EXCELLABUST

EXCELLING LABUST IN MARINE ROBOTICS

TRAINING 1

Report

19-20 July 2016

Consiglio Nazionalle delle Ricerche

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691980.

1. VENUE

CNR Research Area in Genoa - Sala Leonardo, 11th floor
Address: Via De Marini 6, 16149 Genoa, Italy

2. SUMMARY

The training followed the planned schedule of educating the participants about the basics of unmanned marine vehicle construction and control, with lectures, presentations and demonstrations given by Marco Bibuli, Massimo Caccia, Angelo Odetti, Andrea Ranieri, Antonio Petitti, Donato Di Paola, Rosalia Maglietta, Annalisa Milella, Davide Chiarella, Massimo Ianigro, and Roberto Colella.

The first day focused on building an unmanned marine vehicle, covering the themes of mechanical design and construction, hardware and software design and implementation. The basics of the design of an unmanned marine vehicle from a naval, mechanical and structural point of view were outlined. An overview of the existing vehicles and the future ones with their peculiarities and requirements was given. Students were shown many examples of choosing the proper building components, with a specific focus on the choice of propellers and of an adequate propulsion system. A brief introduction to the hardware and software design of marine robots was given, with a focus on how the robot's electronic hardware design has a huge impact on the reliability, efficiency and modularity of a marine robotic vehicle. Students were familiarised with recent developments in the form of advanced libraries and open-source frameworks developed by the community and the rapid development of fast, cheap, and power-efficient CPUs enclosed in small packages that relax many of the limiting factors imposed on robot's software by hardware design. The first day concluded with a visit to the CNR-ISSIA Marine Robotics laboratory, where students could see and interact with a variety of both completed vehicles and those in various stages of construction.

The second day focused on cooperative control and perception for heterogeneous unmanned marine vehicles with topics on cooperative guidance and mission control, cooperative perception and environment characterisation, human-robot interaction languages, and the use of UAVs for ecosystem monitoring. The focus was on guidance aspects, the extension of the concept of virtual-target based path-following in order to achieve the task of motion coordination among a team of unmanned robotic platforms, mission re-planning strategies, decentralized task allocation algorithms, and mission execution control methodologies. An overview of perception systems and methods for ambient awareness of mobile robots in field applications was given, including recent advances from single robot to cooperative perception. Machine learning techniques as an increasingly popular approach were introduced, along with classification problems and some computational and statistical learning theories, with attention to the computer vision and robotics domains. Students received a glimpse of how the development of fully automatic systems is based on the integration of robotics and image analysis. Human–Robot Interaction (HRI) languages were introduced. In particular, the creation of a gesture-based language for underwater environment, which extends the one already used for diving, was be described: the choice of alphabet, syntax, semantics and communication protocol with error handling was investigated, and students had the opportunity to learn and test out some of the gestures among themselves. Finally, a presentation about the integration of UAV in real-world scenarios was given, related to projects carried out by the Field and Interaction Robotics Group at ISSIA, together with some of the experimental results achieved, including some aspects related to the marsupial sea-air systems.

The training also presented the opportunity for meetings between students and researchers from several universities and institutes, leading to many idea exchanges and conversations about common research interests and potential future collaborations.

3. LIST OF PARTICIPANTS

1. Anja Babić, anja.babic@fer.hr, University of Zagreb Faculty of Electrical Engineering and Computing
2. Ivan Lončar, ivan.loncar2@fer.hr, University of Zagreb Faculty of Electrical Engineering and Computing
3. Marin Stipanov, marin.stipanov@fer.hr, University of Zagreb Faculty of Electrical Engineering and Computing
4. Milan Marković, milan.markovic@fer.hr, University of Zagreb Faculty of Electrical Engineering and Computing
5. Ivana Mikolić, ivana.mikolic@fer.hr, University of Zagreb Faculty of Electrical Engineering and Computing
6. Filip Mandić, filip.mandic@fer.hr, University of Zagreb Faculty of Electrical Engineering and Computing
7. Nadir Kapetanović, nadir.kapetanovic@gmail.com, University of Sarajevo
8. Satja Sivcev, satja.sivcev@ul.ie, University of Limerick
9. Stefano Pierantozzi, stefano.pierantozzi@ul.ie, University of Limerick

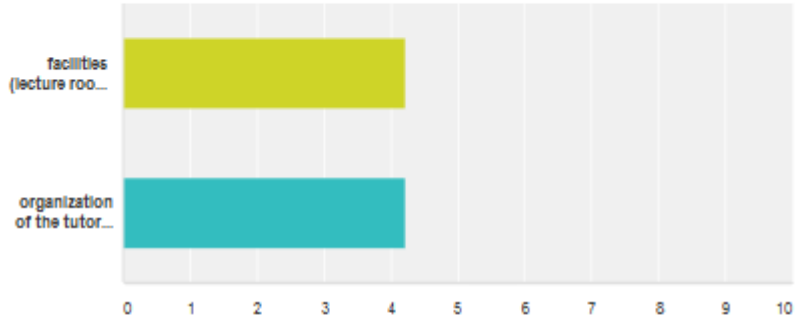
4. SURVEY RESULTS

Q1

Customize Export

How would you rate the quality of:

Answered: 9 Skipped: 0



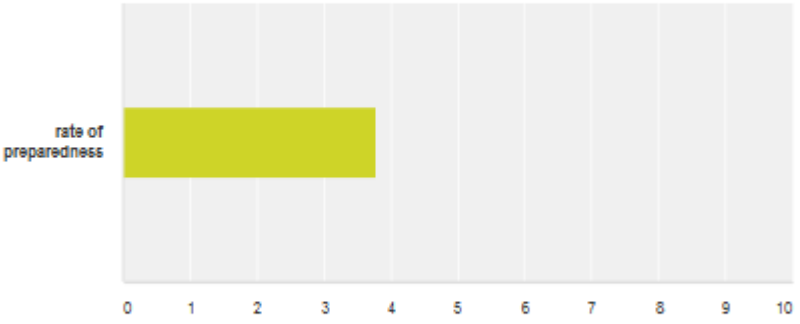
	Bad	Below average	Average	Above average	Excellent	Total	Weighted Average
facilities (lecture room, wireless Internet, etc.)	0.00% 0	0.00% 0	22.22% 2	33.33% 3	44.44% 4	9	4.22
organization of the tutorial (syllabus, breaks, etc.)	0.00% 0	0.00% 0	22.22% 2	33.33% 3	44.44% 4	9	4.22

Q2

Customize Export

How would you rate your preparedness for the training?

Answered: 9 Skipped: 0



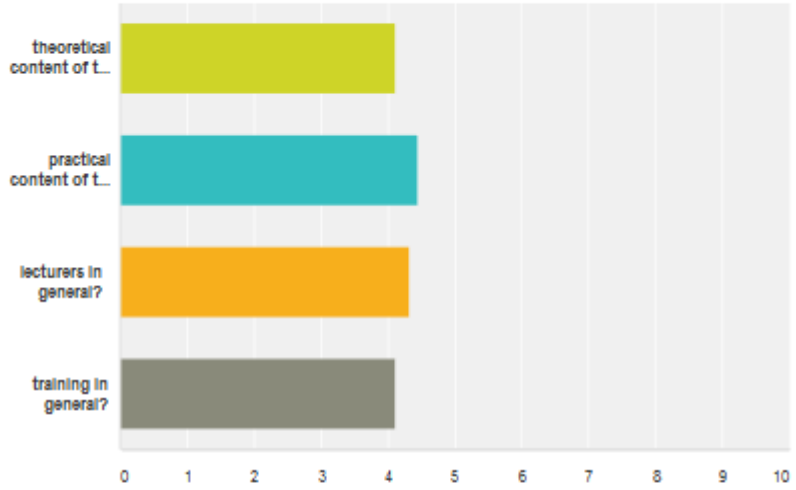
	Bad	Below average	Average	Above Average	Excellent	Total	Weighted Average
rate of preparedness	0.00% 0	0.00% 0	44.44% 4	33.33% 3	22.22% 2	9	3.78

Q3

Customize Export

How satisfied were you with the:

Answered: 9 Skipped: 0



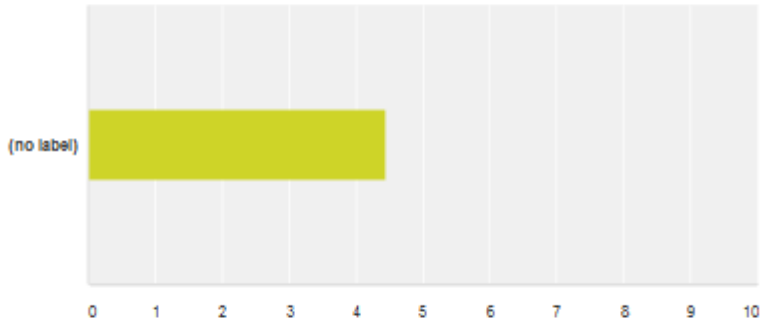
	Bad	Below Average	Average	Above Average	Excellent	Total	Weighted Average
theoretical content of the training?	0.00% 0	0.00% 0	22.22% 2	44.44% 4	33.33% 3	9	4.11
practical content of the training?	0.00% 0	0.00% 0	11.11% 1	33.33% 3	55.56% 5	9	4.44
lecturers in general?	0.00% 0	0.00% 0	11.11% 1	44.44% 4	44.44% 4	9	4.33
training in general?	0.00% 0	0.00% 0	22.22% 2	44.44% 4	33.33% 3	9	4.11

Q4

Customize Export

How knowledgeable in the training content was your lecturer?

Answered: 9 Skipped: 0



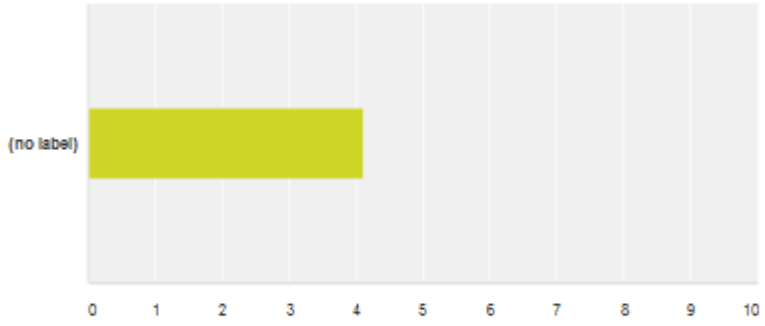
	Bad	Below Average	Average	Above Average	Excellent	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	22.22% 2	11.11% 1	66.67% 6	9	4.44

Q5

Customize Export

Did the training meet your expectations?

Answered: 9 Skipped: 0



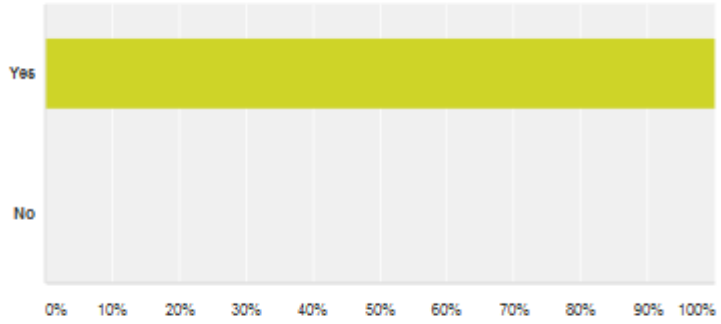
	Bad	Below Average	Average	Above Average	Excellent	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	22.22% 2	44.44% 4	33.33% 3	9	4.11

Q6

Customize Export

Would you attend another training organized within the scope of EXCELLABUST project?

Answered: 9 Skipped: 0



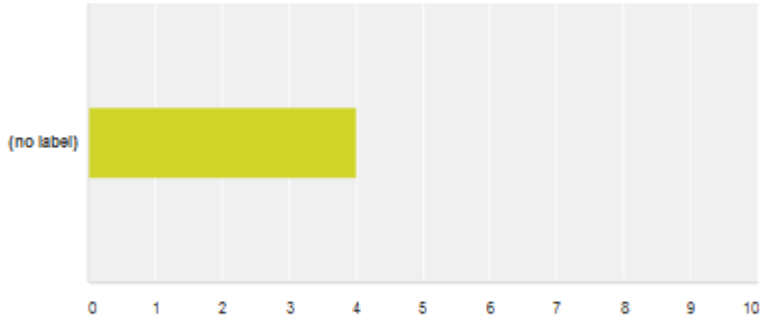
Answer Choices	Responses	
Yes	100.00%	9
No	0.00%	0
Total		9

Q7

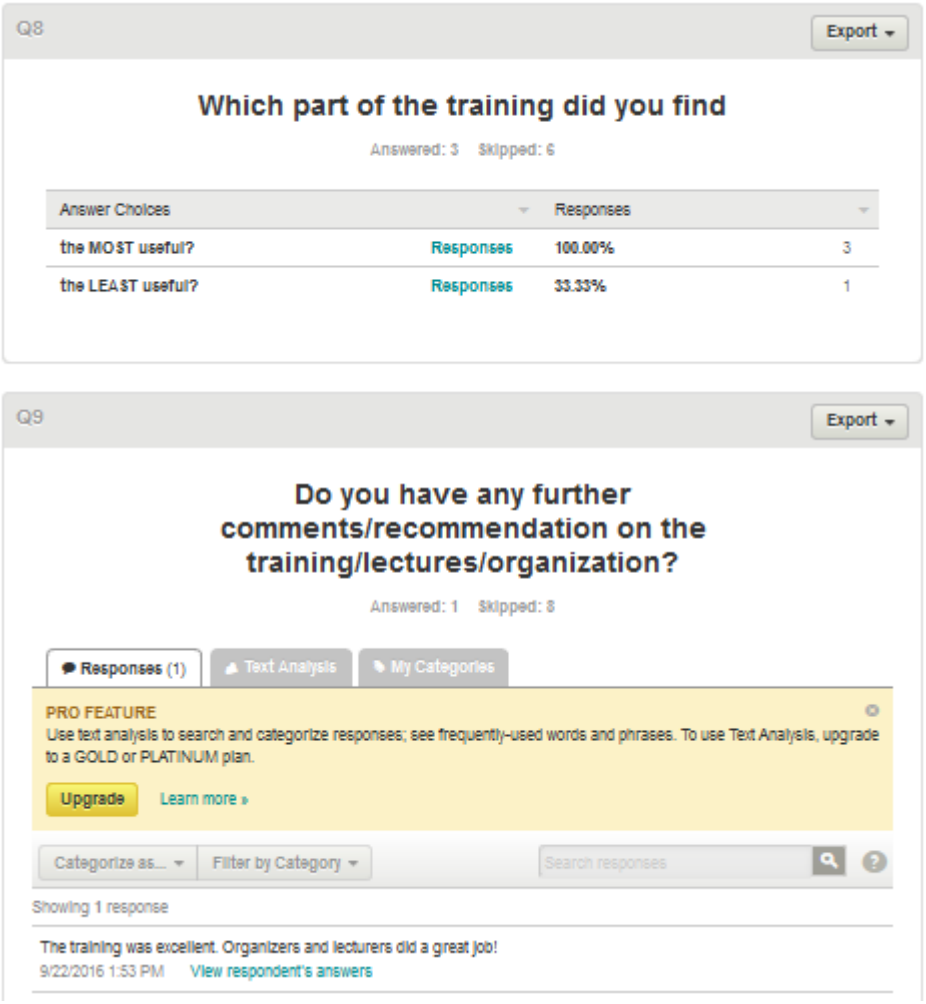
Customize Export

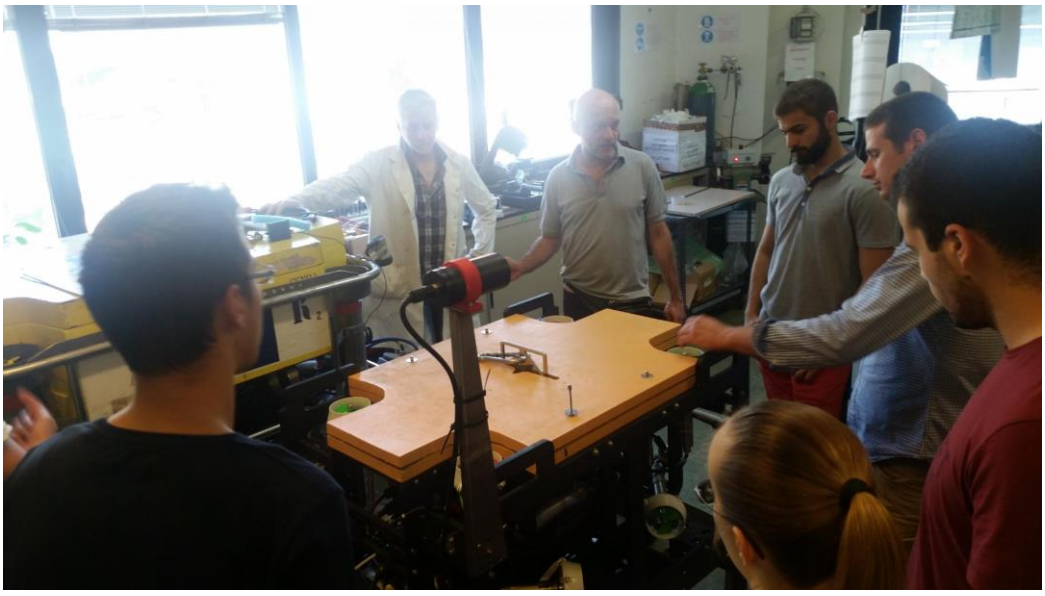
How would you rate your level of knowledge about the topic of thetraining after attending tutorial, compared with the knowledge you had about the topic before attending the training?

Answered: 9 Skipped: 0



	Bad	Below Average	Average	Above Average	Excellent	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	22.22% 2	55.56% 5	22.22% 2	9	4.00



5. PHOTOS

All photos are available here.