Laser Strings for Installation in a Harp Sculpture

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Customer Background

In 2012, Irish President Michael D. Higgins unveiled artist Joey Burns' "Yellow Bittern Harp" in Co. Cavan Ireland. After sitting on display for some time, it was moved due to ongoing renovations. Mr. Burns decided that the harp should get a renovation of its own with the installation of a laser string system to make it an interactive piece, and it will find a new home in the Town Hall on display for visitors of all ages.

Problem Statement / Scope of Work

The School of Engineering Technology is in need of a laser string system which will take the place of physical strings in a pre-existing harp sculpture, with 16 laser "strings" for an individual to play.

Designing an electrical system alongside making a physical mock-harp for it to go inside of to test the proper functionality, along with creating necessary documentation for future installation.

Requirements

- Ambient Performance
  - Laser diode must output at least 5% more lumens than ambient light level of room.
- Unintrusive Design
  - System must fit into the harp with minimal alterations and cuts.
- Easy Maintenance
  - Laser diodes must be able to detach from the housing.
- Modular Design
  - The system muse be able to be removed from the harp with relative ease.
- Laser Range
  - Laser diodes must be able to reach the bottom of the harp (1.5m to furthest point).
- Electrical Adaptability
  - Must be able to adapt to European electrical standards.
- MIDI Integration
  - System must utilize MIDI functionality to allow customizability.
- Dimensions
  - System must fit into the existing harp's dimensions.
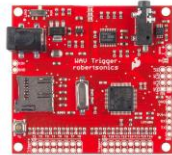
Experimentation and Concepts

Raspberry Pi
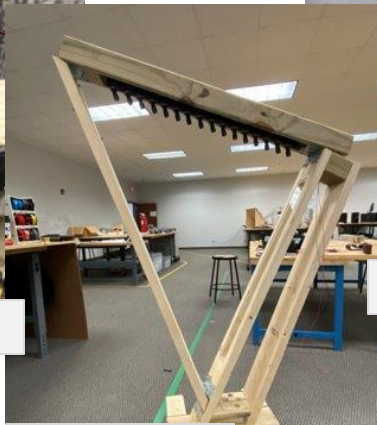
Arduino Due

MIDI

WAV Trigger

Micro-Pivoting Housings

80/20 Aluminum

Final Design

Electronics

Receptor Rail

Laser Rail & Full harp view

FMEA

- Laser diode produces signal
  - Diode lens is unfocused
  - Wires are shorted out
  - Diode is burnt out
  - Loss of system power
  - Misalignment of laser beams
  - Red filters are dirty
- LED provides feedback signal
  - LED is burnt out
  - LED function is reversed
  - Loss of system power
- MIDI produces the correct audio
  - Wires are connected to the wrong ports
  - Misalignment of laser beams
  - Loss of system power

Testing

The extent of our testing came through trial and error or our midi code