Project Documentation

Project Title: 3D Led Cube

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Basic Aim:

To create a 3D led cube which is capable of showing pre-defined animations.

Integrating it with MATLAB to display graphs.

Motivation:

We searched for some arduino projects on internet there we found about LED cube.We were really impressed to see it.

So, we finally decided to make LED cube.

Theory:

A LED cube is like a LED screen , but it is special as it has

3D.We can think it as of low resolution displays.

In normal displays it is normal to stack pixels closer to each other in order for better resolution but LED cube has its limits.

<u>Working</u>:

The LED cube has 512 LEDs. So it is impractical to dedicate a   IO port for each LED.Instead LED cube rely on optical phenomenon called Persistence of vision.If you flash a LED really fast it will remain in your retina for some time even after LED is switched off.By flashing each layer of cube very fast after one another it gives the feeling of 3d.

With this setup we will need only 64(anode) + 8(layers) IO ports to control each led.

<u>Anatomy of LED cube</u>:

LED has two legs one positive and one negative .The positive end is connected to the pillars of LED cube which acts as anode.The negative one is connected to the layer.

Hence ,to switch on a particular LED we have to give current to the corresponding pillar and ground the layer.

IO Port requirements and multiplexing:

For an 8x8x8 LED cube we need 72 IO pins.But we can reduce this by further multiplexing.We used nine 4051 8-bit multiplexer.8 multiplexer used to control the pillars and last one used to control the layers.This multiplexer had eight IO pins to control pillars and three pins to control the values assigned to these eigt pins.

Power Supply:

This step can be easily overlooked as a we think that LEDs draw   less current but here there are 512 LEDs so there might be power problem. So, we decided to use Switched-Mode Power Supply(SMPS).It is a source of constant voltage and high current.

Choosing and Testing LEDs:

In this we thought to use diffused LEDs as using clear LEDs might pose some problems like if a particular clear LED is on then it brightness may cause the nearby LEDs which are switched off to appear switched on. So, we used diffused LEDs.Also before using them in cube we tested each LED by making small circuit on breadboard.

Circuit:

We have used 9 multiplexer.The first 8 multiplexer are for the pillars(anode).The 8 IO pins of a multiplexer are connected to base of NPN transistor. The emmiter is connected to pillar and collecter is given 5V.The 8 IO pins of multiplexer for layers (cathode) is also connected to base of NPN transistor but here the collecter is connected to the layers and emitter is grounded.

The 4 pins of multiplexer will be connected to the ARDUINO MEGA. These four pins will decide what value to be assigned to the IO pins. So, we wil use 36 pins of arduino.The power source is given by SMPS.

Code:

The software used for coding programes for the cube is Arduino 1.0.2/1.5.2   and the matlab programs require arduino support package which is downloaded from arduino website.

With Matlab GUI interface we created buttons which when clicked trigger some code which plots a graph and controls the arduino.

Future improvisations:

Variation in size can give better resolution.

Use of Bit Angle Modulation can improve brightness of LEDs.

Full integration with   MATLAB to plot 3D interactive graphs.

Use of RGB LEDs.

Important Links:

A demonstration of LED cube
http://www.youtube.com/watch?v=6mXM-oGggrM

Guide on making LED cube
http://www.instructables.com/id/Led-Cube-8x8x8/?ALLS TEPS

http://www.hownottoengineer.com/projects/lc.html

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At last, It is always fun in learning something new.We learned many things about electrical circuits and some programming tools which may help us in future.