Box Designer

1.   Company Background

Dr. Owen Hildreth is an Assistant Professor in the Department of Mechanical Engineering at the Colorado School of Mines. His primary research is on nanometer to centimeter-scale additive manufacturing technologies. He has written numerous MacOS applications for custom data-collection and visualization as part of his research.

2.   Project Description

We have a Glowforge Laser Cutter in my lab. It is awesome and we use it all the time for various projects. We often make custom boxes to store delicate equipment using our laser cutter. This is a pain because there aren't any good, GUI-based applications for the macOS to make box templates. While there are numerous open-source and web-based applications to make templates, most of them are form-based (*i.e.* you type in overall values and select options, but you can't move features around using the cursor). I'm a mechanical engineering and am used to full-featured CAD packages. However, most CAD packages aren't designed to make laser-cut boxes. You have to manually design each cutout and tab, if you get the laser line width wrong, you then get to manually update all of your features.

Our goal is to make an easy-to-use, yet powerful, GUI-based box template designer for macOS. The application interface should be similar to a Computer Aided Design (CAD) application, with the ability to view the box and features in isometric 3D, select those features directly from the 3D view, and manipulate those features. We need to be able to add features, specify their options, have intelligent defaults and global defaults for features, and drag features around.

A Field Session started the Box Designer project in Summer of 2020. We would like to continue this work by adding or improving the following features:

Required features:

- Keep current camera angle, position, and zoom.
- Replace the save algorithms with Swift's built-in archive capabilities
- Add dedicated buttons and logic for Exporting the .pdf layouts
- Add option to specify the physical dimensions/limitations of the print area and have the exported layouts adjust to fit within those dimensions and add additional .pdf files as necessary.
- Add option to export each side as a separate .pdf
- Control the location of any internal separators
- Add options, logic, and GUI for both horizontal and vertical walls
- Add options to add or and delete sides of the box
- Add options to change units between inches and mm
- Add optional settings for kerf, margin, padding, and stroke
- Add capability to create additional cut outs for holes (circular, square, rectangular, etc.)
- Add capability to create text for engraving or cutting
- drag features with snapping options for common snaps (center, midpoint, end)
- specify specific location for features
- multiple joining options (tabbed, slotted)
- multiple lid options (tabbed, short slide, long slide, handle)

This project is an excellent opportunity for students to create a graphics-based application with immediate real-world applications. Students will get experience with Swift, macOS API, 3D graphics, and 3D graphical interactions.

2.1   Deliverables

1.   Final design report (mandatory for all teams)

2. Working application for designing boxes that meets the specifications listed above.

2.2 *Summary*

Develop the communication protocol that will be used on next-generation scientific and manufacturing equipment.

3. Desired Skill Set

Curious, self-motivated, students interested in making useful applications. Experience writing applications for macOS, iOS, or the Swift programming language is a plus.

4. Preferred Team Size

3-5 students

5. Internship Opportunity

Lab research opportunities continuing application within Hildreth's lab.

6. Location for Work

Off-site and on-site at Colorado School of Mines.