# Laser Harp

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## Executive Summary

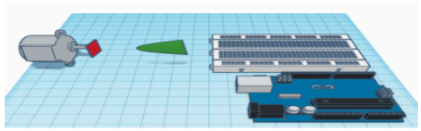
Laser Harp is an electronic instrument mimicking the performance of a string-based harp. Our mission is to replicate the function of the harp with light laser used as trigger points to play the corresponding notes of the harp. This instrument is designed to be highly portable, requiring only a power supply. With this project, we aim to inspire students and musicians to experiment with an electronic device that can play music. This would also pique interest of students in embedded systems and inspire them to pursue interests in STEM majors and projects. Musical educators can use them to teach music in a more interactive and fun way, making their students feel more immersed with the use of their hand gestures. We also would expect professional musicians to adopt devices such as this and others to make performances seem cool and different.

## Background

This project is about a group of UTA engineers coming together to build a functioning electronic device from simple individual components. This device will then be used later to show potential future engineers what they can be made with the skills and knowledge that they will learn while they attend UTA. The goal of this is to convince more people to take a career in STEM oriented fields. This project will also show off the potential and skills of students who complete the UTA engineering curriculum. When this project is completed, it will help draw new students to the school just as sports teams draw new students. A laser harp is electronic instrument that uses lasers to receive input from the musician and plays a corresponding musical note depending on the laser touched. For these reasons, most people will see the laser harp as something unique and interesting, some-thing that they wouldn't see in their normal day-to-day lives. Therefore UTA has decided that this instrument should be used to present the UTA engineering department in a fun and exciting way

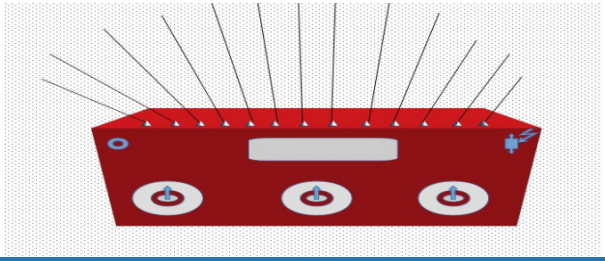
## Experimental Setup

The Laser Harp, or simply the Harp, will be able to play music like a normal harp would, except instead of having physical strings, it will have green lasers that, when interrupted (such as by an end user's hands), will play the tones that a normal harp would. It will have 8 distinct lasers that will play 13 distinct notes, allowing users to play notes in different octaves. As shown in the image below, there will be a mirror (red) attached to a stepper motor (grey). A single laser (green) laser will be pointed at the mirror. The motor will have 8 steps and will go through the steps to give the illusion of having eight laser beams constantly pointing upwards. This set up will be connected to an Arduino and breadboard (shown in the figure). There will be a built-in speaker (not pictured) that is to play the notes when the corresponding laser is broken.



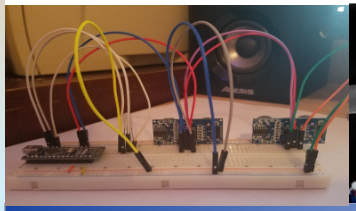
## Experimental Test Plan

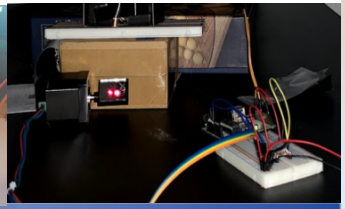
- We had originally planned to meet twice a week at the senior design lab for testing out parts and assembling the Laser Harp
- This proved infeasible given our collective situations due to COVID-19, so we got the parts from the lab and distributed them amongst ourselves for individual independent testing of each part
- Once tested each part then was incrementally added to each other to slowly implement each part into the system
- It was more of a challenge than it would normally be to implement a test plan efficiently, since testing could not be done together
- With our adapted test plan we were able to do the most amount of work with minimal waiting on each other to finish testing their parts
- The original design is shown below. Without access to the senior design lab, we have been unable to 3D print a case.



## Experimental Results

- When testing we decided upon an eight array laser setup. Since we noticed how accurate the sonar sensor is and the limitations of the stepper motor we decided thirteen beams would not be best for our project.
- The sonar sensor works in conjunction with our system to detect the distance at which the hand break the path of the laser. This is the most vital step in determining which note of the harp should be played.
- The images below depict out testing setups at home. On the left we are testing the sonar sensors, while on the right is the testing of the laser in tandem with the stepper motor





## Conclusions

Coming to the end of our project, taking a broad overview, our team is on track to meet our original plans, with some adjustments along the way. Some adjustments we made to improve our project and some were unavoidable circumstances that had to be dealt with as best as possible. Through the year we have been able to take away a lot of important lessons that will be vital to our success in the real world. One important lesson we noticed was "Expect the Unexpected" which is important in a project with mainly hardware and deadlines. In relation to parts, they can malfunction or not work as expected which you need to have quick solutions so your project does not get delayed. In the future we hope to add easier controls to the system such as LCD setting displays or even better parts for a more seamless design. Though we would not have any project without our sponsor, UT at Arlington, they have funded this project to help show off not only Computer Science to others but to show off the skills of our team. Thank you to everyone who had a hand in this project!

## References

-Professor Shawn Gieser

-Sanika Doolani

2020 UTA College of Engineering Innovation Day
April 22, 2020