

**VEX VRC - 2022 / 2023**  
**Reverse Engineering Online Challenge**  
**Summary Support**



**Sloan Canyon Robotics**  
**Team No. 74177M**  
**Henderson, Nevada**

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# 1. Introduction

Our team, 74177M consistent of ten (10) members. Our team has an on-going joke about something called a wild dancing cactus. This cactus dances to different songs and has the ability to repeat phrases you say in a mocking tone of voice. This dancing cactus is very similar to many animatronics we see around the holidays. Have you ever seen one of those singing snoopy characters? They might look simple but theres a whole complex electronic system allowing the fun dancing characters we love.

Then we came across the reverse engineering challenge. We took this challenge to help our team understand the inner working of the hilarious dancing cactus. For this challenge we considered were an iphone 8, a TI38 calculator, a multimeter, and a HP chromebook computer.

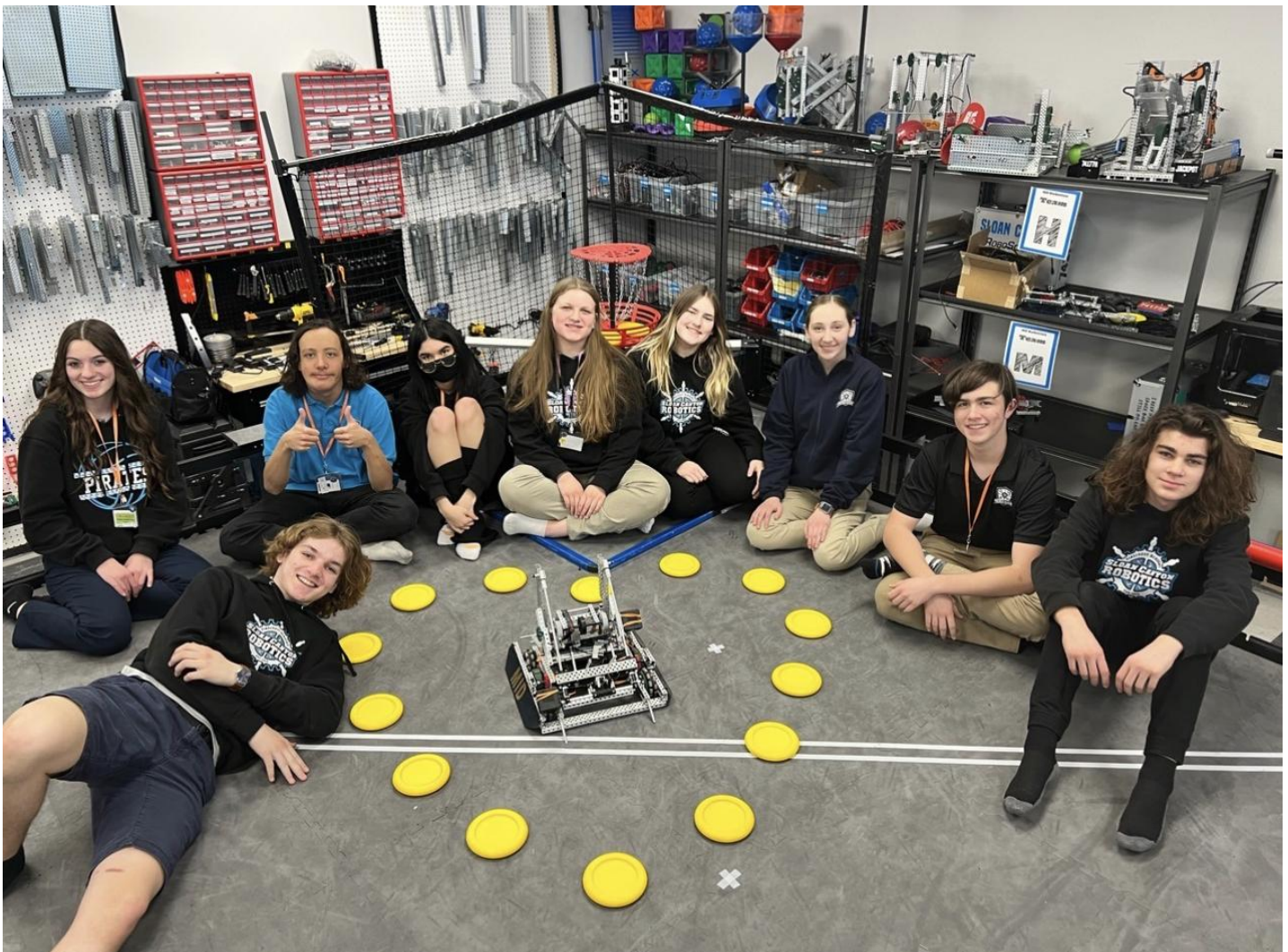
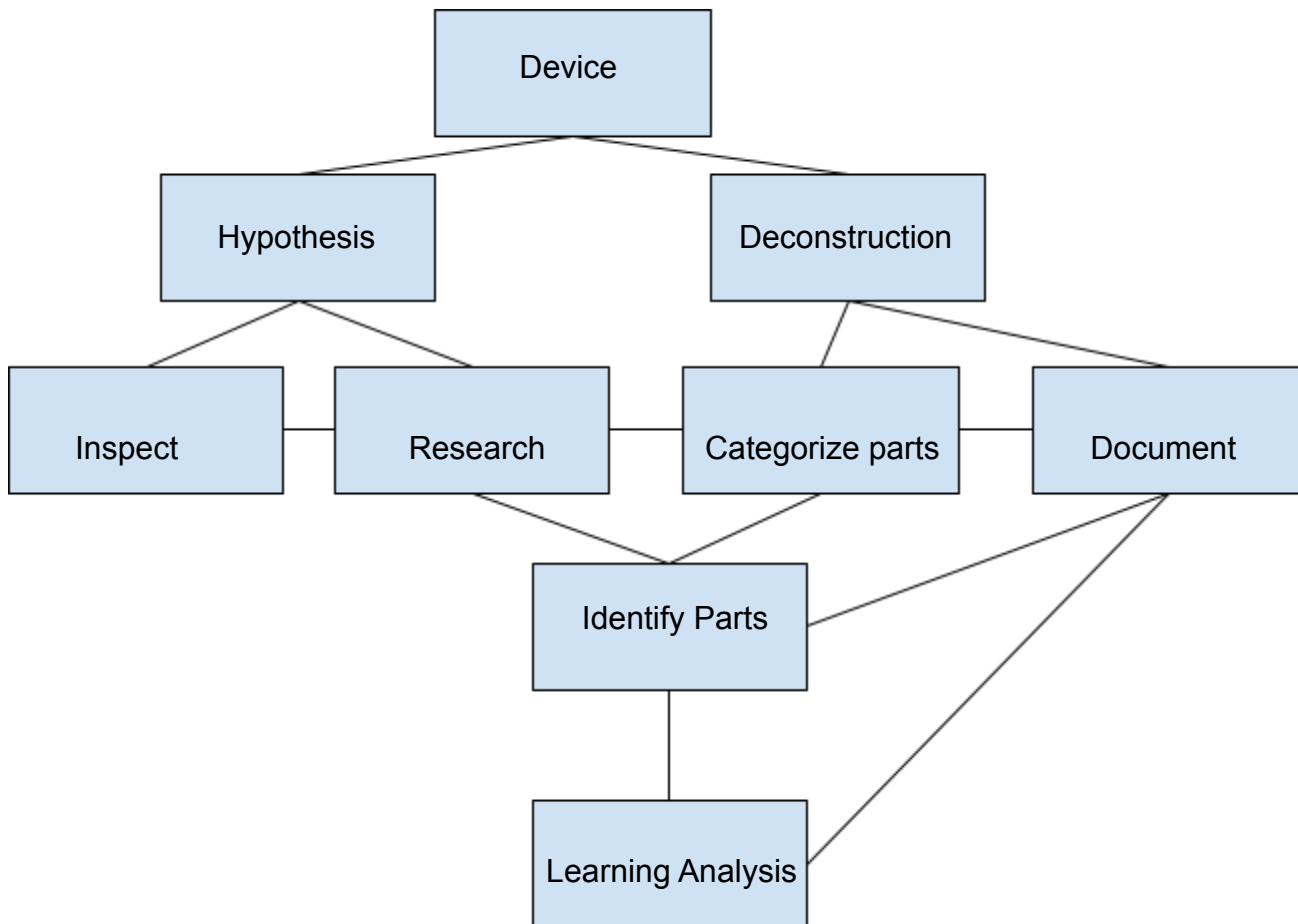


Figure 1: Team Image

## 1. Approach



*Figure 1: Reverse Engineering Plan*



## 2. Disassembly



Figure 2: Intact Cactus



Figure 3: Cactus with upper shell off





Figure 4: Bare Cactus



Figure 5: Support Tube detached

## 4. Device components

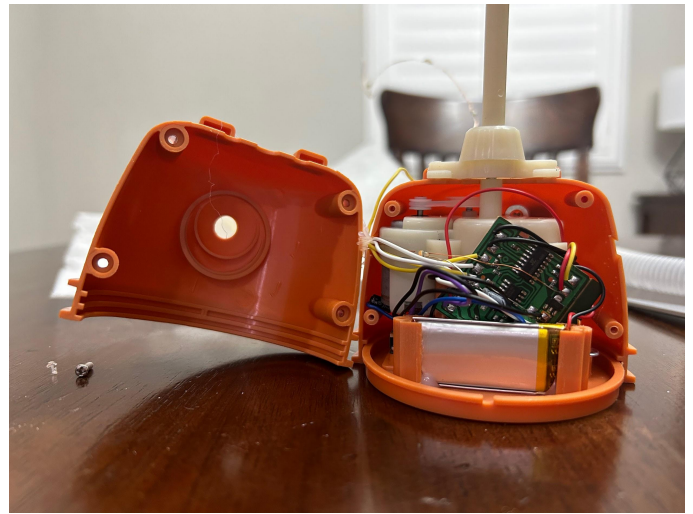
### 4.1 Un-electrical devices

Device	Image
<p><b>Structure Support Tube</b></p> <p>This rod holds the structure of the cactus and is connected to the actuating rod, which causes it to move.</p>	
<p><b>Actuating Rod</b></p> <p>This rod directly connected to the DC motor. This rod initiates the movement of the cactus.</p>	



## Outer Casing

Protects motor, motherboard, and speaker. This also acts as a base for the Cactus and its pot.



## Gear system (Gears, shafts, Gear casing)

Gears: Provide torque to the motors spin.  
Gear ratio - 189:3,584

Shaft: This is what holds and is connected to the pulley system so the gears spin.

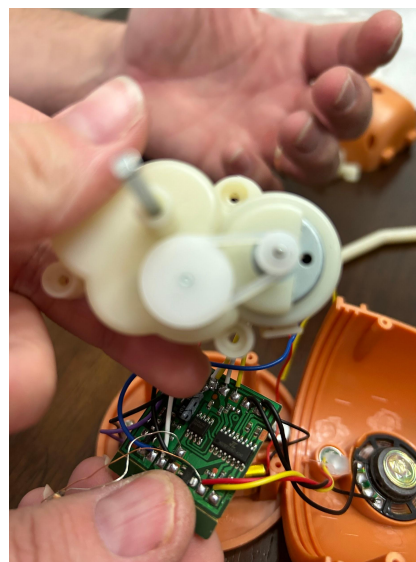
Gear Casing: This protects the system and keeps everything in place.



## Pulley system (Sheaves and drive belt)

Sheaves: Connected to the motor and gears to make both systems move at the same time.

Drive Belt: Connects both Sheaves to make them move together.



## 4.2 Electrical Devices

### Rechargeable Battery

This battery provides power to the whole system and connects to the main powerboard.



### Recharge port

Port used to plug in cord which is able to recharge the systems battery.





### On/Off switch

Switch which is used to turn the system on and off.



### Microphone

Listening device that translates to the speaker of what to repeat back to you.



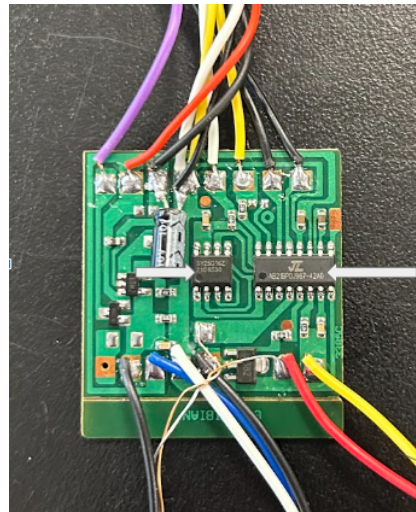
## Speaker

Used to project music and repeat voices.



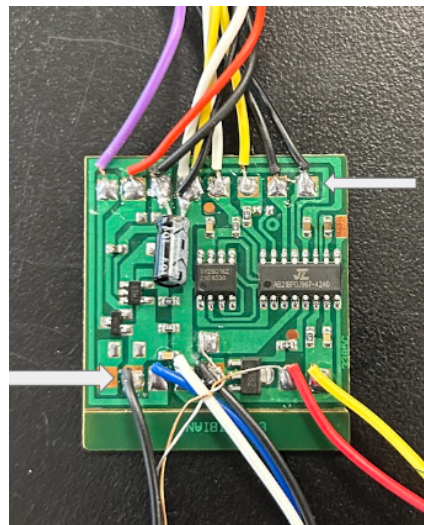
## Silicone Chip

Is the brain of the circuit board and is responsible for communicating and storing all programs.



## Connection Point

Connects the wires to the circuit board



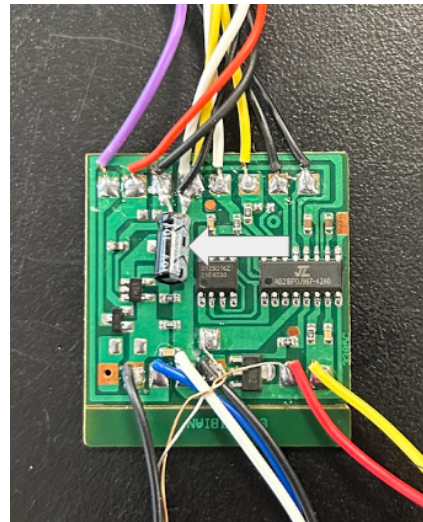
## DC motor

Is the start of the systems movement.



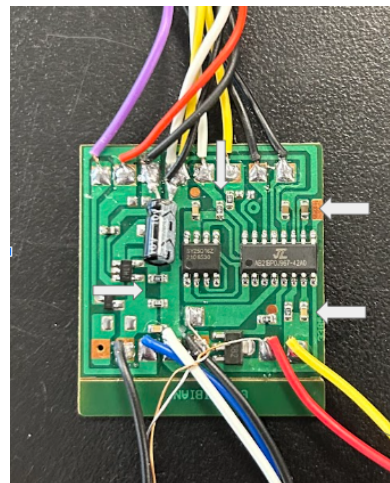
## Capacitor

Capacitor #1 (To DC motor)  
Capacitor #2 (To motor and switch)  
Holds charge to help protect the motor.



## Fuses

Protects the circuit board and wires in emergency overheating it will melt to break connection and save the rest of the circuit board.





## 5. Summary Report

### 5.1 Findings, lessons, and further questions

In total the dancing cactus consists of 15 parts. While trying our best to research all parts but found some trouble with the circuit board. It seems to be produced by some chinese company. Any research we tried led us to an asian shopping website.

One Main thing we should do the next time we attempt this challenge is research the circuit board and start a few months later.

Here are three things we learned that we can apply to our competitive robotics class:

1. How to read and identify the parts of a circuit board
2. To see the complete part display some mechanisms must be completely destroyed.
3. Taking things apart will help you develop a logical understanding of how you favorite electronic devices function.

Why did you chose the dancing cactus?

Our team chose to deconstruct the dancing cactus because it was something all ten members of our team was curious about. It seemed as if all our other options some members has some experience with. Although no one from our team could name and recognize every part in the dancing cactus. This challenge would represent a learning experience for all team members.



# References

(E. Czarnecki, Personal Communication, January 8, 2023)

How to Read Circuit Boards and Identify Components [Solve],  
<https://www.pcbonline.com/blog/how-to-read-circuit-boards-and-identify-components.html>.