Boxmaker Software
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> *Note: the boxmaker software is available from: https://github.com/rahulbot/boxmaker.*
> *The original is deployed at: http://boxmaker.rahulbotics.com/*
> *This note describes the modified version, adapted for use at the Champaign Urbana Community Fab Lab.*

Overview

The 'boxmaker' creates a six-sided box with tabs for press fitting. The output is a PDF file which can be edited with Inkscape or sent directly to the Epilog laser. See Figure 1 for sample output. Note that the output can be edited to add decorations or adjust the layout or features. As long as the drawing is not rescaled, it will work as expected after editing.

The program has a command line interface, with 12 arguments, some of which will not need to be set by users. Figure 3 shows an example invocation, Table 1 lists the parameters.

The 'boxmaker' is a java application which is packed into a single .jar file

The program creates a six-sided box with the "front" and "back" size width x height, "right" and "left" sides size depth x height, and "top" and "bottom" size width x depth.

The edges of the box have tabs and slots for press fit. The slots are size slotDepth x slotWidth, where slotDepth should be the thickness of the material.

Figure 2 sketches an example side to show the meaning of the parameters.

Note that setting the "epilogLaser" parameter (the tenth item in Table 1) will make the lines .001 in, suitable to cut out on the CUCFL Epilog.

Needed: A User Interface

A user interface (UI) for this program would basically collect the user's specifications for the size of the box, the size of the tabs, and the material (to allow for the width of the laser cut). A good interface will make it easy to understand what the parameters do, and will check for plausible combinations.

The "laserCut" parameter should be used to adjust for different materials. We should determine recommended settings for common materials (3 & 6 mm acrylic, plywood, etc.)

The output should be returned to the user in a convenient way. This depends on the design of the interface. A web-based interface will return the PDF file as a download. A local app will write the file to a local or network disk.

The UI might optionally show the result in some way. Perhaps a thumbnail of the PDF can be displayed (a la Figure 1).

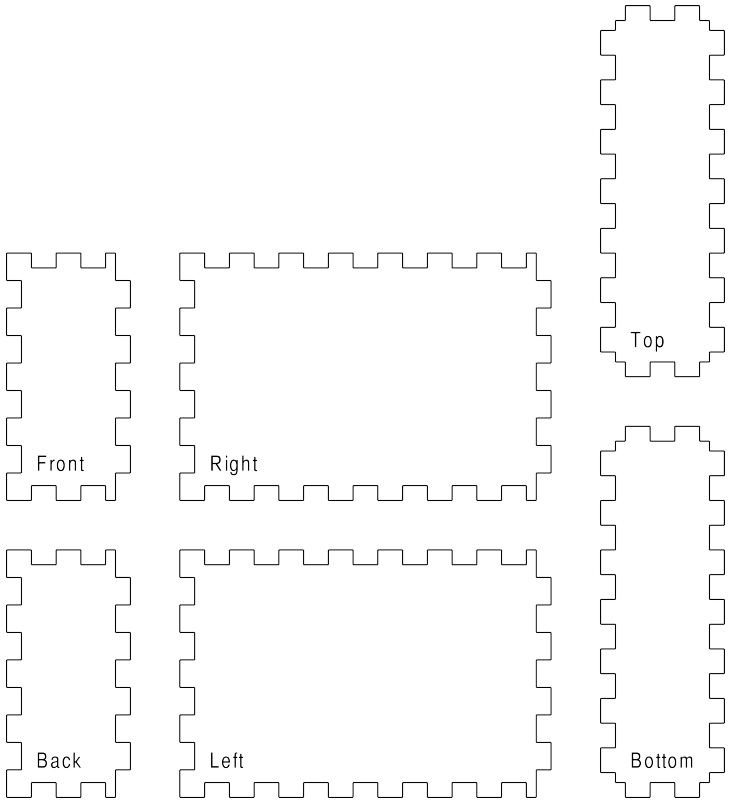

Figure 1. Example output (w = 25, h = 50, d = 75, slot w = 5, slot d = 3)

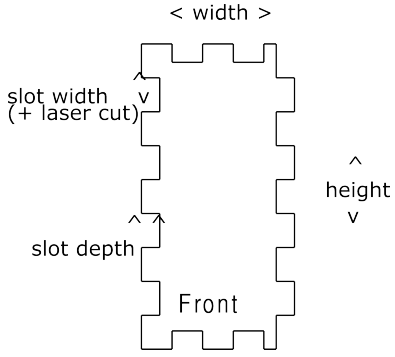

Figure 2. Diagram illustrate the parameters of the box.

```
java -cp BOX.jar com.rahulbotics.boxmaker.CommandLine bob-box6-acrylic-p-$A-$B-
    $C.pdf $A $B $C 3.0 0.004 5.0 false true true true true
```

Figure 3. Example invocation.

Table 1. List of Parameters

Argument (all dimensions in mm)	**Meaning**	**Recommended setting**
Output file	The file to write the PDF into.	File should have extension ".pdf"
Width (mm)		
Height (mm)		
Depth (mm)		
Slot depth (mm) == thickness	Should be set to thickness of material	
Cutwidth (mm)	Depends on material	TBD: get table of suggested values
Slot width (mm)	(suggestion: adjusted to dimensions)	
Draw bounding box	False== suppress box	false
Hide text	True == suppressed auxiliary text	true
Epilog line width	True == lines are .001 in	true
compact	True == try compact layout	true
Portrait/Landscape	True == portrait, false = landscape,	Use this to deal with specific cases.

Heuristics

The "cutWidth" parameter adjusts the box to allow for the material burned away. For a given material, this value can be used to create a very tight, snap fit.

Table 2 gives some suggested values for commonly used materials. These values provide a starting point, which may need to be adjusted in any given case.

The parameters of the box are subject to logical and practical constraints. For example, the dimensions of the box cannot be smaller than the thickness of the material!

Table 3 gives some heuristics which express some important constraints. Boxes that violate these rules should be flagged as likely to give poor results (if they can be made at all).

Table 2. Suggested values of cutWidth for common materials. Note, these settings make a very tight, no slip, fit.

Material	Suggested "cutwidth"
1/8 (3mm) acryllic	.25 mm
¼ in (6mm) acryllic	.1 mm
1/8 in (3mm) birch veneer plywood	.2 mm

Table 3. Suggested logical constrains on the parameters.

Variable Value	Heuristic
Width, Height, Depth	> (slotDepth * 3)
Width, Height, Depth	> 1 mm
SlotWidth	> (slotDepth + cutWidth) == (thickness + cutWidth)
SlotWidth	< (min(Width, Height, Depth)/3)
cutWidth	< slotWidth / 10

Future Work

The current version of the software makes a simple attempt to compactly lay out the sides, to minimize wasted space. This process is not optimal, and many cases may need to be adjusted by hand (e.g., using Inkscape). In addition, the layout currently has no recognition of the limits of the epilog laser. Ideally, it would lay out parts to fit the 12 x 24 inch bay, possibly in more than one drawing, if needed.

These and other improvements might be implemented in future versions.

Acknowledgement

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