

Clive Mitchell's Low-Tech Techno Art



There's a big difference to how an electronic ornament looks in a gadget shop and when you have it at home. Flashing light effects can get quite annoying after a while and motors that seemed silent in the shop will make themselves very audible in a quiet room. This project is for a piece of passive techno art that neither flashes or makes any noise. It specifically uses low intensity diffused LEDs to create a form that is pleasant to look at, but doesn't get "in yer face". The design is based around a printed circuit board, but with a bit of ingenuity and careful wiring you can still build it without one. The simplicity of the unit means that it's easy to expand the size to create quite large panels or even a multiple of panels to match your requirements.

I have to admit I spend a lot of time making techno art and while in the past I tended to get quite technical and cram PIC microcontrollers and discrete oscillators into everything to make the art perform in an interesting manner, I suddenly realised that animated objects were actually rather visually intrusive and would invariably get switched off. Thus the idea of a very basic grid of LEDs in a frame came about.

While the main picture with this article shows me with a rather large 180 LED unit, the device described here is a small version designed to fit into a fairly standard three inch square picture frame. It has an array of standard 5mm diffused LEDs in your choice of red, orange, yellow or green. The LEDs are wired in series circuits of four with a 330 ohm resistor for each circuit and powered by a cheap unregulated power supply (wall wart). The LEDs chosen for the project are the traditional Gallium Arsenide type as opposed to the newer Gallium Nitride type. It was decided to use traditional LEDs because of their natural warm colour. The more modern technology blue LEDs tend to be a bit dominant if used and also have a higher forward voltage which would mean a bit of resistor or circuit juggling to allow their use. I did build one unit with a single blue placed in the middle, and it actually detracted from the appearance.

I've designed a PCB artwork for this project which may be included with this article, but otherwise can be downloaded from the web-page that supports this project at:-

<http://www.galliumproject.co.uk>

That page has the required tif image file for accurate artwork sizing, but I've also included a short section of 10th inch scale on the sides of the PCB artwork to allow you to verify that the image

has been printed out correctly.

If you don't already have the facilities to etch your own printed circuit boards, then now might be the time to take a deep breath and dive in. The procedure for doing this is as follows:-

Print the artwork onto a transparency with a laser printer. The transparency can either be proper laser film or in my case I use good quality tracing paper that can handle the heat of the laser printer process. The artwork is printed as if you were looking through the circuit board from the component side, and this means that the printed side of the transparency will face the circuit board material when you expose it. This enhances the sharpness of the transferred image. I'm afraid that I've never had much luck with inkjet printing of transparencies. The inkjet black just doesn't match the density of the fused pigment on a laser print.

The single sided printed circuit board material is a laminate of fibreglass or resin bonded paper which has a thin layer of copper foil on one surface. For photo transfer the copper then has a layer of ultra violet sensitive laquer applied. The laminate can be bought pre-prepared in this manner with a black plastic peel-off film protecting the light sensitive surface.

The protective layer is peeled from the laminate in low room lighting levels and the artwork is applied to the light sensitive surface. The artwork is then illuminated by ultra violet light which reacts with the laquer to weaken it. Once exposed for the correct duration, the PCB is developed in a solution that removes the weakened laquer exposing the copper that is to be removed. Note that many developers are quite caustic so use proper gloves for handling the PCB.

Once Developed the board is rinsed and immersed in an etchant like ferric chloride which is sometimes heated and agitated with air bubbles to speed the etching process up. The etchant removes all the exposed copper leaving the track layout on the PCB. When etching is finished the PCB can be washed then drilled. A miniature hand held craft drill is best for this. Once drilled the PCB can be cut to size to fit into your chosen frame. A suitable guillotine is best for this, but you can make do with a fine bladed saw.

The resistors get mounted on the back (copper side) of the PCB and once soldered in place the excess leads can be cropped from the front face of the PCB. If you wish you can now paint the front of the PCB before mounting the LEDs. I tend to use a layer of aerosol primer and then add a few layers of metallic finish automobile paint. Have patience and let the paint dry properly to ensure a tough finish. Now comes the fun bit. Deciding the colour and layout of the LEDs on the PCB. This project is specifically intended to have a random pattern. To create the randomness you should put equal quantities of the chosen LED colours into a dish and give them a good stir. It helps to pre-crop all the LED leads down to about quarter of an inch beforehand and you should note that the LEDs contain a little anvil shaped reflector inside which is normally connected to the negative (short) lead. The negative side of the LED case also has a small flat area to help with polarity identification.

The LEDs are picked out from the dish at complete random without actually looking at the dish. This ensures a good random pattern that will probably have significant clumps of same-colour LEDs. If you don't have a soldering frame that holds lots of components in place while you solder them, then you are probably best soldering each LED in one at a time. Be wary of overheating the LEDs and ensure that they are oriented with their anodes towards the positive symbols at one end of the PCB.

Once all the LEDs are soldered on and cropped, you can get the 12V DC 300mA unregulated power supply, cut off it's output connector and solder the leads directly to the PCB after checking the polarity of the output with a meter. Plug the power supply in and hopefully your piece of techno art will suddenly illuminate. If it doesn't, then try reversing the power supply connections. If a cluster of four LEDs is out, then one may be incorrectly oriented or there may be a bad solder joint. When mounting the PCB into a picture frame make sure that whatever is used to hold the

PCB in place doesn't have metal bits on it that could short the back of the PCB. Also make sure that the power supply cable has a space cut for it and that it doesn't get trapped against a sharp solder joint that could eventually poke right through to the copper conductor and cause a short circuit.

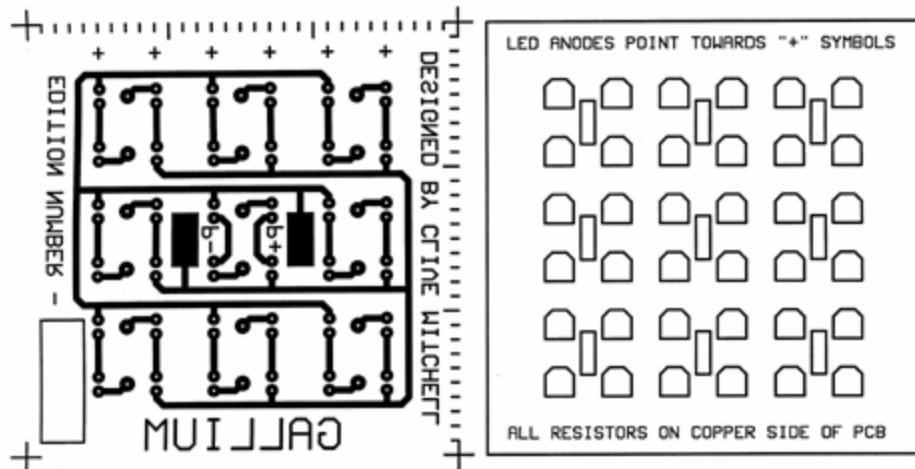
Once you've created your piece of techno art you should make it official by sending a low resolution (640 X 480 max) jpeg image of your illuminated piece to the email address shown on the www.galliumproject.co.uk site and I'll email you back a unique edition number to write in the little box on the back of the PCB. That way you can own a piece of techno-art that is part of a unique series that spans the globe.

Here's a list of components sourced from the Allied catalogue.

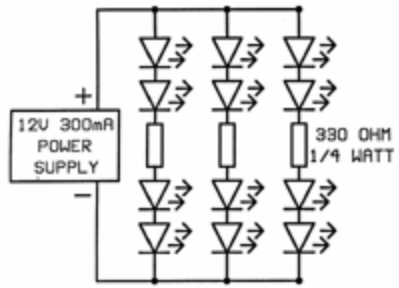
Please be aware that I live in Scotland and the original design was based around locally available components. These seem to be the nearest equivalents, but there's no harm in checking...

- 928-9725 12V 300mA PSU (unregulated)
- 782-0057 Orange diffused 5mm LED
- 782-0060 Red diffused 5mm LED
- 782-0065 Yellow diffused 5mm LED
- 782-0070 Green diffused 5mm LED
- 832-0276 Pack of 1/4W 330 ohm resistors
- 661-0365 Laser transparency film
- 661-0315 Exposure kit
- 661-0310 Photofabrication kit

Printed Circuit Board and Component Layout



Wiring Schematic



THREE OF NINE SERIES CIRCUITS SHOWN