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Autonomous UAV-Glider Launch and Recovery System

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MARINE & MARITIME INTELLIGENT ROBOTICS

Overview

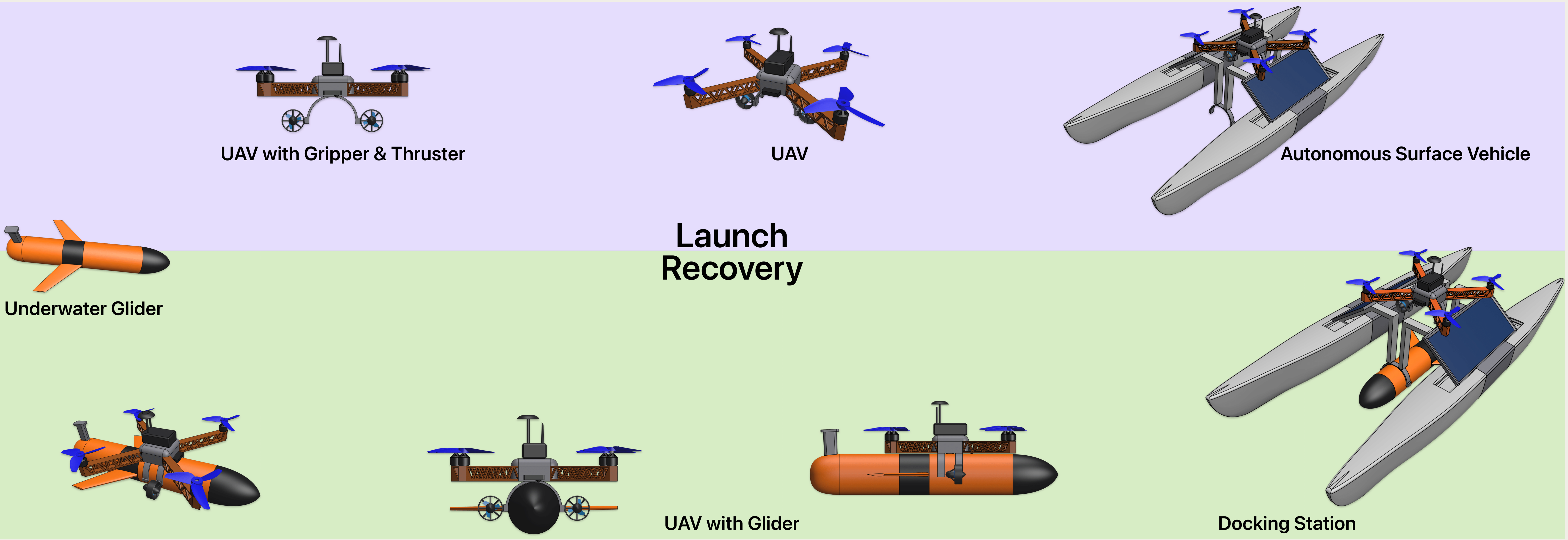

Figure 1. Proposed Architecture

Motivation

The efficient launch & recovery of underwater gliders is crucial for the continuity and long term oceanographic missions. Traditional methods of glider recovery are often challenging, resource intensive, and require significant human intervention.
The primary motivations for this research are as follows:

- **Ease of Integration:** The proposed system can be easily deployed with existing glider designs, facilitating quick adoption without significant modifications.
- **Precision Navigation:** Utilizing an RTK (Real-Time Kinematic) navigation system, the system can achieve precise location and navigation. The drone's navigation capabilities are sufficient to meet these requirements.
- **Glider Detection:** State-of-the-art object detection algorithms can be employed to effectively identify gliders on the sea surface, ensuring accurate and reliable recovery.

State of the Art

1. The authors have developed and validated a robust and efficient recovery system using a Remotely Operated Vehicle (ROV) equipped with an grasping system to hold the glider in underwater and return to the station using Adaptive Sliding Mode Control-Proportional Integral (ASMC-PI) control[Huynh 2022].

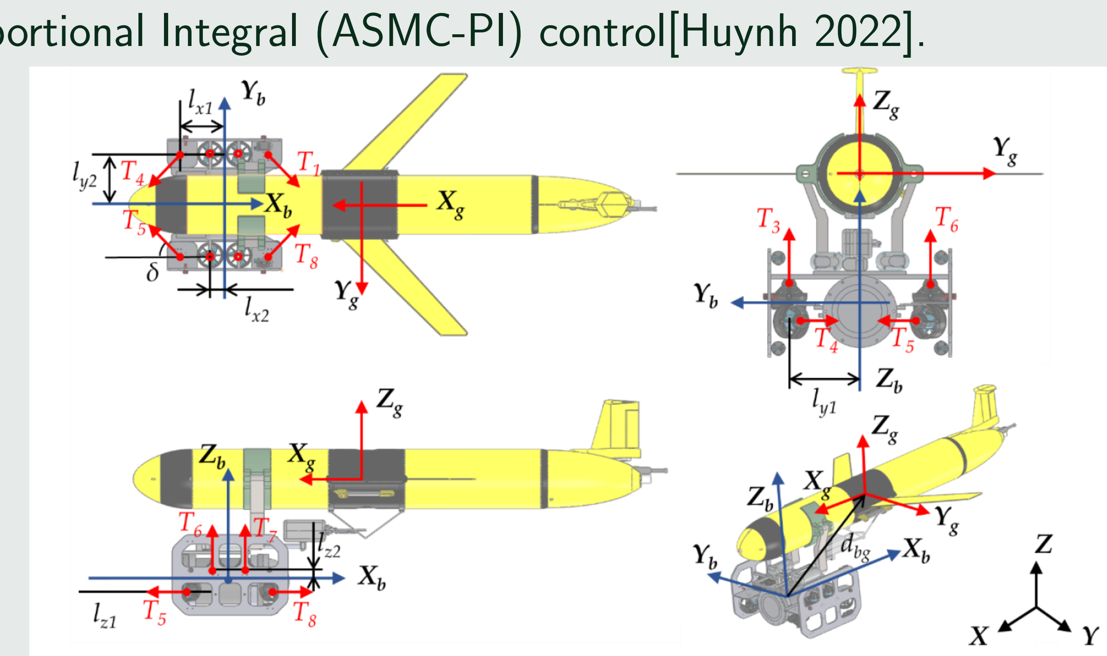

Figure 2. Schematic drawing of the glider recovery system using the ROV.

2. In this paper the authors have developed and tested a system that uses a multi rotor UAV for the deployment and recovery of Miniature Underwater Gliders (MUGs). The UAV employs computer vision and a custom Aruco marker for glider detection, and utilizes an Electro-Permanent Magnet (EPM) mechanism for capturing and releasing the MUGs, allowing for efficient and flexible operations at sea[Zolich 2021].

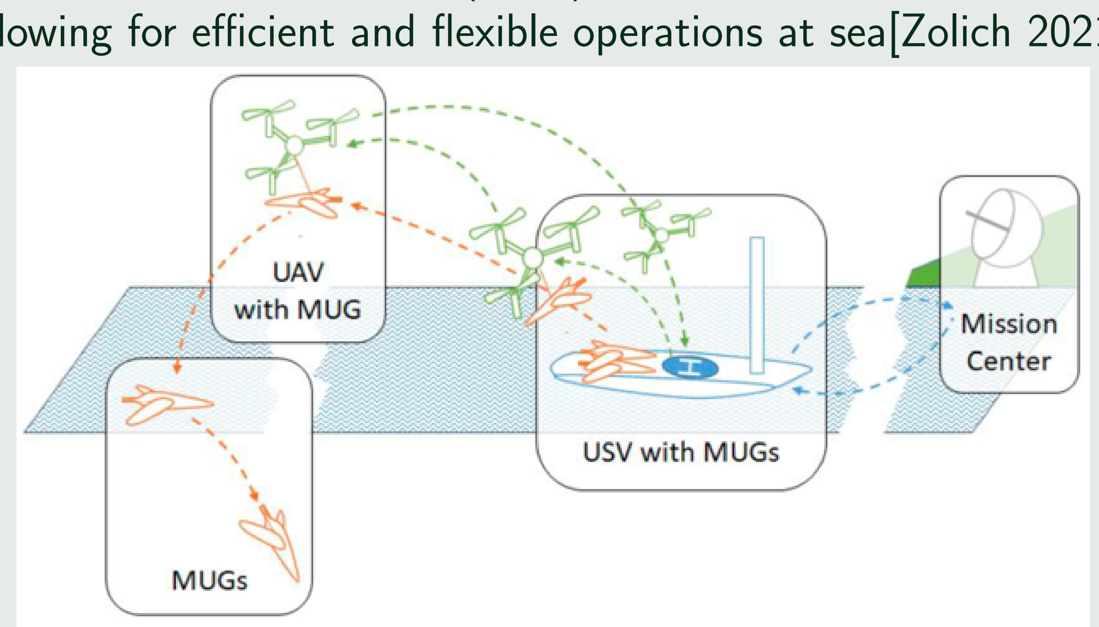

Figure 3. System concept

Research Proposal

1. **Grasping and Thruster module in UAV:** Designing and Developing a reliable and effective grasping mechanism for the drone to securely attach to the glider.Adding thrusters to the drone to assist the glider in navigating back to the USV

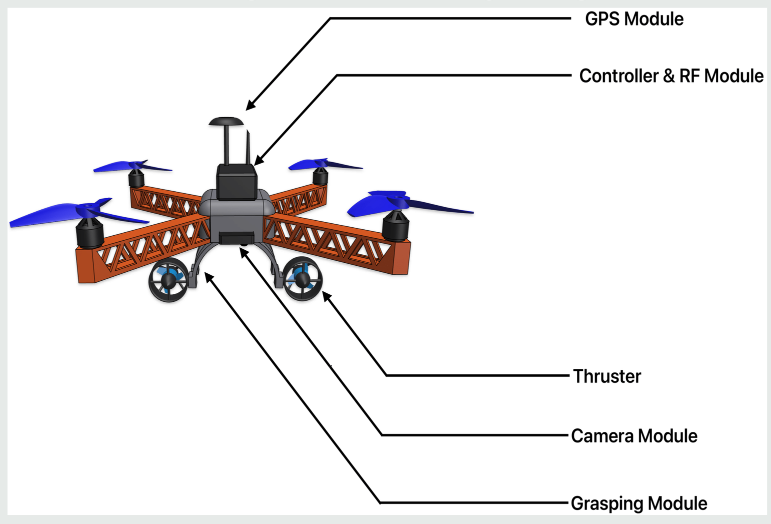

Figure 4. Grasping and Thruster module in UAV

2. **Glider Detection & Navigation:** To accurately detect and locate underwater gliders on the sea surface using drone-mounted cameras and return to the docking station with the glider.

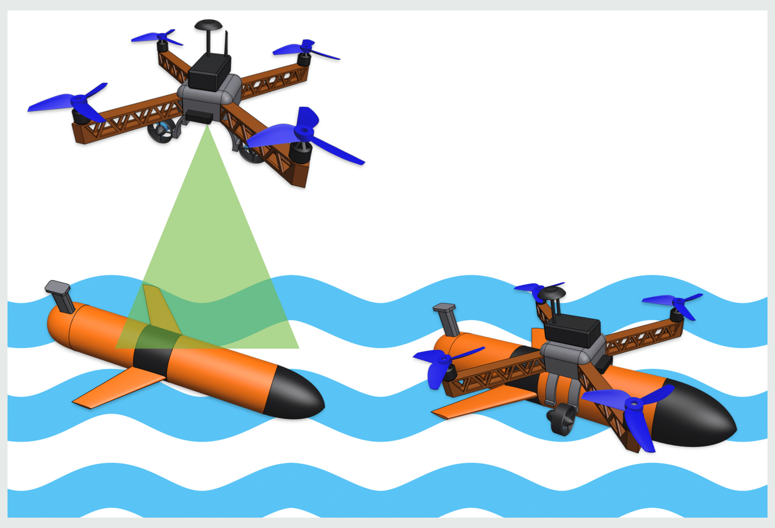

Figure 5. Glider Detection using vision and attached to the Glider Autonomously

3. **System Design:** Developing Overall System design for LARS ensuring that the entire system operates autonomously with minimal human intervention.

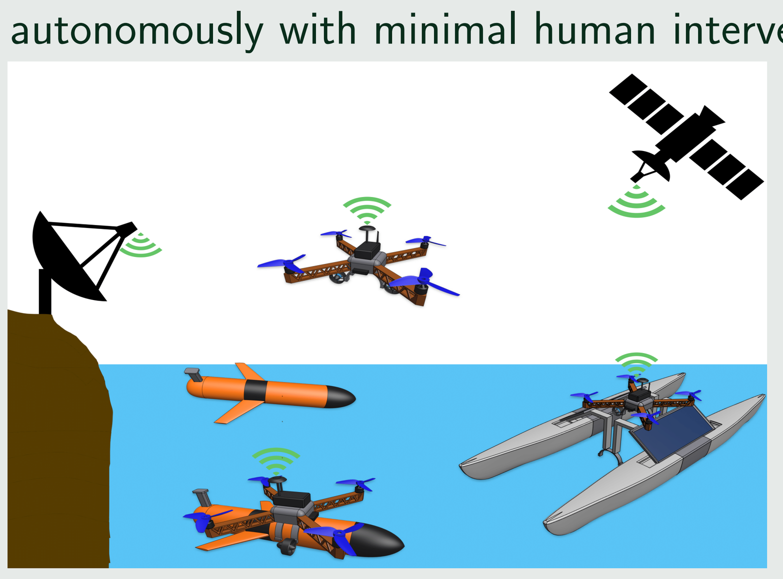

Figure 6. Overall System

References

Huynh, e. a. (2022). "Development of Recovery System for Underwater Glider". In: *Journal of Marine Science and Engineering* 10.10, p. 1448.

Zolich, e. a. (2021). "Unmanned Aerial System for deployment and recovery of research equipment at sea". In: *2021 Aerial Robotic Systems Physically Interacting with the Environment (AIRPHARO)*. IEEE, pp. 1–8.

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