ExpROVer - Milestone 1 - User Manual Draft

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Projeto em Engenharia Informática

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User Manual

Version Control

Version	Date	Authors	Changes Log
V0.1	12/03/2019	António Santos (AS), Beatriz Borges (BB), Gonçalo Marques (GM), João Monteiro (JM), Sérgio Gasalho (SG), Tiago Almeida (TA)	First draft of the User Manual.
V0.8	12/03/2019	AS, BB	Revision and update of the User Manual.
V1	16/03/2019	BB	Integration of project mentors' feedback.

Abbreviations and Acronyms

CV - Computer Vision

ROS - Robot Operating System

ROV - Remotely Operated Vehicle

VRP4 - VideoRay Pro 4

1. Introduction

The ExpROVer is a software that allows its users to control Remotely Operated Vehicles (ROVs), specifically designed for the VideoRay Pro 4 (VRP4). It is open-sourced, free, supports various platforms, and even integrates several intelligent capabilities, such as object recognition, and semi-autonomous maneuvers.

It is comprised of 3 main elements:

1. One or more end devices, with the ExpROVer mobile (android) or Web App,
2. A server computer, connected to the ROV and running the ExpROVer backend application,
3. And the VideoRay Pro 4 ROV.

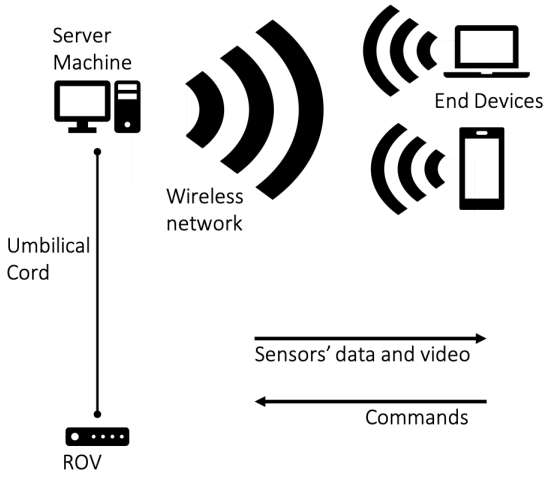


Figure 1. A simple diagram of the ExpROVer system's components.

TThe server machine is a computer connected to the VRP4's umbilical cord, and will first bridge the ROV's software with the ROS, and secondly process the inputs received by the ROV, with CV technology, to detect objects.

End devices communicate with the server machine through a wired or wireless network, using either the developed web interface or a specialized mobile application. They receive the VRP4's sensors data, and can also send high-level instructions with which to control the ROV.

As such, the ExpROVer software can offer connectivity to your VRP4 from any device, provided the setup was correct, as well as an elevated movement autonomy - requiring less training on

ROV operation from the user - and high confidence video analysis, detecting objects and fishes; or even a great starting point to easily modify in order to suit user needs[1].

[1] The addition of support for new peripherals requires some understanding of ROS.

2. System Objectives

ExpROVer aims to be a software solution that simplifies a ROV's operation while promoting the development of new software modules which enhance the availability of ROV appliances.
The main objectives of ExpROVer solution are the following:

- Remote access to ROV through ROS
- ROV control, at anytime, from anywhere, through any device with connectivity through a Web or an mobile application
- Several semi-autonomous maneuvers enablement:
  - Pre-programmed paths following:
    1. straight line movement
    2. turn a given amount of degrees
    3. combinations of **1** and **2** and
    4. movement in a straight line until a change is detected in the video feed.
  - Automatic return to the surface, and
  - direction maintaining.
- Built-in object detection and recognition systems
- Fully open-source code, providing the possibility of creation of new modules to suit more specific needs or features

The use of ExpROVer software provides its user with several benefits, such as:

- ➢ higher operational efficiency when maneuvering ROV, due to Computer Vision and navigation helper functions, reducing both your workload and the focus required to operate your VRP4
- ➢ significant costs reduction, since less training is required, due to the myriad of available helper functionality and customizable peripheral integration
- ➢ the option of remotely controlling the ROV will also noticeably diminish the operational costs

- ➢ higher flexibility in control options, since ExpROVer allows the ROV to be controlled with a wide range of end devices over a web interface, as well as a dedicated Android interface
- ➢ deep customization possibilities, allowing its users and community to fully tweak the software to fit their needs and VRP4s configurations
- ➢ great user mobility in ROV data monitoring, from anywhere, at time, requiring only connectivity between the end device and the server machine (which is connected to the ROV via the umbilical cord)

3. Walkthrough of the System

3.1. Installation

The ExpROVer solution comprises two options:

1. Base system
2. Complete system

In the base system the user installs the software in the PC connected to the ROV. This software will enable the reading the ROVs' sensors values and writing the instructions into the ROV.
In this option the user should:

- Download the base system software from the ExpROVer website
- Unpack the software and run it
- After successful installation the graphical user interface should appear

In the complete system option the user should:

- Download the complete system software from the ExpROVer website. This solution brings also the Computer Vision and pre-programmed navigation features,
- Unpack the software and run it in the server that is connected to the ROV
- After successful installation the graphical user interface should appear

For the apps installation proceed as following:

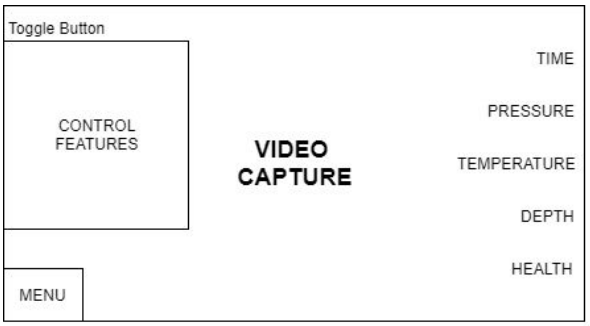
- Download the ExpROVer mobile application to your smartphone, or open the web interface through a browser of your choosing.
- After successful installation the window with the graphical user interface must appear
- Configure the connection enabling that the web and mobile applications reach the server connected to the ROV.

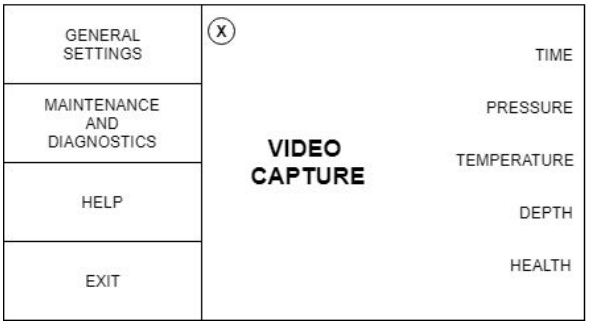
- Test the connectivity to the server

3.2. Getting started – Base system

Run the software already installed by:

- Double clicking in the ExpROVer icon.
- The graphical user interface should appear as in the following figure, which depicts a mockup of the system after establishing a connection to your VRP4. The bottom figure shows the menu expanded.





To operate your ROV:

- (to be continued)

3.3. Getting started – Complete system

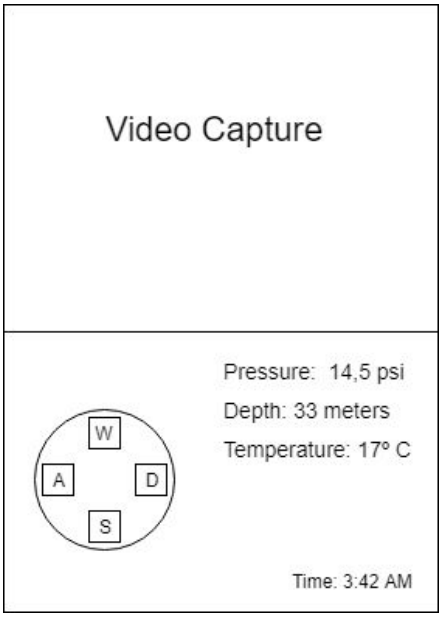
- **Web application**

(To be defined. The interface should be similar to the one previously shown, including

the CV and pre-programmed paths buttons).

- **Mobile application**

(To be defined. A very draft mockup is shown below).



4. Troubleshooting

4.1. Problem#1

4.2. Problem#2