Developing a Control Room in Virtual Reality to Improve Underwater Remotely Operated Vehicle Piloting

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Abstract

We developed a prototype virtual reality (VR) control room to streamline underwater remotely operated vehicle (ROV) operations during missions. Typical ROV control rooms consist of a wall of fixed monitors, each displaying a separate piece of telemetry data. Our prototype displays this telemetry data over live footage from the ROV’s 180°, 4K stereo camera, creating an immersive multi-user 3D VR experience, enhancing piloting and pilot-scientist collaboration.

Prototype

Scientist
Digitally selects points of interest for exploration

Pilot
Controls ROV while wearing VR headset

Features

1. Live stereo footage creates an intuitive sense of scale with depth perception
2. Hand-based control allows pilots to easily reconfigure UI elements
3. 3D data overlays provide pilots with live telemetry data in a novel format
4. Multi-user support helps scientists communicate points of interest to pilots

Impact

Makes piloting more intuitive by giving pilots full spatial awareness
Increases flexibility by making displays reconfigurable
Enables advanced features by consolidating data streams
Enhances collaboration by including collaborative features for pilots and scientists

Future Work

Improve UI based on further pilot-scientist testing in MBARI’s test tank
Test in the deep sea to ensure the system is robust
Integrate more advanced features such as automated specimen recognition and tracking

System Architecture

ROV Data - LCM Network - LCM Packets
Stereo Camera Feed - Capture Card - Camera Feed
Dewarped Camera Image - Data Overlays & UI
Unity
VR Application
Desktop Application