LASER HARP PROJECT

IRENE IAROCHEVITCH

New York City College of Technology, Brooklyn, New York 11201

INTRODUCTION

A laser harp is an electronic musical instrument, consisting of several laser beams to be blocked in order to produce sounds. The harp works as a MIDI controller, so it doesn't make sound itself, but generates a stream of MIDI data to drive an audio synthesizer. In a framed version of the harp, each beam strikes a photocell, and when the player's hand interrupts it, the sensor prompts an Arduino microcontroller to send a MIDI "Note On" message. Additionally, a range sensor reads the position of the hand, which spawns MIDI controller messages that change the sound's qualities.

My goal is to design and build a relatively inexpensive (<$500) framed laser harp. Also, because it is just a MIDI controller, I want to try to use the harp not only to control the sound, but also lighting fixtures and probably some other devices, such as stepper motors.

## BUDGET ESTIMATE

SUMMARY BY CATEGORY

Category	Budget
Framing (poplar)	$40.00
PVC pipe w/sockets	$20.00
9 Lasers 50mW, green	$225.00
1 Arduino Uno	$30.00
2 D connectors 25 pin female	$5.00
1 MIDI port female	$5.00
1 MIDI cable m/m	$5.00
Electronic components (photo-resistors, resistors, LEDs, chips, sockets, etc.)	$57.00
Total	$387.00

ACTUAL SUMMARY
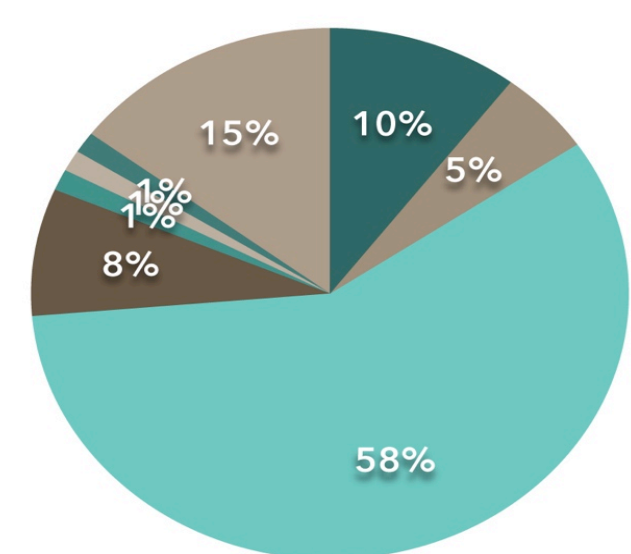
10%
5%
58%
8%
1%
1%
4%
15%

- Framing (poplar)
- PVC pipe w/sockets
- 9 Lasers 50mW, green
- 1 Arduino Uno
- 2 D connectors 25 pin female
- 1 MIDI port female
- 1 MIDI cable m/m
- Electronic components

BUDGET BAR GRAPH

$300.00
$225.00
$150.00
$75.00
$0.00

Framing (poplar), PVC pipe w/sockets, 9 Lasers 50mW, green, 1 Arduino Uno, 2 D connectors 25 pin female, 1 MIDI port female, 1 MIDI cable m/m, Electronic components

■ Budget
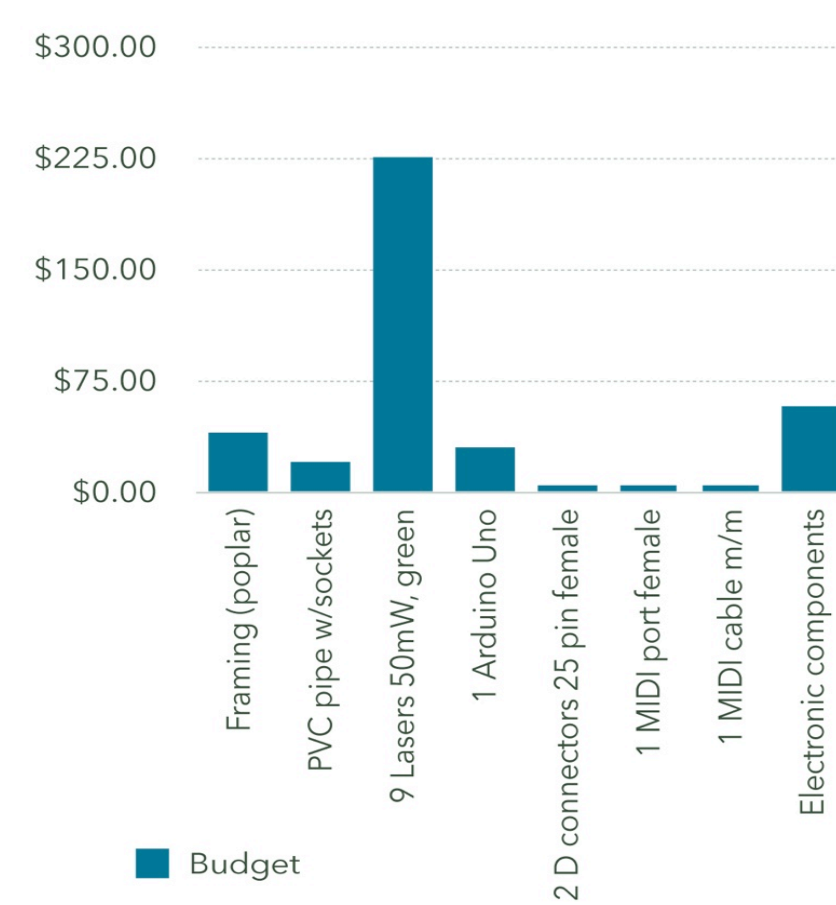
LABOR ESTIMATE

- Research ~ 50 hours
- Frame and Circuit Design ~ 10h
- CAD Drafting ~ 4h
- Materials Ordering ~ 2h
- Code writing, circuit assembling, testing and soldering ~ 20h
- Full design implementation ~ 50h

  LABOR ESTIMATE TOTAL: **136 hours**

PROJECT TIMELINE

FRAMED LASER HARP PROJECT
TIMELINE
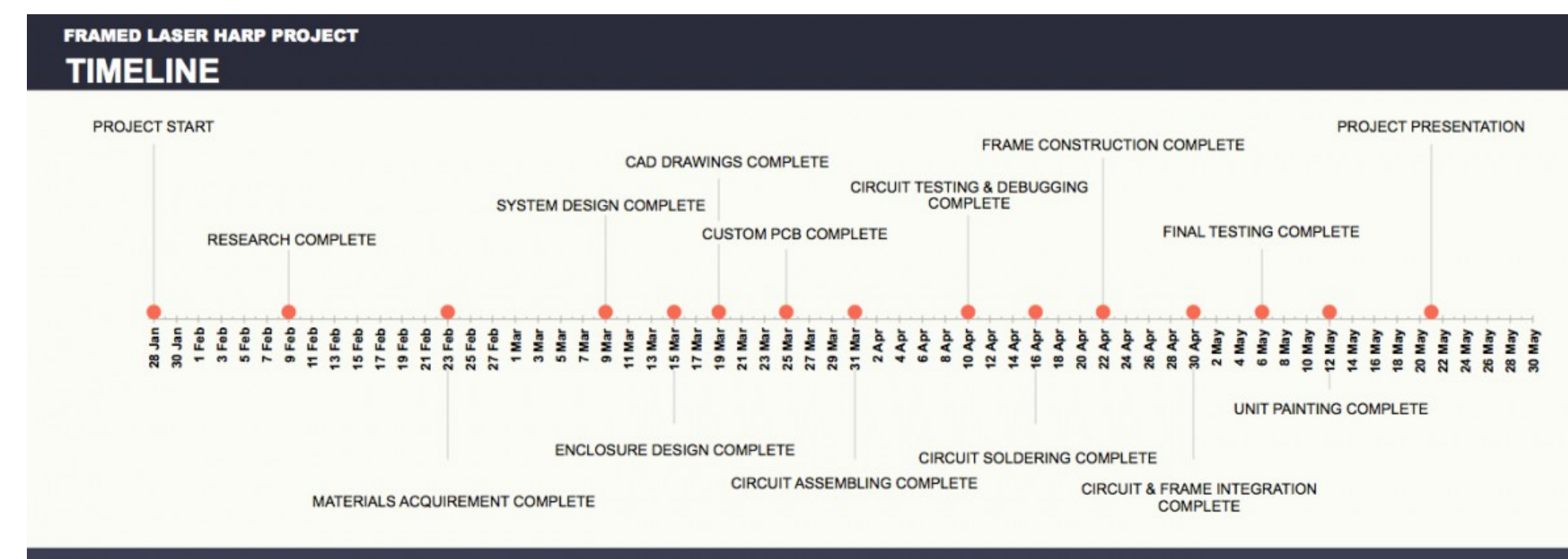
SPECIAL CONSIDERATIONS

- Lasers are dangerous to work with. Appropriate PPE is required
- ILDA laser operator certification may be required, depending on the laser type
- Incorrect attachment of electrical components or modifications to the design could lead to electrical shock or fire.

BIBLIOGRAPHY

Huntington, John. *Show Networks and Control Systems*. New York: Zircon Designs Press, 2012. Print.
Karvinen, Tero, Kimmo Karvinen, and Ville Valtokare. *Make: Sensors.* Sebastopol: Maker Media, Inc, 2014. Print.
Margolis, Michael. *Arduino Cookbook.* Sebastopol: O'Reilly Media, Inc, 2011. Print.
Mims, Forrest M. III. *Electronic Formulas, Symbols & Circuits.* Master Publishing, Inc. 2004. Print
Monk, Simon. *Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards*. McGraw-Hill/TAB Electronics, 2014. Print.
Platt, Charles. *Make: Electronics*. Sebastopol: Maker Media, Inc, 2009. Print.
Waguespack, Curtis. *Mastering Autodesk Inventor 2015 and Autodesk Inventor LT 2015: Autodesk Official Press*. Sybex, 2014. Print.
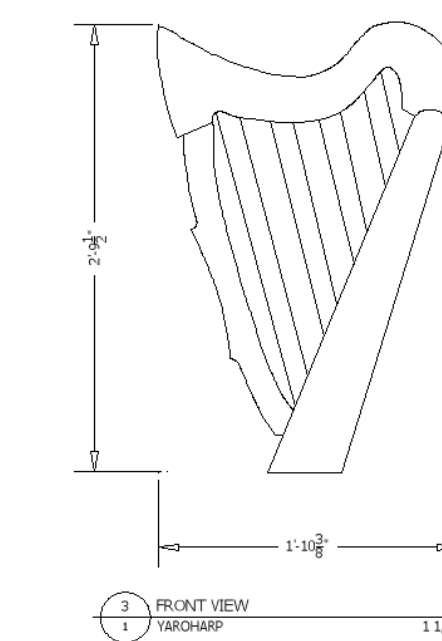
METHODS
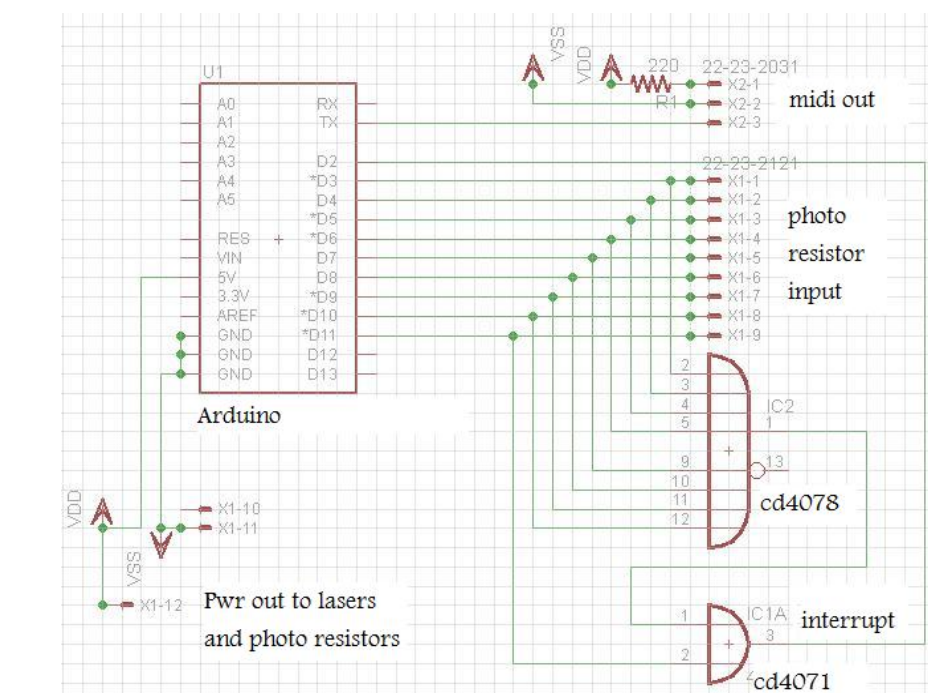
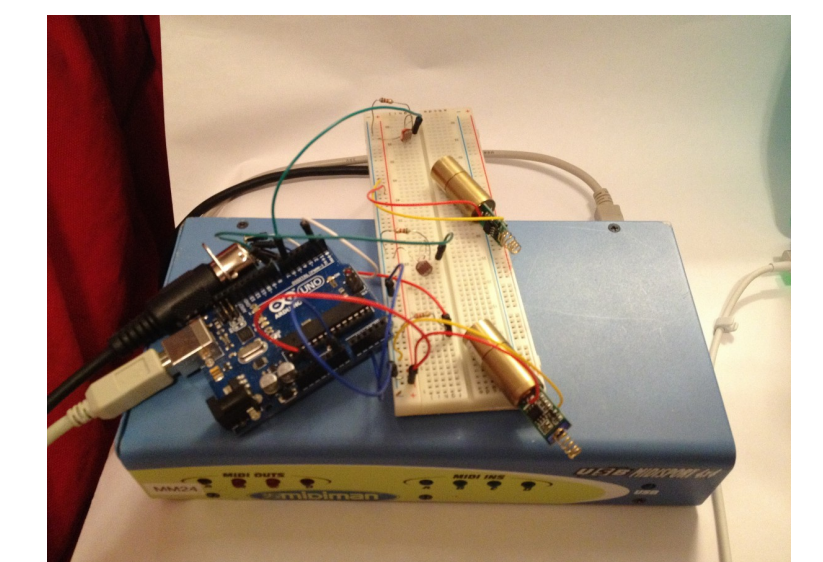Pic. 1.1. *Laser Harp Schematics*
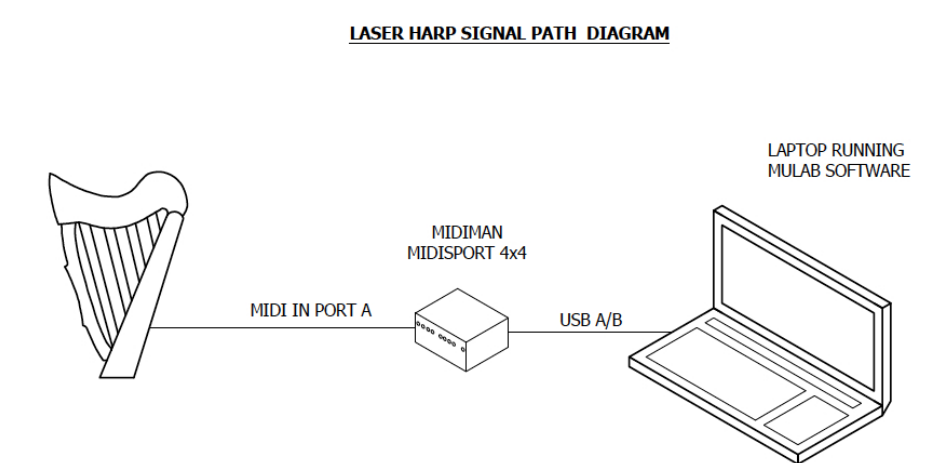
Pic. 2.1. *Laser Harp Signal Path*

RESULTS

Pic. 3.1. *Laser Harp Front Elevation (concept)*

Pic. 4.1. *Laser Harp Enclosure Prototype*

Pic. 5.1. *Initial Circuit Test*

CONCLUSIONS

Laser Harp is a relatively complicated system, which combines different entertainment technology areas together. The final product will show various skills that I acquired in course of my study at City Tech. These skills include, but are not limited to the ability to control various devices using MIDI, ability to use the Arduino microcontroller and to write programming code, ability to build laser harp enclosure using different materials, ability to manipulate automated lighting fixtures, sound software, and mechanical devices through MIDI. Also, the laser harp is extremely attractive visually and, at the same time, is a very challenging project to build.