UNIVERSITY OF LIVERPOOL

School of Engineering

Design Proposal Report - PDS

MNFG601

Board Lamp

Group 02

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Date of Submission: 10/01/2022

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1.0 Summary

This project entails the conceptualisation, design and development of USB powered LED light. This product can be mounted easily on any computer lid and can be portable at the same time to provide sufficient lighting on the keyboard in low light conditions, also it can be placed on the table or similar flat surfaces to be used as source of light. This unique feature of our product will also illuminate the facial area of the person using it while video conferencing.

The product design specification helps us in understanding the trends in current market, the flaws of the current product available in the market, the potential customers and future competitors. Formulating the product design specification widens the idea on characteristics of the performance specifications and its key factors can be compared with the current working models in the market. The performance specifications should act as a set of guidelines which will help in evaluating future developments of the desired product.

Looking into the legal aspects of the project is the next milestone in product design specification. It helps in understanding the different standards that complies with our design and also prevents us to avoid any ideas and concepts used before. Patents of products having similar functions must be closely checked, so that it does not hinder the future developments and success of our product.

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4.0 Introduction

This project is aimed to design a USB LED light effectively in a way that it can be mounted easily and can be portable at the same time. The unique design of this product enables it to be mounted on the laptop or notebook lid and provide sufficient lighting on the keyboard in low light conditions. In addition to that it can be mounted on the table or similar flat surfaces to be used as source of light. With this unique mounting feature, we can use this USB LED light to aid as a light source to illuminate facial area while video conferencing.

Most of the existing products in the market are unable to brighten the whole keyboard space uniformly. As these products have limited flexibility and restricted to the area near the USB port which leads to casting shadows over the keyboard, blocking the visibility of some keys. After looking at the products in the current market, we decided to develop and design a better product that can overcome the drawbacks mentioned above.

This project aims to design an improved version of an USB LED light that is easier to use and affordable for the end user. This can be achieved by identifying the problems with available products in market and providing a better solution for customers. Another focus of the project is to make the product more flexible and provide a mounting feature to capture more market. The project should be open to potential changes and adaptions in design regarding the versatile usage of the product and making it more accessible to the common market.

A pool of good resources is must for the successful completion of project. A project planning software is to be used to visualise and to cover the overall progress of the project. The designing and visualizing part of the project will be mostly covered by using the CAD software Cero parametric 8.0. The conceptualization, modelling and setting up the parameters are expected to be done using Creo 8.0. Microsoft office is also a main managing software used at different stages of the project to communicate and to document the entire project.

There will be phases in the prototyping part of this project, where the group has to work with hazards chemicals, equipment and machineries. Safety measures has to be put in place to avoid mishaps during these stages. The risks surrounding the project should be identified and tackled during the course of project. The possible threats should be eventually eliminated at the end.

5.0 Product Design Specification

5.1 General Product Description

The product is a Portable keyboard light called ‘Board lamp’ that can be quickly attached to a laptop or placed on a surface to provide sufficient lighting for computer keyboards in low light conditions. The name ‘Board lamp’ conveys the ability of this device to be paired with laptop and to provide lighting for the keyboard. The Board lamp can also be used to light up face of the user during a video call or while recording videos using the laptop camera. It can be powered using a USB port to power the LED and can be controlled using a slide switch at the top.

5.2 Commercial Considerations

5.2.1 Customer

The potential customers for the portable keyboard light are the people who are using full-sized mechanical keyboards, portable keyboards, and laptops with no keyboard backlighting. Even though most of the high-end laptops comes with keyboard backlighting, there is a large number without this feature exists in the market. Mainstream computer users including programmers and designers often prefer full-sized mechanical keyboards rather than congested laptop keyboards. These portable wireless keyboard works on battery and can never afford backlighting which could significantly reduce the battery life of these devices. The portable keyboard light can be used to provide enough light to see and distinguish the keys even at completely dark or low light conditions for wireless keyboard users.

There are some products already available in the market for lighting laptop keyboards. But these products are designed to only light up the laptop keyboards. They are constrained to the PowerPoint and highly restricted in flexibility to move around. Most of these products are also unable to provide uniform lighting and cast shadows of hands while typing. The unique selling point of the proposed product is its high flexibility that comes with approximately 1-meter wire length and multipurpose foldable covering. Users can easily alter the position of light according to their needs and can be mounted over the laptop or placed on a surface. The product includes simple electronics, and its life span is expected to be at least 3 to 5 years if used properly under normal conditions. The part most prone to failure is the mechanical sliding switch, which can be easily damaged if subjected to rough usage. Even though this is a simple product technically, the functionality makes it stand out and can target potential computer users including students, IT professionals, designers, etc. The standardized

USB port will ensure seamless compatibility around the globe, irrespective of the location of the customer. The most preferable way to reach the market is by online shopping websites which can give worldwide exposure to the product. Similar products are available in the market and are priced from £3 to £10. So, the product should be ideally prices around £7, which will attract a wider range of customers and helps to stay competitive in the market. The product can be mass-produced at a cost of around £5 and this makes the pricing realistic and achievable.

5.2.2 Market

The potential market for Board Lamp covers a wide range of computer users. Software developers, IT professionals, designers are some of the users targeted by the product.
A product with this range of flexibility and functionality compared to other products of the same category available in the market can easily occupy around 10% of the market share. This is achievable because most of the other products are manufactured by untraceable Chinese manufacturers with no guarantee or reliability. But these products are cheap and cover around 60-70% of the market. The genuine manufacturers with proper product specifications and branding are limited. However, they cover around 20-30% of the market. we are targeting this part of the market and with proper design and branding, it is realistic to achieve one-third of this market. The competitors also lack the flexibility offered by our product.

The best way to reach customers is through online shopping websites. They offer a better reach around a large group of customers and can make the process easier.

5.3.3 Competitors

5.3.3.1 Companies and Products

A competitor company may be considered as a rival company who sells a product which performs like our product and the primary function will be the same. It can vary from our product in many ways. From the design to function there will be many areas where the product varies.

Unlike other products the competitor of our product is around the globe. A key factor to be noted is that, since our product is small and is of very marginal cost, the volume of production will be huge. This has resulted in the mass manufacturing of similar products focussed in one area, China. China is the pinnacle of manufacturing products in a huge volume.

During our research, we have found that though the availability of the products that performs the similar functions are widely available, it was all with the same design but were manufactured by different companies based in China.

Though many companies are manufacturing such products in China, no information was found on these companies in world wide web. Hence the authenticity of these products is minimal and are least reliable for its functions. Other companies that we found are noted below:
(i) Gembird

The Gembird is a Chinese company which manufactures electronics. Their product 'USB Laptop/notebook flexible 5V LED keyboard night light' functions like our product. It is having a flexible neck that can be adjusted to the user's requirement. This product is widely available across the globe. The main trading company of this product in UK is Kenable.

Figure 1. Kenable USB Laptop Light.

(ii) i2 Gear

i2 Gear is having a USB powered LED light that performs similar to our product. It is having a flexible gooseneck which can be adjusted as per the user requirement. The Unique selling point of this device is its adjustable brightness. The brightness in this device can be adjusted in two steps using a switch.

Figure 2. i2 Gear LED light.

(iii) Amazon

Amazon is an online shopping website, and it is having many numbers of USB powered laptop light. Unlike what we see, there are different products with different design and different function available in it. But the manufacturers of many of these products were not traceable and no proper manufacturing companies were found for many in our research. Almost all of these products were having a similar flexible gooseneck design with different shaped light heads.

Figure 3. Amazon products.

5.3.3.2 Unique Selling Point

The unique selling point of a product is the key point that makes it different from its competitors. It can be anything from the design, quality, function, properties, material. Our product is also having a unique selling point which make it different from its competitors.

The common design of the USB powered LED light is with a flexible gooseneck having a light mounted at one end and USB power at the other. This design allows

the user to plug the USB to the laptop/notebook and use the light for the keyboard. This design only gives light to the side where it is plugged in. So, the other side of the keyboard will be dim lighted, and the output of the product is not met to its fullest.

The product which we propose is mounted on top of the screen so that the light to the keyboard is equally distributed and the user will have a better experience in the dark. The design is made in such a way that the product can be fitted easily on the monitor screen using its unique foldable coverings. These covering are joined by hinges, and this allows it to be folded and used even in travel.

Another unique selling point of our product is its foldable covering. This enables our product to be used also as a table light. The compact design of our product makes it easy for travel and office use.

5.3 Performance Specification

The Performance specification creates information to be later be referred to as a testing method to whether a design is meeting given criteria. A coding system and importance rating has been created to make referencing individual statements simpler at a later date.

5.3.1 Function

Table 1. Function section of Performance Specifications.

Nº	Description	Importance *Low (1-5) High*	Notes
1.	Capacity	5	The product must be as compact as possible to transport without hassle. The product should be mounted, plugged and used easily.
2.	Efficiency and effectiveness	4	The support on products must be stable. The device should be simple to mount, remove and pack without breaking or twisting. It can be plugged easily.
3.	Weight	3	In order to fit the product on screens and carry it efficiently, the weight of the product should be as low as possible, also keeping the strength for functionality.
4.	Scope and Fitting	4	This product must be compatible with all the laptop screens and should be able to fit firmly while perform its function. It

			must lay stable on a variety of flat surfaces.
5.	Storage	3	It must require as little space as possible in storage. User should be able to store so that moving components do not get damaged. The product should be easy for to put in to and bring out of storage.
6.	Utilisation	4	The product should firmly rest on screens and user should be able to operate the switch. It should be easy to keep the product on any surfaces. The wire should not hinder the usage.
7.	Operating temperature	4	The product should operate between temperature range of -5 to 50oC without any performance compromise. It should not overheat above 60oC.

5.3.2 Material

Table 2. Material section of Performance Specifications.

Nº	Description	Importance *Low (1-5) High*	Notes
1.	Appearance	3	The product must look safe, appealing and aesthetic when it is mounted or stored. The electric circuit components should not be visible.
2.	Colour	3	The product should have a glow of cool white light.
3.	Density	4	Product should have low density to be light in weight.
4.	Ductility	4	Product should have sufficient ductility to avoid breakages/misshaping when in use, storage or transit.
5.	Elasticity	4	Product should have very small elasticity to remain in shape and maintain its rigidity.
6.	Hardness	5	Product should be hard enough to avoid any deformation.
7.	Phases	5	Product must be in solid state.
8.	Purity	1	Purity can be maximised during materials selection process.
9.	Recycling content and potential	2	Product should have good range of recycling potential to increase the

			product's sell-ability.
10.	Strength	3	The product should not break on impact or dropping on the ground. It should withstand casual tensile forces applied on wire. The product should not snap under normal handling forces.
11.	Texture	3	The casing of product must be smooth so that human interaction is not uncomfortable or unsafe. The mounting part can be coarse for better grip.
12.	Viscosity	5	The product should not have any flowing properties as rigidity is essential to maintain its shape.

5.3.3 Dependability

Table 3. Dependability section of Performance Specifications.

№	Description	Importance *Low (1-5) High*	Notes
1.	Availability	2	The product should be available to the customer widely. It needs to be simple to buy and use directly without any additional equipment.
2.	Disposal	2	Most of this device should be recyclable. Components susceptible to damages should be replaceable with ease.
3.	Level of service	3	The maintenance schedule should be eliminated as far as possible. It need to be working without changing any parts frequently.
4.	Life cycle Costs	4	The costs involved with regular use of the product must be minimised. No additional accessory is required to make the device work.
5.	Maintainability	1	Maintenance must be eliminated. Switch, wire and casing should be easily accessible for easy maintenance when necessary.
6.	Reliability	2	The product should work easily for 3 to 5 years under careful handling. Joints and USB must be reliable and work successfully at all times.

7.	Redundancy	1	The product needs to be closed properly for carrying such that there are no components are left out. The big casing to hold the electric components safely and provide easy grip on screen.

5.3.4 Environment

Table 4. Environment section of Performance Specifications.

Nº	Description	Importance *Low (1-5) High*	Notes
1.	Access	1	Product should be easily accessible for use.
2.	Air and water flow	3	This product should not come in contact with water as it will be damaged.
3.	Altitude and depth	3	This product will be used above the ground level on laptop lids or table surfaces, directing towards the face of the person/keyboard.
4.	Corrosion	1	Corrosion will bear no effect on this product.
5.	Erosion	2	The product should have erosion resistance.
6.	Force	4	The product must withstand the operating forces while using switch, mounting and unmounting. The product should stay intact while storing or transporting.
7.	Mass	3	To be light-weighted and storage purposes mass should be kept to a minimum.
8.	Noise, vibration and shock	2	This product will have stain resistance.
9.	Pollution	1	Any kind of pollution must not be produced.
10.	Precipitation	2	Product should withstand high humidity and precipitation levels.
11.	Pressure	5	This product should apply sufficient pressure on the computer screen/lid to remain in fixed position and not wobble.
12	Radiation	1	Radiation will bear no effect on this

			product.
13.	Relative Humidity	1	Relative humidity will bear no effect on this product.
14.	Temperature	4	The product should operate between temperature range of -5oC to 50oC without any performance compromise. It should not overheat above 60oC.
15.	Velocity and acceleration	1	The product must be easily manoeuvred at all places.

5.3.5 Ergonomics and Aesthetics

Table 5. Ergonomics and Aesthetics section of Performance Specifications.

Nº	Description	Importance *Low (1-5) High*	Notes
1.	Accessibility	3	This product will be easily accessible, easy and convenient to use for variety of people. Mounting the product onto and remove off the monitor screen must be suitable for comfortable use by average person.
2.	Controls and display	4	The displaying part of the product is LED bulb side, and it can be clearly identified. There are no electronic displays in device. Switch, as control, should be easily identifiable for the user and simple to function both correctly and comfortably.
3.	Illumination	5	The product should illuminate majority part of keyboard/facial area and avoid overshadowing. The location of LED bulb in the device should be clearly visible.
4.	Mass	3	For transportation and mounting on laptop lid purposes, the mass of the product must be kept to a minimum.
5.	Operating force	4	The product must withstand the operating forces while using switch, mounting and unmounting. The product should stay intact while storing or transporting.
6.	Size and shape	3	Size of the device should be no more than the standard fist size of an average

			human, when folded. It should mount on computer screen comfortably as an accessory without interfering the screen part. The product must not have sharp shape and complex parts to fold/unfold.
7.	Visual impact	3	The product should look durable and aesthetic. It should portray its functionality to mount. USB cable should be separately noticeable from LED and mounting part.
8.	Transportability	4	The product should be made easy for transporting through bags and purses with effective storage. It should not interact with other products, as to tangle or mount or turned on.
9.	Texture	3	The casing of product must be smooth so that human interaction is not uncomfortable or unsafe. The mounting and support part can be coarse for better grip.
10.	Noise, Vibration and Shock	1	This product should withstand normal shocks and vibrations and produce almost zero noise, during usage or transit.

5.3.6 Interface

Table 6. Interface section of Performance Specifications.

Nº	Description	Importance *Low (1-5) High*	Notes
1.	Accessibility	1	Product components should be easily accessible for easy use, maintenance and repair.
2.	Configuration	3	The product should function smoothly as per the customer's requirements.
3.	Compatibility	4	The product must be compatible with different mounting scenarios and areas. Must be functional for use when connected to different sources of USB type-A.
4.	Custom and culture	5	The product must not be shaped in a manner to offend the customers.
5.	Emissions	1	The product must not emit any pollution

			whilst in use. Recycling potential must be increased as to reduce emissions through disposal of the product.
6.	Heat Input and Output	3	Temperature ranges should not affect the functionality of the product.
7.	Interchangeability	2	Product should have some interchangeability to easily replace/repair parts when damaged.
8.	Local Utilities	5	Power supply with USB input is required to function.
9.	Redundancy	1	The big casing to hold the electric components safely and provide easy grip.
10.	Security	1	The product is to be used by members of the public and so maybe misused on a regular basis.
11.	Size and Shape	5	The total size of product should be compact and easy to handle.
12.	Use and abuse tolerance	2	The product should withstand reasonable use and abuse without compromising performance.
13.	Visibility	5	The switch and bulb must be clearly visible to use.

5.3.7 Cost and Timing

Table 7. Cost and Timing section of Performance Specifications.

Nº	Description	Importance *Low (1-5) High*	Notes
1.	Availability	2	The product should be available to the customer widely in first targeting market which is UK. It should be consistent throughout the year. It needs to be simple procedure to buy and use directly without any additional equipment.
2.	Installation and commissioning	3	Installation of the product should be quick simple mounting and plugging the USB process. There should not be any assembly required to perform to use the device. Clear instructions should be supplied with device s to demonstrate their use. These must be free of charge.

3.	Life cycle costs	2	Cost must be minimised for increased usage, cost on maintenance must be minimised. The product should work easily for 3 to 5 years under careful handling. The product must be used without costing any additional accessory and charges.
4.	Transportation and storage	4	Size and weight of product need to be minimised to decrease cost of transportation and make storage effective. With the compact size of product, it should be stored, transported and sold in single units. Wire should not get tangled.
5.	Range and scope	3	Time to market should be minimised to increase potential market. This product should cost between £5 to £7 and to be sold in shops and online stores.
6.	Unit Cost	5	To attain the sufficient profits, the product should cost less than £5 to produce. Materials and processes used to make the product should reflect good quality whilst remaining as cheap as possible.
7.	Marketing and sales factors	4	Marketing must draw on unique selling points of the product. The easy incorporation of special features such as USB feature and unique fitting. The increased functionality, compatibility and decreased price of the product.

5.3.8 Safety

Table 8. Safety section of Performance Specifications.

Nº	Description	Importance *Low (1-5) High*	Notes
1.	Accessibility	1	Product should be easily accessible during use and storage.
2.	Custom and culture	5	No provocative or offensive material should be within the product.
3.	Emissions	1	There should be very little emissions during manufacturing and disposal must be minimised.

4.	Ergonomics	4	The product can be used and mounted with ease. Accessible to wide variety of people.
5.	Protective clothing	1	No protective clothing required.
6.	Security	1	The product is to be used by members of the public and so maybe misused on a regular basis.
7.	Signs and Instructions	2	Safety warnings and documentation for usage should be provided with the product.
8.	Tools and Equipment	1	No additional tools required.
9.	Testing and auditing	5	The product should meet all standard government regulations.

5.4 Regulatory Requirements

5.4.1 Legislation

Government rules and regulations must be followed on each step of the project. Abiding the government and international standard for the project is something to be taken care of.
The recent change in UK and EU (Brexit) have resulted in changes in supply chain and selling of products across Europe. These changes have to be noted and a proper working solution for global approach have to be considered.

5.4.2 Patents

It is essential to know if there are any similar products in the industry which will affect our products future. We have kept a keen observation on finding similar products and designs during our design and development stage. We have managed to come up with few patents of the design of similar products.

Table 9. Patents that may need closer consideration with project expansion.

S. No	Patent No.	Title	Author
1	USD810328S1	USB Ellipse LED Light	Pengcheng Chen
2	USD476106S1	Detachable computer light	Darren. C. Kim
3	US6802629B2	USB powered computer light	Mark Howard Krietzman, Yu-Hsin Chen

Figure 4. USD810328S1 Patent 1

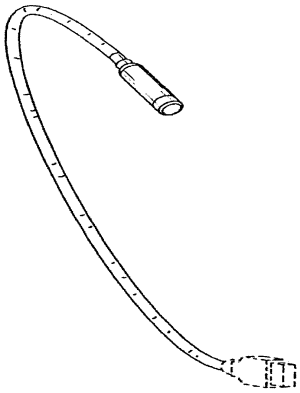

Figure 5. USD 476106S1 Patent 2

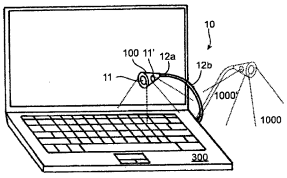

FIG. 1A

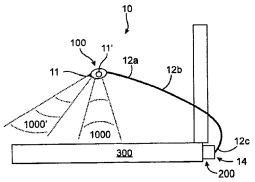

FIG. 1B

Figure 6. US 6802629B2 Patent 3

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