

### Abstract

The overall goal of this research project is to design a 2-D model of an object to be carved by a CNC machine. These machines are typically made of different mechanical parts that are controlled by a coding language known as G-code. CNC machines are similar to 3-D printers but good at engraving or carving out 3-D objects out of materials such as wood.

In this research, different programs were examined that would allow the design of a 2-D model of objects from scratch. Then the 2-D designs were converted to a form that the CNC machine could read and carve out. The program Inkscape allows the user to create 2-D figures so that it can be imported and used by CNC machines, while Cura allows the conversion of files to G-code so that the objects can be carved out in a CNC machine. The objects used are an owl, a pyramid, and a box.

A CNC machine is under construction at this time and the objects designed will be carved out when the machine is ready.

### Project Overview

This project was conceived for the purpose of researching, learning, and understanding the different aspects that go into creating a 2-D design of an object that can be used in a CNC machine to carve out the object. The software Inkscape was used to design a 2-D model of an owl, a pyramid, and a box. Then the software Cura was used to create the G-codes of the designs. At this point, these G-Code files can be uploaded into the Arduino microcontroller which is being used to control the CNC machine's movements. This ensures that a particular engraving of an object can be performed.

### What is a Computer Numerical Control (CNC) Machine?

A CNC machine is a device that is able to accomplish a multitude of tasks such as, cutting and carving various materials. Some of these materials include wood, plastic, and foam. These machines can be built and customized in different ways to adapt to the needs of the user. For example, if you want to draw a picture that you designed from an external program, you can program a CNC machine using G-codes to draw the picture.



### Shapes and Figures Created

During the research project, different objects were created using the program Inkscape. The objects were an owl, a pyramid, and a box. The pyramid was created using the point and click and the drawing tools in Inkscape. The owl was imported from the internet into Inkscape to be changed to an STL file. The box was also created in Inkscape using the 3-D object drawing tool. In terms of ease of use, Inkscape and Cura were the easiest to make and manipulate shapes. These 2 programs were used the most when researching and developing the different figures that will be eventually converted to G-Codes before feeding into a CNC machine.



### Continued / Future Research

The CNC machine is still in development as of current. In the future, we plan to finish acquiring the parts needed to complete the machine. After that we will use the Arduino Microcontroller that we already have in our possession to run tests using G-code. After we determine whether the CNC Machine is ready to be operated, we will start engraving and carving objects.

### Pictures of CNC Machine (Still in Development)



### References

- <https://inkscape.org/en/about/>
- <https://ultimaker.com/en/products/ultimaker-cura-software>
- <http://www.shopbottools.com/mProducts/WhatsCNC.htm>

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