

Ontario Christian High School

# Principles of Engineering

---

## Technical Report

Mini Industry Challenge: Final Phase

Scott Aznoff, Joshua Grunder, Joshua Mulder, Ethan Yeh, Austin Drown, Russell Peterson, Ryan Price, Jordan Moss



Submitted to: Mr. Sifuentes

Submitted by: The Class

Submitted on: February 7th, 2025

# Table of Contents

<b>Abstract</b>	<b>2</b>
<b>Introduction</b>	<b>2</b>
<b>Design Process/Brainstorming/Research</b>	<b>2</b>
<b>Final Product Description</b>	<b>6</b>
<b>Testing and Evaluation</b>	<b>8</b>
<b>Reflection and Challenges</b>	<b>8</b>
<b>Future Recommendations</b>	<b>8</b>
<b>Conclusion</b>	<b>9</b>
<b>References</b>	<b>9</b>
<b>Appendices</b>	<b>10</b>

# Abstract

After successfully completing the brainstorming and prototyping phases, we needed to create a final product for the drama production. Our prototype demonstrated that the main component of the entire system, the spring loaded magnets, could be successfully controlled by a remote control servo and drop petals. Our main goals for the final product were to enhance the aesthetics in multiple aspects, optimize issues we encountered during the prototyping process, and complete it before the deadline of February 7th.

# Introduction

In the Mini Industry Design Challenge, our team was tasked with designing a prop rose for the Beauty and the Beast Musical, set to take place in February. The rose must have petals that can be remotely triggered to fall. Since this is a product for a Drama production, the rose must look aesthetically pleasing, and be visible from anywhere in the auditorium. At the start of the project, we outlined our main objective: to create a prop rose that not only met the requirements for the drama production but also went above and beyond to stand out by making creative additions to enhance the final product (ex. dynamic lighting, larger-than-life, etc.).

# Design Process/Research/Brainstorming

The first few days were spent outlining how we would design the product. The first step

of our design process was to brainstorm ideas individually; each member of the team came up with 2-3 ideas, and then we combined certain aspects of our ideas to create our final design idea.

One problem we had when brainstorming was trying to choose what technique to use to make the petals drop. We took ideas from a website made by Steve Murch, which contained detailed steps for how to build a prop rose. His original design employed the use of magnets with servos, but he also made a second design that used air pumps instead.



Steve's original design ([image credit](#) - Steve Murch)

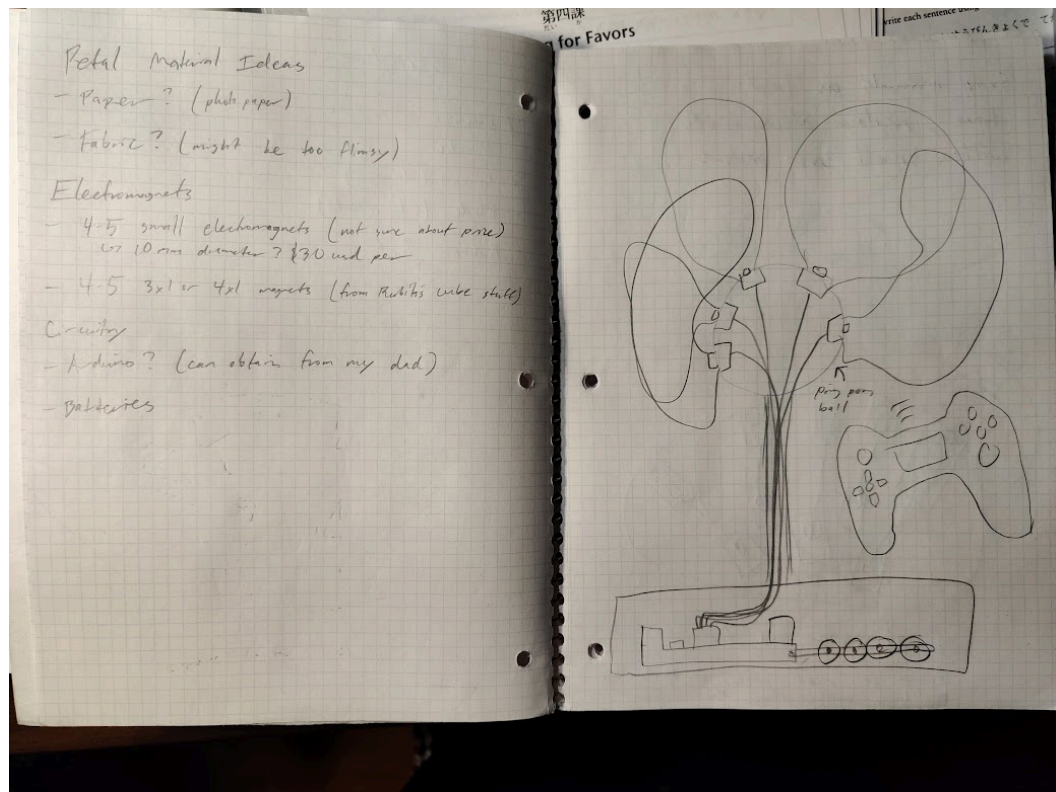
From his designs, we came up with 3 options: electromagnets, servos with spring-loaded magnets, and air pumps. Originally, we were going to focus on using electromagnets to drop the petals, but we ran into a problem: electromagnets would have to be constantly active for the petals to stay on. All of the electromagnets we researched could only stay on for at most a minute or two before they overheated or failed. This was a large problem, and we decided to

abandon the electromagnet idea. The second option used normal magnets rather than electromagnets. Magnets are attached to strings that are pulled by servos located in the base of the flower. When the servos pull the strings, the magnets are pulled inward and become unattached to metal in the petals, causing them to fall. This idea is more power-efficient compared to the design that uses electromagnets because it only requires power when the motors are activated rather than needing to sustain a constant current. The third option was to use air pumps to push the petals outward. This design has fewer moving parts, thus lowering complexity, but we chose the magnets and servos because of the aesthetic appeal.

During the prototype phase, many key decisions were made. For the brains of the prototype, we initially decided to use a Raspberry Pi. Mr. Yeh came up with a better idea, to use parts from a remote control airplane. This was way more practical because it didn't require a whole computer and code to run; all of the parts worked together out of the box. It requires less space for batteries because the original design required 2 AA batteries per servo, plus 6 batteries for the Raspberry Pi, but the RC design can power up to 8 servos, along with the signal receiver, with a small LiPo battery. It fits what originally required 14 AA batteries and a relatively large brain part into a package the size of a 2x4 lego duplo brick.

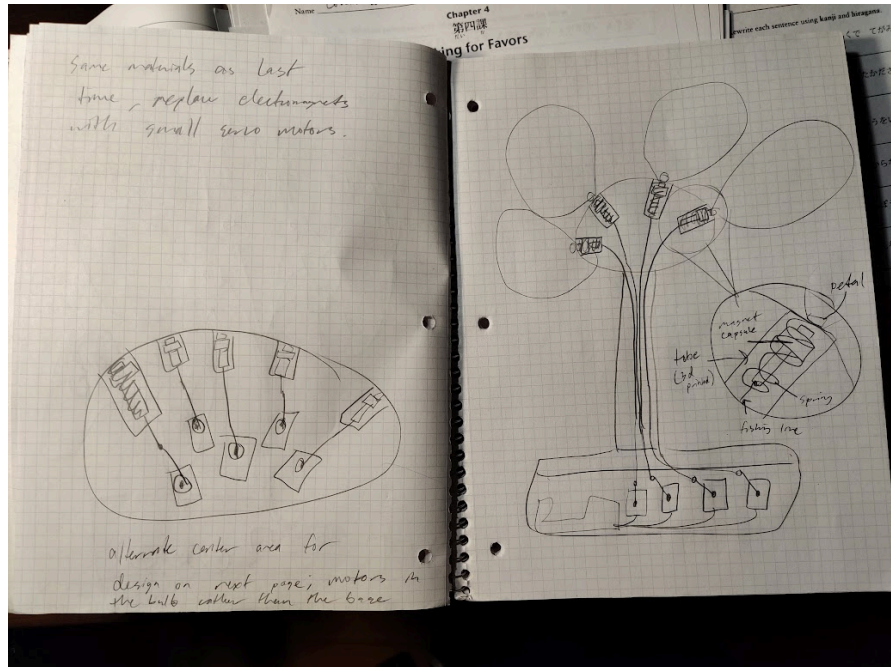
In the final product phase, because all of the mechanics worked, our sights were set on what the audience would see: the aesthetics. First, we made the stem curvy to simulate the organic shape of a rose. A couple of small iterations, and we had a final stem and we tested to make sure the fishing line could carry tension through curves, which worked. We wrapped the stem in floral tape. Alongside this, the aesthetics department researched solutions for lights to go along the base and stem. Then the bulb was modified to be more accurate to a real rose. Several

features were added to the base: turf was placed around the bottom of the stem, bark was glued around the perimeter of the base with help from the Skilled Trades students, and we faced a problem with the LED lights. They needed to be remote controlled, but when the receiver was in the base, the signal from the remote could not reach. To solve this problem, we added 2 holes so that the lights could surround the rose stem, and the wire would run from the stem through the base to the area behind the base, so we could access it backstage. During the performance, the lights are to be on the entire time and when the last petal falls, the lights turn off. This solution should allow us to turn off the lights from backstage.

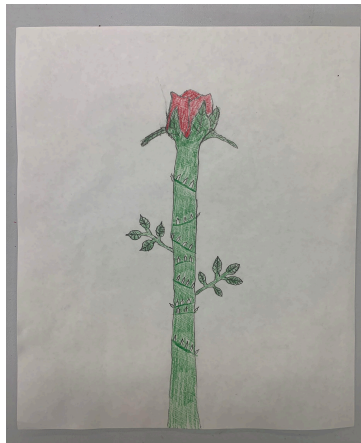


Electromagnets Design - Initial Sketch





Servo Motors Design - Initial Sketch



Aesthetic Design by Josh

## Final Product Description

Our final product is a remotely controlled, aesthetically pleasing, petal dropping rose

Aznoff, Drown, Grunder, Moss, Mulder, Peterson, Price, Yeh

designed for the production of Beauty and the Beast. The plot requires petals to fall off the rose at specific times throughout the play. These can be controlled via a remote control. There are LED lights on the rose that will be active for the entire play, and can be shut off from backstage, sort of remotely. The product has gone through several refinement stages, and we are confident that it will function well for the play.

The design can be easily transported and shipped for marketing purposes, although the glass dome may be particularly fragile when handling. If this were to be a product that we sold, it would probably be shipped in separate pieces (i.e. the base separate from the stem, and the bulb in multiple parts) so that the customer can fine-tune the mechanism on their own. Shipping could damage the fishing line, so leaving that for the customer to handle is a valid option. We could probably sell this for a couple hundred dollars, although ordering the parts to construct may be a whole different problem. Our design is not optimized for mass production because that wasn't among our main criteria when creating it.



Improved Aesthetics, unfinished



## Testing and Evaluation

Many of the distinct features of the rose were tested separately before it was assembled to ensure efficiency. The stem was 3D printed with an organic curve and split into sections to ensure that the fishing lines didn't interfere with each other when the servos were activated. We tested this with the fishing lines and could feel an equal tug from the end opposite to the one where the tug was initiated. For the LED's, the receiver would not receive the remote signal when it was in the base, so we solved this problem by taking the receiver outside of the base.

## Reflections and Challenges

There were many challenges in this project that we had to overcome. Fine tuning the shape of the petals through bending the staples took some time, as the petals would only fall if they were the right shape. Adjusting the servo motors also proved to be a challenge, because some of the times during testing they wouldn't go far enough down to disengage the magnetism. Finding the right lights to match the effect we wanted was difficult. The first ones we ordered were inaccurately advertised and were Christmas colored rather than white, so we had to return those and find different ones. Despite the challenges, I believe that we have made a successful product and that it will improve the magical effect of the play dramatically.

## Future Recommendations

Our design functions well for its purpose. However, for an industrial product, it's difficult to receive parts, assemble, and transport. Future designs could improve its ability to ship in one

piece, or allow it to be shipped in multiple pieces and have a pain-free customer assembly process. Another issue was the fact that there has to be backstage access to turn the lights off. We could create a way for the lights to be controlled from the same remote as the servos for simplification, with the same range as the servos.

## Conclusion

After the prototype proved successful, all we had to worry about was the aesthetics. The design was fully functional, so we just needed to make it look good, which was our second most important criterion. Many improvements were made to create the magical feeling Ms. Berniklau needed for the play, and we are all pleased with how it turned out. It should function well for tech week, and give the overall play a nice touch.

## References

Murch, S. (2023, January 1). *Build your own enchanted rose prop*. Steve Murch.

<https://www.stevemurch.com/build-your-own-enchanted-rose-prop/2018/02>

Murch, S. (2024, June 17). Enchanted Rose 2.0 with falling petals. Steve Murch.

<https://www.stevemurch.com/enchanted-rose-2-0/2023/01>

# Appendix

**MR. YEH** - He helped out a ton with the electronics and the actual transmitting/receiving aspect of the design. This most likely would not have been possible without him and his ideas.



Gantt Chart ([link](#))

Part(s)	Cost
Mini Servos (10pc)	Free (Ethan can supply)
Fishing Line	Free (Scott can supply)
Springs	Free (Ethan can supply)
3D Filament (green)	\$15 on <a href="#">Amazon</a>
Raspberry Pi	Free, on the condition that it is returned after the show (Ethan can supply)
Glass Dome	\$52.50 from <a href="#">here</a>
Wooden Base	Contact Woodshop
Fake Rose Petals (giant rose)	\$35 on <a href="#">ebay</a>

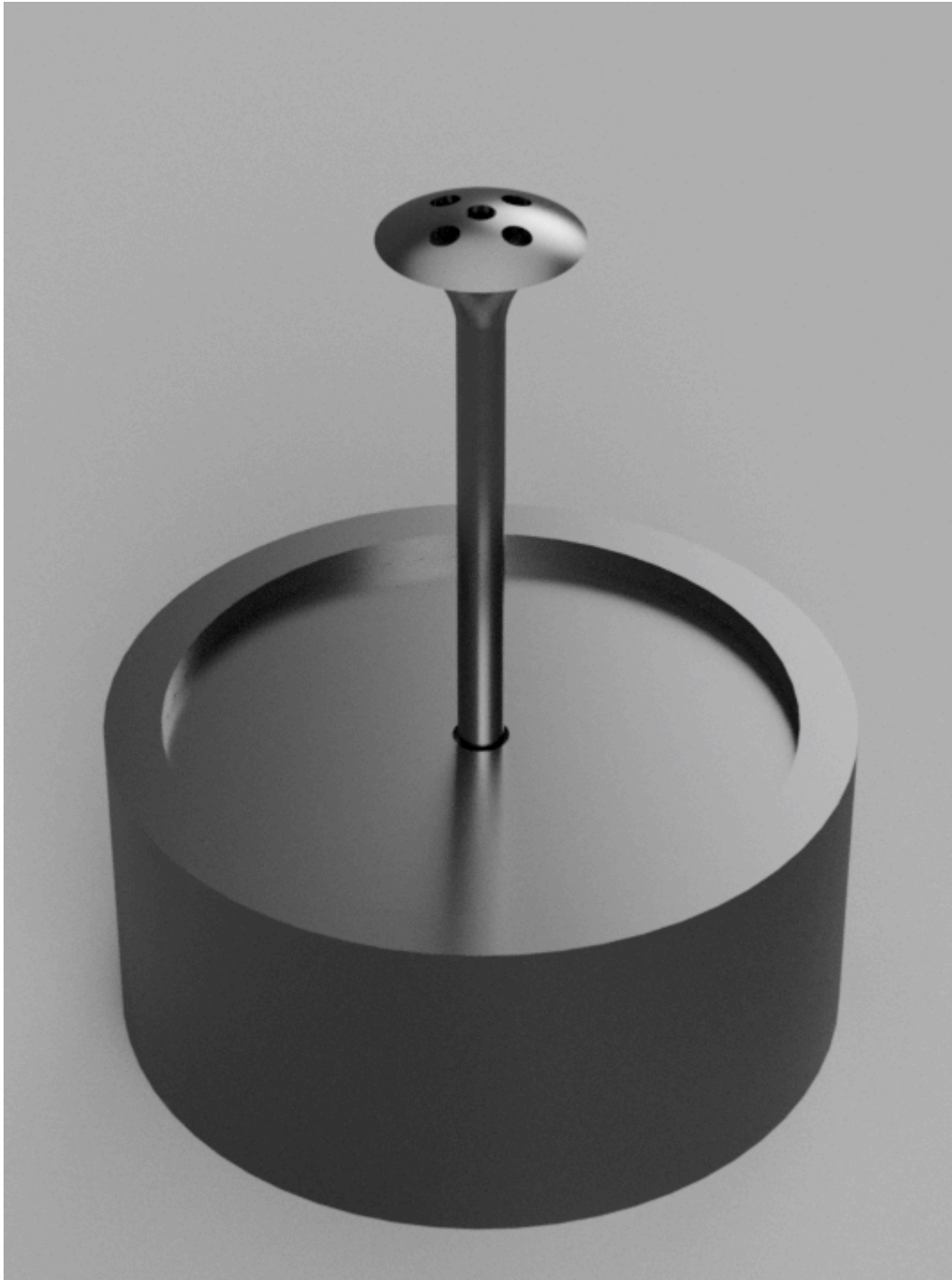
prop to steal petals from)	
Neopixel lights	\$50.85 on <a href="#">adafruit</a> (exact same as stevemurch)
Rod Magnets (12 pc)	\$11 on <a href="#">amazon</a>
Rubber Thread Caps (assorted)	\$5.50 on <a href="#">amazon</a>
Total	\$160 ± \$10.00

### Cost Analysis

3D model images



3D modeling the rose

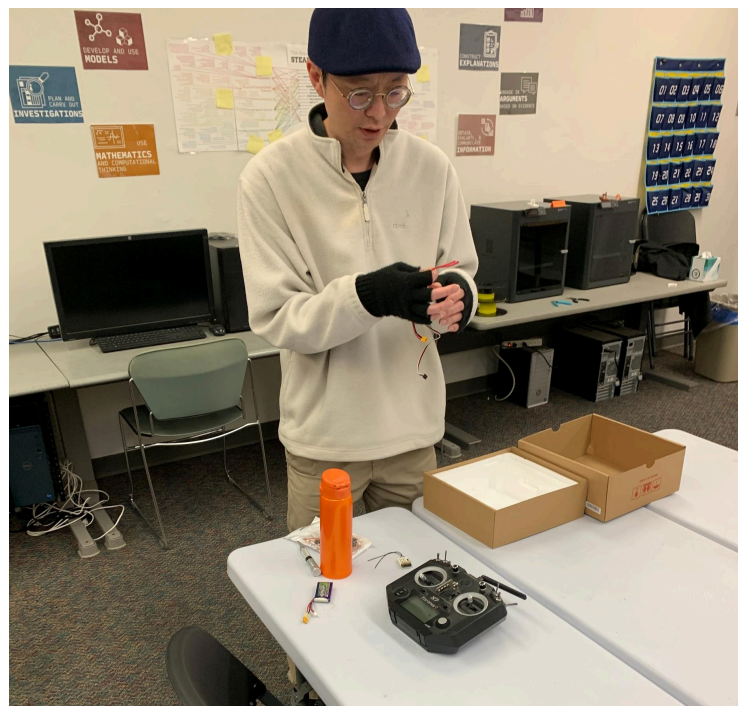


3D model render





Mr. Yeh showing us the Raspberry Pi



Mr. Yeh showing us the RC system



RC system



Fine tuning the magnet capsule

