Project Report

EE302 – Introduction to Embedded Systems

3D LED Cube

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ABSTRACT

Our project consists of building a 3-dimensional LED array that will be able to display various graphics through the concept of persistence of vision. The array will also be sensitive to motion in three directions, allowing it to focus certain graphics to a targeted audience through motion detection. There will be several options for display including non-directional animations and direction focused graphics. We will be using infrared sensors to design and build a motion detection system that will be fed into our processor. The processor will, through several inputs, decide what graphic to present and will feed it to an MPLAB. The MPLAB will then process the necessary data and output to the 64 LEDs to be used in the 3D array.

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1 INTRODUCTION

This section addresses following questions.

- What are you looking at?
- Why are you looking at it?

1.1 Problem Definition

What are you looking at?

The goal of this design is to be able to output and modify the LED array fast enough to see a persistent image:

• The first issue that must be dealt with is the physical construction of the array. The array will be 4x4x4 LEDs, accounting for a total of 64 devices. Due to lack of accessibility, we will have to make certain that each LED is functional and stays so throughout the construction.

• A sturdy base and casing will also have to be provided for the array, as the construction doesn't allow for a large amount of structural integrity. A wooden base and a Plexiglas case is proposed to deal with this issue and to protect the LED array from general jostling and movement.

• Due to the very large number of LEDs that need to be used at once, current considerations will have to be considered, verifying that we have enough power to supply a good level of luminescence so that we may not only turn on all LEDs but also modify them through pulse width modulation.

Why are you looking at it?

we are looking to make the code as fast as possible, so as not to create a bottle neck in our refresh rate.

- Since each LED needs to be controlled individually, memory issues will have to be considered when adding more graphic options. Otherwise, we will have to find ways to streamline our code to allow for more variety without a significant increase in the memory needed.

- The motion detection system will be built from scratch using infrared detection. It will be able to detect motion and focus an image to wherever the motion is detected Other Things to Look for in this Section.

Point is that the introduction part is another trigger for the reader. If after reading this part, the user is not bored yet, you have won him over.

- We have chosen the implementation of this project based on our team's experience and the simplest methods by which we see to complete our goals. When constructing the actual LED array, we have chosen to construct the array in layers, verifying that all LEDs function after every step. Due to proximity soldering there is a high chance that some of them may burn out and we would like to catch this early on. Once we have all layers completed, we will stack them and solder the layers on by one till they are fully assembled. We shall also place several strong strands of wire to support the structure and increase its integrity.

2 LITERATURE SURVEY

This section addresses following questions.

- Who else looked at this problem?

2.1 There are two ways in which we can fashion the code to control the LEDs. The first would be to preprogram individual bits to be retrieved and outputted sequentially. This is the brute force method, but it may prove easier than the others. The main issue however is memory allocation and size, for multiple graphics or the addition of new ones we will probably need to add external memory to process it. The second method which is the one we will attempt is to make code as intelligently as possible so that the designs can be created and output directly from the microprocessor, without other hardware required. This method may be slower, but it would be more eloquent and require a physically smaller design. The best solution may be a combination of the two systems to achieve a maximum number of graphics possible. Some Other Guidelines

3 RESEARCH METHODOLOGY & ANALYSIS

How are you looking at the problem?

3.1 Research Methodology

As for as the question of research methodology is concerned we have explore many cited papers and come to the point what are the best options for that we can use in order to implement the project. By reading all the research paper and the guideline the have proposed we concluded and start working on the project further. Here are the few cited papers reference that we have studied so far.

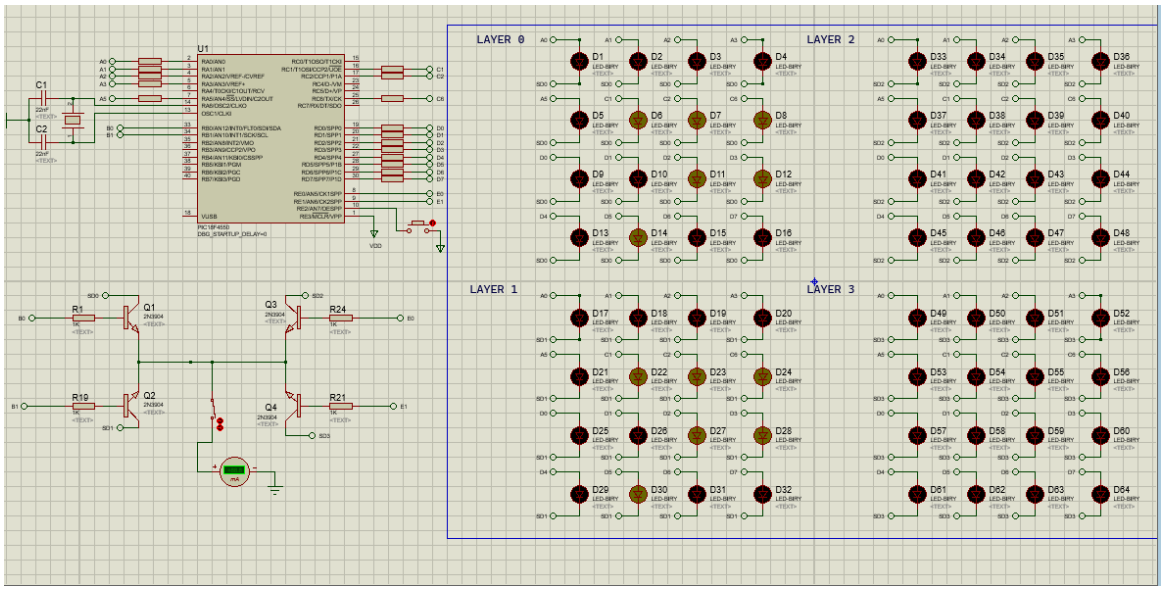
3.2 Analysis

There are two ways in which we can fashion the code to control the LEDs. The first would be to preprogram individual bits to be retrieved and outputted sequentially. This is the brute force method, but it may prove easier than the others. The main issue however is memory allocation and size, for multiple graphics or the addition of new ones we will probably need to add external memory to process it. The second method which is the one we will attempt is to make code as intelligently as possible so that the designs can be created and output directly from the microprocessor, without other hardware required. This method may be slower, but it would be more eloquent and require a physically smaller design. The best solution may be a combination of the two systems to achieve a maximum number of graphics possible.

3.3 Components

Name	quantity	price
LEDs (blue)	64	5 x 64 = 320
Fiber Veroboard	1	400
stripe Jumper wires	40 pins	180
Female headers	40 pins	40
Transistors (npn 2n3904)	4	40
Resisters	20	200
Push button	1	10

4 DESIGN OR THEORETICAL FRAMEWORK



5 IMPLEMENTATION & RESULTS

This chapter deals with

- Implementation,
- Testing and results

5.1 Implementation

As for as the implementation of this project is concerned first of we implement the project on hardware and then as well as performing it on software as well. We first design it and start working on the hardware that took a pretty much time because there we a number of leds that needs to be placed on the board without getting it fused and checking at the same time is it properly working or not. As time went on and we got it done successfully.

5.2 Testing & Results

Once the hardware portion is completed the most important part was to test it by configuring with the software, so we coded on software and implement the project on that. On our first day we were facing some problems and as time went by, we were at our best level and had achieve the required things and solved each problem that we were facing by getting help from different sites.

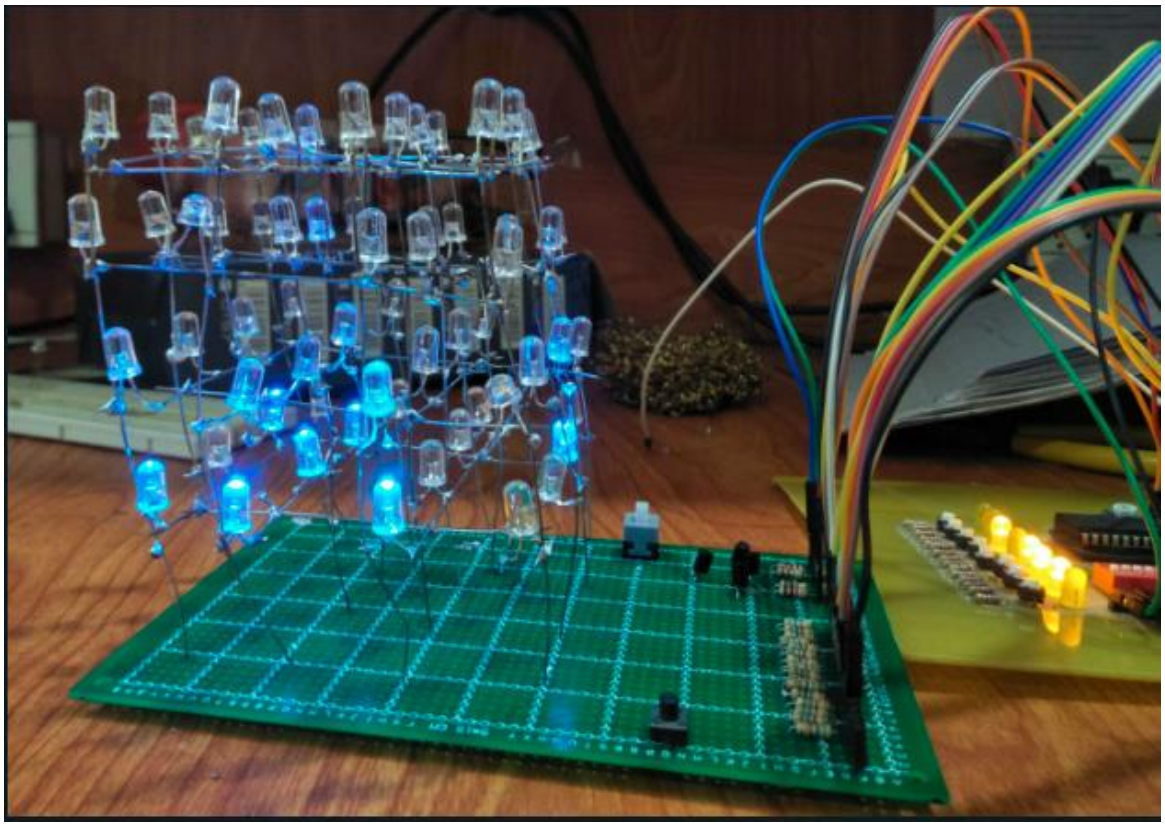
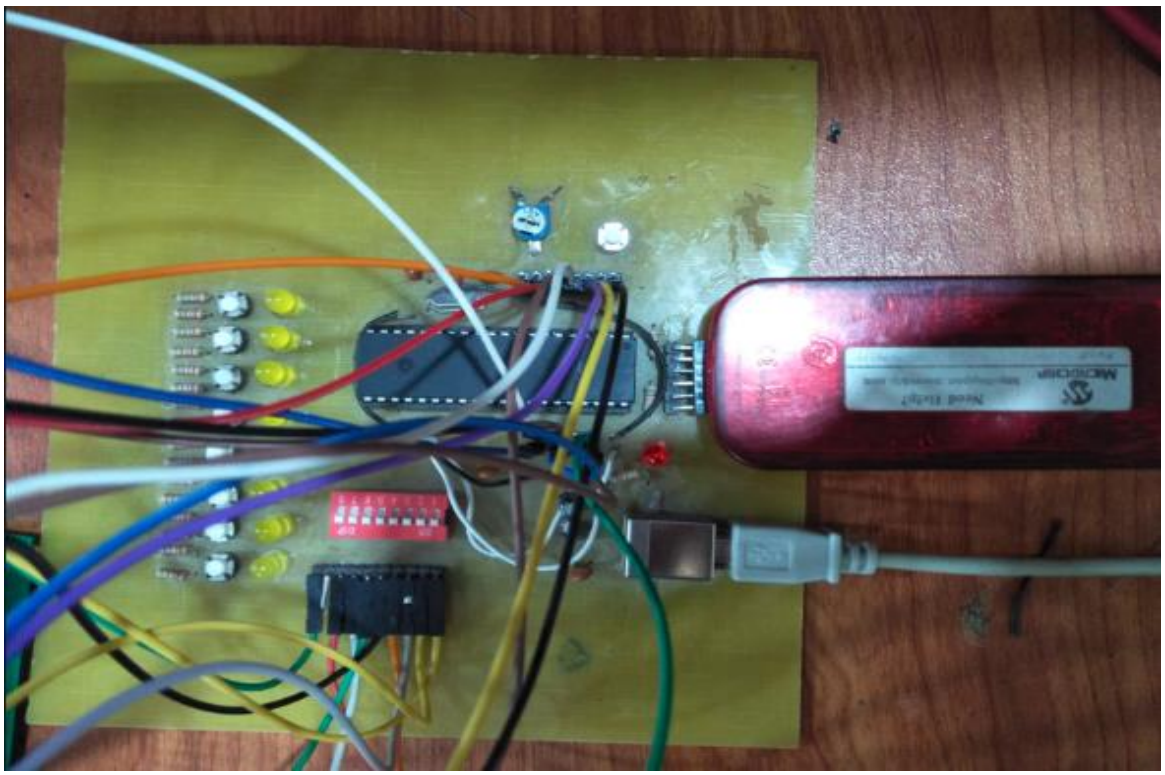


Figure 5.1



6 CONCLUSIONS

This is usually the last chapter in the report which addresses following questions.

- What are the limitations of your work?
- What are your conclusions?
- What next?

6.1 Limitations

Limitations of our project that we found through out the design and implementation of this project are as follows.

We can only use 23 pins of PIC18-4550 out of 40.

We cannot deliver current more than 200mA.

6.2 Achievements

We have finally got it done while going through many stages and after a long labor of time. Our project is now working by following all the above-mentioned steps. The hardware and the software both are doing the best work. We have achieved the project design of 3D Cube led animation with full of performance.

6.3 Future Work

As for as the future work is concerned the project has a wide range of applications and there are multiple ways to modifying this project and these are as follows,

- We can change its animation by using an interruption push button.
- With the help of ADC mic, we can change of it animations like glowing of the LEDs.
- By using the UART we can make it wireless by using the Bluetooth interfac

REFERENCES

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[2] tomazas/ledcube8x8x8: 8x8x8 3D LED Cube source code (github.com)
[3] tomazas/DotMatrixJava: Java 8x8x8 ledcube control software (github.com)