Trident submarine robot successfully tested at sea

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Trident project.

In its final assessment, the European project Trident has submerged its I-AUV (autonomous underwater vehicle for intervention) in the Port of Sóller (Mallorca). The vehicle has been able to find and retrieve independently an object in an unknown seabed facing the adverse conditions presented by the open ocean.

Unlike other methods, based mostly on remote control or single-purpose systems, the project coordinated by Pedro J. Sanz, professor of Computer Science and Artificial Intelligence at the Universitat Jaume I of Castellón (Spain), proposes a new methodology that provides the robot with multitasking skills and autonomous manipulation for intervention operations in unknown submarine spaces.

According to Sanz, "Trident demonstrates the feasibility to attack the problem of intervention in the context of the search and retrieval of any object at an autonomous level regardless of this object. It is based on a multipurpose system that incorporates a two-stage strategy: in the first stage, the system is released into water. It builds a visual map of the seabed by scanning the area of interest where the goal of the intervention is. After this, the system rises to the surface and has to be told, before launching it back into the water system, which is the goal of the intervention and what do we want to do with it. In a second stage, the operation is executed".

Trident arose in March 2010 from the successful RAUVI project after contacting the lecturer Giuseppe Casalino, from the University of Genoa, chief representative of underwater robotics in Europe. After that, the project was extended to the rest of Europe, with new partners from Portugal, the United Kingdom and Italy, in addition to the Spanish participants: the Universitat Jaume I, the University of Girona and the University of the Balearic Islands.

The new project expands and exceeds the expectations of the former RAUVI project in the integration and improvement of the mechatronics of I-AUV. Thus, the vehicle has a new and more powerful arm, and the new right hand is much more complex and multipurpose.

In addition, its more robust and efficient control algorithms have shown that Trident I-AUV is able to overcome difficulties regardless of the

adverse conditions of seabed.

UJI researcher Pedro J. Sanz explains how, in one of the tests in the Port of Sóller, "before an unexpected problem of loss of a degree of freedom in the arm, thanks to the visual free floating manipulation and using other degrees of freedom of the vehicle itself, there was no problem in supplying the deficiency and in successfully solving the recovery of the object that we had planned".

The coordination of the project, carried out from the Universitat Jaume I, has required intensive work planning many months away. "We are a total of eight partners, and each partner plays a role in accordance with their experience, knowledge and research capacity. For example, the arm mechatronics is assumed by Graal Tech, a spin-off from the University of Genoa; the development of the robotic right hand is undertaken by the University of Bologna; experts from the University of Girona are in charge of the autonomous underwater vehicle... and thanks to our experience, the UJI contributes with control handling algorithms, using multisensory information. In addition, we develop all aspects of the simulation tool that has to be generated to previously test in virtual reality all the actions that we want to transfer to the real scenario", according to professor Pedro J. Sanz.

However, Sanz continues, "evolution has been much faster than we could have imagined, thanks to the prior existence of the Spanish project, whose core followed a similar direction with respect to autonomous underwater robotics. In fact, in the first annual assessment by European reviewers, held in May 2011 at the Underwater Robotics Research Centre (CIRS) in Girona, the mechatronics available thanks to the Spanish project RAUVI was introduced in a pool and the I-AUV was able to evolve in order to recover a model identical to the black boxes in commercial aircrafts".

Subsequently, in October 2011, the project was carried out in a real scenario, dipping the robot into the sea of the bay of Roses and performing an experimental validation of the whole system in the final conditions of seabed. These tests settled the basis for integrating the rest of the mechatronics.

Finally, in October 2012, end experiments were carried out at the port of Sóller, where a reviewer of the European Union was able to verify that the objectives were successfully achieved.

The purpose of the project was originally based on exploring progress ways for the generic problem of "search and recovery" on the seabed in an autonomous way. In particular, the recovery of aircrafts black boxes, motivated, among other reasons, by the news of the tragic disappearance in the Atlantic Ocean of the Air France plane that made the Rio-Paris route in June 2009, helped to choose this context as a common thread throughout the project, with respect to the actual stages of validation. But this autonomous intervention system opens up new possibilities and offers potential applications in the field of underwater archaeology, oceanography and offshore platforms for oil and gas extraction, among others.

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