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Automatic System for 3D Photogrammetry of Small Artificial Biotopes Using the Crawler Remote Operating Vehicle at OBSEA Observatory

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I. ABSTRACT

Nowadays, the need to save the sea is getting more recognized, which is why marine technologies are so important. These can perform different functions complicated by people or help in science studies. 3D photogrammetry can help with different seabed studies, such as marine biology [1] or visualizing the evolution of a marine artificial biotope [2]. Getting the evolution of a marine artificial biotope can help with different issues investigations such as the ecological niche, the functional relationship between biodiversity and ecosystem processes such as production, and the applied problems of nature conservation such as designing nature reserve systems or networks.

This work is based on the OBSEA cabled observatory [3], that is part of the European Multidisciplinary Seafloor and water column Observatory (EMSO), and Remote Observation Vehicle (ROV), the underwater Crawler [4], a modified version of the "Wally" platform series. The new ROV is easily deployable for monitoring benthic communities, such as biotopes. The Crawler has an 360º HD camera with a 180º tilt embedded in a glass sphere on the front of the vehicle, allowing a panoramic view (FOV). The control of the Crawler camera has been enhanced with a semiautomatic underwater 3D photogrammetry. Semiautomatic, because the Crawler control and the image taking was automatic, but the photogrammetry part, was manual. For the 3D photogrammetry we have tested different opensource programs, such as Agisoft Metashape, Meshroom, Regard3D and COLMAP.

All these programs generate a 3D model through imported images. Images must be taken along the entire surface of the desired object, using different angles and directions, to obtain more or less detail with more or fewer images. We have done a review to choose the best option, and in our case, it was Agisoft Metashape, using the demo version.

Agisoft Metashape	Stand-alone software product that performs photogrammetric processing of digital images and generates 3D spatial data. AgiSoft PhotoScan Standard (Version 2.0.0) (Software). (2022*). Retrieved from http://www.agisoft.com/downloads/installer/
Meshroom	Free, open-source 3D Reconstruction Software based on the AliceVision framework. Meshroom (Version 2023.1.0) (Software). (2023*). Retrieved from https://alicevision.org/#meshroom
Regard3D	Regard3D contains many third-party libraries and programs. All of them are published under an open-source license. Regard3D (Version 1.0.0) (Software). (2023*). Retrieved from https://www.regard3d.org/index.php/download
COLMAP	COLMAP is a general-purpose Structure-from-Motion (SfM) and Multi-View Stereo (MVS) pipeline with a graphical and command-line interface. It offers a wide range of features for reconstruction of ordered and unordered image collections. COLMAP (Version 8.3) (Software). (2023*). Retrieved from https://github.com/colmap/colmap/releases

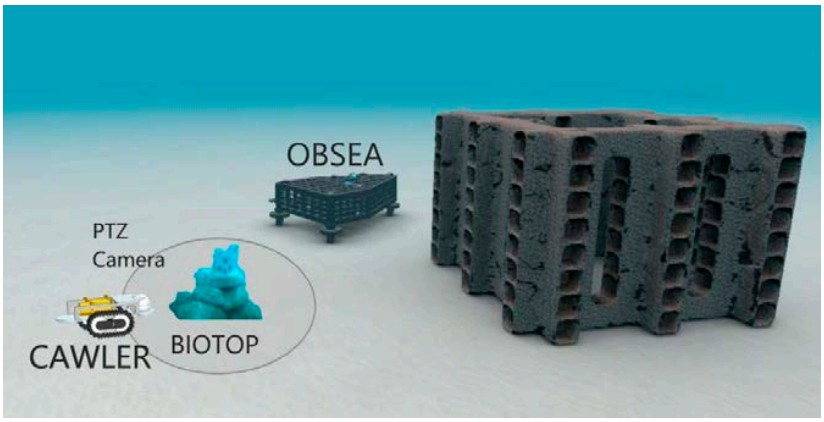

Figure 1 3D photogrammetry of small biotopes with Crawler

In this work we present the results obtained through a circular circuit around the biotope, as shown in Figure 1, stopping at different point to take photos at three different angles, close enough to detect details. And, as the photos are taken, the Crawler processes and calibrates them, to create the photogrammetry more easily later.

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