Multiplexing Based Displaying of Data in a 3D Matrix of LEDs

Project report submitted in partial fulfillment of the requirement for the degree

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS & COMMUNICATION ENGINEERING

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UNDER THE GUIDANCE OF
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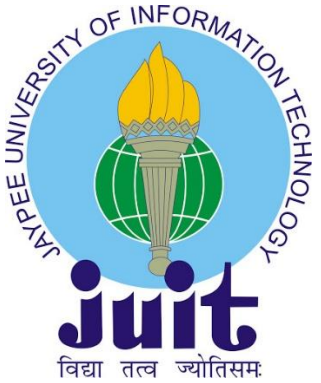

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

MAY 2020

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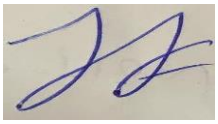
DECLARATION

We hereby declare that the work reported in the B. Tech Project Report entitled **"Multiplexing Based Displaying of Data in a 3D Matrix of LEDs"** submitted at **Jaypee University of Information Technology, Waknaghat, India** is an authentic record of our work carried out under the supervision of Dr. **Naveen Jaglan.** We have not submitted this work elsewhere for any other degree or diploma.



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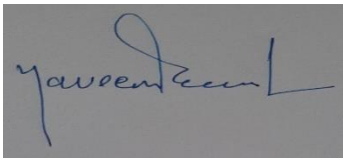
This is to certify that the above statement made by the candidates is correct to the best of my knowledge.



Dr. Naveen Jaglan

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Date: 28/07/2020

ACKNOWLEDGEMENT

We would like to articulate our deep gratitude to our project guide **Dr. Naveen Jaglan**, who has always been source of motivation and firm support for carrying out the project. We express our gratitude to **Dr. Naveen Jaglan**, professor and head of department, electrical & electronics engineering for his invaluable suggestion and constant encouragement all through this work.

We would also like to convey our sincerest gratitude and indebtedness to all other faculty members and staff of department of ELECTRONICS AND COMMUNICATION ENGINEERING of JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, who bestowed their great effort and guidance at appropriate times without which it would have been very difficult on our project work.

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ABSTRACT

Our undertaking comprises of building a 3-dimensional LED array that will have the option to show different designs through the idea of constancy of vision. The array will likewise be touchy to movement in three ways, permitting it to center certain designs to a focused-on crowd through movement identification. There will be a few choices for show including non-directional movements and course engaged illustrations.

1.0 Summary

The Multipurpose Hexahedron is an intractable electric system displayed as a 3-D array of light emitting LED's, which uses three modes of working with the key aim to create visually pleasing images and animations as per the wish of the user. The key aim of our project is to display 3-D images rapidly to create a form of visual illusion which will look like an animation. The two additional mode selection functions that cube carries out are, on "movable" mode, making use of accelerometer in order to emulate the behavior of fluid moving in a container. The listening mode relies on a VU meter to listen to audio and then display light animations according to the audio input given by the user

The key inspiration for our project has been Nature. Animations display core aspect of nature such as rain falling and a snake rattling in the nature are some of the key animations. In the rain animation the LED's lighting sequence make it look like that that rain falls on the floor and disappear. Four LED's light up to create the snake animation. The movement of water is simulated through movable mode. The accelerometer allows to implement this by turning the LED's on and off in a water-like manner as moment is sensed. The ambient sound comes in role as the listening mode responds to it. This is implemented by the VU meter that senses the audio and transmits it to be visualized later into a light show.

Our design of the cube has 512, three-millimeter, LED's with an ultimate dimension of eight square inches and eight by eight by eight LEDs. We are able to design and RGB LED cube with the same dimensions but uses 5mm, four pin, clear Red-Green-Blue LED's. The ultimate design is enclosed in a poly-carbonate sheet that is shatter proof such that viewers can lift it up and move it around to inspect it and use it in a safe environment. Power chord and small switch which controls the different modes of cube are the only two electrical peripherals exposed to the user.

2.0 Description

2.1 Introduction

These intriguing structures built by arranging light emitting diodes (LED) into a cube. Cubes can range from 2x2x2 in dimension to larger ones of 32x32x32 LEDs. These LED cubes leave the user admiring the three-dimensional patterns. Our aim is to bring a new turn to the LED cube and make it an immersive user experience. Creating Unison of technology, the user is able to engage with it, and do more than just be a mere spectator from far.

The idea is to construct an 8x8x8 cube of unicoloured LED. The cubes main function will be to project and display 3-D images by lighting up the LEDs in a format controlled by a microcontroller. Upon finishing of the rudimentary task, more than one functions were added. The 2nd function made the LED Cube's lights imitate fluid in a cube derived on the inputs from an accelero-meter. Third function makes the LED Cube Volume Unit (VU) meter. Success of the prototypes made us add new features to it, leading to construction of a physical RGB cube. The task was to create a link between different technologies give the adequate output, as well as to make the cube itself rugged enough to held and played by with the user,

In, this document we will discuss the development processes for this project. A background in embedded systems will allow the user of this report to fully understand the report.

2.2 Motivation

Having come across various LED cube projects of varying size, and capabilities of 32x32x32 LED cubes. It was decided that this project was interesting and productive if done correctly. The project initially seemed overly simplistic initially and we thought of ways to make it more interesting. The presence of VU meter and color organ found on the audio devices inspired us to apply this feature to our project, making it an interesting piece to put in parties where the colors would react to the music. The idea that the project was programming intensive made it although more appealing to undertake. Finally, this seems like a reasonably fun and flexible project to undertake during our final semester of our degree in technology.

2.3 Objective

The aim is to create an interactive RGB LED cube, enclosed in a clear container this will allow all to pick it and rotate it; also have a cube that reacts to the sound. A single pole triple throw switch would be placed on the front or side of the casing which will enable the user to reorganize the status of the cube's behavior (displaying programmed images, a fluid physics emulator and a sound reactor). Programming the microcontroller was an extremely difficult task of the project. Our team's familiarity with C has made this the main programming language for the project. Selecting and establishing an input method for uploading animation will be also a key task here.

Project was divided into sub goals to achieve this. Initially starting with extensive research on the subject, s including past projects and tutorials, as well as researching possible peripherals. After the research, a prototype of a 3x3x3 LED cube was constructed to test peripherals. The key aim is to understand how the entire process works, giving us foundation to achieve next level goals. The second goal is to understand how the VU meter, accelerometer and LED sink driver works. We have used the 3x3x3 cube to test these devices at an individual level before scaling up to the 8x8x8 cube. Once the final design was working, the PCB diagram was agreed upon and ordered. After finishing the work of the RGB cube, it went through testing to ensure it met all the criterions set at the start.

2.4 Specifications

The system comprises of five key peripherals, first being the LED cube which would display the output from the device which would sense. The lighting up of LED depends upon the calculation from inputs. The embedded electronics such as microcontroller and IC units along with SPTT form the second core component that will provide with computation. The other three component deal with input in the system. they are the image-code, the VU meter and the accelerometer. Figure 2.1 Illustrates using a block diagram how components relate to each other as a coherent unit.

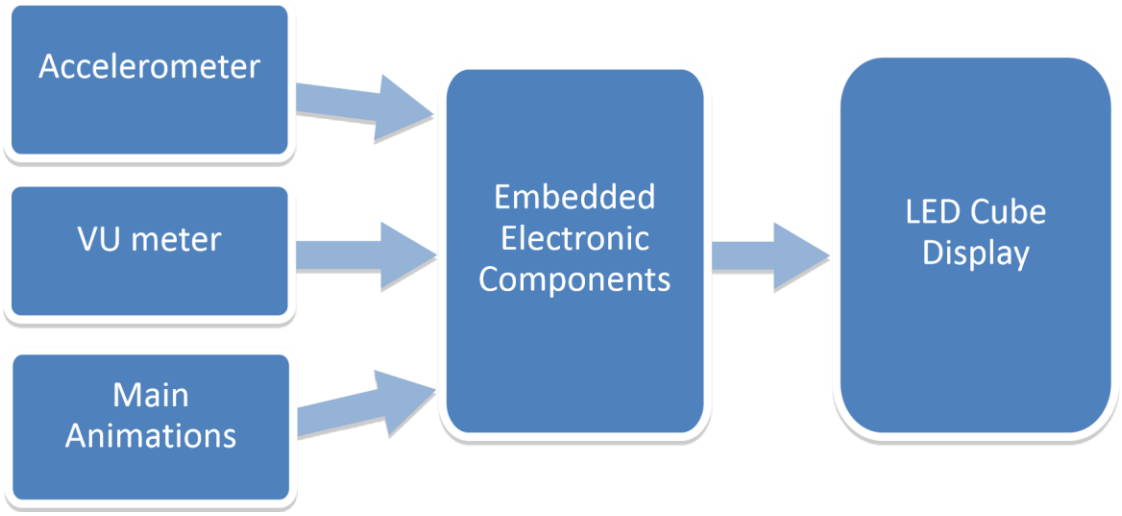

Figure 2.1: Block Diagram of the System

The next four subsections deal with main specifications for the led cube.

2.4.1 Physical Requirements

The physical dimension of the cube are as follows:

- Five sides with 512 LEDs in total.
- Blue LED will be used.
- Weight around 10lbs.
- Glass case will be used to store it.
- Switch will be there for the user.

2.4.2 Environmental Requirements

The environmental dimension of the cube are as follows:

- Dry indoor dark place will be required.
- Stand should absorb the vibration caused by music.
- Acceleration should be sensed.
- Capability to sense sound.

2.4.3 Hardware Requirements

The hardware dimension of the cube are as follows:

- Peripherals must work off on 5Volt DC or less
- Must be accompanied with an on/off switch
- Approach to change the state of LED Cube to one of the three. Model of creating a communication with the PC
- Microphones of reliable quality to register sound
- A peripheral to measure the movement
- LEDS with high luminous intensity.

2.4.4 Software Requirements

The software dimension of the cube are as follows:

- Software should not exceed the memory on the microcontroller
- Have three states in which will be given at any time to the LED cube.
- Software Code will be written in C programming language
- Capable of being uploaded through a FTDI USB connection

3.0 Literature Review & Research

3.1 Helping Prototypes

In this time and age, new ideas that solve unique problems are hard to come by leading to different approaches to the same solution. For instance, the LED solid shape has been over and again finished with a wide range of instructional exercises discovered on the web. So as to dazzle, the solid shapes are made bigger and increasingly beautiful utilizing an ever-increasing number of complex calculations. Scarcely any individuals have tried to pass and striving to accomplish variations in the LED 3D structure and shape, focusing on simply making it a visual more appealing. A team has realized the design with an accelerometer and an alternate team utilized a volume unit (VU) meter. In our project we have created an assimilation of best of both projects into one. In the following sections we talk about the teams' undertakings, alongside some others that have added to our plan. The thought is by gaining from past endeavors and disappointments the group can encourage the production of a unique LED 3D shape with different capacities, something that has not yet been published online or any medium as of now.

3.1.1 LED Cube 8x8x8 Instructables

The primary platform that we referred to during our examination was instructables.com. The website gave an extremely exhaustive bit by bit guidance set to fabricate a LED block. From social affair of the materials required, to hypothesis of activity and nitty gritty procedure of completion of each progression, the platform proved to be an incredible resource for gathering information as we had the option to increase and widen our understanding regarding the matter. As per the venture creator, the assemble took around four days to construct the block, and additional four to five days were devoted exclusively on the development of code that would control the LEDs.

The author of the original project suggested few prerequisite skills to undertake the project which include basic understanding of soldering, electronics and embedded systems, coding/programming skills, and few others. The author also strongly suggested to not undertake this as the first embedded systems project due to the complexity in programming and construction of the cube (complicated soldering). Nevertheless, in light of the composure and aptitude of our team towards both programming and electronics this task did not seem unfathomable, but still would be difficult.

For one to familiarize themselves with the cube the building blocks that make up the cube must be understood. One should initially understand the construction on an elementary level, that would be an LED. The author divides the cube into smaller and smaller structures from slices or layers to columns to LEDs. In every layer the cathodes of all the member LEDs are connected together by soldering them on a jig. Similarly, the anodes of all the LEDs in a column are connected together using soldering. This type of construction will allow the ability to control all 512 LEDs on the 8x8x8 cube by the use of multiplexing. All 64 anodes of all the columns are connected to the main bord to independently while also connecting the 8 layers of the cube to the current sinks.

The creator of this project utilizes the transistors and MOSFETS switching circuit in the mainboard to control the voltage and thereby the flow of current to one specific layer or LED; to deliver the 3D picture, the transistor from the present layer must be killed, the picture for the following layer must be changed, lastly the transistor for the following layer must be turned on.

The cube is constructed of 8 layers and 64 columns giving a total of 512 LEDs. To control all 512 LEDs a total of 512 IO ports would be required even in this modern day a development board with these many IO ports is not available so the technique used to control all 512 LED is Multiplexing. As previously explained, we had 64 columns and 8 layers by using multiplexing we can address all 512 LEDs using just 72 data lines. Using multiplexing the layers and columns are switched on and off at a very high rate taking advantage of the modern shift registers and clock speeds leading to an effect called persistence of vision. Persistence of vision means our human eye sees or perceives an LED to be switched on for a fraction of a second even though it is turned off. By taking advantage of this phenomena we can present an LED to be continuously switched on while it is in reality being switched on and off at a very fast rate. This also reduces the total current consumption of the cube as only a few Leis are turned on at a particular time allowing us to Overdrive the LED fast there specified continuous current and even at times past their allowed peak current.

The following table (table 3.1) lists the number of anodes and cathodes required for the number of elements on the cube side for example we are currently discussing about an 8-element cube which results in a total number of 512 LEDs with 64 cathodes and 8 anodes. The total number of inputs required to control all the individual LEDs.

	(x^2)	(x)	(x^2+x)
Cube size	**Anodes**	**Cathodes**	**Total**
2	4	2	6
3	9	3	12
4	16	4	20
5	25	5	30
6	36	6	42
7	49	7	56
8	64	8	72
9	81	9	90
10	100	10	110
11	121	11	132
12	144	12	156
13	169	13	182
14	196	14	210
15	225	15	240
16	256	16	272

Table 3.1: Cube size table

As observed from the previous table we can see the total number of required inputs to control a cube with n elements increases exponentially. This has played an important factor for choosing to construct an 8x8x8. To be able to represent a figure in 3D a large number of pixels or LED is required. Choosing to construct a cube with a larger edge size would have exponentially increased the cost, time required for construction, complexity and the total number of input and output ports.

Another significant parameter that would affect the size of the cube is the total consumable current. The following table (Table 3.2) lists the amount of current that would be required to light up all the LED simultaneously. Please note these are numbers for a layer not the entire cube. to obtain the current that will be consumed in the entire cube multiply the current with the number of layers. For instance, in an 8 by 8 by 8 cube there are 64 led is in a level or layer so the total current consumption of a layer would be 640mA (at 10mA each) and 5.1 ampere if lighting the entire cube at once. The peak current that is required to overdrive the LED is substantially higher which would lead to an even higher current consumption or reduce peak brightness.:

Cube size	Leds per layer	Total mA at X mA per LED	
		10mA	20mA
2	4	40	80
3	9	90	180
4	16	160	320
5	25	250	500
6	36	360	720
7	49	490	980
8	64	640	1,280
9	81	810	1,620
10	100	1,000	2,000
11	121	1,210	2,420
12	144	1,440	2,880
13	169	1,690	3,380
14	196	1,960	3,920
15	225	2,250	4,500
16	256	2,560	5,120

Table3.2: Power Requirements for different cube sizes.

Please note the above table (Table 3.2) denotes the current consumption only for or a specific geometry, i.e. a cube.

The next order of business would be a selection of a microcontroller. as stated, before a microcontroller which has 512 input output pins to control each LED individually does not exist and if it does it is not feasible for cost. So, show the technique that has been used is multiplexing using 8-bit shift registers or latches (74HC587). This bank of shift registers (eight total) takes 11 Input and spits out 64 output lines for each column. This architecture is the primary candidate for selection to be used in our project is illustrated in the below schematic.

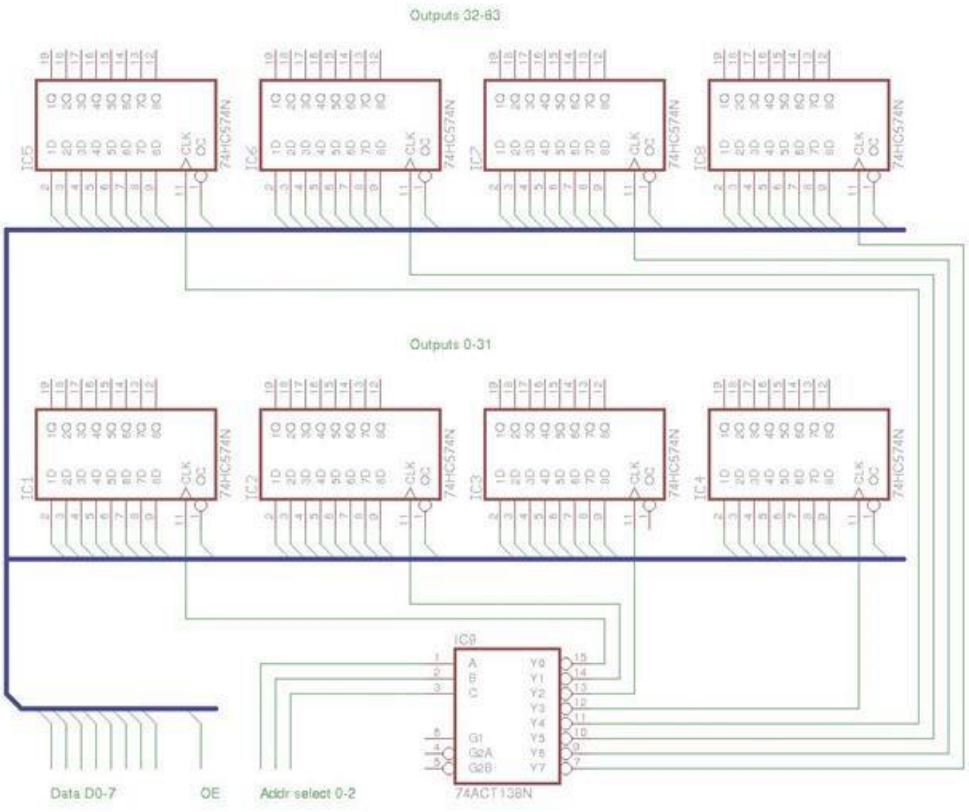

Figure 3.1: Schematic for 3-to-8 decoder and latches used to control

In the past figure, the life structures of the circuit are spread out. The yields of the 3to-8 decoder associate with the clock of each lock. Each lock will fill in as a sort of straightforward memory for the 3D square, holding 8 bits of data which are to be spoken to on the yield pins. Additionally, the contributions for the entirety of the locks are associated together utilizing a transport.

The author of the tutorial proceeds to explain his thought process behind choosing each of the components that comprise other parts of the project. He mentions the importance of choosing an adequate power supply that could supply the required current without hampering the functionality of the cube, size of the light emitting diodes which would be the pixels of the 3D display. He further sheds light on the importance of choosing the right component as it might affect the final outcome. He also mentions that factors like runtime, final application, etc. must be considered so that components with sufficient mean time to failure are chosen.

The following not many areas of the creator's undertaking are about the genuine structure of the 3D shape, actualizing the product to show the LED movements, lastly assembling everything to wind up with the completely useful solid shape. Generally, the development of the genuine 3D square truly boils down to a great deal of tolerance, and a consistent hand.

So as to make a stylishly satisfying LED 3D square, the creator recommends that it is of most extreme significance for it to be entirely balanced; that is, each light discharging diode should confront a similar way, and both the cathode and anode legs of each drove must be generally a similar length with the goal that the last item comes out as a nearly symmetric block. This can be accomplished by utilizing a transitory fastening rig.

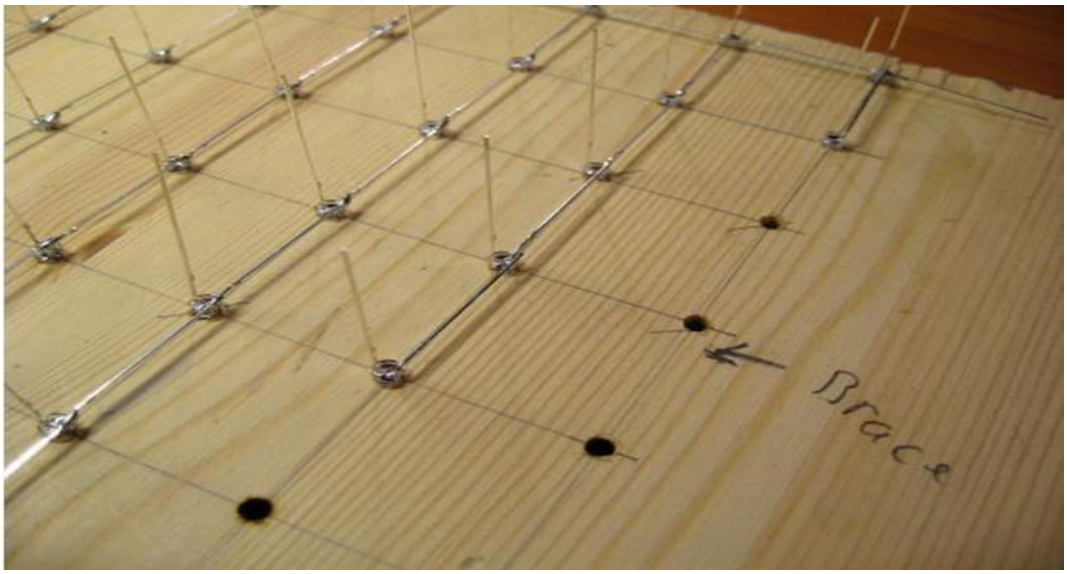

Figure 3.2: Using a piece of wood as a soldering jig for the LED cube.

As seen in the above figure stencil is made out of wood. wood being readily available and easy to manipulate is the best contender for this task. Square mesh was marked with pencil with each side being equal to the length of the anode. hole drilled at the intersection of the rows and columns resulting in a perfect square shape. The diameter of the holes is equal to the diameter of the LEDs which allows them to be kept in place perfectly without moving and allows soldering without any motion hassle of folding in place.

After the completion of all the layers they were attached to each other using a similar jig made out of wood and also attached to other circuit components temporally allowing the ability to test the construction. The cube was tested using a preliminary code written in C. The compiler used was an open source AVR GCC compiler.

As indicated by the creator, it is truly fitting to initially begin a little scope model before really captivating in the full undertaking. The creator worked in developing a 4x4x4 measurements solid shape so as to completely get a handle on the idea driving it, and figure out the genuine task that was to come. Our gathering has gone to the choice of following a similar arrangement of work. In this manner, we will start by developing a 3x3x3 LED 3D shape. Along these lines it will be conceivable to get acquainted with the

inward activities of the block, just as create experiments to use in the full undertaking, and furthermore to execute accelerometer and UV usefulness with this littler model.

3.1.2 University of Portland

A team from University of Portland design an LED cube allowing it to take motion feedback. their aim was to incorporate fluid like motion in the cube so that it mimics a cube of water presenting a mesmerizing effect. They incorporated a microelectromechanical system (MEMS) device. It was a 3 Axis accelerometer which good sense acceleration from 3G to 11g in either of the three Axes. The MEMS device used was the MMA7341L 3-Axis accelerometer.

The main microcontroller of the cube is similar to almost all other projects found online. it was an Arduino Duemilanove. in our construction we aim to use a different microcontroller which has a higher memory, slightly higher clock speed and much more RAM. the criteria of choosing the correct microcontroller is discussed later in the report. The fact that this microcontroller is found so often and project like this has shed some light on qualities that you must consider while selecting a microcontroller for our project. for instance, the accelerometer and the VU meter produce an analogue output so we require and analogue to digital converter to Interface the provided data with our Digital circuit. The importance of bit depth or resolution in addition to the fact that we might need more than one analogue channel is also a good criterion while selecting the microcontroller.

The fact that very a smaller number of components were used in the construction of the project is also very fascinating. Most of the work of electronic components has been supplemented by heavily using multiplexing and other techniques like decoding and encoding. The largest the higher the number after register and other junction components being used. An in-depth analysis of the project revealed that custom tips for integrated circuits were used to minimize component count reduced by the MOSIS foundry

The control unit for their undertaking propelled us to make a comparative model. This group utilized the Arduino improvement board as referenced previously. This necessary the 3D square to have numerous associations one after another. The Multifunctional

Hexahedron will have a decreased number of outer associations, in a perfect world one only for power. This undertaking is one of the better ones discovered on the web yet the utilization of LED drivers may have been a superior alternative, which is the thing that we considered. This filled in as an extraordinary bouncing off point and we trust our task is an improvement to this undertaking.

3.1.3 Pocket LED Cube

This particular approach established the foundation for the construction of IR LED. this led cube of 3x3x3 dimension Was used to generate a comprehensive understanding of the functionality and the working of the LED cube so that we can incorporate and implement it in our design.

This LED cube was built using the commercially available ladyada's MiniPOV Version 3 kit, which contained red LEDs (8 in number), a factory programmed microcontroller, a serial port connector and an AA battery case. The cat is design to construct a row of LEDs which can be programmed to glow in any order. the team modify the layout and code for this application.

They start by fastening the LED's all together utilizing a square of wood with the format of the 9 LED's in each level. They drill the 9 holes and spot the LEDs inside them topsy turvy with the goal that they can mastermind the cathode and anode legs to the ideal format. They start the fastening of the legs until they have one strong layer of LED's. They rehash the above stages multiple times until they have three layers of 9 LED's. From here they patch the entirety of the layers together to have the completed LED 3D square, portrayed in Figure 3.3 underneath.

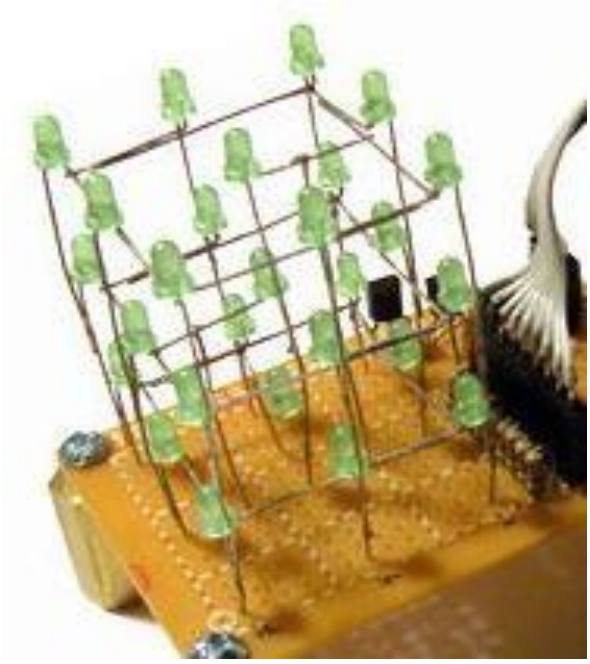

Figure 3.3: 3x3x3 LED cube.

3.1.4 RGB LED Cube

while reviewing the online tutorials Mini volume unit meter projects that used LED were found. one such project was found on craigandheather.net. The team had designed for element LED cube with RGB LEDs. the team has shared the complete schematics of the project and identify the components that were used so that recreation is easy. they have used a condenser microphone and an operational amplifier to increase input gain. the input of the microphone is segregated into 7 different frequency bands using a seven-brand graphic equalizer. The main controller was an Arduino UNO. the creators did not specify any unique reasons for choosing this particular microcontroller.

The reason the design was unique was the Graphic analyzer which separated the input audio signal into 7 different plants eliminating the need of analogue to digital converters. the total expense that had occurred for the construction of the project has not been discussed. From this design we have also incorporated the fact that the creator used a PCB to eliminate the need for wires and entangled mess.

The shortcoming of the project was the way an individual led reacted to the input signal the creator had not use the prebuilt Arduino libraries.

3.2 Research on Components & Technology

After studying the process and learning things about building the cube. Now we had to gather and index our knowledge and start making the cube. Now the whole concern was to study and select the best components that fit our project and give us desirable outcome. For that we deeply studied and researched about them and including different varients of the same components. After selecting and finalizing the components we ordered them accordingly, so that work can be started as early as possible. This below segment is all about the parts 0considered for the project.

3.2.1 Embedded Processor

The most important part of the 3D LED project is the processor used as it acts like the cerebrum of the project. Out of the vast variety of microprocessors available on the internet we decided to check some and make our decision. We also kept in mind while choosing our component which will fullfill our desired goals as discussed above in Section 3.1. Principle focal point of the installed processor were Streak memory, pin check, working recurrence, simple to advanced change capacities and cost.

ATmega64A4U

Microcontroller decided to use in our project was ATmega64A4U. Perfect controller for the 3D LED with low-power utilization, decreasing warmth creation. Perfect to fullfill our needs with Xtreme execution 8-piece preparing, additionally containing a max throttle USB gadget interface.

Most project requirements utilized 16 - 32 Kbytes memory. Since the controller will house the source code for three unique capacities the chose microcontroller has 64 Kbytes, twofold the sum. It is conjectured that a lot of content will be put away contrasted with past undertakings. Along these lines, this sum should give us some space for squirm room. It is hazy if this will be adequate memory until preliminaries are performed. additionally, if time grants and more highlights are included, this will imply that the memory should increment.

The ATmega has simple to computerized change abilities which will be of incredible assistance. The accelerometer and VU meter we intend to work with produce simple signs. The goal is to work with advanced signs to speak with the LED drivers. This will set aside us time and cash, since we no longer need to come to fruition with different methods for changing over the simple signs. The ATmega has 12 ADC channels. The This was picked more than 4 or 8 channels since various simple gadgets will be associated and it is uncertain what number of ports with will take up. A more prominent number was picked as a precautionary measure. Likewise, the inspecting rate for the ATmega's ADC is 2000 ksps which is multiple times more than that of the plain ATmega.

The measure of broadly useful information/yield pins (GPIO) was of concern. The picked controller has 44 pins, which ought to be all that could possibly be needed. In light of research, around 32 pins should work fine. By and by, a bigger sum was chosen out of precautionary measure. Our structure plan starting at now is to actualize sequential information contribution to the LED sink drivers. this will decrease the quantity of pins utilized in general, yet just on the off chance that something goes amiss. The alternative to multiplex numerous pin yields is as yet accessible.

Two alternatives of correspondence between PCs are given the ATxmega. The all-inclusive offbeat collector/transmitter (USART) and 2.0 widespread sequential transport interface (USB). One of these strategies will be utilized to transfer program code to the controller. Additionally, the USART and sequential fringe interface (SPI) can both be utilized to send bits sequentially to the LED drivers.

3.2.2 Accelerometer

Exceptionally valuable little contraptions that give a wide range of uses are accelerometers. They are used to detect both static and dynamic quickening. The LED Cube that the group has constructed will take into consideration a "mobile" mode, where the real 3D shape is dealt with and tilted by the person, making the solid shape show a passing on water-like effect. Such effect couldn't be achieved in a more effective way than with the utilization of an accelerometer.

Like different segments utilized in the undertaking, there are a few elements to talk about while thinking about which sort of accelerometer to utilize. Above all else, a choice must be made between a simple or advanced accelerometer, which has been dictated by the idea of the undertaking's equipment. Additionally, different particulars have been taken in thought, for example, number of tomahawks, most extreme swing, and affectability.

The point of the group, as expressed in the undertaking targets, was to have usefulness for the 3D cube to show a water-like impact. This infers the solid shape will be dependent upon 3 D developments, just as inclining the 3D square along the x, y, and z tomahawks. There exists an opportunity for the gathering to actualize three-dimensional usefulness, which implies that the 3D shape will be liable to incline on each of the 3 tomahawks and topsy turvy revolution. The gathering took in thought this usefulness, and it will be actualized in the last plan. The gathering additionally talked about the opportunities for spinner usefulness for significantly progressively reasonable and passing on development impacts. Be that as it may, because of time imperatives, spinner usefulness was not taken in thought for the last structure.

3.2.3 VU Meter

The other condition for the last plan was that majority of the activities depended on music. The first step is to understand how the connection will be established Our aim is that LEDs will imitate show in a radio. The product segment will help address precision in the video presentation. The next stage takes an inside in segments that form connection. There are two approaches to go about role of the VU meter. We will utilize a sound jack and a music-player as information to utilize sound. Along these lines, we chose to utilize encompassing sound as our contribution to expand the mobility required in the task details.

For the input of the sound track through sound jack music will be played through a music player for e.g., iPod. The sound system information would require two separate circuits to separate the various frequencies or use coupling capacitors to incorporate the sound system sign to mono info. The plan didn't require high solid devotion to work; along these lines, the mono information would have been executed for disentanglement purposes. After the sign was separated, it was sent to the microchip. In the sound jack choice, less electronic segments were expected to actualize the VU meter circuit and the information would be entirely dependable at the same time, we would have required an outside gadget to play the music and sound line append to the undertaking. It would diminish one of the fundamental particulars, which is the mobility of the venture. The other choice was to actualize the encompassing sound. A receiver joined to the circuit barricade would pick the sound wave and impart the sign to an operational intensifier. Again, the sign would go to an incorporated circuit to be separated into various frequencies lastly be sent to the chip. With this alternative, the venture would respond to commotion in the encompassing region and any sort of music played, with the drawback being that a sound player and speakers are expected to play music. Accordingly, we chose to utilize surrounding sound as the contribution to our vu meter to expand the mobility prerequisites in the task's particulars.

MSGEQ7

The UV is a seven-band produce by Mixed Signal Integration. This circuit take the sound sign and partitions the sound into recurrence of 63Hz, 160Hz, 400Hz, 1KHz, 2.5KHz, 6.25KHz, and 16KHz. These circuit is anything but difficult to actualize in light of the fact that just require four coupling and decoupling capacitor and two protections.

The low force utilization makes it perfect for the project since we are going to use an extremely low force flexibly. Additionally, the voltage activity is perfect since it tends to execute with different segments. The serious issue of this coordinated circuit is that just give seven band recurrence and the solid shape have eight layers. The issue can be resolve by continually illuminating the base layer or just let the 3D shape respond just from layer one to layer seven. An official choice will examine in the product segment. Another issue to mull over is the mistakes that may happen while acquiring information from any simple gadget. In any case, the Figure 3.4 gives a period graph and help to comprehension of how the MSEQ7 functions. First, we need to impart a sign to reset; at that point a sign for the strobe. At last, after the strobe signal goes low, the yield sign can be perused. The strobe and reset info can be given by the microchip, and the yield goes straight forwardly back to the chip. Accordingly, just three associations are requiring between the chip and the microchip. Realizing those defers will radically decrease the opportunity to go into mistake code.

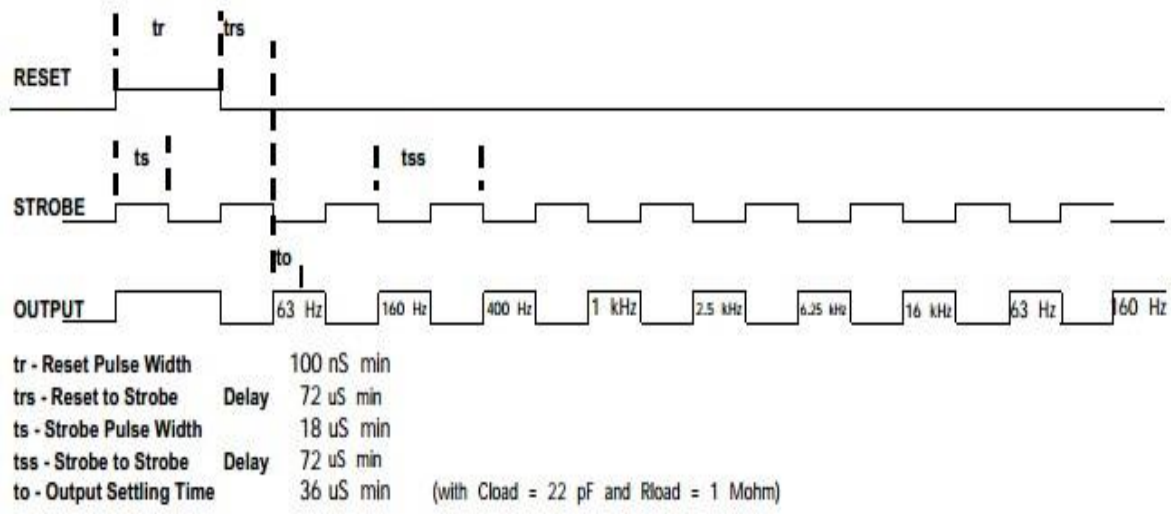

Figure 3.4: Strobe Timing Diagram for MSGEQ

3.2.4 Power Supply

Another electrical segment that is absolutely critical for the achievement of this undertaking is the force flexibly. During the examination phase of the task, three choices for the force gracefully were thought of: a battery-powered battery, a divider mole power flexibly, and a USB port. Inside the bounds of this segment, numerous variables that prompted the determination of an appropriate force gracefully will be talked about. The structure detail of our venture expresses that the 3D square will be required to be versatile, and furthermore have the option to oppose sudden developments. For 3D model to be in working state, the usage of reasonable electronic parts from various sources and voltage ranges are required. The LEDs that were picked for the project each require 3.4V and 20 mA. Entire 3D LED cube consist of 512 LEDs. Thusly, in the event that one was to turn on all LEDs simultaneously, amperage of 10.24 Amp will be required, remembering this is just from the LEDs, and not including the staying electrical segments of the circuit. Generally, the circuit could go from 20 mA to in excess of 11 Amp in a matter of milliseconds, and along these lines the chip will be liable to harm. This is the place the guideline of determination of vision becomes an integral factor, as just a given layer of the 3D shape will be turned on at some random time. The chip, ATmega1284 has a general working force flexibly voltage from 1.6 V to 3.6 V.

The accelerometer has a working voltage run from 3 to 5 V and most extreme current of 2 mA. The realistic equalizer has a working voltage go from 3.3 to 5 V and greatest current of 1 mA. However, the structure will require under 5 Volts and under 1 Amp.

The primary alternative is to utilize three AA batteries. Another idea was to utilize a battery-powered nickel–metal hydride battery (NiMH) with 1.5 V and 2500 mAh or a 9 V and 1200 mAh lithium batteries. The two choices can be in the PCB and will make the last plan free. This alternative is reasonable and extremely simple to execute. There will be no swell in the voltage and a modest direct controller can be utilized. On the off chance that AA batteries are utilized, at that point it should be revived or supplanted following 2 hours of utilization. The subsequent choice is to utilize divider mole power flexibly. For this situation we should utilize a stage down transformer, a rectifier, and channel. This alternative gives a higher force at the same time, the yield will have a wave voltage. This alternative is of comfort, in light of the fact that the voltage controller can be outside and distant from the chip and not add additional warmth to the circuit. PC USB port was the last choice to use as the force gracefully. The USB 2.0 particulars give a solid and stable force gracefully. The drawbacks of this choice are the reasonableness and lower convey power. USB have a shut voltage go from 4.4 to 5.25 V and a most extreme high-power current to 500 mA and the force that can be attracted to a limit of 2.25 Watt. In this way, blend of divider and USB alternative was picked to control up our venture. It will have USB connector mount to the PCB. It will give us the alternative to gracefully control from a PC or divider mole with a USB port.

3.2.5 Voltage Regulator

The choice for a particular application can be controlled by assessing every segment independently. Table 3.3 has the parameters to be consider for the choice. The complete max current is 393 mA. The basic voltage point for all the diverse part is 3.3 to 3.6. The select voltage activity will be 3.4V on the grounds that we don't need get excessively shut to the maximum activity purpose of the microchip. Additionally, the others parts don't need to work up to the maximum limit; moreover, 3.4 volts is in the LED's activity point. The USB flexibly voltage is 5V. The controller should sink 1.6 volts which is the 32% of the info. The kind of information voltage will shift from a from a PC or divider mole. For the exactness necessity, the voltage controller can go down to 3.3 volts or 9.7% and up to 3.6 volts or 10.59%. The calm current isn't an issue in the structure on the grounds that not battery will be utilized. The last venture doesn't require exceptional component, for example, low force shut down or converse info assurance in light of the fact that there is just a single method to associate a USB port and consistently will be associated.

	Part number	**Voltage range**	**Max load current**
Microprocessor	ATxmega128D4	1..8 to 5.5 V	200 mA
LED driver	TLC5940NT	3 to 5.5 V	120 mA
Accelerometer	DE-ACCM5G	3 to 5 V	2 mA
Op-Amp	LM324N	3 to 30 V	50 mA
VU meter	MSEQ7	3.3 to 5 V	1 mA
LED's	3mm	3.2 to 3.4	20 mA

Table 3.3: Voltage and current operations

A direct customary is the best alternative on the grounds that is the more monetarily reasonable. Additionally, the plan can have proximally 10% resilience and straight controller is inside five percent resistance the controller will be acclimated to gracefully a yield of 3.4 volts by choosing the ground to yield leg opposition of 1kilo ohm and ground leg to ground of 2.4 kilo ohms.

3.2.6 Sink Drivers

TLC5940

The TLC5940 has 16 channels, which contain an independently flexible 4096step dim scale PWM splendor control just as a 64-advance steady current sink, which modifies varieties in the splendor between LED channels just as other LED drivers. These capacities are both controlled and available by means of the sequential interphase. Interfacing one resistor sets the most extreme measure of current for the entirety of the 16 channels. In light of figuring's of different groups who have built up an eight by eight by eight LED 3D shape, the required gracefully voltage went from 3 volts, if simply utilizing the customized movement, to 5 volts if running the 3D square while synchronous utilizing the USB to sequential converter. The scope of providing voltage permitted by this LED driver was anyplace between 3 to a limit of 5.5 volts, which implies this LED driver fell inside the required parameters to work this LED 3D shape.

The Arduino sheets bolster the libraries of the TLC5940, which encouraged the coding and working procedure of the program. Using the TLC5940 library we had the option to encourage the way toward programming the Grayscale PWM brilliance activity, which permitted us to slowly control the splendor of the LEDS giving us a smooth eye-getting visual of the LED lights

3.2.7 Latches and De-multiplexers

Concerning controlling the 8x8x8 LED 3D square, it was essential to stretch the way that the entire 3D square required 72 IO lines to work: 64 for every section, and 8 for each layer. This was an issue in light of the fact that there are no microcontrollers with a DIP bundle that have that numerous IO lines accessible for use. While examining past ventures, there were two or three recommendations with respect to the answer for this issue, one of them being the utilization of locks or de-multiplexers.

It was to the greatest advantage of the gathering to examine these segments, and weight the points of interest and disservices that they give when contrasted with the option of utilizing LED drivers.

74HC574 8-bit Latch

It highlights separate D-type contributions for each flip-lemon and 3-state yields for transport arranged applications. in this This specific kind of lock is utilized in the projects that was noticed during our research work, for the exploration part of this record, and way data in regards to the contributions of this chip can be found at this area. Extra highlights and advantages of the 74HC574 include:

- ESD insurance
- Specified from −40 °C to +85 °C and from −40 °C to +125 °C

On the off chance that locks are to be actualized in the last structure, they will end up being helpful, as they can fill in as a sort of basic memory. The hook can hold 8 bits of data, and these 8-bits are spoken to on the yield pins. So as to recollect and stack the on/off conditions of 64 LEDs, 8 hooks will be required.

Be that as it may, the LED drivers are an ideal arrangement rather than the 74HC574 8-piece hooks. On the off chance that the gathering chose to utilize these locks in the last usage, an array of 8 hooks will be required. Be that as it may, utilizing the LED drivers, for example, the STP16CP, just 5 of these drivers will be required, in this way lessening the expense of materials and having a productive and increasingly dependable set-up with less segments.

74HC138 3-to-8 Line Decoder/De-multiplexer

An issue emerged, where 8 IO were in command of controlling the CP line for every 1 of the 8 hooks. Answer we found was to use 3-to-8 Line decoder/de-multiplexer. The 74HC138. A portion of the highlights and advantages of the 74HC138 include:

- Capability of De-multiplexing
- Memory chip select encoding
- Active LOW totally unrelated yields

This specific circuit has 3 info lines and 8 yield lines, which is advantageous for a LED 3D shape of size 8. The info lines can be utilized to control which of the 8 yield lines will be low whenever, while the rest are high. Every one of the 8 yields will compare to every one of the 8 hooks. Since this segment is utilized related to the hooks, it won't be a piece of the gathering's last usage, as the gathering will select the LED driver arrangement. In any case, these segments gave extraordinary knowledge into the elective arrangements that can be applied to accomplish the venture's destination

3.2.8 RGB Light Emitting Diode

RGB LEDs are light emitting diodes, much the same as the single-shading LEDs, they are capable of indicating an array of hues by mixing the 4 essential conditions of this LED. The hues red, green, blue, and white are the primary methods of this LED. There are various sizes available of these LEDs according to our work, we will be using 5mm diffused RGB LED's. Figure 3.5, describes the structure of the RGB LED, which will be explained in the passage below.

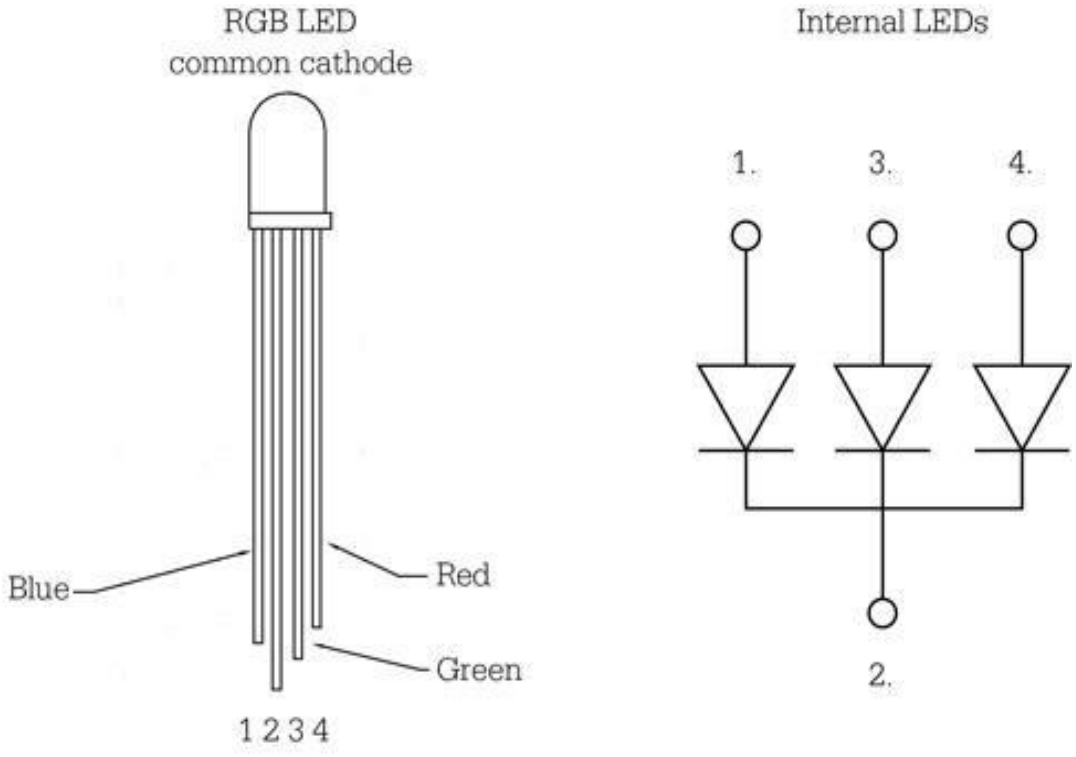

Figure 3.5: Diagram of RGB LED

The RGB LEDs is totally different single-shading LEDs. 4 leg LED were used in this project. Out of four three of these legs are anodes controlling each shading Red, Green, Blue, whereas the fourth leg, the longest of all is the cathode. Working of both type of LEDs is totally different in every aspect. Taking care of a current through the chose shading anode leg is in the controls of shading lights. The thing that matters is in the variety of hues. On the off chance that current is provided to more than each shading anode in turn, the LED will light the two hues and make a blend of hues. This considers dissemination of shading to occur, this is hard to achieve with single-shading LEDS. Delivering similar measure of current results in bringing about a white light, which isn't normal, and more than likely won't be utilized in this project. Drawing up

excessive current may result in heating of the circuit and eventually there will be ride in temperature of the cube, which will adversely affect our cube.

Using the RGB LEDs in this project will give the group a bit of freedom and scope of over utilizing the single-shading LEDs. The capability of creating pictures and examples on the solid shape in different changing patterns will greatly affect the perception over the single-shading LEDs. Another bit of scope of utilizing RGB LEDs over the single shading is the chances group will get to use their animation and use animation and display it on cube.

3.2.9 Switches

The kind of switch needed is of some significance to the general task and in this manner vital in this structure report. The present arrangement of having three modes in the 3D square. Installing a touch screen to control was also thought about. But wasn't accepted because of the cost and other technical issues. Therefore, a basic switch with three phase selectors was chosen to install in the project. The mode determination will be founded on the pin number accepting current on the small-scale controller. The moving the change to one of three positions will guide current to said pin, changing the condition of the machine. The Amico 3 Position SP3T 1P3T PCB Mount Slide Switch Right Angle 4 Pin switch was chosen because of its effortlessness and modest expense. Drawback of the part being modest, is the delivery time takes a little while

3.3 Architecture

The square graph found in Figure 3.6, nearly exhibits how the whole framework can be distributed into three significant segments; sensing, processing, and display. The below figure also outlines the parts in every subsystem and how they interface. Every one of the three significant segments are comprised of numerous parts Now that the segments have been chosen, this segment will additionally examine the instruments and clarify their connections with each other. Both the equipment & programming viewpoints will be secured.

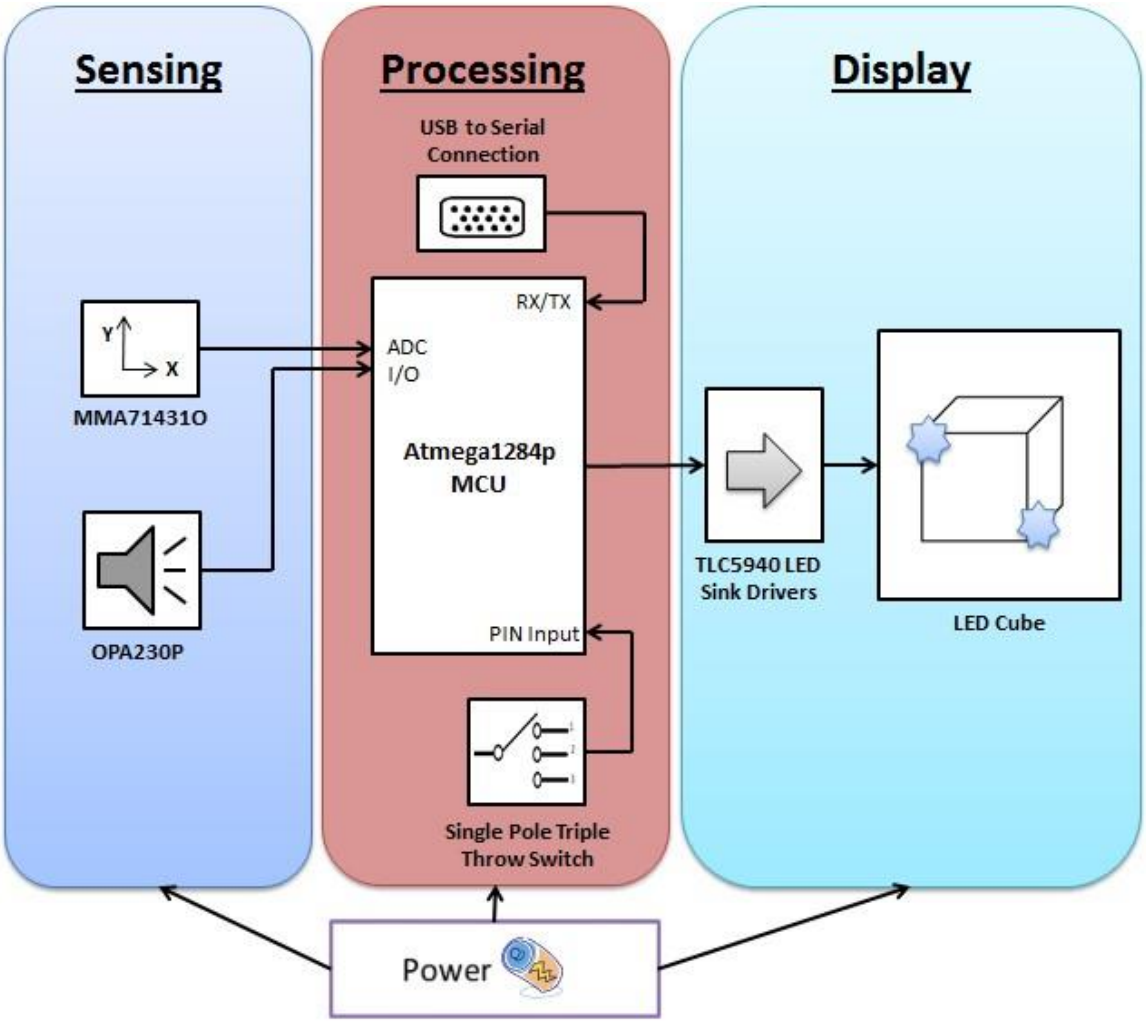

Figure 3.6: Subsystem block diagram

3.3.1 Hardware Architecture

Displaying smaller parts of a system

The most straightforward smaller one shall need to be the main thing to display to the user. The ppt will provide the delivery of the cinematic scene that is determined by the handling smaller function system that is part of a larger system. Parts being used to made up the screen that will display the data is the emitting diodes and driver of light emitting diodes, 500 light emitting diode and 4 light emitting diodes software's to be more accurate so that result produced will be good.

The 3-Dimensional square figures shall be made by 8 layers of light emitting diode sheet, each sheet being 8 light emitting diodes in width and length. The finished item will be check for security from the clients. The Cube is held together through the light emitting diodes themselves by utilizing the anode and cathode legs as help through fastening them together. Patching is going to be work escalated as we shall be having a no greater than 600 welding focuses. The Layer and the cathode leg are bowed for 64 light emitting diodes and are being focused to made an eight*eight net in which each bulb is associated. The layer would at that particular time is going to have 64 anode legs that should be utilize to interact between the layers by placing them onto one another like in the form of stack. It is going to make 64 sections of bulbs that are assigned with the cathode leg. While doing this step, it is necessary to keep have sufficient amount of gap between the bulbs to have a sight of the light emitting diodes through the figure. Very far placed or near to each other, taking direction from 3d graphics. Additionally, using the broken piece could be used until the 3D four sided is developed is of high trouble, that was a reason for testing each individual light emitting diodes before diffusion is essential. Eight individual wires will be utilized to give current to each layer. With the 64 cathode slots and 8 anode layers, the block is going to be treated as a 2-d array in the code, when turning on a bulb, it would basically be calling cubes [layer] [column].

The 72 associations are going to the light emitting diode sink drivers. Its driver is going to have 16 yields in that manner just requiring 5 of these parts. 4 of them will come to control the cathode segment and is going to have layer shuffled. Drivers is going to set alone the physical circuit board and would definitely offer one with the handling subsystem. Various types will impart a particular place to the drivers such as the capacitors transistors and resistors. Extraordinary course is not required as it seems out sorting would do the trick.

Processing Sub-system

That part of a particular system will take in account the contribution provided by that system and gives a particular detail to showcase about its system. That was the place where the data was handled taking the use of ATmega1284. The design of this framework containing of the ATmega1284 microcontroller, MAX232 IC unit and the Amico 3 position SP3T switch parts. The objective was to put each one of those segments on the physical circuit board that was required the physical circuit board will be taken away in a particular holder that is made up of plastic with switch that is present.

The microcontroller data would be as much as the pressure is particularly applied. the things that would be not accepted and the things that would be registered will only depend upon one of the three pins that the microcontrollers were a supporting voltage at the particular time that was determined. the sleeping between the modes that are present in the event in a fair manner in a straight method such that large part of the people with no knowledge about a particular switch and then they can mark that's which to use to gain its capability to use.

PC and cut will coordinate with each other in a manner through max232 IC unit A RS-232 link should be taken into account to interact with the max232, which changes as the RX, TX, CTS and RTS is going to tell the ATmega1284. That way our code will be transferred to cut. The ATmega1284 shall be edited in the C language. As noted, for all intents and purposes each segment will be associated with the uC, along these lines making it significant that a best number of pins are accessible. This likewise remembers the parts for the detecting subsystem.

Sensed Sub-System

That subsystem takes Information that would depend upon its environmental factors and is going to deliver a yield that is sent to prepare a system that is a part of a particular system. This would react to the noise and the movement depending upon the user's activity Framework would involve the two parts one would be the accelerometer and the second would be the voltage unit meter

The DE-ACCM two-pivot accelerometer will be utilized to record development of the 3D square. It produces two simple yields for the X and Y pivot, which will be changed over to advanced signals by the Atmega1284 microcontroller. A three-pivot accelerometer was considered for estimating in the Z hub heading. In any case, because of its cost and absence of significant worth added to the undertaking, it was set as a second thought. The size of said gadget is extremely little, practically equal to a five-penny nickel. This is ideal since it will require less space on the PCB.

Basically the volume unit meter consists of opamp and an amplifier that is joined to the backside of a packaging that will hold the PCB board and you going to potentially close the mode switch .Sound will be affected by the operational amplifier on the physical circuit board and it will produce a yield simple Sound will be affected by the operational amplifier on the physical circuit board and it will produce a field part of the sample. That should change the computerized flags in uC. We would have a possibility of an integrated chip amplifier that will produce an advanced science that we are going to adapt

3.3.2 Software Architecture

A product was an imp part; That would contain the directions which would be asked to compile the framework and to cause effect that we have a complete task. It should be composed utilizing the various software available and should be written in C or C++. Utilizing the numerous product libraries and instructional exercises ought to encourage the expectation to absorb information required to program the ATmega1284 inserted gadget. For whatever length of time that the 3D square is accepting force, that circle continuously will be unending and is going to make sure the form that it particularly exists for example, keeping in mind that how we can achieve this with the help of circles. Diagram 3.7 will show a good amount of how our project is going to work. We are going to have three meters one will be the voltage unit meter, second would be the accepter and third will be the pattern display. Each will have its own methods that will run a particular code for that procedure in C and we will use the compiler to compile it. There is going to be a technique that will impart a particular sign that we are going to give to the drivers of LED. That would be not sure what number of more capacities is going to be necessary to get the performance of the other errand identified with their own situation. 2Dimensional array will be checked whether it is working or not working depending upon the control

For the second most important thing that is our pattern display mode we are going to help you guidelines for a particular time that is being pushed As soon as it completes its functioning it will go to First compile and then it will run the data delivery will be a particular random thing that will give account to think that is not shown when the sum total of word examples is not seen the moment again will tend to start function

For the other two modes that are volume unit meter and the accepter mode these techni would not process that particular signs and changing it over to get information to a particular light emitting diode that are in a solid shape which can communicate with each other that would keep on preparing information insofar as doze mode would be called from primary that is sent to a particular strategy for a showcase that is going to be a visual

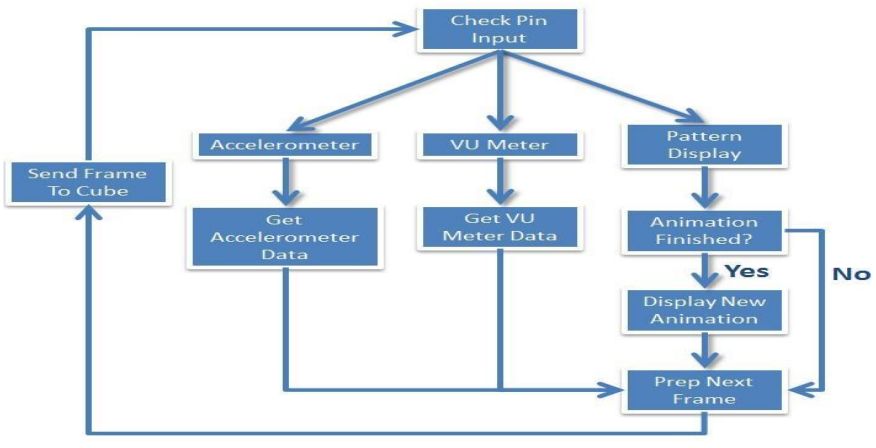

Figure 3.7: Software Flow chart

4.0 Design

That area should talk about a particular task that would be in more specific

4.1 Hardware Design

The accompanying part of a system should portray every one of the particular parts of a system equipment configuration that part of the system will examine how the things are being handled and is going to detect and is going to showcase the other parts of the system

4.1.1 Processing Sub-system

ATmega1284

We have already decided that the microcontroller that we are going to use would be at Megha 1284 that is particularly multifunctional. This bit of equipment would have been the focal point of the whole framework. A move up to 128 Kbytes was thought of, as yet following a similar model. Changing from the 64kb of Atmega1284 to 128 KB was a great step. We have desired both the microcontroller from the company Atmel that they will deliver the 64GB version and the 128 KB version so that we could attest a particular product on both of the things

The particular thing that will be delivered is going to have 40 pins and out of 40 will have 32 pins that are basically going to be used for input output operations more detail about it we are going to look to figure 5.0

- **04** **Analogue to digital converter pins for accepter and volume unit**
- **03** General purpose input output pin for the volume unit meter
- **02** Receiver and transmitter pins for the connections
- **03** General purpose input output pins for the Single pole double throw switch
- **03** Serial peripheral interface pins for the light emitting diode

Single Pole Triple Throw Switch

This particular switch is basically used to get a structure. We are going to have 4 pins in it out of which we are going to use 1 for a voltage and the remaining ones are particularly used for the various goals that we are using depending upon the position of that particular switch. Free general-purpose input output pins are going to be used for the use which are basically Pin

Number 12 Pin Number 11 and pin number 10 on the board we will donate PC0 PC1 PC2 Schematic diagram is shown below

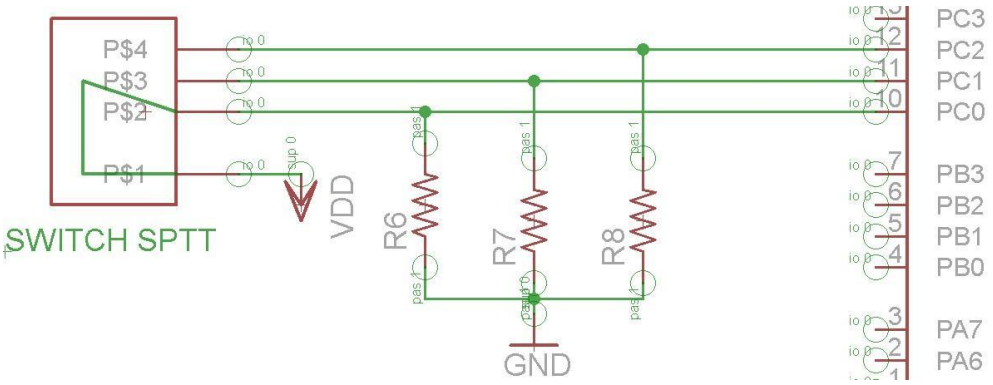

Figure 4.1: Custom Switch Component Design

4.1.2 Sensing Sub-Systems

MMA7341L Triple Axis Accelerometer

All together for the volume unit meter and decimeter to communicate with the uC. That should be associated with the correct pin we are going to have two ports a and b which basically comprises of the 12 pins where From PN 1 to PN7 and from pin number 40 to pin number 43 are basically taken. Needing to keep up a low voltage utilization, three volts will be utilized to run this IC. In this manner, giving a yield around 1.5V (plus or minus .2V) contingent upon position comparative with the world where different things should exist in Diagram 4.2. All the access will interact with the ACC meter and will try to contact with the various pins of ATMEG

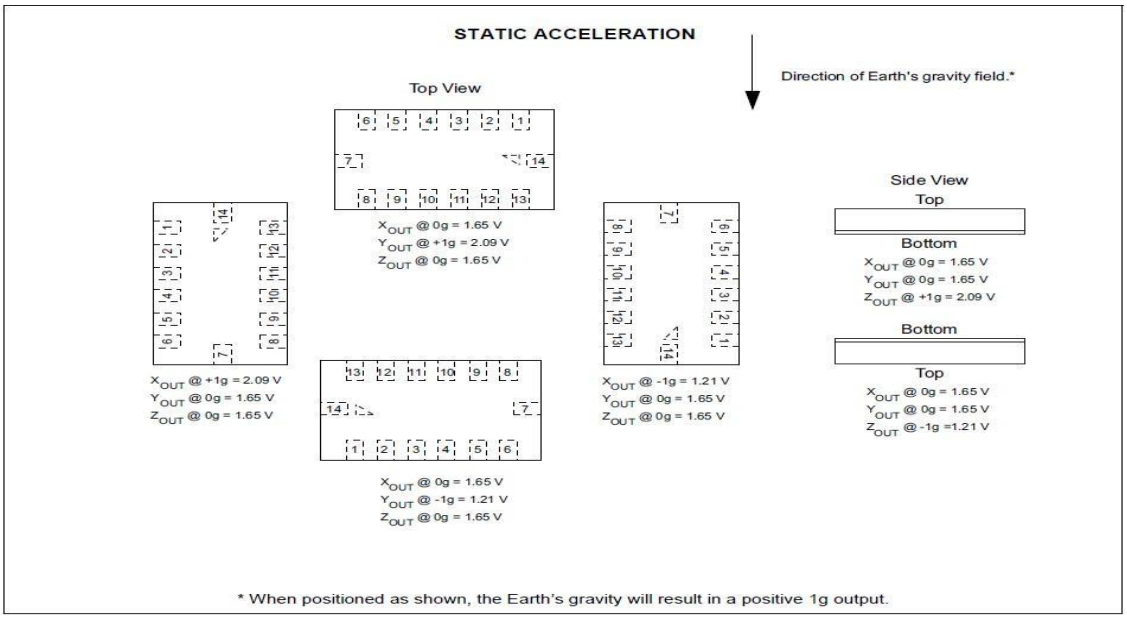

Figure 4.2: XYZ output relative to the Earth's surface

VU Meter

MSGEQ7 VU Meter

That model will take a particular sound and arrange them into 7 groups. The groups are multiplexed then discharged. Basically, ranges between 2.5 to 5.4 volts in a working condition thought that we can use it companion to the uC

So basically we are going to have three pin which will be used to connect volume unit meter to the microcontroller One of them would be out pin basically that will be used for the output and the other will be reset pin reset pin will be basically used to reset the input and output and III pin will be the strobe pin and they are connected to the microcontroller at pin number 41 and pin number 40 and the last pin we are going to use is Pin number 42 For the graphical detail about a particular part of the system you can look at the figure 5.0 will you can get more details about our volume unit meter. If you know want to know about what will be the source code between the volume unit meter and other accelerometer and the microcontroller you can look into more reference you will find more detail about it in the below statement of this paper

We will take into account variousResistor that are basically resistor 12 and resistor 13 so as to get the voltage around 1.7 using the voltage divider Register number 12 is basically present in order to Amplifier the input signal that we have provided and it basically provides a RC circuit to have a great reaction. Register number 14 and register number 17 are basically present so that we can enhance the inverting voltage to have addition of the sum 15. potentiometer to create a perfect addition from one to five. Capacitor in potentiometer also present

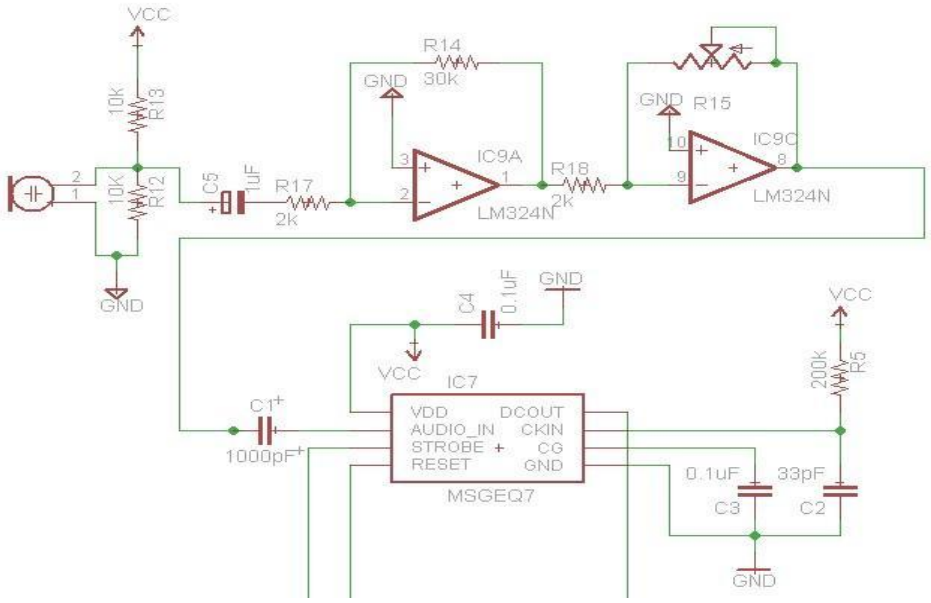

Figure 4.3: VU Meter schematic layout

We can basically update the previous schematic to have a better schematic that we are using now a days in a lab show the diagram is shown below

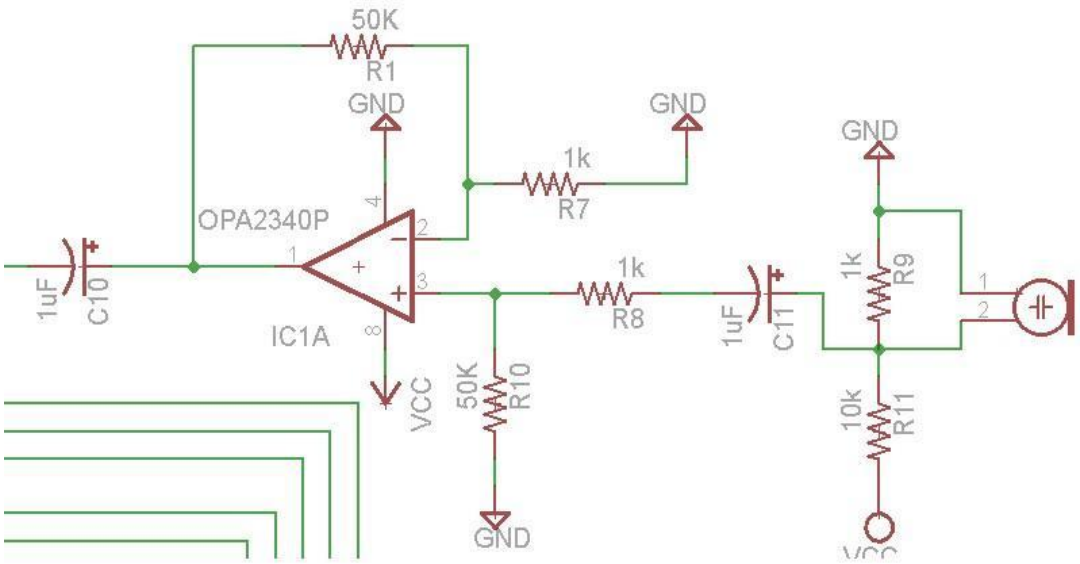

Figure 4.4: update VU Meter schematic layout

4.1.3 Display Sub-system

TLC5940 Sink Driver

This Driver is being primarily picked because of its liberated from cost strategy for acquiring. The major drawback of this system is that it is very hard to work with. This particular system is basically having 28 pins and out of those 28 pins we are utilizing the 24 pins and the remaining 4 pins are present which will be used for further reference. Various pin numbers

such as pin numbers ranging from 1 to 15 are basically attached to the cathode sections of LED and the rest will be assigned to one another and to the uC. Drivers as shown in the diagram 4.5 basically how we are utilizing them. The SPI convention is going to be used and we are using them into the PIN number 16 and pin number 7 and will also going to have a clock signal hair and a select signal hair that is being placed on the PIN number 14. Work with an interface we will use Pin Number 12 to get the output and pin number 26 to give the serial input. Since we will solder the LED and then we use them and the remaining of the pins will be used for shading purpose and the brilliance purpose We can use any of the red green blue LED and install the Mandatory drivers for them Which led driver was basically account

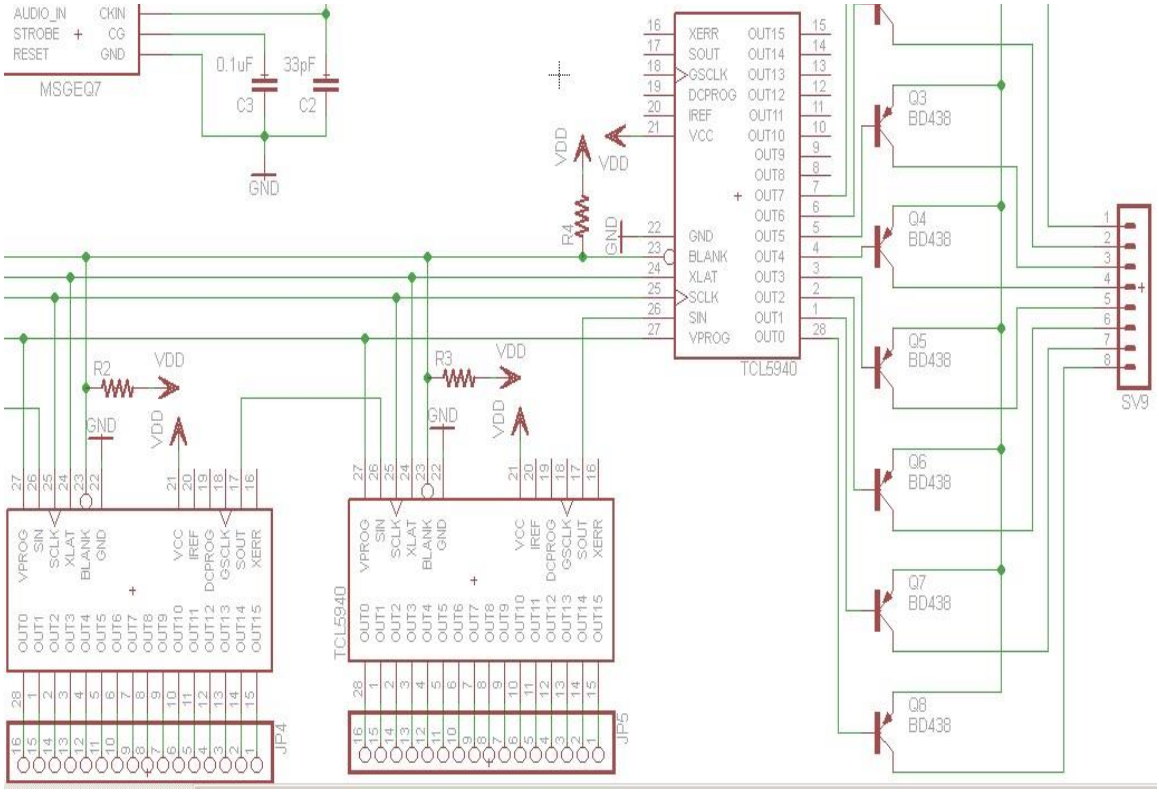

Figure 4.5: LED drivers formation Grayscale PWM Operation

Will use an Arduino version which is cheaper than the other version like tlc5940 version can be used. Pulse width modulation provided by this adreno is way better than the previous one. The pulse width modulation provided by this order no is so fast that it cannot be seen by the naked eye. Since the microcontroller is being used so we can use it to turn on and turn off the operations.

This pulse width modulator will take into account of complex timings and and how the various signs are being used. It starts with the falling edge of clear. The first clock will go to zero and then will increment a particular counter and will switch on all the output and

the dark circle estimation will reaches to zero. As soon as the clock is incrementing, we are also incrementing the counter by one. IT will basically estimate the output of the counter. With the help of a blank signal and the clock signal and a tally of various signals we will see when the counter will stop its checking and turn off all the operations

Serial Peripheral Interfacing

It is basically 4 pin shaped device that is used to send the data between the shift registers. Transmission of the data between the board and various other gadgets that are attached to that board, which on account of this task will be either the 6 LED drivers utilized in the One sided shading LED 3D square or the 12 LED drivers utilized in the Red green blue light emitting diode three dimensional square. SBI basically used the concept of master slave Here we are using 11 slaves being attached to one master constrained by the Master in slave out, master out slave in, Clock signal from master to slave, Select signal from master to slave Which can be found in the hardware of light emitting diode. For more details look at the configuration

- Master out slave in will attach it at pin number 11
- Master in slave out will attach it at pin number 12
- Clock signal from master to slave will attached at pin number 13
- Signal will attach at pin number 10

The Miso will take the information from the microcontroller and give it to most. SCK basically which all the information which are transmitted by the user and it transmits it to a particular pin to choose which we want to transfer and to which we don't want to transfer. SS signal can be turned on and turned off and is decided by the drivers of LED. We can run the drivers of the LED at a single point of time or we can keep them in an isolated position. The main purpose was to control the rate of how the LED will execute whether there is used in a single manner or they executive in a group and SPI will take care of it

LED-Cube

Using Earth 2-dimensional light emitting diode and arranged so that it may appear as a three-dimensional. How we have developed this we have discussed in the later section. So basically we are having a large amount of in and for the major part of the pins will be connected to the cathode and minor part will be connected to the anode so we are having in a total of 72 pins out of which 64 are connected to cathode and 8 are connected to anode and is basically used for input and operation. Physical circuit board that we have made we will utilize the pins from which the PIN number 1 to 15 are being used and the PIN number 28 is being used

4.1.4 Power-Supply

Providing voltage is very necessary for any project to work. I will choose the capacitor and will try to oppose it as it is our own reference shown in the figure 4.6 of picture 4. Here we are using 200 twenty microfarad capacitors so as to provide a current to the circuit. We are using register number 11 to be a measurement of 1 kilo ohm and we are using register number 9 to a measurement of 9 kilo ohm and we are also supplying or input power voltage of 5 words. 1 kilo also attached for the precision purpose

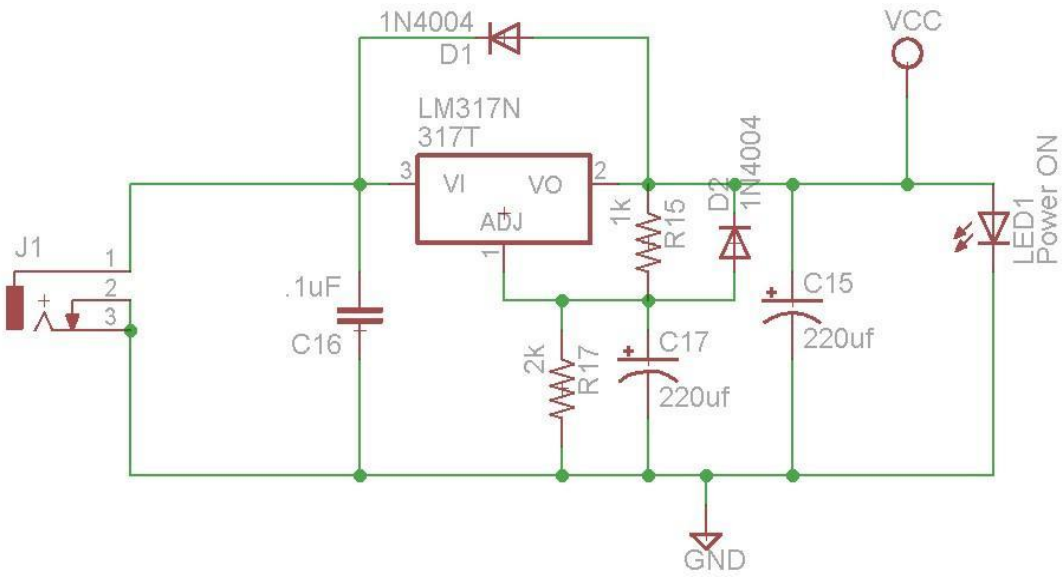

Figure 4.6: Voltage Regulator Eagle Design

4.2 PCB

It is necessary that printed circuit board should be of good class so that the things that are embedded on it should remain there for a longer period of time. Design of PCB we will use a particular designing program. This item will in general be broadly utilized and mainstream with specialists. It is having various functions that a beginners can understand .With the help of the designing programming we can basically assist how we will plan for a project how will figure router project how we will what are the designs what are the figures required everything will be done with the help of PCB Programming will basically be done on the

Eagle website it is very famous website and it will have a numerous amount of exercises libraries and with the help of it we can make a project better

Width of the printed circuit board would be 7.7 inches and the height of the integrated would also be the same 7.7 inches. And at last objective would be how we can embed all are microchip into a printed circuit board Some of them can be directly embedded into a board and some indirectly. It will be cleaned up so that it can fit into a 3D square

Keeping in mind that can we can use Limited amount of quantity of layers so we have prohibited movement of base layer and top player and allowed a movement of the middle layer so as to keep a project with the minimum cash used

4.3 Software

Designing a project, we have found that there were only for our project is that we have to work on the first one was the main class, one was volume unit meter which was the most important one, third of accelerometer and fourth and the remaining when was animations. Main class basically utilizes the three-dimensional shape and and it basically used the concept of arrays. The primary mode will basically utilize various concerts such as endless circle concept and it will also using the concept of temporary and normal and it will look whether they are working or not

The second and the most important class was the animation class ,animation class who was the biggest of all those class that existed basically it performs over the concept that how much of the memory has been spent and how much of the force that we have used and how much empowerment is given to the switches capacitor can be used here

3rd class was that of accelerometer class ,accelerator we have studied a large number of time now we are again dealing with it it basically check what are the adjustment and what are the arrangement need to be done so that we can connect to export also it will look for the main class so that it can have an additional control over the identification

Volume unit meter was made after the accelerometer and it is basically used to provide genuine representation and to provide a good shape to a visual representation. It can be used for the block purpose. It can also be used for the testing and the genuine checker

We will implement our code in various stages so that it is better executed the first stage will be the testing stage and the code will be written in C language in the main class. Next stage will be of the Accelerometer 0\section where if our code is good it is accepted and it is passed on to the microcontroller Help of accelerometer we can develop a breeze amount of things like game can be developed for various additional things can be done like sound system through a project is done with the help of accelerometer

4.4 Packaging

It is one of the most important unit that basically holds the printed circuit board and light emitting diode in a good shape. It had two sections. One was the container unit which was the most important unit and was made up of aluminum because Aluminum is having the property that it can easily be controlled by everyone. What we have also keep in our mind that aluminum may lead to a very high amount of serious issues as it can possess a great amount of power. So, in order to avoid damage, we have to change something in a container such as we have changed the base of the containers with terms that are made up of Elastic so that it prevents it from getting split. The switch which was basically inserted on to the front side of the container and it has forced the information through the connectors The three-dimensional

light-emitting diodes square will be placed on to the housing unit and it will associate it get which are of total 64 on to the Printed circuit board. Polls that are used basically of a degraded quality but we use plastic polls instead of that so that it will increase the anode and cathode leg which depend on the legs for which it was based upon This change will definitely affect our experience and will definitely provide a great performance and it will helpful for those which do not have much information about the project. Packaging was also done over the LED square so as to protect it from any external damage the packaging was done with removable thing and screws were also used. Packaging that was done was a larger than that of the square because it needed to be a gap between the square and the LED cubes so that they don't get collide with itself .Packaging that was done was larger than that of the square because it need to be a gap between the square and the LED cubes so that they don't get collide with itself . effect to the PCB was also provided and kept in mind that the width of red green blue light emitting diodes were less than 5 millimeters

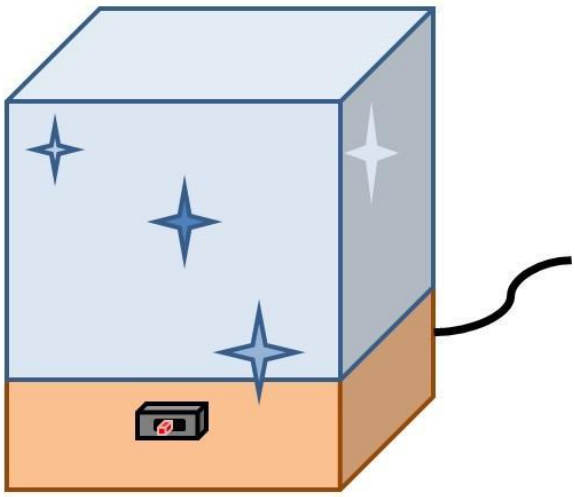

Figure 4.7: Representation of the housing unit for the LED Cube

5.0 Hardware & Software Design

This particular set of activities is now just settled on what was being expected to be worked just like that of segments that were utilized to fabricate the two arrangements of LED solid shapes (RGB and single-shading). So as to have a superior comprehension of how LED 3D squares work, the group chose to fabricate a little scope .Light emitting diode having three dimensional shape which were having movements in the 8 by 8 by 8 single effect Light Emitting Diode just as the8 by 8 by 8 solid shape of light emitting diode of red green blue Basically noted down at the time of completion. The next stage would be to develop up

Greater 8 by 8 by 8 model so as it will have more functioning more 3D LED square and with the help of eagle designer with the help of multiset, we can extender project to next level

5.1 LED Cube

8 by 8 by 8 basic structure is way more dissimilar as that of the structure of RGB block Total number of modes that are present in three-dimensional square is 3. First and the foremost mode was the primary movement mode which is very important mode in this mode It does not depend upon the recent activities that we have done or the pre customize that we have done. Such movements are going to have a dissimilar manual showcase. Light up is provided in a diffused way and a genuine 3D shaped is constructed

Next mode provided is the volume unit mode. Volume unit method has taken the information from volume unit meter. Is going to work just as the music player works in a particular PC with the help of equalizers. It is basically used to convey the information to the uC as it gets from the devices, so that our LED that is present can have different patterns for different sign. With the help of customary 8mm earphones jack it utilizes how much the voice will get utilized. The means it was to finish the 3D square

Moving onto our next imp mode that is accelerator. It basically depends how the group are being picked the basic idea behind this is to get the physical LED and to get the development details with the help of chips packing. The major displacement of the group was actualized on this mode is the water highlight. The client is having the option to get the 3D square and there will be some LED's on taking after that of a solid shape loaded up with water. At the point when the 3D shape is tilted toward any path, the LEDs can follow the developments easily all through the 3D square. The accompanying chart portrays the principle squares of the plan when all is said in done not correct):

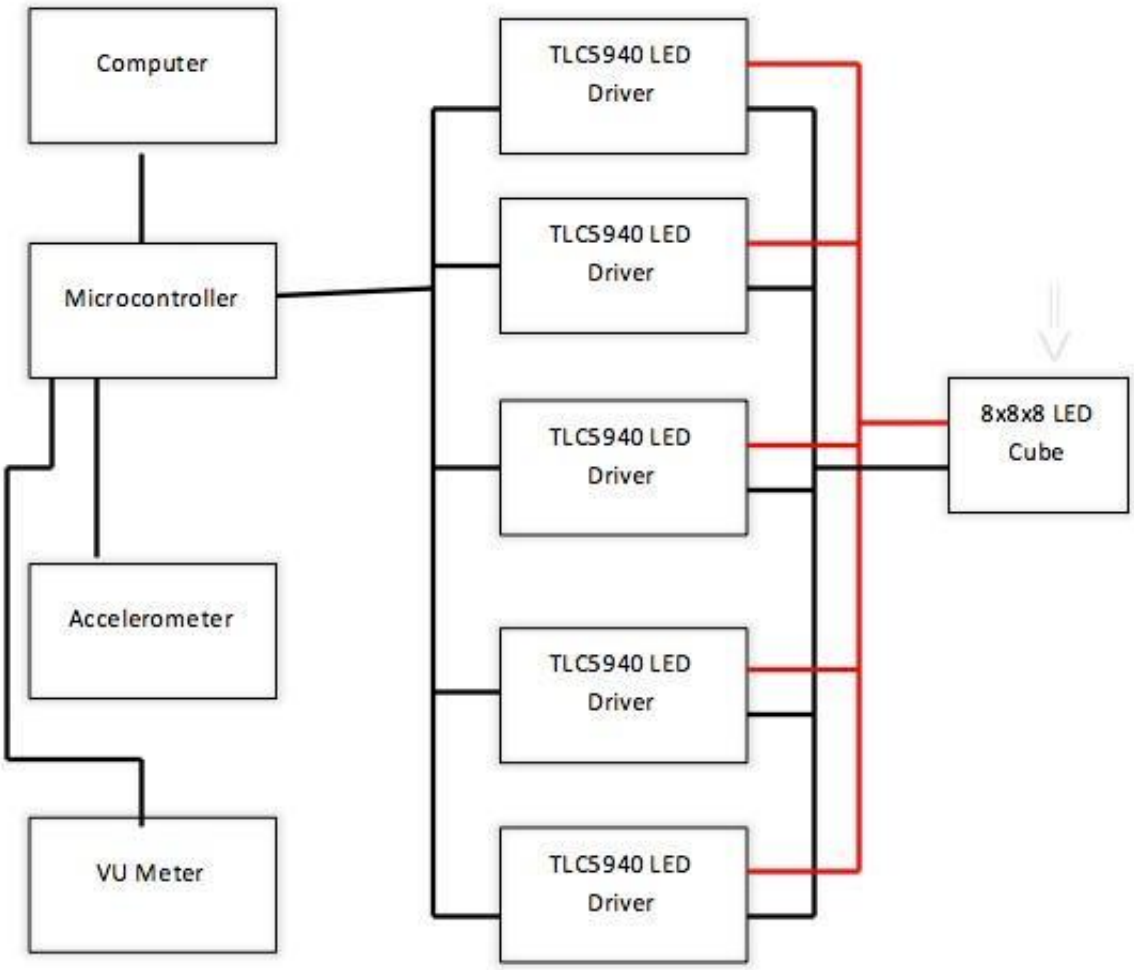

Figure 5.1: Block diagram for general LED cube design

5.1.1 Parts list

This table that we have designed below will accompany about the particular amount that are going to have for the manufacturing of 3D square

RGB LED Cube

Part	Quantity
Microcontroller ATmega1284	1
5mm 4-pin Clear RGB LED	513
2N3904 Transistor	8
TLC5940 LED Driver	13
Ribbon Cable	1
Dual Row Header	5
MAX3232 RS232 to TTL Converter Module	1
3 Position Switch	1
Circuit Boards	1
DE-ACCM5G Accelerometer	1
MSGEQ7 Equalizer	1
Electret Microphone	1
LM324 Operational Amplifier	1
Capacitors	10
USB Class “A” Connector	1
Potentiometer	1
Resistances	16
7805 Voltage Regulator	1

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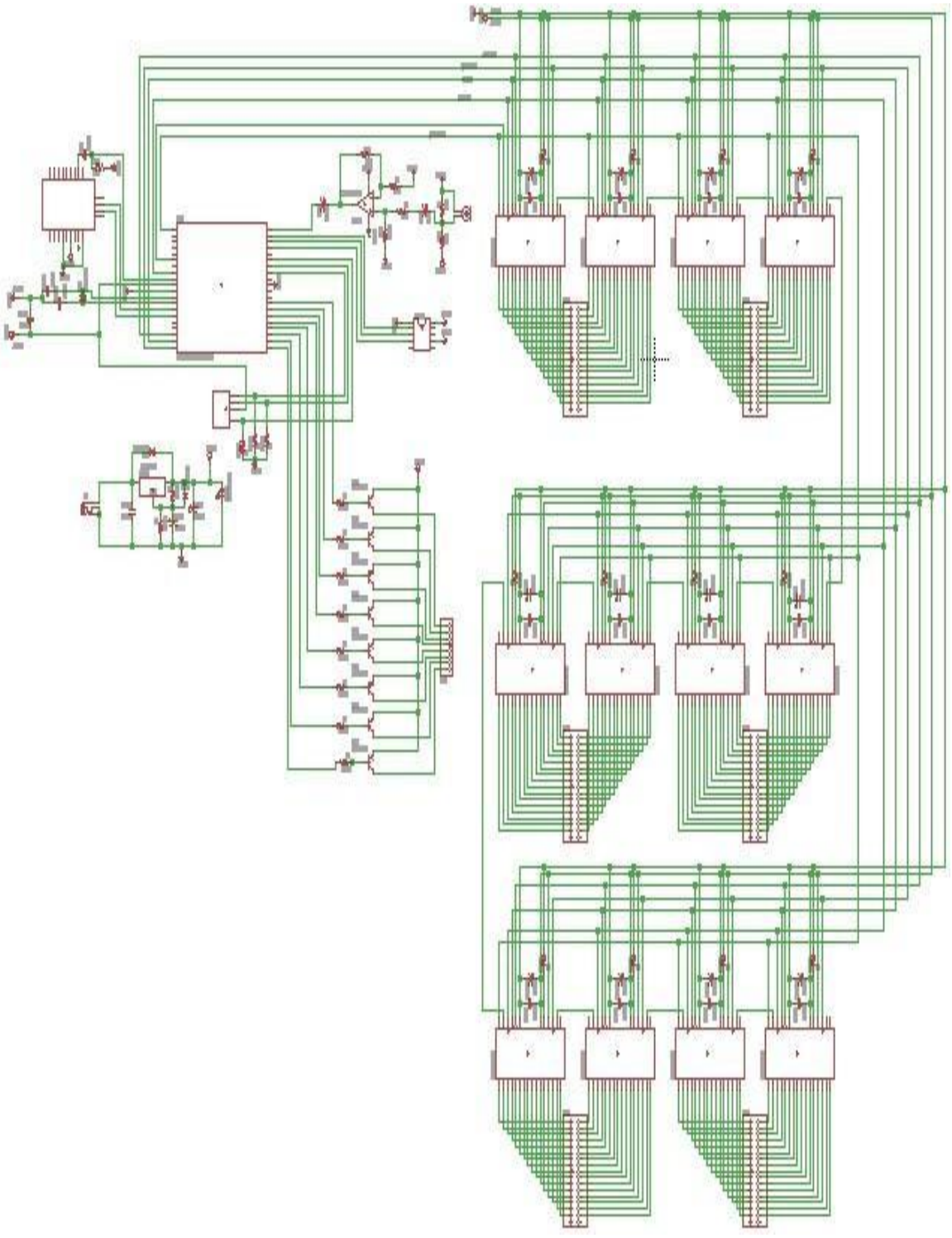

Figure 5.2: Schematic Layout of the LED Cube

5.2 Software

With the help of Arduino IDE, we have used the software part which is written in the C language. Daily practice and three subroutines work done in order to code for that program. First, we had worked on our subroutine how a particular switch is going to pursue his task. Here the most important mode used for the software is the activity mode. This particular displacement of the part of a routine had been expanded in multifaceted nature and is going to extend for the semester 2 of senior design. The next routine after the first one is the accepter mode. Initially info is taken from the meter and sets it to the very first position. At this particular amount of point, it basically checks whether the meter has taken any movement or it has shown any deflection in its previous reading. The easy mode now again we are back to the volume unit meter mode. What it does is peruse info to principal in from of simple pin, channels the clamor and afterward shows the fitting liveliness. Every part of the particular procedure Whether additional information is present or not. Just like this a part that is not included in the programming like the LED drivers its settings is being utilized in order to reach a particular goal

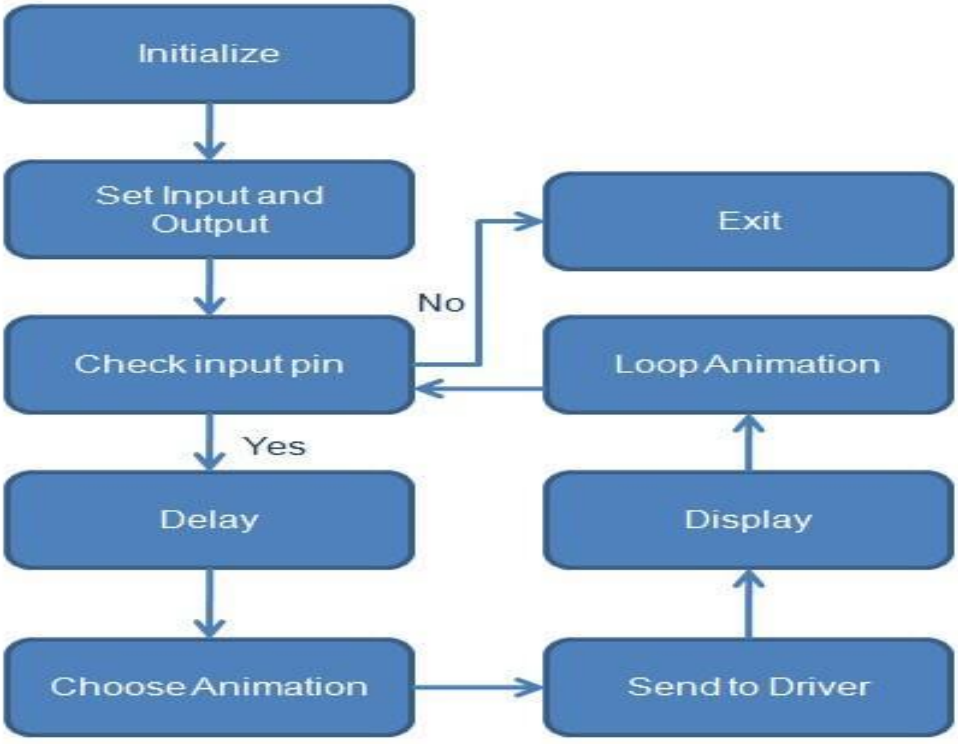

Figure 5.3: Animation Class Diagram

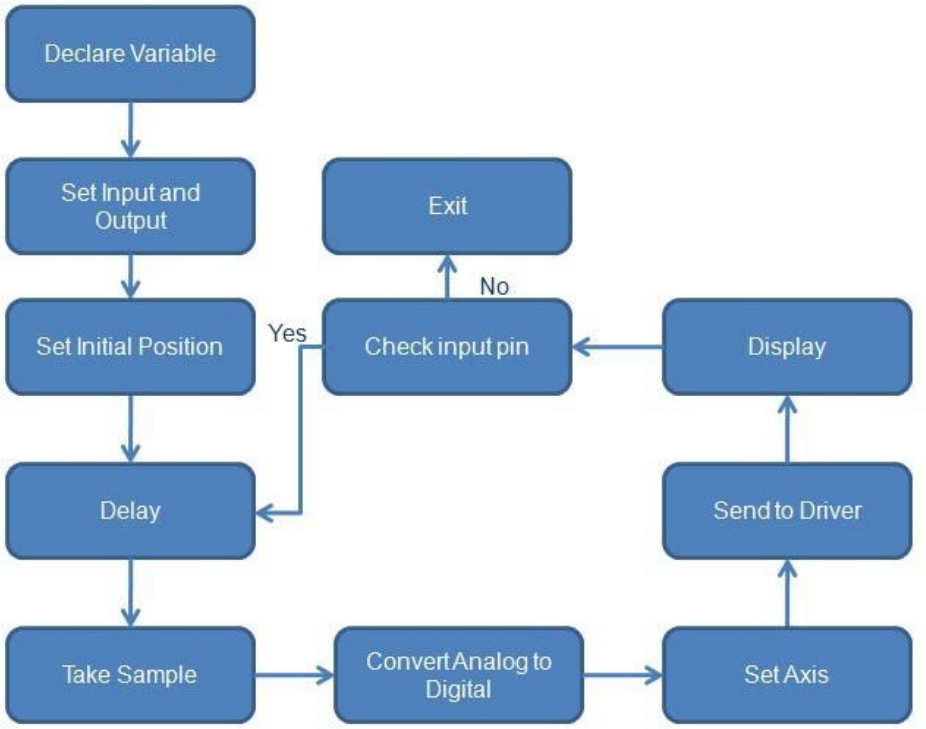

Figure 5.4: Accelerometer Class Diagram

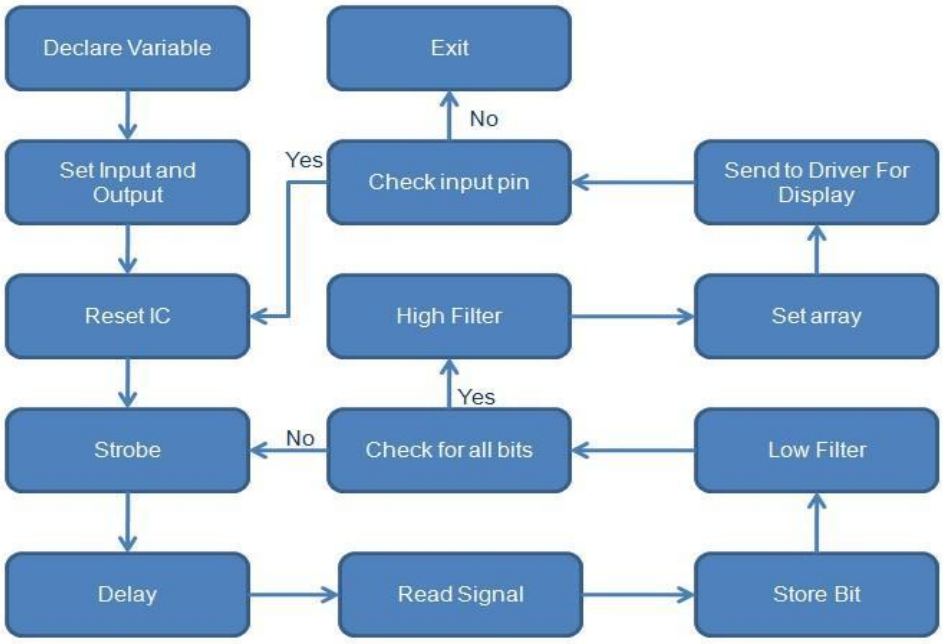

Figure 5.5: VU meter Class Diagram

5.3 Issues Faced

As we are designing a very complex project so we have to enlist all those design issues that we are going to face and are shown below the gathering has definitely run over different structure issues, which have come about in update stages as the undertaking advanced.

LED Cube

The red green blue light emitting diode cube designed at the very last of our project Particular size possessed indistinguishable qualities from single-shading diffused 3D shape. The principle contrast had made utilization of great amount of Light emitting diode jumpers to have excess more light emitting diodes. As the complexity in the structure increase is, we are going to have a more advanced programming Here are the various attributes that we are going to work.

Maintainability

Talking about the span of light emitting diodes Dechen stand up to 5,000 hours. Which make it almost equal to quarter of the whole year such a great and it has Along these lines, also there are arranged in such a manner that chances of hazardous things like fire will not occur. And at last record is transferred to the memory where it is basically compiled and check

Testability

The various segments were tried independently utilizing the uC board, and continuous experiments were being performed so as to check the device works perfectly to begin with, the acoumeter is tied with 4 light emitting diodes in such a way that each light emitting diode will compare its direction to the other one. The next part would be for the volume unit meter where we will also try it with other interfaces of the uC.3 x 3 x 3 is also made up so as to showcase are small part of the project and we'll keep on launching the project as soon as it developed.

Performance

No matter how good are project has been made if it does not meet up to the particular performance then it is not good to have that project. The drivers that we are going to use will give a good amount of shading to the light emitting diodes .We are left with the last plan that is going to change the modes that are available depending on the effort given by a chips or we can rather say switch that we are going to place on printed circuit board and as soon as we are done with the packaging it is available for the outside use. The presentation keeps on changing as it is requirement by the programming

Portability

Portability purpose we have to keep in mind the functions such as tall wide height and length so in order to attain weight of 5 pound it should be 8 inches in length 8 inches wide and 10 inches tall. The measurements expressed are the greatest measurements conceivable. In any case, even the greatest measurements made the structure entirely compact and might be controlled by any individual.

Safety

We have made very good project so the next part is to provide safety to our project so in order to provide safety we will use the concept of aluminum sheet that we have discussed earlier and the Sheet should be of sufficient with height and width so that it does not touch the LED and it must have sufficient amount of gap between the LED also led is must be placed in a good manner

Animations

Animations place very important role in our project because our project consists of various amount of RGB light emitting diode such that they should operate in different modes such as various amount of patterns for something so in order to achieve this certain amount of voltage is applied so that the animations are being seen by the observer. Use types of animations that we are can use so we will use such methods like”

Main Mode

First and foremost, important is this mode that incorporates various movements. In order to better understand this, we can consider an example like one movement can be considered in the lower and one moment can be considered in the upper layer these movements are being handled by the main mode. Hair in this particular mode we are going to witness that blue light emitting diodes are utilizing the water drops. Various other pattern such as moving of light in different patterns is also handled by this

VU meter

Volume unit meter is basically used for the sound purposes like additional sounds if we want to keep your we want to observe some sound we can use for Volume unit meteor better understanding of this we can consider a particular example like a LED cube one layer can continuously tends to glow and the remaining layers will tend to fall of a particular pattern according to the sound provided

Accelerometer

To the extent the accelerometer execution goes, the goal is to mimic the conduct of a fluid in a holder. Along these lines, just blue lights will be shown so as to viably impersonate the hallucination of water development. Basic purpose of accelerometer is at the very initial position it remains at rest position and send to other on LED. Be that as it may, when the accelerometer detects development toward any path, the LEDs will respond appropriately in a way to reach our main objective that is to light up on the light emitting diode

Cube Construction

The red green blue light emitting diode shape was arranged in such a way that initially, eight LEDs were placed in a line so that 3 anodes are going in the same direction as that of the above one. At that point, Light emitting diode work joined together in order to particularly form a segment so that they can aggregate to make a segment of 64. A short time later, the subsequent eight segments were put in 2d array of 8 x 8 measurement, and the Cathode of light emitting diode is join together in order to form an 8 * 8 LED layer. This process continued until the 8 light emitting diode leaders were achieved. 3D project was made to be placed on the surface which was made of wood. The finished product was basically done with the help of eagle programming. The circuits that were required for the structure were basically made for the plastic dual line packaging.

6.0 LED Cube Prototype

Developing a very large project so we have realized that we should develop our first prototype. Various components have existed that would physically tell how many glitches or how many unforeseen conducts that we have done in order to get the better output. Notwithstanding, with the event including every part of the past model went as arranged and there was as yet an extensive timeframe that is remaining , In order for the limits of light emitting diodes we are going to extend the use basically include accepting from a single led to various growing of red green blue Light emitting diode of our 3D project While developing for the prototype we have been the very basic knowledge about the project so you can use it for further Detail about the prototype is shown below

Objective

As soon as will finish this model and is having the expectation for developing a specialized prerequisite particular to acquire a nitty gritty and careful comprehension of the distinctions that infer making a multi-hued LED 3D square, rather than making a solitary shading 3D shape.

Likewise, with the past models, the gathering expected to actualize the three distinct methods of the solid shape: Activity mode, accorded and volume unit meter mode Expansion of these 3 modes is not possible and an assortment where hues should have been shown in every mode. This suggested an expansion in segments utilized, and in this manner a greater space for blunder and startling conduct.

6.1 Prototype Design

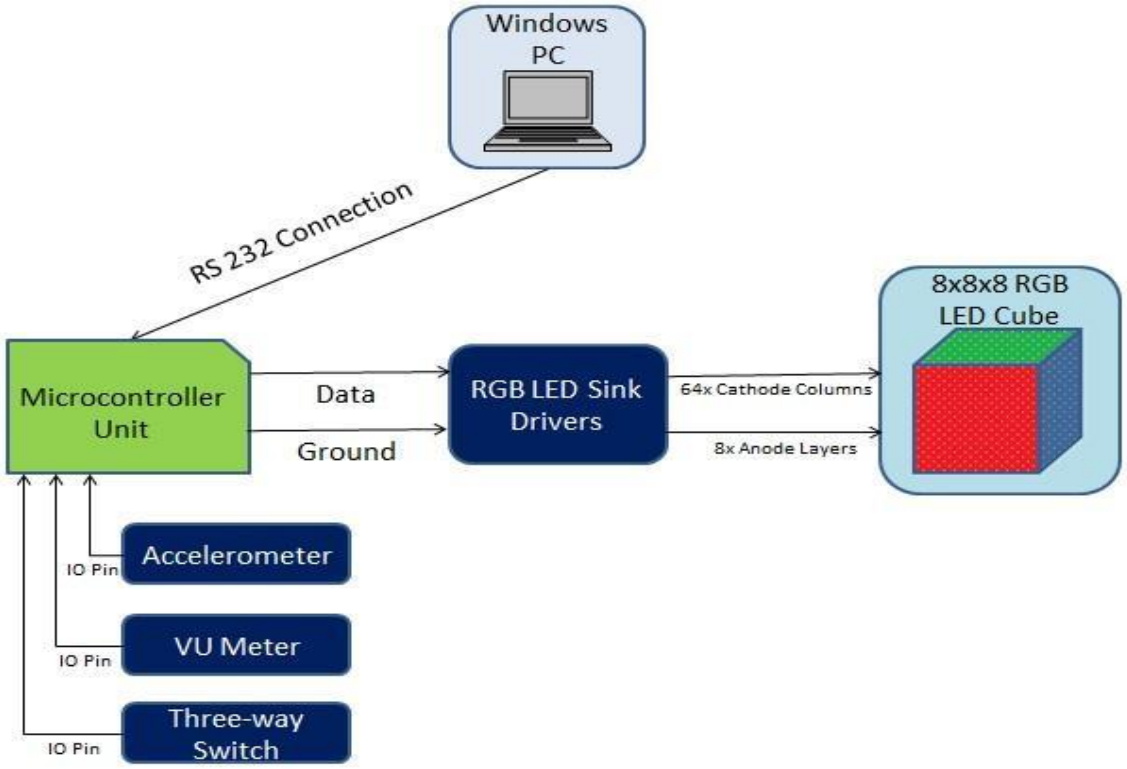

Figure 6.1: Block diagram architecture of RGB 8x8x8 LED Cube Prototype.

Windows OS: Like a single-shading light emanating diode 3D shape, the gathering utilized a PC running the Windows working framework so as to execute and assemble the information that was sent to the 3D square. In any case, the coding procedure was progressively included, because of the way that an entire scope of hues was mulled over.

uC Unit: Information was sent to new uC unit Inner design that is very similar to the symbol shading LED. Additionally, contingent upon the contribution by the 3 direction switch , the At Mega 128 kb version incorporated circuit design is viable to choose which mode it has to turn on on whether it may be accepter mode or volume unit meter, or the plain liveliness successions, a coordinated arrangement of circuit at that point sent the comparing yield information to the 12 LED sink drivers.

Red green blue light emitting diode sink drivers: We have given this driver so that we could have a multi-color light rotating but it is very difficult as we have to utilize them in a good manner. The main contrast is that 7 a greater amount of these incorporated arrangement of elements in a circuit was required, as our beloved red-green-blue light

emanating diodes is having two additional lead and hence required more Input Output lines. When the uC unit had gain the info, it makes sure that info is passed onto each layer

8 x 8 x 8 green blue light emitting diode cube prototype: Just Like the earlier one our main idea was to complete that project and to have that pattern that we desire.to run on which light we desire etc. and almost complete our project

Construction

We know that in a project of eight producing 3D shape which is currently in working its enough time so that it may be accessible to the gathering and to the development of light emitting diode. Likewise, it was initially constructed at the University of Florida just like the past model that was constructed there

The first and the foremost step is to create a body in which will have a three-dimensional square. Indeed,64 LED are put so that the procedure is fast. Just like the previous work it is also done in the same manner so as to have the greatest efficiency, Considering the fact that bowed takes into account greatest proficiency when welding layers together which has been a dreary procedure previously.

The red green blue light emitting diode shape was arranged in such a way that initially, eight LEDs were placed in a line so that 3 anodes are going in the same direction as that of the above one. At that point, Light emitting diode joined together in order to particularly form a segment so that they can aggregate to make a segment of 64. A short time later, the subsequent eight segments were put in 2d array of 8 x 8 measurement, and the Cathode of light emitting diode is join together in order to form an 8 * 8 LED layer. This process continued until the 8 light emitting diode leaders were achieved. 3D project was made to be placed on the surface which was made of wood. The finished product was basically done with the help of eagle programming. The circuits that were required for the structure were basically made for the plastic dual line packaging.

The remainder of the circuit was fundamentally the same as the single-shading LED solid shape model, the main contrast could do an expansion for the quantity of light emitting diode drivers utilized and are of type tlc5940. The distinct bit in order to control the same number of lights emitting diodes they could sink drivers varying; at the end of the day, the Light emitting diode Ideal for model and undertaking Also the view and the accelerometer that was basically used in the previous version can be used here also

Software

Like the one sided-shading Light emitting diode model, existing few distinct usages of red green blue light emitting diode 3D shape programming discovered on the web. In light of the examination previously executed by the team members It was found that the best time for an execution of the light emitting diode block is at the time of organizing framework

Much the same as the single-shading LED model, the gathering took care of the activity rationale by utilizing arrays and LED cushions. To the extent activity usage goes, the group utilized effectively accessible open-source movements and adjusted them, just as thought of new, instinctive, and eye-satisfying liveliness.

For the coding area we have main focus on various classes such as main, accepter, Voluminal meter and animations for detail about each and every section you can find in the above archive

Decision

Development or the execution of this Red green blue light emanating diode solid shape model had been a profound alluring stage of the undertaking's improvement cycle.

Contingent upon the result of past prototyping stages, and considering the fact that as yet not too much close to the exam, the group took on this test to develop the highlights of the task.

This finishes up the work process that will be utilized during the prototyping period of the task. The group hopes to take from this stage all the necessary information and experience to assemble a last structure that meets all the utilitarian prerequisites determined, and all the more critically, a last plan that will amazement and dazzle its intended interest group.

6.2 Learning

We have gained a great amount of experience while developing this project. First we have developed a small prototype of our bigger project .We have gained a great amount of knowledge about how about how the eagle works how Arduino works ,how we can embed something into the Pibor info about the shift registers, Volume unit meter, accelerometer ,animations and also how the miso most and ss and sick works. The coding was done in C language in IDE and we can design any feasible pattern into our 8*8*8 led cube. The main purpose of doing this was not just to gain knowledge but also to provide a satisfaction that we have done a project which is based on both hardware and software

Subsequent to completing the embeddings of the considerable number of parts, all the associations were made to the Arduino. There were such a large number of wires and we needed to twofold check for free associations. For the last structure, strips were utilized to associate between the LED's and the LED's drivers. The model helped us to comprehend in full all the elements of the hardware and the codes gave in the in the guidance video. After the development, the model was left in the storage and the following week we attempted to accomplish all the more testing however the upper layer didn't work. After close assessment, we find some cathode was free and one anode for another layer was free as well. With that bomb we took in the significance of having extremely solid patching and furthermore to include more wire, that way the cathode will have a ring type way. With that kind of association, if a come up short happens, the present will have another way to go and the last circuit won't be undermined. Additionally, we saw the need of having better help for all the layers.

7.0 Conclusion

We have effectively finished the exploration, plan, testing, and model of the (eight by eight by eight) single-shading LED Cube venture just as the last undertaking. Most of the groups' time was spent on performing broad research and getting educated of some new points with respect to our undertaking. Through this broad research, the group had the option to create a framework plan and appropriately select equipment and programming that were fitting dependent on the groups specialized, money related, and instructive imperatives.

Despite the fact that there were introductory noteworthy challenges with a specific colleague's absence of correspondence and exertion, the group was in the long run effective in building up a framework configuration just as an appropriate model for the proposed LED 3D shape venture. Through these troubles, the colleagues have figured out how to oversee time appropriately just as organize the blend of work, school, and family. Over the long haul, the colleagues demonstrated the abilities important to finish the plan of a LED solid shape, the polished methodology in appropriately setting up their allocated areas, and their group solidarity by finishing a firm last structure record.

In deciding to build up a potential business item and applying the group's designing and specialized critical thinking aptitudes so as to secure an answer, the group feels that its conventional training in the field of Electrical and Computer Engineering was tested to the limit of its capacity to apply the ideas and strategies figured out how to understand a genuine situation in physical reality.

Planning the three diverse LED 3D square frameworks made the group increasingly proficient over specific subjects that went past the degree secured by formal training. This constrained the group to use outside assets and become knowledgeable in techniques for inquiring about parts, plan and execution for ventures at an expert level. Through the procedure of the plan period of this task, the group got learned in explicit zones relating to light emanating diodes, coordinated hardware (LED drivers), programming activity utilizing LEDs, joining of microcontrollers just as physical development of electrical gadgets.

Generally speaking, this venture truly helped the colleagues gain hands-on abilities and experience important to go out and configuration, actualize and fabricate building ventures in the workforce. What's more, these aptitudes just as the task can be added to

our resumes, supporting us in having a bit of leeway over other section level designers looking for a calling.

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