

## **Project Description**

Lithophane.py is a program that creates lithophane models which are pieces of art or images that are only seen when backlit by an external light source. A stl file that can be used to 3D print the lithophane model will be generated based on user image input and the geometry selected along with other customizable options such as border and thickness.

## **Competitive Analysis**

There are a few other types of lithophane generating platforms. The two that were most readily found are <http://3dp.rocks/lithophane/> and <https://itslitho.com/>. Both platforms allow the user to input an image and generate a lithophane stl file ready for 3D printing. More specifically, the first website only allows for lithophane models with one image to be generated in a variety of forms including a flat surface and a curved surface. There are also other customizable options such as rotating, flipping, and copying an image. In the second platform, only the flat geometry for the lithophane is available to be generated. However, additional features on this website include changing the contrast within the image itself to change the definition and depths in the lithophane.

My program will be similar to these existing ones as it will also be able to generate lithophane models for images with various customizability in terms of the overall height and border width of each panel. With time, additional features will allow the user to edit the image itself before creating the model similar to the second website. The program is also unique from the existing ones in that it will allow 3D models to be generated with multiple image inputs for various 3D geometries. This is the main feature of the program that competitors do not offer.

## **Structural Plan**

The finalized project will be finalized in four separate files. There will be one file in which a singular image will be converted to an stl file. This file will then be used by another file that combines stl meshes to the desired 3D geometry. The third file will be for the visual models generated of the 3D models. And, the fourth file will be for the user interface which will run the app and allow the user to upload their images, download the stl model, and customize the object.

## **Algorithmic Plan**

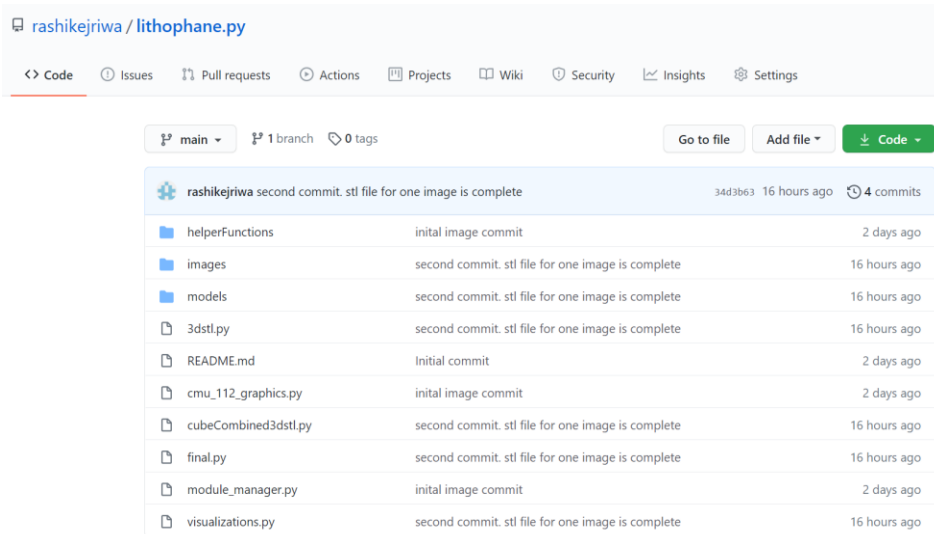
There are two main algorithmically complex parts for the program. The first is generating the stl model for a singular image. To do this an image will first be converted to a greyscale image and a list of pixel location, in terms of x and y location, along with the grayscale value from 0 to 255 will be created. This will then be altered for a given thickness and used to build a list of all of the triangular faces connecting the points in this list. These triangular faces will then be used to create a mesh and save an stl file. The second part of the program takes these existing stl files and converts it to 3D geometry using rotation and translation to combine the files. Lastly, the combined file will be downloaded as an stl file that can be imported into a separate 3D modeling program for slicing. (Based on time, the algorithmic complexity will continue to increase with a larger variety of 3D geometries given a certain input such as number of faces of images).

## **Timeline Plan**

- Nov 30* Lithophane stl file for singular image should be completed  
Lithophane stl file for the cube geometry should be completed with the same image
- Dec 2* Image resizing based on the smallest given image for 3D geometries  
User interface should take user inputs (images and customizations) and download an stl file of the lithophane
- Dec 5* Implement a third 3D geometry  
Make user interface easier and better to use (display the 3D model on the UI)
- Dec 7* Add additional customizations and features and finalize all components of project

## Version Control Plan

I will back up the code by pushing any changes and updates made to GitHub for the duration of the term project. The repository can be found at <https://github.com/rashikejriwa/lithophane.py>.



## Module List

PIL

NumPy

Matplotlib

## TP2 Update

The algorithmic complexity of the project was increased to be a dynamically changing project with a new user input. The user will be able to enter the number of faces that they wish for their 3D geometry to have, and the program will generate this. `Lithophane.py` is no longer limited to a 'hardcoded' shape (i.e. a cube). Stl files of prisms with three, four, five, six, seven, eight, etc. faces can now be generated.

## TP3 Update

No algorithmic changes were made. The UI was enhanced and the model is now displayed once the stl file has been saved to the desktop.