ELECTRONICS SUMMER PROJECT

STACKABLE 3D DISPLAY

June 21, 2018

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1. ABOUT THE PROJECT:

We were impressed by the idea of making 3D LED cube which displays custom animations. Hence, we decided to act upon this project.

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INTRODUCTION-

The project is a 3D LED CUBE DISPLAY (8x8x8 PIXELS) which displays different patterns stored in the microcontroller. This LED cube is like a LED screen, but it is special in that it has a third dimension, making it 3D. Think of it as many

transparent low resolution displays. In normal displays it is normal to try to stack the pixels as close as possible in order to make it look better, but in a cube one must be able to see through it, and

more spacing between the pixels (actually it's voxels since it is in 3d) is needed. The spacing is a trade-off between how easy the layers behind

it are seen, and voxel fidelity. Since it is a lot more work making a LED cube than a LED display, they are usually low resolution. A LED display of 8x8 pixels are only 64 LEDs, but a LED cube in 8x8x8 is 512 LEDs, an order of magnitude harder to make! This is the reason LED cubes are only made in low resolution. A LED cube does not have to be symmetrical; it is possible to make a 7x8x9, or even oddly shaped ones. Here we have an 8x8x8 shaped one. The code is written in the C language using AVR studio and it is burned into the ARDUINO using the pony prog 2000.The circuit needs to be mounted on the mechanical structure or platform where it displays the patterns that are

stored in the arduino as indicated in the codes. The patterns are displayed on a 3D structure which is made up of stainless steel rods. The messages can be changed as per user need by rewriting the arduino in-built memory. The complete display system circuit is power supply run on 5V, 2A which is provided ex-

ternally.

THEORY

3D LED CUBE is a evolution from 2D DISPLAY. Before this, 2D DISPLAY is usually used in many electronic devices to display something. After that,

3D takes a part on the electronic technology world. The first era of 3D LED CUBE is built the 3x3x3 pocket led. It just use 27 led to shown some text display or interactive design. The cube's 3D construction is straightforward and easy to solder using the included jig and instructions. With use 27 led's, the design or text that display is not too clear. It runs using a PIC16F690 and a piece of software written in VB.NET. After that, 4x4x4 LED CUBE has been

introduced. 64 led's has been used to show the 3D view. Many type of controller can be used to develop this project. PCB is one of the controller that been used. For example, Atmel Atmega16 microcontroller and AVR microcontroller. Each LED can be addressed individually in software, enabling it to display amazing 3d animations. On the programming side, many type of coding can be built for this project such as FPGA, mat lab and c language. Now 8x8x8 3D LED CUBE with 512 led's has been choose for this project. It has two ways can be choose as

controller for this project or by arduino controller board .Have a same concept, but with a different works. C language with hex files will

be use to run the program. The reason why will choose C lan-

guage because it related with microcontroller interfacing subject that had been taken for all electric and electronic student. It will be use as a software to run this program. This unique way of displaying messages is a very eye catching and much more stand out compared to the two dimensional normal panel displays.

CIRCUIT DIAGRAM

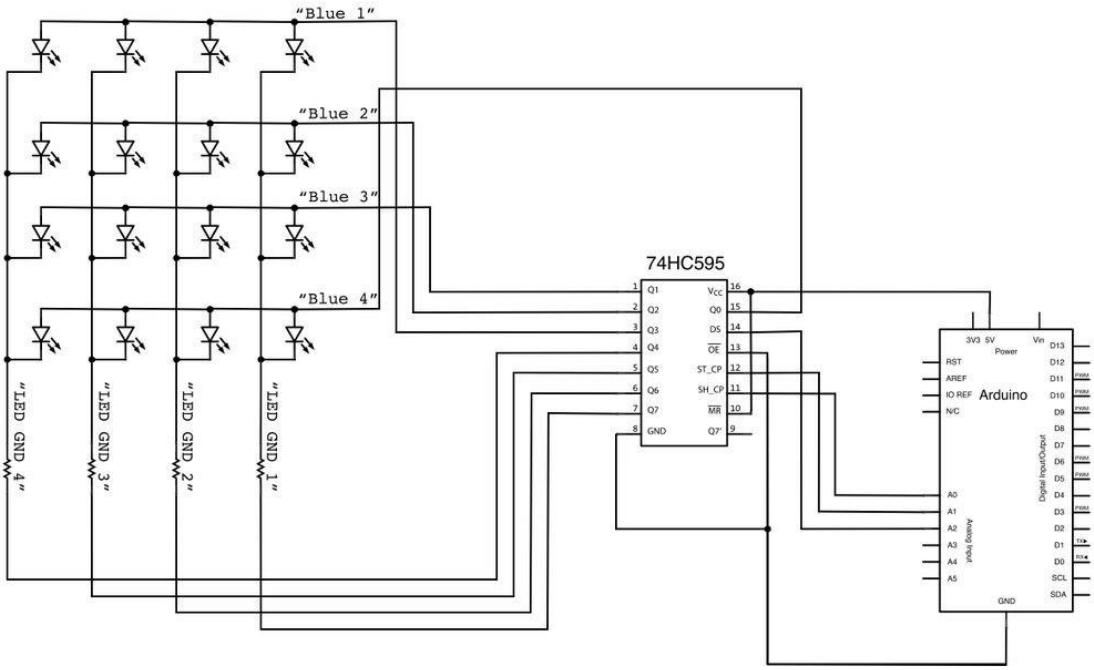

Fig1

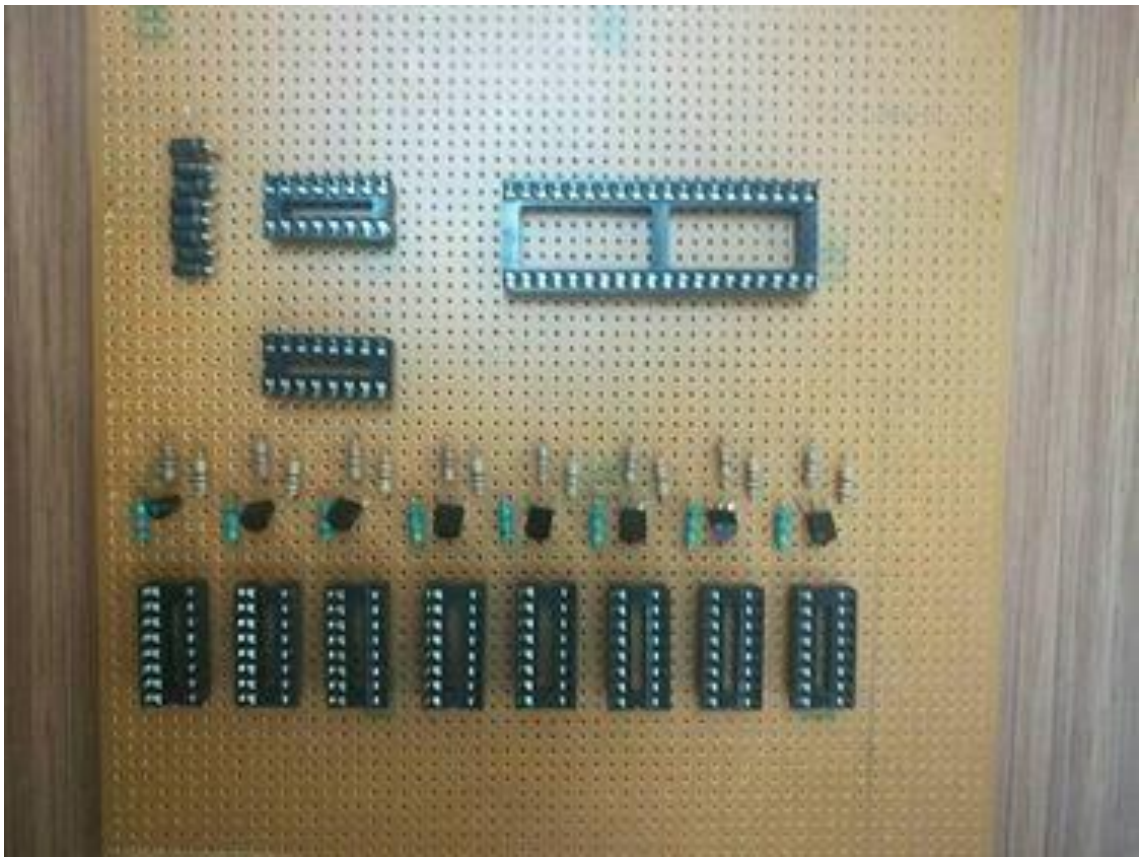

Fig2

EXPLANATION

This 3D led cube is made up of stainless steel rods with 512 leds. There are 64 anodes 8 cathodes.

The LED cube is made up of columns and layers. The cathode legs of every LED in a layer are soldered together. All the anode legs in one column are soldered together. Each of the 64 columns is connected to the controller board with a separate wire. Each column can be controlled individually. Each of the 8 layers also has a separate wire going to the controller board. Each of the layers is connected to a transistor that enables the cube to turn on and off the flow of current through each layer.

WORKING

A LED cube is like a LED screen, but it is special in that it has a third dimension, making it 3D.

Think of it as many transparent low resolution displays. In normal displays it is normal to try to stack the pixels as close as possible in order to make it look better, but in a cube one must be able to see trough it, and more spacing between the pixels (actually it's voxels since it is in 3d) is needed. The spacing is a trade-off between how easy the layers behind it are seen, and voxel fi-

delity.

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an order of magnitude harder to make! This is the reason LED cubes are only made in low resolution. A LED cube does not have to be symmetrical; it is possible to make a 7x8x9, or even oddly shaped

ones.

This LED cube has 512 LEDs. Obviously, having a dedicated IO port for each LED would be very impractical. Thus there comes the need of a micro controller with 512 IO ports, and run 512 wires through the cube. Instead, LED cubes rely on an optical phenomenon called persistence of vision (POV). When a led is flashed really fast, the image will stay on the retina for a little while

after the led turns off. By flashing each layer of the cube one after another really fast, it gives the illusion of a 3d image, when in fact we are looking at a series of 2d images stacked onto one another. This is also called multiplexing. With this setup, there exists the need of only 64 (for the anodes) + 8 (for each layer) IO ports to control the LED cube. There are anodes, cathodes, columns and layers, for this led cube.

In order to light up an LED, we have to run current from the anode to the cathode. The LED cube is made up of columns and layers. The cathode legs of every LED in a layer are soldered together. All the anode legs in one column are soldered together. Each of the 64 columns is

connected to the controller board with a separate wire. Each column can be controlled individually. Each of the 8 layers also has a separate wire going to the controller board. Each of the layers is connected to a transistor that enables the cube to turn on and off the flow of current through each layer.

By only turning on the transistor for one layer, current from the anode columns can only flow through that layer. The transistors for the other layers are off, and the image outputted on the 64 anode wires are only shown on the selected layer. To display the next layer, simply turn off the transistor for the current layer, change the image on the 64 anode wires to the image for

the next layer. Then turn on the transistor for the next layer. Rinse and repeat very fast.The layers will be referred to as layers, cathode layers or ground layers. The columns will be referred to as columns, anode columns or anodes.

The control unit is quite simple, 3 ports of the AtMega32 were used.

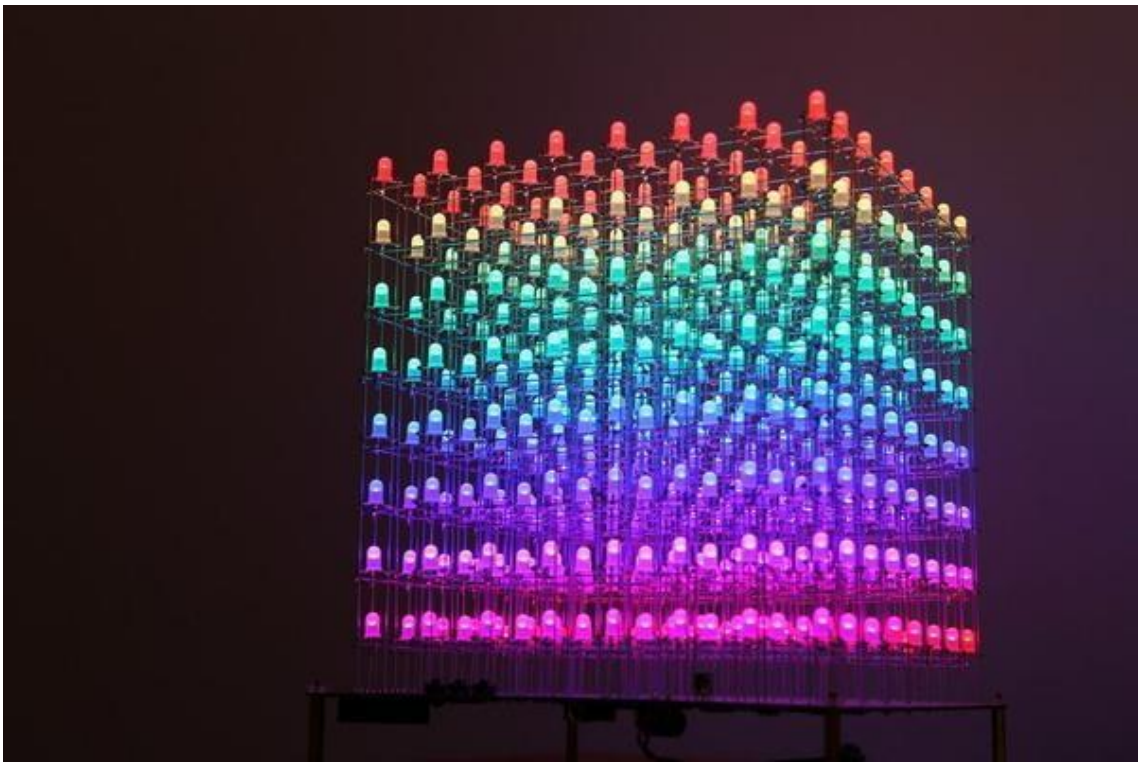

Fig3

Fig4

OTHER APPLICATIONS

The 3D (three dimension) stacked package technology is developing trend of the integrated circuit advanced high-density packaging, which

can easily meet the developing of smaller footprint, lower profile, multi-function, lower power consumption and lower cost for the cell phones and consumer products like digital cameras, MP4, PDA and other

wireless devices.

3D stacked package integration enables a new era of technology convergence between on-chip interconnects and packaging, addressing at the same time circuit performance and functionality for a wide range of applications. Although the stacked chip package can integrate more functions in ultrathin space, and even can contain one or more SoC, in some cases, the rate of good product or the quantity of KGD (kind

good die) can affect the whole 3D package's performance, i.e. if one stacked chip is invalid, the effect can destroy the whole package. In order to avoid this failure mode in the package, each chip's pretest should be completed before stacking. Therefore, comparing with the chip stacked package, stacked package can introduce a pretested solution in a single stack package. In recent years, Stacking of device chips in small and thin fine-pitch ball grid array packages has evolved into the stacking of packages themselves to achieve the same end. There are two primary ways to stack packages to achieve such vertical integration: PiP (package-in-package) and PoP (package-onpackage).

RESULT

We have achieved our goal upto 50 percent in this project. We have successfully designed the 3D led cube framework. It has been tested and it works perfectly fine with 2D layer , when programmed. We have also completed the making of circuit on PCB using multiplexers, transistors ,resistors and microcontroller Atmega 32. We have already checked the efficiency of circuit on 2D display. We expect that it will work perfectly fineonn 3D as well.

We believe that we will be able to accomplish the task before the deadline. We will be ready with 3D LED cube fully programmed to display

different alphabets and hence capable of displaying it.

A WORD OF THANKS

We want to whole heartedly thank our team mentor Ashok for guiding and helping us throughout the mid term of project. Whenever we faced any difficulty he was always ready for helping us. He has done a lot of hard work in making us achieve this goal. Without his help it would be very difficult to complete this.