info. LED, light-emitting Diode (brief for the light emitting diode).The is a Horizontal panel display, composed of small LED modules that exhibit text, signals Grayscale, along with other information.

LED Display is one of the best and easy project you can do with Arduino. i e. it is just an illusion made by LEDs that are rotated in circular or oscillatory fashion so that it seems to us that letters are appearing in the air out of a rotating disc/bar on which LEDs are mounted.

Accordingly In the code, delay of some milliseconds needs to be applied between the blinking of LEDS, and in this case it is one millisecond but you can vary it as per your motor speed and other variables. Blinking of all LEDS one by one makes an illusion of a complete alphabet thus in this way a whole word is made to appear. Speed of motor needs to be high enough so that our eyes cannot feel the blinking effect of LED's.

In the circuit, a pair of IR LED and Photodiode is used as an interrupt. When this pair move over the white strip it signals the Arduino that it has reached the starting position and LED's starts blinking according to the text. So in this way LED's blinks in the same pattern all the time after this interrupt point and we can see the text displayed on it.

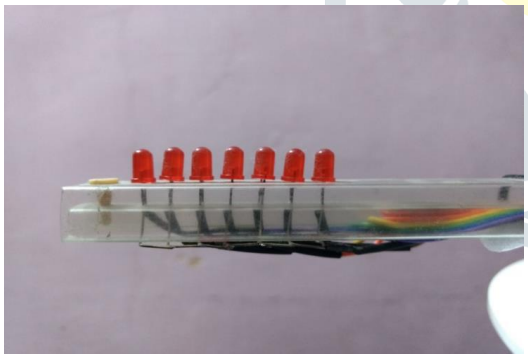


Fig.LED display

Battery Description

The Hi Watt 9V battery is an affordable, reliable, dedicated low-power solution to provide sufficient energy to your circuit. Ideally used in circuits with low power consumption so that it can work for longer durations.

Applying the red lead to the positive or smaller round terminal of the battery and the black lead to the negative larger round lead of the battery should get you a reading of between 8 and **9.5 volts** on a decent 9 volt battery with some life in it.

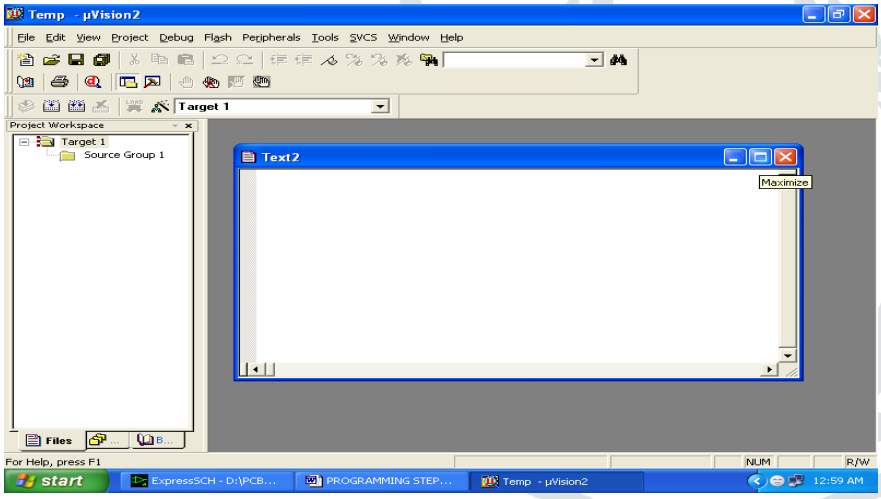
Features:-

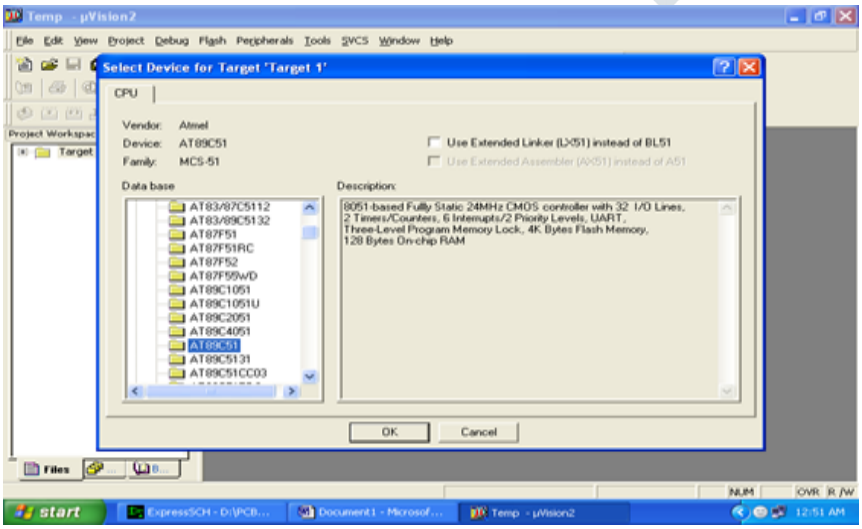
- Model Number: 9V 6F 22
- Battery Type: Zinc Carbon
- Size: 6F22 006P
- Jacket: Metal
- Single Battery Dimensions (mm): L- 26. 5, H - 48. 5, W - 17. 5 (Max)
- Nominal Voltage(V) :9V
- Discharge Resistance(Ω): 620
- Cut-off Voltage(V): 5.4

Fig. Battery

Product details:-

BATTERY TYPE	RADIO BATTERY
Capacity	2900mAh (Min 2750mAh)
Max Charge Current	0.7C 2A
Nominal Voltage (Volts)	9
Discharge Termination Voltage	2.5V





VIII. CONCLUSION

The Perception of illusion Display presented in this project was designed using a Dialog red led as the main controller. We demonstrated that the design works by writing the word "HELLO" using LEDs. Some improvements that could be made to the design include:

- using multiple red less to increase the amount of states possibilities to print a longer message or animation.
- Add more LEDs to the array. It may be helpful to use surface-mount LEDs rather whole LEDs to decrease the mass of the spinning motor.
- including a microcontroller could allow you to change the message displayed by using I2C commands to reconfigure the red led design. This could be used to create a digital display.

This display device is a step into the future technology. It not only provides with a better viewing experience but it also opens new ways to change the way one has been seeing display devices. The proximity sensors can be added with each LED so as to pinpoint locations on the display without hamper in the rotating ring. The touchscreen can be added in order to reduce complexity and to make it user than through friendly for the general public who do not possess knowledge of programming .Thus the POV devices can set up a benchmark for upcoming neoteric technologies.

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I take this opportunity to thank all the classmates for their company during the course work and for useful discussion I had with them.

Under these responsible and talented personalities I was efficiently able to complete my project in time with success.

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