The Surveying & MARiTime internet of thingS EducAtion (SMARTSEA) *(Marta Plaza-Hernández, Juan Manuel Corchado, George Katranas)*	**"Cercetări Marine" Issue no. 49** **Pages 173 - 178**	**2019**

Short communication: THE SURVEYING & MARITIME INTERNET OF THINGS EDUCATION (SMARTSEA)

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ABSTRACT

Over the past five years the Internet of Things (IoT) technology has grown rapidly, finding applications in several sectors. Large shipping industries are already investing in IoT techniques to optimize transparency, safety and reduce costs. However, there is a global shortage of trained engineers and technicians to handle this new technology safely. The SMARTSEA project, financed by the European Commission, aims to develop an interactive MSc course on Maritime and Surveyor IoT systems which help complete the market void in technical and maintenance specialists generated by the prompt expansion of the Smart Maritime & Surveying industry. The course duration is eight months, plus three mobility periods; two of them to participate in large-scale laboratories, and a 1-month industrial placement.

Key-Words: Internet of Things (IoT), SMARTSEA, MSc course on Maritime and Surveyor IoT systems.

AIMS AND BACKGROUND

The Internet of Things (IoT) is a network of physical "smart" devices embedded with electronics, software, sensors and actuators that allows interconnectivity among devices and data exchange. This new technology has grown rapidly (Manyika, J. *et al.*, 2015), finding applications in several sectors (e.g. energy, healthcare, industrial, IT and networks, security and public safety, transportation, etc.) (Beecham Research, 2019). In the maritime industry, the implementation of IoT technology enables shipping companies to connect their vessels in one platform, allowing data sharing with the entire corporate ecosystem. IoT systems are set to reduce inefficiencies, risks and costs at the same time that provide live sea-to-shore connectivity that stakeholders can exploit for decision-making.

EXPERIMENTAL

An essential part of the maritime sector is the asset inspection for insurance and quality purposes. This task is handled by maritime surveyors, certified professionals (International Institute of Marine Surveying, 2019) (Lloyds Maritime Academy, 2019) hired by port authorities and environmental agencies. Large shipping industries are already investing in IoT/ICT techniques to optimize transparency, safety and reduce costs (Accenture, 2019), (Chi, L., 2017). However, there is a global shortage of trained engineers and technicians to handle this new technology safely.

The European Union's Erasmus+ Programme is a funding scheme to support activities in the fields of education, training, youth and sport in Europe (European Commission, Erasmus+, 2019). The activities under one of its Key Actions (KA), *KA2: Cooperation for innovation and the exchange of good practices*, let organizations from different countries work together by developing, sharing and transferring best practices and innovative approaches (European Commission, EACEA, Erasmus+ Actions, 2019). SMARTSEA has been one of the selected proposals, which have started on the 1st of November 2019. Its primary information is compiled in the table below (Table 1).

Table 1. SMARTSEA project information

Project title	The Surveying & MARiTime internet of thingS EducAtion (SMARTSEA)
Project number	612198-EPP-1-2019-1-ES-EPPKA2-KA
Project duration	3 years (1st Nov 2019 – 31st Oct 2022)
Maximum EU grant	971,365.00 EUR
Degree (credits/hours)	MSc on Smart Maritime & Surveying Systems (60 ECTS/1500 hours)
Learning and mobility activities	8 months lectures (Oct 2021 - May 2022); 2 x 14-days exchange between teaching universities (Dec 2021 & Mar 2022); 1-month industrial experience (Jul 2022)

RESULTS AND DISCUSSION

The SMARTSEA project aims to develop an interactive MSc course on Maritime and Surveyor ICT/IoT systems, which helps complete the market void in technical and maintenance specialists generated by the prompt expansion of the Smart Maritime & Surveying industry.

The project focuses on the following objectives:

- ✓ Address participants from backgrounds with fewer opportunities

- ✓ Enhance cooperation and mobility between countries
- ✓ Create a course recognized by academia/industry by using ECTS credit system
- ✓ Create cost-effective reconfigurable tools and an online platform to reduce the learning cost in academia and empower distant learners
- ✓ Increase competence in new languages
- ✓ Equip educators with new tools for conveying knowledge
- ✓ Ignite entrepreneurship by using interactive teaching methods

The consortium consists of six universities: University of Salamanca, University of Ljubljana, International Hellenic University, Maritime University of Szczecin, Tallinn University of Technology, Escola Superior Náutica Infante D. Henrique, one research centre (National Institute for Marine Research and Development "Grigore Antipa"), two SMEs: Cerca Trova Ltd, ECQA GmbH and three environmental surveying and shipping companies: Creocean, RINA Hellas SA, Danaos Shipping Company Ltd.
Partners will present the most recent knowledge and technology on Maritime Engineering, Shipping/Environmental Surveying and IoT systems on the component and systems level. The educational institutions involved have a high potential in marine surveying, engineering, high-tech applications and hold facilities equipped with instrumentation for testing and development of the IoT systems. Additionally, the SMEs and shipping/environmental surveying companies constitute the industrial part of the project, bringing appropriate experience and techniques.

The work breakdown structure is based on six Work Packages (WPs), comprising the definition of specifications towards creating the educational materials, the course deployment, the student exchange activities and an industrial placement.

WP1 includes the definition of course materials and deployment specifications. The development of the course lessons will be approached in WP2. WP3 will deal with the creation of the interactive reconfigurable laboratory apparatus and an e-Learning platform. The developed course material in WP2, WP3 and the e-Learning platform will be available to the students via WP4. In WP5, the consortium will evaluate the distribution and exploitation potential of the MSc. WP6 will ensure global project coordination.

Course Syllabus and Experiment Design

The course will run during the third year of the project in parallel at two of the academic institutions: University of Ljubljana (FMTS) and International

Hellenic University (IHU). The course lessons will comprise 24 modules split into two timeslots (TS1, TS2) (Table 2).

Table 2. Course syllabus

Code	Title TS1	Code	Title TS2
TS1.1	Marine Control Systems	TS2.1	Remote Sensing & Positioning
TS1.2	Marine Surveying	TS2.2	Distributed Ledgers/Blockchain
TS1.3	NI LabVIEW Training	TS2.3	Lightweight Materials
TS1.4	Data Acquisition & Sensors	TS2.4	Underwater Comms & /Navigation
TS1.5	IoT Platforms & Systems	TS2.5	Data processing
TS1.6	ROUV Electric System	TS2.6	Geographical Information Systems
TS1.7	Artificial Intelligence	TS2.7	Underwater Physics
TS1.8	Marine Environment	TS2.8	Entrepreneurship
TS1.9	Safety at Work on Sea	TS2.9	Business Administration
TS1.10	Diving Observation Techniques	TS2.10	Maritime Legal Arrangement
TS1.11	Language Lessons	TS2.11	Language Lessons
TS1.12	Intermediate Project	TS2.12	Developing Tool Demonstrator

The course lessons will guide the following set of experiments: (1) NI LabVIEW® Training, (2) Data Acquisition & Sensors, (3) IoT Platforms & Systems, (4) ROUV Electric System, (5) Lightweight Materials, (6) Data Processing, (7) Intermediate Project, and (8) Developing Tool Demonstrator. The central hardware elements chosen for this purpose are from (National Instruments National Instruments, 2019). These well-known products provide powerful and flexible technology solutions.

Learning Mobility Activities

The consortium has allocated 40 student placements to participate in the MSc course. Both universities where the teaching will take place, FMTS and IHU, will receive 20 students who meet the entry requirements. Students will participate in 1500 teaching hours, awarding the equivalent ECTS credits.

The MSc course includes three mobility periods. For the first two 14-day periods, the students (plus two educators) from one university will travel to the other teaching partner to participate in large-scale laboratories. For the last mobility period, 1-month industrial placement, students will split into four groups. Two groups will install a Remotely Operated Underwater Vehicle (ROUV), previously developed, at the two surveying companies

(RINA Hellas SA. and Creocean). Likewise, the other two groups will install the developed IoT demonstrator at the two shipping partners (Danaos Shipping Company Ltd. and Maritime University of Szczecin).

CONCLUSIONS

Overall, the SMARTSEA course will bring to the EU and in South & East Europe activities to increase the uptake of subjects where skills shortages exist due to the market rise and improve career prospects. The course also innovates by designing and developing a curriculum that meets the learning needs of students and is relevant to the labour market and societal needs. This is done by using open and online, blended, work-based, multi-disciplinary learning and new assessment models. By improving and extending the supply of high-quality learning opportunities tailored to the needs of individual low-skilled or low-qualified adults, they enhance their literacy, numeracy and digital competences. Also, their key competences will enhance the possibility for aiming at lifelong learning options or higher qualifications. Adding the skill validation acquired from this course by equating it to ECTS credits, creates further chances for employability. The SMARTSEA course is designed not only to educate the participants in the field of Maritime surveying ICT's but also to create transnational initiatives that will cultivate active citizenship and ignite entrepreneurial thinking.

Our mission is to provide an innovative curriculum in the theme of Maritime & Surveying IoT systems & land-based infrastructure that includes interactive teaching methods and partnerships with major educational and industrial organizations, giving students a solid grounding for starting a fruitful career in the corresponding industry or enable professionals to gain extra skills & knowledge and at the same time prompting local communities and authorities to embrace the new technologies and their benefits. Hence, the output of the partnership is to design a course that will give additional skills to those interested in a maritime career and allow the partners to create an ongoing course that will go well beyond the duration of this project.

Acknowledgement. The Surveying& MARiTime internet of thingS EducAtion (SMARTSEA) project is financially supported by the European Commission in the Erasmus+ Programme under the project number 612198-EPP-1-2019-1-ES-EPPKA2-KA. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Co-funded by the Erasmus+ Programme of the European Union

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