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Abstract

Combining Engineering, CAD, and Digital Media Design to create a unique marketable product.

3D printed Book

Lithophane Digital Media Design



Digital Media Design Final Year Project

# Introduction

For my final year digital media project, I have decided to do something unique. Digital media is available for everyone, however those without sight are missing out on the new stories we tell our kids. The idea is to create a product that the user will be able to feel the story as they’re reading the story. From the images below, the text is written in words, this is for the demonstration for the university to see. For future renditions, a braille version can be created, along with audio description. With new technologies available to the public, I have decided to collaborate with the school of engineering at Plymouth University to create a 3D printed story book.

# How are images 3D printed?

A greyscale image consists of blacks and white shades building up an image. The idea is the darker parts of the image will require less light passing through the plastic whereas the lighter parts of the image will be thinner, letting more light pass through.

The University uses the product Ender 3 PROs for their teaching and so I have decided to print the project using this printer. The specifications for printing lithophanes are different compared to conventional prints. As conventional prints use infill (A cross sectioned pattern) within the product to save material. But as we are monitoring the light that passes through the image this setting will have to be turned off and the design will be printed as is.

To create the lithophane, the website (<https://lithophanemaker.com/Framed%20Lithophane.html>) has been used as this will let me adjust certain factors to tune the design to print to my specification. Such as resolution, min/max thicknesses to deduce the light transfer through the lithophane. As well as size parameters to house the project. Figure 1 shows the difference from a digital drawing to a lithophane image. The software CURA has been used as this software is well established for this kind of project.

Text

Description automatically generated Text

Description automatically generated with low confidence

Figure 1 - Image to CURA lithophane

# Creating the housing.

For this project, I have undertaken additional study to learn the software Fusion 360 with lessons from the faculty of engineering robotics students. One thing to note is there is a tolerance between a 3D design and the physical dimensions of the product. I have learnt this through the lessons and am able to tune my design to fit together using a tolerance of 0.4mm. This value may vary from printer to printer. Figure 2 shows the design I have created. I’ve decided to create the box in two parts to allow the components to fit nicely together as well to avoid any infill as that will be a waste of material and for a marketable product, a waste of money.

Graphical user interface

Description automatically generated Graphical user interface

Description automatically generated

Figure 2 - Fusion 360 Design

# Creating the Light source.

For the light source, I have decided to use an LED based light as they do not increase in temperature unlike a light filament (Old-fashioned bulb) increases in temperature causing the plastic to warp. This requires extra circuitry as a regular bulb can be plugged into mains, however an LED voltage will have to be stepped down to work. Under supervision, learning the techniques of soldering, using heat shrink, crimping connectors I have created a light source suitable for this project.

I have decided on this square LED light from Amazon (<https://tinyurl.com/2p8uvjhw>) as the light coverage is even across the entire square.

# Bill of Materials

As this is a marketable product, an invoice has been created. As this is a demo unit, this device is powered by mains (240V), but for a product this can be converted to use batteries. To reduce the cost of this device, LEDs can be created in house and less material can be used to create the product reducing the cost significantly. Depending on demand, filament, hinges, and components reduce in price significantly on bulk orders.

INVOICE - 3D printing and design services

|  |  |  |
| --- | --- | --- |
| Invoice: 001  Invoice Date: April 20, 2022  Due Date: May 1st, 2022 | Bill To  Ms. Tamera Chilcott  Digital Media @  University of Plymouth  Plymouth, Devon, UK  07735838307  Tamera. Chilcott@ students.plymouth.ac.uk | Bill From  Mr. Shahin Haque  Robotics @  Plymouth University  Plymouth, Devon, UK  07563182418  Shahin.haque@ students.plymouth.ac.uk |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID | Description | Qty | Price | Total |
| 01 | White Polylactic acid (PLA) | 1KG | £20.99 | £20.99 |
| 02 | Wood Polylactic acid (PLA) | 250g | £9.99 | £9.99 |
| 03 | Hinges | 1pc | £10.99 | £10.99 |
| 04 | Light Source | 1pc | £10.09 | £10.09 |
| 05 | Mains Power Connector | 1pc | £9.99 | £9.99 |
|  |  |  |  |  |
| 06 | Labor | 162 Hours | £0.00 | £0.00 |
|  |  |  |  |  |
| **Sub Total** | | | | 62.05 |
| **Sales Tax 0%** | | | | £0.00 |
| **Shipping & Handling** | | | | £0.00 |
| **Total** | | | | **62.05** |

Terms and conditions

Please send payment within 30 days of receiving this invoice.

PLEASE MAKE A PAYMENT TO

Beneficiary Name: Mr. Shahin Haque

Beneficiary Account Number: 85060936

Beneficiary Sort-Code: 090128

Bank Name and Address: Santander