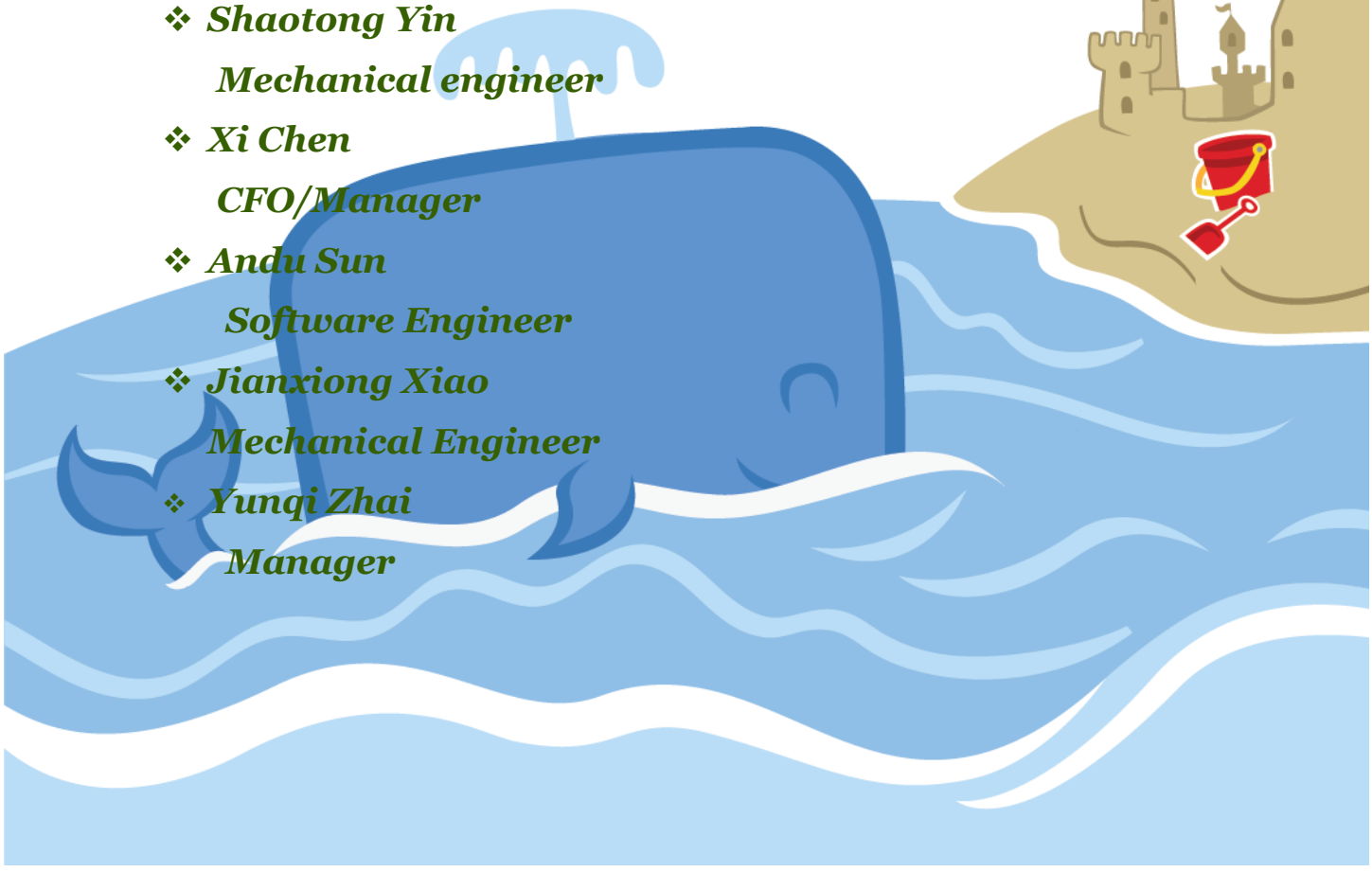
Zhicheng ROV Team

Team Members :

- ***Yuanjia Zhang***
  CEO/mechanicalengineer
- ***Enze Lu***
  CTO/Software Engineer
- ***Tianyang Zheng***
  Mechanical engineer
- ***Shaotong Yin***
  Mechanical engineer
- ***Xi Chen***
  CFO/Manager
- ***Andu Sun***
  Software Engineer
- ***Jianxiong Xiao***
  Mechanical Engineer
- ***Yunqi Zhai***
  Manager



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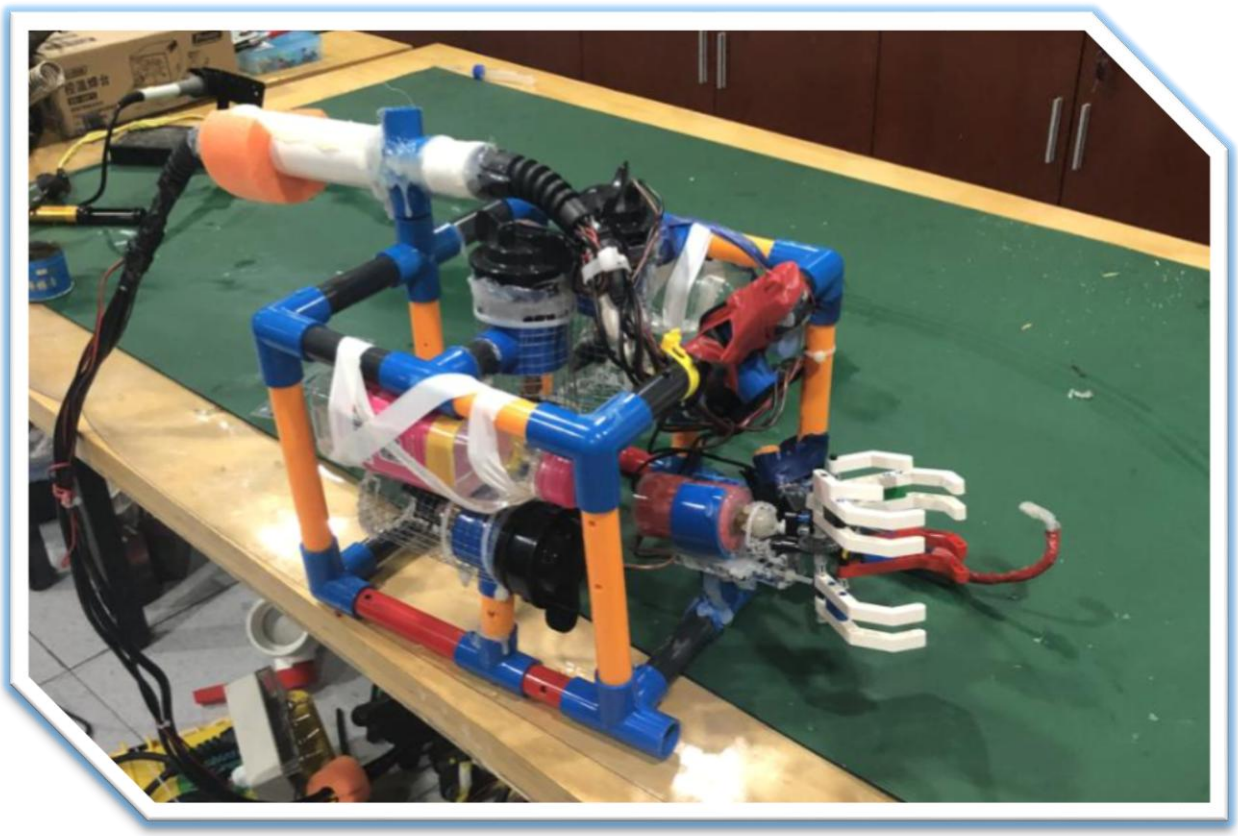
Abstract

The underwater robot made by our team can safely complete all kinds of catching and fishing work under the water. Since the whole world is now advocating conservation and environmental protection, we chose some waste materials in life to make this robot this time. The entire robot is only 45 centimeters in diameter, which makes it possible to work in small Spaces. The robot's grasping tools are made up of mechanical claws, hooks and nets, which also enable the robot to handle most fishing and rescue tasks. The four motors also give the robot good mobility. All the members of our group spent a week to complete the production of the robot, and then spent some time to improve and optimize it. Finally, we have passed the test to ensure that the underwater robot can safely complete the underwater task and return to the ground intact.



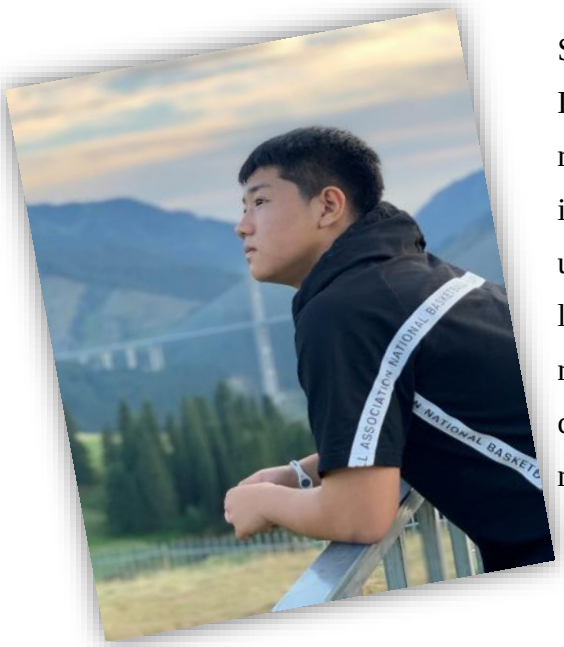
Company Profile

Our team is made up of teachers and students from Beijing No. 35 High School. The group had previously competed in MATE ROV competition in China once and had accumulated some experience building underwater robots. There is two mentors and 8 students in our team. We have a clear division of labor, and each team member is responsible for the field he/she is good at. Everyone on the team loves the ROV and works hard on it, which makes us very united.

Zhi Cheng ROV Crew

Yuanjia Zhang is a 10th grade student in Beijing NO.35 School. I am very good at building and making stuff out when I was in elementary school, so it makes me to be a manipulative person. I have been making robots for 1 years and the reason why I'm so interesting in robots are because they can be really powerful. They are can define by infinity，the possibilities in robot are infinite.

My name is Enze Lu. I like machinery very much. Since I was a child, I always disassemble and assemble all kinds of things. I have participated in robot related activities since primary school. And participated in the robot competition organized by the school and won the first prize, such as RoboCup. I like to talk with my teammates very much and think more in the conversation.



Shaotong Yin is a senior student in International Department of Beijing NO.35 High school. I'm really good at hands-on things, which I find very interesting and cool. I have been in touch with underwater robot for one year and have learned a lot about robot. I love and like learning to make robot very much. At the same time, I am very confident that the robot we made can get a good ranking in this competition.

Tianyang Zheng is attracted by the charm of robot production. From primary school, he came into contact with model airplanes and was very good at making them. When he entered high school, he came into contact with robots and found that there are many similarities between them. Hope to show his ideas in this competition. The task is very challenging,we are try to do it.

My name is Andu Sun, I am a senior student in the international department of Beijing No. 35 Middle School. I am good at assembling machinery and circuits. I worked with the ROV for about four months. I think the robot is a very interesting thing, it adds luster to my life.

My name is Xi Chen. I like to study robots and oceans, so I choose to take part in this competition. When the teacher said that I could join the team, I am so happy. I studied the mechanical claw in the team, designed it according to the task, and came up with several models. We discussed which is better. I hope our team can achieve good results.

My name is Jianxiong Xiao.I like swimming and diving, from junior high school.I began to participate in the robot competition. When I know this item, I immediately signed up to participate in, sometimes we practice in the swimming pool, I can also help teammates put props. I think this game is in line with my interests. I like it very much.

Yunqi Zhai is a senior high school student in Beijing NO.35 high school.

I have some knowledge of programming and I am interested in robotics

Mentors:

- My name is Ziyu Tian, teach students information technology& computer courses and is also a robot instructor in Beijing NO.35 high school,guide students to participate in a variety of robot competitions, such as RoboCup. I'm very interested in underwater robot production and hope to achieve good results .
- Huan Wang also instructs robot in the team,she gives lots of guide and support.

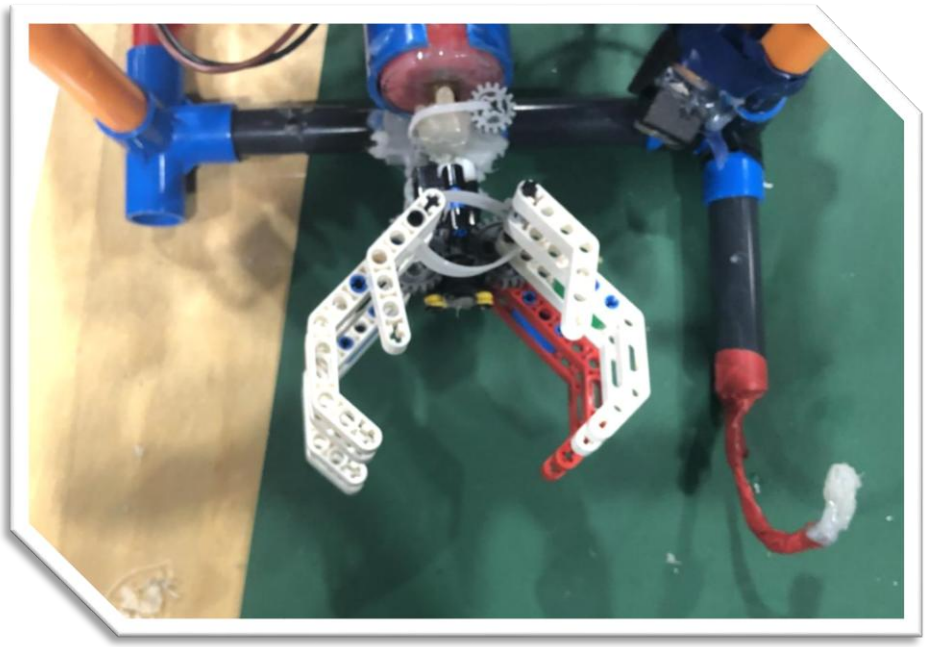
Design Rationale

1. Propelling System

The propulsion system of the underwater vehicle is mainly controlled by four motors. First, two motors in the middle control the robot's ascent and descent. We combined the control lines of the two motors so that the two motors could work together at the same frequency. We chose to use two motors together to control the rise and fall of the vehicle because it provides more flexibility and horsepower. Under a certain depth of water, the water pressure will be very high, which will cause difficulties for the robot to dive. The two motors will also help the robot to complete the dive work better. The forward, backward and steering motion of the robot is controlled by motors on both sides of the robot. As the robot moves forward, both motors rotate at the same speed to propel the robot forward. When the robot wants to go backwards, the motor turns in the opposite direction, pushing the robot backwards. When the robot turns, it makes use of the speed difference between the two motors to turn left and right. Each motor is equipped with its own independent protective cover to prevent debris from interfering during operation.

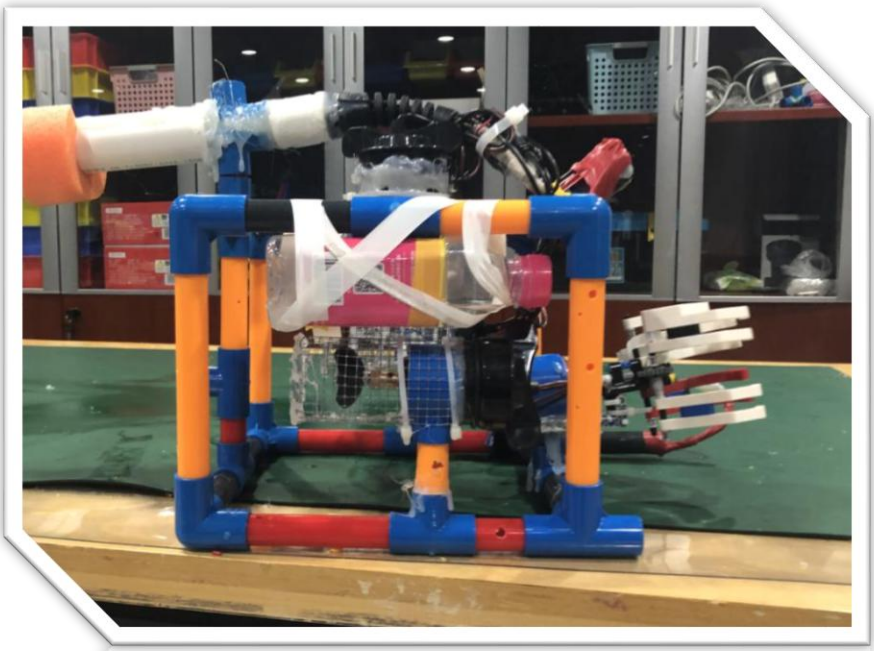
2. Scraping tool

The grasping tool of underwater robot is composed of mechanical claw and hook. The mechanical claw is controlled by a motor, which can be opened and closed through the rotation of gears. The motor of the mechanical claw is connected with the double knife double throw switch, so that it is easier to control the opening and closing of the mechanical claw. The hook is simply attached to the extension lever of the machine. In some cases, the target of the task is not convenient to grasp, so we will choose to use hooks to tick it out, which is more convenient and fast. Another reason is that the claws are not strong enough, and they detach because of the great traction force. But the hook is different, the hook is all hard links, can withstand more traction, to avoid the claw decoupling situation.



3. Buoyancy system

We used two bottles as tools to adjust the buoyancy of the robot. Floats were not chosen because they could be adjusted more precisely by adding water to the bottle. In the picture, it is fixed by waterproof tape. After adjusting all the tools in the future, we will use other stronger ways to fix it.



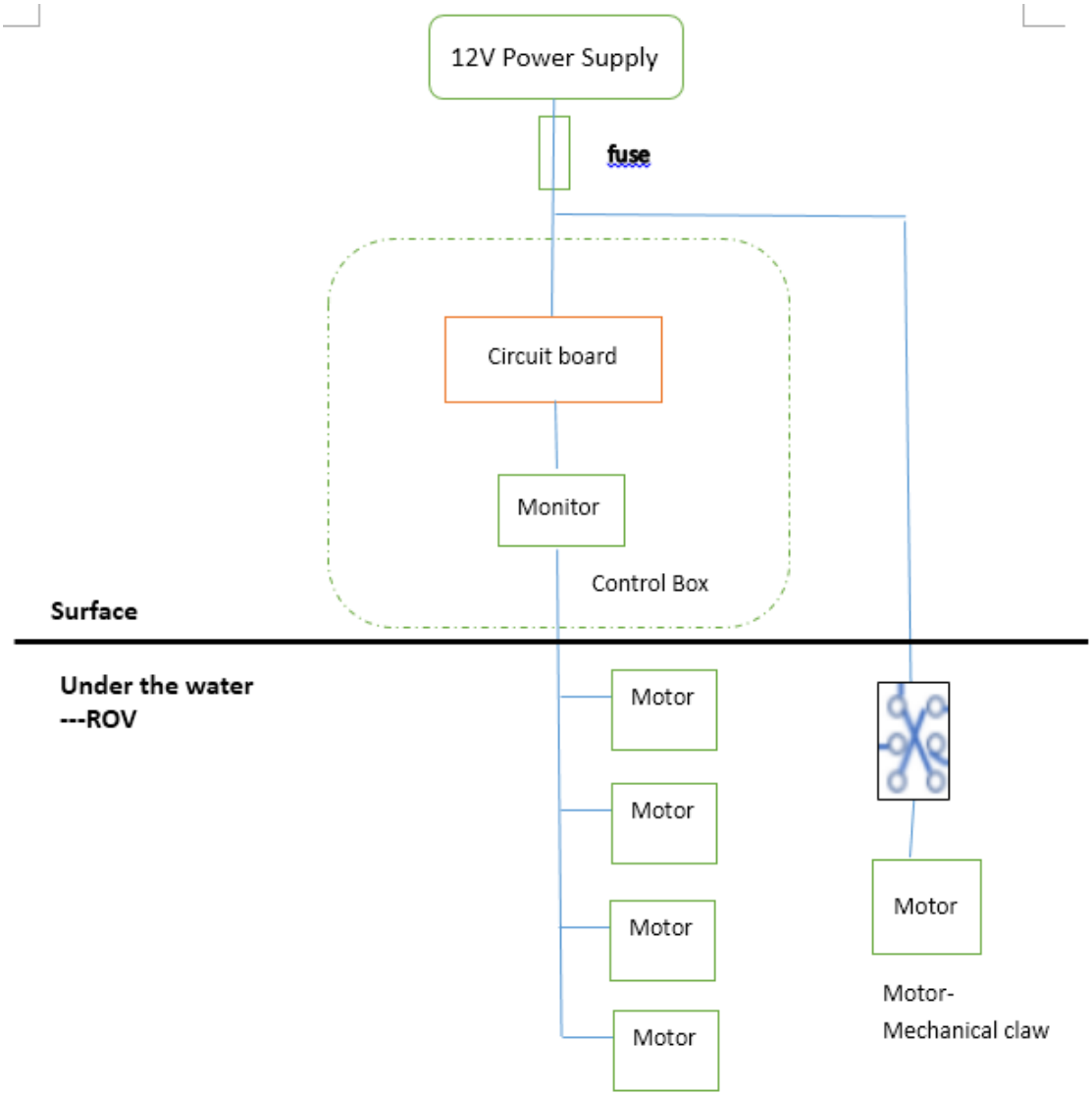
4. Stress relieving

We put all the wire harnesses together and did stress relief for them. We solved this problem by putting a plastic tube around all the wiring harnesses and attaching it to the ROV's frame. The other end of the plastic pipe is fixed to the thickest rubber thread. This way, when the robot is pulled by the glue wire, the wire connecting the motor to the camera will not break due to the strong pull.

5. Nets

We put an iron net like a cube on the front end of the machine. The front end of the iron net can be opened and closed, and it can be opened and closed freely through the rotation of the motor. We can use this device to catch debris on the surface of the water. When we find debris on the water through the front camera, we will lift the robot to the highest plane. The device will then rise to the surface. When the iron net surface, we only need to control the robot flexible forward, can complete the fishing on the surface of the water.

Systems Integration Diagram



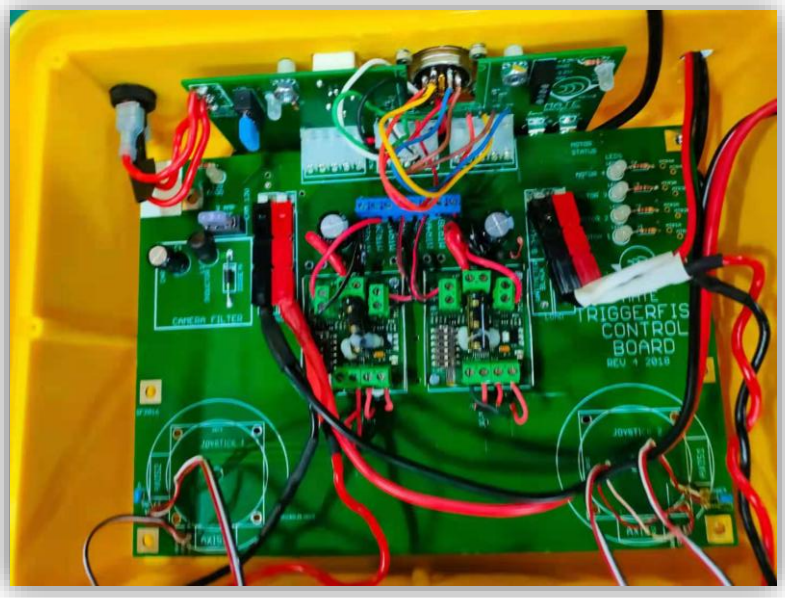
Safety

Company safety review：

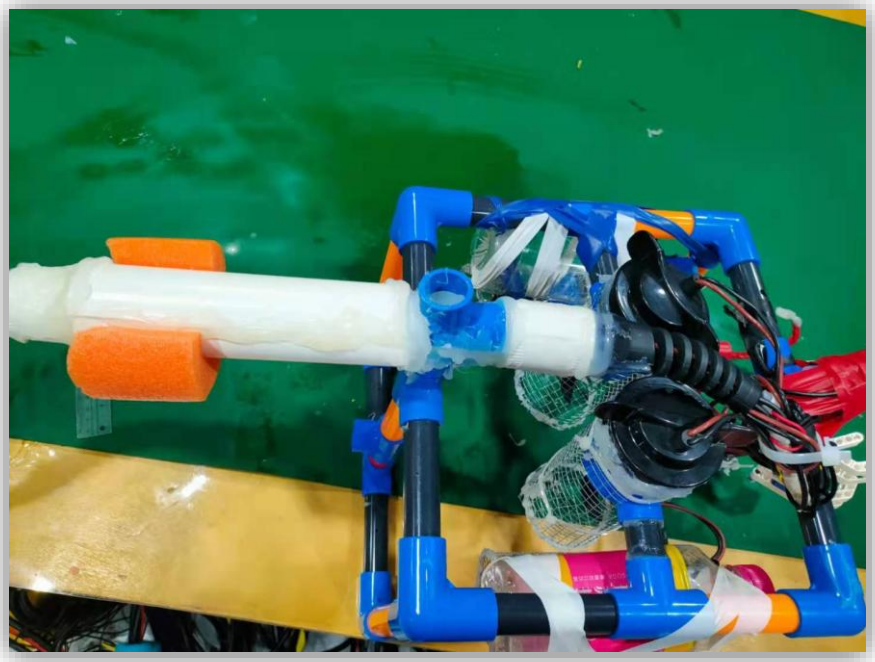
• Anderson Powerpole connectors are the main point of connection to the MATE supply (ELEC-010R). ----Satisfied

• A properly sized fuse is within 30 cm of the main point of connection. The company must use a ruler to show this distance (ELEC-008R). ----Satisfied

• The inside of the control box is does not have exposed wiring (ELEC-017R), the control box is neatly laid out with attention to workmanship (ELEC-022R), a separation and identification of 120VAC wiring from DC and control voltages (ELEC-023R). If AC wiring is not used in the control box, include a statement saying no AC is used. ----Satisfied



• The tether leading to the ROV has adequate strain relief (ELEC-024). ----Satisfied

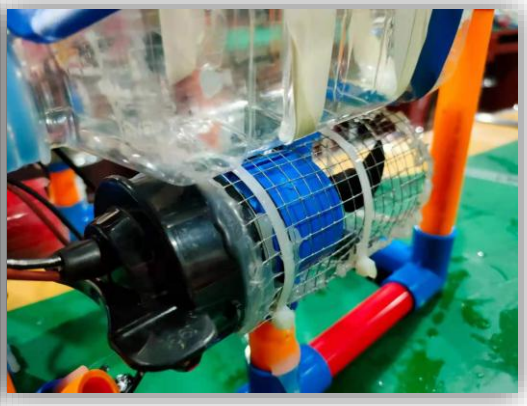


• If hydraulics / pneumatics are used that the company has passed the Fluid Power Quiz (FLUID-014). If fluid power is not used on the vehicle, include a statement saying no fluid power is used.—NO Fluid Power

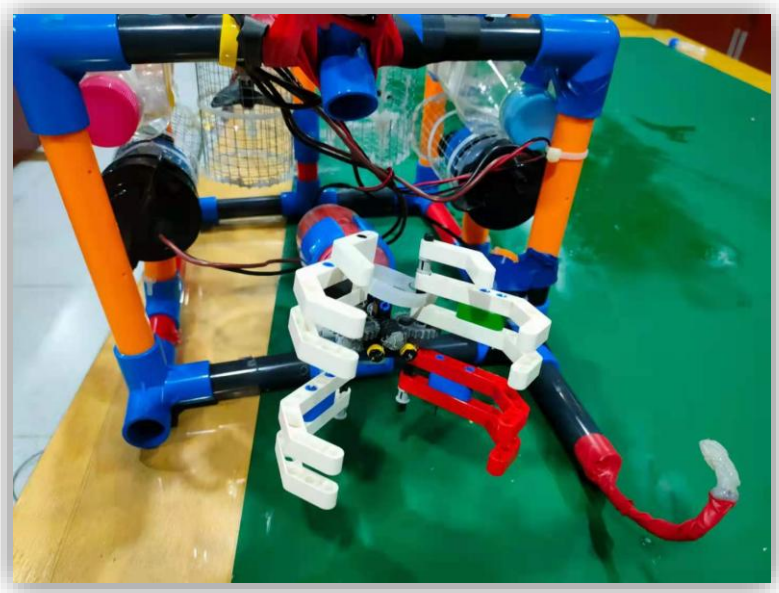
• Companies using only manually powered pumps should include information about the system.-NO powered pumps

• Any watertight housing on the vehicle can withstand pressure at 4 meters ----Satisfied

• All propellers are shrouded and have propeller guards (MECH-006). ----Satisfied



• The ROV has no sharp edges or elements of the ROV that could cause damage (MECH-006, ELEC-017R). ----Satisfied



Testing and Troubleshooting

1. FEMA

Mode of Failure	Cause of Failure	Effect of Failure	Occurrence	Severity	Detection	RPN	Required action
The machine does not rise steadily	Buoyancy configuration is not stable at the center of gravity	Cause the robot to tilt, easy to grab the object missed	5	8	8	320	Adjust the buoyancy center and move the buoyancy configuration back
Mechanical claw teeth filing	The closing Angle of mechanical claw is too large	Destruction of mechanical claw structure	3	5	4	60	Pay attention to observe the degree of mechanical claw closure, shut down the motor in time.
Mechanical claw can not be completely fixed grasping objects	Grabbing objects skew or even fall out	Unable to complete the fetch	3	8	4	96	A fixed groove is arranged inside the mechanical claw, so that the grasping object can be fixed in the fixed groove

Camera flooding	The camera is not waterproofed properly	The camera doesn't give us a very good view in the water	1	9	2	18	Get a new camera and make it waterproof again
The lift motor is difficult to control	We have a double pole double throw switch connected to the rising motor	It's not convenient for us to suspend robots in water	2	8	2	32	We changed the wiring to the motor and connected it to the main control box
It is easy to lift the head when the forward motor pushes the robot forward	Forward motor placement problem	This causes the robot to be unable to move forward flexibly	2	9	7	126	We fine-tuned the position of the motor to put it slightly forward

Total RPN: 652/6000

Future Improvements

Our team as a whole did a good job in this production. Our machine performed well in several tests. There were several discussions along the way. When we encounter difficulties, the whole team members will calm down and think alone and work overtime to solve the difficulties. This shows that our team is very united. But there is still room for improvement. In the future production process, I think we should have more opportunities for group discussion, so as to better concentrate everyone's thoughts. Put everyone's good ideas into the robot making process. When we encounter difficulties, we can also have a broader idea to solve them. The second point is the division of labor. We should be more clear about the tasks assigned to each person in the team, and integrate them after each person finishes his or her own work. This can also make our team more efficient.

On the machine side, our next task is mainly to improve the device of the mechanical network. Because in several tests, the working efficiency of the mechanical network is not very high. We need it to perform better in the following tests. This way, we don't have to work too hard to achieve the floating goal.