

Final Project Documentation

Two Lamps

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ATLS 3100 Form - Spring 2025

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Project Requirements – Two Lamps

Main Project Requirements

- Create a set of two physical, functional lamps that are recognizably part of the same design family.
 - Each lamp must be at least 8 inches tall.
 - Each lamp must use a different primary material (**or be mixed according to the conversation had with Aiden**)
 - Lamps should direct and shape light in an intentional way (e.g., directional, ambient, etc.).
 - Shades and/or bases must be original designs (not store-bought).
 - Functional lighting components (bulbs, sockets, cords) may be off-the-shelf.
 - Lamps can use any style or light source, including LEDs.
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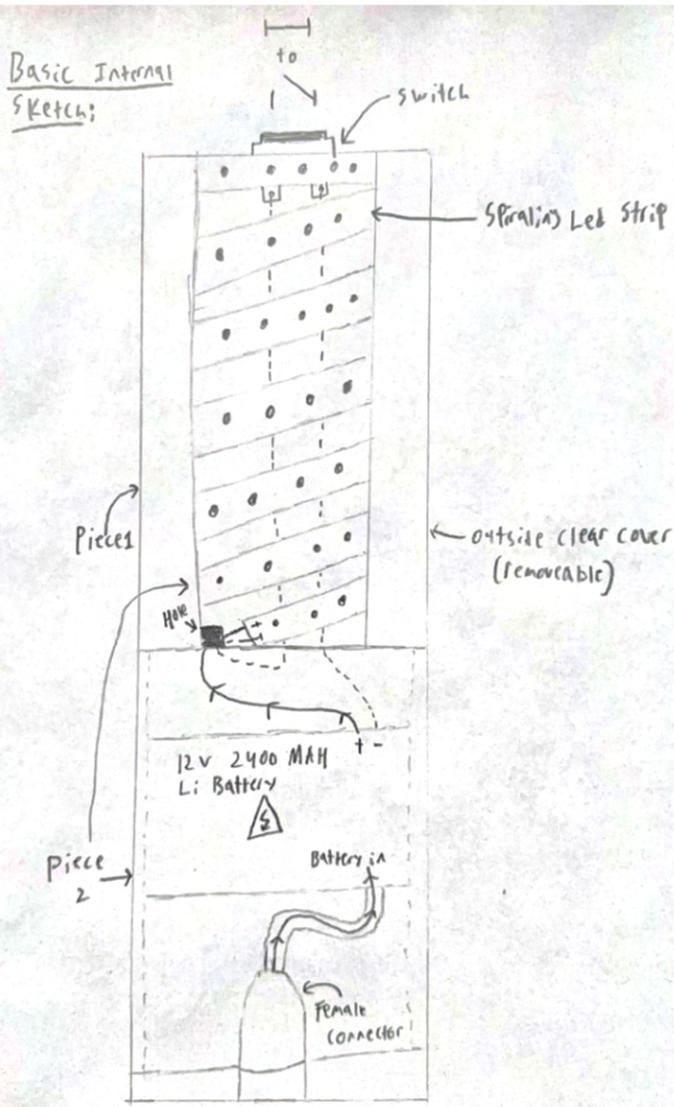
Specific Object Requirements

- **Mountable on a Wall**
 - Each lamp must securely mount to a vertical surface (wall sconce style).
 - The mounting system must allow for easy attachment/removal of lamp itself.
- **Usable Off the Wall**
 - Lamps must function when removed from the mount (e.g., for handheld or table use).
 - Should be visually appealing both on and off the wall.
- **Rechargeable via Mount**
 - Charging begins automatically when the lamp is docked.

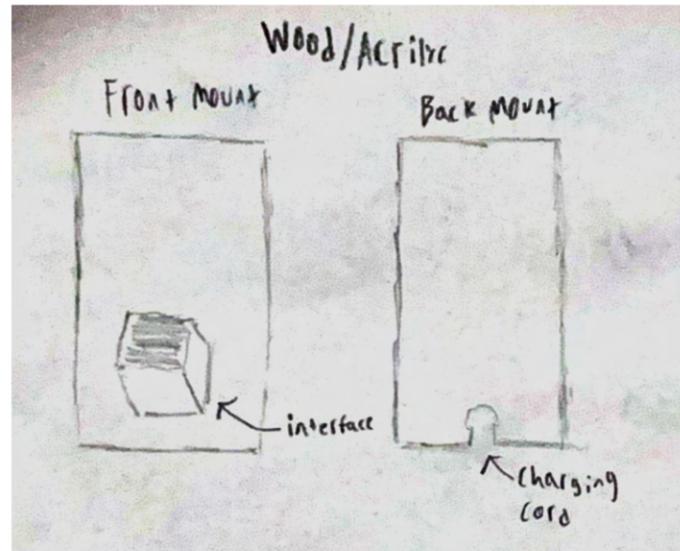
- **Battery-Powered**
 - The internal battery must support at least 1 hour of continuous use.
(Hypothetically, it should work with the 2400mAh)
- **Functional On/Off Switch**
 - Must be a physical switch (**toggle**, pushbutton, or capacitive).
 - Easily accessible in both wall-mounted and off-wall states.
- **Friction Fit or Magnetic Docking**
 - Mount should require little force.
 - Lamp should “slide” in place to satisfy user experience.
- **Orientation-Agnostic Docking**
 - Lamp should dock and function regardless of left-right orientation.
- **Ambient, Non-Directional Lighting**
 - Light must softly fill the area without harsh shadows.
 - Shade must diffuse light evenly in all directions.
- **Minimum Height: 8 Inches**
 - Meets the project’s minimum size requirement.
- **Material Variety Across the Pair**
 - Materials used in both have to be fairly visibly created from two different forms of manufacturing.
- **Consistent Design Language**
 - Both lamps must clearly look like they’re part of the same family (e.g., same form, color palette, or surface texture).
 - Differences in material should be a design feature, not a flaw.

Sketches

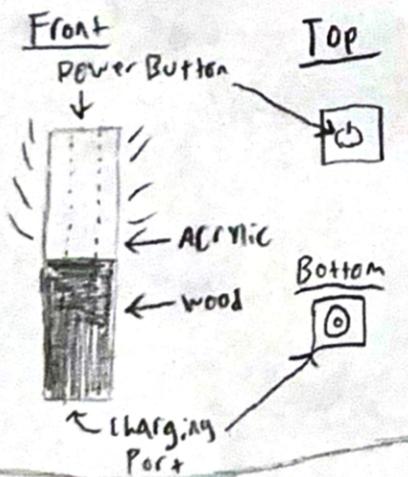
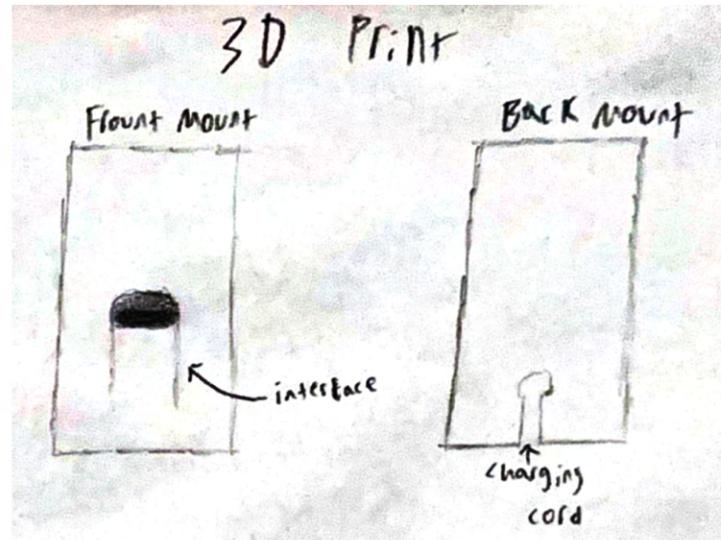
Internal Sketch



Wood Mount

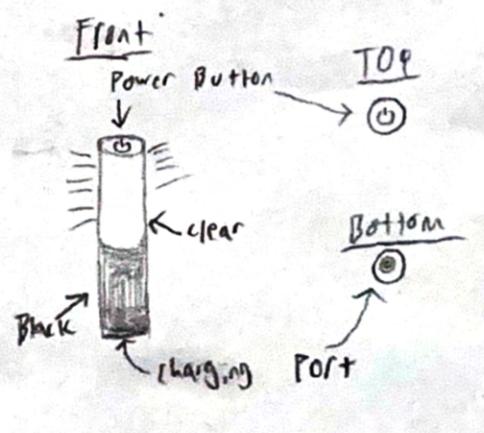


Plastic Mount

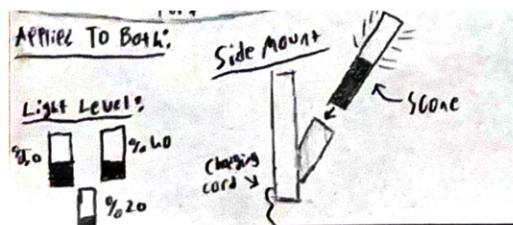


Wood
overview

Plastic
overview



Applies to both



References

*Square
Sconce*



*Minecraft
Torch*



*Example of
light vs base*



*Household
use*



*Wall
use*

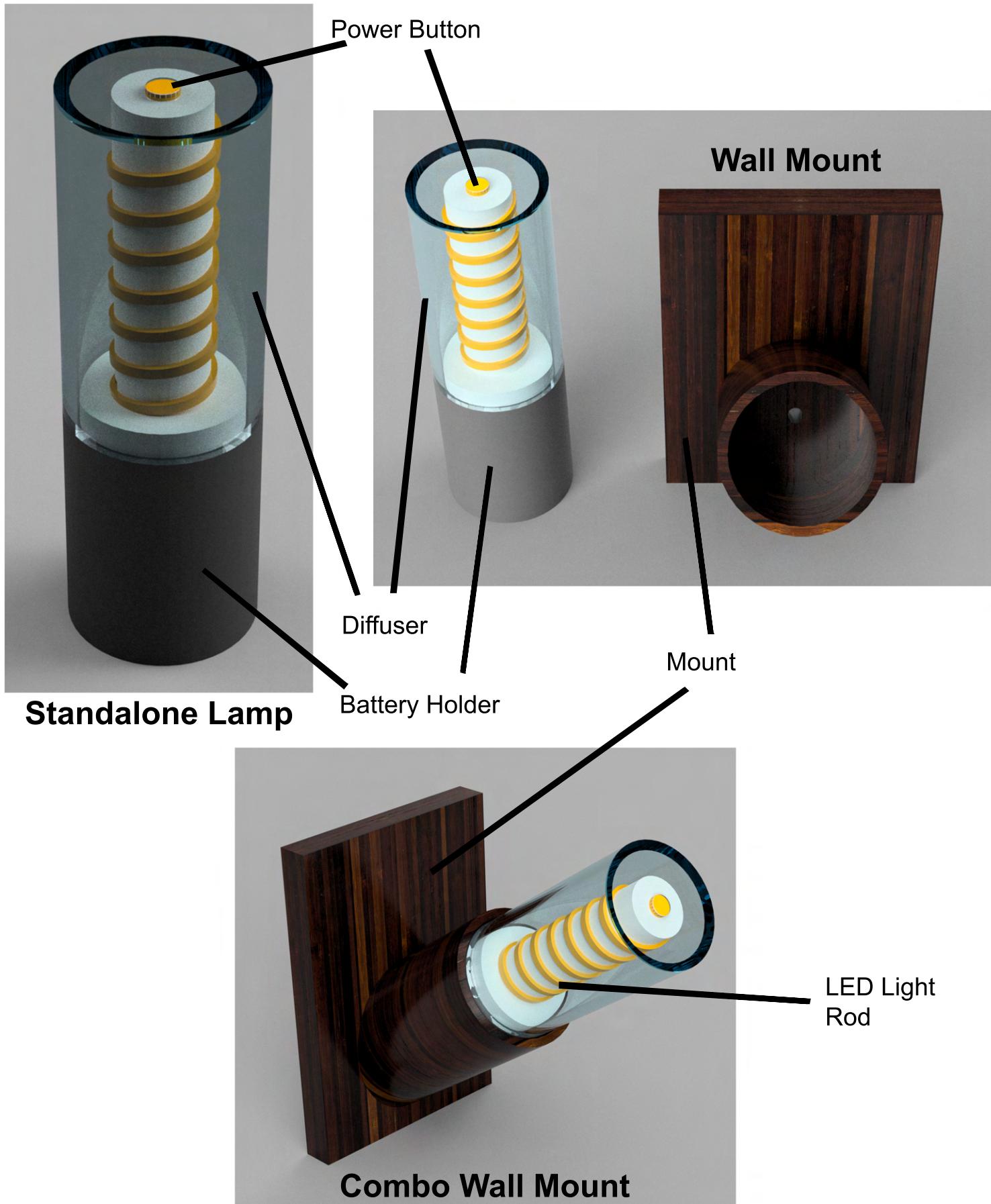


*Battery
use*



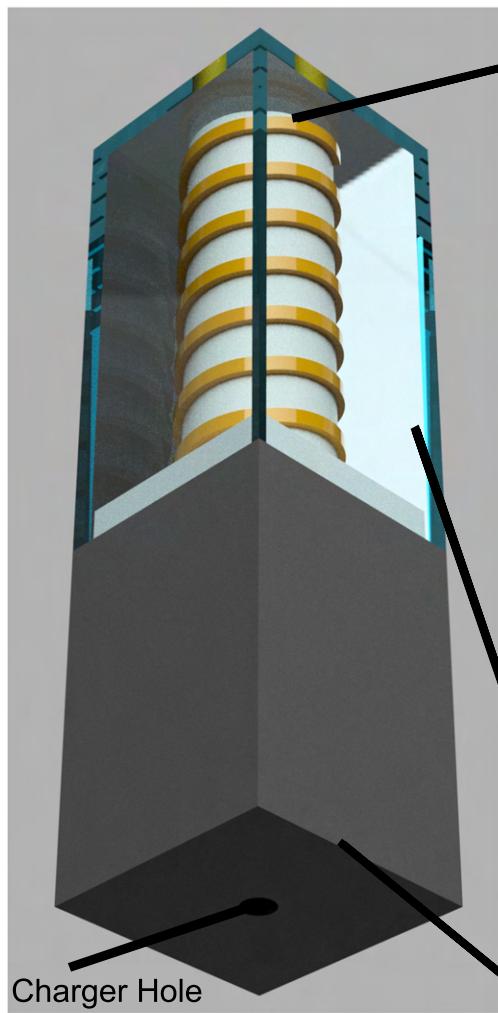
Sconce 1

Perspective Views



Sconce 2

Perspective Views



Standalone Lamp

Power Button

Diffuser

Battery Holder

Charger Hole

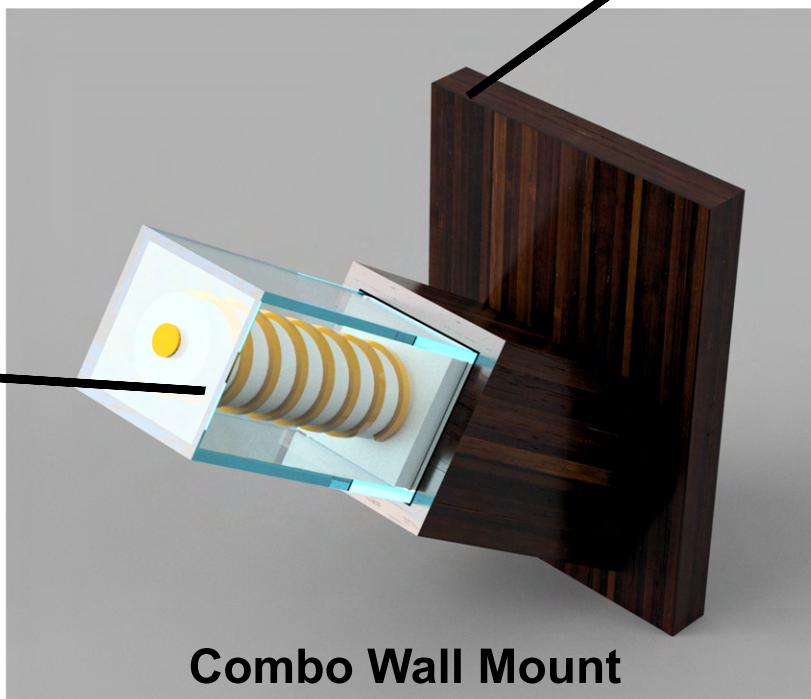
Wall Mount



Mount

Charger Hole

LED Light Rod



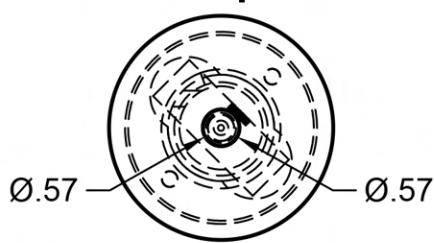
Combo Wall Mount

*All measurements in **INCHES**

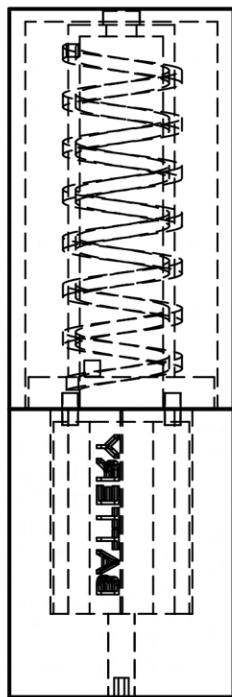
Sconce 1

Orthographic

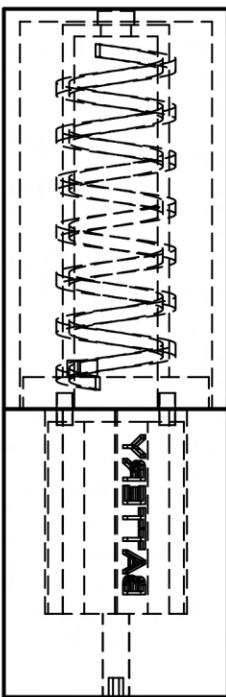
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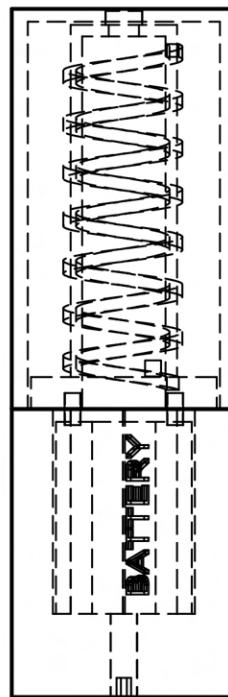
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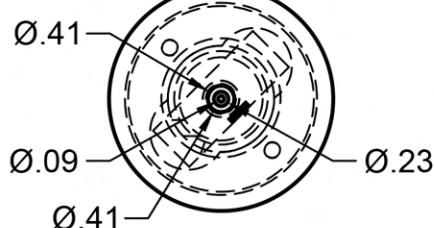
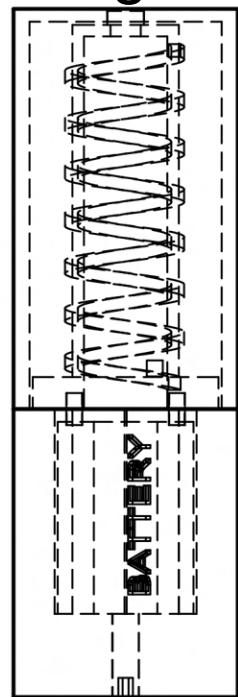
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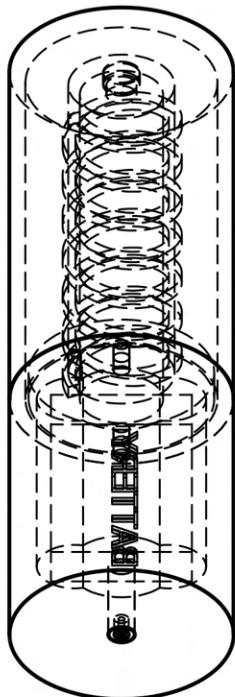
Front



Right



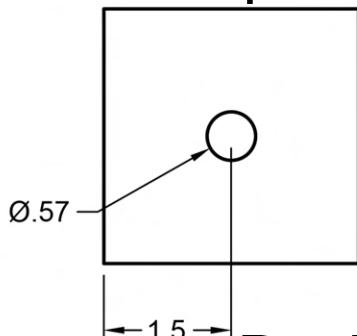
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Isometric

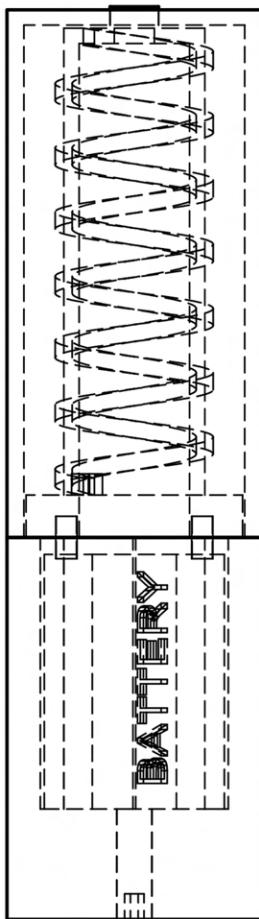
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Top



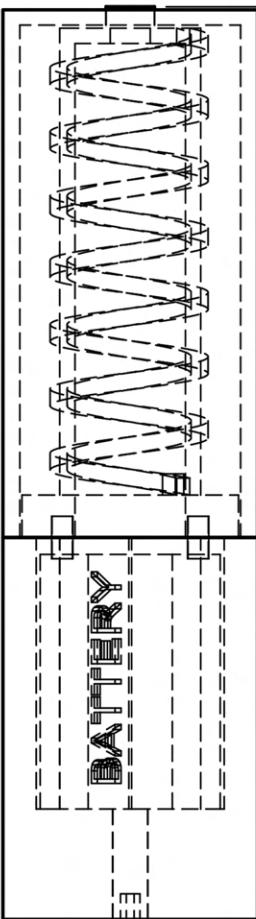
Sconce 2
Orthographic

Left



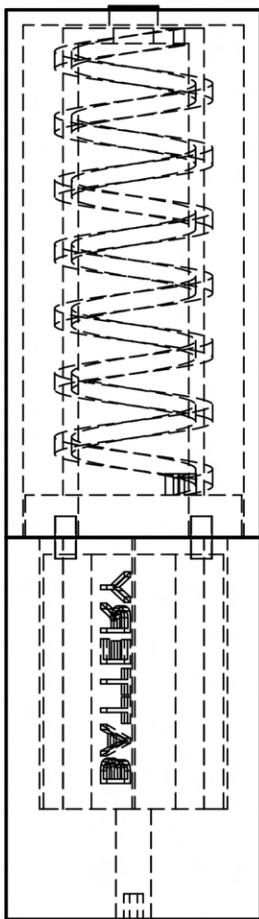
10.72

Back



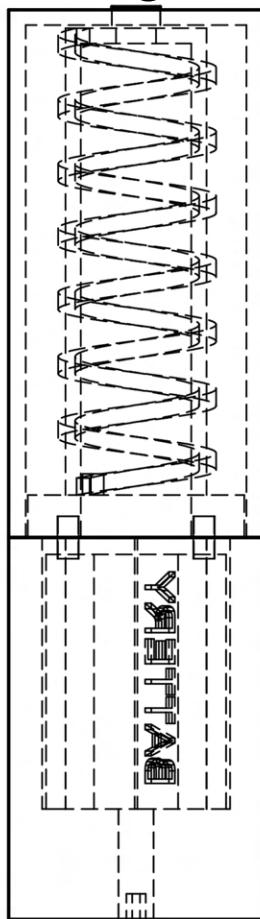
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Front

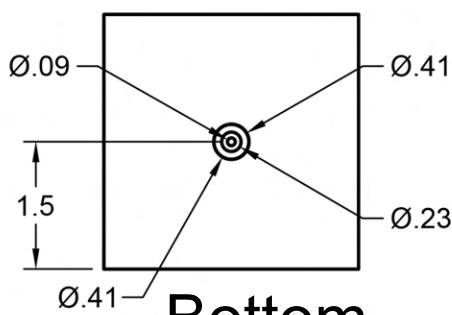


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Right

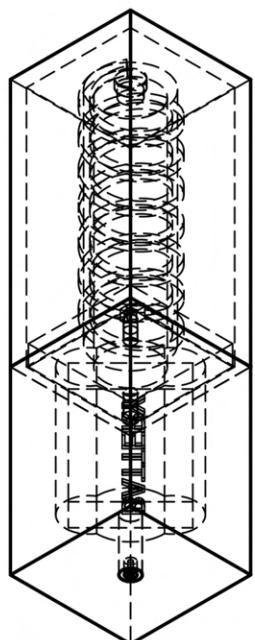


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Bottom

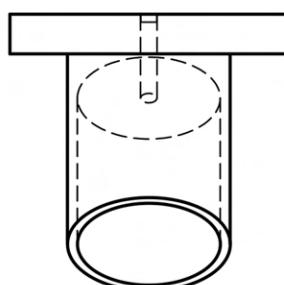
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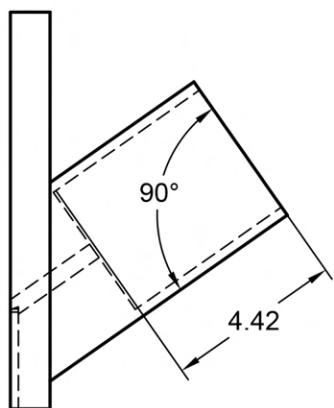
*All measurements in **INCHES**

**Sconce 1
Mount**
Orthographic

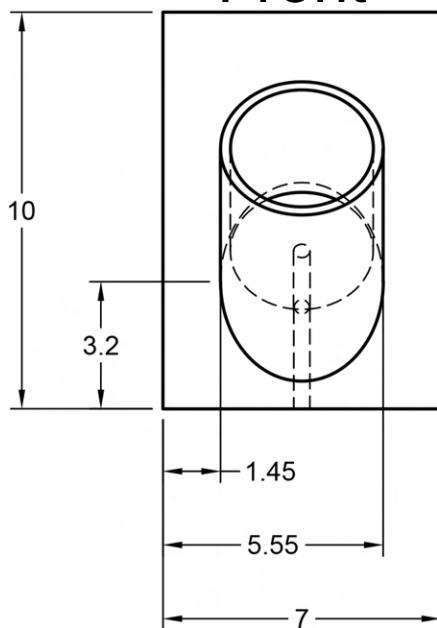
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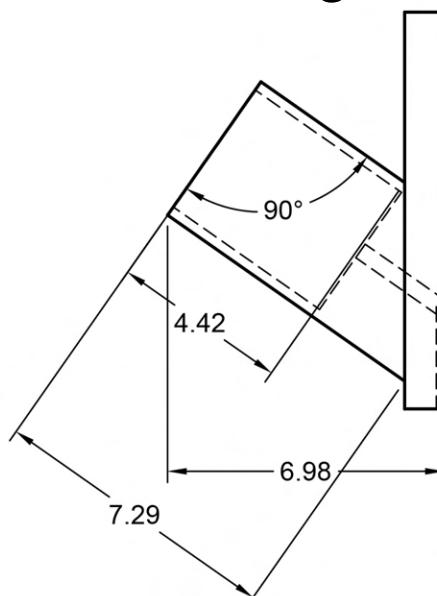
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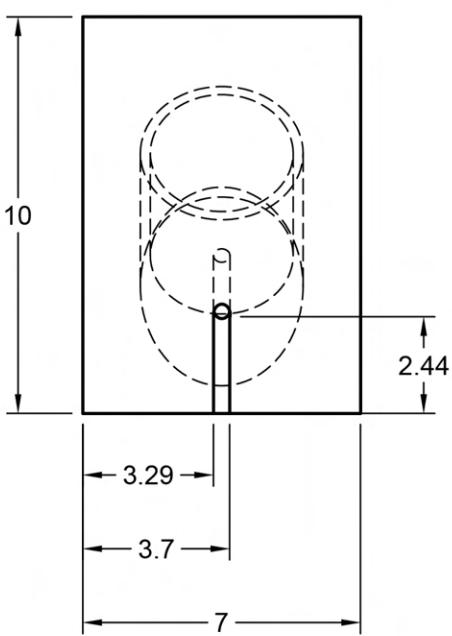
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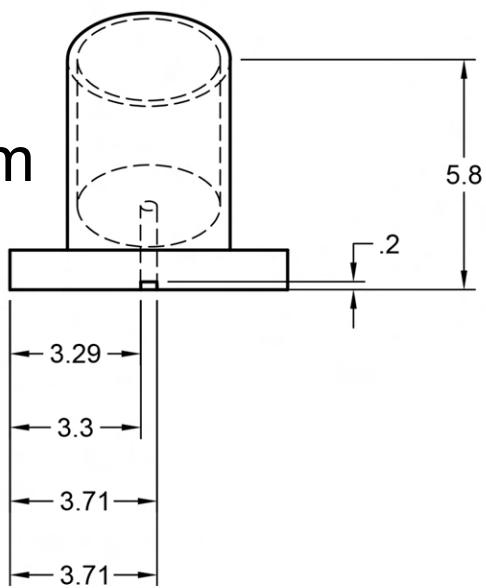
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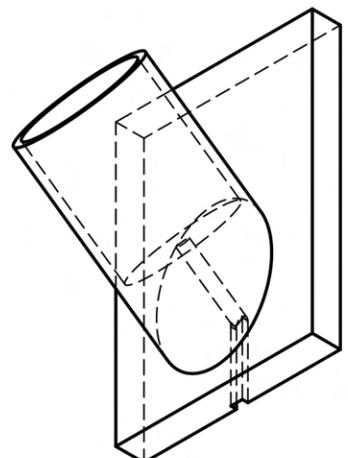
Back



Bottom



Isometric

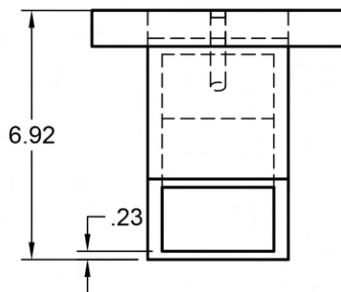


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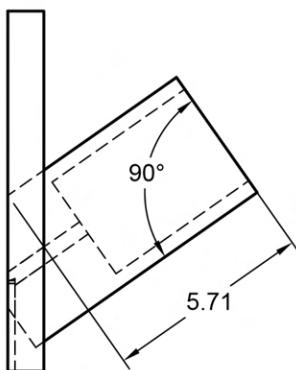
Sconce 2 Mount

Orthographic

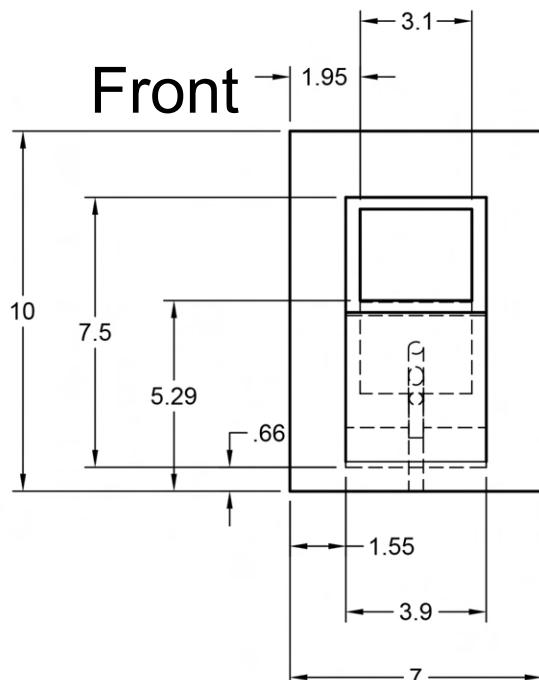
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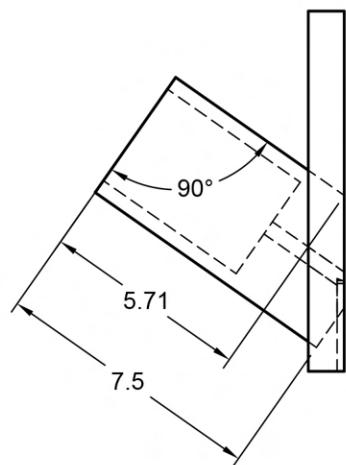
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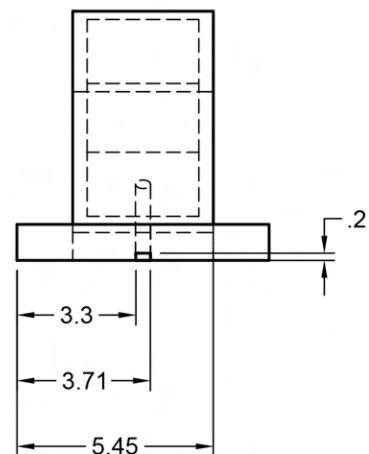
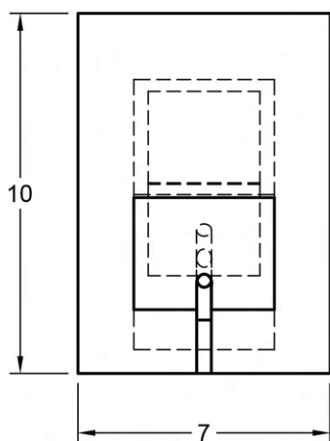
Front



Right

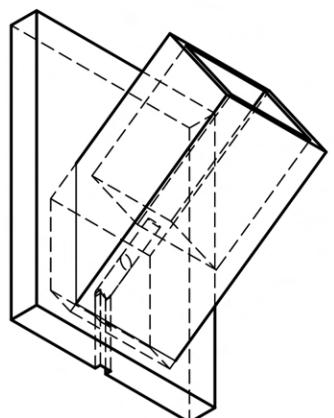


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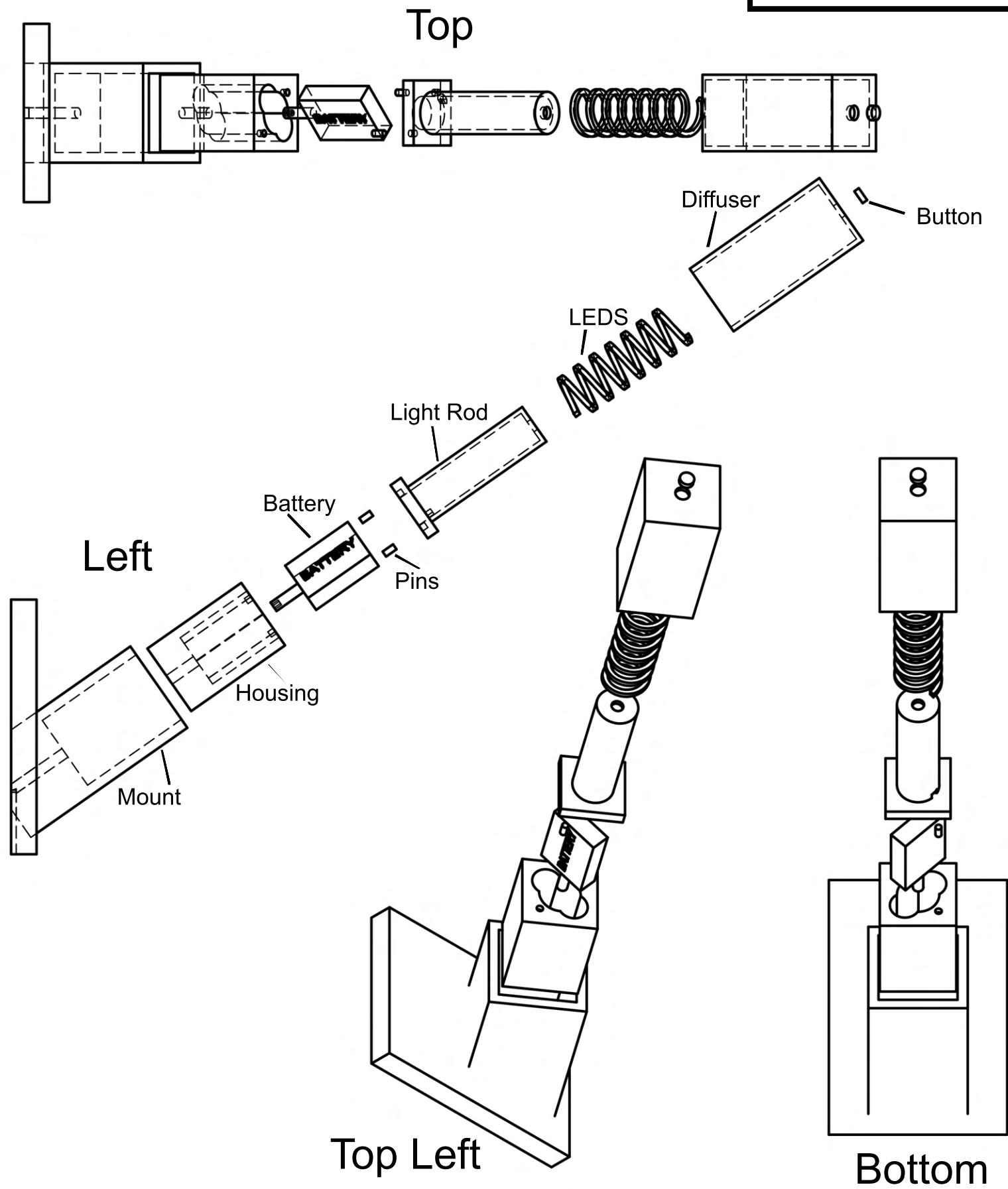


Bottom

Isometric



Sconce Exploded Monocolor



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Initial Concept

When I started this project, my initial idea was to create a set of lights that used radio frequency, modulators, and an Arduino inside each light to detect how far apart they were and adjust their brightness accordingly. As I investigated further, I realized significant issues with this idea: extensive wiring and insufficient space within the lamps for efficient functionality. Eventually, I decided to abandon this concept.

Inspiration and Sketching

Next, I started looking online for inspiration and found a light fixture called a sconce. It intrigued me because it looked usable both as a flashlight when detached from the wall and as a simple fixture when mounted. With this inspiration, I began sketching.

My final design involved four total pieces: two mounts and two lights. The lights contained rechargeable batteries spiraling up into a rod covered with LED strips, topped with a button. A diffuser enclosed the LEDs. The batteries were rechargeable, with a charging port at the bottom of each light and chargers within the wall mounts, allowing them to charge while mounted and function as portable flashlights when detached.

Alongside my sketches, I created a detailed list of project requirements: the lights had to be usable off the wall, chargeable on the wall, 8 inches tall, and have a power button at the top. I also produced interior wiring diagrams, placing the charging port at the bottom and housing the battery inside. Wiring extended into the light rod, connecting its negative side to a toggle button at the top, which then connected to the LED strip through a hole in the rod. Since both battery and LEDs operated at 12 volts, resistors were unnecessary.

Designing the Models

I began designing the models, starting with the square light, which comprised seven pieces, including the battery and button. Dimensioning each component was straightforward, as I measured the battery and LED sizes to accurately design the battery holder and light rod.

After completing the square light, I moved on to the circular version. The primary difference was its cylindrical shape, avoiding sharp corners that would pose issues for wrapping LEDs. To handle this, I designed a circular rod suitable for both lights. I modeled the circular light similarly to the square one, adding color differentiation to clearly distinguish between the diffuser and the body. I physically modeled the battery, button, and LEDs to ensure accurate proportions.

Next, I designed the mounts. Using the base width of the lights and battery holder height, I created large back plates with angled extrusions to orient the lights upwards. I included an offset for thickness, extruded it downward until the battery holder was completely covered, and added a hole for the charging cord with a channel for the wire running down the mount's back.

Construction

Initially, I planned to construct the lights using acrylic. The square diffuser seemed straightforward, but the circular diffuser proved challenging. I decided to handle this later.

Beginning construction, I 3D printed the square battery holder and immediately realized the battery charger didn't fit due to zero tolerance. Adjusting dimensions resolved this, and I updated the circular design similarly. Next, I 3D printed the light rod and encountered another tolerance issue with the button, which I also resolved.

To convert the diffuser to acrylic for laser cutting, I designed interlocking slices, which I successfully cut at Colorado Plastic Works and assembled using superglue.

The electronics assembly involved inserting the battery, securing the charging port, connecting wires, and adhering the LED strip to the rod. Ensuring internal stability was challenging, so I decided not to glue the diffuser permanently to allow for future adjustments.

For the circular diffuser, practicality forced an alternative approach. I alternated nine laser-cut acrylic slices with four 3D-printed slices and a black cap. Assembly mirrored the square version, and I separately assembled the diffuser for placement over the rod.

Before final assembly, I optimized peg sizing through trial and error, choosing .231 inches as optimal. After printing multiple peg sizes, I easily assembled and glued the components.

Lastly, I 3D printed the mounts. After testing different tolerances, a .05-inch tolerance worked best. Initially successful, I encountered an unexpected issue—the charger sizes differed slightly from the charging ports. I resolved this by using hot glue to secure the chargers snugly within the mounts.

Final Assembly and Installation

The final assembly involved meticulous placement and secure fastening of components to ensure internal stability. This required careful wire routing, stable adhesive applications, and precise fitting of all elements. Final mounting proceeded smoothly once the charging issue was addressed, with both lights fitting securely and functioning as intended.

Overall, despite numerous challenges, careful planning and iterative problem-solving allowed me to successfully complete this ambitious project.

Detailed Challenges and Solutions

Throughout the project, I consistently considered how to effectively incorporate acrylic. The square diffuser converted easily to interlocking slices, while the circular diffuser required inventive solutions due to its impracticality of numerous stacked acrylic pieces. Eventually, a hybrid approach of acrylic and 3D-printed materials resolved this issue.

Tolerance issues emerged repeatedly, initially with the battery holder and later with the button hole. Careful adjustments in Fusion 360 and subsequent reprints resolved these problems, ensuring precise fitting of all components. Optimizing peg sizing was another iterative process, ultimately leading to the ideal peg size of .231 inches.

Mount designs required careful attention to tolerances and charger dimensions. Initially confident in my measurements, I discovered slight size discrepancies in the actual chargers, necessitating adjustments during assembly, effectively resolved with hot glue. Despite these setbacks, systematic problem-solving led to successful final construction.

Post-Creation Reflections

What I Would Change

After building my project, the main thing that I would change is the size of the charging hole on the mounts, and also the way the diffuser was built for the circular light. As cool as it looks, it was very hard to get all of the pieces of the circular diffuser to lineup correctly when gluing so it looks a bit rough around the edges. If I were to change this, I would probably just 3-D print it out of a clear PETG material. As for the mount, I would probably just make the charging hole a bit smaller so that the charger fits into the mount snuggly without needing to add glue. Or, I would split the charger into its positives and negatives and create a magnetic amount for each of the lights. I feel like this could work a lot more efficiently. However, the circular light would need two different size circular magnets so that it could be installed anyway you wanted.

One other thing I would change is the pure size of the lights themselves. Even though it was a requirement for the projects to have the lights be at least 8 inches tall, I think it would be really cool to have these lights as more of a flashlight rather than a sconce.

Lastly, I also want to allow the lights inside to be neo pixels instead of bright white light. I think this could be really awesome because then it would allow the lights to give more of an ambience.

What Needs Complete Rethinking

One thing that needs to be completely re-thought of is the charging system. Even though I really like how it works currently and agree that it works very well, I think it would be super awesome to do a magnetic charging system instead. It would make the connection of the lights and the mounts much more seamless and also allow for a perfect connection every single time. I don't think it would be too difficult to do with the square light, but it might be a bit more of a challenge to do it with the circular light. All it would take, though, is a bit of guessing and testing and also some more experience with electronics to keep things from overheating.

Advice for Future Students

Some advice that I would give to future students working on this project is to keep it simple. I felt like my project was way more complicated than it actually needed to be. However, I really enjoyed making a product that I thought of completely from scratch and building it to its full potential. This is a project that you wanna make sure that you actually have time to do and won't get overwhelmed by it, but also a project where you can really showcase what you're able to do. In other words, I recommend to students who are doing this project to challenge themselves, but not overwhelm themselves. You should understand that finals time is very busy and that some ambitions aren't possible to do, but also don't cheat yourself by doing an easy project when you could be doing something awesome.