

15-294 Final Project

Remote Control Luminaries

The Noctilux

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1 Introduction

Fear of the dark is a common and typical fear for most children. I was one of those kids who were afraid of darkness so that I would tuck myself in my bed before calling my parents over to turn off the lights for me. I couldn't stop thinking how nice it would be if I could turn it off while I'm still in bed. As I grew up and became an electrical engineer, instead of being afraid of darkness, I'm defeated by my own laziness. I want to simplify everything in my life, including the process of getting off my bed, walking through the messy room, getting the switch and tripping over in the dark messy room on my way back. Equipped with the knowledge I have acquired from courses I have taken, I started thinking about my childhood dream. This inevitably led to the idea of building a remote control lamp. The design process for the Remote Control Lamp was very innovative and dynamic. However, because of time and hardware constraints, for the purpose of 15-294 final project, I decided to make it into a decorative Remote Control Luminary. The remote control and lighting of this project is accomplished by using Arduino technology. The decorative component of the project is designed in SolidWorks and 3D printed by the NVBots. The exterior container is made using laser cutters. Because it's a decorative luminary that has the best visual effect in the dark places, I decided to call it the **Noctilux**.
[-Noc: night, -lux: light]

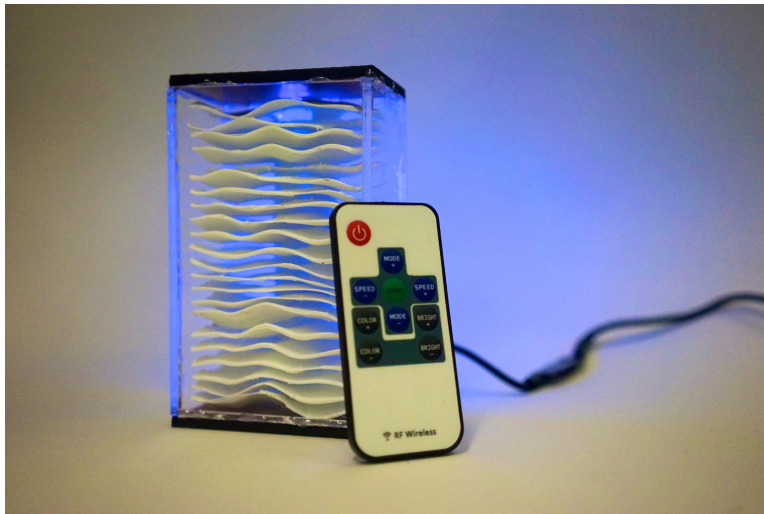


Figure 1: Remote Control Luminary — The Noctilux

2 Design Details

For the circuitry technology part of this project, I started off experimenting with the IR sensors, LED light bulbs, the IR remote control and programmed some of the easy lighting patterns on the Arduino UNO. However, my goal is not only to make the Noctilux work as expected, but also to make it visually pleasing, which requires some good amount of circuit simplification. And instead of using a bunch of low cost light bulbs, I adopted a more energy efficient, brighter and safer LED strip.

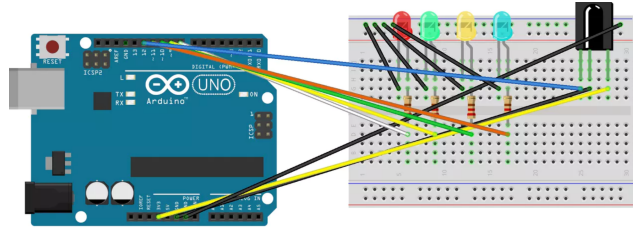


Figure 2: Basic Arduino IR Circuitry

The frequency of the remote control that came with the Arduino starter kit was separately tested so that I can program different modes/light patterns on my LED lights. For example, changing colors of the Noctilux and having the LEDs shine in very interesting patterns.

(See demo video for an interesting pattern: **The Heartbeat** pattern I call it)



Figure 3: Remote Control for the Noctilux. **COLOR+** and **COLOR-** are for changing colors of the LED. **MODE+** and **MODE-** are for changing the lighting pattern. **SPEED+** and **SPEED-** are for changing the frequency of the repeating lighting patterns.

For the decorative component of the Noctilux, I adopted NVBots 3D printing technology for the complex shape I had in mind. The shape (**Figure 4**) looks like a bunch of wavy plates stacked together. I wanted it to resemble moonlight shed waves on a peaceful lake. The shape is designed such that it maximizes the visual effect with the LED lights and create a soothing and relaxed feeling for the user.

Each undulating plate is designed by a face curve feature in the sketch tools and connected

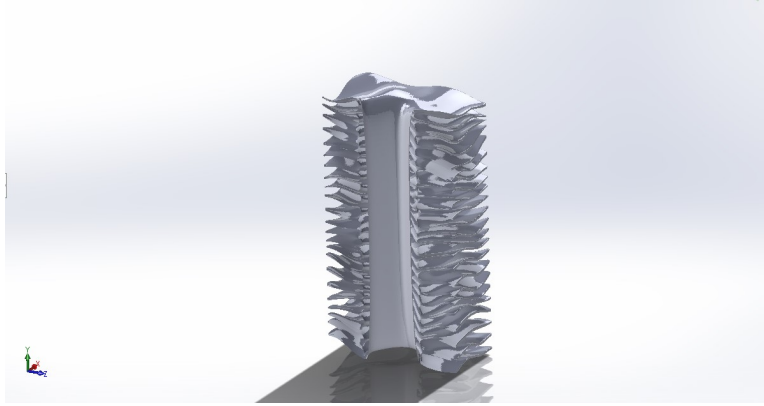


Figure 4: Wavy Plates in SolidWorks

through a lofted cut feature in the central axis. The lofted space in the central axis provides me the necessary space to place my ugly circuits and LED strip. The central lofted cut was made by projecting a sketch onto top plane shown in **Figure 5**.

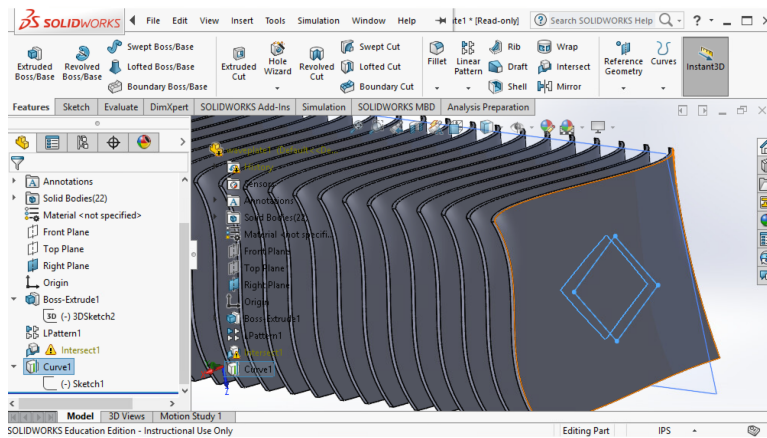


Figure 5: Lofted Cut projection

For the exterior container, I laser cut the $\frac{1}{8}$ in clear acrylic for the two sides and the front, cork wood on the top and bottom and $\frac{1}{4}$ in acrylic on the back side. It's noteworthy that I intentionally used a slightly thicker acrylic on the back. The reason is that I don't want the user to see the back side of the Noctilux because it's where the circuits are placed. However, because it's a luminary, I did not want to completely block the light from shining through the surface so the material has to be transparent. Therefore, I thought of using a slightly thicker piece of acrylic and sand-papered it so that the frosting finish would hide the circuits in a beautiful and slick way while letting all the lights shine through and diffusing the lights into the environment in a more gentle way. I adopted cork for the top and bottom because I wanted it have enough friction and have a nice contact with the user's table. Moreover, acrylic on the bottom is very easy to get scratched and it will jeopardize the visual aesthetics of the Noctilux. I made a hole for the cable to sneak out of the box for whatever power source the user is willing to use. It works with any computer USB outlets or portable battery. Because it's LED lights, it does not dissipate much energy into heat, so it's safe to use.



Figure 6: Container Front, Back, Side views

3 Iteration Process

The original idea was to make a Remote Control Lamp of a bigger size. The current version of Noctilux is actually an unexpected ideation from the original design. Because the interior

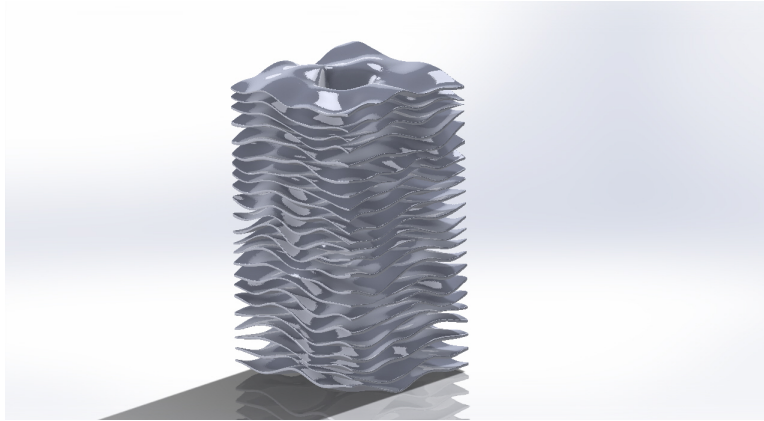


Figure 7: Original Design of the Remote Control Lamp

wavy plate is a very complex shape for the NVBots to handle, it would've taken a huge amount of time to finish printing. So I had to scale down the size and cut the plates in half vertically. With the inspiration of Professor Touretzky, Varun and Aijin, I turned the lamp idea into a more interesting decorative lamp. This iteration process taught me a lot about the real world prototyping. Because of technology and other constraints, the designer have to be creative about using the resources available to manufacture the product that is closest to the expectation. Sometimes, the result can be surprisingly stunning. It is something that one will never have thought of in the first place.

4 Demo Photos



Figure 8: The Noctilux



Figure 9: The Noctilux

All the .stl files and gallery photos can be found at this link:
<https://drive.google.com/open?id=0B3P926an06jeTXc5czkzbnhQVms>

References

- [1] DesignSoftware: Modeling a Wave Spring
<http://www.engineering.com/DesignSoftware/DesignSoftwareArticles/ArticleID/10242/Modeling-a-Wave-Spring-in-SOLIDWORKS.aspx>
- [2] How To Bro YouTube: How to make ir remote control home automation using Arduino multiple channel
<https://www.youtube.com/watch?v=56rLeyLHuho>
- [3] Innova Systems: Projecting Sketched Curves on Faces in SolidWorks
<https://www.youtube.com/watch?v=0q5zv04nL9g>
- [4] GrabCAD: Tutorial - how to use a loft cut feature
<https://grabcad.com/tutorials/tutorial-how-to-use-a-loft-cut-feature>