

IDC School of Design
अभिकल्प विद्यालय



IIT Bombay

Project 3

Ambient lighting for home

-Name-

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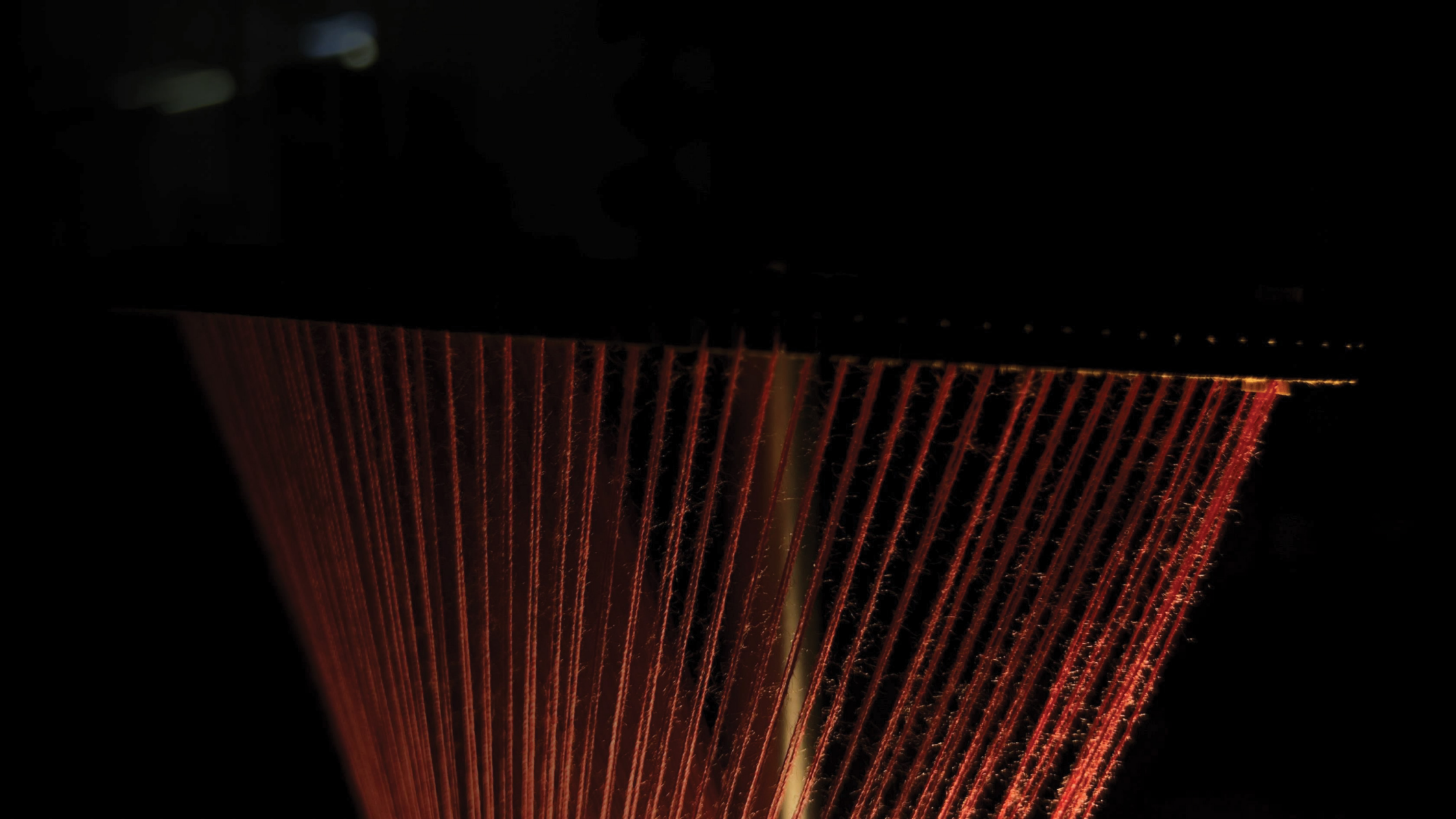
-Under the Guidance of-
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1. History of lights

In 1802, Humphry Davy invented the first electric light. He experimented with electricity and invented an electric battery. When he connected wires to his battery and a piece of carbon, the carbon glowed, producing light. His invention was known as the Electric Arc lamp. And while it produced light, it didn't produce it for long and was much too bright for practical use.

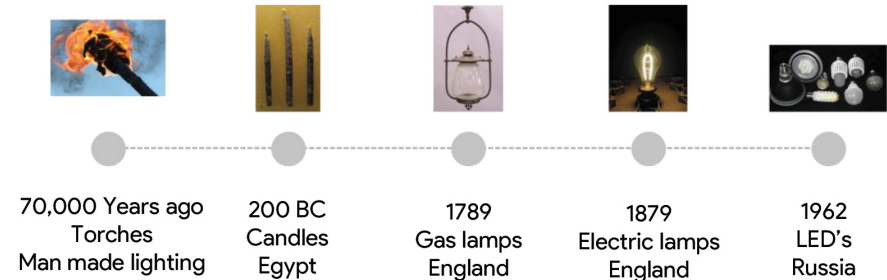


Image 1 – History of lights

Over the next seven decades, other inventors also created “light bulbs” but no designs emerged for commercial application. More notably, in 1840, British scientist Warren de la Rue enclosed a coiled platinum filament in a vacuum tube and passed an electric current through it. The design was based on the concept that the high melting point of platinum would allow it to operate at high temperatures and that the evacuated chamber would contain fewer gas molecules to react with the platinum, improving its longevity. Although an efficient design, the cost of the platinum made it impractical for commercial production.

In 1850 an English physicist named Joseph Wilson Swan created a “light bulb” by enclosing carbonized paper filaments in an evacuated glass bulb. And by 1860 he had a working prototype, but the lack of a good vacuum and an adequate supply of electricity resulted in a bulb whose lifetime was much too short to be considered an effective producer of light. However, in the 1870's better vacuum pumps became available and Swan continued experiments on light bulbs. In 1878, Swan developed a longer lasting light bulb using a treated cotton thread that also removed the problem of early bulb blackening.

2. Sustainable Lighting

Sustainable lighting is lighting designed with energy efficient light sources. "There are simple design strategies and some materials that can facilitate the energy saving advantages of natural light.

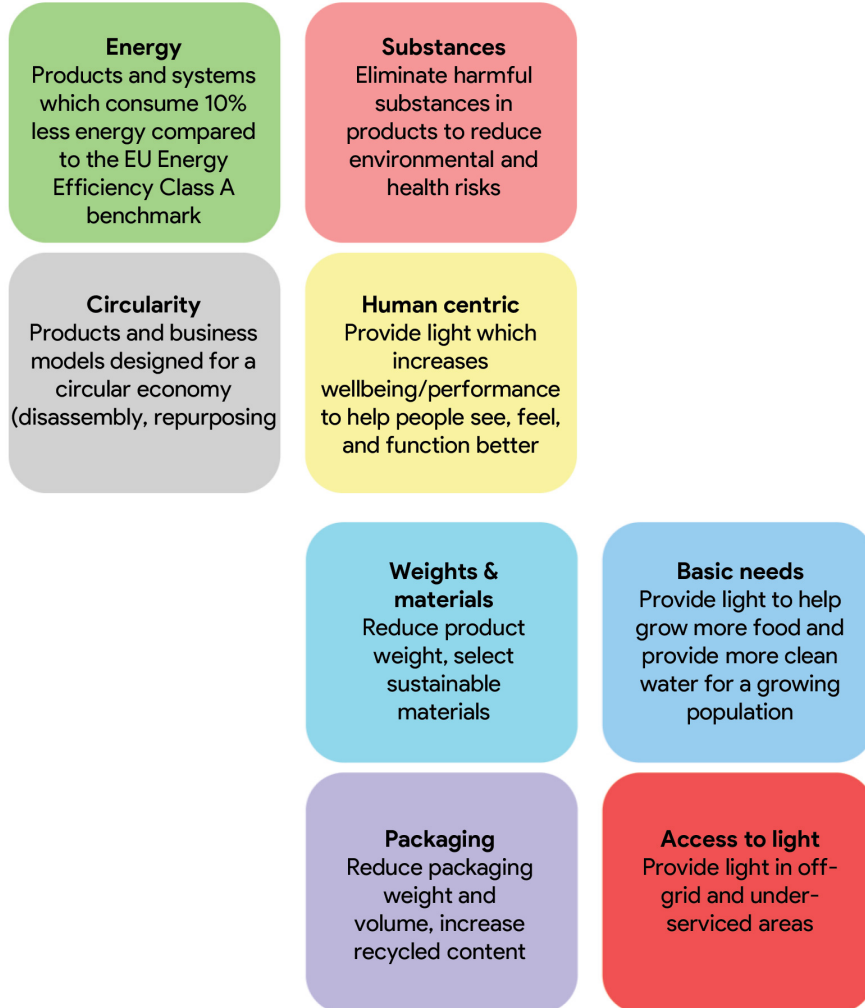


Image 2 – Sustainable lights

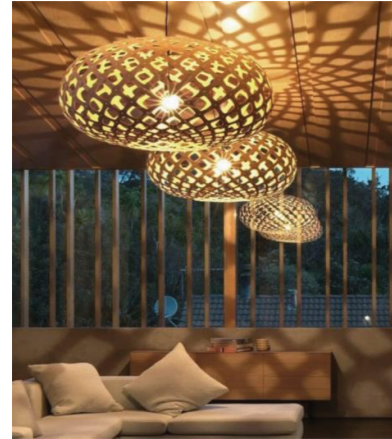
2.1 Why we need sustainable lighting?

Sustainable lighting design offers various well-being and environmental benefits in addition to economic advantages for clients and users. Often the ambition for renovations or new applications goes along with a higher quantity of lighting instead of finding a better lighting quality with an adequate amount of energy.

The downside is that they contain mercury. It's only present in tiny amounts, thousandths of a gram, but it can be environmentally damaging if the light bulbs are carelessly disposed of by, say, ending up in landfill.

3. Market Study

3.1 Sustainable Material Lighting



1

David Trubridge pendant light

Inspiration -

The design based on the Maori name for the small fresh water shrimps that live in New Zealand rivers.

Designed for spaces like -

commercial spaces, museums, restaurants, cafes, and hotels

Materials used -

Sustainable bamboo

Keywords -

Minimalistic & lightweight

first impressions -

The design of light is meant to showcase the beautiful shadows and reflections created by light by using simple light form.

Cost per piece -

\$380 - \$650

<https://www.sustainablejungle.com/sustainable-living/eco-friendly-sustainable-light/>



2

Salt crystal lamp

Inspiration -

These salt crystal lamps are carefully shaped to retain the unique, natural shape and crystal structure of the salt rock.

Designed for spaces like -

restaurants, cafes, hotels, House interiors

Materials used -

Salt crystal, sheesham wood base

Keywords -

Naturally inspired, minimal, mood lighting

first impressions -

Unless and until someone will glow bulb inside it, it will just look like some naturally inspired form sitting on the surface.

Cost per piece -

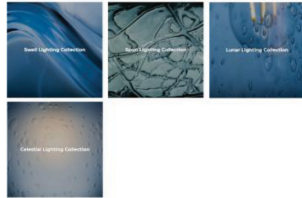
\$50 - \$60

3

Bicycle glass co.

about company -
The company focused to make lights by recycling glass waste to make lighting.

collections -



Materials used -
Recycled glass

<https://www.bicycleglass.com/sustainable/longlife/ready/sustainable/light/>



3.2

Bicycle glass co.

Collection -



The Spun Style features beautiful web-like trails that intersect and trace the surface of the glass. Each hand-blown spun shade is unique and made to order in Minneapolis, Minnesota with locally recycled glass.

Designed for spaces like -
restaurants, cafes, hotels, House interiors

Materials used -
Recycled glass

Keywords -
traditional, transitional, beach-style, and contemporary.

Cost per piece -
\$100 - \$500

<https://www.bicycleglass.com/sustainable/longlife/ready/sustainable/light/>



3.1

Bicycle glass co.

Collection -



The Swell Style features a beautifully distorted band that wraps around each hand-blown glass shade. Our artisans apply each swell design by hand, no two pieces are the same.

Designed for spaces like -
restaurants, cafes, hotels, House interiors

Materials used -
Recycled glass

Keywords -
traditional, transitional, beach-style, and contemporary.

Cost per piece -
\$100 - \$500

<https://www.bicycleglass.com/sustainable/longlife/ready/sustainable/light/>



3.3

Bicycle glass co.

Collection -



This style is a variation of our popular Lunar collection. These seeded glass shades feature a beautiful bubbled pattern but with a fully frosted finish, giving the light a softer and more opaque look.

Designed for spaces like -
restaurants, cafes, hotels, House interiors

Materials used -
Recycled glass

Keywords -
traditional, transitional, beach-style, and contemporary.

Cost per piece -
\$100 - \$500

<https://www.bicycleglass.com/sustainable/longlife/ready/sustainable/light/>



3.4

Bicycle glass co.

Collection -



The Lunar Style features a spontaneously seeded glass surface. The bubbled design is handcrafted from 100% recycled glass. Each shade is sustainably hand-blown.

Designed for spaces like -
restaurants, cafes, hotels, House interiors

Materials used -
Recycled glass

Keywords -
traditional, transitional, beach-style, and contemporary.

Cost per piece -
\$100 - \$500

<https://www.sustainableliving.com/sustainable-living/eco-friendly-sustainable-light/>



5.

Moon scraplight

Inspiration -

The Moon Scraplight Pendant is handmade from re-purposed cardboard boxes and features a non-toxic fire retardant treatment.

Designed for spaces like -
restaurants, cafes, hotels, House interiors

Materials used -
Cardboard

Keywords -
Naturally inspired, minimal, warm, Welcoming

first impressions -
The design looks like its inspired from the moon and it gives welcoming vibes.

Cost per piece -
\$500 - \$700

<https://www.sustainableliving.com/sustainable-living/eco-friendly-sustainable-light/>



4.

Goodie 's 2 tier

Inspiration -

This elegant two-tier pendant presents contemporary design handcrafted from Elephant grass indigenous to Ghana.

Designed for spaces like -
restaurants, cafes, hotels, House interiors

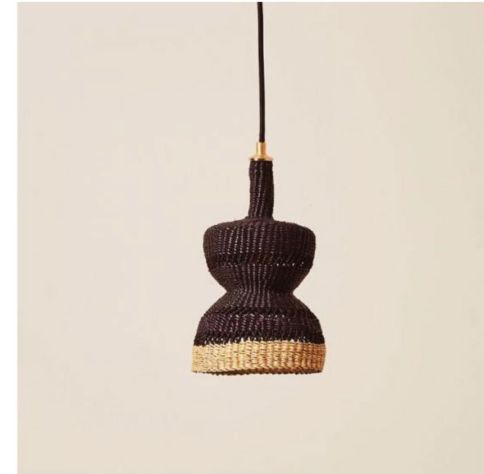
Materials used -
Elephant grass

Keywords -
Naturally inspired, minimal, warm, Welcoming

first impressions -
The design looks like pendent and feels warm, at first glance it feels like naturally inspired and welcoming.

Cost per piece -
\$200

<https://www.sustainableliving.com/sustainable-living/eco-friendly-sustainable-light/>



6.

Banana leaf wall sconce

Inspiration -

Banana Leaf Wall Sconce features tropical fantasy of warm weather and balmy breezes in hand forged steel with Banana.

Designed for spaces like -
restaurants, cafes, hotels, House interiors

Materials used -
kabebe shell, sustainable chocolate tiger shell glass

Keywords -
Naturally inspired, minimal, warm, Welcoming

first impressions -
The design is the clear impression of banana leaf which made from the sustainable materials.

Cost per piece -
\$400 - \$500

<https://www.sustainableliving.com/sustainable-living/eco-friendly-sustainable-light/>



7.

Lannapassa

Inspiration -

A traditionally handwoven Thai bamboo trap basket, re-purposed into a beautifully minimalistic wall bracket pendant light.

Designed for spaces like -
restaurants, cafes, hotels, House interiors

Materials used -
fishing trap bamboo

Keywords -
Naturally inspired, minimal, warm, Welcoming

first impressions -

The reflections created by the product over the wall surface is beautiful, the product feels lightweight, easy to install

Cost per piece -
MRP 7400

<https://www.pinterest.com/pin/1000000000000000000/>

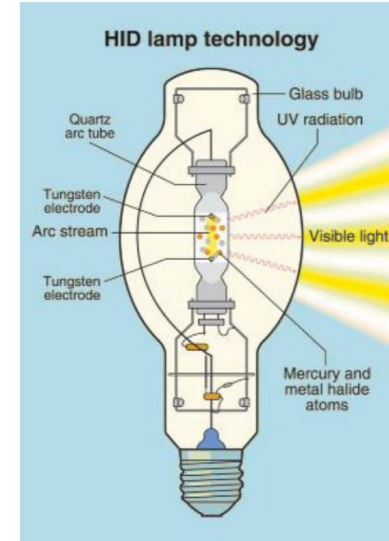


Image 3 – HID lighting

3.2. LED & HID Lighting

3.2.1 . HID Lighting

High Intensity Discharge is an overarching term for a gas-discharge light. They are the oldest type of electrical light Among the common types of HID lights are mercury vapor, low and high pressure sodium and metal halide lamps. Other less common variants include ceramic metal halide and xenon short-arc lamps.

HID lamps produce light by sending an electrical charge or “arc” between two tungsten electrical conductors (electrodes) and through an ionized gas (also known as “plasma”) which is housed inside the bulb. HID lights require ignition which is typically provided by a voltage pulse or a third electrode (an additional metal part) internal to the bulb. Once lit the electrical arc begins to evaporate the metal salts inside the bulb which significantly increases the luminous power of the bulb while simultaneously improving lighting efficiency. HID lighting requires a “warm-up” period because the lighting intensity is dependent on and changes as the material inside the bulb is evaporated into plasma.

Additionally, as the light heats up it requires additional voltage to operate. Voltage requirements in HID bulbs are balanced by an electrical ballast (essentially a device that limits electrical current to that required to operate the lamp). As the HID light ages, more and more voltage is required to produce the same amount of light until eventually the voltage exceeds the fixed resistance provided by the ballast and the light goes out (fails). HID lights become less and less efficient over time because they must use more and more voltage to produce the same lumen output as the light degrades.

3.2.2. Major Deficiencies in HID Lighting

A portion (roughly 30%) of the energy emitted by HID lights is infrared (which in terms of lighting output means it's entirely wasted energy). Although this figure is worse for older variants of the technology and better for new HID bulbs, it's a relevant inefficiency in either case. Of note, both incandescent and fluorescent bulbs are worse than HID with respect to the percentage of radiation that is infrared vice visible light.



Image 4 – LED lighting

HID lumen output can significantly deteriorate as the bulb ages. Some HID bulbs produce 70% less visible light after only 10,000 hours of operation. Most HID lighting emits a significant amount of UV radiation. Due to this deficiency HID lamps require UV filters to prevent fading of dyed items exposed to their light, degradation of lamp fixture parts, or serious injury (sunburn or arc eye) to humans and animals.

HID lights are omnidirectional. Omnidirectional lights produce light in 360 degrees. This is a large system inefficiency because at least half of the light needs to be reflected and redirected to the desired area being illuminated. The need for reflection and redirection of light means that the output is much less efficient for omnidirectional lights due to losses than it would be for the same light if it were directional by its nature. It also means that more accessory parts are required in the light fixture itself in order to reflect or focus the luminous output of the bulb (thus increasing unit costs).

3.2.3. LED Lighting

LED stands for Light Emitting Diode. A diode is an electrical device or component with two electrodes (an anode and a cathode) through which electricity flows - characteristically in only one direction (in through the anode and out through the cathode). Diodes are generally made from semiconductive materials such as silicon or selenium - solid state substances that conduct electricity in some circumstances and not in others (e.g. at certain voltages, current levels, or light intensities). When current passes through the semiconductor material the device emits visible light. It is very much the opposite of a photovoltaic cell (a device that converts visible light into electrical current).

Major upsides of LED -

LEDs have an extremely long lifespan relative to every other lighting technology (including HID). New LEDs can last 100,000 hours or more. The typical lifespan for an HID bulb, by comparison, is 10-25% as long at best (10,000 - 25,000 hours).

LEDs are extremely energy efficient relative to every other commercially available lighting technology. There are several reasons for this to include the fact they waste very little energy in the form of infrared radiation (much different than most conventional lights to include HID), and they emit light directionally (over 180 degrees versus 360 degrees which means there are far fewer losses from the need to redirect or reflect light).

Very high light quality.

Very low maintenance costs and hassle.

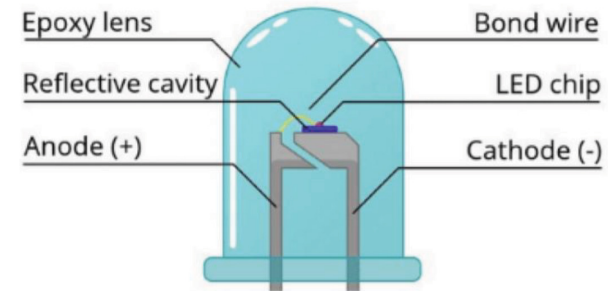


Image 5 – working of LED

3.2.4. Construction of LED

Light Emitting Diode (LED) works only in forward bias condition. When Light Emitting Diode (LED) is forward biased, the free electrons from n-side and the holes from p-side are pushed towards the junction. When free electrons reach the junction or depletion region, some of the free electrons recombine with the holes in the positive ions. We know that positive ions have less number of electrons than protons. Therefore, they are ready to accept electrons.

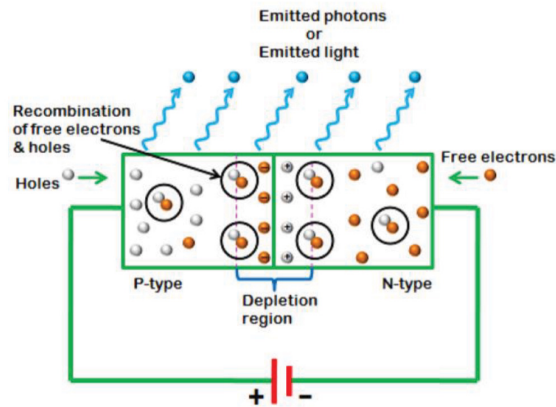


Image 6 – working of LED 2

Thus, free electrons recombine with holes in the depletion region. In the similar way, holes from p-side recombine with electrons in the depletion region.

3.2.5. Types of LED's

a. Mini LED's

Given how the technology surrounding LED lighting has become highly advanced over the past decade or so, these lights are getting smaller and more compact. That being said, one of the more common types of LED lights today is miniature LEDs, which include chip, nano, and pico LEDs. These lights are extremely small and typically come in a single color or shape. The common applications where we see these miniature lights are in remote controls, calculators, and mobile phones. And given the less complex design and minuscule size, these lights can easily be placed onto a circuit board without needing a device used to control heat. This makes these lights perfect for technologically advanced industries across the globe. In addition, it's important to note that these lights come in three different types:

Standard
Low-current
Ultra-high output

b. High power LED's

As the search for more power has resulted in the expansion of the LED industry, high powered LED lights were created to suit the needs of people all over the world. Due to the increase of technology surrounding diodes, high-power LEDs were born. These LEDs produce a far higher output compared to other types on the market thanks to their ability to provide a higher number of lumens. Additionally, it's important to understand that these high-powered lights can vary based on their Luminosity Wavelength Voltage.



Image 7 – High power LED

c. Alphanumeric LED's

This is another popular form of LED lighting, which is typically seen on older digital clocks. However, their popularity has decreased over the years due to the advancements in the industry. Different types of LEDs today use far less energy and have more flexibility in terms of visuals.

But to really understand alphanumeric LEDs, it's important to understand the four different types out there, which include:



Image 8 – alphanumeric LED

d. 7-Segment

This type of alphanumeric LED can only handle a specific set of letters and all of the numbers. This makes the ability of this type a bit limited, but can still be very useful.

b. 4 and 16-Segment

These types, also referred to as star-burst displays, work effectively given that they can cover the whole Roman alphabet in uppercase, including having the ability to display numbers 0 through 9. The 4 and 16-segment types are essentially the same thing, but the only difference is that the 16-segment model has a break on the top and bottom bars, which enhances the visuals of how the characters appear.

e. Matrix

Matrix is the smartest and most flexible type of alphanumeric LEDs. It can handle lower case words, upper case words, every single number, and many symbols as well.



Image 9 – Matrix

f. Lighting home LED's

Some of the examples of home lighting include illuminators, LED bars, and LED lamps. But as we stated previously about other LED lights, heat is also a problem here. However, many manufacturers have found solutions to help combat this heat issue. They've used ceramic and aluminum bodies around these bulbs that involve fins that expand the area in which heat can escape from. And given the wide variety of purposes and the different applications that use this type of lighting, the forms of heat control vary greatly for LED lighting.



Image 10 – Home LEDs

g. RGB lighting -

These LED lights work by the combination of red, green, and blue emitters. These three lights are combined in various ways to appropriately produce the requested color. And given the sophistication of these controllers nowadays, essentially any type of color can be created by RGB LED lights. This works because electronic circuits are used to control the diffusion and mixture of the colors. Given this high level of control and customization, RGB LEDs are commonly used as status indicators, accent lights, and for light shows and video displays. The uses and capabilities of these lights vary greater and can be used in many different applications.



Image 11 – RGB lights

3.3. Solar lighting

The principle of how solar lighting works is actually quite simple. The physical explanation behind why it is possible to collect the solar energy and transform it into lighting lies in the photovoltaic effect which is being used in a solar panel or photovoltaic cell that is able to collect the solar energy (i.e. the energy that is produced by the Sun) throughout the day-time. After being collected, the energy is usually stored in a rechargeable gel cell battery and used later in the evening when there is no sunlight to produce lighting.

Renewable energy has increasingly become the subject of discussions that seek to find causes and solutions to the rising environmental crisis and pollution. Indeed, there are no doubts that conventional, industrial production of energy is using up our exhaustible resources too rapidly. Hence this way is far from being sustainable and in not so distant future will cause many problems of a scale larger than the one we are facing currently. However the situation is not all that gray and hopeless as new inventions and technologies are developed by scientists who dedicate their effort to discover new more environmentally friendly alternatives.

In the past few decades, solar energy has been identified as one of the most effective of all the inexhaustible and renewable energy sources and many countries already are doing a great job in promoting households and companies to invest in solar panels. The energy collected by solar panels can be used for various purposes and one of them is to produce solar lighting. Basically, it is a lighting system that provides and stores its own energy from its own source.

3.3.1 How Solar lighting works?

When a photovoltaic (PV) cell is exposed to sunlight, voltage and electric current are created in the cell. This process is based on the photoelectric effect in which light is absorbed and excites an electron to a higher energy level. The main difference between the so called photoelectric effect and photovoltaic effect is that in the first case, the excited electron is bounced out of the material while in the second process it is still contained inside the material.

However, in both cases, an electric potential is produced related to separation of charge carriers. Hence, to prevail the created potential barrier, the incident light should have enough energy. The figure below shows the both photoelectric effect and photovoltaic process schematically.

3.3.2. Benefits of Solar light

Environmentally friendly: Using solar lights plays a major role in reducing the global carbon footprint that is a problem nowadays—created from non-renewable energy sources. Solar LED lights utilize a technology that is renewable which decreases the problems caused by the exhaustion of our planet's resources.

Unlimited energy: Whether you use yours as solar yard lights or one solar lamp in the middle of your living room, another great thing for going solar is the fact that it is an unlimited source and inexhaustible by itself. As long as you live in a place where there is sunlight, there is absolutely no reason why you can't use solar lights the entire time and produce energy out of them.

Cost-effectiveness: The biggest advantage of solar lighting is its cost. Even though they usually include a higher upfront cost, the best solar lights pay for themselves over time—best seen through the fact that they don't use any electricity but the sunlight.

Little maintenance: Easy to be maintained, the solar light products only require a few check-ups and cleaning throughout the year. There is literally nothing else much that you have to do to ensure their longevity.

Wide variety of styles: There are numerous styles, shapes, sizes, and types of solar lighting. All of them were designed to be aesthetically and visually pleasing. The entire range of solar motion light is great and there are literally tons of products that can fit your style and needs.

3.3.3. Types of Solar light

Solar lighting can be installed in different areas. From homes to parking lots, sensitive areas and remote locations where no grid infrastructure exists, it removes the costs of trenching and wiring which is why it is considered as the cheapest solution in numerous cases. The two main types of solar lights are:

Outdoor solar lights Indoor solar lights

a. Outdoor solar lights -

The outdoor solar light market is very popular nowadays. These products can be very useful when it comes to anything from lighting garden paths during the night or decoration for the home, backyard or terrace.

As many of you already know, solar LED lights charge up when the sun is shining. Therefore, the outdoor lights receive a lot of sun energy, storing it for later use and resulting in brighter lights. When they are fully charged, some solar lights can last up to 10 hours.

Aside from their cost-effectiveness, using these solar outside lights gives you the freedom of choosing where you want to place your lights. There are no wires at all, which means that you can place as many solar powered outdoor lights as you want.

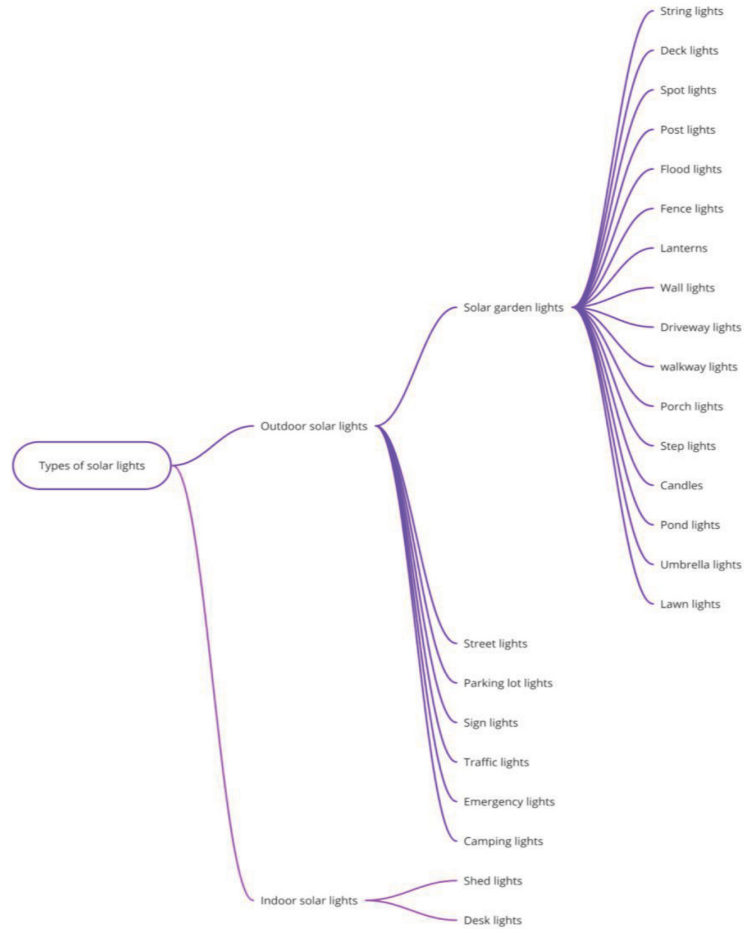


Image 12 – types of solar lights

1. Solar string lights -

Solar string lights are energy-efficient and help with any decorative attempts. They can illuminate the outdoor space at home or work, and can also be used indoors. They are easily wrappable around trees which gives them an extra benefit. You can also position them in branches, shrubbery, furniture, and home and office signs.



Image 13 – Solar string lights

2. Solar deck lights -

Also known as solar patio lights, these solar LED lights come in a variety of styles and choices. They give the perfect ambiance to stairs, walls, siding and patios, creating a rich and vibrant effect.

There are lots of solar-powered deck lights from popular manufacturers—allowing homeowners to gain a gorgeous and soft glow without any wiring. Knowing that wires do not look good on stairs and walls, this type of lighting is the perfect type of fixtures for long-lasting solar LED technology.



Image 14 –deck lights

3. Solar spot lights -

In times when the popularity of the solar industry is at its peak, new advancements have brought solar spot lights to life. They are perfect for placing on any walls or high areas (spots) which is how they got their name.

Designed to illuminate larger outdoor areas, these types of solar LED lights use solar energy and can be placed on any corner, above the doors and every focal point of the outdoor area. To make sure that you are getting the brightest solar spot lights, consider the lumens measure as the main indicator for the strength of the lights.



Image 15 –Spot lights

4. Solar Post lights -

According to many design experts, solar post lights come in a variety of styles. As you probably know, post lighting can truly make the difference for safety—and lighten your garden in style. Also, this type of solar-powered lights is known for creating a more relaxing and useful atmosphere for entertaining.

Apart from serving as decoration, solar post lights are the most environmentally friendly way to light up your pathway, driveway and garden. They are known for providing beautiful effects and a relaxing vibe to any outdoor environment.



Image 16 –post lights

5. Solar flood lights -

Outdoor solar spot lights known as flood lights are perfect for illuminating certain areas and floods. This is obviously the most important aspect because based on that area you need to choose the right LED flood light type, level of brightness as well as the durability of light. There are lots of places that can be illuminated with a flood light and many manufacturers are trying to make LED solar spot lights suitable to different situations and areas.



Image 17 –flood lights

6. Solar fence lights -

Solar-powered lighting finds another great use in the solar fence lights. Their name obviously comes from the fact that they are used on the fence. Also known as garden fence solar lights, these create a wonderful atmosphere which is visible from both inside and outside of the backyard.



Image 18 –Fence lights

7. Solar lanterns -

Solar lanterns are a popular type of solar lights. There are in fact many different sub-categories of this type including hanging solar lights, solar garden lanterns, etc. A solar LED lantern can be great not only for use in the home but for camping activities as well. In times when camping equipment needs an update, outdoor solar lanterns are the perfect answer.



Image 19 –lanterns lights

8. Solar wall lights -

Besides being a green option, solar wall lights equal free electricity which is why they are great for the outdoor areas. A solar wall light is not only an important piece of equipment for your outdoor use—it can also be invaluable in emergency situations.



Image 20 –wall lights

9. Solar driveway lights -

The driveway is often a place where lights are needed—but homeowners don't actually care for putting ones around it. This is mostly because of the fact that standard lights need wires or batteries and can be an additional cost in the electricity bill.



Image 21 –driveway lights

10. Solar walkway lights -

Also known as solar path lights, these can create the perfect ambiance for your guests and yourself, illuminating your walkway and making sure that your outdoor area is not dark or scary. They are cost-efficient, easy to install and attractive—but also shockingly bright when compared to traditional wired options.



Image 22 –walkway lights

11. Solar Porch lights -

A solar-powered porch light can come in many shapes and forms. Aside from modern solar lights, these cheap solar lights can come in a vintage form. You can illuminate your porch using solar power and save energy and cost. Affordable and reliable, these porch lights are an inexpensive way to provide bright illumination.



Image 23 –porch lights

12. Solar Step lights -

Slim and featuring the very best of solar LED technology, the solar step lights are a stylish addition to the home. They add a sufficient amount of lighting and are very modern, which is why they are a popular choice for many homeowners. Also, they are easy to install and eco-friendly, coming with a built-in solar panel.



Image 24 –step lights

13. Solar candles -

Outdoor solar candles can be the best replacement to the traditional flame lights. While candles are romantic and nice, they can tip and cause a disaster, spill hot wax or tempt a tiny child to injure themselves. This is why flameless solar candles are seen as their perfect alternative.



Image 25 –candle lights

14. Solar pond lights -

With no AC or DC power needed at all, solar pond lights and solar pool lights bring a new revolution in lighting. Charged by sunlight, they will continuously light up during the night and submerge the garden and pool in beautiful colors.



Image 26 –pond lights

15. Solar umbrella lights -

The concept of solar umbrella lights is a revolutionary one because of the actual placement of the lights. Embedded into the umbrella, these LED lights are positioned well and allow you to use the umbrella not only for shade during the day—but also for illumination during the night.



Image 27 – umbrella lights

16. Solar lawn lights -

There are a lot of types of solar lawn lights out there on the market. These include solar LED lights being used in different parts of the lawn. For example, there are solar flower lights, angel solar lights, solar mushroom lights, solar ball lights and many other options



Image 28 –lawn lights

17. Solar street lights -

Solar-powered street lights are usually independent of the utility grid, which can make them affordable and completely wireless. Without any connection to an electricity provider, an all-in-one solar street light can be the perfect way to save on electricity and be used by neighborhoods, communities, and cities.



Image 29 –street lights

18. Solar parking lot lights -

Solar LED parking lot lighting is one of the most efficient ways to provide lighting to parking areas without the need for standard electricity and utility power. The solar parking lot lights are products of a system which provides no electric bills for the lifetime of the system. Installed in many businesses and industrial facilities, the solar LED parking lot lights provide security, sustainability and an eco-friendly image for the business.



Image 30 – parking lot lights

19. Solar sign lights -

Solar sign lights may have not crossed your mind, but are a useful addition to any illuminated sign and something that is used all around the world. They can come in the form of solar-powered street signs, solar-powered traffic signs or signs which advertise a specific business.



Image 31 –sign lights

20. Solar traffic lights -

Solar-powered traffic lights are a new revolution in traffic signaling. Powered by solar panels which are positioned in road intersections, they are efficient and automatically control the flow of traffic without actual electricity being used.



Image 32 –traffic lights

21. Solar emergency lights -

Solar emergency lights are perfect for emergency cases which result in power outages. They are bright, have the power to illuminate different areas and often come with an in-built power bank that charges your devices. This makes them an additional source of electricity too and gives them use in outdoor situations.



Image 33– emergency lights

22. Solar camping lights -

The concept of a solar camping lantern has been embraced by many campers and outdoor enthusiasts all over the world. The ideal features you should consider when searching for the best solar-powered camping lights include brightness, long-lasting, quick charging and mobile charging features too.



Image 34 –camping lights

b. Indoor solar lights -

Just like the outdoor models we have reviewed above, indoor solar lights also come in many different types and offer different features. The general rule to know when it comes to these solar LED lights is that they can be only used indoors and are typically connected to solar panels which are located on the top of the building.

Perfect for use as alternate power sources but also main power sources, these solar lights offer a lot of fruitful benefits. Below are the two main types of indoor solar lights.

Solar shed lights -

Solar lighting for sheds is something every homeowner should consider. You can position the solar shed lights in any location you want, making sure that there are enough LEDs, lumens and lux to illuminate your shed.

Solar desk lamps -

Solar energy can even be used on your desk—in the form of solar desk lamps which are completely flexible and remote accessories that you can bring everywhere with you. Because of its “no-cords” design, you can use a solar desk lamp on your desk, in your bed, in the kitchen at night or wherever you need it.



Image 35 – Indoor solar lights

3.3.4. Role of architecture in sustainable lighting

1. Orientation

South facing windows with appropriate overhangs provide indirect light in the summer, and both heat and light during the winter. East and west facing windows let in light during the morning and evening, but may cause glare and admit heat during the summer. North facing windows can also be used for daylighting, as they admit relatively even, glare-free light and almost no unwanted summer heat gain. The number, size and glass type of north facing windows should be carefully considered, however, as they do not contribute to passive solar heat gain in the winter, and lose more heat than insulated walls.

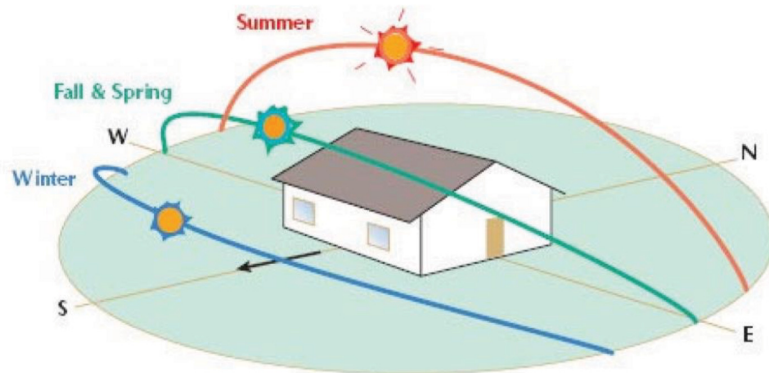


Image 36 – Orientation

2. Reflecting light

Reflecting light reduces glare and allows it to reach areas that would otherwise lack natural light. Simply painting interior walls and ceilings a light color can help provide reflected light. Light shelves are a good strategy for providing shade for south facing windows and reflecting light deep in to a space.

A light shelf is a horizontal light reflecting overhang placed above eye level with a transom window placed above it. External shelves are more effective at providing shading than interior shelves, but a combination of the two will work best to provide even lighting.

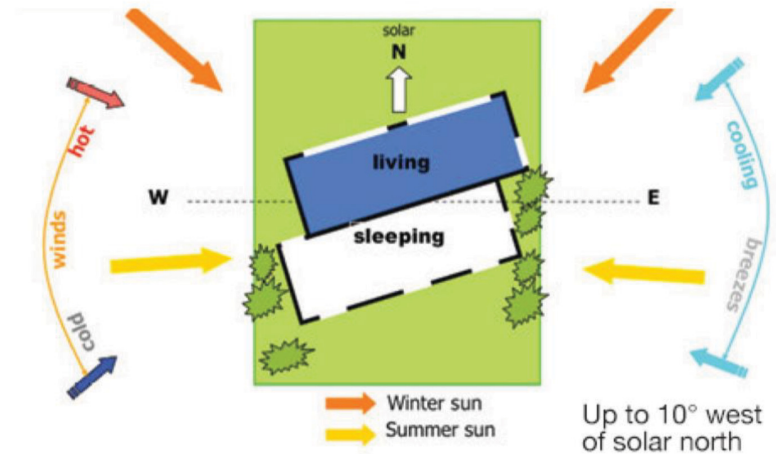


Image 37 – Reflecting light

3. Clerestory windows

Clerestory windows are vertical windows near the top of a wall. They bring light in high up in a room and illuminate the ceiling. The reflected light from the ceiling is a soft, indirect light and mimics sky lighting. They also allow light to penetrate deeper in to room than windows set at a standard height, especially when used in combination with adjacent light colored overhangs and light colored ceilings.

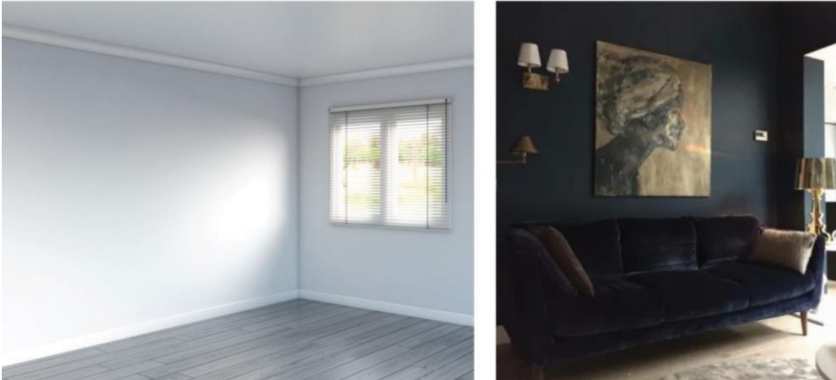
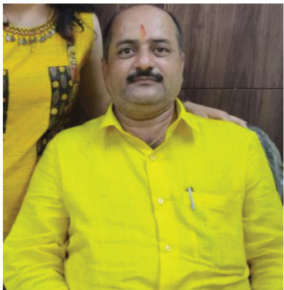


Image 38 – Clerestory windows

4. Initial Design Brief

Make a sustainable lighting for home use having sustainable light source and materials which has glimpse of Indian culture.

5. User study – User 1



Anand Laxman Burbure

Profession - Railway AC contractor

Age - 47 years

Family background - wife, 2 children,
father and mother

About him -

Anand sir is a Railway AC contractor by profession and has very reputed family as well as financial background. He recently bought a 4 room spacious bungalow as he has 6 family members including him.

He travels a lot due to his professional requirement so he insures safety of his family. He renewed his home and believes in sustainable lighting can reduce his expenses as well as maintenance.

Total expense for LED and solar lighting -

LED lights (all) - 2.5 Lacs

Solar light fitting - 7.7 Lacs

Monthly income -

12-15 Lacs

Monthly light bill -

2500-3000 /-

His thinking about sustainability -

He recently started installing solar panels for electricity and moving towards 100% sustainable home.

His home has 100% LED fittings.

Total LED fittings -

Panel lights - 70 qty

Decorative lights - 22 qty

Outdoor lights - 10 qty

5.1 Home visit and observation



Image 39 – Home visit 1



Entrance with LED Strips (on wooden door frame)

5.1.1 Outdoor Lights



LED wall light
Power -
type - decorative light
outdoor
Cost - 1200/-



Solar outdoor light
Power - 60 watt
type - outdoor
illumination light
Cost - 5000/-



Crystal electric LED
light
Power - 200 watt
type - outdoor
illumination light
Cost - 1700/-



LED wall light
Power - 3 watt
type - decorative light
outdoor
Cost - 700/-

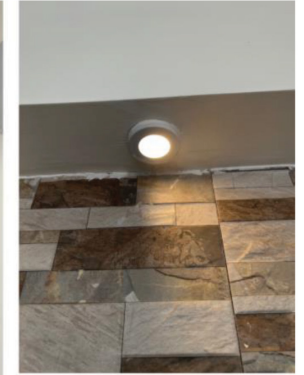


Solar outdoor light
Power - 60 watt
type - outdoor
illumination light
Cost - 5000/-

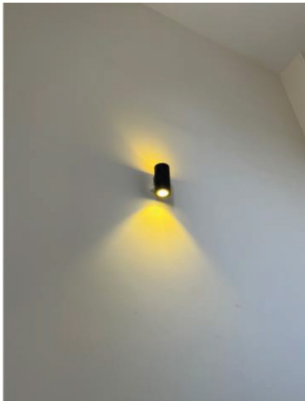
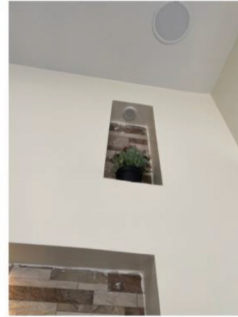


Changi LED light
Power - 6 watt
type - outdoor
illumination light
Cost - 1600/-

5.1.2 Indoor Lights



LED Biscuit light
Power -
type - decorative light outdoor
Cost - 1200/-



LED indoor light
Power -
type - decorative light
Cost - 3800/- each



Chandelier
Power -
type - decorative light
Cost - 7200/-

5.1.3 Role of Architecture



Large window (basically its clerestory window)

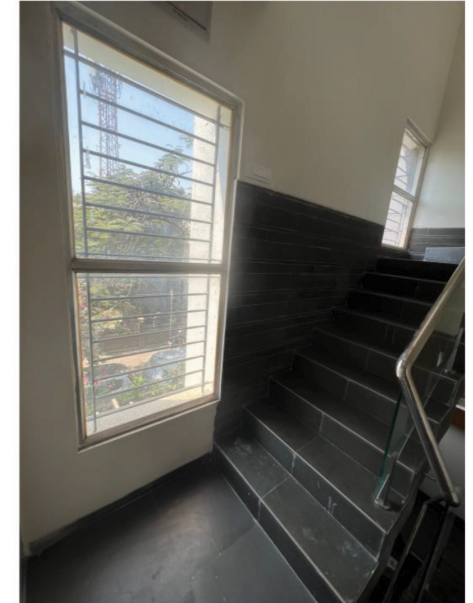


Image 40 – Role of architecture

5. User study – User 2



Moreshwar Shinde

Profession - Relation manager -
Suzuki

Age - 32 years

Family background - Retired gov.
employee father, mother, Brother
(advocate)

About him -

Moreshwar has 6 years of relation manager experience and build his home by taking bank loan in back 2009.

He has open wiring inside his house and he use LED tubes and bulbs.

HE thought LED has low maintaince and after knowing this since in 2016, he is using LED's.

His thinking about sustainability -

He doesn't afford POP ceiling so he never bought LED panel lighting but he is only using LED tubes and light bulbs.

Monthly income -

30K

Monthly light bill -

3000 - 4000 /-

Total expense for LED lighting -

LED lights (all) - 16 k

Total LED fittings -

Panel lights - 0

Decorative lights - 0

Outdoor lights - 1 qty

Indoor lights - 8 qty

5.1 Home visit and observation



Image 41 – Home visit user 2



His house has only 1 outdoor light

5.1.1 Indoor lights



LED wall light
Power -
type - Indoor light
Cost - 1200/-



Indoor light
Power - 60 watt
type - Indoor illumination
light
Cost - 680/-



LED wall light
Power -
type - decorative light
outdoor
Cost - 1200/-

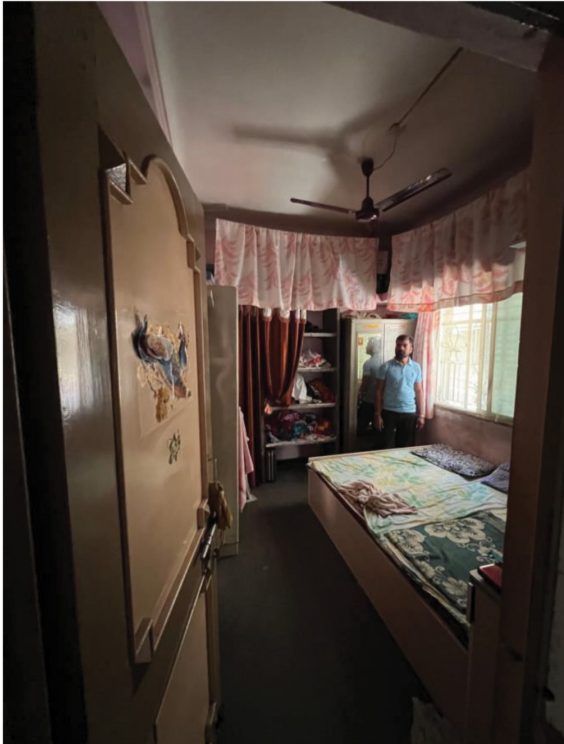


LED wall light
Power -
type - decorative light
Cost - 1200/-



Indoor light
Power - 60 watt
type - Indoor illumination
light
Cost - 680/-

5.1.2. Role of Architecture



Daytime with no light



Daytime with light

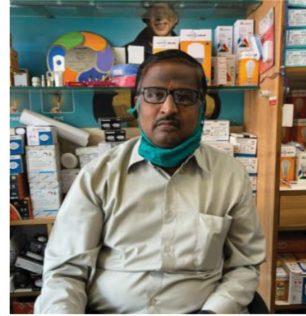
6. Findings from Persona

1. User requires low maintainance lights.
2. As 28% of Indians are middle class, they only afford lighting which fulfills their minimum requirements. they never bought decorative lighting except festivals.
3. To change light, it requires stool or chair and its not possible for senior people to climb and change the tube light,
4. Solar fitting is very expensive but one time investment.
5. LED's are harsh to eyes.



7. Visit to electric shop and Construction site

7.1. Electric shop owners persona



Mr. Anil Patil

Profession - Wholesalers

Age - 58 years

Family background - Retired father, sister and brother

Monthly sale -
30-40 Lacs

Solar fittings -
4.5-12.5 Lacs

About him -

Mr. Anil is in this business since last 32 years. Since he started business he saw very increased demand for LED's since last 10 years and recently the same demand he saw for the solar light fitting.

He said, nowadays, builders only provide ready to move houses for customers and they have preplanned positions for lighting. The most famous light for indoor is LED panel lights which requires POP ceiling.

His business model -

30% of his clients are B2C and 70% of his clients are B2B. He has active 40+ builder contracts for light fittings and out of 40, 12 are solar fittings.

His thinking about sustainability -

Mr. Anil believe sustainability and he said most of his customers buy LED's indoor lighting and out of which, 60% customers bought LED pannel lighting. Customers frequently ask him about solar lighting fittings.

7.1.1. LED Market trends



Panel LED's with ring
low cost

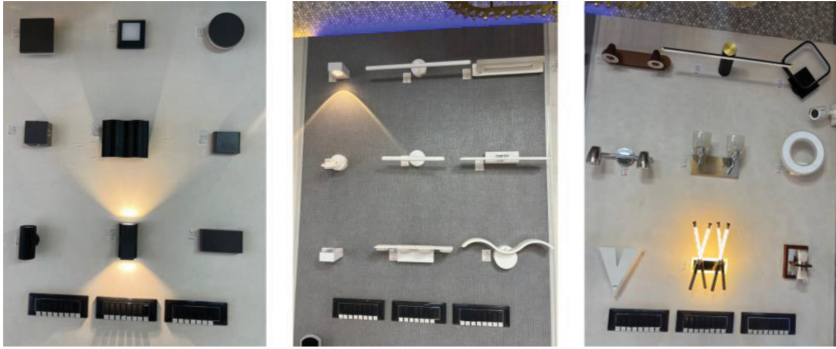


Panel LED's without outer
ring looks more clean
Slightly higher cost but
most of the customer buy
this

7.1.2. Decorative LED Lights



Image 42 – Decorative lights



Concealed wiring



It needs to cut the wall according to the wiring path to install fitting and then it will be covered using concrete.

7.2. Construction site visit and Persona



Project engineer - Mr. Amar Patil.
Experience - 11 year+

He did 13 building electrical fittings till date
and 2 solar light fittings.



Concealed wiring and joints.



Fixed positions for tube/LED's
(cannot be change after the
location of the light is finalized)

8. Findings from visits

1. For the new construction sites, the builder decides the fittings and position of the light. once its done, its very difficult to change.
2. Builder For panel LED light fittings which is currently most popular requires POP ceiling.
3. Electric shops mostly deal directly with builders for light fittings where they will get their 60% of profit margin.
4. 90% customers borrow LED lights and there is no maintaince for LED's.
5. after every 2 years, customer need to change chocks of LED's.
6. Current trend is for the concealed wiring fitting which is more precise and safe.



9. Solapur Spinning and weaving mill

I belong from Solapur, Maharashtra. Solapur is famous for “Solapuri Chadar and Towel business” and all looms are operated manually operated.

I got an Idea of “Can we make a shade from the leftover textile material from Solapur?” so I started doing research for scope keeping “Previous research” in mind.

9.1. About Solapur Spinning and Weaving mill

Solapur is known for its textile industry. Once it had Asia's largest spinning mills. The development of the handloom weaving industry in Solapur seems to have commenced during the regime of the Peshwas. There were numerous small independent artisan weavers in the industry. Each artisan-house had one or two looms which were generally handled by the head of the family. The family was the unit of work and the women and the children helped the weaver in preparatory processes and in some cases in dyeing also. The rise of the modern factory in India in the 1970s altered the organization of the local hand-loom weaving industry. They have been manufactured by Patuakhali weavers from South India since their presence in Solapur in the 1950s. Many companies manufacture chaddars in Solapur district.

The 'Solapur Spinning and Weaving Mill' was the first mill started in Solapur by **Gopaldas Murarka in 1877**. It was reputed to be the biggest mill in Asia at that time, having approximately 20,000 looms. Today it is known as the 'Juni' or 'Old Mill'.

Currently 2000 to 3000 are the active mills in Solapur both small scale and large scale.

9.2. Visit to Solapur Weaving mill



Mr. Vasudev Channa

He has more than 40 years of experience in this field and he is currently planning to automate the whole milling process.

There are 3 processes to create loom,

1. Winding
2. Wharfing
3. Loom



Video

9.2.1. Winding Process



Image 43 – winding process

The process starts with winding the loom according to the desired pattern of chadar and towel. The process is done manually by workers by selecting each shade of color and winding it around the 60 inch roller.

9.2.2 Wharfing Process



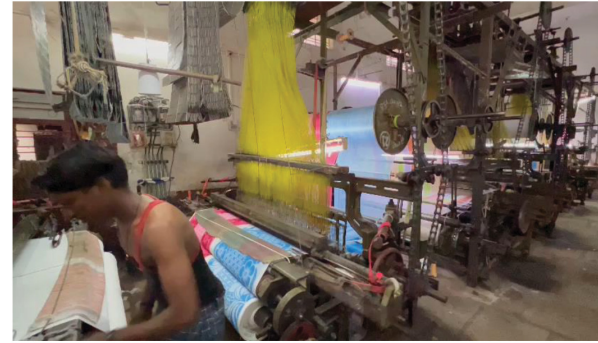
Video



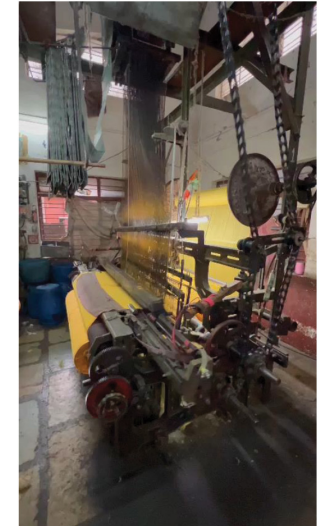
Video

There are 3 processes to create loom,
1. Winding
2. Wharfing
3. Loom

9.2.3. Loom



Video



Video

There are 3 processes to create loom,
1. Winding
2. Wharfing
3. Loom

9.3. Leftover/Waste materials



Image 44 – leftover textile threads



Video

Monthly 20 kg of cotton from 10 loom machines and 30 kg of loom strings wastage from the wharfing machine.

Wastage cost is around 14-15k per year.

10. Redefined Design Brief

Design a light for home and office area which creates ambient light as well as bright light by using sustainable materials like waste textile threads, glass and bamboo.

11. Recap

Sustainable lights - LED, HID & Solar lights

Materials - textile waste (in the context of Solapur)

General context - Glass and bamboo

11.1 Users



Luxurious home

Reviews-

LED's are harsh for eyes

Uses 2 different lights for ambient light and bright light



Middleclass home

Reviews-

Poor indoor natural light.

Need to switch on light on day.

11.2 Product Study

Mostly used lights from market study and user study	Market Costs	Most common price point where user can buy light
Table lights	120 rs - 10,000 rs	300 rs - 3000 rs
Wall lights	1200 rs - 4000 rs	1200 rs - 2700 rs
Hanging / Ceiling lights	1000 rs - 20,000 rs	1000 rs - 8000 rs

11.3 Product Brief

Light type - LED

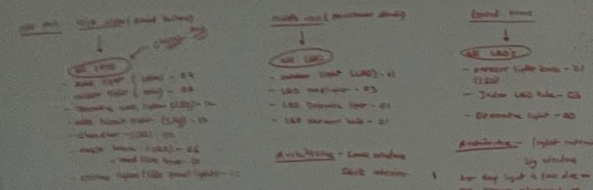
1. Table light
2. Wall light
3. Ceiling/hanging light

Material - Textile waste, Glass, Bamboo

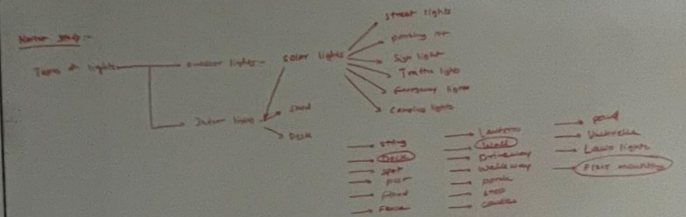
Upper class to middle class for home and office area.

Experimental types -

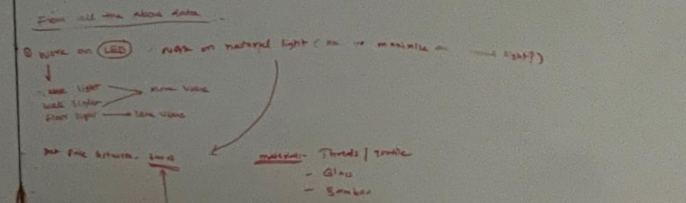
Light - LED, CFL, HID, Gas discharge
Material - Polycarbonate, acrylic, frosted glass, paper, etc. white, colored (color in design)
 material: aluminum, stainless steel, brass, copper



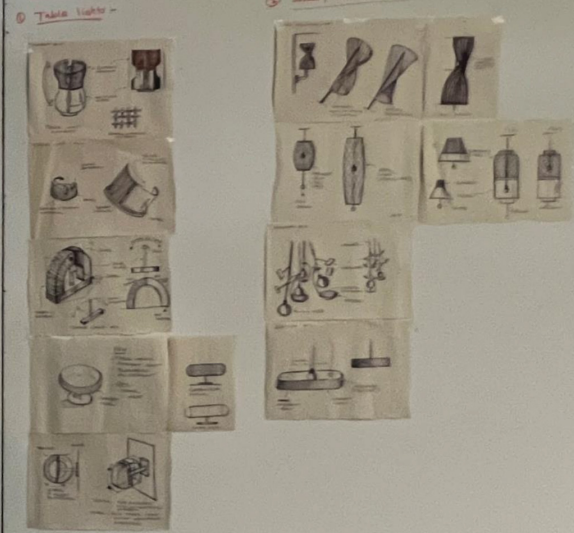
Material & construction
 - LED strip - 1000-2000 lux
 - LED spotlight - 100-200 lux
 - LED track light - 100-200 lux
 - LED pendant light - 100-200 lux



From all the above data
 - LED strip - 1000-2000 lux
 - LED spotlight - 100-200 lux
 - LED track light - 100-200 lux
 - LED pendant light - 100-200 lux

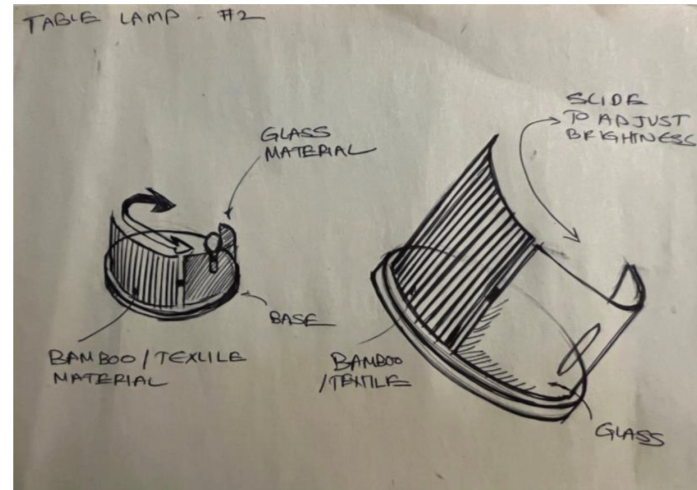


Types of lights

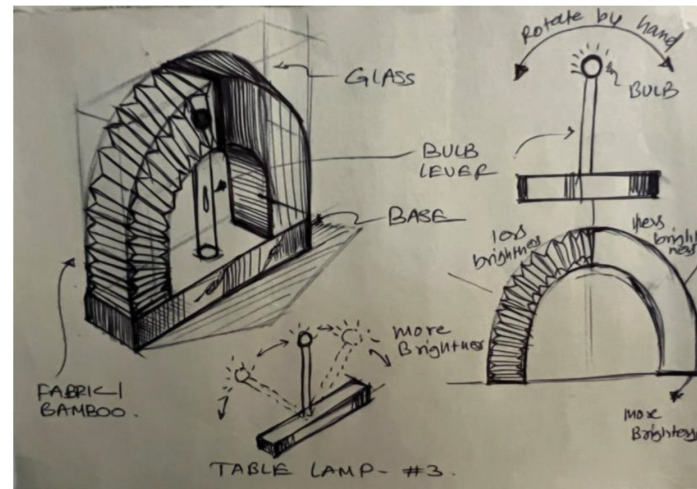


12. Design Ideations

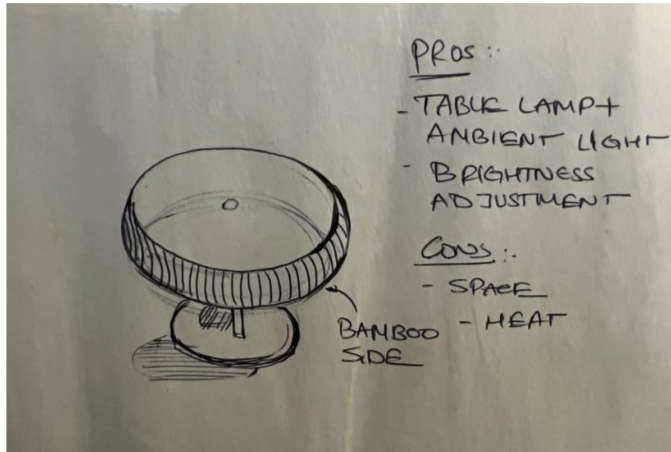
Ideation is a creative process where designers generate ideas in sessions (e.g., brainstorming, worst possible idea). It is the third stage in the Design Thinking process. Participants gather with open minds to produce as many ideas as they can to address a problem statement in a facilitated, judgment-free environment.



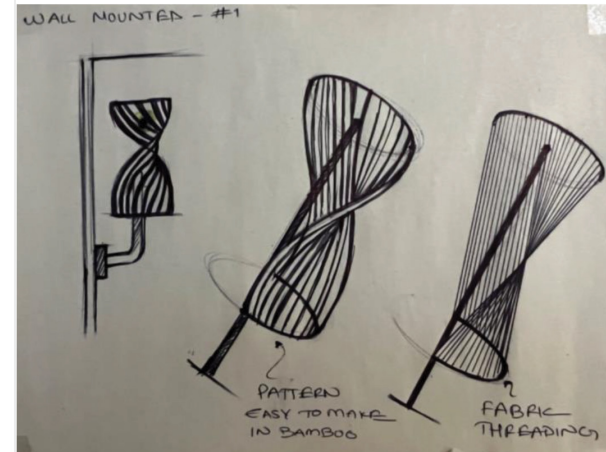
Ideation1



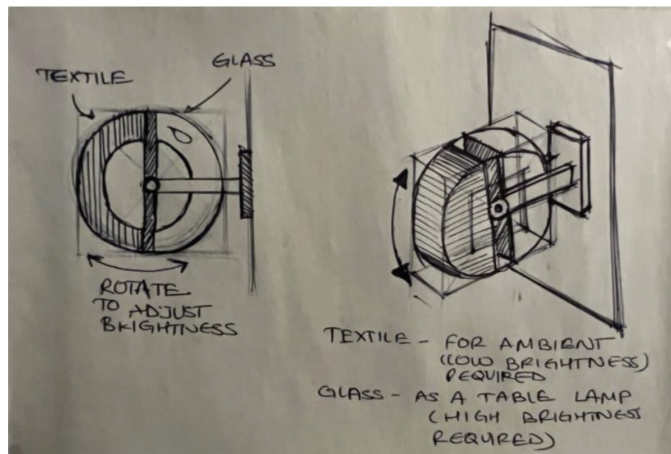
Ideation2



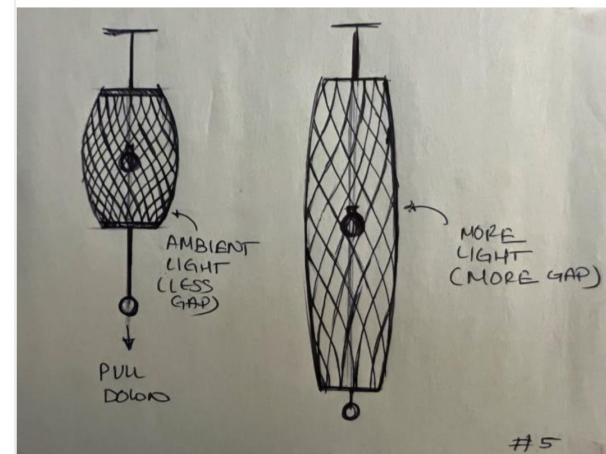
Ideation 3



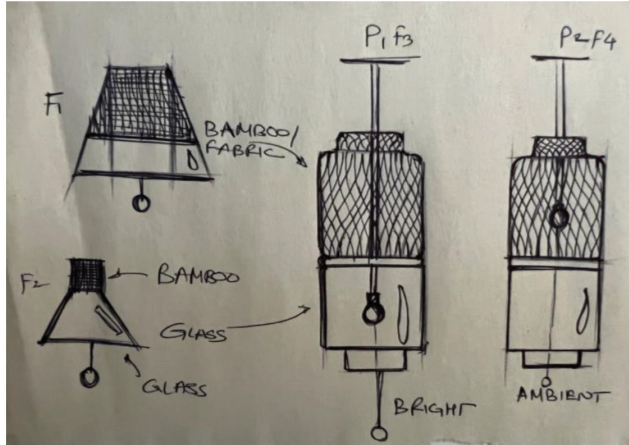
Ideation 5



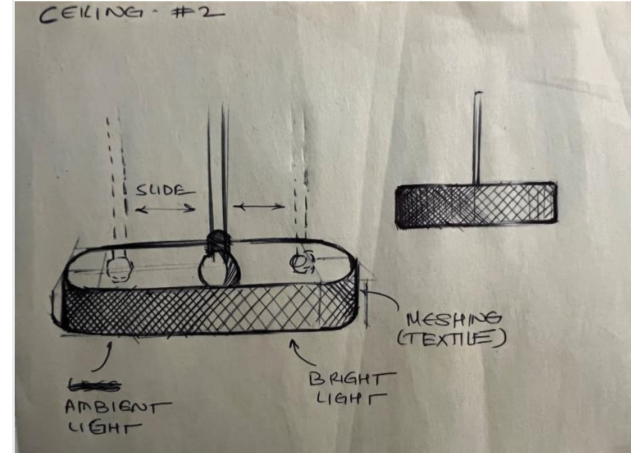
Ideation 4



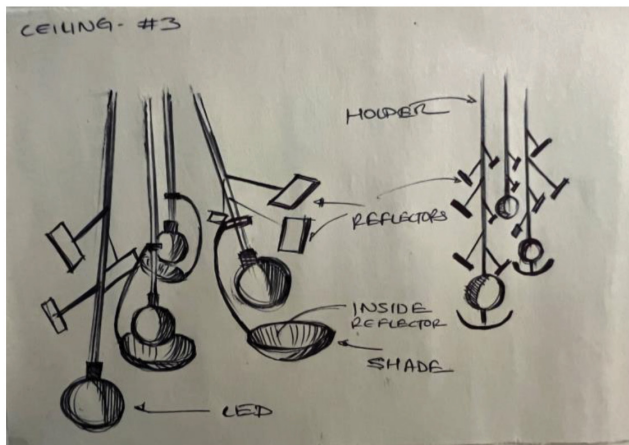
Ideation 6



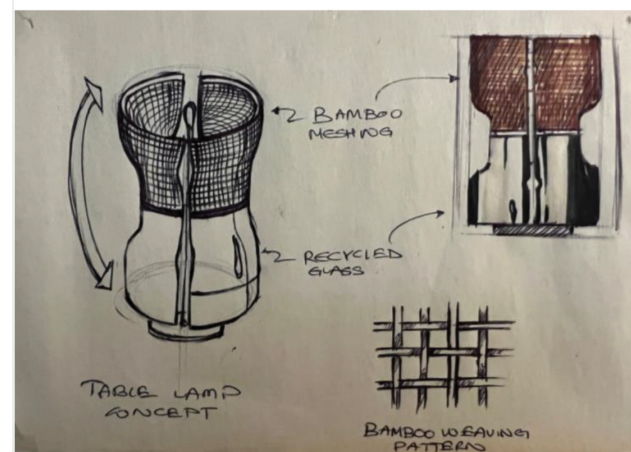
Ideation 7



Ideation 9



Ideation 8



Ideation 10

13. Three Design Directions

From the above ideations, I selected 3 design directions keeping in mind all the user research and their needs.

The following 3 design directions focused on to resolve the user painpoints,

1. Harsh LEDs
2. Novelty
3. Cheap in cost

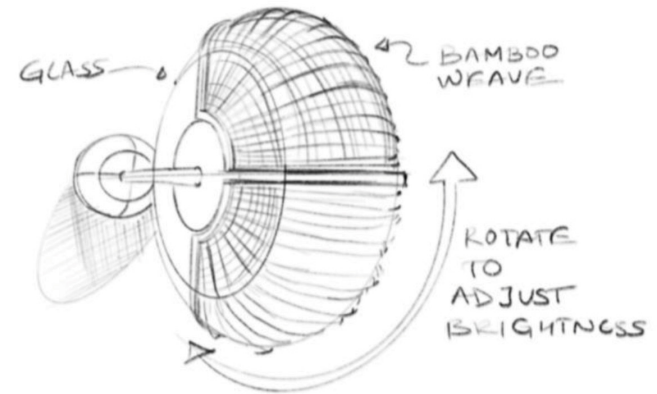
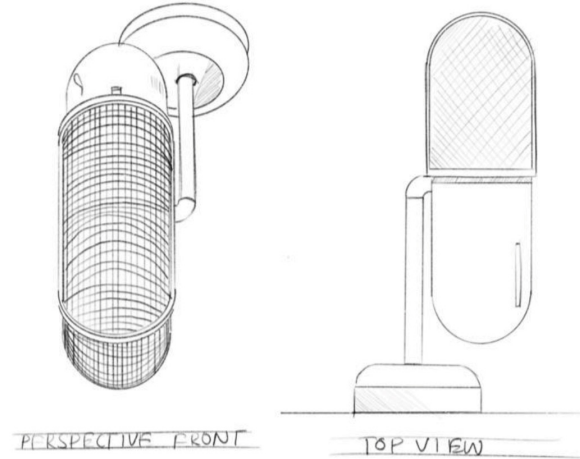
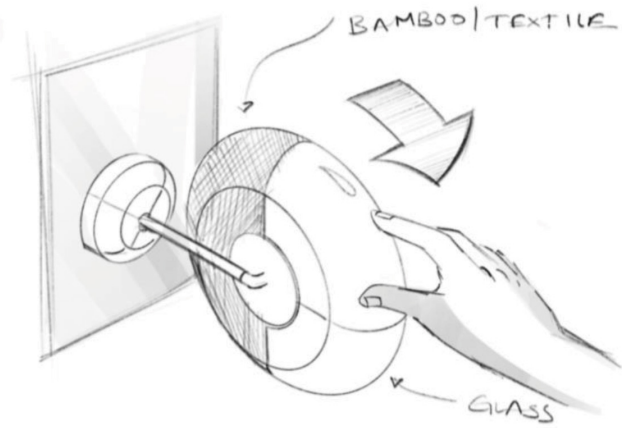
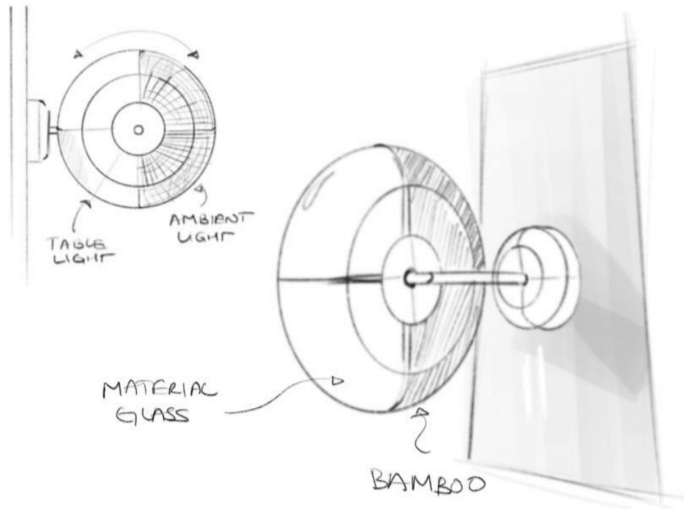
13.1 Design Direction 1

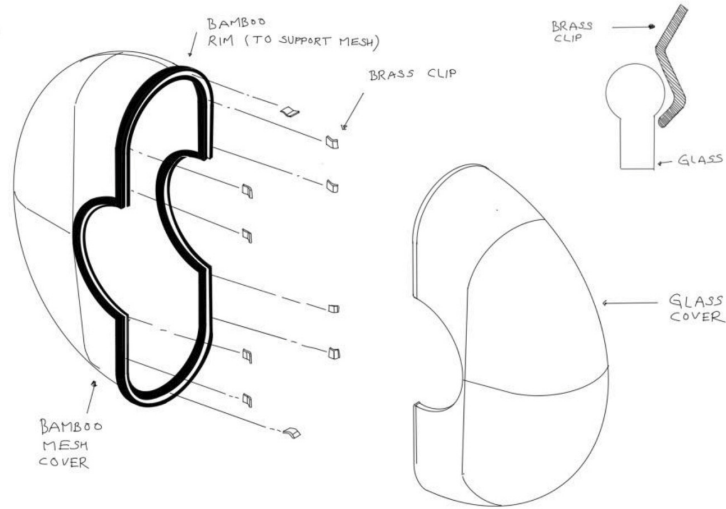


Image 45 – Moodboard

What is Moodboard?

Mood boards are physical or digital collages that arrange images, materials, text, and other design elements into a format that's representative of the final design's style. Mood boards can be used for creating brand designs, product designs, website designs, and pretty much any other type of design project.





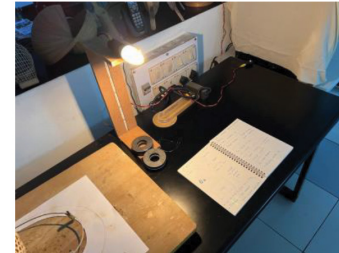
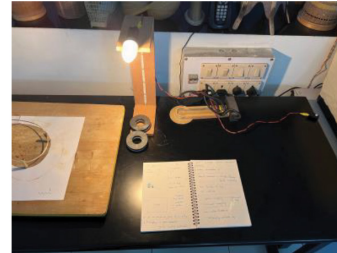
About the design direction 1

The above design direction is the design of the table lamp which is made from 2 different materials,

1. Bamboo
2. Recycled glass.

User can rotate the table lamp to adjust the brightness. To save the table space, This lamp can be mounted on the wall. Bamboo shade gives pleasant ambient light and glass shade gives enough light to read book or work on the table.





13.1.1 Digital Renders



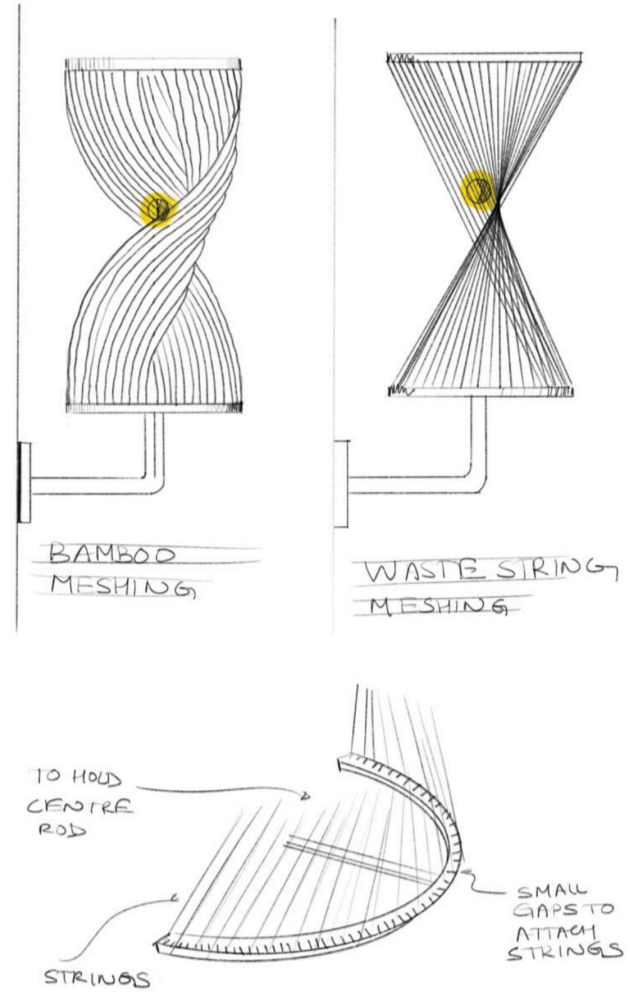
As I discussed above, the following renders shows how the proposed light will work under 2 different user needs. Ambient light and full bright light.

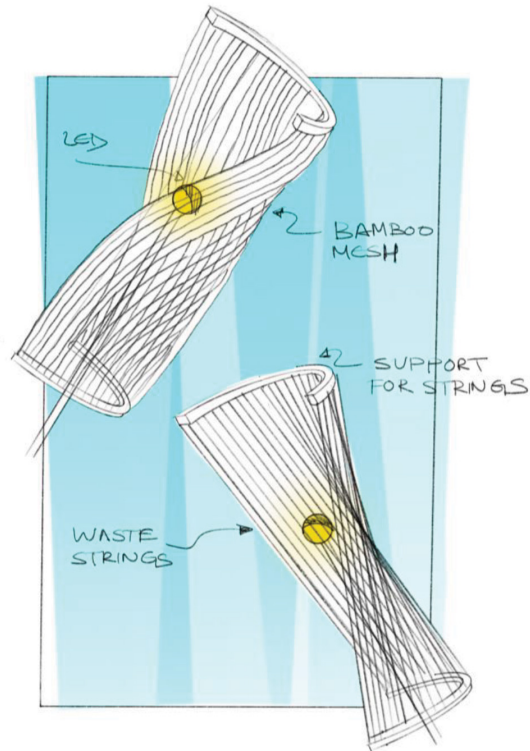


13.2 Design Direction 2

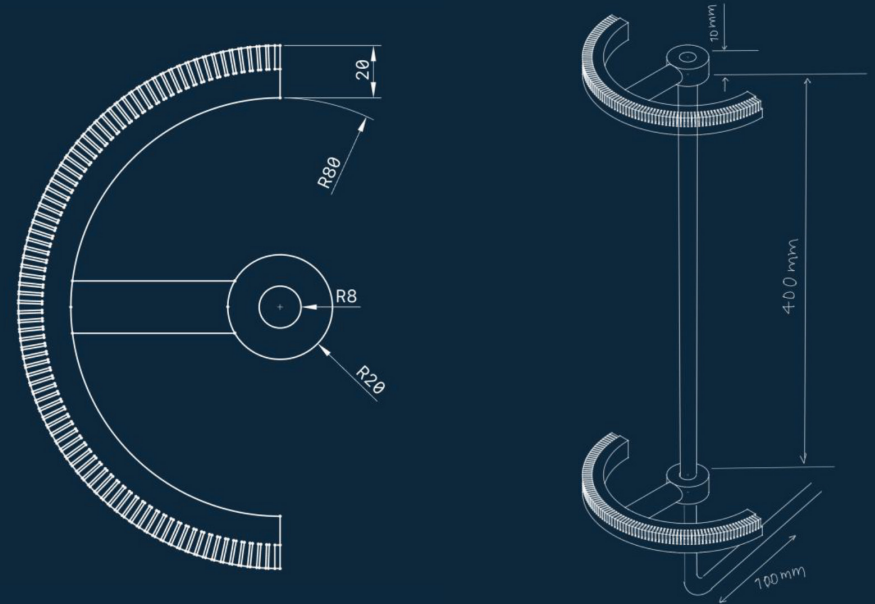


Image 46 – Moodboard

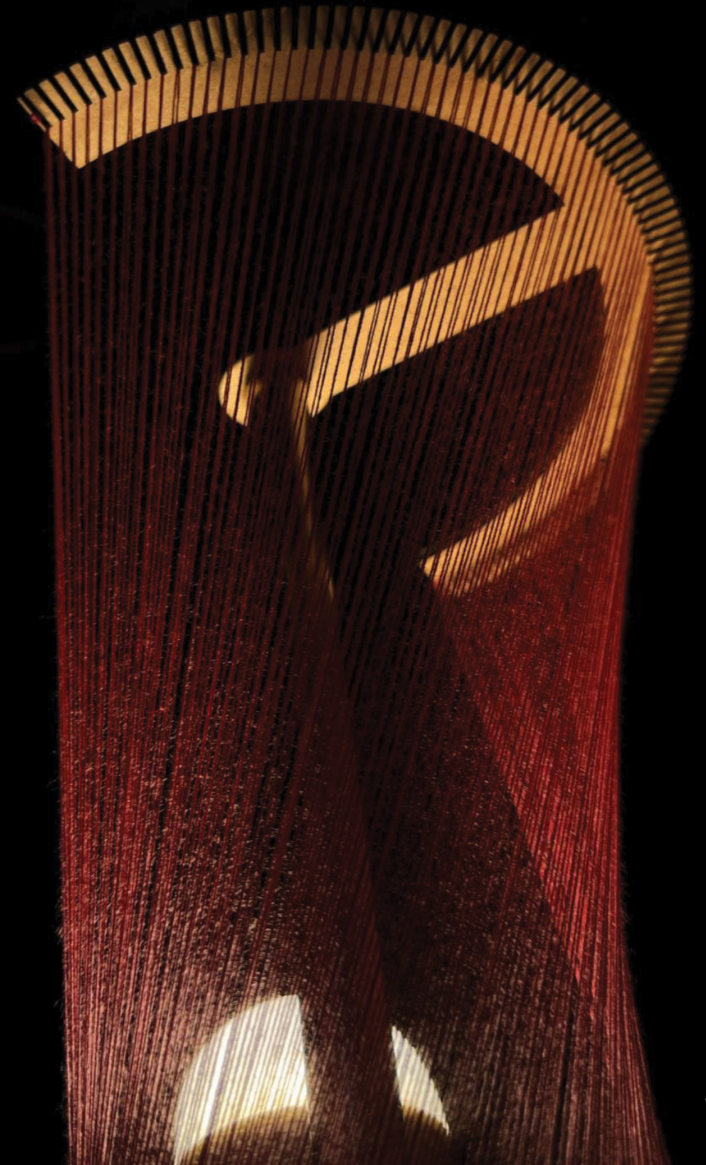


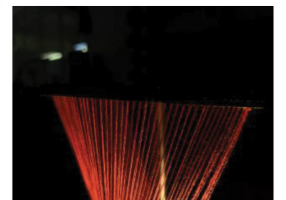
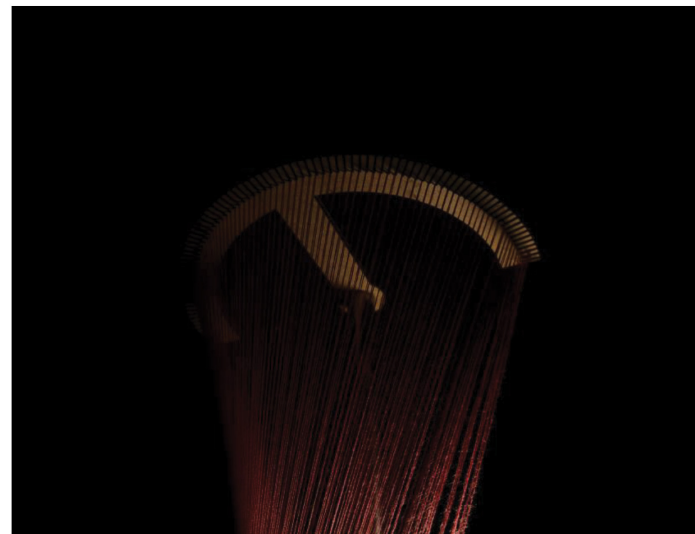
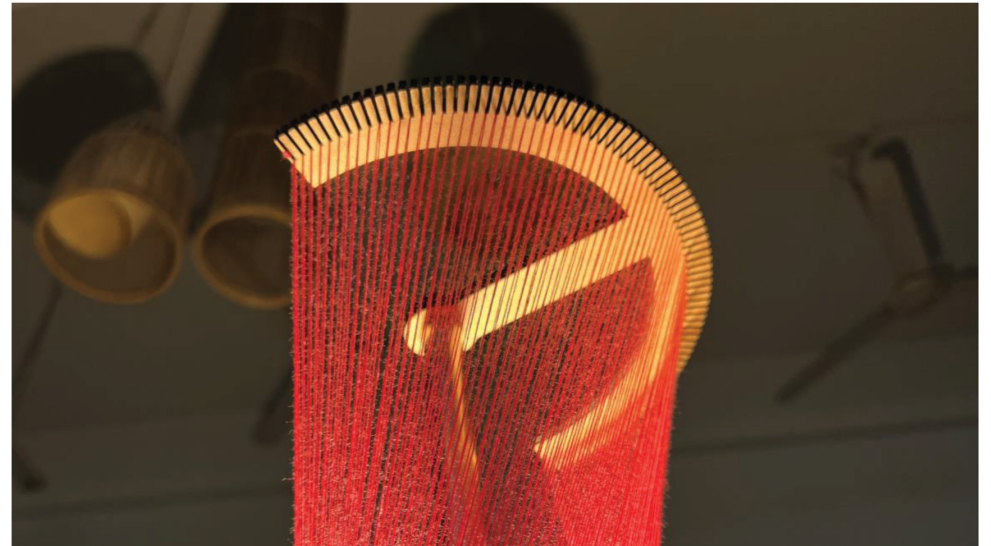
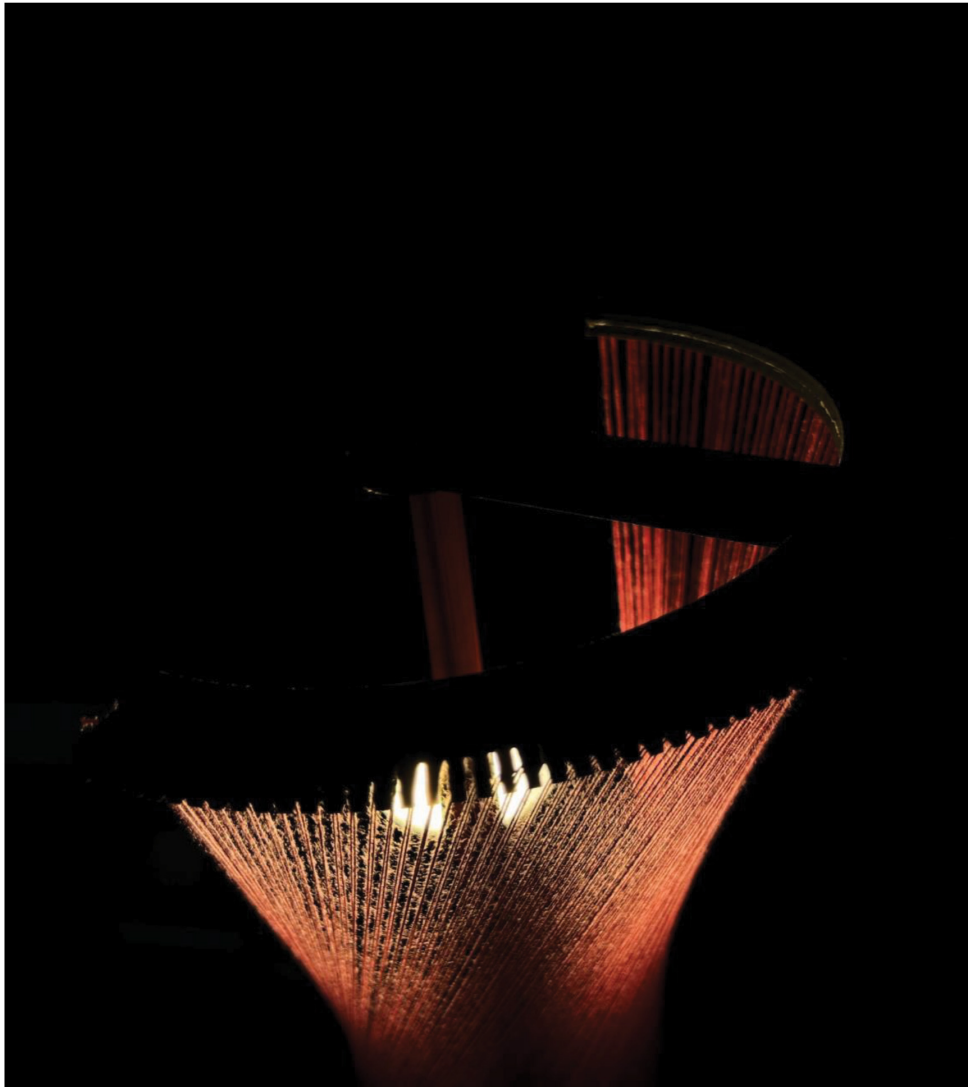


Keeping in mind the context of Solapur, the above light is a wall mounted ambient light, has light shade made from the leftover textile material which are threads and it will create ambient light.

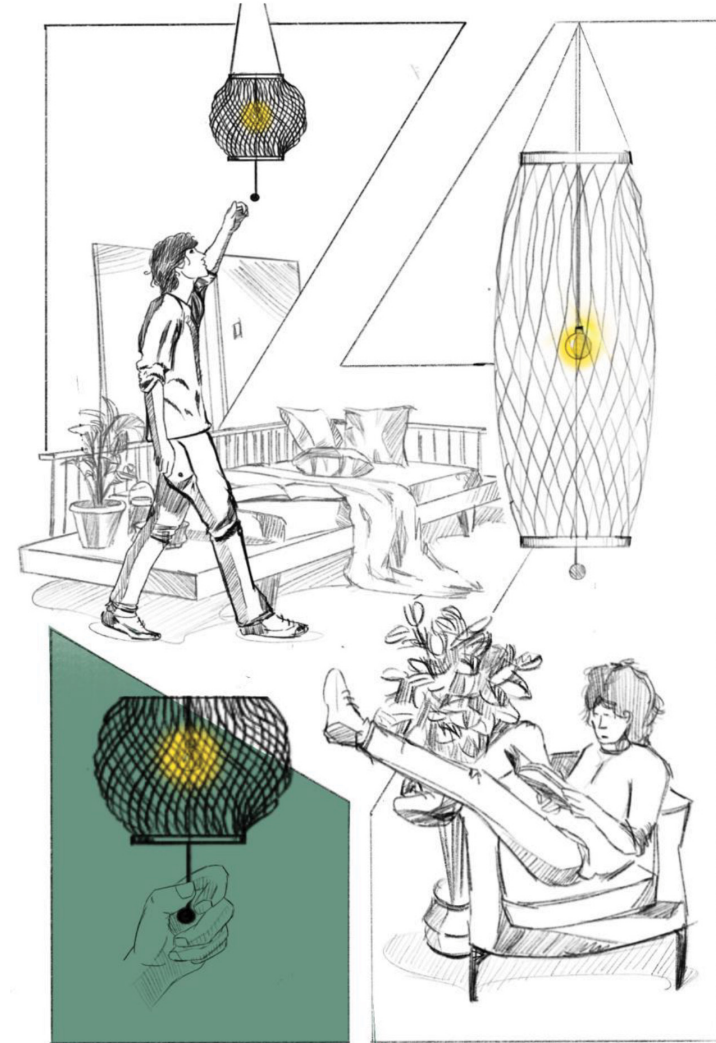
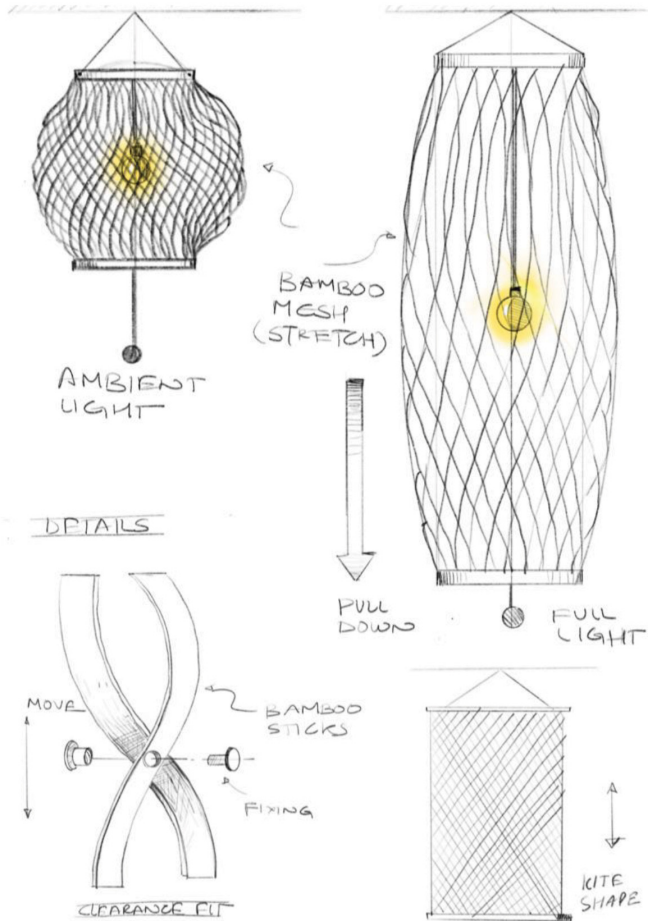








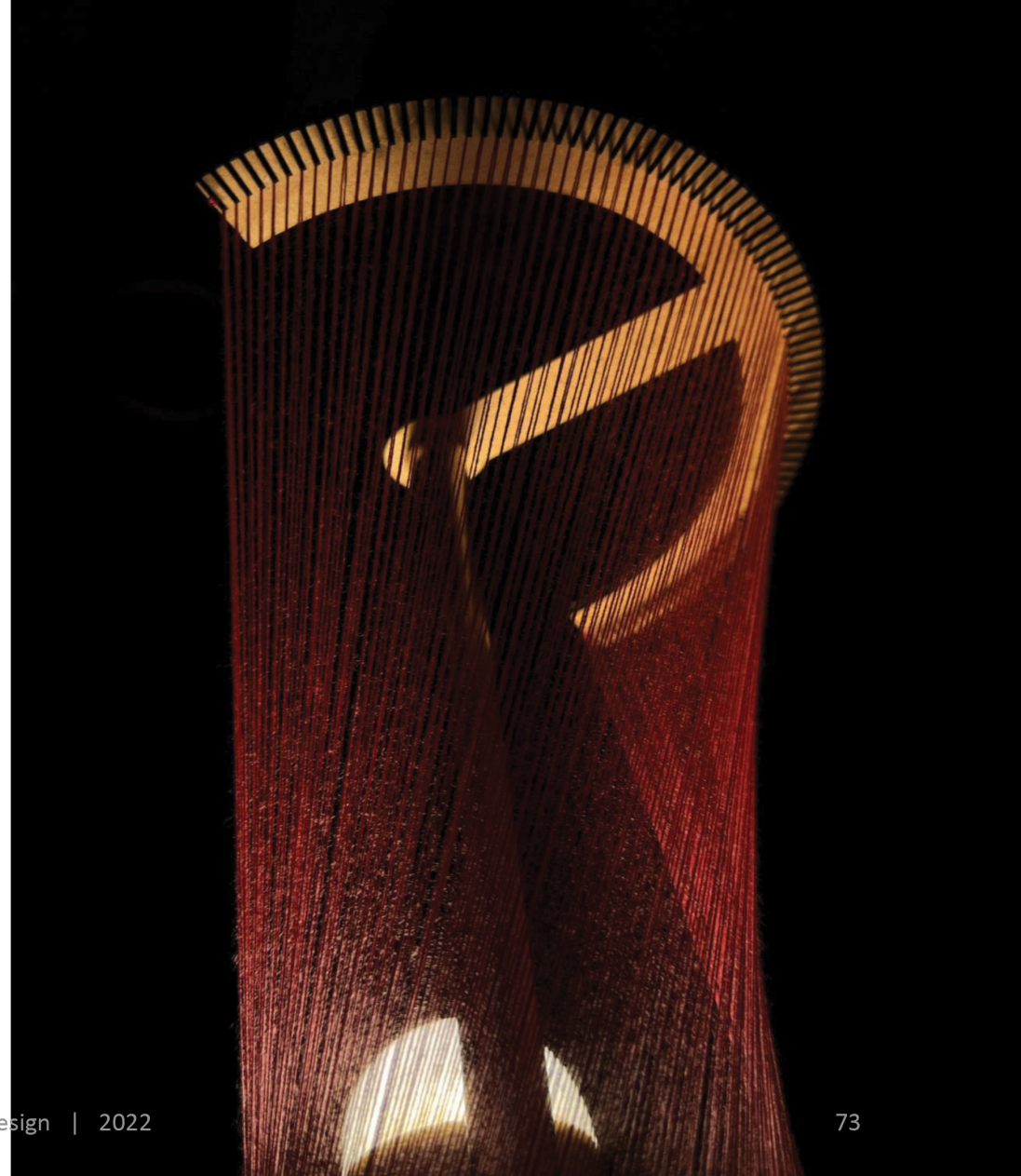
13.3 Design Direction 3



14. Selected Design Direction

Reviews on selected design direction –

Light source is exposed
Solapurness is missing
Thread pattern is unique in wall lamp

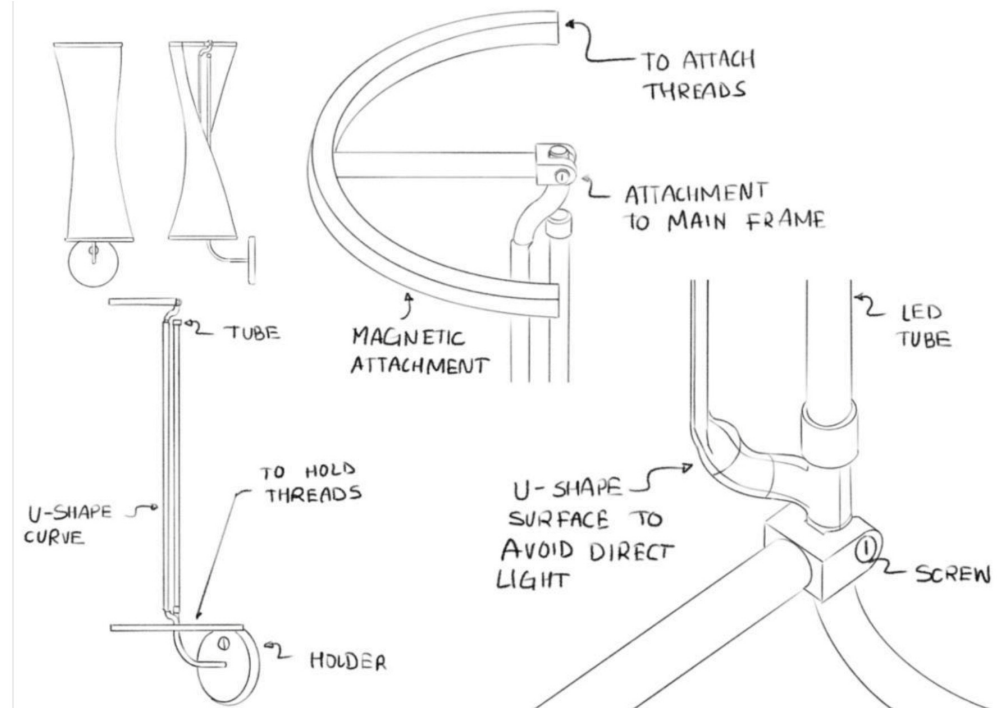


15. Final Design Brief

Design a wall light for home which creates ambient light using leftover textile materials.

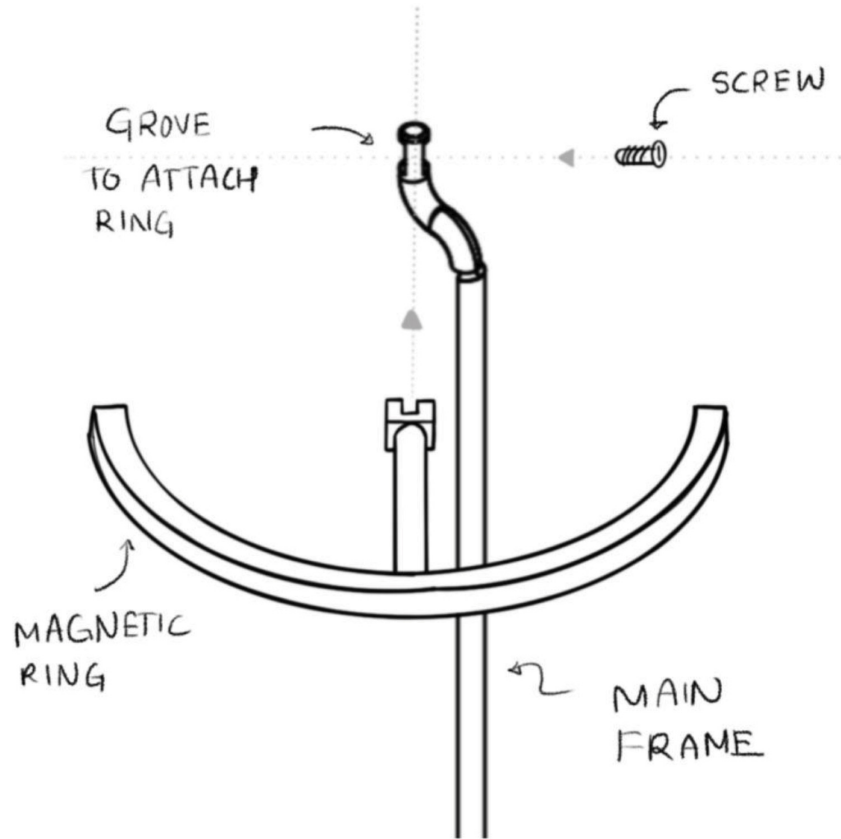
16. Main frame Design

Main frame is the part of wall light where all components of light like, LED tube, light shade and all other attachments will be mounted.

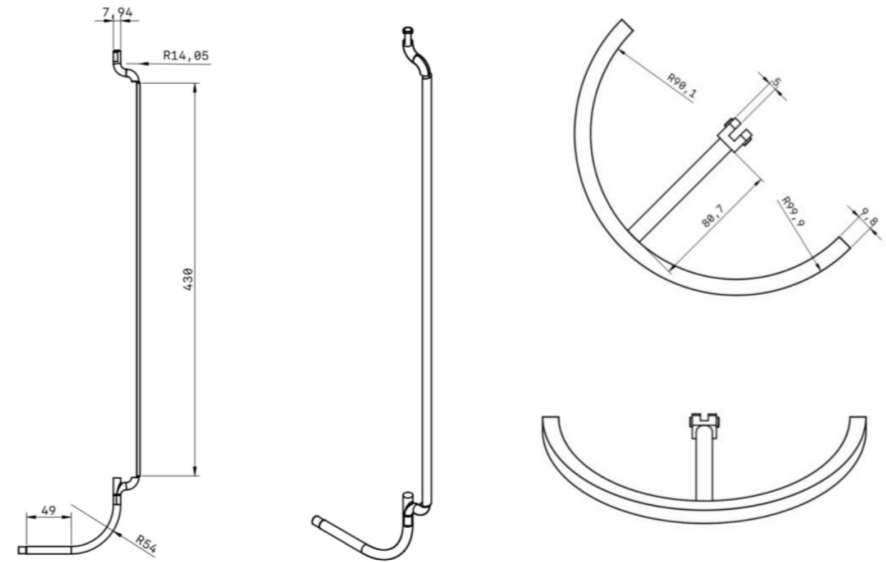


The above sketch shows how the mountings for the shade and light will assemble and their details.

16.1 Assembly Details

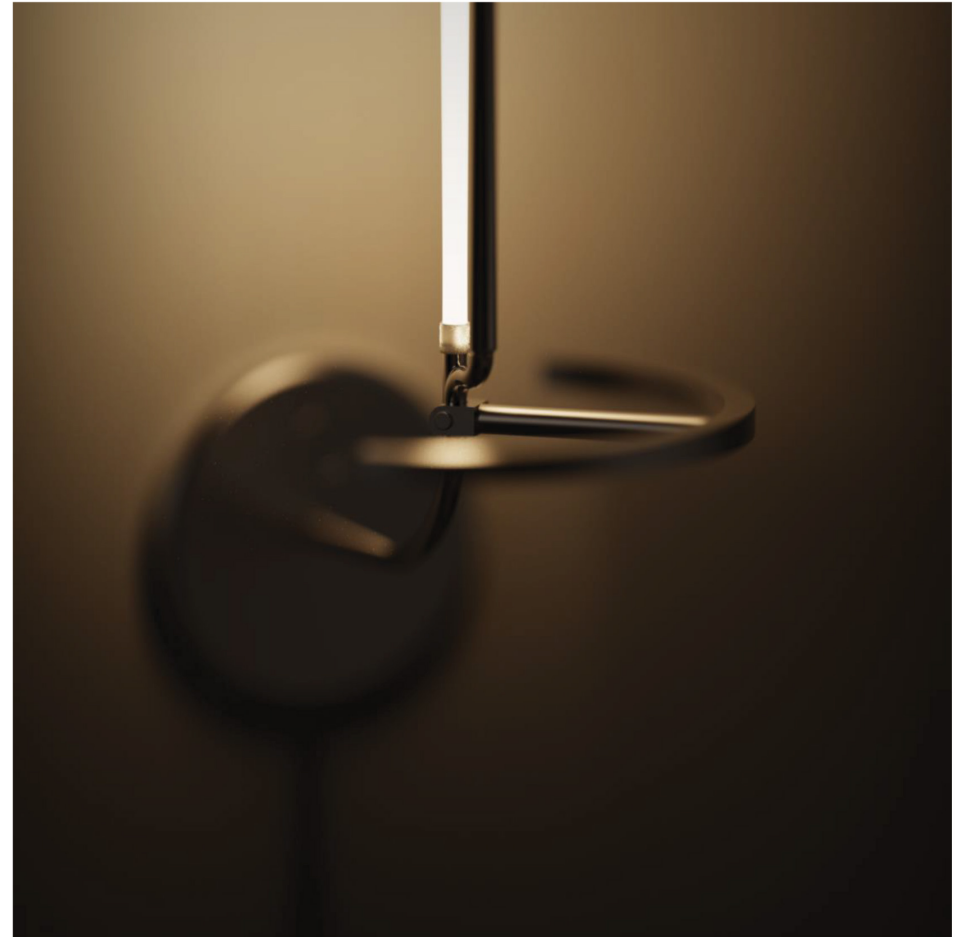
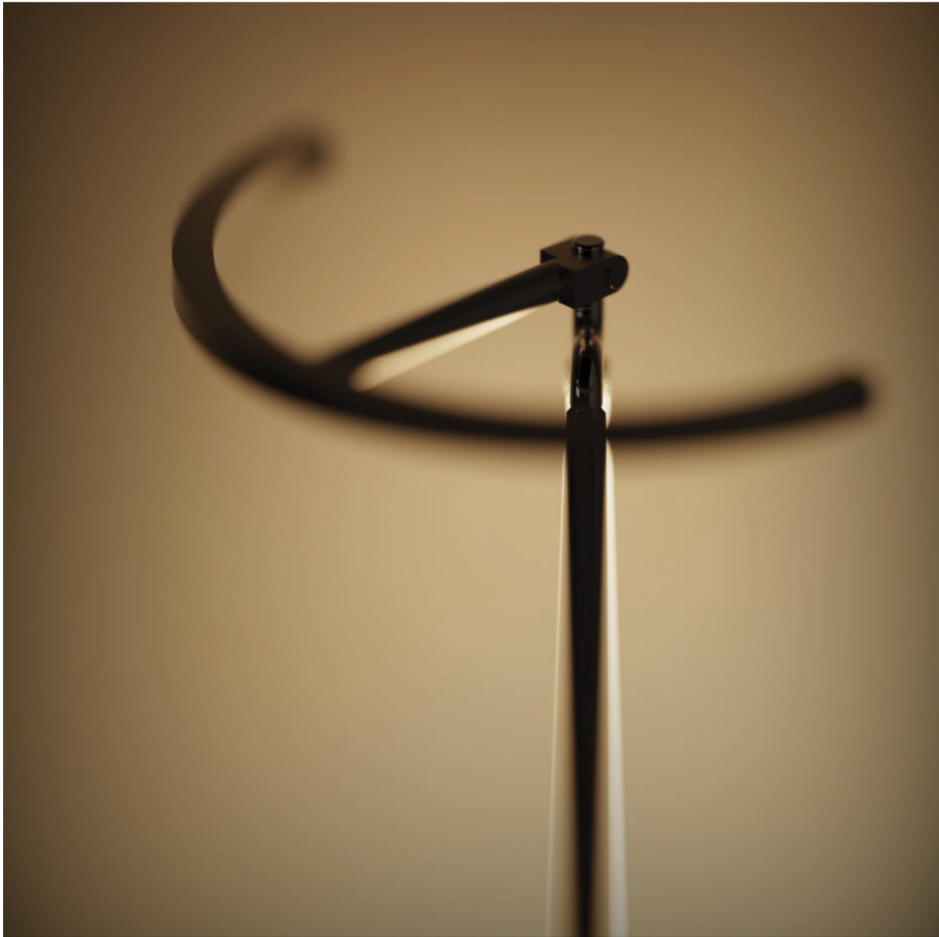


16.2 Detailed Drawing



The above detailed drawing has the mail frame product dimensions.

16.3 Digital Renders



16.4 Working rig details

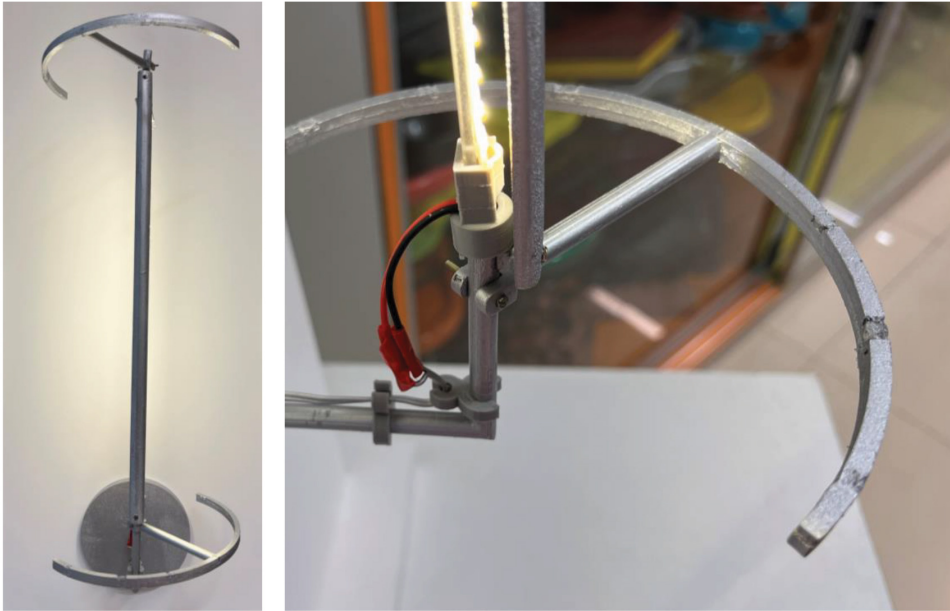


Image 47 – Working rig 1

The following working rig is made from bamboo and 3D printed parts.

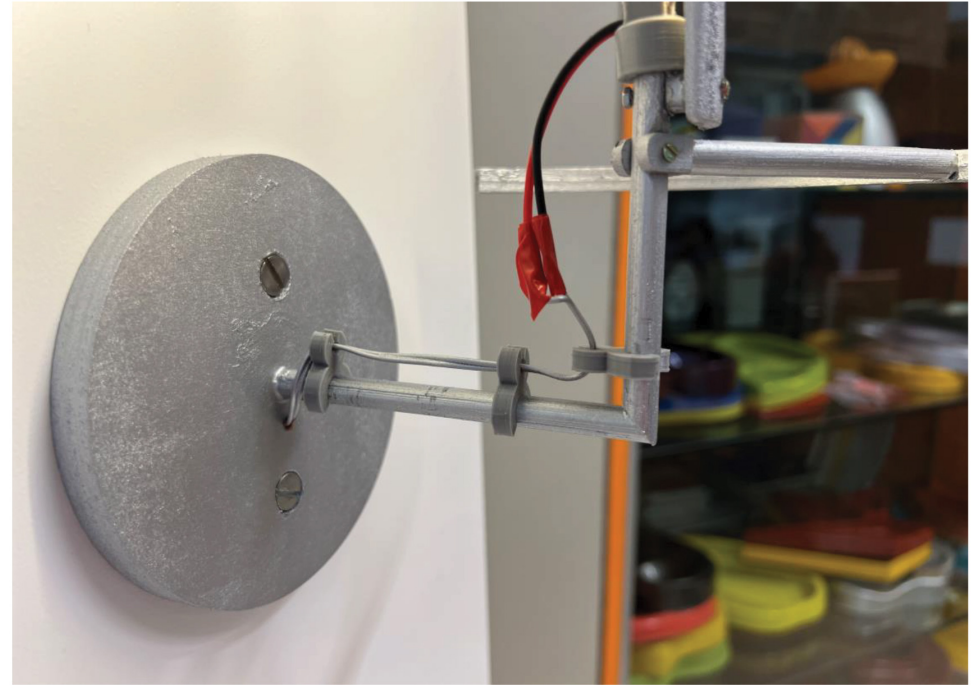
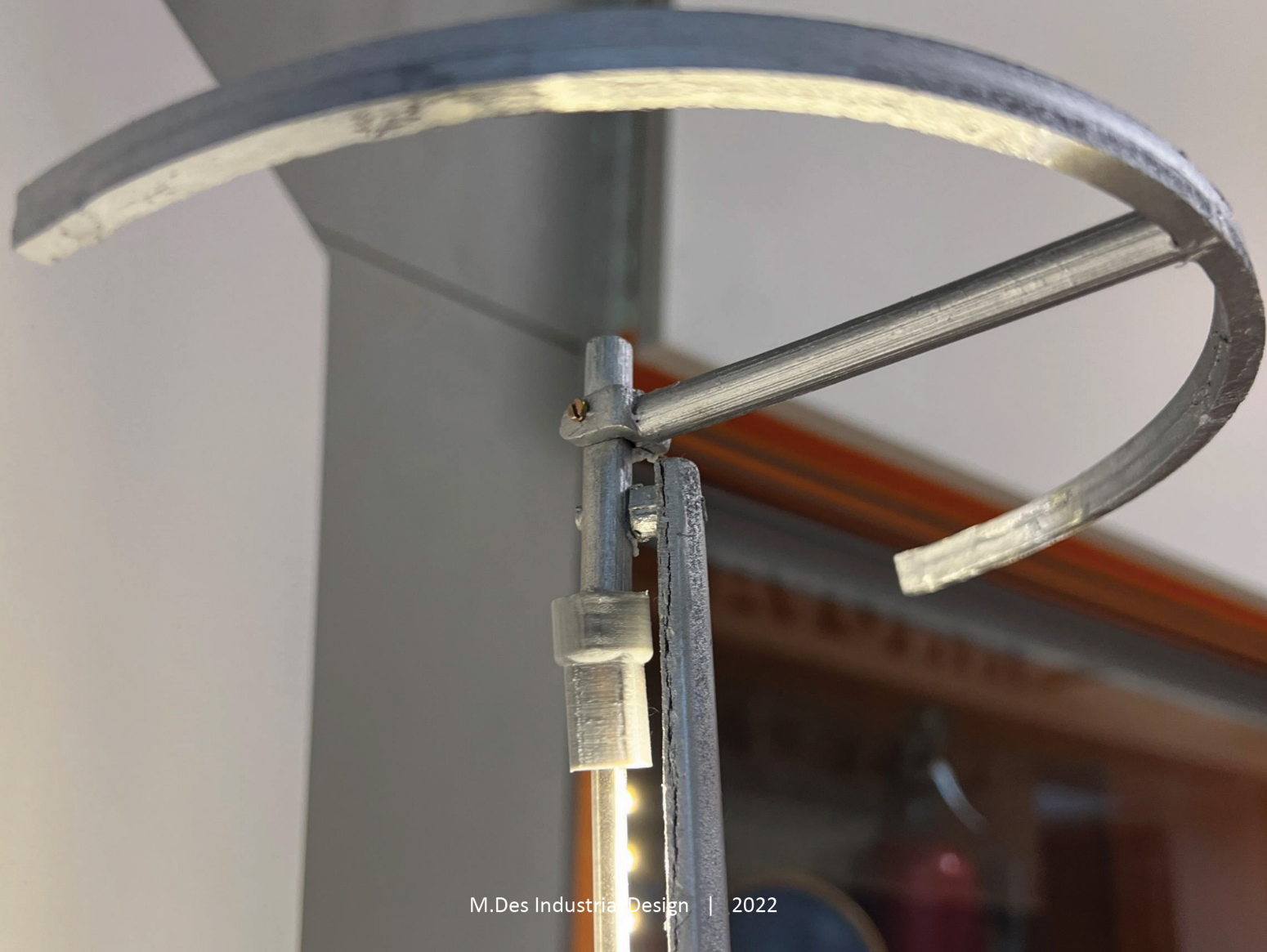


Image 48– Working rig 2

The above image shows how this light will mount on the wall. (LED wire details was not finalized while making this rig)



17. Shade Design

1. as I am using the leftover material from Solapur textile industries, most of the leftover material is threads.
2. Threads create “Moiré effect” when they overlap.
3. To create “Moiré effect”, the threads should be straight and in tension.

17.1 Understanding Patterns - Traditional

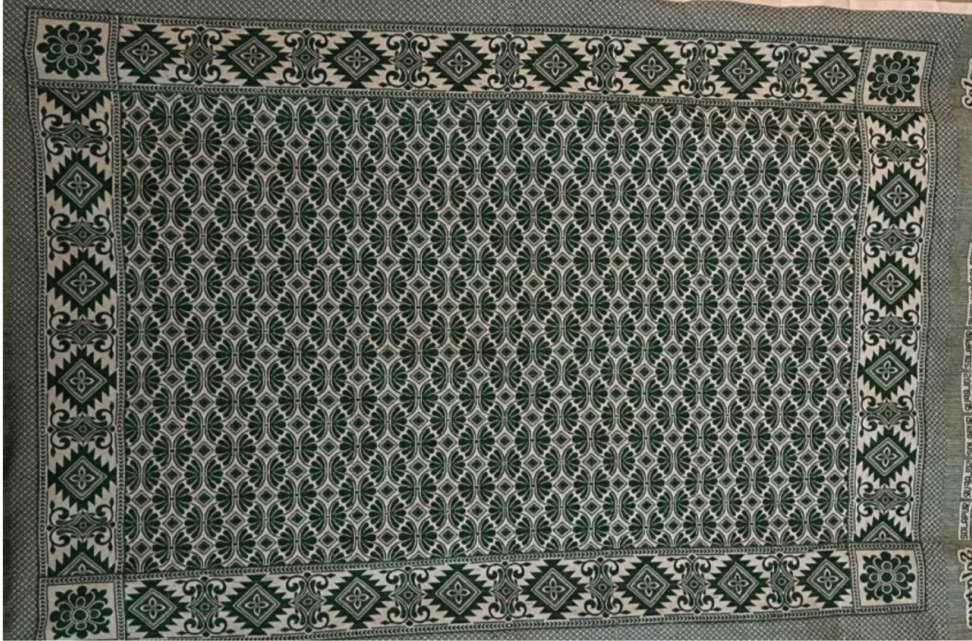


Image 49– pattern 1

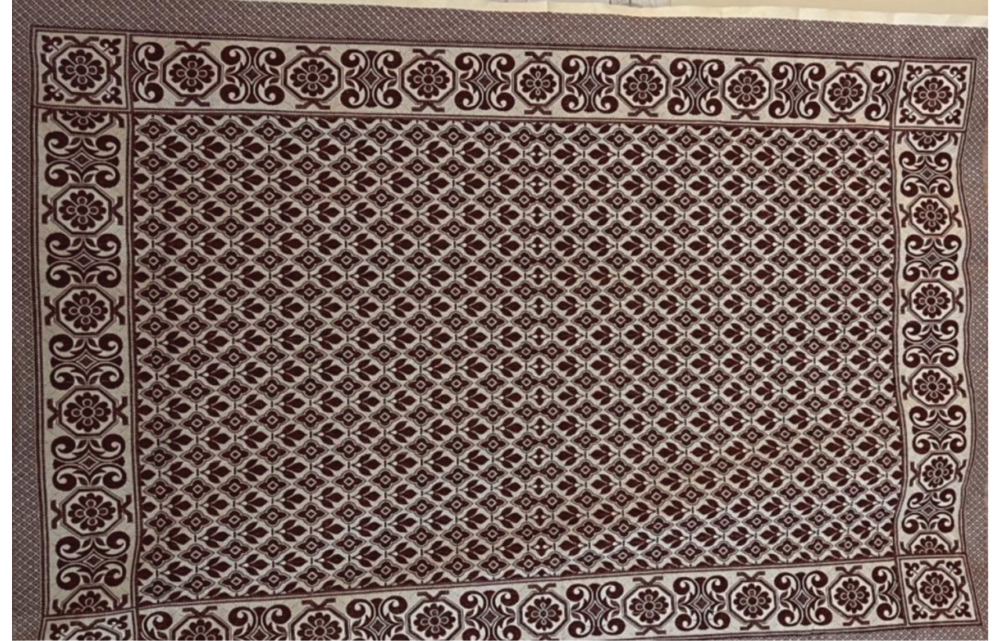


Image 50– pattern 2

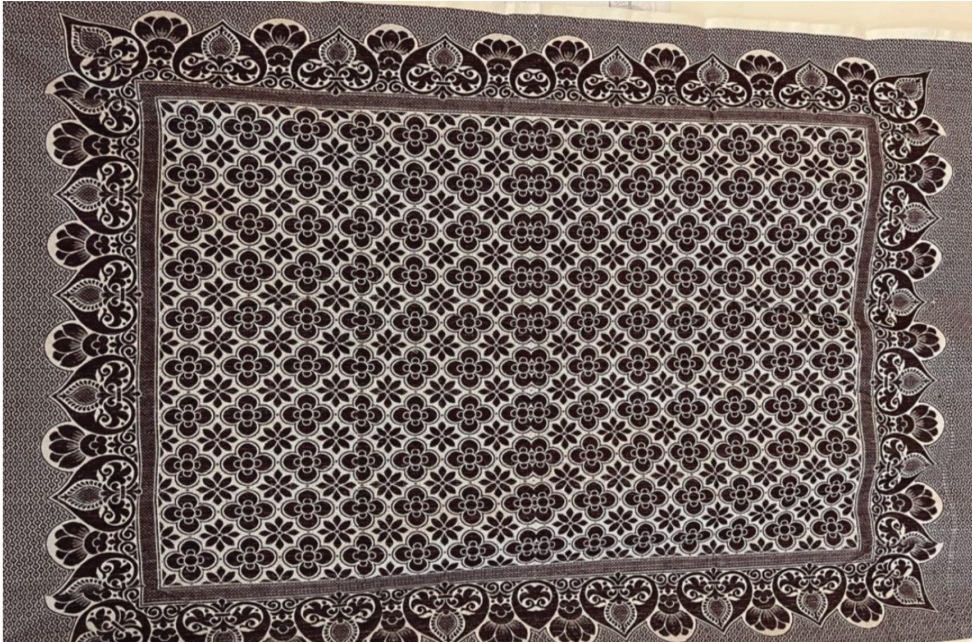
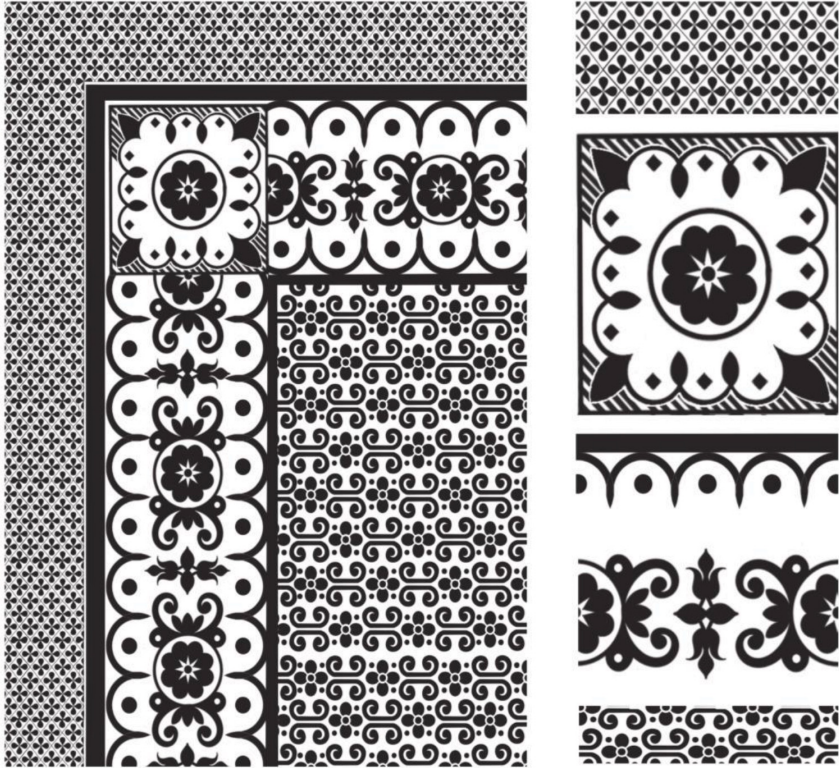


Image 51– pattern 3

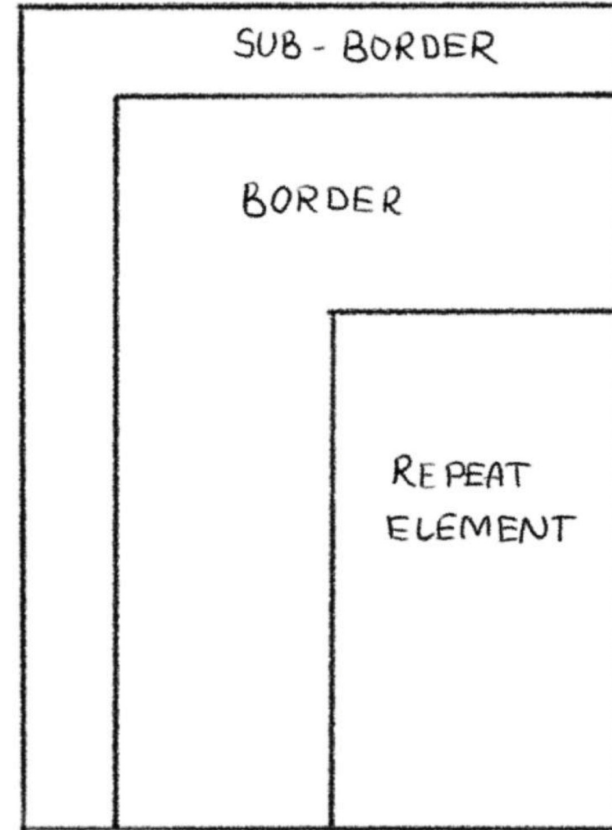


Image 52– pattern 4

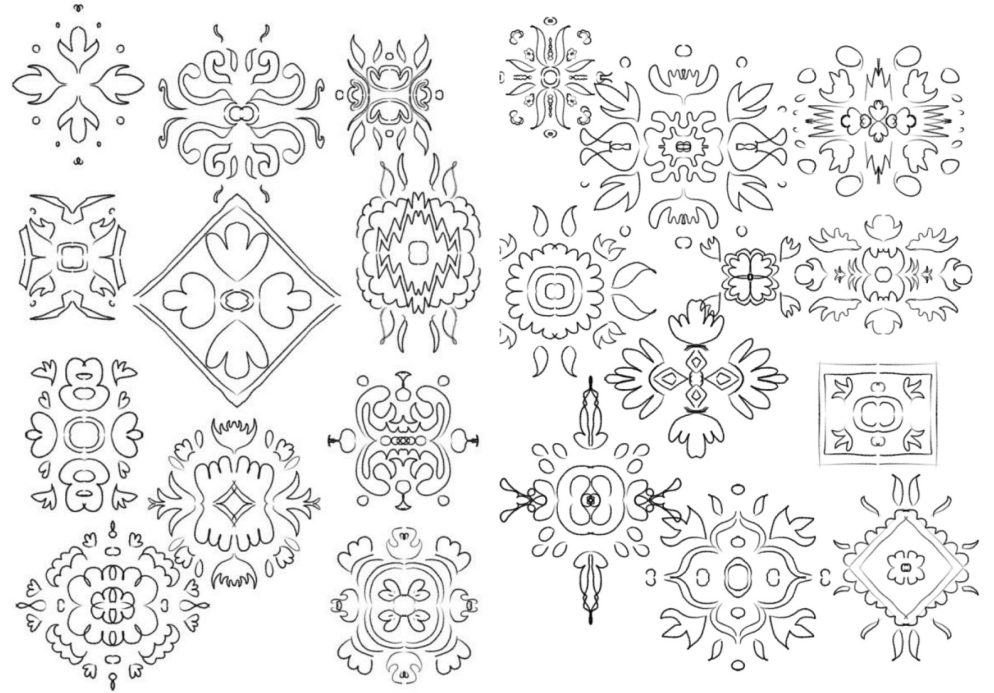
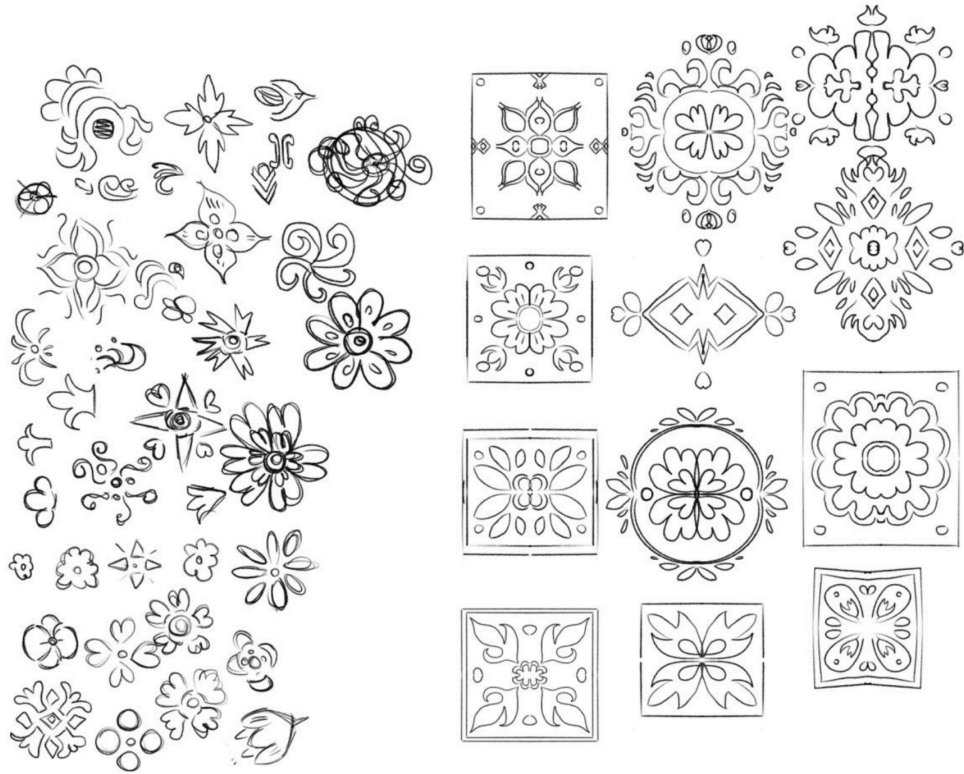


The above pattern extraction is from the Solapur chadar and its breakdown to the most common and repeated elements. As you can see, The typical Solapur chadar has 3 main elements,

1. Sub-Border
2. Border
3. Repeat element



17.2 Pattern explorations



After understanding of patterns and breaking down into elements, I stated to extract the different patterns and curves from chadar which gives the chadar its “Solapur Chadar” Identity.

17.3 Final patterns for stamps

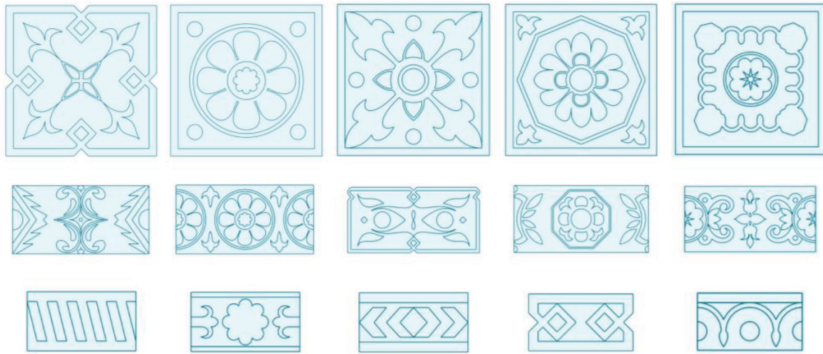


Image 53– 5 shortlisted patterns

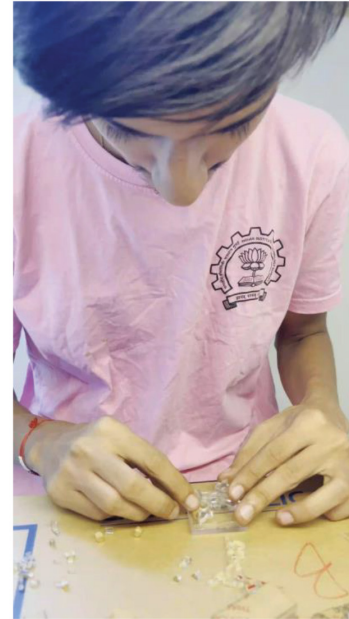
After pattern ideations, I shortlisted 5 of them to make the stamps. The stamps can be used to print the pattern on cloth (This process is not industrialized, this process is used only to make the working rig)



Image 54– Laser cutting of patterns using acrylic sheet



Image 55– Creating patterns using the acrylic sheet



Video



Video



Image 56- Pattern stamps made from acrylic

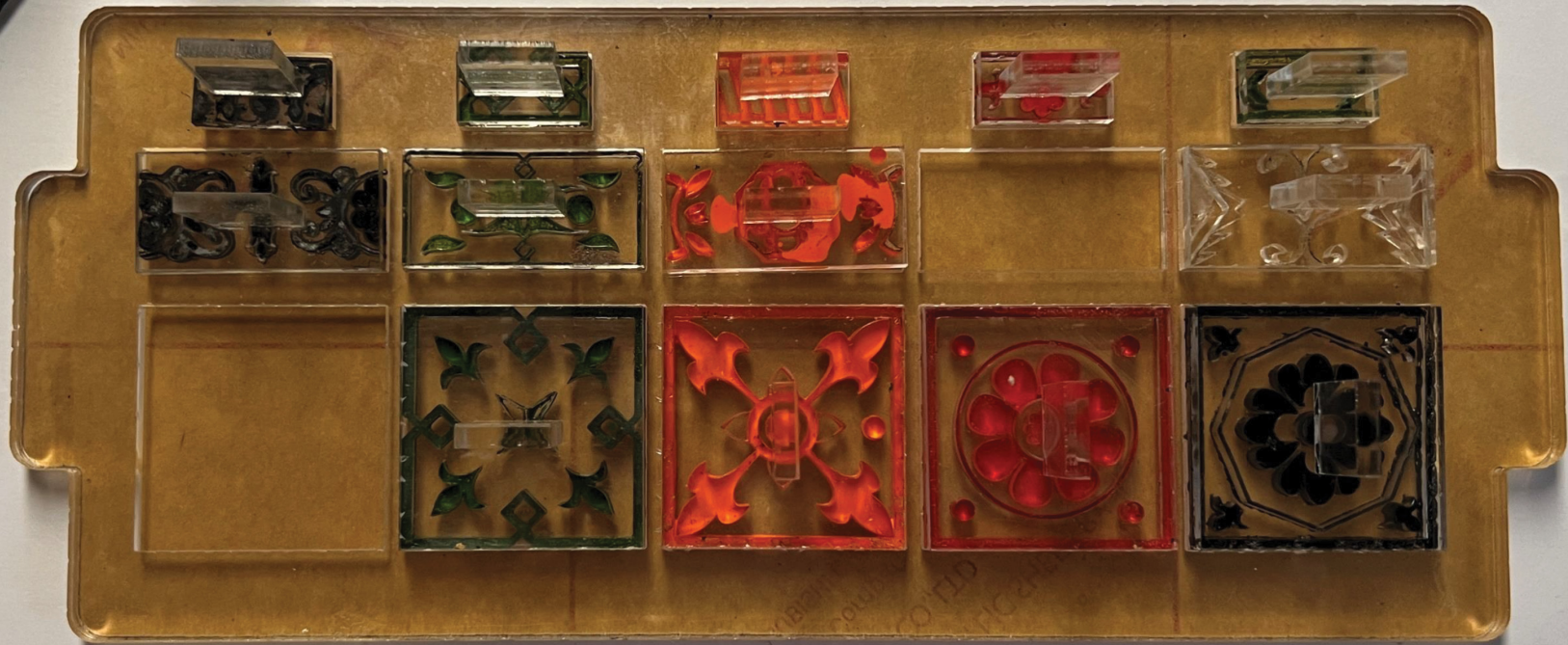


Image 57- Pattern stamps and tray



Video



Video

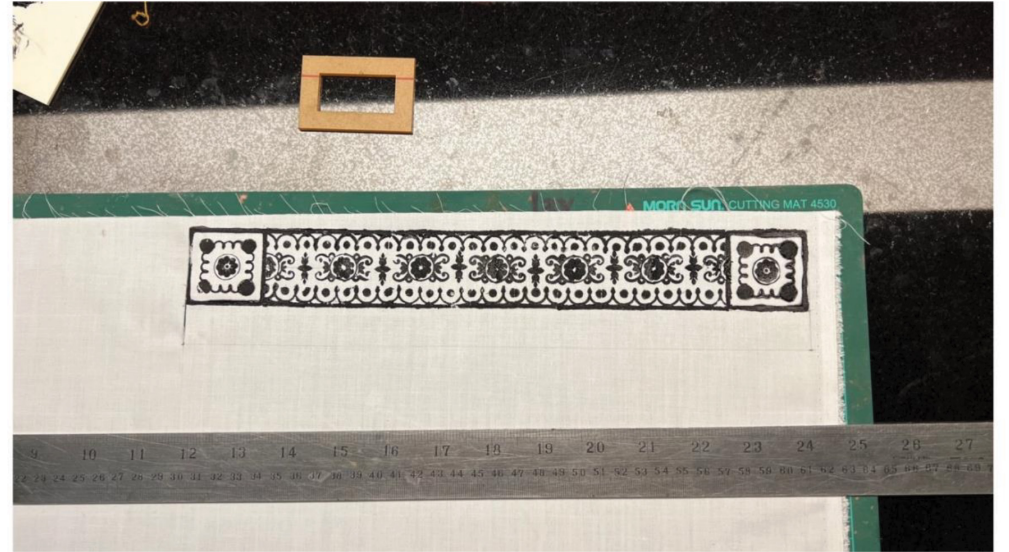


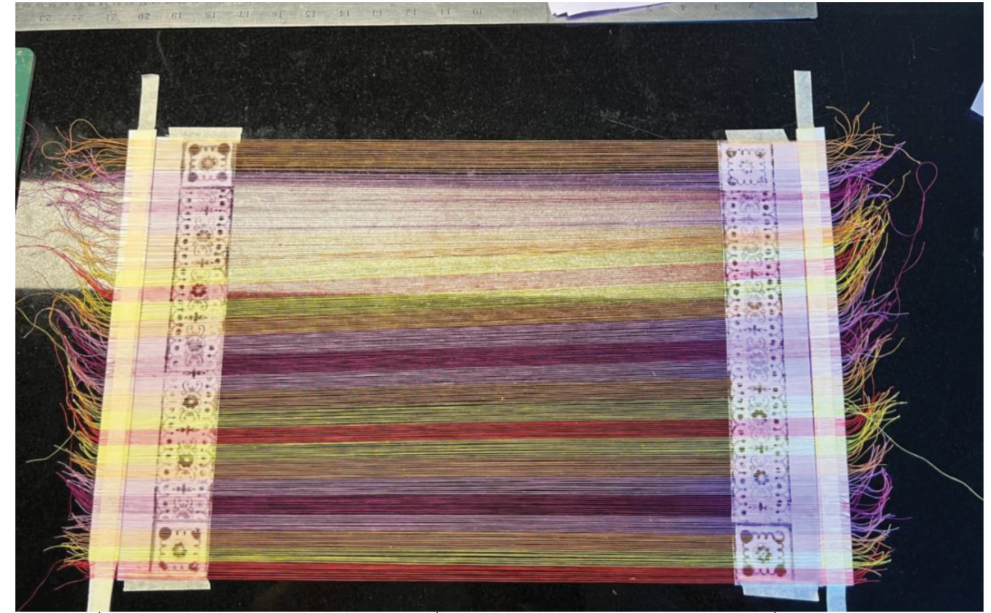
Image 58- Final pattern stamped cotton cloth

17.4 Making shade using leftover textile thread



Image 59– attaching the threads using two sided tape

After making the shade border using the stamps, I started to make the lamp shade using the leftover textile threads. (This process can be used for making working rig only)



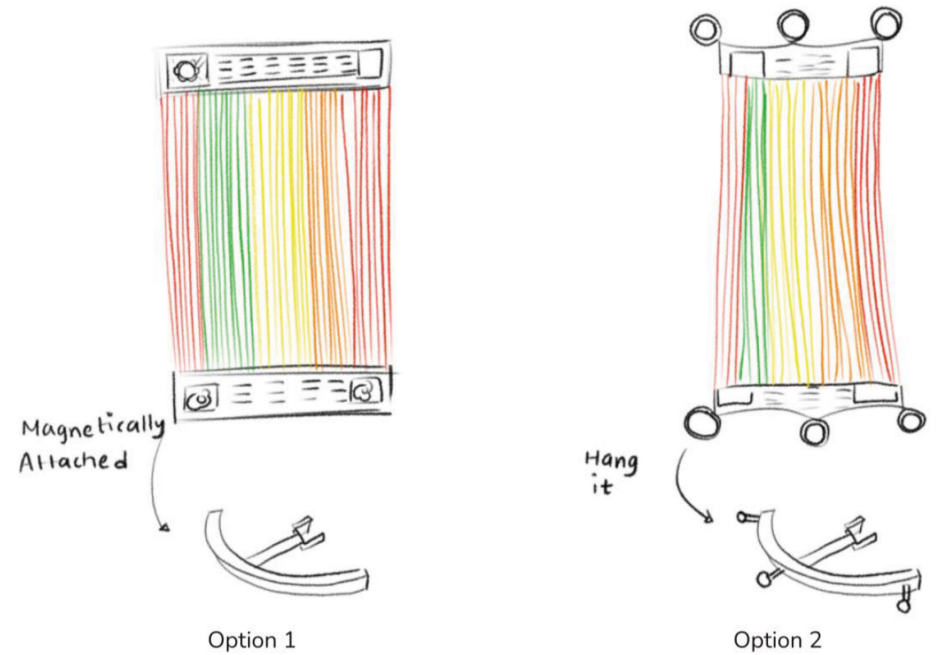
Double sided tape

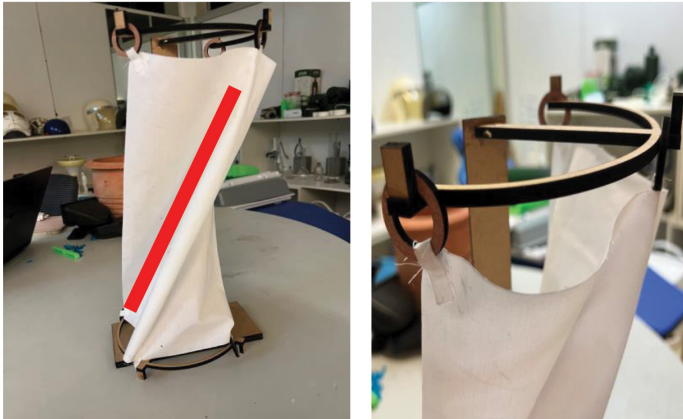
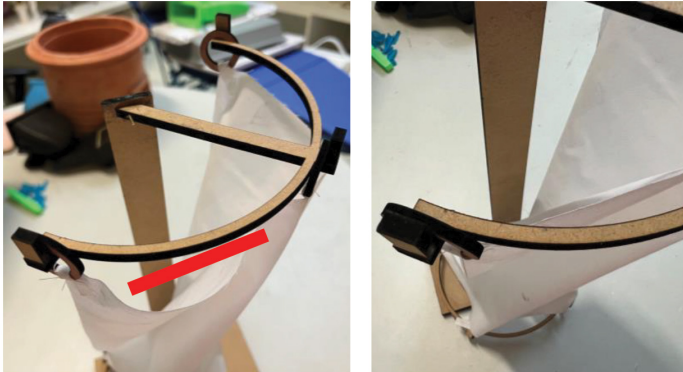
Thread

Border pattern

18. Shade attachment

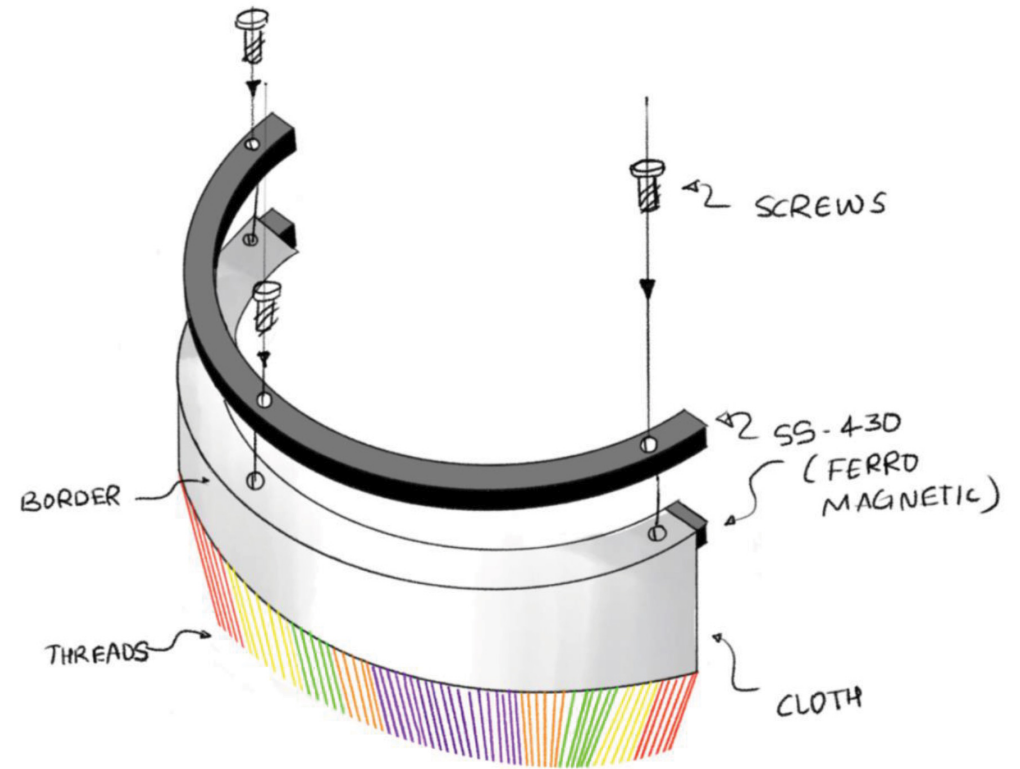
1. as I am using the leftover material from Solapur textile industries, most of the leftover material is threads.
2. Threads create "Moiré effect" when they overlap.
3. To create "Moiré effect", the threads should be straight and in tension.





2nd design for shade attachment unable to form the arc structure in order to create the moiré effect, so its rejected.

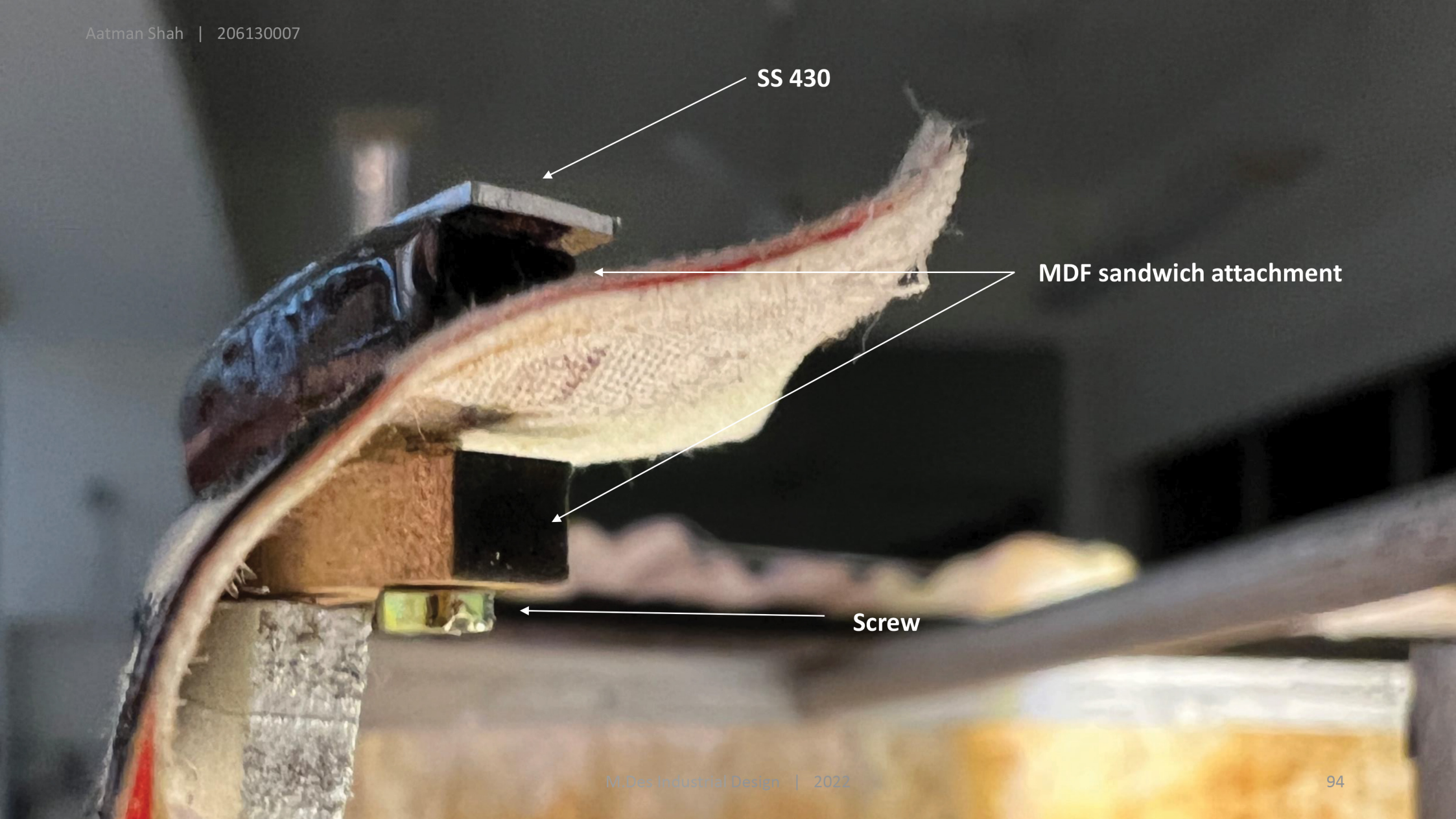
18.1 Magnetic attachment details



SS 430

MDF sandwich attachment

Screw





18.2 Final Working rig









tulah.



My Gratitude to Prof. B.K. Chakravarthy for continuous guiding me through-out the process. I am thankful for Prof. Avinash Shende for his presence during product detailing and his guidance.

Special thanks to Prof. Sandesh who made me available Bamboo Studio for work.

I am always thankful for my batchmates, Deepti, Lingraj, Deepak, Ajit, Syam, Aakash, Nayanika for their feedbacks and helping me out during the project.



- Further work -

Industrialize the manufacturing process
Packaging details
Final Product



Thank you.

- Design is the never ending process, There is always
scope for improvement -

References

1. <https://www.bulbs.com/learning/history.aspx>
2. <https://www.toptal.com/designers/visual-identity/guide-to-mood-boards>

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