

Jump the Moon is a non-profit art studio that makes it possible for everyone to make art despite disability issues. Various pendulums have been used to paint in the past, but these pendulums have not been controllable. The goal of this project was to create a pendulum that uses gravity as the primary driving force and enable artists with all types of abilities to adjust the height and colors released.

- Y-pendulum with variable ratio
- Start and stop painting
- Switch colors while in motion



The wireless remote is run by an Arduino and features an on/off switch, potentiometers, and winch controllers. The on/off switch allows artists to switch all the potentiometer values to zero. When the potentiometers are at zero, the servomotors are closed, cutting off the paint flow of the respective canister. The winches allow the artists to adjust the pendulum ratios.



Mounted in the ceiling at the art studio, the y-pendulum can be controlled to create unique paintings on canvases laid below.

Paint Control

A critical function of this system is the ability to control the level, and color of the paint flowing from the pendulum. To test the control of the paint flow we filled each bottle with paint and tested to see at which angle the servo motor would stop the paint flow. The angle varies from motor to motor because of the slight differences in the gear alignment and the connectivity of the arm with the roller. Pinpointing the correct angle is an important step to ensure the paint flow can be controlled without overworking the servomotors. Once each servomotor was tuned to be able to stop the flow of paint without, this angle was set as the maximum value for the potentiometers. The servomotors were also tuned to open just to the point that the tubes are fully expanded, this ensures that each point in the potentiometer creates a difference in the paint.

Shape Distinction

The purpose of choosing a y-pendulum over a single string pendulum is to give the users the ability to make distinct shapes by changing the ratio of the y. A normal painting pendulum uses one line, and in correlation, one plane of movement. The y pendulum is restricted by both the circular motion of the regular pendulum portion on the bottom, and the back-and-forth movement of the y portion on top, creating unique shapes that vary with the ratio of these two sections. To ensure that our design met this requirement we attached a pendulum head to our system and picked a random y ratio. We then swung the pendulum and allowed it to paint. Then we changed the y ratio and repeated the test. From this we found that our product can produce distinct shapes by varying the y ratio.

Lessons Learned

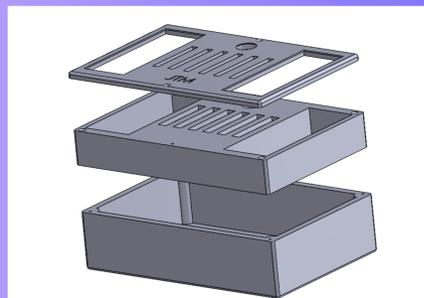
Throughout the span of this project, our team learned to utilize our different areas of expertise to translate customer desires and requirements into a functional product. We found that by including the customer throughout the different iterations of the product, we were able to more quickly and accurately converge on the form of the final product and deliver the customer an item they are satisfied with.

Room for Improvement

Like any design, there are improvements that could be made. The biggest feature we would have liked to have iterated more is the remote control. The controller we made is a basic product demonstrating function over form. This was done because throughout the project timeline our sponsor continued to discuss how they would like to improve it in the future with assistive technologies, which was not within our capabilities given the timespan of the project. By providing the most basic remote form now, the sponsor will more easily be able to adapt it to whatever avenue of technology they prefer in the future without having to recreated an overcomplicated system.

Conclusion

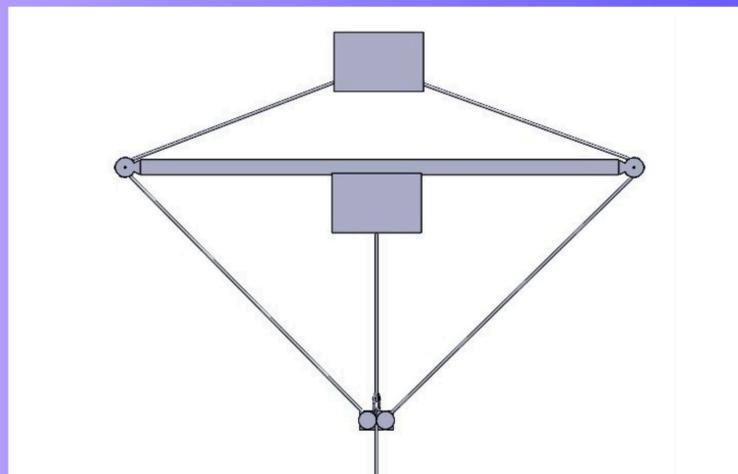
The Remote Controlled Painting Pendulum made for jump the moon meets all customer requirements and constraints. The device was required to have the ability to modulate the flow of a variety of liquids demonstrating a myriad of viscosities as well as be raised and lowered at two distinct points, controlled by a wireless remote while being safe to operate. The device had to operate in an accessible area of an art studio, be visually appealing and be able to be stored out of the way when not in use. The flow modulation of liquids was designed through multiple iterations of a pinching servo design; beginning with a cam method, moving to a channel and ball method, and eventually resulting in the use of a roller against a wall (seen to the left). The use of two winches creates the variability in the y pendulum design and allows the pendulum length to be retracted into the winches when not in use, creating a unique ceiling fixture and allowing the pendulum to be stored out of the way of the studio. To create a safer environment when the pendulum head is swinging, it was determined that the metal cable in the winches would be replaced with paracord. The pendulum head was then fitted with all necessary subsystems for functional paint flow and painted by our sponsor to be visually appealing. The electronic functions of the design are run through Arduino boards and transceivers, creating a customizable painting experience without the need to physically connect to the pendulum itself.



The remote casing is made of three parts – the electronics housing, the slider and switches placement, and a lid to tidy up the look and hold the components in place.



The paint flow regulation system utilizes servomotors and rollers to pinch the tube based on the potentiometer value.



The y design of the pendulum adds a second axial plane of movement restriction, creating unique paint designs. Two lines connect to the winch controlling the y aspect of the pendulum. These two lines are strung through pulley wheels on either side of the pendulum and then down through the dual line pulley to the pendulum head. This dual line pulley is hung from the other winch, allowing the user to adjust the location of the axis point.



The custom pendulum head features six paint containers to hold the primary colors, black and white, and water. By controlling the flow from each of these containers, a wide variety of paint colors is possible.