

## **Project 3 - Lighting a Building and Adding Sparkles to Water**

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This project is all about using an Arduino microprocessor to randomly turn LEDs on and off in two similar environments: first as lighting inside of a building, and next as sparkles in a water feature. Additionally, the sparkling water adds the visual highlights and the sound of moving water to a waterfall.

Wait a minute! How are these projects similar? Well, lights in a building are turned on when someone is inside a room. They stay on for a while then are turned off. They do so in a random fashion, as people come and go through different rooms, and they stay on for random times. And sparkles in a water feature also come and go randomly, just much more quickly. So it might be possible to control both lights in a building and sparkles in water with the same Arduino code, but with different timings. Two projects in one? Let's see if it can be done.

I'll start with the building lighting project. I will be using an Arduino Nano from LAVFIN, a Nano socket from a no-name vendor (AMAZON ASIN: B07MGVC18K), a 9V power supply and a few segments of white "LED strips" I purchased from AMAZON, ASIN B07SZMBPFT (the second letter in the ASIN is a zero, not an "O"), and a small DPM pre-assembled building from my layout.

Building interior walls.

Wiring the LEDs;  
5V

Installing the LEDs

Downloading the code  
What is special about the code

The Results

On to the water feature. I wasn't sure just how the LEDs would interact with the resin that I would use for the water (I use polyester resin (PR) from Michaels to make custom pens and pencils, so that was what I had on hand). I used Woodland scenic "shaper sheet" to make several 8" by 6" creeks, and applied plaster to stiffen them, letting them

dry for 24 hours. I then drilled 9 holes in each one to accommodate the LED, then covered the holes with green "Frog Tape" (painters edging tape). In each creek I planned on placing three white 5V LEDs, two blue and two white traditional LEDs with resistors, and finally two more 5V white LEDs which I would tint with LED paints. I decided to

- 1) paint one creek shades of gray and cover it with clear resin
- 2) paint shades of blue with clear resin
- 3) black wash with minimal blue resin
- 4) no paint but just blue resin (Royal blue, sky blue, turquoise)
- 5) paint shades of gray and blue and minimally tinted blue resin.

I created the creek samples and poured about 1/4" of resin in several pours, waiting about 15 minutes for the resin to start to harden before pouring. Polyester resin allows me to make additional pours about every hour. PR is catalyzed from a syrupy liquid to a solid using Methyl Ethyl Ketone Peroxide (MEKP) and I use about 5 drops per ounce of resin (use a postal scale and be accurate); always follow label instruction, wear glasses and gloves.

Resin/Paint decision

Added sound

Landscaping (plants and rocks)

Needed resistors: in-line or circuit board?

Changing the timing in the code.

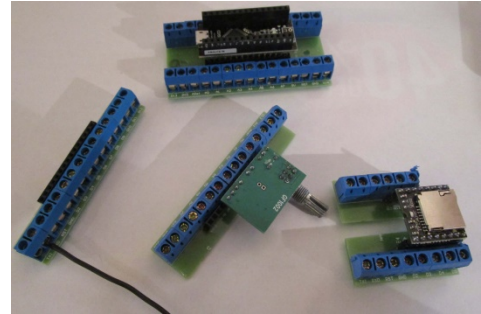
The results

~~Many advanced modelers have water features somewhere on their layout. Perhaps a waterfall, a spring, a river or a normally dry gulch which turns into a torrent after a thunderstorm. These are usually static displays, but what if we could enhance water features with sparkling water and the sounds of moving water.~~

For this application, I wanted to make printed circuits. I learned about a simple yet functional circuit design program called "EasyEDA", which is a free web-based application that can also run natively on a PC. Check out <http://www.EASYEDA.com>. Just make sure you design the circuit on the back of the board. You can send the design off to a fabricator for a very reasonable price. Also, take a look at EasyEDA tutorials on YouTube. I am not a hardware guy, but it was not an unreasonable learning curve; first learn how to add a pad (a connection point), draw a line, change the size of a pad and thickness of a line, and how to align components and add text; not much else is needed for simple model railroad circuits.

I think I would use tape or putty to control light leaks around edges of building walls.

I prefer using screw terminal blocks to connect wires to a circuit, instead of placing jumpers onto pins or sockets. The solution would be an expansion board for the MP3 player, but I found none available commercially. Getting creative, I decided to make one by cutting up an Arduino Nano expansion board, available from AMAZON (ASIN: B07MGVC18K). I started by cutting one right down the middle. Next, I took one half and cut it perpendicular to the first cut at pin 9. That left me with one piece with 8 pins and the other with 6 (we lost pin 9 when we cut the half board into two pieces). But since we use only pin 16 on one side, we have enough sockets to do the job. I placed the MP3 player onto the pieces, such that pins 1-8 were on the larger piece and pins 11-16 of the shorter piece.



To stabilize the assembly, I wanted to mount it on a piece of styrene about 1/2" larger in each dimension than the socket assembly. The assembly measured about 1 5/8" square, so I cut two pieces of 0.04" thick Evergreen plastic sheet (Evergreen part 9040), and then laminated them together into a thicker piece. I drilled #43 holes into each corner. I then hot glued the assembly onto the styrene.

Similarly, I wanted an expansion board for the PAM8403 amplifier. I took the other half of the Nano expansion block and placed it into the sockets. I had 5 more pins than I needed, and could have shortened the expansion block if I wanted to.

SureRockCo has a 30 minute YouTube on how to make interior boxes to constrain building illumination. <https://www.youtube.com/watch?v=75KBJmQFyTA&t=2s>. It has no narration but has a lot of good information in text over the video. The first 14 minutes are more about building the interior pod structures/boxes, and the remainder about adding interior decorations (plants with Woodland Scenics field grass, etc).

Mikes Trains (<https://www.youtube.com/watch?v=FpqC4RrGqfQ>) did the "how i add lights to my buildings" video. He has a ton of recent train videos, most around 15 minutes. 12V on a switch, not that innovative.

Model Train Technology has a good video at <https://www.youtube.com/watch?v=yzRDdRQsLnw&t=3s>. Its electronics is a "LED Scene Controller which is DCC. He also uses "Gallery Glass" for windows. Part 1 is 7 minutes and part 2 (<https://www.youtube.com/watch?v=1IQUtqQtvKQ>) is 14 minutes.

HO Scale Customs has a video (#7 in the series on building craftsman kits) on installing window glass at <https://www.youtube.com/watch?v=1IQUtqQtvKQ>. He uses Aleens tacky glue (upside down bottle at Michaels for \$2) applied with a tooth pick. Michaels also has acetate sheet. #6 (<https://www.youtube.com/watch?v=6kBqvoewrPc>) is also interesting on how to cut windows into walls. #8

(<https://www.youtube.com/watch?v=wNdEg8eoJrA>) is how to install window dressings.

I like this guy's work.

<https://www.youtube.com/channel/UCCHLrCVLcLyZNII8QDdJH1Q>