

Firefly

We all need a light of hope



Firefly

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Final Year Project (FYP) submitted to the School of Animation, Arts and Design,
Sheridan College in partial fulfillment of the requirements for a
Bachelor of Craft and Design in Industrial Design

2022/2023

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FIREFLY

Acknowledgments

Faculty of Craft and Design

Thank you to my advisors Scot Laughton, and Doreen Stegmuller for all that you have done, which I will never forget. I truly appreciate you and your time you spent helping me with this project. Your help meant the world to me! I ended up having a project that I am so proud of.

Thank you to Mickey Wang, my studio technologist, who was always there to help!

Thank you to my friends and classmates, who made my last days fun to spend, and full of laughter.

And finally, thank you to my parents, and brothers for supporting me and helping me throughout the whole time.

You all have had an amazing impact on my life

The Academic Year 2022/2023

Firefly Light

“Hope is being able to see that there is light despite all of the darkness”

Desmond Tutu



HCI

ORDER CONFIRMATION

NAME	ADDRESS
PHONE	CITY
STATE	ZIP
COUNTRY	

DATE: _____

TIME: _____

AMOUNT: _____

STATUS: _____

Handwritten text on a piece of paper, possibly a note or receipt, written in Arabic script. The text is partially obscured by the candle and other papers.

Additional printed text on a document, likely a form or receipt, located in the bottom left corner. The text is mostly illegible due to the low light and angle.

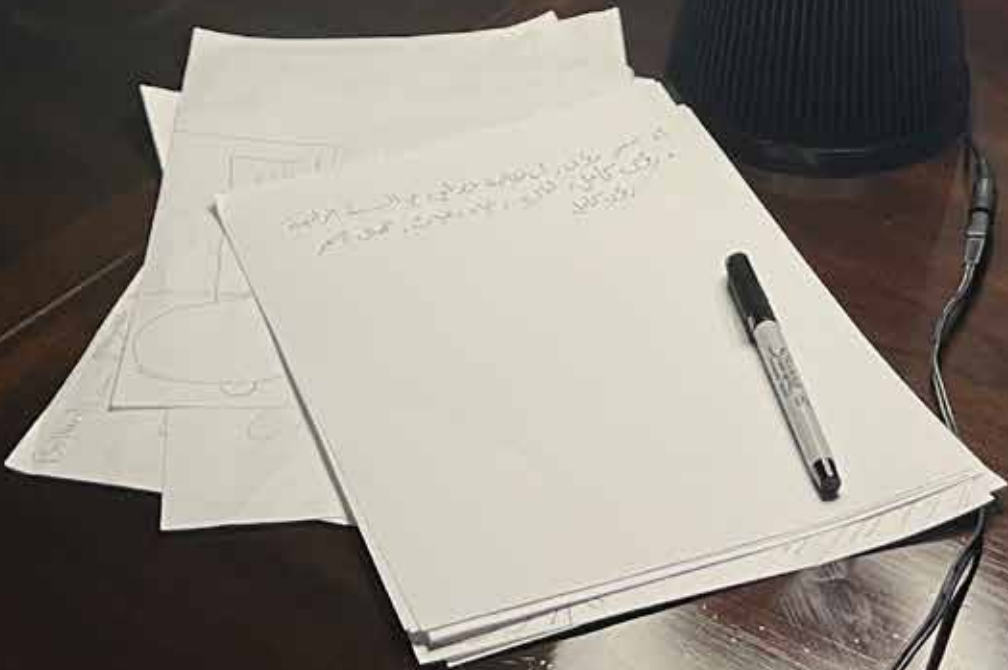


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Fig 1: A new predictive model for more accurate electrical grid mapping

Introduction

BACKGROUND

Growing up in a war situation for a few years in my life where I lacked many things, one of them is electricity which means lacking light. It was one of the most important issues I faced when growing up. For example, studying, eating when you barely see your food plate. Taking a shower with a candle is for sure not fun at all where the candles will keep turning off because of the steam. Also, talking to your family is a struggle when you don't see their faces.

In addition, architecture and interior design was one of my main interests. While observing different designs, environments and decorations, I noticed how lighting can make a huge difference and would totally change the space and mood.

However, personally light can change my mood drastically and impact my energy, not to mention that it has been scientifically proven that light impacts our brain activity. That is why I want to design a light that is able to impact people's lives and change their moods. I want the design to touch their souls and serve their needs in many different ways.



These pictures I took in 2012-2015 when the war was going on and it shows how we used to spent most of our nights.

Using Candles was a real struggle, so I designed this bottle like candle, where I used longer lasting materials than candles to last long and to produce more illumination.



This picture show most of our evenings and this is how much illumination we get when we use flash light in a room. You can barely see our faces!



This also show the same evenings in different rooms when we didn't have enough flash light or when the battery of flash light turns off. So we use candles instade which gives worst illumination than a flash light.



Fig 3: TOPSHOT-PALESTINIAN-CONFLICT-GAZA-ELECTRICITY

THE ISSUE

Despite the innovation and technology development, humanity is facing accelerating degradation of the planet and its resources. Where over 1.2 Billion people still don't have access to electricity. Also, the world is now facing an energy crisis all over which is leading many countries to raise prices and limit consumption.¹

Moreover, one of the main issues that happens during power outages is being left out without lighting, hot water, heating/air conditioning, and phone services too. To add on, having limited light sources forces people to share spaces while doing different tasks in these situations.

DESIGN PROPOSAL

The design aims to reduce the daily struggle for people who live in places where they don't have access to energy sources. Also to improve the daily interaction with light to satisfy all their needs of illumination. Also, to reduce the energy usage and messiness that is created from having different light sources for different tasks in people's rooms.

The design will provide the freedom in choosing colours, brightness, and light directions. Using sustainable materials like wood and metals for long lasting products.

The system will help people to charge their light from natural sources like sunlight, and during their daily activities like cooking. It will have the flexibility to be used as one object, as well as separate different objects for all family members to have their own space with their need of illumination.



Fig 2: Gaza: Looming humanitarian catastrophe highlights need to lift Israel's 10-year illegal blockade.

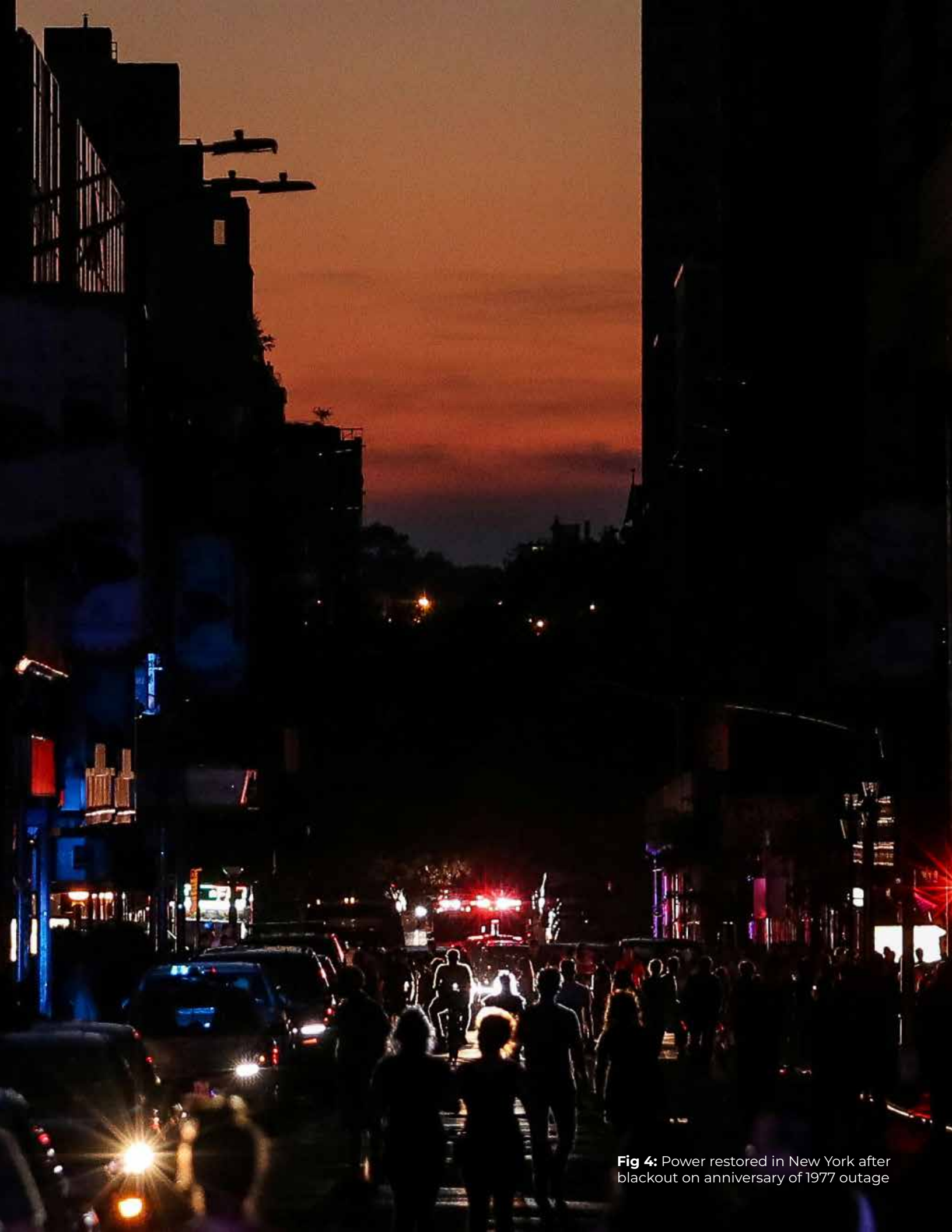


Fig 4: Power restored in New York after blackout on anniversary of 1977 outage

Research

Light is essential and we don't really realise the importance of it unless we almost lose it. As life develops our interactions with lights almost increase.

Light is electromagnetic waves² that also exist in many other products that we don't necessarily see but use it plays a vital role in our daily lives. It impacts almost every sector where many things are being made through the science and application of light, like TV, computer, phone, microwaves, and more. Lighting industry is a huge industry worth USD 118 billion, and expected to reach USD 163 billion in 2027, which means there is always room for improvement.³



Fig 5: Light and Its Properties



Many people don't really think about how essential light is in their daily life and how many light objects they use in their daily life. While doing some research on lighting and the nature of light, I learned more about light, specifically its nature, diffusion, reflection and more. To start with, what is light?

"light, electromagnetic radiation that can be detected by the human eye ". Furthermore, different wavelengths make the light different in its uses. Our eyes can only see a fraction of wavelengths, while long and short ones are not visible, like radio, x-rays, and more. ⁴ Moreover, each colour of light has a different wavelength and our retina perceives these wavelengths which impacts our brain and that is why we feel either energetic or calm in a different colour environment. Easier way to explain this is that if you are on a boat and the waves are high you will be energetic, running around to keep your stuff in place, and if there are low waves then you would be calm enjoying the trip. Same way light waves impact our eye's retina which sends messages to the brain and that is why it impacts our energy levels.⁵ To add on, "Light is made up of all the colours mixed together. White light can be split up to reveal red, orange, yellow, green, blue, indigo and violet. A prism is an object that can break up white light to show the different colours that it's made up of." ⁶ Which means we can turn a white light into many colours if we change and control the surface and angle is directed towards. For example, why is the sky blue? "oxygen and nitrogen in Earth's atmosphere scatter electromagnetic energy at the wavelengths of blue light (450–485 nanometers). At sunset, the sun's light makes a longer journey through the atmosphere before greeting your eyes." Which basically we are just making the light journey longer to get different colours.⁷

MARKET RESEARCH

I started to look into the market for some products that change light direction in a creative way. Since many people have mentioned the need for different lights for different tasks. In my own opinion all lights that are used for different tasks are all the same, they are just different in shape, light direction, color, and brightness.

I also looked into products that don't use normal electricity outlets. I wanted to see camping products for off grid situations. I started looking into different generators and products that have energy free systems.

Some important definitions for different ways to generate energy

Solar energy “uses the sun’s light and heat to generate renewable or ‘green’ power. The most common form of solar energy is harnessed by solar panels, or photovoltaic cells. In photovoltaic power stations, they’re arranged almost edge-to-edge to capture sunlight in large fields.”⁸

Thermal energy “(also called heat energy) is produced when a rise in temperature causes atoms and molecules to move faster and collide with each other.”⁹

Magnetic generator: “Moving a magnet around a coil of wire, or moving a coil of wire around a magnet, pushes the electrons in the wire and creates an electrical current. Electricity generators essentially convert kinetic energy (the energy of motion) into electrical energy”¹⁰

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Fig 6: Rechargeable LED Camping Lantern. Using hand crank for emergency situations.



Fig 7: Lumir. A light that get charged using a candle



Fig 8: BioLite. using heat to produce energy to charge your phone and to use light.

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Fig 9: SFIR - This lamp plays on all forms of a circle more of a playful design. Used more as a decoration than illumination.



Fig 10: Philips hue- system where you are able to control different light solutions.



Fig 11: Elevation lamp - from direct to indirect light. We can Just control direction of light.

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Fig 12: Designed to look like a modern day chandelier. Designed by : Sohyun An & Hyunji Shi



Fig 13: This just showing different colour temperatures in the market

FINDINGS

Most illumination fixtures are limited with different things, and tasks.

Switches is the main and almost only interaction with the light which unfortunate that some designs still not considering this as a main focus point for most people.

Most products are made to be designed for specific purpose not taking many things into consideration.

They either focus on brightness not color. Sometimes changing light direction but not brightness,,, etc.

Some new designs are considering multiple tasks like elevation lamp which turns the focus from direct to indirect light. However, still having limitation to other main purposes that most people use in their bedroom.

I learned more about thermal energy products which is really nice to see.

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Fig 14: Blackout 2003: How Ontario went dark



Fig 15: Gaza: Looming humanitarian catastrophe highlights need to lift Israel's 10-year illegal blockade.

Interviews

I conducted many interviews with people who live in many places in the world to see their different experiences with electricity and lighting and the way they perceive light.

I asked people in Canada about their experience and struggle with light. I also asked many people in Syria about their daily interaction with light. These interviews helped me to take many things into consideration while making the product.

I also spoke to professionals such as a designer and the steps he takes while designing a light. As well as that, I talked to a production manager who works in a lighting company to learn more about the manufacturing process and things to keep in mind while designing.

Also, I talked to the sales manager that works in a lighting company, to get her point of view on what are the things that customers care about when buying a light.

INTERVIEWS

01

Rodrigo - College student

Rodrigo talked about the main reasons he interacted with light daily, which was mainly to fall asleep, to read, and to get ready. He also described how different lights might impact the quality of doing a specific task where he mentioned that he doesn't use his bedroom to do his work but rather he uses the kitchen, because it has better lighting than his bedroom. Also, he talked about different materials where he tries to avoid plastic and go for long lasting materials like wood and metals.

02

Sofia- College student

Sofia discussed how her lamps set her for a different mood for the day. Also, she talked about how she had to use different lights for different tasks like getting ready versus the homework lamp. She said that she doesn't like that her lamp is only controlled from her phone where sometimes her phone is off or not in the same room and she can't turn the lamp on because of that too.

03

Zoey - College student

Zoey talked about the top tasks she uses light for, which are: To go to bed, for makeup, to study, to see at night, for her cats at night, and for relaxing. Her main struggle with a specific light is when she can't control the brightness or color which causes her to use multiple lights for different tasks. Also, she mentioned that she would like to have a portable light that she can move around to be able to study in different rooms and not get stuck in one room because of lighting.

04

Vincent - College student

Vincent likes gaming and he described how light helps him to get immersed in the game. He said that having coloured lights are usually applied to parties and gaming so that it gives you the full experience, especially because it syncs with what is happening on the actual screen. It also sets him for different moods when he changes colors. He mentioned that he likes to customize his light in color, shape, and brightness, where different brightness might hurt his eyes. Also, he really gets scared to touch the light bulb since he is sensitive to heat, which some products have the on/off switch very close to the light bulb.

05

Cedric - College student

Cedric started by looking at different cultures and countries who use different light temperatures which are influenced by the weather outside. Where cold weather areas use warmer light temperatures than hot areas. He mentioned how he doesn't like looking directly at a light bulb because it hurts his eyes which he ends up turning the light to the wall to diffuse it. He also doesn't like the look of wires which show messiness in the room. He described different types of switches that he doesn't like, where some are on the wire and some are near a light bulb. Where he explained that it is hard to hide the wire and reach to the switch. Continued, by sometimes hard to find the switch which hurt his eyes looking at the light bulb.

06

Kim- Sale manager

Q1: How would you consider a product to be strong enough so it can compete with other products in the market?

Our biggest thing is we have our own foundry and product is made and completed within the same company and we stand by the product we sell.

Q2: In your years of experience, what do customers focus on and ask and complain about when buying a fixture?

what our warranty is and is made in China. They really care about the quality overall.

They complain about Production and delivery time, sometimes pricing.

Q3: When selling a product, what are the things you first mention to get them interested in your product?

That we own our own foundry, especially if it is a Canadian customer, I mention it's made in Canada, because they know that we have standards here and quality checks. We stand by our products.

Q4: Any advice that I should consider when making my design?

Make something that is more modern looking, that's what people are looking for these days.

INTERVIEWING PEOPLE IN SYRIA NOW



Just to start off by mentioning that I didn't talk about my project nor that I am doing a light because I wanted to see their answers without being influenced by my project.

I asked all of them about what is the most important thing they can't do without electricity.

All answers mentioned (Light) as their main struggle that they face during a power outage. Where they can do many things like washing cloth and cooking without electricity but not light.



This is the light they use now, where they have to share this one room for this light.



Here where it shows in morning and night the same place, and how the whole city is so dark and that even though her family live downstairs, she struggles going there.

07

Safa - Masters student

Safa talked about her experience in Syria where she had to share the same space with her four other siblings while she was doing her masters which was a real struggle for all of them since each one of them had a different study style. She said that they only had one battery that gets charged only when electricity turns off which is only about an hour a day. This causes the battery to not charge fully and only be enough to illuminate one lamp. Also, she mentioned how they couldn't charge their phones fully which was a struggle for them when they needed to stay connected during the day.

We talked about people who already tried different ways to produce electricity through kinetic energy like biking, solar panels, and windmills. She said that biking took so much time and energy from them to produce an hour of light which wasn't effective at all. She mentioned the best ways now people are starting to use solar panels but it also gets impacted when

08

Akram- A father of 3 kids

Akram talked about the hard life there and how it is very expensive to buy a regular gasoline generator and turn it on, and even limited access to gasoline in the market. He mentioned how he had to get the connections for different lights to try to keep the whole room illuminated for his kids which created a huge mess around the wires as shown in the picture. He said when he is outside he gets so worried and wants to contact his family but he can't due to the limited phone charge they have because of power outage. He also describes that he can't control the brightness of these LEDs which cause him headache and hurt his eyes sometimes.



This is the light they use now, where they have to share this one room for this light.



This is the light he mentioned that he had to add to get enough illumination in the room



This is the light they use now in main room

09

Omama- A mother of 4 kids

Omama mentioned the struggles she is having with her kids to provide for them the perfect space for studying while she is also doing different activities in the same room, because of limited lights. She also talked about how she feels disconnected to the world because her phone keeps turning off. Moreover, she uses a battery that gets charged when electricity is on which is only an hour or two a day. She also talked about how hard it is for them to get hot water for showers because of limited resources. She also mentioned the messy cords that are on the wall and all around just to turn the light on.

INTERVIEWS

10

Purchasing and production manager “Jeff Freeman”

Q1: What is the maximum lumens capacity an interior lighting has?

It depends on the size of your room, like what you are trying to light up. Incandescent bulbs most of those run from 600 to 800 lumens. Lumens are mostly how much light is given off.

Q2: Would I be able to have one light bulb to represent cool, warm, colourful lights, or would it have to be two different light bulbs?

Yes sure you can. There is new stuff in the market. We bought a smart bulb for my daughter's room where she can control the bulb from her phone and she can basically choose any colour from a full spectrum. Most lights now are made to be adjustable where you can switch from warm to cool depending on the task you do. The driver of the light has to be adjustable and the light bulb too.

Q3: What type of painting/ materials would be good enough for interior lighting?

Powder coating is really nice and sustainable, however there is indoor powder coating rated too because you don't really need UV, or weather protection necessary for indoor use. You can go to any colour spectrum. Material wise if you are going for strength yes metal might be an option but you have to think about weight and cost. Most people do plastic for most interior products, but for plastic you can only use wet paint. You can do very thin metal too depending on the shape you are doing. Maybe look into 3D printing where they 3D printed steel bottle opener, but if you are doing mass production maybe look into die casting it might be better in time and price.

Q4: What are the types of dimming controls that I can consider in my design?

Dimming controls will bring down the current which will bring down the brightness. The driver controls the dimming which again you have to get a smart programmed driver.

The driver controls brightness but colour wise the LED chips itself has to be smart. Where the phone connects to the driver which controls the light but the led has to be compatible. As far as I know All led are dimmable but its whether the driver is dimmable or not.

Most outdoor fixtures are controlled by the city. What they do is run lights at 80% of light capacity and after 12 o'clock they dim them down to 60%, and after 3AM even more until they turn them off after the sunrise. However, let's say there is something or the cop looking for something they can turn them on fully where it is like daylight to help them see the full area.

11

With designer of the year “Scot Laughton”
QUESTIONS:

Q1: What sources/methods/research helped you the most when taking the final design decisions? Any advice on things I should pay attention to when I am finalizing my project?

It should answer your original brief. The best thing is to start showing it when working on prototypes to take some feedback, step by step. When I did my light design I would draw different lights and explore more until the moment you know what exactly you would be doing.

Q2: How do you evaluate a lighting product? How or what would you consider to be good or bad design?

I think usually my first response to an object is what is telling me is used for and how well does it meet these expectations. I don't like things that feels cheap. The light quality always has to be excellent and serve the purpose. I don't like when the light make weird and distracting shadows. To satisfy all the basics and have a strong presence.

Q3: What are the most important things to focus on while designing a light fixture? What specifically would be your focus?

Light has been for a long time not just for utility, it's an opportunity for designers and architect to explore the sculptural nature of lighting, or things that holds the source light. There is many types of lights and you should investigate what kind of task you might do. I don't personally say there is a main focus, but I would definitely research a very broad range of lights because they all have different motviater that driving them. There is a huge factors that you can play with when it comes to lighting.

Q4: As a successful designer who was named (designer of the year in 2003), what do you think is the main reason behind your success? In other words, what was the main reason, in your opinion, that your floor lamp design became an award winner?

I think it was successful because no one had done before. “Luck comes to the ones who are prepared”. It was successful because the narrative was there too, like my design was based on the cone was the energy source, the cube is the foundation and earth, and sphere the space rotation. The language and the narrative hit to the core for architecture and designers where they can relate. Aesthetics view I describe my work as quiet exaggeration. There is always something that a little exaggerated, but there is always some quietness to it too. It kind of stood in the space, you saw it, you can interact with it but it wasn't screaming for attention. Materiality is very important too, where the interaction between you and the object add value to it.

SURVEYS

Q1

What are some of the pain points you face daily with your interaction with lighting?

“I prefer lights that i can change the brightness depending on the task i need it for. Also the ones that can change color to set the mood. I have one lamp that doesn't have a switch and i have to plug and unplug to turn it on... i find that annoying”

“I have to keep on switching lights one which get annoying because sometimes i forget to turn them off”

“My phone light is too bright when I look at memes at night”

“Sometimes when it is a gloomy or dimmer day, it gets too dark to use natural light to emit in a room, but when I use the interior lighting in my room I get dissatisfied with how bright it gets at that time of day because I prefer a more natural lighting look at that particular time. Though I'm forced to use it because I need to light up my room anyway”

“I can't sit in places with white light”

“Too static, light intensity is fixed, I need to change lights as the day progresses and I lose sunlight(warmer lights at night) I don't have enough electric plugs for my light needs.”

Q 2

What is your favorite light object and why?

“My hue lamp because i can change it to any colour, set up an alarm that wakes me up with light and i can control everything from my phone”

“My night light because it looks like an alien head and changes colour”

“My phone’s light, because I can use it any time I need it”

“Warm light is easier to look at”

“I have a singular RGB mood lamp that cycles through different colours and I like it because I can set it to different colours depending on the vibe I want. For example, if I like a more mellow, lo-fi, chill vibe, I set the colour to either violet or blue.”

“The ceiling light”

“I love my make up warm light because its help me and make enough light overall my bedroom”

“A LED Moon that has an internal battery and changes light (cool/warm) by touching it and can be dimmed by touching and holding.”

“I am obsessed with my laptop’s RGB light. I like RGB lights which changes colours automatically.”

FINDINGS

From interviews conducted I learned about other people's struggles, and it is hard to see how people still have the same difficulties I had a few years ago. It was a great insight to learn and take things into consideration on many levels. Like what kind of activities they most need light for and what the constraints of these lights should be. I also learned that many people in Canada have 3 and more lights in their bedroom only !! Also, most people under the age of 30 are using their bedrooms as an office as well, which leaves them with many light products for different tasks. Where they use it for different activities and purposes, because one light has limitations to their specific needs. Some of the main pain points are,

- Plug and unplug, switch between each object
- Different timing during the day require different color temperature
- Not enough plugs for light needs which makes it hard for switching
- Too many wires around
- Problems with switches
- Not being able to control brightness
- Can't change colors
- Room size is small
- Can't use one light to satisfy all their needs
- People like to also control the direction of the light either in a specific section or it could be the whole room.
- It is so important to have adjustable light in many aspects

These interviews gave me a better understanding of what other people use in their daily life. Also, asking about their interaction aspect of their light fixture gives more information about things to focus on. Most people prefer portable lights as it gives them more freedom to move around with them, since we don't always do the same task in the same place.

Talking to a sales manager gave me insight into how much customers value the quality and trust local made products. Also that customers will buy products when they see the confidence that you have in your own design. I concluded from Jeff's interview the importance of considering the quantity that my product will be produced with. He taught me about many manufacturing process like die casting, and 3D printing to take into consideration while making my design. I learned about different paint options and how it is applied. Also, I learned about dimming controls and what aspects I need to focus on depending on my needs for the design. I gained a lot of valuable information from Scot's interview about things that will improve and help me with my design process. Talking to a designer and gaining their view is very important when it comes to the story and harmony between all the parts of the design. He mentioned the value of making things have strong precision and serve the purpose that is made for.

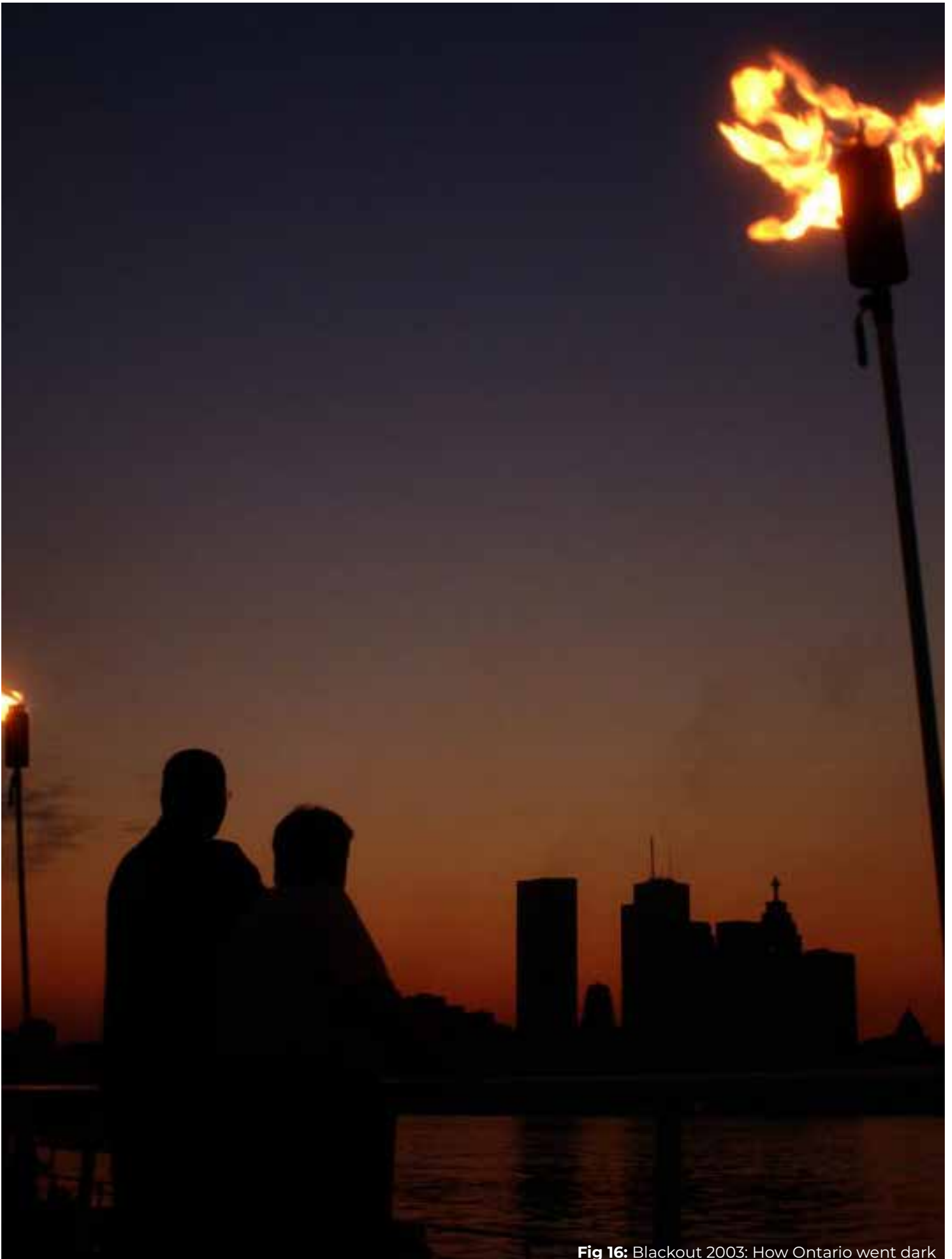


Fig 16: Blackout 2003: How Ontario went dark

A DAY IN MY LIFE

This study is observing the daily interaction and its struggle with lighting. Analyzing my daily interaction with light is eye-opening to many opportunities that I could be able to develop and pay attention to in my product. Like adjusting brightness, and colors, better interaction with switches, and considering changing the direction of the light for different needs. This brings the focus mainly to people who use their bedroom/office for different light sources for different tasks.

In Canada

In Canada my whole experience was changed for sure where I can use electricity freely. However, I noticed how I started to get really interested in lighting when I started seeing how a light can change my mood and the whole space around me. I started using different lights for different tasks that serve my needs better. Like mood light, reading lamp, and makeup ring lights.

I started to notice the flaws of these products much faster and started thinking of solutions to it. Like some of them I can't control brightness and color which was one the main issues I faced since I got used to colder color temperature lights but now here in Canada most lights are warmer.

In Syria

We mostly used flashlights or battery charged LEDs, and candles. We really struggled getting the LEDs to be charged when there was a power outage for a few days or so.

I really struggled in Syria studying, in which I had to keep moving the candle around and placing it on the top of the book just to be able to see and prevent shadows from covering the words. Moreover, at the end my eyes will hurt so bad from how low illumination the candle will produce. Talking to my family and eating food where I can barely see my plate. Taking a shower at night was a real struggle where the candle would keep turning off because of the steam. Also if I am using a flash light I will have to keep changing direction to be able to see without getting my eyes hurt because of direct light.







Fig 17: Living Without: Electric Light

Synthesis

Different methods of research are an eye opening for different experiences and needs that others might use and others don't. It is a great opportunity to expand more and have the focus on specific problems that most people have in their daily interaction.

The aim is to create All in one object

Seeing people around the world still struggling for light is very sad. There is a huge space for developing a products to fill their needs of illumination without their need for electricity. It also could be used for people who got camping and live off grid.



Fig 5-18: Light and Its Properties

ANALYSIS

Firefly Light



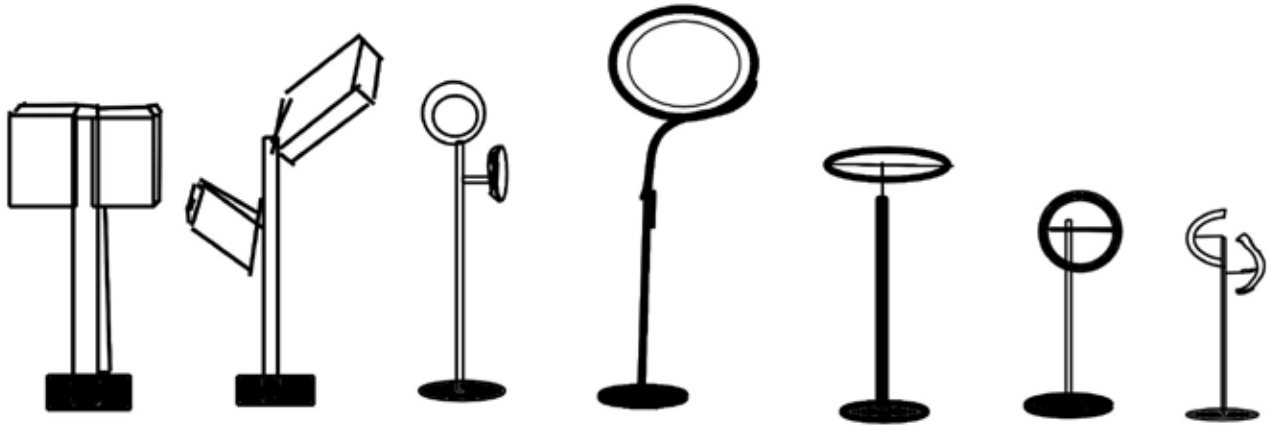
Also, Since many people are complaining about the messiness and the amount of objects they need in their rooms and the issues that related to it, which opens up the space for a new product development. It might have different parts but overall will create a one object that has harmony, it will be aesthetically pleasing that will simplify and have most of our bedroom's fixtures and needs in one object. It will have the focus on the main tasks that most people do in their bedrooms/ office, like getting ready to sleep (relaxing), at night while sleeping (for better vision at night), Reading, getting ready (makeup/ clothes), chilling, decoration, and working on homeworks for some people. It will be portable, easy to use, and very practical.



Fig 19: Days after a power outage, New Yorkers keep a wary eye on the grid as heat wave peaks

Ideation

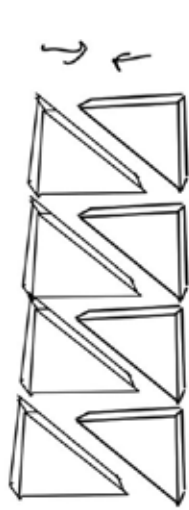
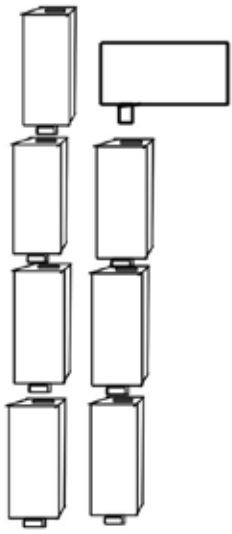
Different light series



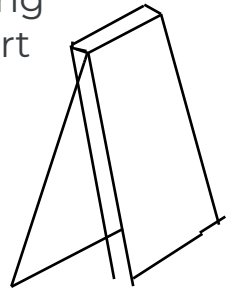
Sketches

I started to explore simple and familiar looking products for people who are off grid for easier usage and maintaining. Also, I started to sketch different ideas to produce electricity.

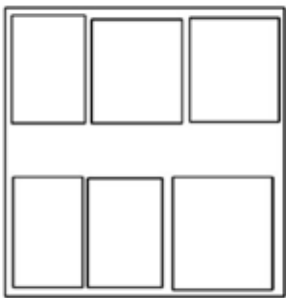
Firefly Light



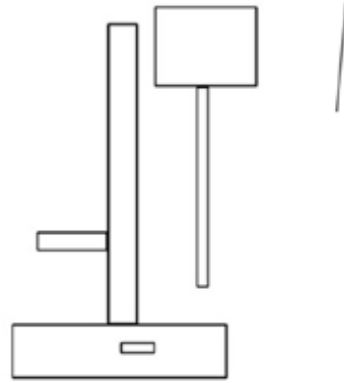
Something to support the light



Different power sources

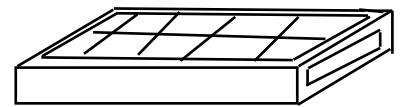


Battery station



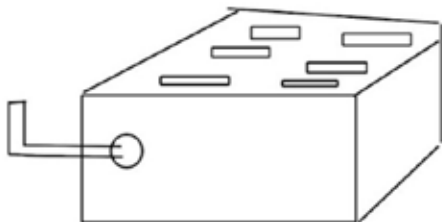
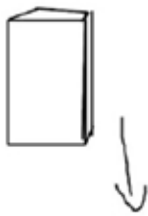
Handcrank

Solar light

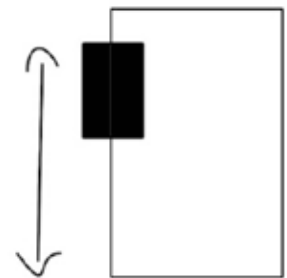
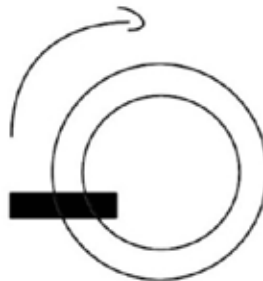


OR

Handcrank



Rotation

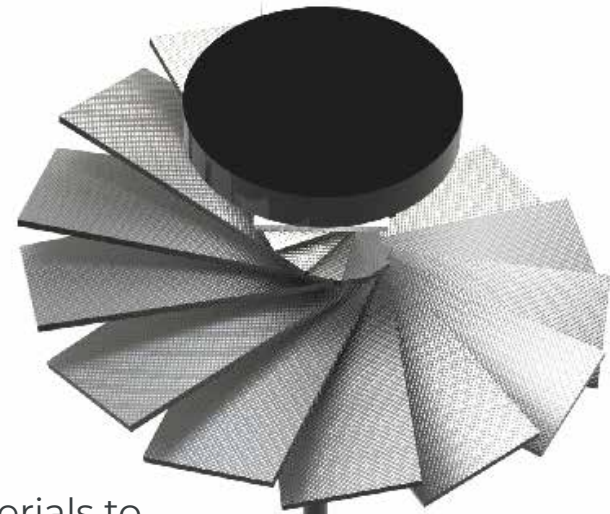


Shaking

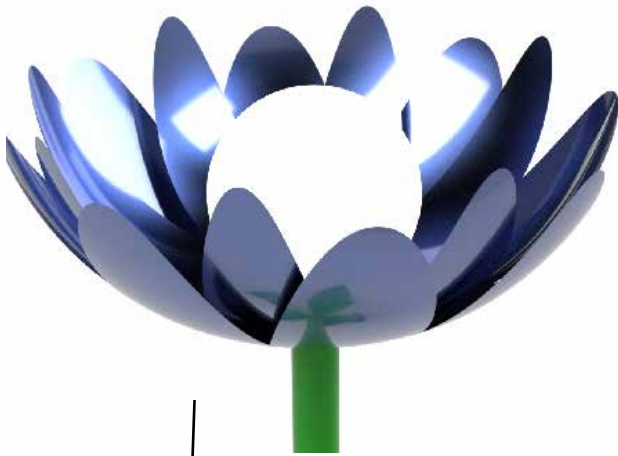
Concept 1

Light reflection

This is much about reflection and exploring ways of making multi-purpose light by changing the direction of light through reflection.



Reflective materials to reflect light to different directions.



Stackable flower petals

To control the light and shows battery information as well as battery storage.



All can be stacked to have the flexibility with light direction.



Same idea flower like shape where the base is flexible and bendable to control the light direction.



Concept 2

The light is a globe that you can interact with and spin it while it is being charged. You can also change the direction of light and diffuse it out through the lens.



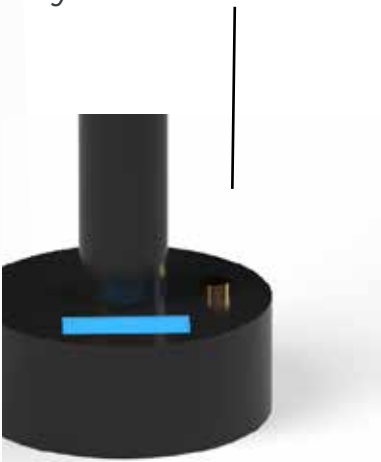
A lens works by refraction: it bends light rays as they pass through it so they change direction.

When it's not used it will be a cover over the lens to diffuse the light inside the globe.

The globe can be rotated to produce the energy to charge while enjoying the interaction.



To control the light and see the battery charge level. Space for removable battery to charge in different ways.



You can extend the light by using this mechanism



Concept 3

The Light idea for the light is the main body and flexible light panels to be moved in the desired direction. all connected to a main battery.



Light panels can be rotated into different directions as well as up and down.



Having a battery storage and USB plug for different uses like phone charging.



Concept 1

Using the Thermoelectric devices that are made from materials that can convert a temperature difference into electricity. This device placed on a hot surface, like oven or BBQ. It will be used to produce extra electricity when having different activities.



A battery to be placed inside to be charged.



Screen to show battery level information.

Handle to hang on different objects.



fig 22: Type of cook-ware

Concept 2

This idea is making a hand crank and bike like option to produce electricity



Removable battery and different USB plugs for charging phone



Stable and effective for both mechanisms

You can take out the handle for hand crank or take both handles out to create a bike like item. Where you can charge it by paddling.



Concept 3

This is also the same idea using kinetic energy using a foot stretcher to produce electricity while peddling



Screen to show batte informations.

Four different batteries can be charged at one time.



Foot stretcher used to generate energy while padeling



More concepts for light



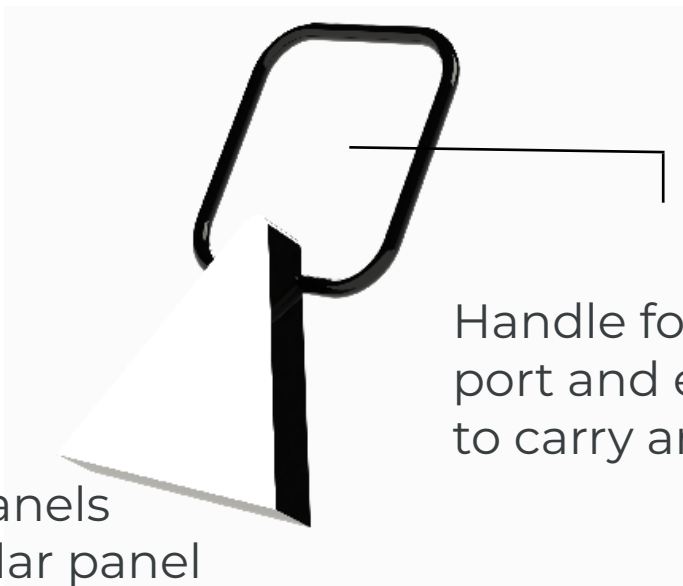
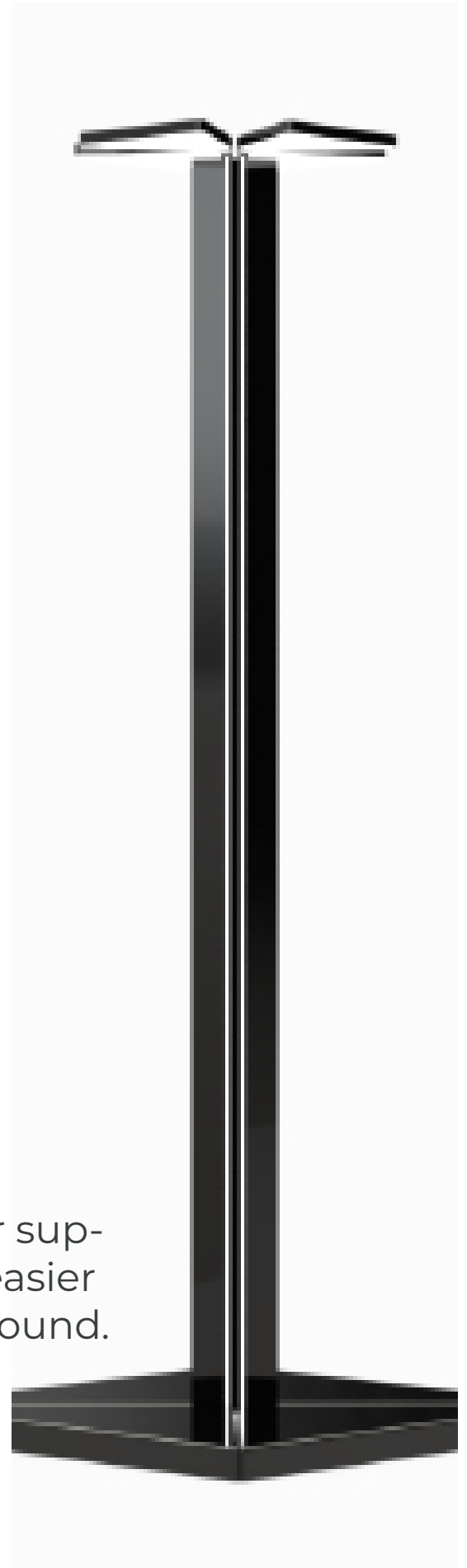
Light collection, where it could be used separately. Reflective materials in the middle to see the product at night.



Pushpin mechanisms to extend the height for more flexibility.



Firefly Light



Handle for support and easier to carry around.

Light panels have solar panel each, to charge the battery

More concepts for power

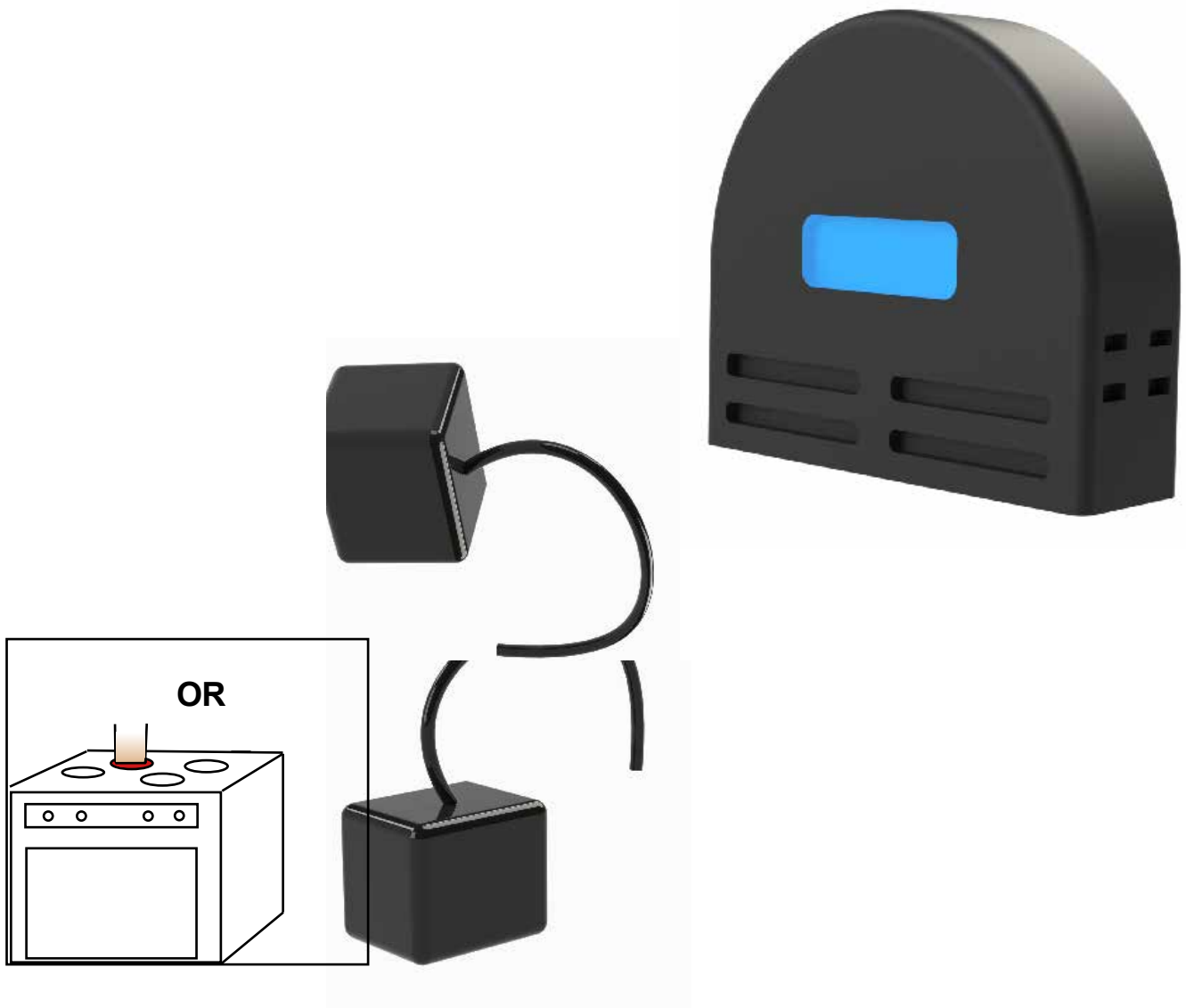
Getting the benefit from daily activity

This concept is using heat to harness the electricity, where the device is being placed on an oven or a BBQ to produce extra electricity.

They can use this product when they are cooking or when they are using a fire place for heating.

It consist from different batteries that later on they can use in each light.

You can connect this extra piece to get the charge from heat where its flexiabile for both fire top and side of a pan.



Getting the benefit of natural light

This concept is using solar panel for natural resources to harness the electricity.

- When the sun shines onto a solar panel, energy from the sunlight is absorbed by the PV cells in the panel.
- When product not in use during daylight, they can place it against a window to charge it.

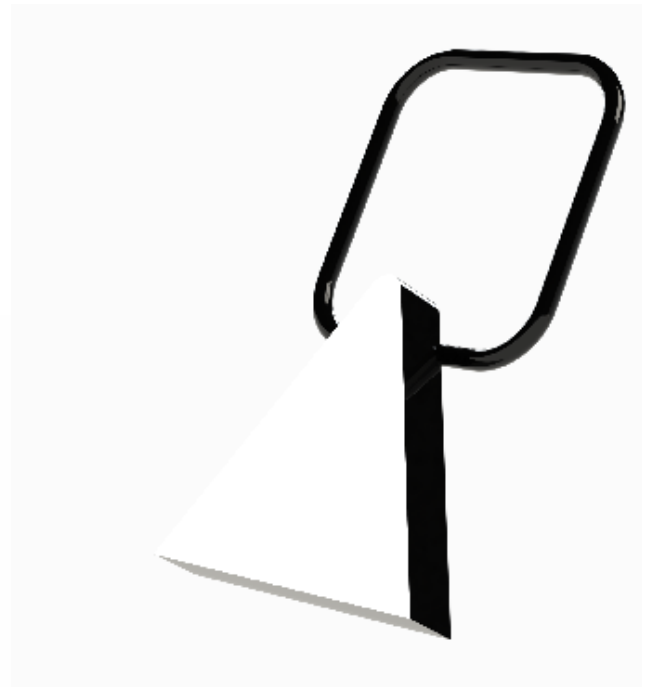


Fig 23: Solar panel +5

FINDINGS

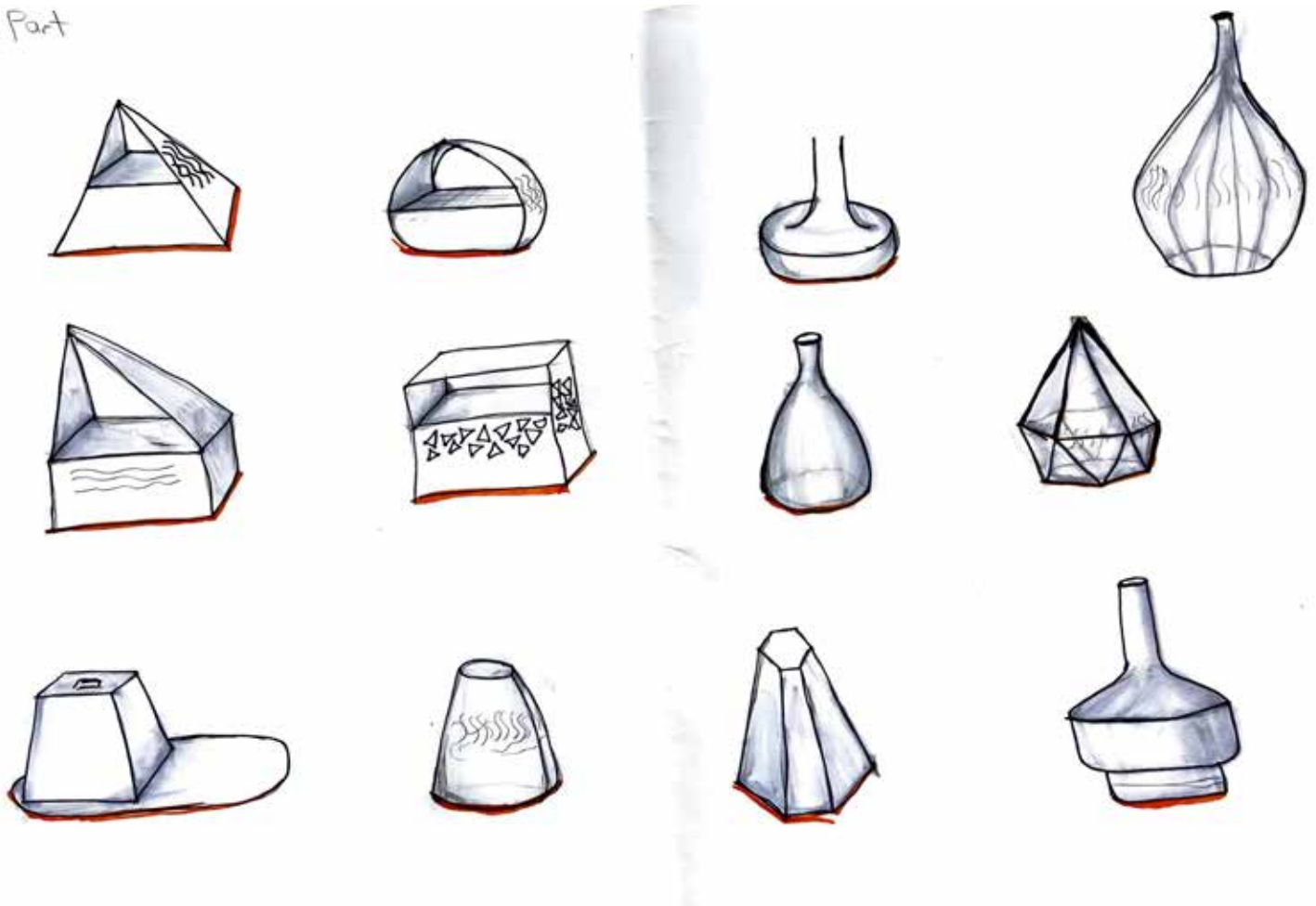
Realizing that these concepts still does not satisfy the purpose of my project fully which I had to step back and explore more ideas and options for an easy better solution.



Exploration

Initial exploration

Part



Further exploration was done to see other opportunities

Firefly Light



Cardboard models.

Curved edges were eliminated since heat will transfer through the sides

Firefly Light



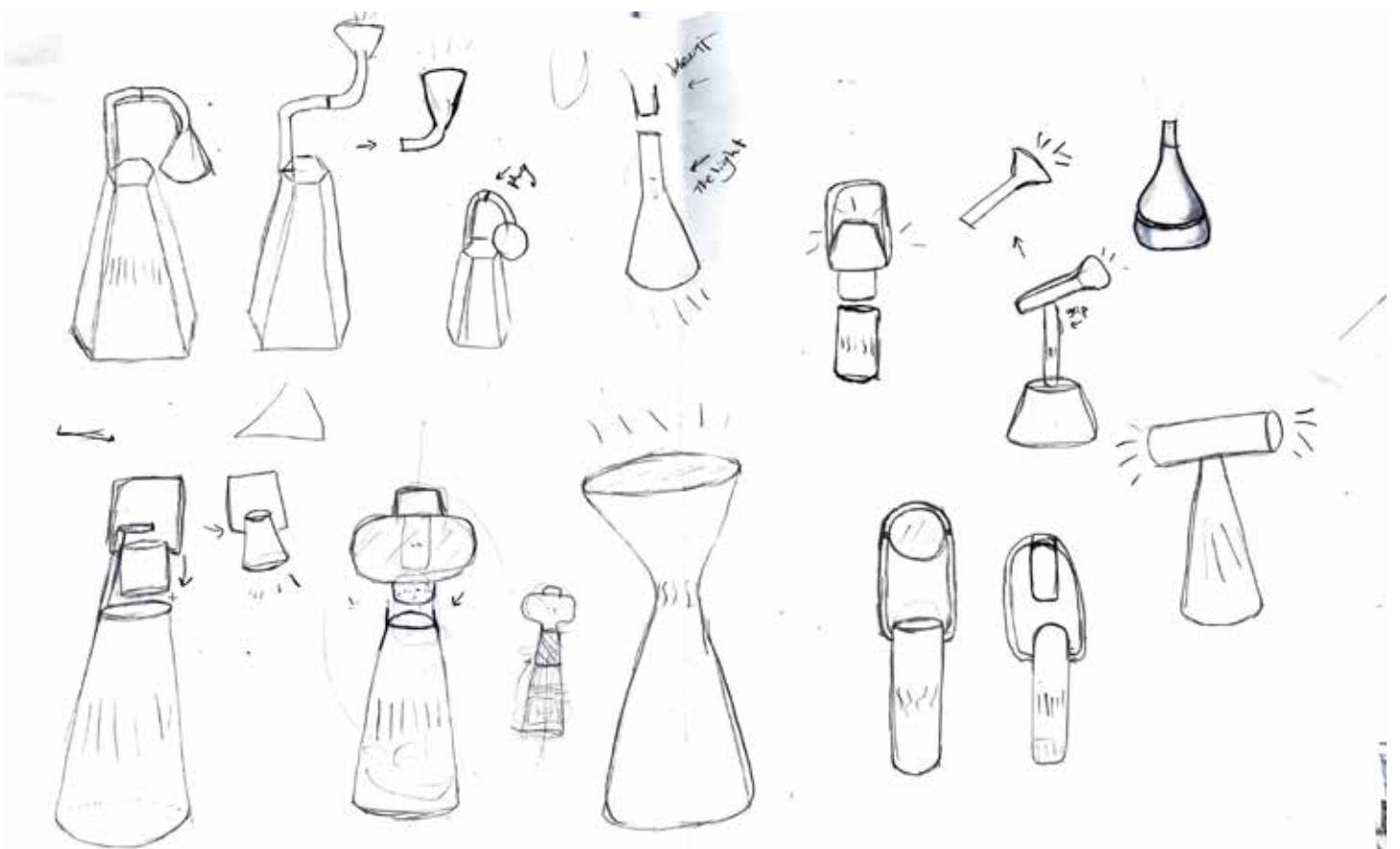
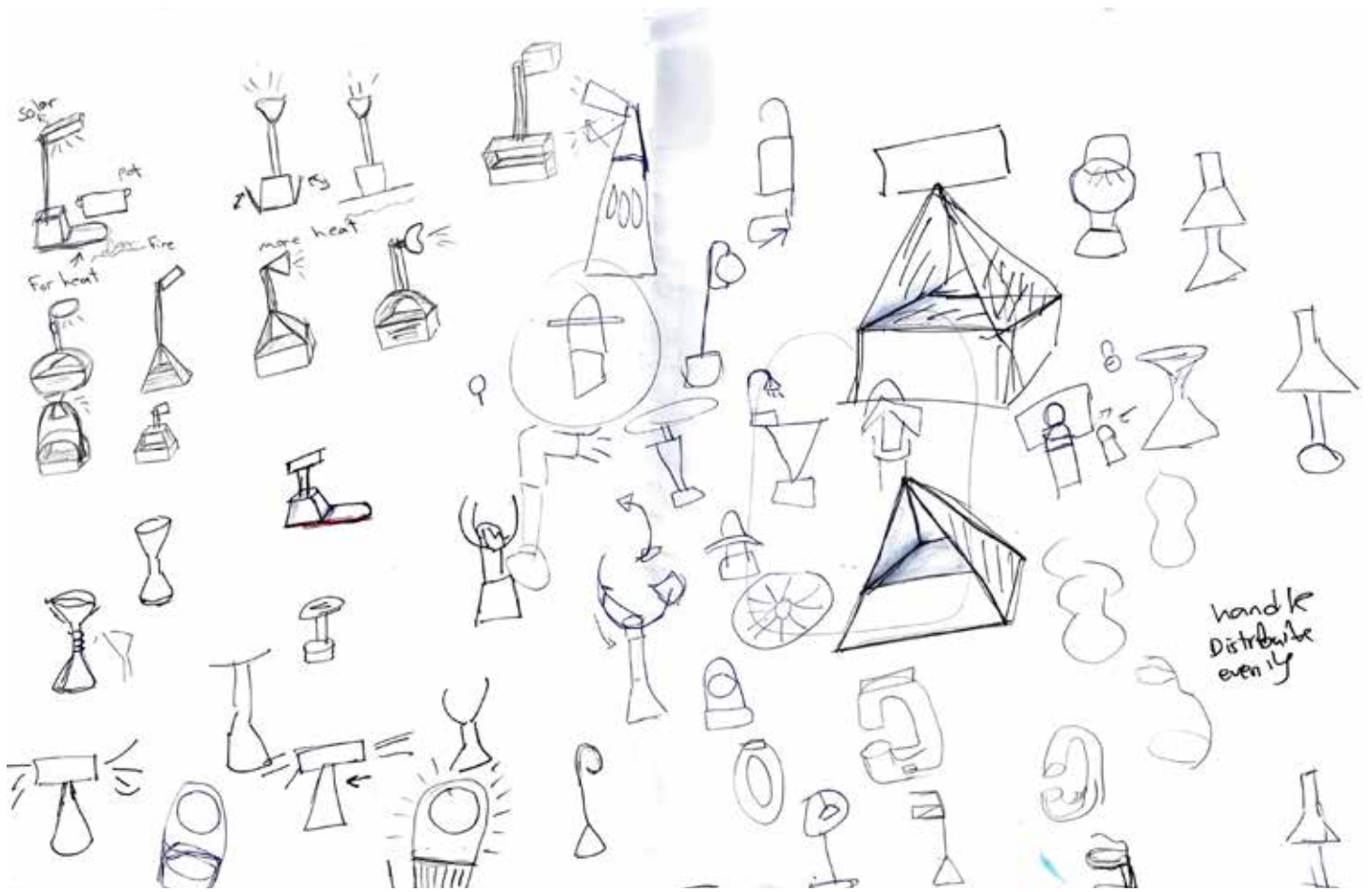
Exploaring the model on solid-works

Firefly Light

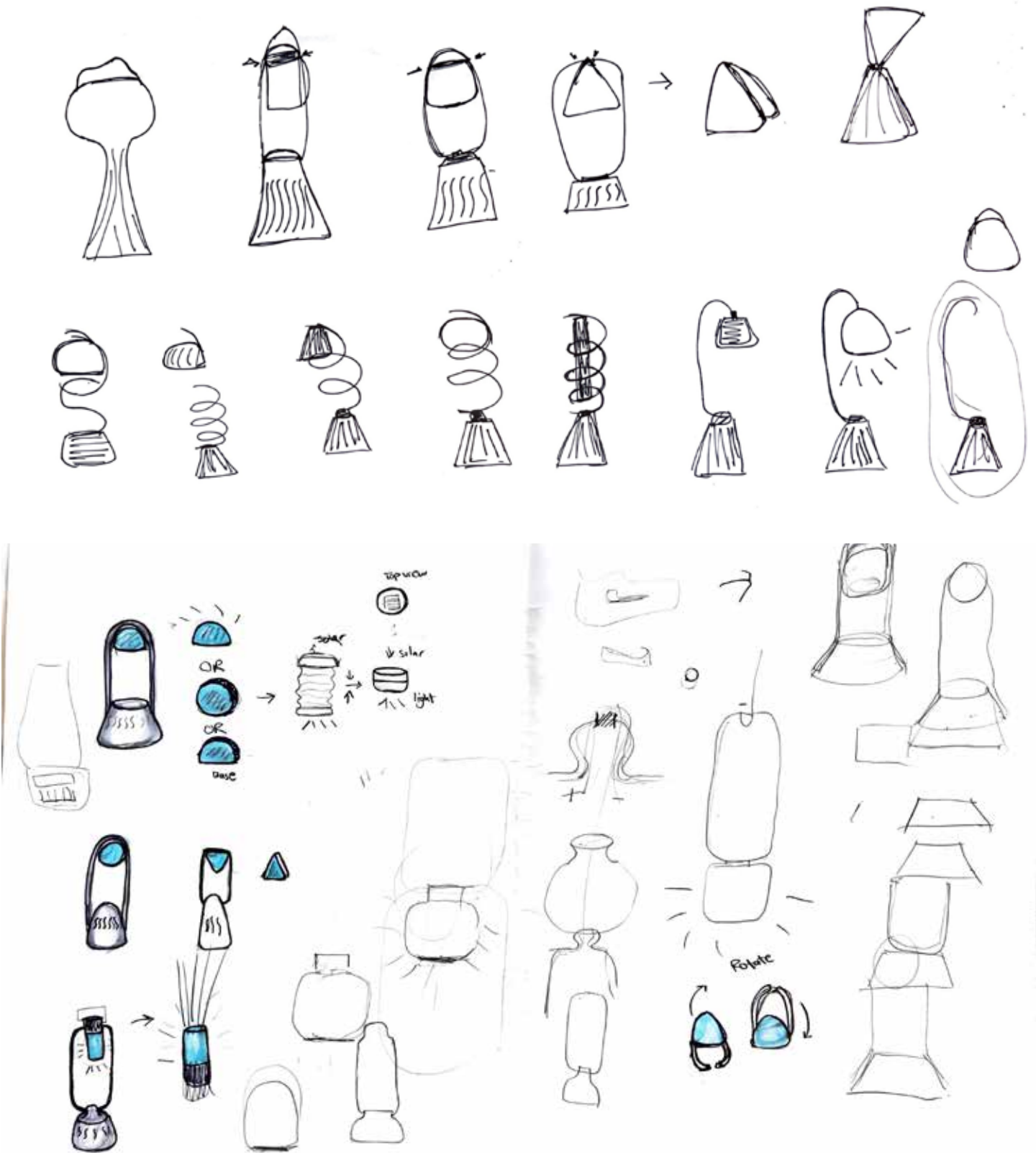


Adding details for protection.
This Idea was eliminated since
front and back won't be effective
for heat

Firefly Light



Firefly Light



More explorations were done for better ideas.

Then I started exploring round bases where sides are all on an angle since heat transfers up and in this case, it would be blocked by the bottom part which will make it cooler to handle.

Firefly Light



Coming up with one sleek
modern design

Firefly Light



Trying to stay with the idea
of an old lantern

Firefly Light



Models were printed in full size to further develop the design

Firefly Light



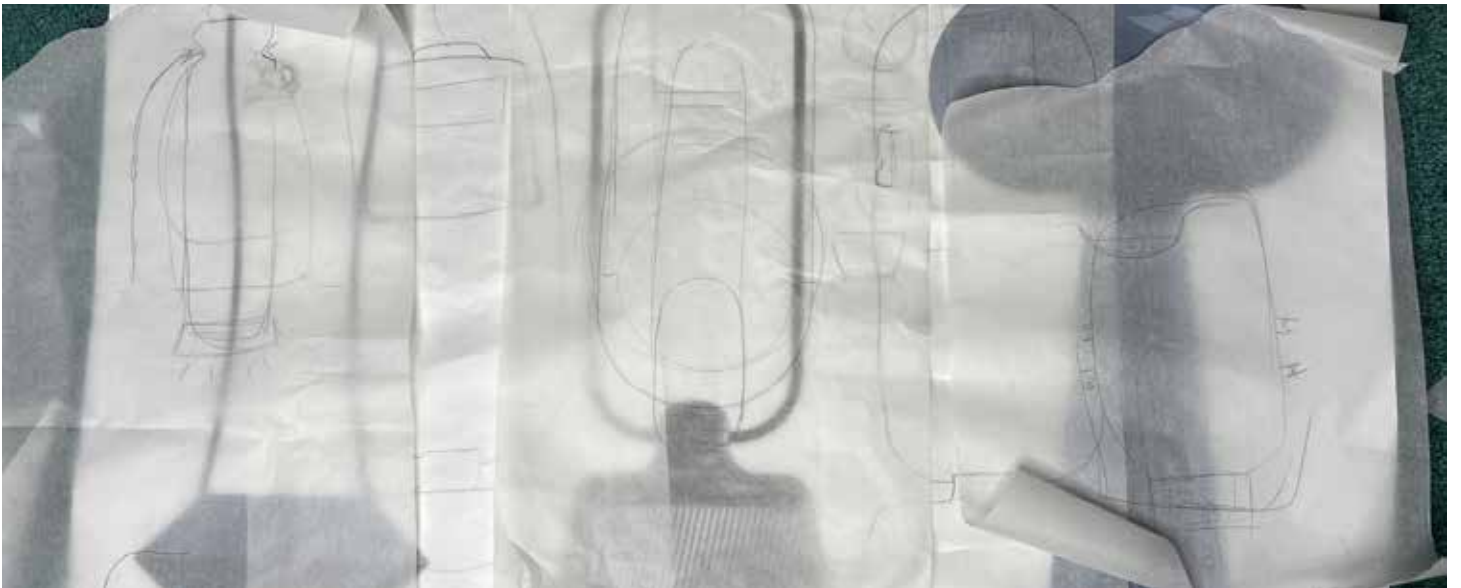
Cardboard models full size were made to have a better idea of the size overall.

Printed full scale

Explored all ideas and sketched over them to get a better sense of how the product would be developed



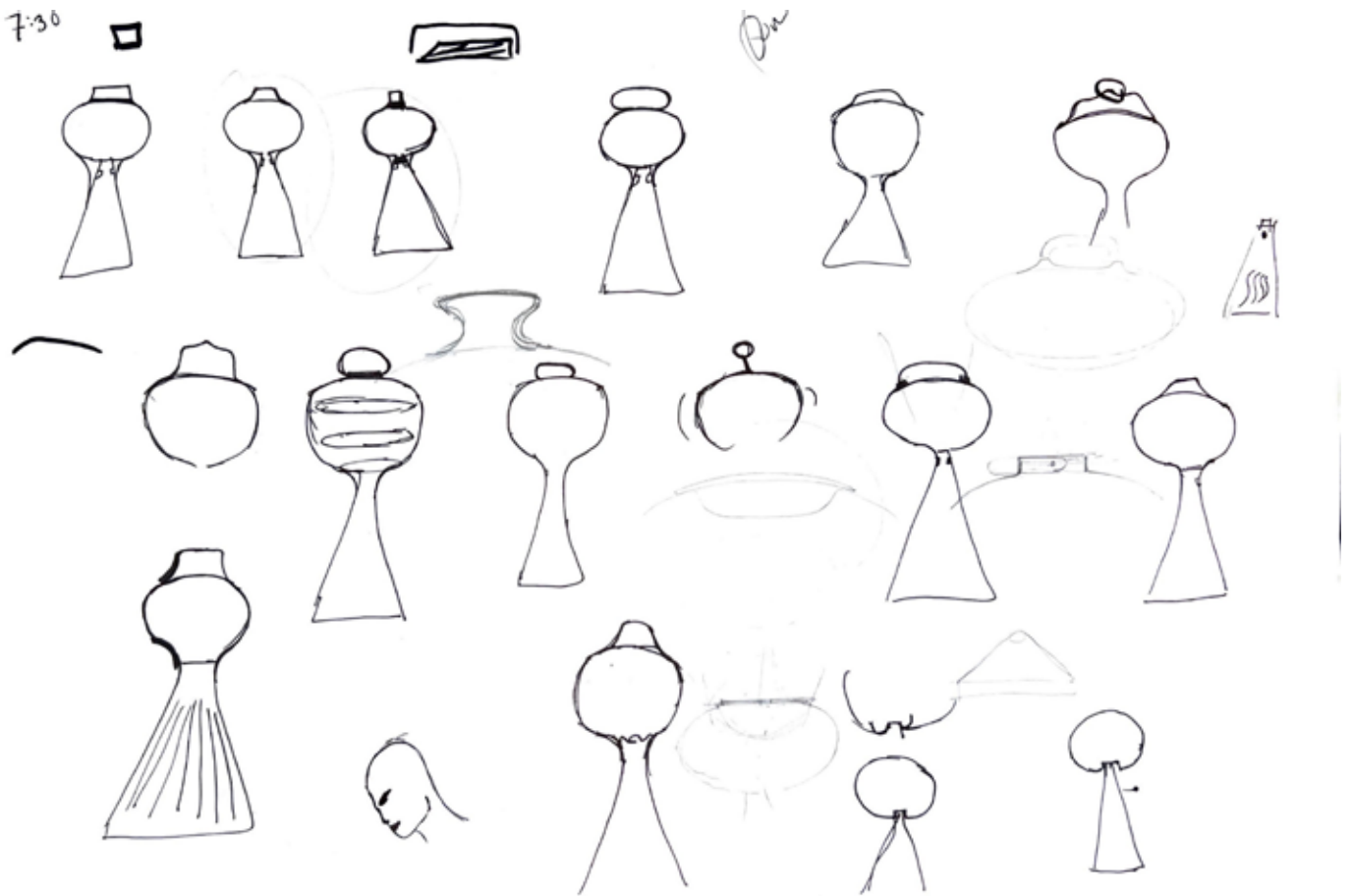
Firefly Light



Further Ideation



Firefly Light



I eliminated the lantern-like model because coming from that background, people are really in love with designs and nice looking objects so I didn't want to have an old vintage light but rather a good looking simple more efficient design where it is easy to handle and work with

Firefly Light



I explored hexagons and different heights cones.

I was keeping in mind the manufacturing process to keep it easy for production and make it more efficient for shipping and assembling.

Eliminated: because it adds busyness and roughness to it.

Firefly Light



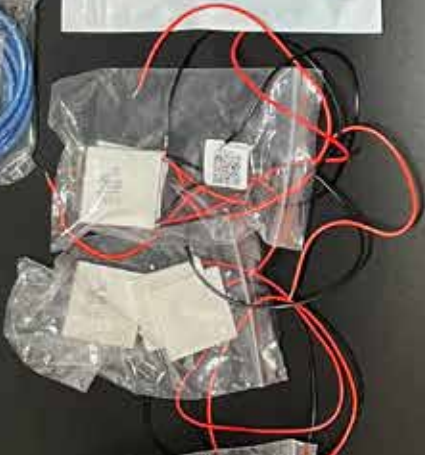
Looking more into round simple structures and trying out different shades

Firefly Light



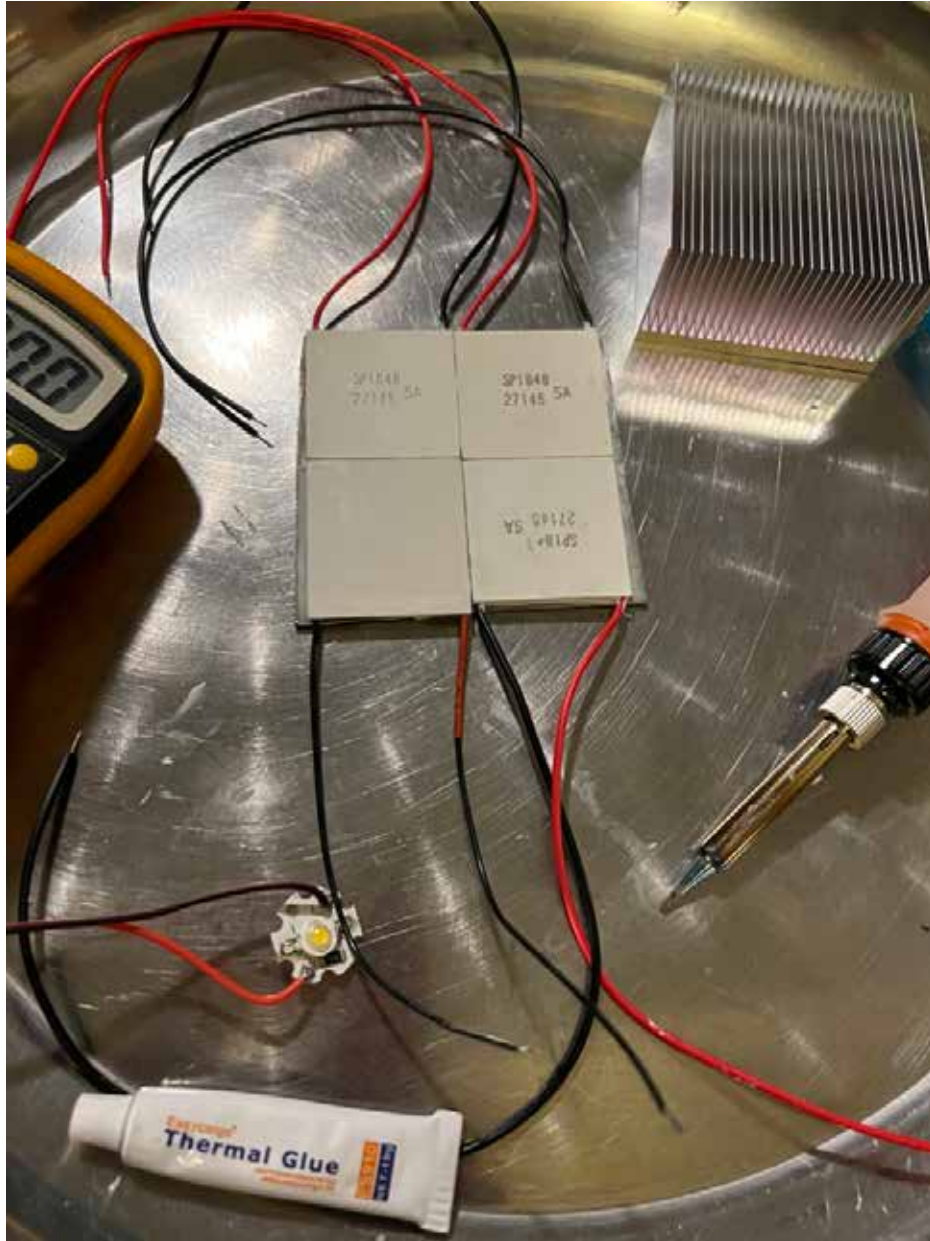
Firefly Light





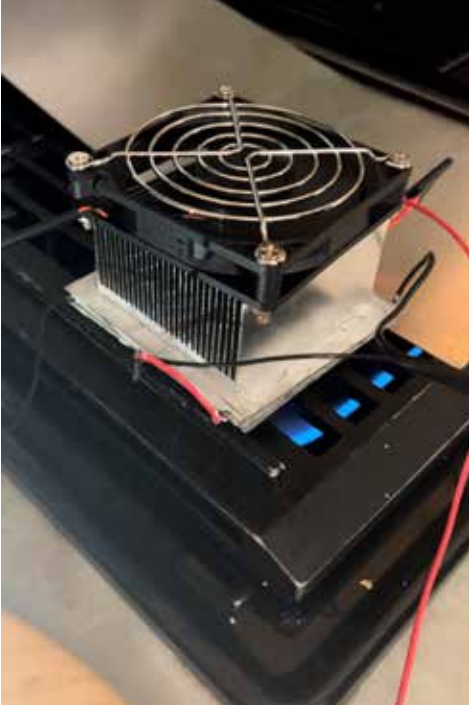
Validation

Firefly Light



Connecting the initial TEG assembly for testing purposes and to validate my concept

Firefly Light



Adding a fan for cooling down

Looking into how much a fan would take and produce which apparently helps producing more electricity than it takes.



Testing how hot it could be after placing it for 30 minutes on the stove

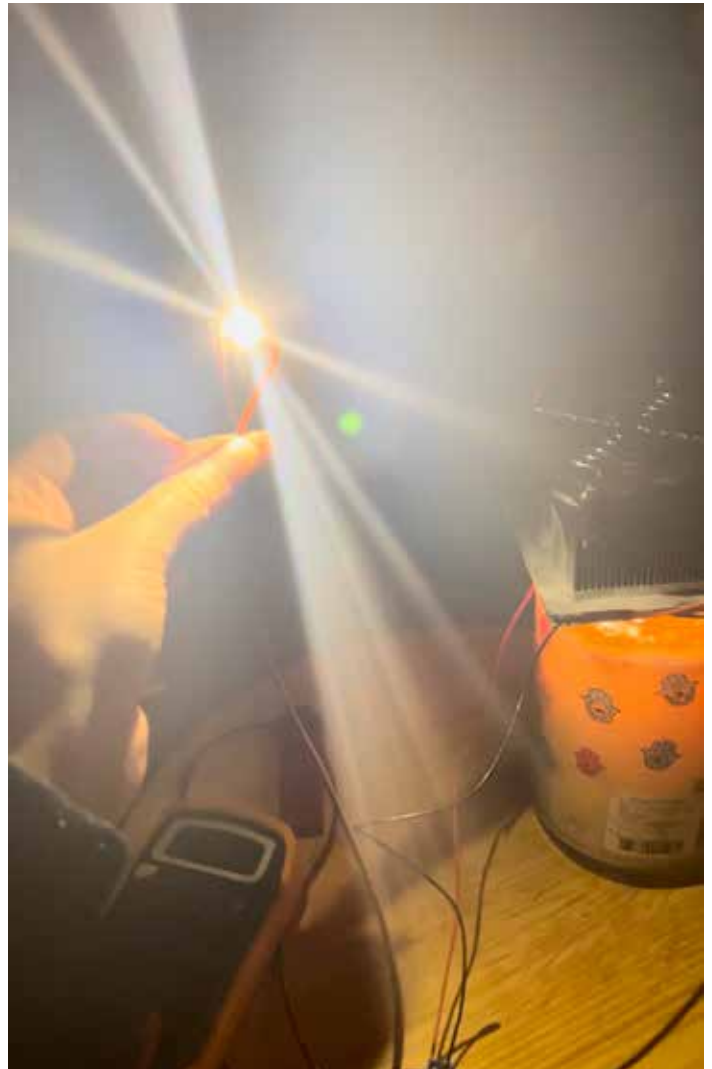


Testing the threshold of a human hands and at what temperature does it gets dangerous.

Firefly Light



Firefly Light



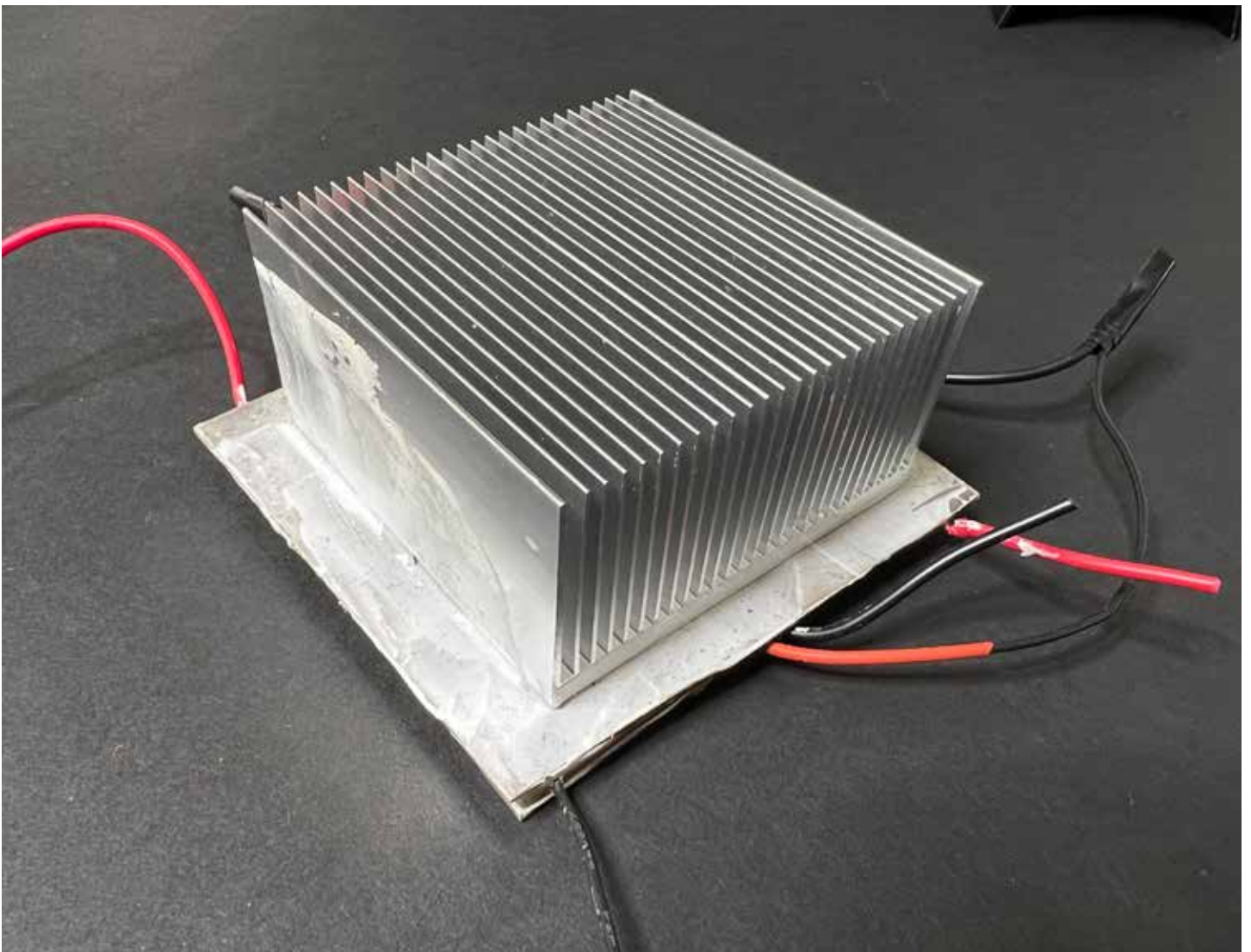
Observation

Realizing I can add a boost step-up converter to raise the voltages to speed up the charging time

Trying a candle rather than a stove top (It takes longer to heat up)

Observation

One of the main things I realized while I was working on the initial validation model is that the heatsink must cover all edges of the TEGs. Otherwise the TEGs might get damaged

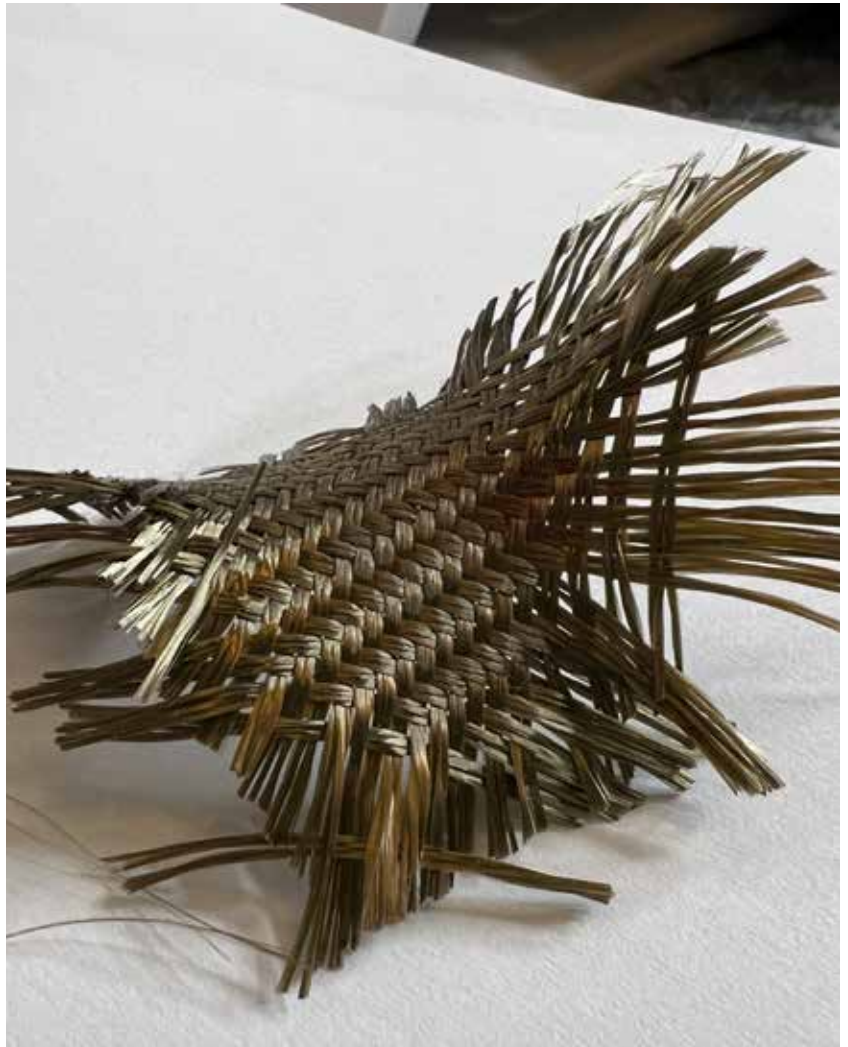




Heat protection

I started looking into different sizes of heatsinks to distribute the heat evenly and more efficient.

I started looking into Fiberglass insulation to protect the wires since they started melting in my first model.



Firefly Light



Materials for TEG

One of the main parts are,

TEG peltiers

Fan

Step up converter which boost up the current

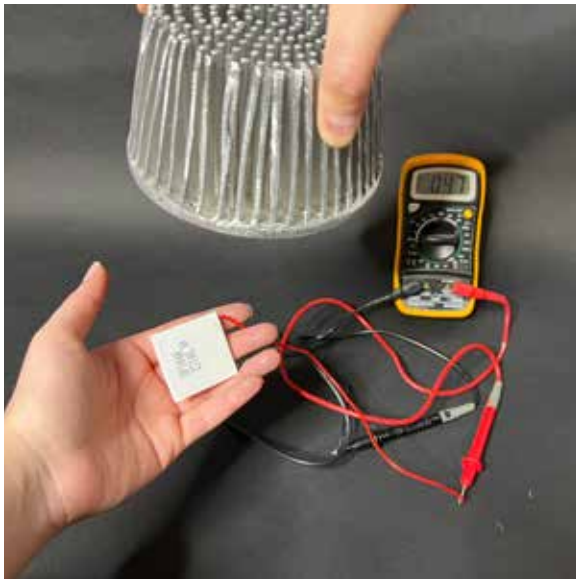
Power Bank

Thermal insulators to protect the wires

Firefly Light



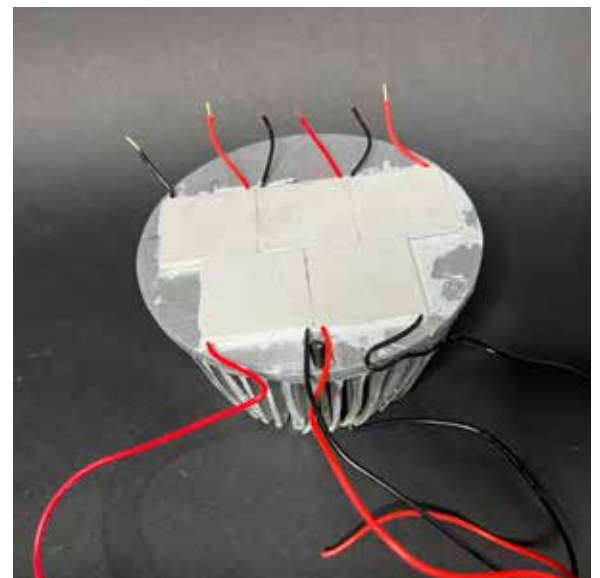
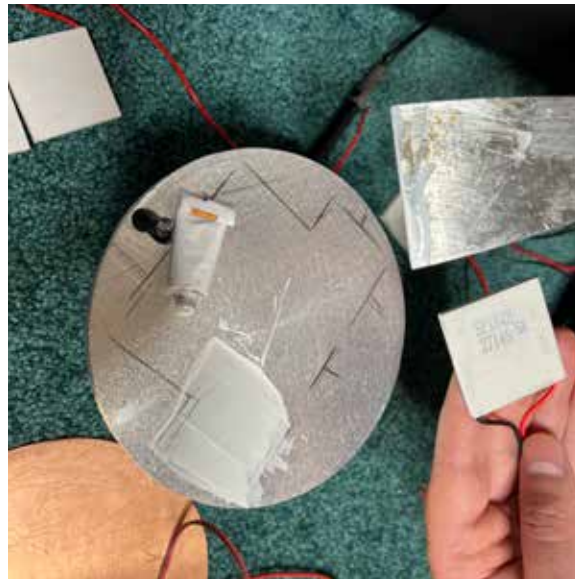
Cutting both the heatsink and cooper plate to fit my working model



TEG Assembly

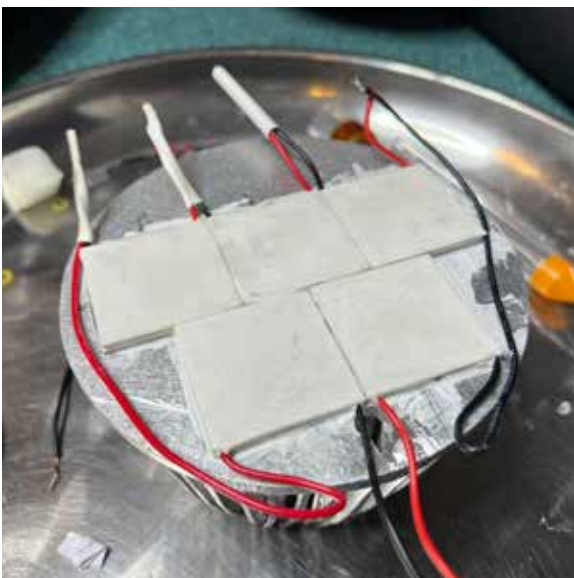
Testing the TEGs

Gluing all of them using thermal glue



Firefly Light

Attaching the TEGs, and the heat-sink base to the cooper plate using thermal adhesive.



Connecting the TEGs using thermal glue, and wiring with thermal insulator and fibreglass insulator.

Testing

Testing the heatsink and TEGs and connecting it to LED light strip.



Firefly Light



Initial TEGs testing output up to 12 V.

Firefly Light



Working model

Preparing the MVP base with heat-sink line sketches.



Firefly Light



Cutting the base heatsink line to enable airflow going through.



Firefly Light



Final observation

Building the Minimum viable product (MVP) as proof of concept.

Trying out different light input such as 5V-12V.

It workde perfectly!

Firefly Light



Disassembling the solar panel from the camping light to learn more about the parts and how solar works.

Firefly Light



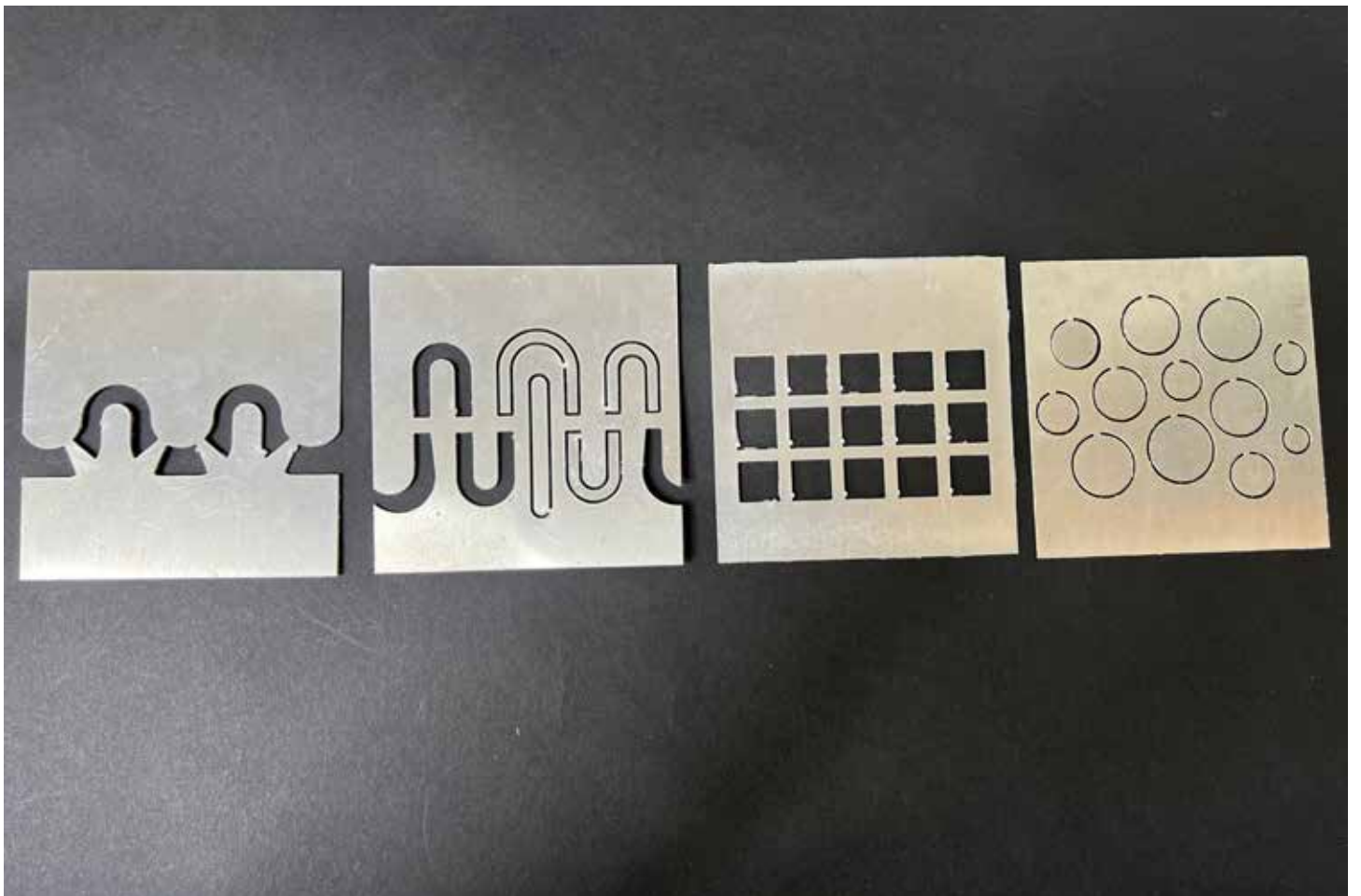
Firefly Light



Cutting different patterns to start testing the efficiency of which pattern might be the best to difuse the heat

Firefly Light

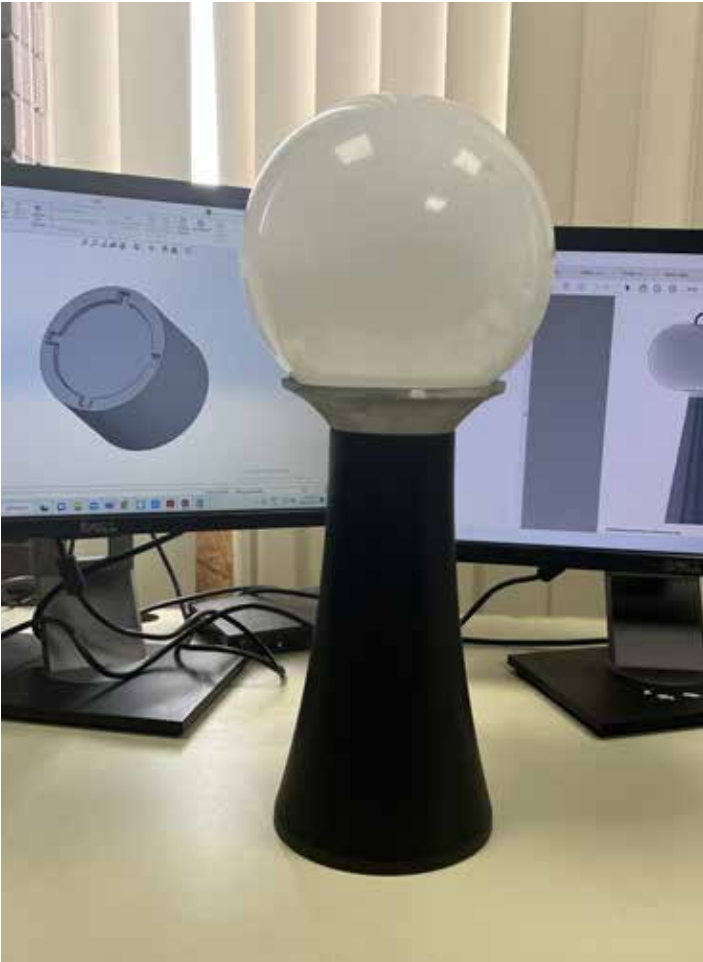
Realizing that the piece that have less connecting points stays cooler way better than others.





Development

Firefly Light



Developing the base form and design.

Exploring different base shapes with various dimensions and curvatures to ensure it's easy to grab.

Firefly Light

Working with height and measurement to see what is best height for a base to release the heat through the body.
As well as, different base size for better stability

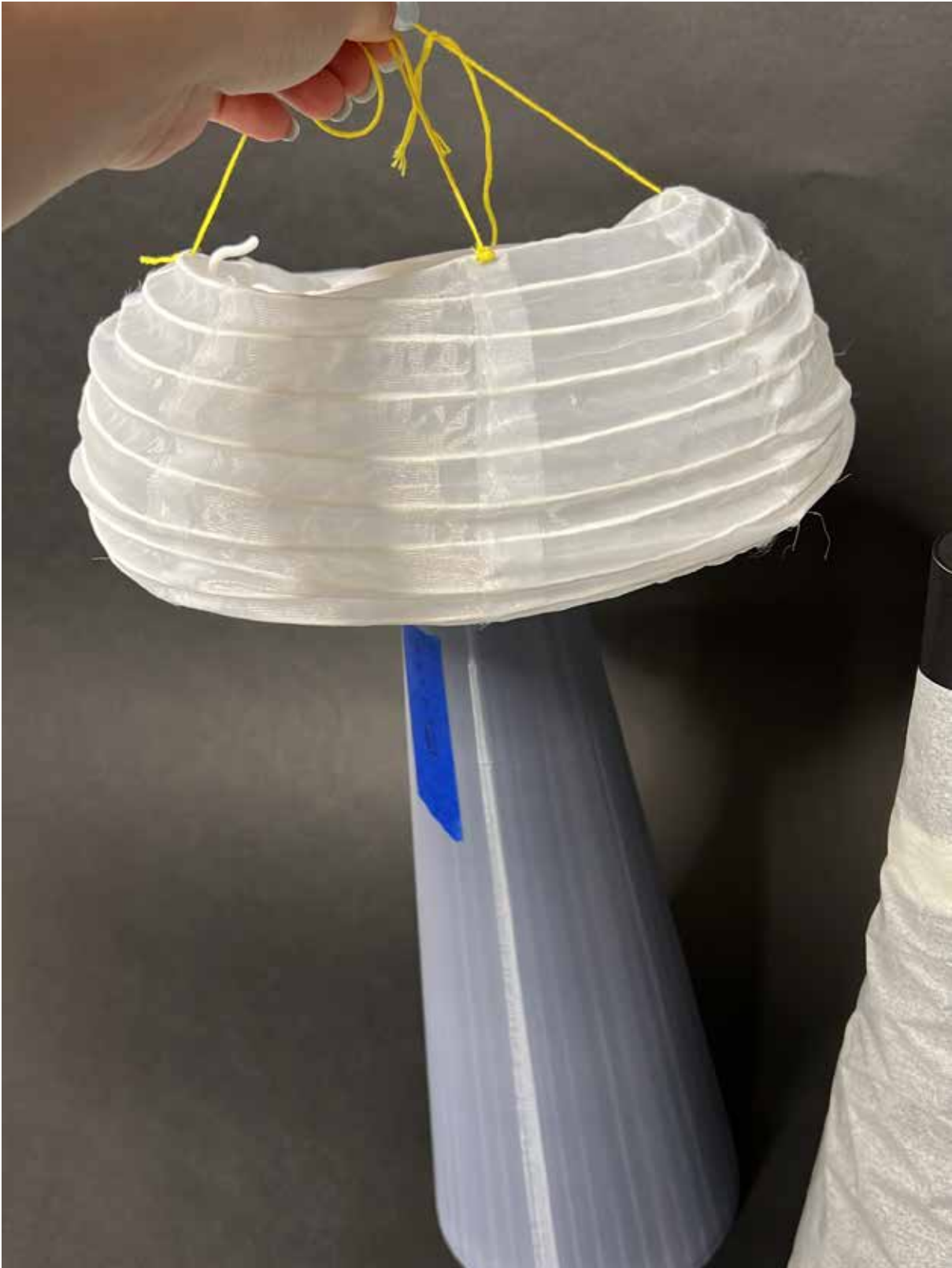


Firefly Light



Putting together the shade and with multiple curved shaped cone bases to have an idea about the overall look of the product.

Firefly Light



Realizing that the straight cone makes it look more elegant and simpler.

Firefly Light



Patterns

After settling on the ideal shape, I started further explorations on the texture patterns.

Looking into different patterns that are more personal to me



Firefly Light



Patterns

Further explorations were done to demonstrate a better looking and better airflow.

Playing with patterns for design purposes as well as for cooling the body where when there are fewer connecting points the body cools down faster

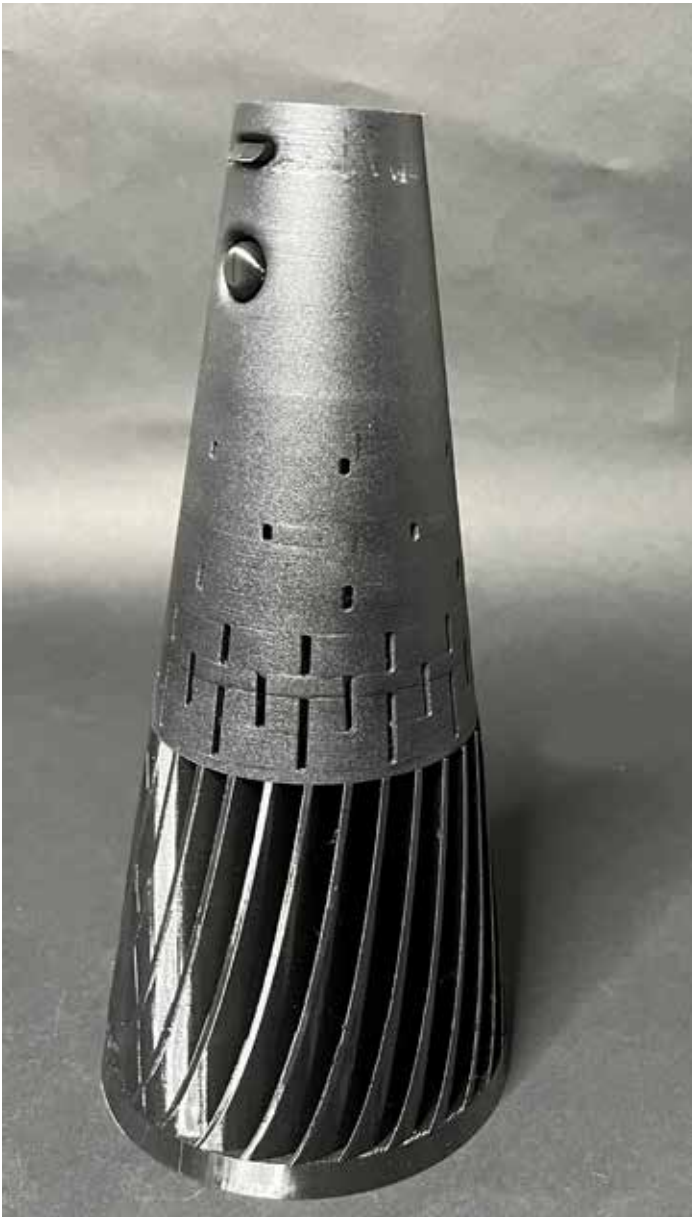
As well as to let the airflow from the fan which also helps cool the body

Base development

The heat sink is one of the most important components, not only it defines the efficiency of the product, but its volume takes almost half of the base, therefore it has to stand out and blend with the product without sacrificing the efficiency.



Firefly Light



Aligning the heat sinks with the top base to pick the best option that follows the baseline.

Firefly Light



Connect Parts

Exploring the joint tabs between the heatsink and top base,for
easy access and assembling.

Firefly Light



I have focused on the part for the quick-release mechanism and designing the connecting part between the base and diffuser

Exploring a twist mechanism. This idea was eliminated due to the pressure that would be applied to the shade every time.

Firefly Light



Firefly Light



Top part Development

Many adjustments have been made to come up with the best way for the push pins and the design.

Firefly Light

Further development on the release mechanism with durability and ease to use.



Adding support parts for the pins so they don't fall out

Firefly Light





Ending up with designing the USB port and battery level indicator.

Pin Development

Many pins were made and designed in order to design the best user friendly pin.



Firefly Light



Started with long thin pins



Making sure everything fits in place



Realized this could cause them to bend and not much efficient

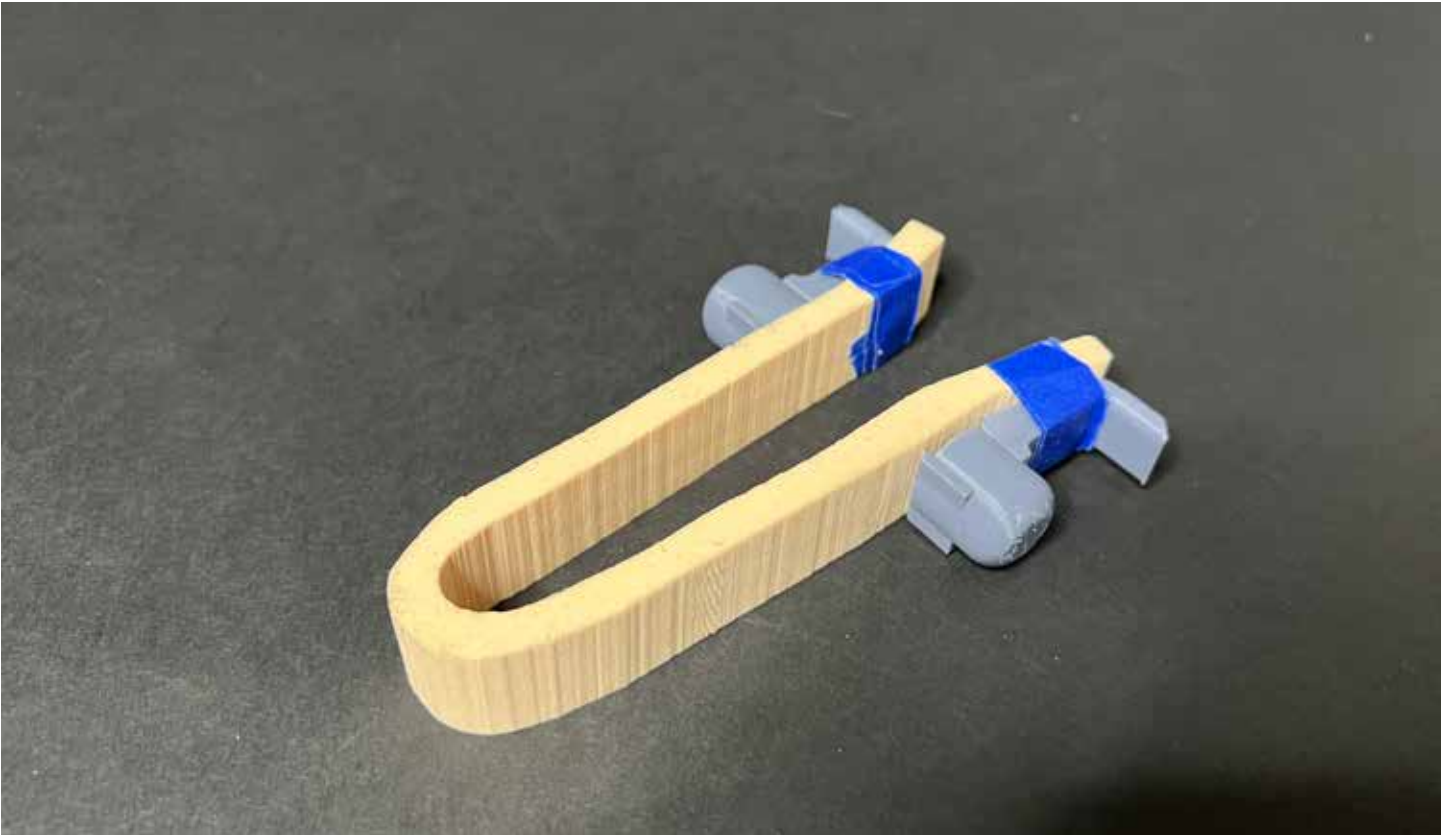
Firefly Light

looking into door handles and different places and then coming up with the wider pins and then working with the angle to let the diffuser slide easily without the need to push the pins



From this model I have realized that the spring is making the pins slides side way.

Firefly Light



That is why with some help we came up with the idea of connecting the two pins which will give it more stability.

Testing it using the bottom part of the shade

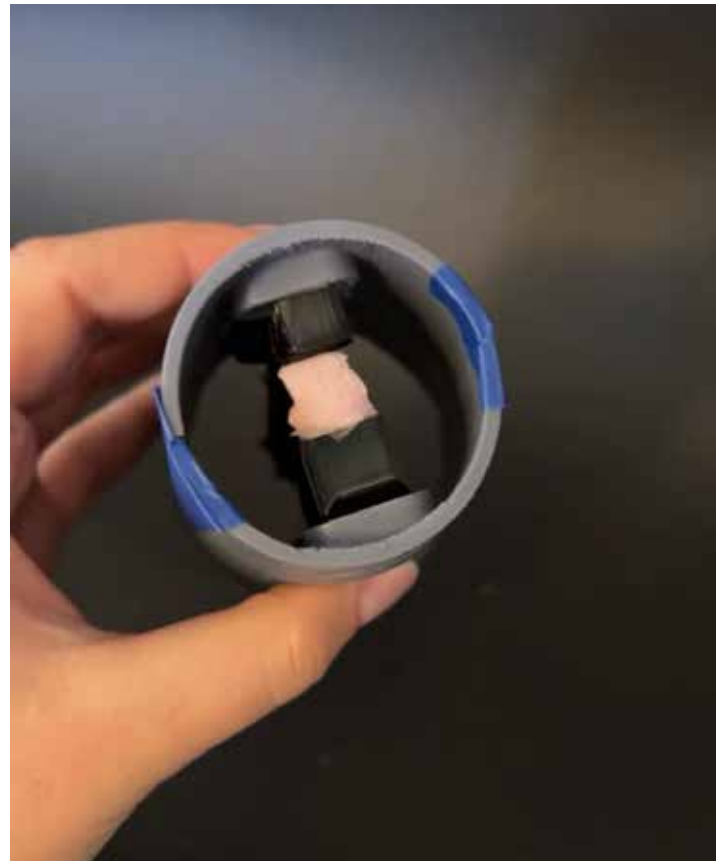


Firefly Light



Changing angles for smothering movements of the pins

Adding a stopper so the pins don't fall



Finalizing

After many tries, I ended up doing a really easy and efficient top part with pins.



Firefly Light



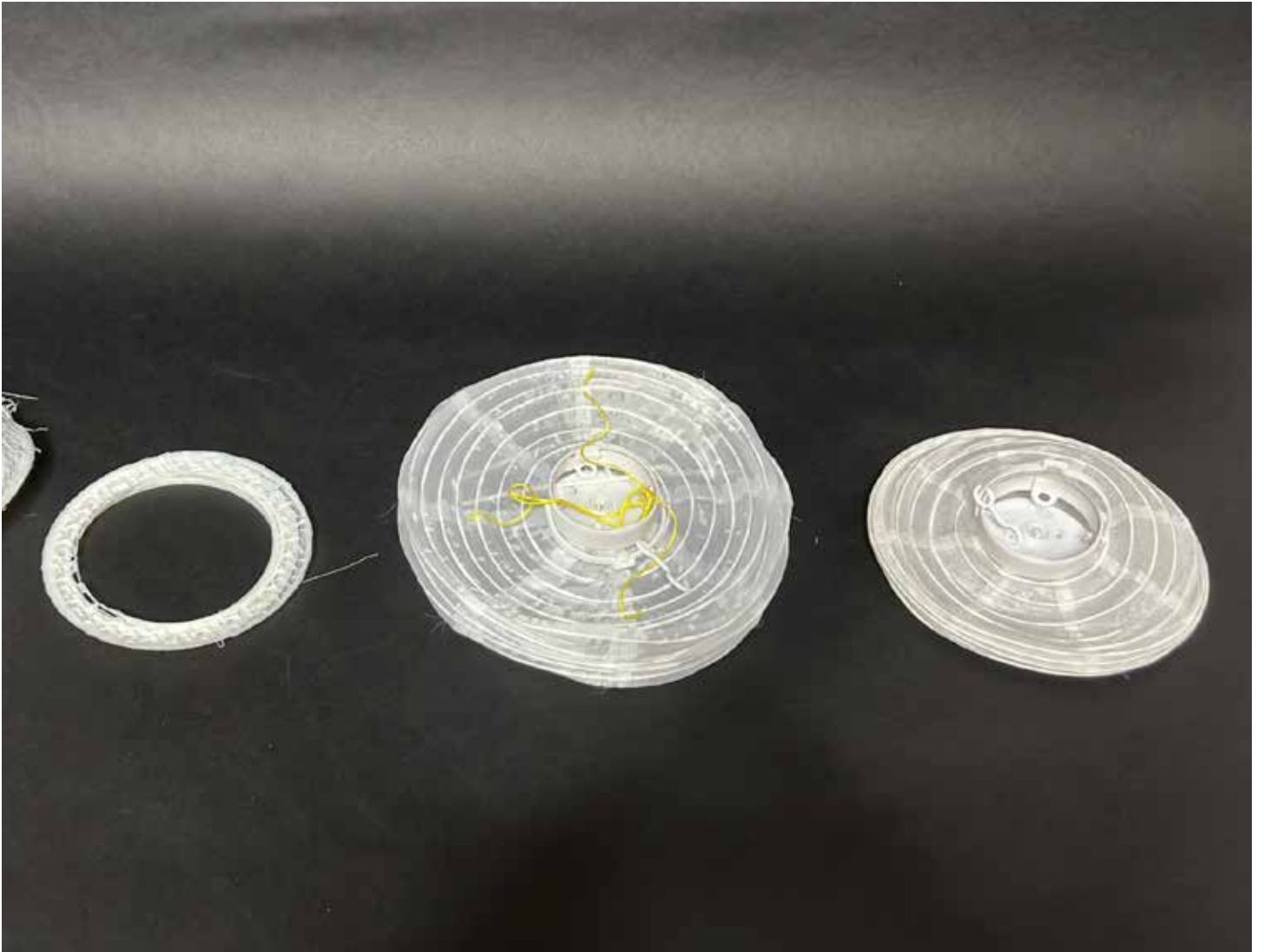
Shade

I have focused on the part for quick release mechanism and to design the connect part between base and diffuser

Firefly Light

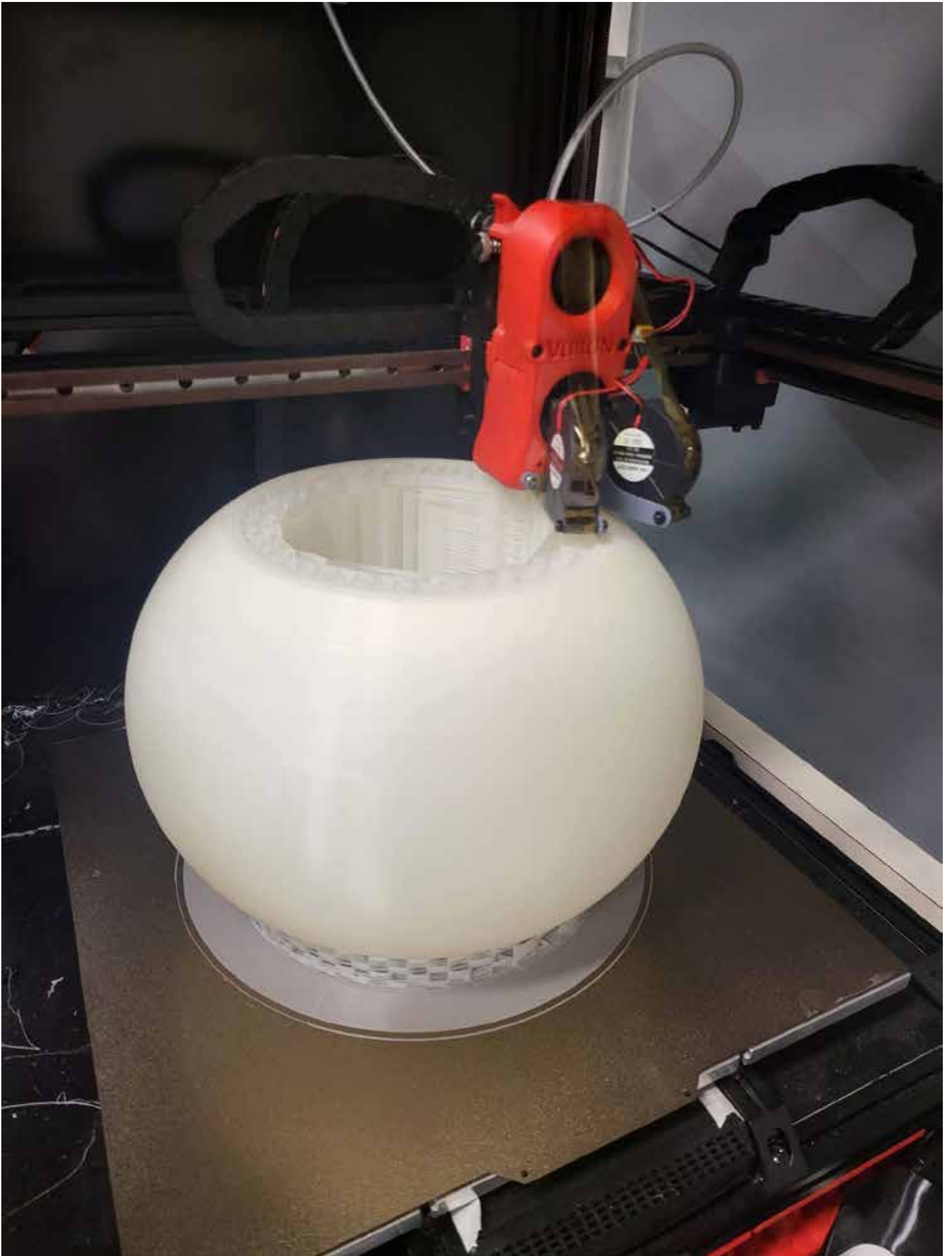


Firefly Light



Playing with various shade options of different heights and sizes.

Firefly Light



Firefly Light



Needed to reduce the support thickness
for cleaner results



Colours of the shade

Testing shade colours that yield better illumination

Firefly Light



Shade lid

Trying multiple shade lid options considering the durability.



Firefly Light



Realizing that two taps were not enough
which I ended up having four taps.

Firefly Light



Handle

Going through different handle designs that are comfortable and strong enough.

Making sure its made from stainless steel and screwed down to the lid





Bottom part

Picking an ideal shade solid base that connects to the primary base.

Development

Adjusting the inside curvature of the bottom part since the pins were sliding out.
Adding two holes for easier usage.



Firefly Light



Firefly Light



Threaded

A shade thread base option to ensure an easy access in case of maintenance, like replacing the LED strip.

LED assembly

Wrapping the shade LED light strip around the metal rod to get an evenly light distribution and yield better results.



Firefly Light



Firefly Light



Thermochromic pain was explored to show the change in temprature.

However, this paint loses its activity after a period of time.

Firefly Light

Glow in dark paint was explored to target the product at night. However, this paint needs to be charged with UV and it will lose its ability to glow after a while.





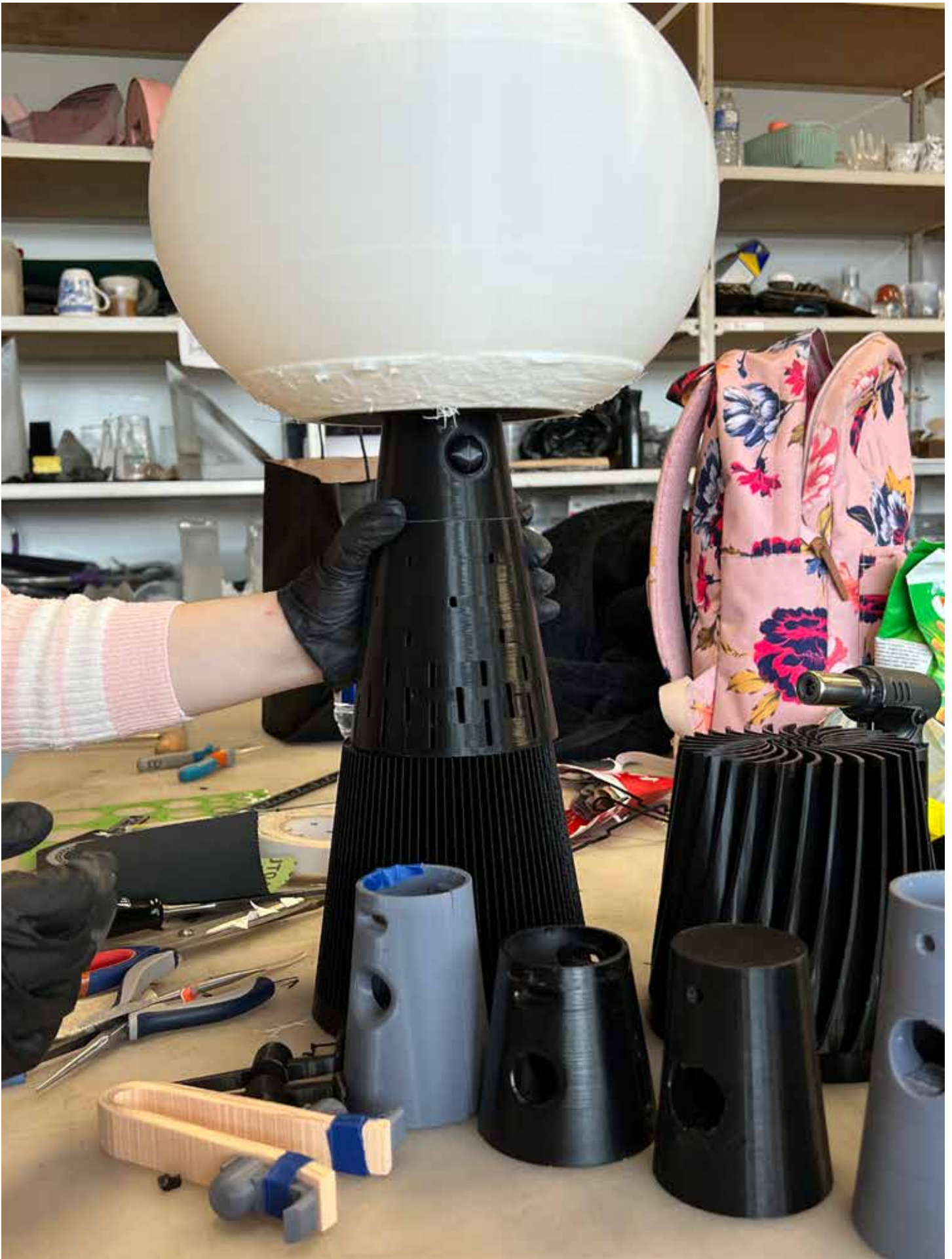
Fabrication

Firefly Light



I started to assemble all the parts after they have been 3D printed

Firefly Light



Firefly Light



Firefly Light



Gluing the top part and fix it with bondo to hide the line. Then cover it with primer and then spray it black.

Firefly Light

Connecting the LED assembly to the bottom part of the shade



Firefly Light



Firefly Light



Firefly Light



Having all parts ready! Now I just assemble them.



Final design



HCI

ORDER CONFIRMATION

Item	Description	Quantity	Price	Total
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30











Firefly Light



The design consists of continuous lines to look sleeker and have better airflow.

USB port and battery level indicator

Firefly Light



Firefly Light



Easy quick release mechanism
The shade can be charged by placing it on the base.

Firefly Light



Firefly Light



Firefly Light

Having a stainless steel handle with a groove for easier to hang

Solar panels

Dimming control button



Firefly Light



The base has a red light which indicates that the TEG is working and charging. Also, it means it's hot to be careful when holding it.

You can charge your phone using the USB port, which glows all the time for better-targeting objects at night.

Firefly Light



IN USE



Place it on the stove



You can leave the shade if you want

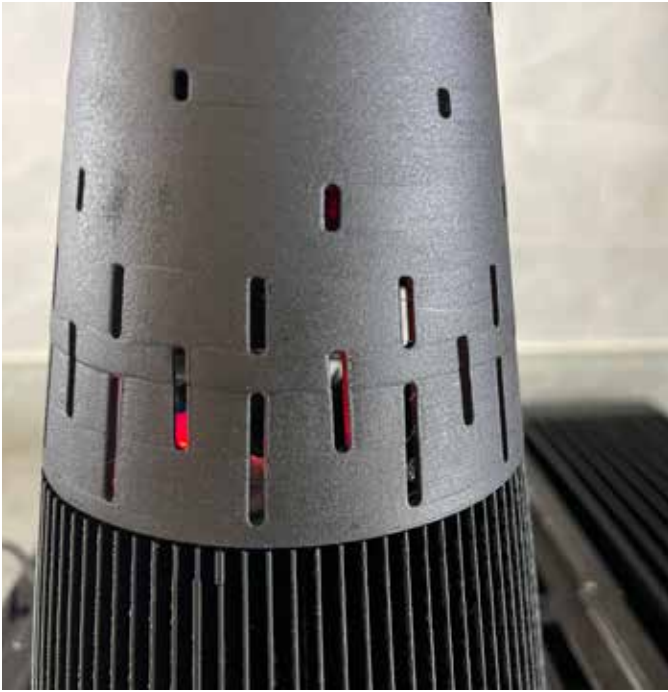


Take it easily



Leave the base on the stove to charge

Firefly Light



Red light on "Means its working"



You can remove the shade by pushing the pins



You can cook and charge your light at the same time



You can double the amount of charging where you place the shade near the window and you get 4 hours of charge in 2 hours only.

Firefly Light



After its done, you can get the shade back and hold your base or you can directly hold it from the top.



Place it on a silicon pad

Firefly Light



To protect your surfaces when its hot

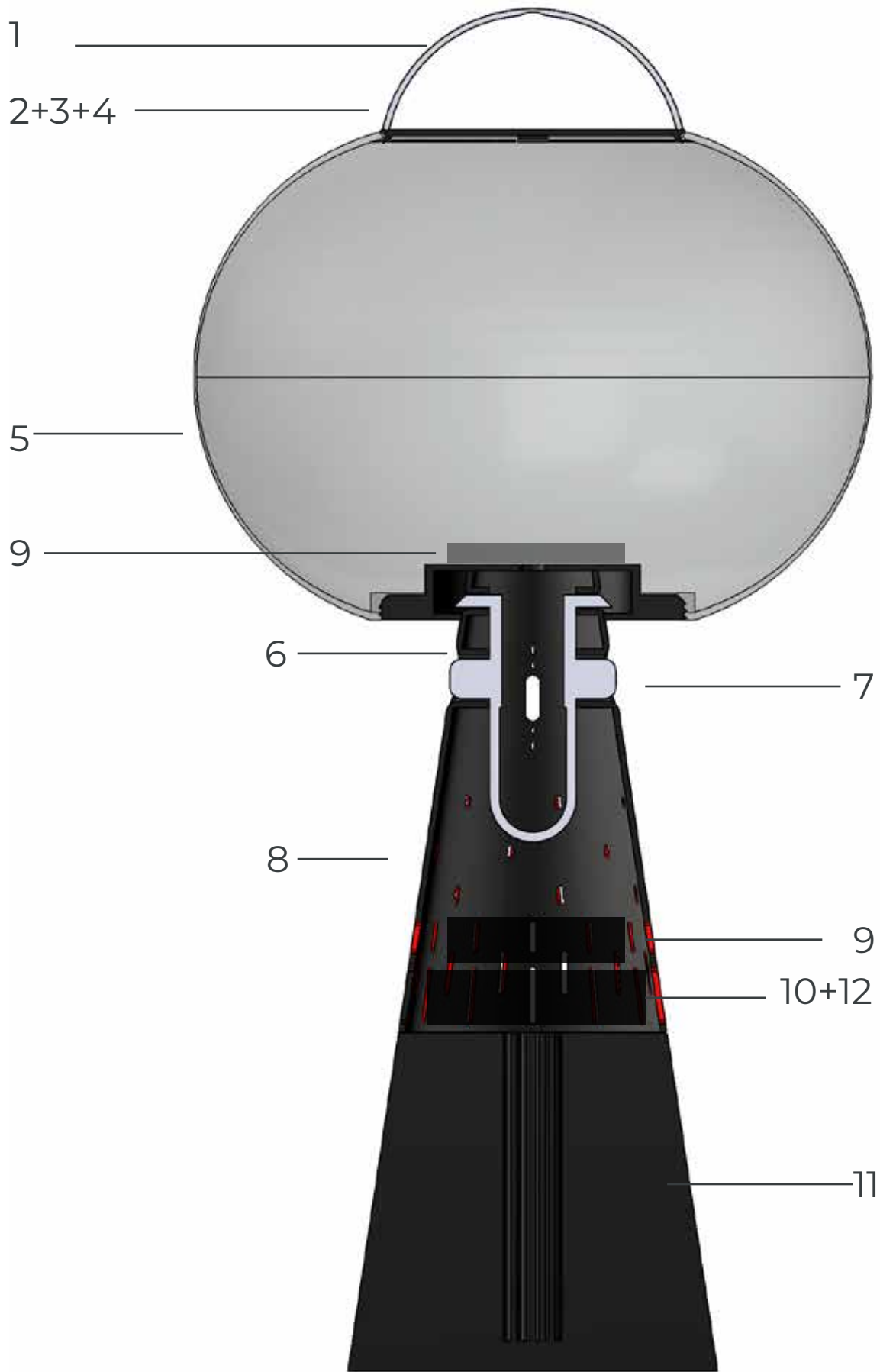


Enjoy your light!

Materials and parts in detail

- 1- handle : made of stainless steel
- 2- Solar panels
- 3- Dimming control
- 4- A polycarbonate shade lid
- 5- Blow molded polycarbonate shade
- 6- Bottom cover
- 7- Metal Pins
- 8- Metal body part
- 9- A power bank
- 10- Fan
- 11- Heatsink alluminum (CNC CUT)
- 12- Step up convertor
- 13- Copper plate for better heat conductor
- 14- Fiberglass insulator

Firefly Light



13

181











Fig 24: The city of jasmine (Damascus)

Reflection

The opportunity I got to make something that might help people who are living the same experience that I had before is so rewarding. From personal experience, I really know the struggle that people go through to get their illumination needs daily. This is why I wanted to make something for them to make their life easier.

I learned a lot about different ways to produce electricity, I was amazed at how hard sometime this could be. I learned through this project how to focus on a specific need and develop an idea for it.

It could be challenging to make an energy system light with aesthetic considerations. However, I enjoyed the full process of my project. I really appreciate all the help I got from the faculty advisers and technologists. Their support helped make a huge difference. The way they believed in me and my project made me very proud of what I had ended up with.

I have realized how many steps it takes to make a fully developed working model. I would be really excited to take this project further, make an actual working prototype and send it over to all these people who are in need to make a difference in their life.

Thanks to everyone who helped me throughout the project!

Index

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- fig 2:** Gaza: Looming humanitarian catastrophe highlights need to lift Israel's 10-year illegal blockade. (2017). Amnesty International. <https://www.amnesty.org/en/>
- Fig 3:** TOPSHOT-PALESTINIAN-CONFLICT-GAZA-ELECTRICITY.(2017). Getty Images. <https://www.gettyimages.ca/detail/news-photo/picture-taken-on-june-13-shows-palestinian-children-at-home-news-photo/695665620?adppopup=true>
- Fig 4:** Power restored in New York after blackout on anniversary of 1977 outage. (2019). Japan Times. <https://www.japantimes.co.jp/news/2019/07/14/world/power-restored-new-york-blackout-anniversary-1977-outage/>
- Fig 5 & 18:** Light and Its Properties. (2022). Lets Talk Science. <https://letstalkscience.ca/educational-resources/backgrounders/light-and-its-properties>
- Fig 6:** Rechargeable LED Camping Lantern. Walmart. <https://www.walmart.ca/en/ip/Rechargeable-LED-Camping-Lantern-Solar-Hand-Crank-Flashlight-Emergency-Portable-Bright-Survival-Lantern-Long-Play-Time-3000mAh-Power-Bank-USB-Charger/PRD3XVK-4O5GRQIF>
- Fig 7:** Weller, C. This sleek LED lamp is powered by a tiny candle flame. (2016). <https://www.businessinsider.com/lumir-c-candle-led-lamp2016-2>
- Fig 8 & 23:** Solar Panel. Biolite. <https://ca.bioliteenergy.com/collections#solar-panels>
- Fig 9:** Yanko Design. (2021, August 27). Yanko Design. <https://www.instagram.com/yankodesign/?hl=en>
- Fig 10:** Porter, J. , Knapp, M. , & Hanson, M. (2021, January 11). Philips Hue review. TechRadar. Retrieved October 22, 2022, from <https://www.techradar.com/reviews/gadgets/appliances/philips-hue-1124842/review>
- Fig 11:** Yanko Design. (2021, December 22). Yanko Design. <https://www.instagram.com/yankodesign/?hl=en>
- Fig 12:** Yanko Design. (2021, December 29). Yanko Design. <https://www.instagram.com/yankodesign/?hl=en>
- Fig 13:** A world of lighting: What is color temperature? (2022, March 21). Lumega. <https://lumega.eu/blog/a-world-of-lighting-what-is-color-temperature/>
- Fig 14 &16:** Spears, J. Blackout 2003: How Ontario went dark. (2013). Toronto Star. https://www.thestar.com/business/economy/2013/08/13/blackout_2003_how_ontario_went_dark.html
- Fig 17:** McCoy, D. Living Without: Electric Light. (2022). The Rustic Elk. <https://www.therusticelk.com/living-without-electric-light/>
- Fig 5 & 18:** Light and Its Properties. (2022). Lets Talk Science. <https://letstalkscience.ca/educational-resources/backgrounders/light-and-its-properties>
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Firefly Light



The end of a new chapter

