

Repurposing Obsolete Vinyl Cutters for the 6th International Symposium on Academic Makerspaces

ISAM
2022
Poster No.:
139

Dylan A. Watts¹

¹Dylan A. Watts; Dept. of Mechanical Eng., Auburn University; e-mail: daw0052@auburn.edu

Introduction

Between 2018 and 2020, the company Provo Craft dropped all official design software support for the earlier models of their 'Cricut' line of vinyl cutting machines. Additionally, no other software is available for these machines because Provo Craft took legal action against any 3rd party company that tried to create software that supported them. These early machines were built extremely sturdily and although the hardware in them is still perfectly usable, they have essentially been forced into obsolescence. Because of this, many of them are likely going totally unused or ending up in landfills. One benefit of this is that they can easily be found secondhand for relatively little money.

Concept and Goals

The main goal of this project is to develop an affordable and easily repeatable method to repurpose obsolete Cricut machines into a computer numeric control prototyping platform that can be adapted to perform a multitude of light duty functions. Once the project is finished, the part files and procedures will be published online and made freely available for anyone who wishes to build their own version or iterate upon the version developed within this project. 3D printing and PCB milling have been chosen as the first two functions to be designed for the machine, but the core CNC platform is designed to be able to accommodate any desired tool and allow for it to be swapped out with others quickly and easily. In order to make the machine as versatile as possible, many different tools and uses were considered while designing it.

Procedure

A. Teardown

Little to no information is available online about what is inside the Cricut vinyl cutters and how they operate, so before any of the designing could begin, the machines had to be taken apart and the components evaluated. Because they are essentially CNC machines themselves, the Cricut cutters contain most of the mechanical parts that will be needed. The part that is most important to this project is the rail and carriage that the cutting blade rides on. The rail is made of a sturdy aluminum extrusion and a belt driven carriage rides along it on V-shaped roller wheels. NEMA17 stepper motors

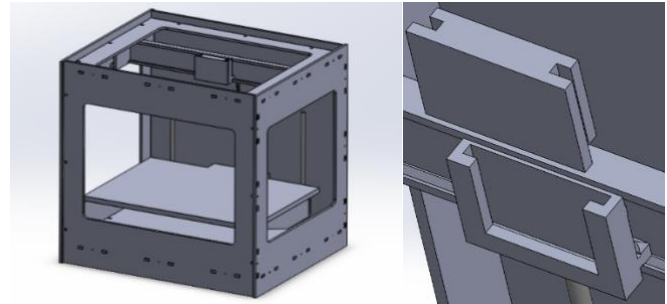


Fig. 1 Solidworks Drawing of Design

Fig. 2 Tool Plate

and standard size drive belt pulleys and idlers were also found inside.

B. Planning and Design

Fig. 1 shows a Solidworks drawing of the design. The machines working area will be roughly 15 x 12 x 12. The X and Y axis are made of the rails salvaged from the Cricut machines and they are belt driven in a coreXY configuration. The Z axis is attached to the bed of the machine which is driven by a leadscrew and rides along smooth rods and bearings. The axes were arranged this way to allow the machine to have a smaller footprint and so that the X and Y axes will be consistent with each other. The frame was designed to be enclosed with acrylic panels if desired and to give the machine a self-contained form. The frame is also designed to be cut out of plywood on a laser cutter and is assembled with captive nut wood joints. Fig. 2 shows a closeup of the concept for the tool changing system. The system involves two plates, one that is removable and will have a tool mounted to it, and one that is permanently attached to the X axis carriage that the tool plate will slide into. Once the tool plate slides into the carriage, it gets held in place by retaining clips that latch onto it. The tool plate is designed to be 3D printed which will enable each tool to have a custom fit fixture designed for it. The rear of the machine features additional receiving plates that tools can be stored on when not in use. The electronics will also be mounted on the rear of the machine and will be based around an Arduino shield and TMC2130 stepper motor drivers.

C. Next Steps

Now that the main design is finished, the plywood frame will need to be adjusted for the Kerf the laser cutter produces on the wood that is chosen. The machine will then be assembled, and testing of the motion system will begin. Once the machine is functional, work will begin on dialing in the specific tools.