Ctrl+Alt+Elite

(Team #3276)

Robot design and innovation presentation

Our Team!

Daiwik

Aaron

Yohan

Sophia

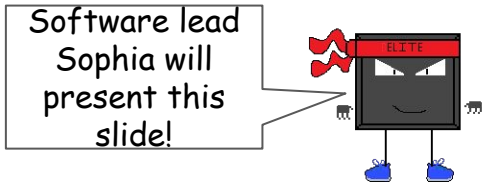
Illyanna

Michael

Innovation Project

Ocean Acidification

By: CTRL-ALT-ELITE



Ocean acidification harms marine life by:

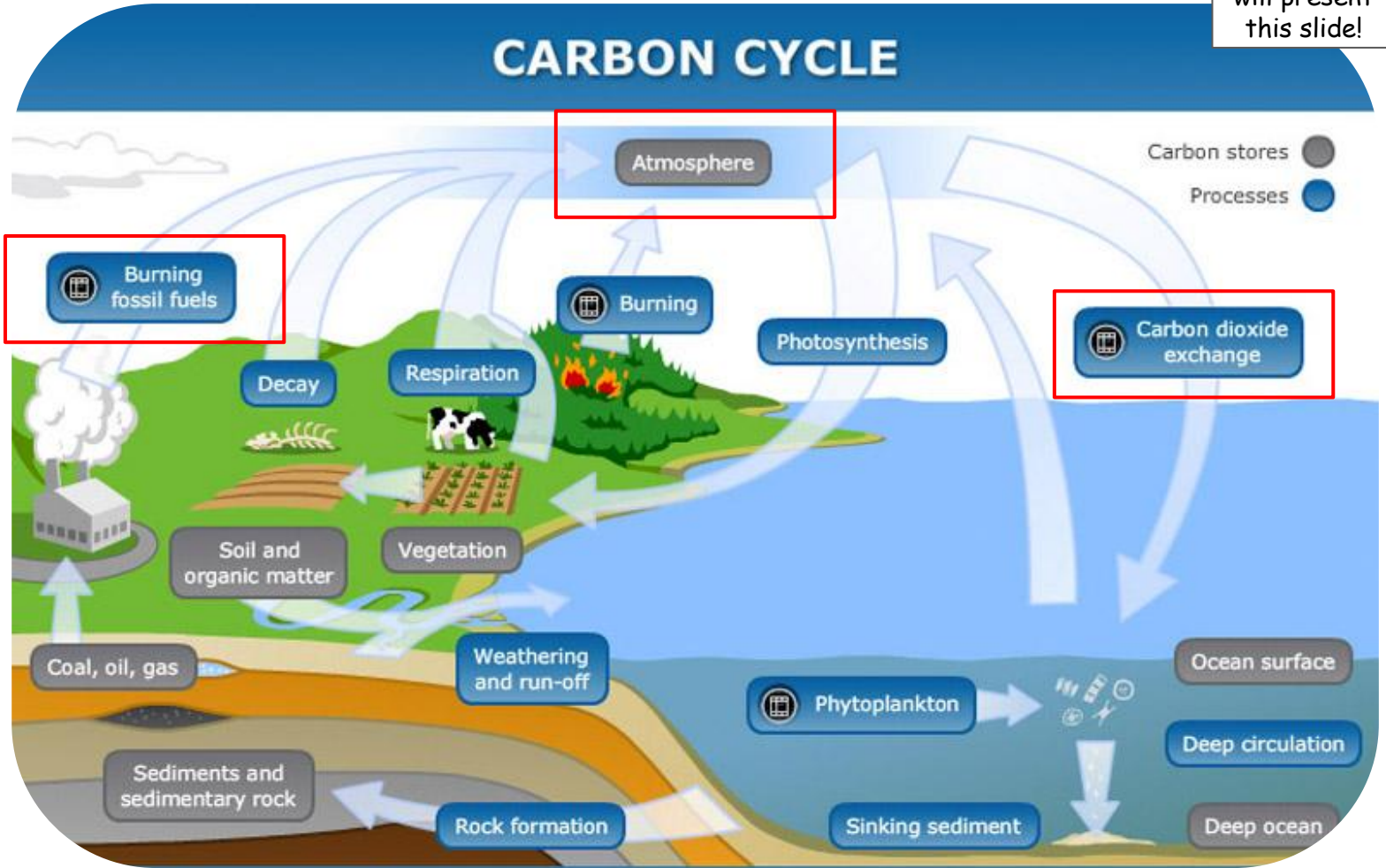
- Many marine species will die due to ocean Acidification.
- It is caused fossil fuels being burned, producing Carbon.
- Carbon will flow into the ocean as the ocean interacts with air.
- Excess Carbon will result in the death of many marine animals and plants.
  - Impacts fishing industry.
  - Kills species before explorers can explore them.

Examples of healthy reefs.

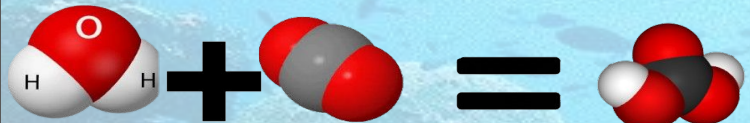
Example of reefs affected by ocean Acidification

How the Carbon Gets in the Ocean

Software lead Sophia will present this slide!

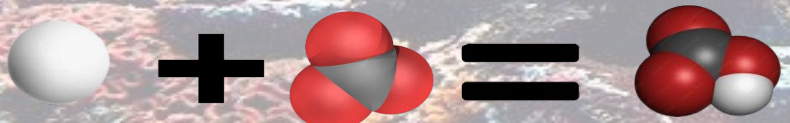


The Process: The Chemistry

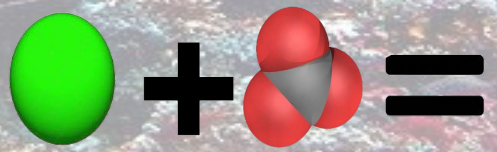


Water + Carbon Dioxide = Carbonic Acid

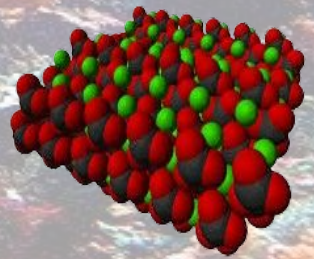
Carbonic Acid − Hydrogen = Bi Carbonate + Hydrogen



Hydrogen + Carbonate = Bi Carbonate

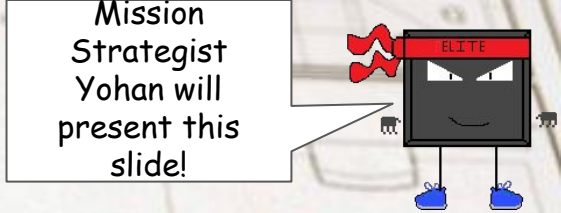


Calcium + Carbonate =



Calcium Carbonate

Our Solution



De-Acidification Plant (DeAP)

- Sits on the coasts of reefs.
- Intakes low pH water and outputs high pH water

The Process of Designing a Solution

- Pumps lead back to the pump house which will contain chambers for electrolysis and the gas chamber

Gas pipes (takes the Hydrogen gas from the electrolysis cells and brings them to gas chamber.)

battery (stores energy to supply for pumps and electrolysis)

Electrolysis cells
(where the hydrogen becomes Hydrogen gas)

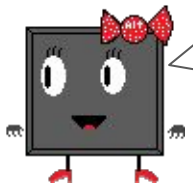
Input pumps (uses centrifugal pumps to bring water with a low ph into the electrolysis cells.)

Hydrogen fuel cell
(Converts the hydrogen into energy to power the batter)

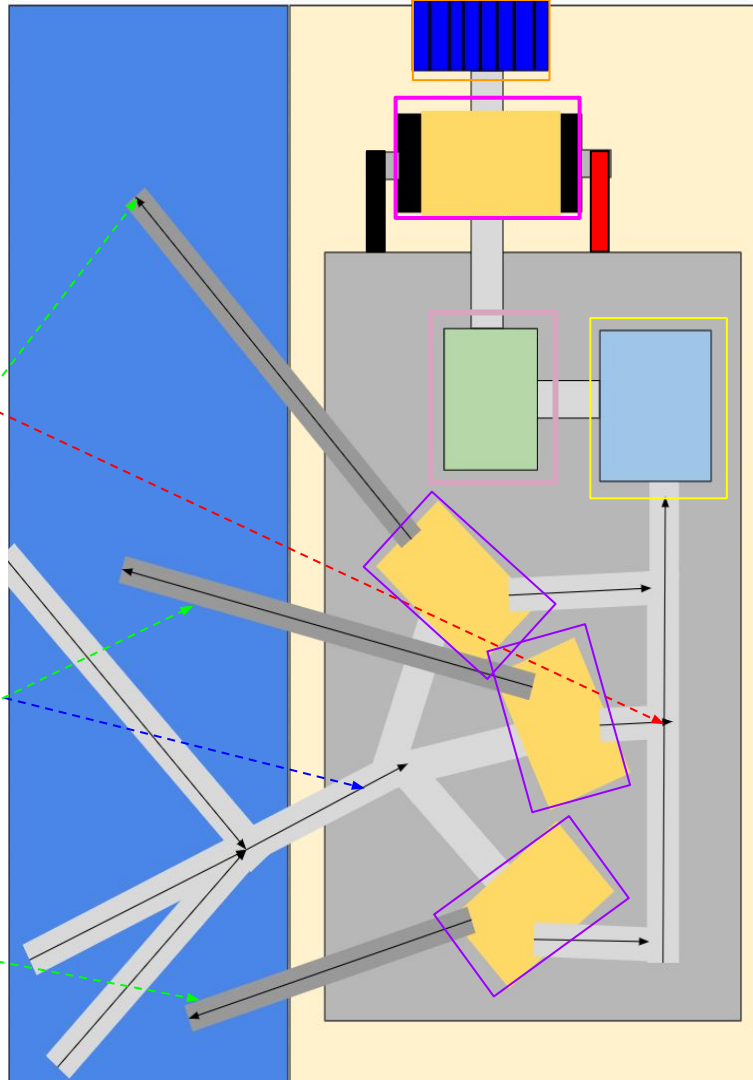
Gas Chamber (Contains the hydrogen H_2 produced from electrolysis and leads into hydrogen cell.)

Output pumps
(takes water that has had the hydrogen removed and is a higher ph and put it back out into the ocean)

Solar panels
(supplies the battery with power using the sun)



Innovation lead Aaron will present this slide!



Electrolysis cells

Water Pipes in
(Brings water from the oceans to go through electrolysis.)

Water containers
(Holds the water and is open on the top to allow H_2 to get out)

Water pipes out
(Takes water out and back into the water after Hydrogen being removed.)

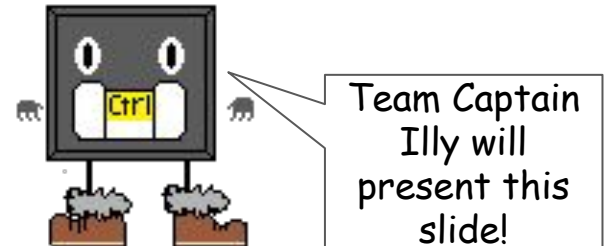
Cathode
(Attracts Positive ions and is negatively charged in water like H^+ also turn H^+ into H_2)

Gas vacuum
(Sucks up hydrogen gas from cathode and moves it into Gas chamber)

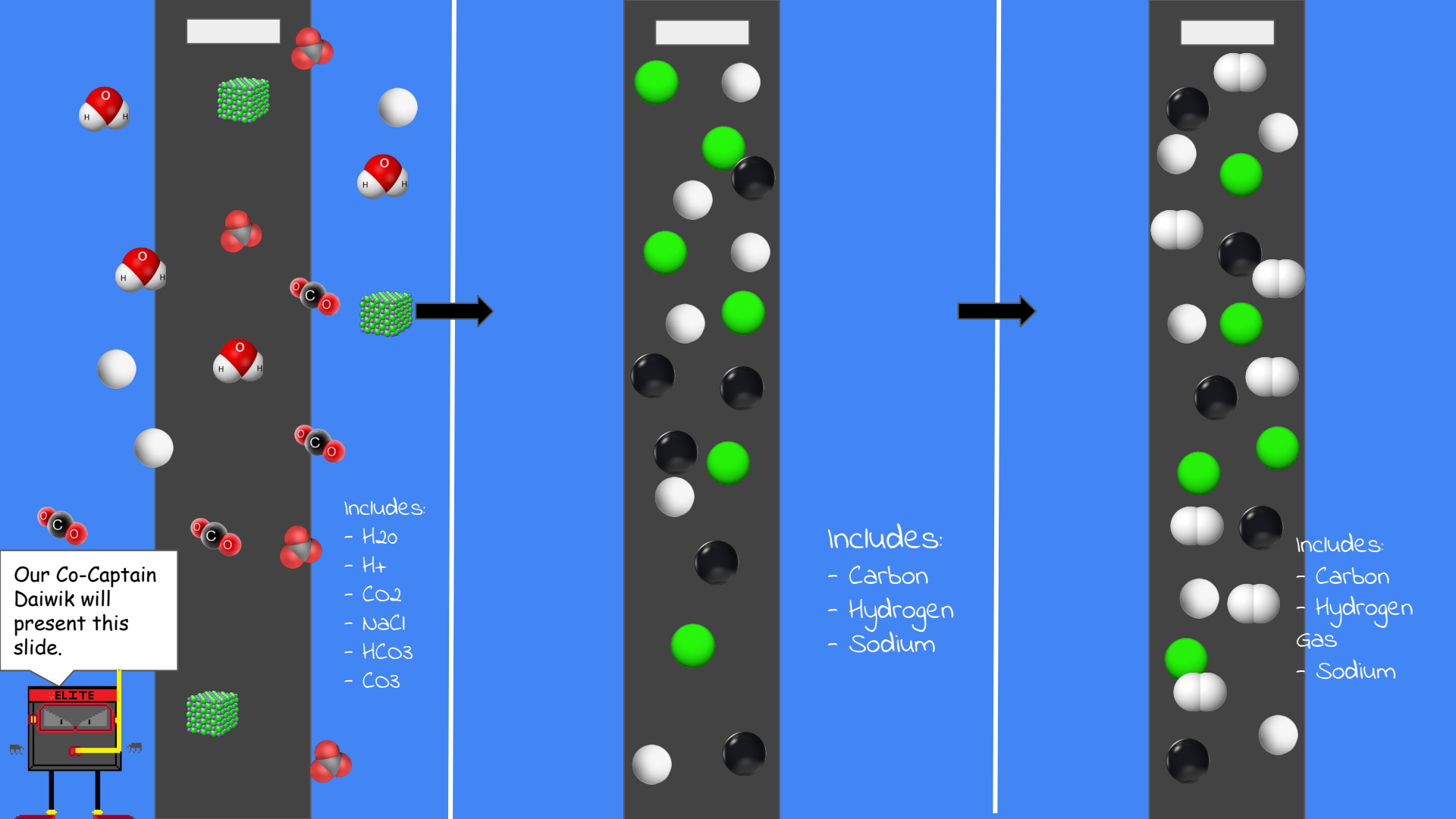
Anode
(Attracts negatively charged ions from the water)

Centrifugal Pump

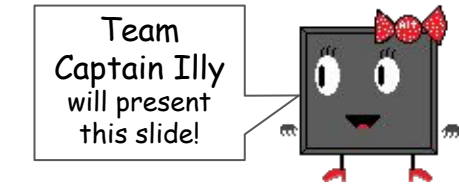
Lets zoom in



Team Captain Illy will present this slide!


Includes:
- H2o
- H+
- Co2
- NaCl
- HCo3
- Co3
Our Co-Captain Daiwik will present this slide.
ELITE
Includes:
- Carbon
- Hydrogen
- Sodium
Includes:
- Carbon
- Hydrogen
Gas
- Sodium

Other Similar Solution



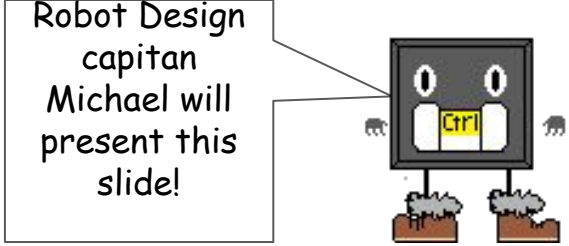
One similar solution that we found was **limestone.**

Source: https://mgtstoneco.com/product/pearl-white-limestone/

Our solution is better because:

1. It can neutralize the acid faster (the limestone takes years)
2. Limestone has to be mined creating other environmental problems.
3. More efficient as paying miners and excavating limestone is more expensive.

Other Innovation Ideas Before Brainstormed

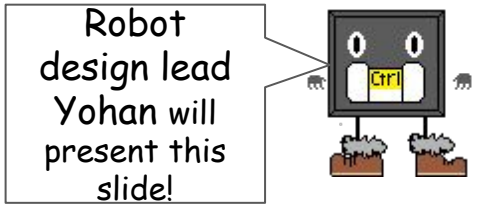


As a team, we came up with many ideas before we settled on ocean Acidification. Here are a few:

- ocean Seafloor Laser Mapping
- Mercury Spilling into the ocean
- ocean Hypoxia

we finalized ocean Acidification by vote. we wanted everyone in the team to have a voice in what our idea would be and what we would be researching.

Research:



Websites & Articles:

- Explaining what ocean Acidification is https://www.youtube.com/watch?v=fgBozLCGUHY
- Fixing the ocean's pH Problem https://www.youtube.com/watch?v=PqFwRMgvMVY
- MIT News - Removing Carbon Dioxide out of Sea water https://news.mit.edu/2023/carbon-dioxide-out-seawater-ocean-decorbonization-0216
- Nature Climate Change Article: "The global potential for converting renewable electricity to negative-CO2-emissions hydrogen"
- NOAA

Experts:

- Adam Galliard - Quality Chemical Engineer at GlobalFoundries
- Matt Leotta - Assistant Director of Computer Vision at Kitware Inc.
- Emmanuel Marrero Quiñones - Multidisciplined Engineer & CMQ/OE at Naval Nuclear Lab

Robot Design

Time-Constrained Design Process

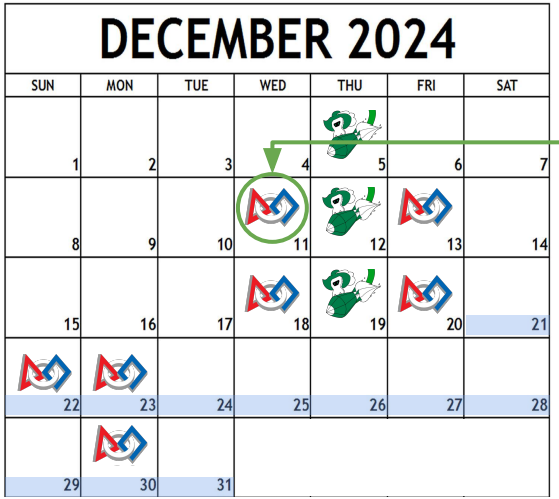
- Formed **only one month ago**
- Only 11 team meetings
  - Mostly over winter recess
  - Extra lab time in club meetings
- Jump started with "Coopertition"
  - learned from other, more experienced Shen teams
- Last week reserved for testing and rehearsal

Our Team Captain Illy will present this slide!

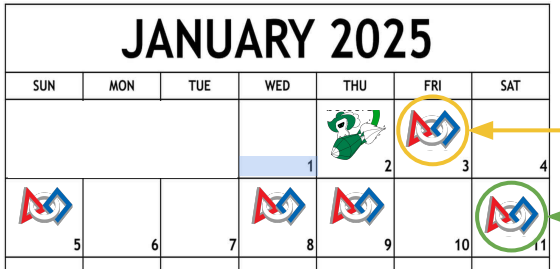
Team Meetings

Shen Club Meetings

Winter Recess



First Team Meeting



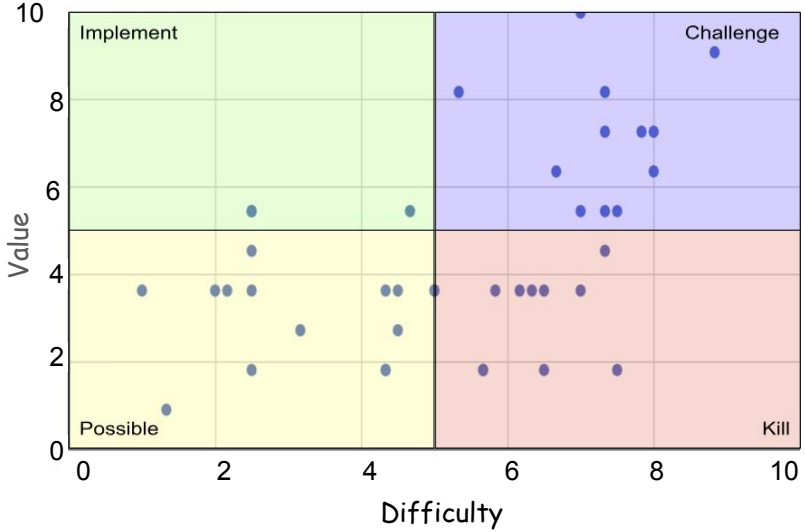
Robot Design & Code Freeze

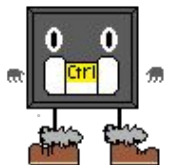
Qualifier

Identify

PICK Chart of FLL Robot Games Missions

Team: Ctrl Alt Elite



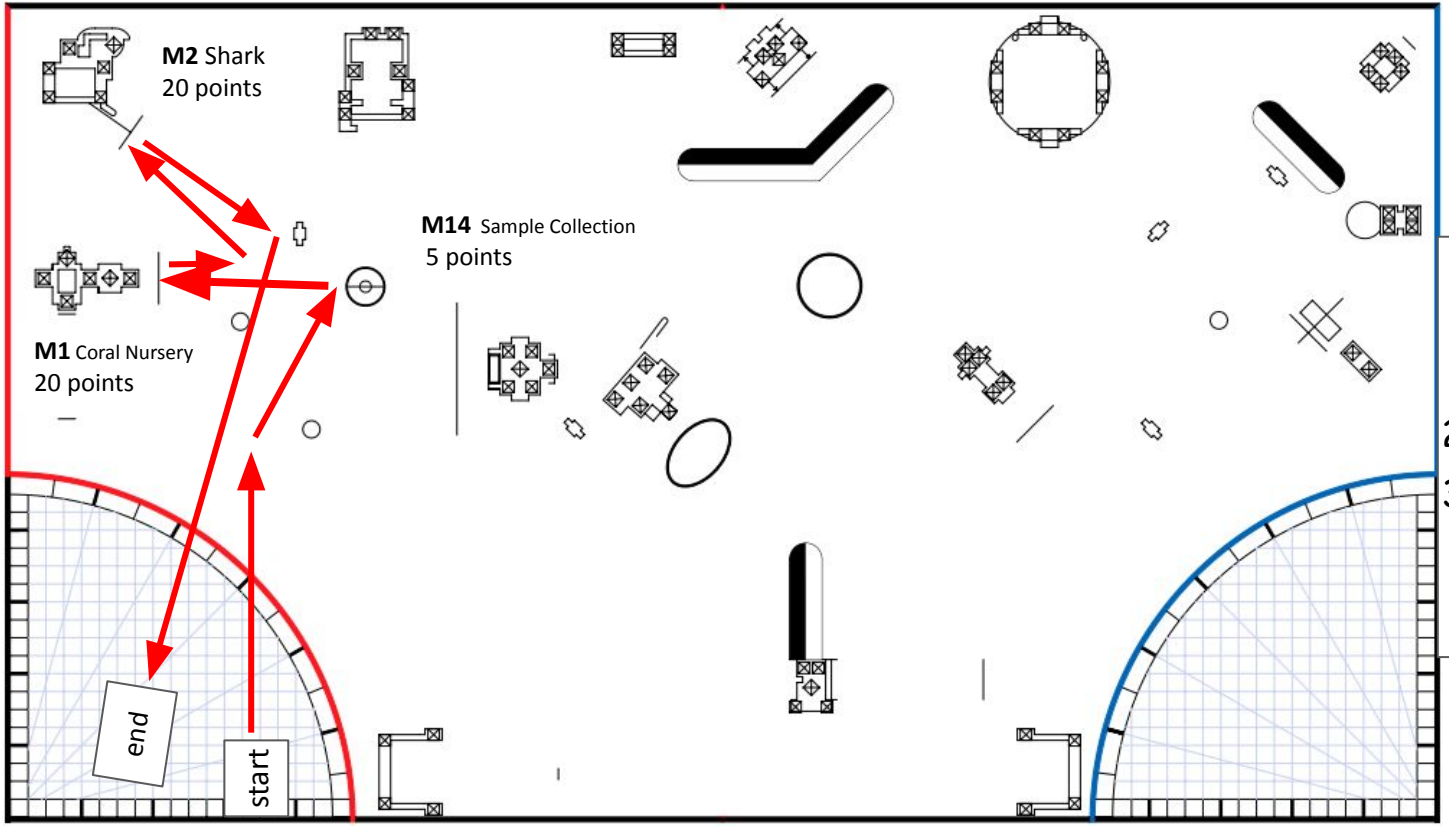


The Co-Captain Daiwik will perform this slide!

Task Name	Points	PICK Chart Difficulty	PICK Chart Value*	Mission Priority
M01-Coral Nursery	20	4.3	3.6	Priority 2
M01-Coral Nursery (Level II)	10	5.7	1.8	
M01-Coral Nursery (Level III)	20	2.0	3.6	Priority 2
M02-Shark	20	2.2	3.6	Priority 2
M02-Shark (Level II)	10	4.3	1.8	
M03-Coral Reef	20	4.5	3.6	Priority 2
M03-Coral Reef (Level II)	15	4.5	2.7	
M4-Scuba Diver	20	2.5	3.6	Priority 2
M4-Scuba Diver (Level II)	20	5.8	3.6	
M5-Angler Fish	30	2.5	5.5	Priority 1
M6-Raise the Mast	30	4.7	5.5	Priority 1
M7-Kraken's Treasure	20	6.3	3.6	
M8-Artificial Habitat	10	5.7	1.8	
M8-Artificial Habitat (Level II)	20	6.5	3.6	
M8-Artificial Habitat (Level III)	30	7.0	5.5	
M8-Artificial Habitat (Level IV)	40	7.8	7.3	
M9-Unxepected Encounter	20	1.0	3.6	Priority 2
M9-Unxepected Encounter (Level II)	10	2.5	1.8	
M10-Send Submersible	30	2.5	5.5	Priority 1
M10-Send Submersible (Level II)	10	4.3	1.8	
M11-Sonar Discovery	20	5.0	3.6	Priority 2
M11-Sonar Discovery (Level II)	10	6.5	1.8	
M12-Feed the Whale	10	7.5	1.8	
M12-Feed the Whale (Level II)	20	7.0	3.6	
M12-Feed the Whale (Level III)	30	7.5	5.5	
M12-Feed the Whale (Level IV)	40	8.0	7.3	
M13-Change Shipping Lanes	20	6.2	3.6	
M14-Sample Collection	5	1.3	0.9	
M14-Sample Collection (Level II)	15	3.2	2.7	
M14-Sample Collection (Level III)	25	2.5	4.5	Priority 2
M14-Sample Collection (Level IV)	45	5.3	8.2	Priority 2
M14-Sample Collection (Level V)	55	7.0	10.0	
M15- Research Vessel	20	5.0	3.6	Priority 2
M15- Research Vessel (Level II Samples Only)	35	6.7	6.4	
M15- Research Vessel (Level III Trident Only)	30	7.3	5.5	
M15- Research Vessel (Level IV Chest Only)	25	7.3	4.5	275 to 295 total
M15- Research Vessel (Level V Chest+Trident)	35	8.0	6.4	
M15- Research Vessel (Level VI Chest+Samples)	40	7.3	7.3	
M15- Research Vessel (Level V Samples+Trident)	45	7.3	8.2	
M15- Research Vessel (Level VI Everything)	50	8.8	9.1	
Max Possible Points	620			

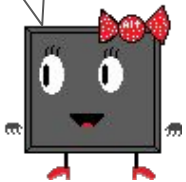
Robot Path Diagram - Program: Red 1

Team: Ctrl+Alt+Elite



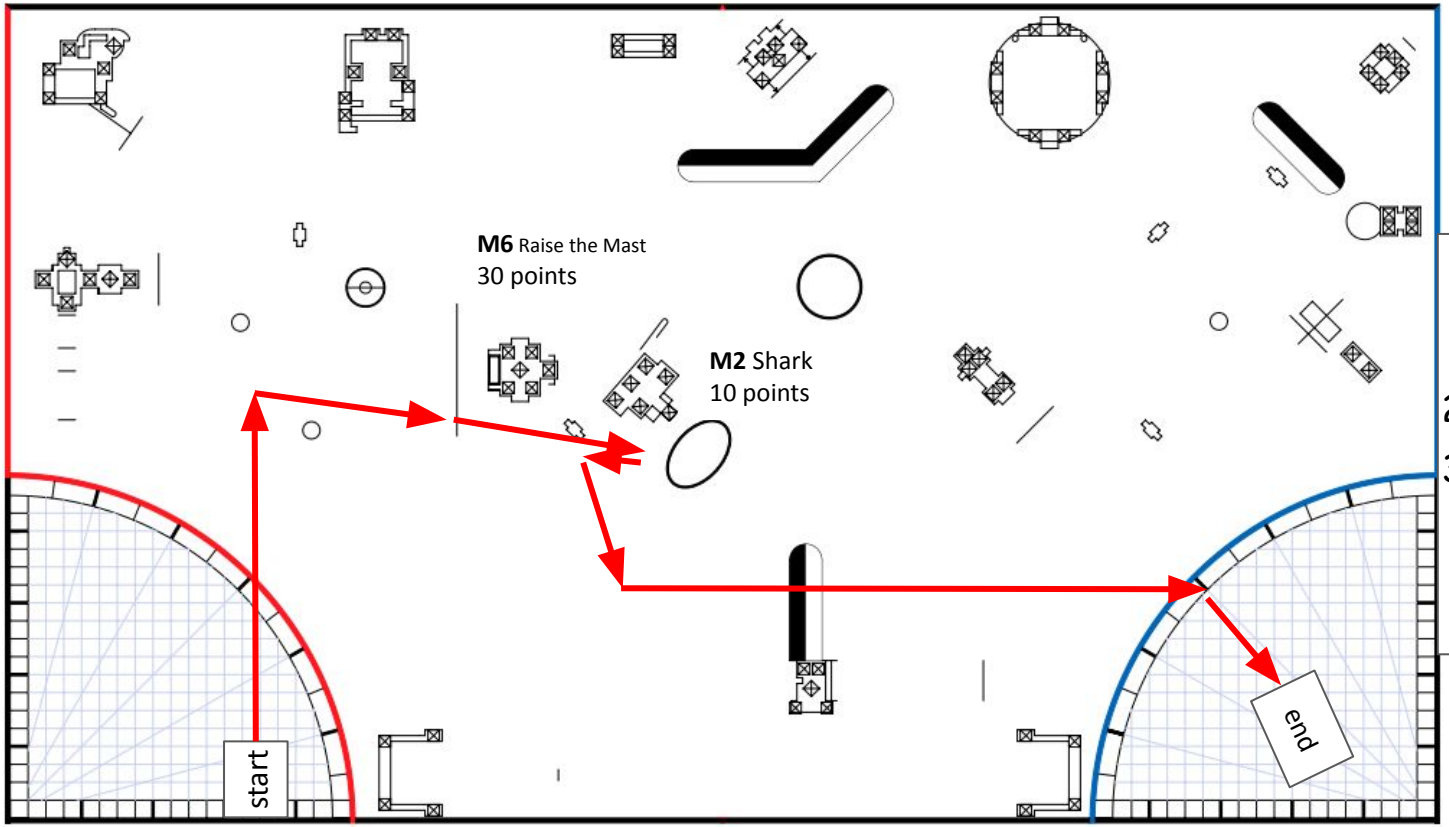
1. Move Water Sample
2. Flip Coral Buds
3. Recover Shark

45 Total Points



Robot Path Diagram - Program: Red 2

Team: Ctrl+Alt+Elite

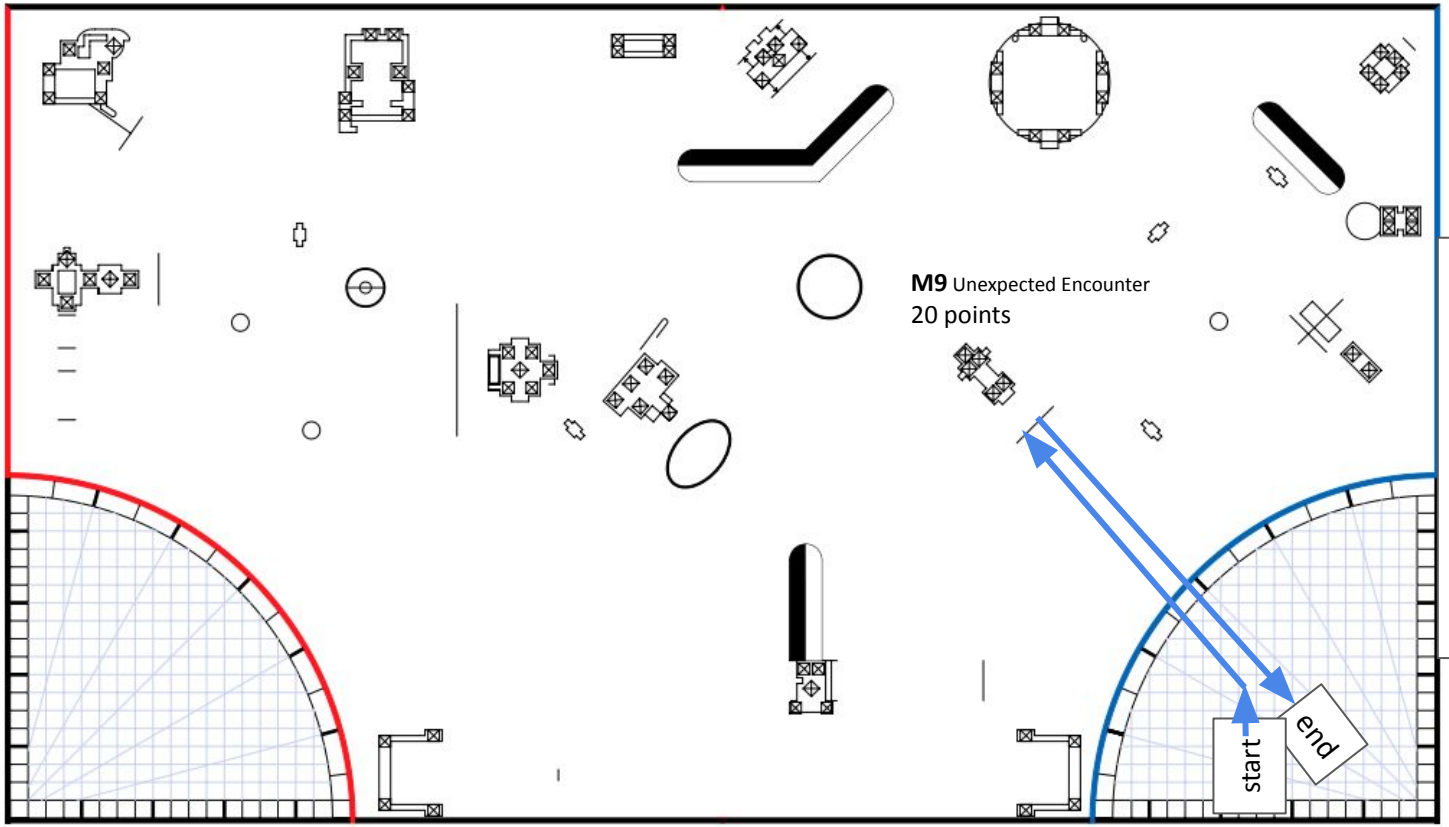


1. Raise Mast
2. Deliver Shark
3. Move to Blue

40 Total Points

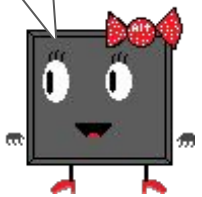
Robot Path Diagram - Program: Blue 5

Team: Ctrl+Alt+Elite



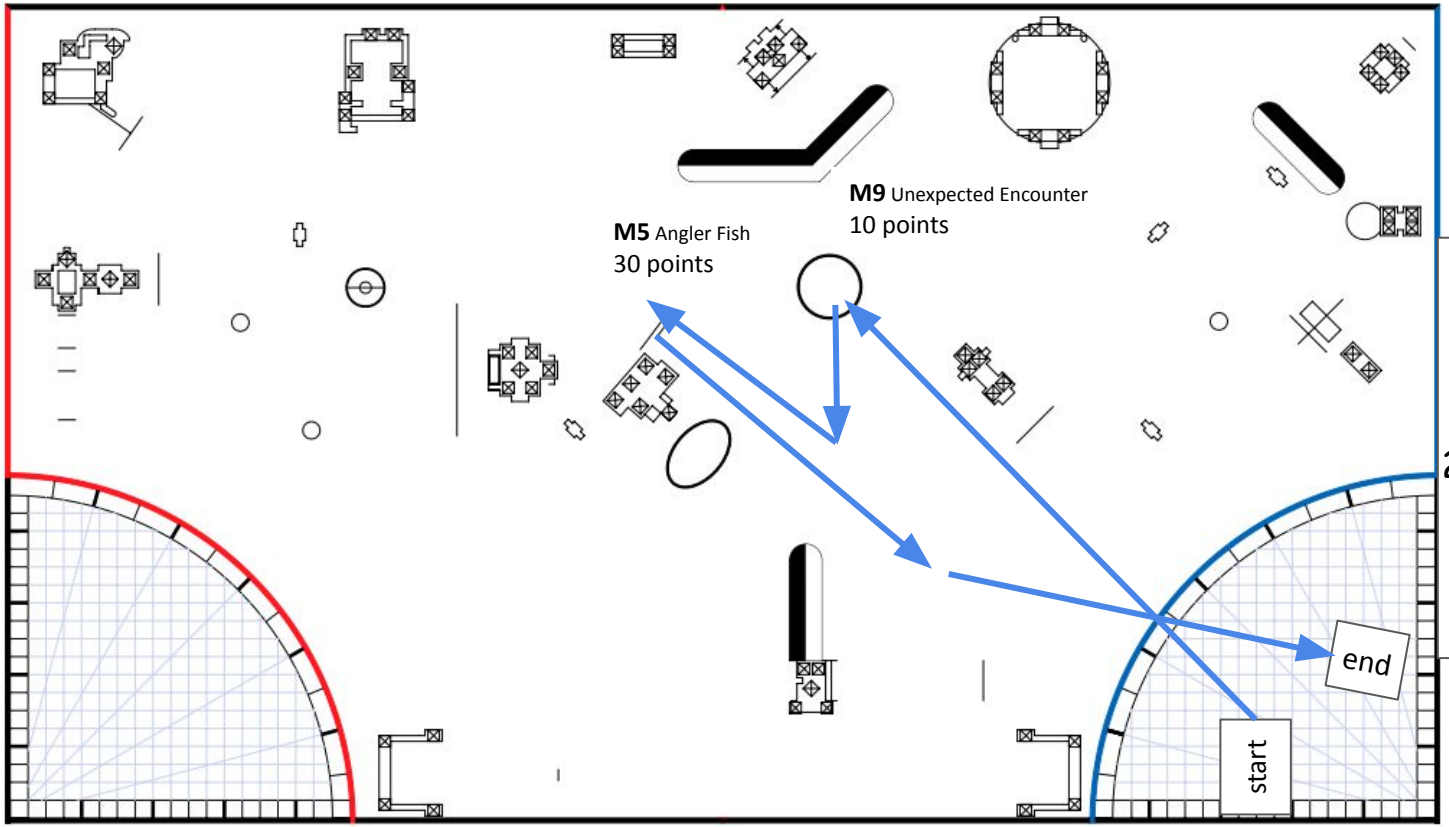
1. Recover Unknown Creature

20 Total Points



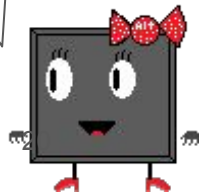
Robot Path Diagram - Program: Blue 6

Team: Ctrl+Alt+Elite



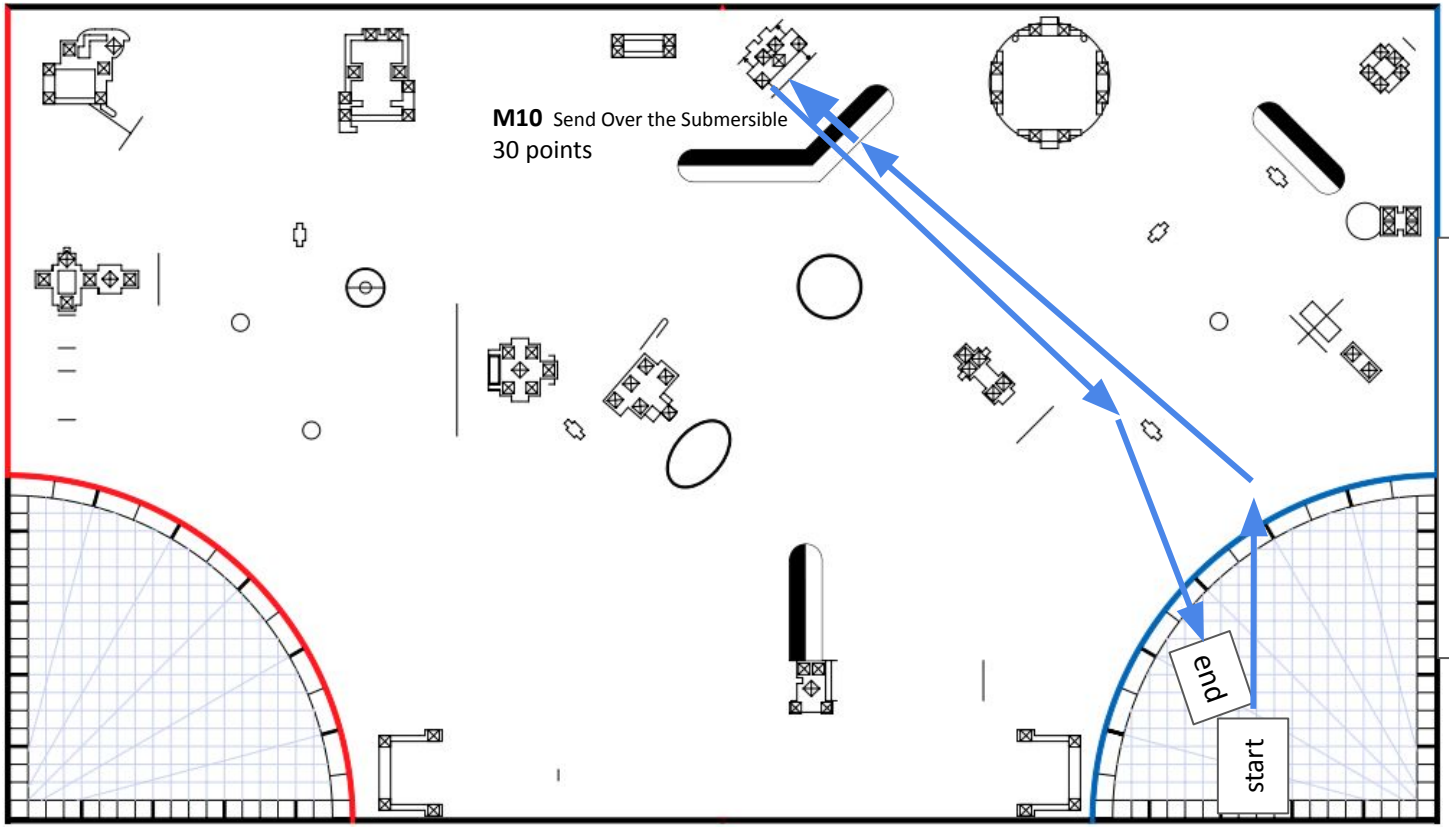
1. Deliver Unknown Creature
2. Latch Angler Fish

40 Total Points



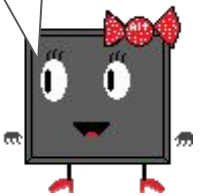
Robot Path Diagram - Program: Blue 7

Team: Ctrl+Alt+Elite



1. Send Over Submersible Yellow Flag

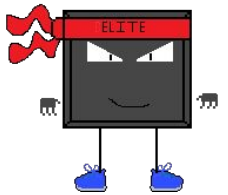
30 Total Points



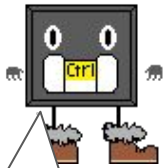
Best Case Scoring

Inspection		20
Red 1		45
Red 2		40
Blue 5		20
Blue 6		40
Blue 7		30
Precision	+	50
Total		**245**

Our Co-Captain Daiwik will present this slide!



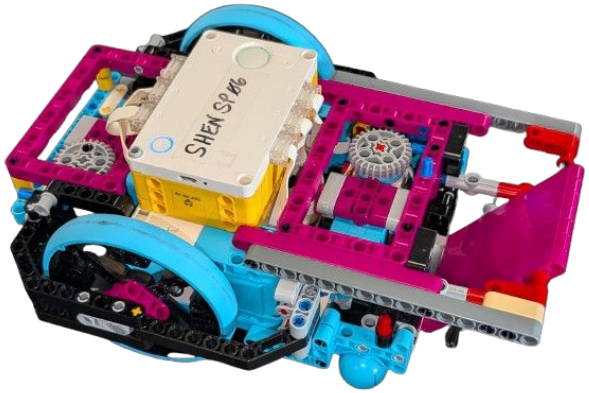
Robot design: What was our design process?



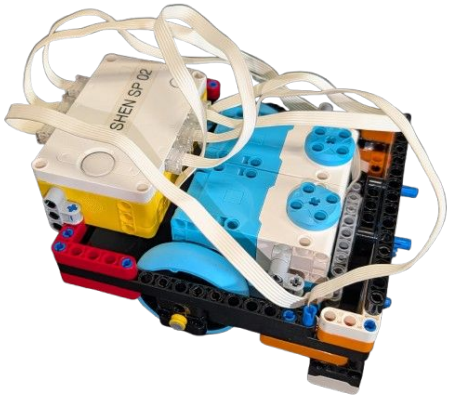
-The team decided to go from the SPIKE Advanced Driving Base base bot that all the club members use to our own bot.

- Since we had limited time, we talked with the Capti-Bytes and it inspired us to form our own design.

Our robot design captain Michael will present this slide!



"ctrl"



"alt"

"elite"

Robot Design (specifications)

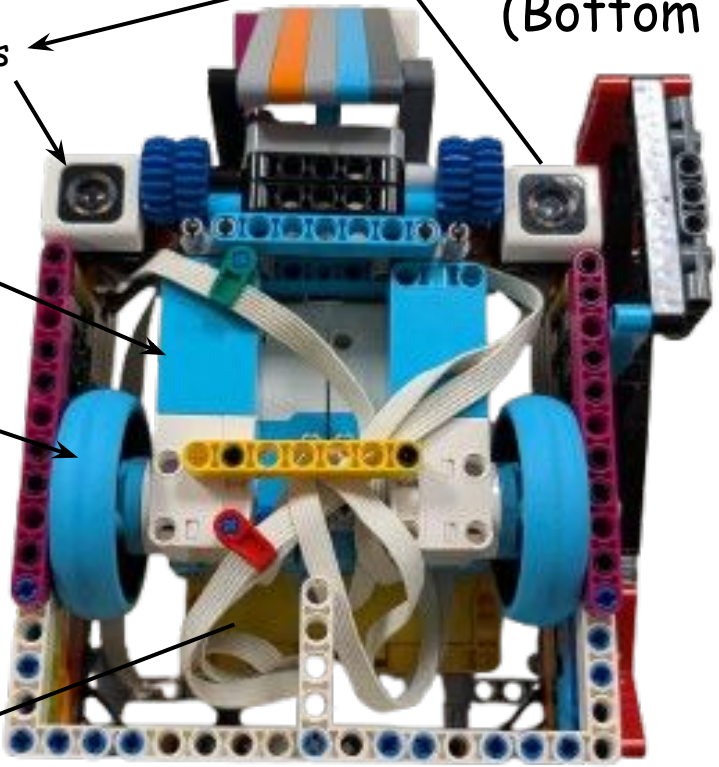
PYTHON

(Bottom View)

Color sensors

Drivetrain:
Small motors for
small wheels

Has wheels on the
inside to square up



Flat back used for 2
things:
- Squaring up
- Unexpected
encounter mission

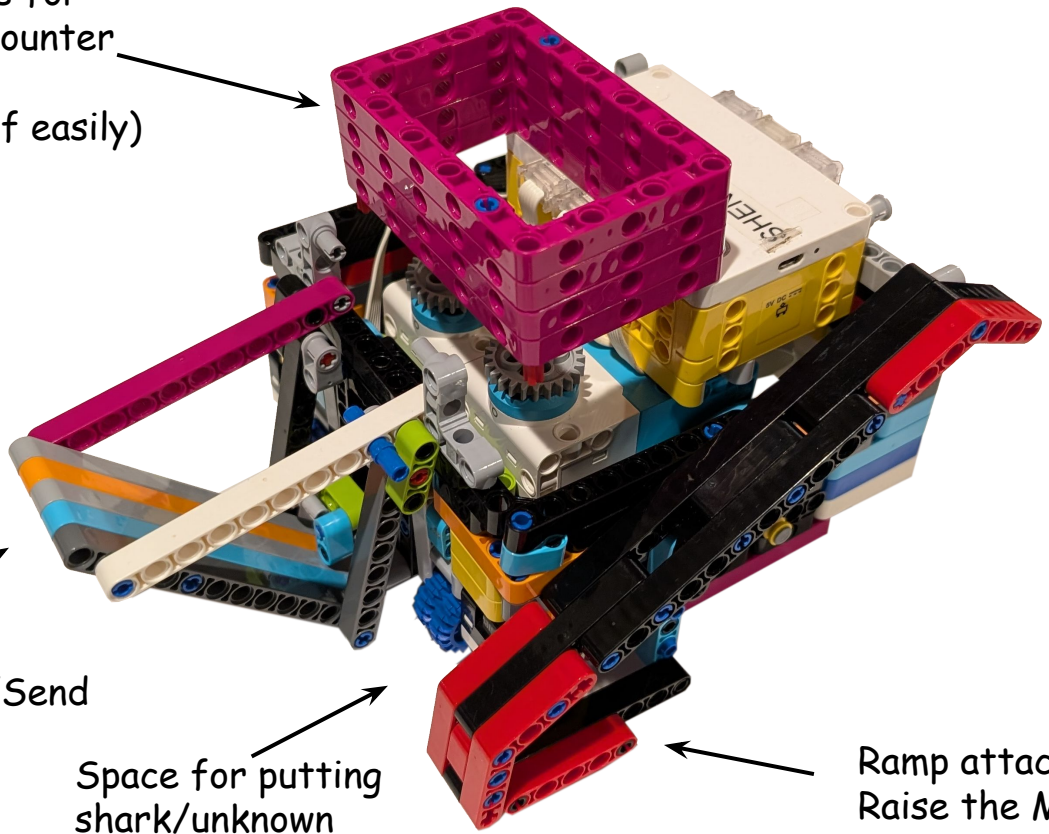
Motion
sensor

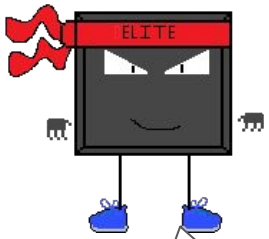
Aaron will
present this
slide

Robot Design (attachments)

Does not need attachment changes

Box attachments for Unexpected Encounter mission
(can be taken off easily)





Our Robot Design Lead Michael Will present this slide

Ramp attachment for Shark/Coral Nursery/Send over the Submersible missions.

Space for putting shark/unknown creature.

Ramp attachment for the Raise the Mast and Angler Fish missions.

Python

- We are using SPIKE Python for more control
- Sophia wrote common drive functions
- Everybody coded mission runs
- Most of us had not used Python before December
  - Some of us had used block code in club teams
  - We learned basic Python from our coach

Our Software lead Sophia will present this slide!

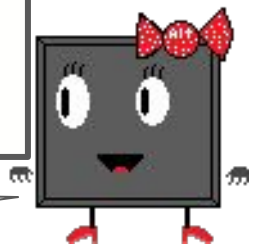
November 16th Rumble

Code

- We wrote "turn" and "straight" functions
  - Acceleration/deceleration stops the wheels from slipping
  - The acceleration and velocity can be adjusted
  - The gyro can be switched on and off globally
- Functions for each run
  - Named by color and number
- Runs are combinations of "turn" and "straight" actions
- Comments were added to document the actions

Connect

```
164
165
166 async def red_1():
167     """or
168     shark tag nursery water sample
169     """
170     await straight(400)
171     await turn(-25, velocity=50)
172     await straight(350)
173     await turn(115)
174     await straight(190, acceleration= 1000, velocity= 1200)
175     #arrived at coral on to shark
176     await straight(-90)
177     await turn(-45)
178     await straight(220)
179     #hit shark and return to base
180     await straight(-200)
181     await turn(120)
182     await straight(600, velocity=1200)
183
184
185 async def red_2():
186     """
187     raise the mast going to blue base
188     """
189     await straight(420)
190     await turn(-95)
191     await straight(330)
192     await straight(70)
193     await turn(-10)
```



Our Software Lead Sophia will present this slide!

Summary

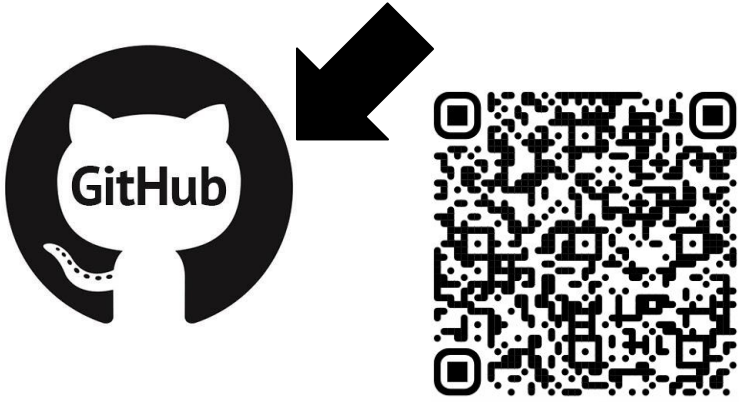
Lesson: We learned that it is so much harder if everyone works on only one area.

-Passive attachments that don't need to be removed save us time.

-Top-mounted motors to support future missions by adding active attachments.

Code Sharing

Click here to see our code



https://github.com/ShenMSTeams/3276-Ctrl-Alt-Elite-Submerged