

ExpROVer - Milestone 1 - Test and Validation



ExpROVer

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Version Control

Version	Date	Authors	Changes Log
V0.1	06/03/2019	António Santos (AS), Beatriz Borges (BB), Gonçalo Marques (GM), João Monteiro (JM), Sérgio Gasalho (SG), Tiago Almeida (TA)	First draft of the Introduction and Positioning sections.
V0.2	11/03/2019	AS, BB, GM, JM, SG, TA	Addition of Test and Validation sections.
V1	16/03/2019	BB	Integration of project mentors' feedback.

Vision

1. Introduction

Remotely Operated Vehicles (ROVs) are underwater vehicles used across several sea- and ocean-related industries, for fish management, research purposes, dangerous maintenance operations and several other tasks.

The VideoRay Pro 4 (VRP4) is the world's most popular small underwater ROV. It incorporates the latest design and technology, making it stand out on the market as the most advanced, capable, and versatile small ROV.

With a maximum depth of 300m, the VRP4 is controlled through an umbilical cord which directly connects it to a computer, which is used by the ROV to send data to the computer and to receive commands from it.



Figure 1. VideoRay Pro 4.
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The VRP4 is controlled through the VideoRay Cockpit software, developed by VideoRay, executable only on Windows - and unfortunately known to be liable to problems and bugs.

Finally, this software requires training, being complex and demanding high levels of prolonged concentration from its users to ensure the proper maneuvering of the VRP4.

2. Positioning

In this section, the main problems and the project's locality are described.

2.1. Problem Statement

The problem of	operating a ROV or improving its functionality range
affects	all business and research institutions which require underwater monitoring or operations
the impact of which is	high labor costs, accidents' susceptibility and error-proneness during operations
a successful solution would be	the reduction of effort and inconvenience associated with operating a ROV, leading to lower expenses, higher efficiency and the enabling of new functionalities' creation.

2.2. Product Position Statement

For	owners of the VRP4
Who	want to control the VRP4 with either less specialized or more productive workers and have higher effectiveness in its operation
The ExpROVer	is a software solution
That	promotes a reduced workload and lower training requirements, offering several helper functionality and high accessibility to the ROV's systems.

Unlike	VideoRay's Cockpit software
Our product	will run on Linux, as well as Android, and will have several additional semi-autonomous features, such as object recognition and smart maneuvering.

3. Test and Validation

The tests will be specified according to the following topics:

- Test identifier;
- Feature to be tested;
- Evaluation procedure;
- Pass/fail criteria.

The pass/fail criteria will be derived from the following series of binary queries which assess the correct functioning of the system.

1. To test the connection with the ROV, and the developed app's interface, questions such as the following will be considered:
 - 1.1. Can a user connect with the ROV via a mobile device?
 - 1.2. Can a user connect with the ROV when using a computer running the Linux OS?
 - 1.3. Can a user unfamiliar with the developed app, but familiar with ROVs, correctly use and understand the interface?
 - 1.4. Can a non-expert ROV user maneuver the ROV as they desire, through the developed interface?
2. To test the computer vision capabilities, questions such as the following will be considered:
 - 2.1. Can the ROV detect obstacles?
 - 2.2. Can the ROV correctly detect fishes?
3. To test semi-autonomous movement capabilities, questions such as the following will be considered:
 - 3.1. Can the ROV execute simple autonomous maneuvers, like collision avoidance?

4. References

Several documents were consulted during the elaboration of this report:

1. Pro 4 Operator's Manual, VideoRay, March 2019, available at http://download.videoray.com/documentation/pro_4/html/index.html
2. Human-Automation Systems Lab general workspace, Georgia Tech ROS Group, March 2019, available at <https://github.com/gt-ros-pkg/humans>