Machine Control Toolkit for LabVIEW

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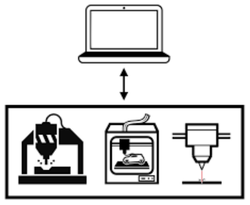
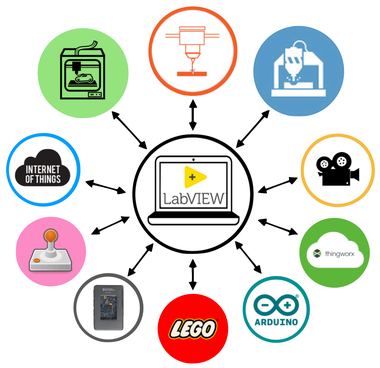
Motivation

The goal of the Machine Control Toolkit is to provide an entry-point for beginning makers to learn about G-Code, while also enabling advanced makers to control their digital fabrication tools in a new way.

Currently, digital fabrication tools (such as CNC machines, 3D printers, and Laser Cutters) are trapped inside a black box. Each machine has a default software that it comes with, and interfaces with only that software.



By harnessing the simplicity of G-Code and the modularity of LabVIEW, the machine control toolkit breaks down the black box and enables users to connect their digital fabrication tools to other platforms and devices.



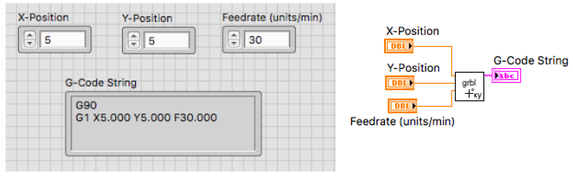
What is LabVIEW?

- Graphical programming language
- Uses blocks called Virtual Instruments (VIs) instead of lines of text to create programs
- Every LabVIEW Program contains:
  - Front panel: User controls and indicators
  - Block diagram: Vis that compose the code

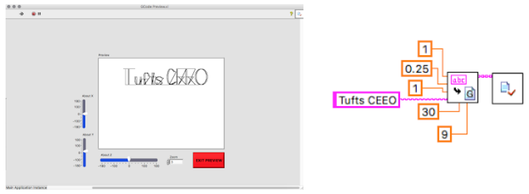
How it Works

- The Machine Control Toolkit is a software library for LabVIEW
- Enables users to control digital fabrication machines that interpret G-Code
- Breaks down G-Code commands into VIs that users can manipulate to:
  - Generate G-Code tool-paths
  - Design their own machine control interfaces.
- Machines are connected via USB to the computer running the machine control code and serial communication is used to:
  - connect to a machine
  - read from a machine
  - write to a machine
  - disconnect from a machine

Move Machine Command:

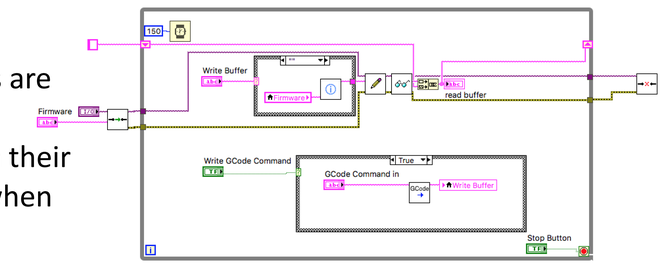


Generate G-Code From Text:



Simple Buffer Setup:

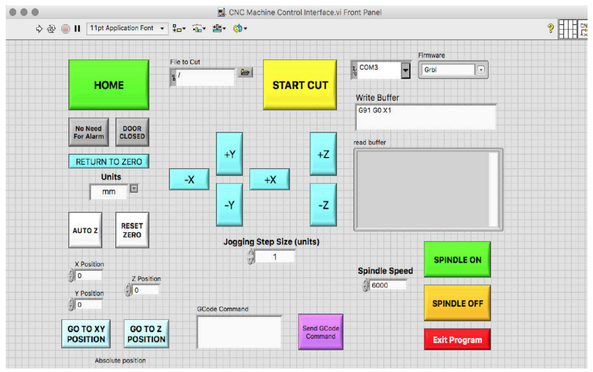
- Comes as part of toolkit
- Structures how commands are sent to machine
- Users can place controls on their front panel which dictate when commands are sent



Example Interface:

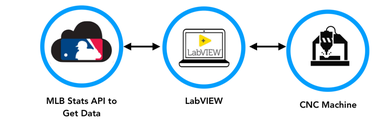
Allows users to:

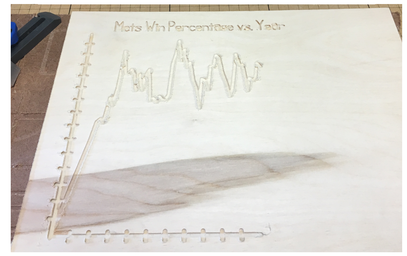
- Preview G-Code files
- Send G-Code files machine
- Jog machine and control spindle
- Zero and Home Machine
- Go to specified position
- View outgoing and incoming communications
- Change machine units



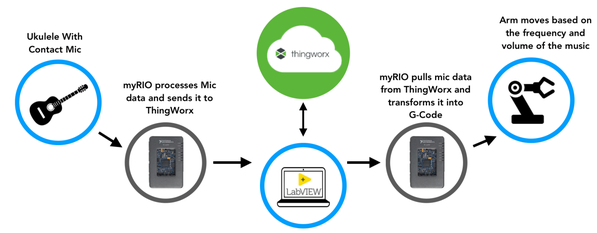
Example Projects

Physical Data Plots: In the example below, data was read in from the internet and programmatically formatted into a graph with scaled axis and a title. The G-Code file for the graph was then sent to a CNC Machine for fabrication.





Cloudelele: This example uses a ukulele with an embedded contact microphone to control a robotic arm.



Future Directions

Main future goals:

- Support more machine firmwares
- Expand the VI library to include controls for laser cutters and 3D printers
- Research what kinds of learning comes from enabling elementary and middle-school students to design their own digital fabrication interfaces

Download at:

https://sites.google.com/site/machinecontroltoolkit/