City University of Hong Kong

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1. Technical Approach and Justification

Challenge Task 1 - Entrance and Exit Gates

MaxBotix ultrasonic sensors are used for measuring the distance between AMS and active underwater beacon. According to the 3D distance, the location of the gates will be calculated. Then control the thrusters of AMS with PID to pass the gate and circle one of two buoys.

Challenge Task 2 – Follow the Path

A DJI UAV will be used for guiding and the AMS will be controlled according to the feedback from UAV and LIDARs.

Challenge Task 3 – Wildlife Encounter and Avoid

Hyperspectral camera will be used for capture the unique spectral signatures of the object. Based on the technical approach, the AMS will be guided to finish the task.

Challenge Task 4 - Scan the Code

RGB camera will capture the colours of the buoy and process it. Then display on the screen of the AMS.

Challenge Task 5 - Dock and Deliver

For mechanical structure, a manipulator will be designed and mouted on the AMS. With the feedback from the force sensor, gripping force can be controlled to grip the target object. An IMU will be mounted on the manipulator to detect the location itself. Then the manipulator can be controlled to release the object over the hole.

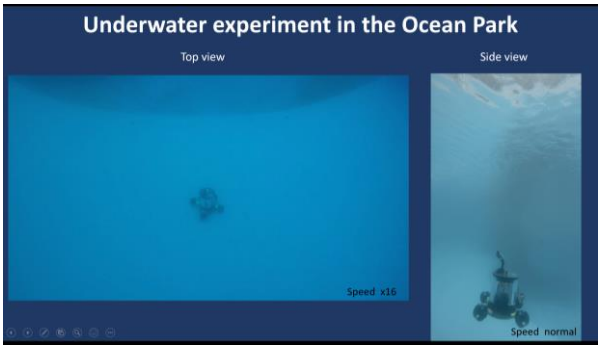
Challenge Task 6 -– UAV Replenishment

The UAV will be controlled remotely to launch from WAM-V. Then recognize the item with the algorithm in Task 5. After that, the control the manipulator to grip the item and transfer to the designated place.

Timeline	
05.2021 - 11.2021	system development and built
12.2021 - 12.2022	Testing sensors in the lab
01.2022 – 02.2022	Testing AUV in the lab
03.2022 - 09.2022	Testing the ASM in the ocean
10.2022 - 11.2022	Final preparation for the competition

2. Team Qualifications

Jing LI: A PhD student of City University of Hong Kong. My research topic is harvesting ocean thermal energy through a bistable morphing box efficiently. I graduated from Harbin Institute of Technology in 2017 with a bachelor's degree in mechanical engineering. As an outstanding graduate, I graduated from Harbin Institute of Technology in 2019 with a master's degree in mechanical engineering. When I was a graduate student, I won the second prize of the master's graduation achievement report exhibition.



Ruhao HUANG: A PhD student of Hong Kong University of Science and Technology. I graduated from Harbin Institute of Technology in 2017 with a bachelor's degree. I won the grand prize in the metalworking internship for designing and building the smart remotely control car as a team leader. I worked in Huawei as a network technology engineer from 2019 to 2020 with Level A in the Monthly Performance (twice) in Huawei.

3. Facilities

IMU, LIDAR, thruster and tools are available in the lab. The NPMM lab of City University of Hong Kong will provide the test venues for assembly. The pool in the Hong Kong Ocean Park can be used for testing on the water.

4. Sponsorships and Partnerships

City University of Hong Kong, Shenzhen Graduate School, City University of Hong Kong Shenzhen Virtual University.

5. Management Approach

Team members will the recruited from the undergraduate and graduate students of City University of Hong Kong. A club will be built for the competition. Team members will be trained every Saturday morning and the preparation for the competition will be conduct every Saturday afternoon. There will be 3 group leaders for mechanical structure, control system and UAV.

6. Rough Order of Magnitude Cost

Items	Costs
Cameras	10,000hkd
IMU	7,000hkd
LIDAR	8,000hkd
Thruster	10,000hkd
Others (lines, other sensors)	10,000hkd
Total	About 45,000hkd

7. Summary

Our team members have the experience in designing and controlling robots and underwater robots. The lab in City University of Hong Kong and Ocean Park of Hong Kong will provide the test venues. We believe that we can complete this compitition because we are willing to persevere and we have enthusiasm.