Project Acronym: IoE - EQ

Project Title: Internet of Energy - Education and Qualification

Reference: 2017-1-IT01-KA202-006251

Programme: Erasmus+

Dates: 01-09-2017 / 31-08-2020 (36 months)

Organizer: CNR - CONSIGLIO NAZIONALE DELLE RICERCHE (Istituto Motori)

Partners:
- CNR - CONSIGLIO NAZIONALE DELLE RICERCHE (Italy). Istituto Motori is devoted to research on energy.
- FHM - FACHHOCHSCHULE DES MITTELSTANDES - UNIVERSITY OF APPLIED SCIENCE - (Germany).
- EVM - EVM PROJECT MANAGEMENT EXPERTS (Spain). Company. Expert in consultancy and project management.
- Cedel - Cooperativa sociale educativa ELIS. (Italy).
- Kaunas STP (Lithuania). University
- MADAN PARQUE (Portugal). Technology park.
- IED -INSTITUTE OF ENTREPRENEURSHIP DEVELOPMENT (Greece). NGO.

Goal: Training program on Internet of energy systems for Businesses and Universities with certifications and based on video lessons production of multilingual didactic materials in 6 European languages.

Activities:
- Design, production and delivery of a set of VET practice-oriented video lessons, units and courses on IoE.
- Creating a set of VET Qualifications, at different levels (it is expected from EQF4 to EQF7)

Participants:
- at least 600 participants to the training courses
- at least 150 students will be awarded of the IoE qualifications
- at least 230 stakeholders will take part to the multiplier events
- at least 4000 people will visit the project website and get awareness of the project outputs

Meetings:
- 4 transnational project meetings
  2. Tenerife/Spain (M7 - April 2018)
  3. Germany (M14 - Oct 2018)
  4. Lithuania (M21 - May 2019)
  5. Madrid/Spain (M28 - Dic 2019)
  6. Italy (M36 - Agosto 2020)- Final meeting
- Virtual meetings for quality controls (bimonthly)

Outcomes:
- O1: New Scenarios of IoE at European level.
  a. Leader: FHM
  b. Activities:
     i. O1/A1 – Assessment instruments
     ii. O1/A2 – Labour market analysis
     iii. O1/A3 – IoE state-of-art and scenarios at European level
  c. Milestones:
i. delivery of the assessment instruments
ii. report on the IoT state of art
iii. report on the training needs analysis
d. Performance indicators:
   i. Number of interviews and/or survey replies successfully collected (>500).
- O2: IoE Qualifications.
  a. Leader: IED
  b. Activities:
     i. O2/A1 – Analysis of the European e-Competence Framework
     ii. O2/A2 – Design of IoE qualifications and e-CF Profiles
     iii. O2/A3 – Validation of the qualifications at national and European level
c. Milestones:
   i. definition of the qualification
   ii. definition of the didactic units
   iii. definition of the LO assessment methodologies
d. Performance indicators:
   i. Number of IoE - EQ certifications produced (4 at least)
- O3: IoE didactic demonstrators
  a. Leader: UNED
  b. Activities:
     i. O3/A1 – Design of the technological infrastructures (CNR-IM, FHM, MAG and CEDEL)
     ii. O3/A2 – Implementation and testing of the demonstrators (CNR-IM, UNED, FHM, MAG and CEDEL)
     iii. O3/A3 - Delivery of the activities (CNR-IM, UNED, FHM, MAG and CEDEL)
c. Milestones:
   i. delivery of the design of the demonstrators
   ii. implementation of the demonstrators
d. Performance indicators:
   i. Number of designed demonstrators (5 at least)
   ii. Number of implemented demonstrators (5 at least)
   iii. Number of students using the demonstrators (300 at least)
- O4: IoE Webinars.
  a. Leader: (EVM, co-leader: UNED)
  b. Activities:
     i. O4/A1 – Webinars models
     ii. O4/A2 – Identification of the webinars contents and authors
     iii. O4/A3 – Realization of the webinars
c. Milestones:
   i. webinars’ model defined
   ii. 25%, 50%, 75% and 100% of planned webinars realized
d. Performance indicators:
   i. Number of realized webinars (15 at least)
- O5: Training courses.
  a. Leader: MAG
  b. Activities:
     i. O5/A1 – IoE Didactic model
     ii. O5/A2 – Didactic units technical production
     iii. O5/A3 – IoE qualifications piloting and final tuning
c. Milestones:
   i. didactic units’ production completed
   ii. open courses digitalized and available online
   iii. beginning of the pilot phase
   iv. end of the pilot phase
d. Performance indicators:
   i. Number of produced didactic units (8 at least)
   ii. Number of available additional didactic materials (> 20 per course).
   iii. Number of students enrolled in each course (> 150)
   iv. Number of students positively concluding the course (> 25%)
  a. Leader: KAUNAS
b. Activities:
   i. O6/A1 – IoE Handbook design and first release
   ii. O6/A2 – IoE Handbook testing and final release

c. Milestones:
   i. first, second and final release of the Handbook delivered

d. Performance indicators:
   i. Number of positive feedbacks on the use of the handbook (> 50 %)

- **O7: Supporting platform.**
  a. Leader: MADAN PARK
  b. Activities:
     i. O7/A1 Project web platform and tools
     ii. O7/A2 Dissemination and research outputs
  c. Milestones:
     i. project website first deployment (end of M2)
     ii. dissemination and exploitation strategy delivered
     iii. leaflets and brochures prepared
     iv. conference papers submitted.
     v. Internal reports
     vi. Partners meetings
  d. Performance indicators:
     i. Number of contacts on the project website (> 4000)
     ii. Number of distributed leaflets (> 1800) and brochures (> 270),
     iii. Number of conference papers (> 5)

**Detail of O3: IoE didactic demonstrators (UNED)**

The output consists of the physical implementation of highly innovative demonstrators of IoE technologies. The demonstrators intend to be didactic labs where the students can make practical experiences in controlled situation but using real equipment. This learning-by-doing methodology is fundamental when dealing with a topic such as IoE, where practical skills are essential. The demonstrators will be deployed as remote labs or virtual labs; this will allow the students to use them even at distance, ensuring a wider audience.

Due to the different skills inside the consortium, the partnership has planned to implement a single different demonstrators at the premises of CNR-IM, UNED, FHM, MAG and CEDEL, for a total of five demonstrators. The chosen partners already have experience of remote and virtual labs and have the knowledge to develop the required software. Then, in case of remote labs, their laboratories already hold components that can be assembled/modified/integrated in order to realize the required hardware. This will allow to realize a relevant number of demonstrators with small costs and in an efficient way.

At this stage, the main topic of interest of the partnership is the integration of the technology developed by the Internet of Thing and Smart Energy systems: the integration of energy systems and IoT, especially in case of distributed production systems, can enhance the management of the network, optimize the power flow, minimize the consumptions and the losses, and bring to the implementation of the so-called “smart grid”. As examples, the demonstrator may reproduce:

- small-scale energy systems, including some distributed renewable sources of energy and load, integrated with IoT-based sensors and controllers to realize an intelligent and automated control;
- small-scale energy storage systems, connected to energy networks and the web, to reproduce a smart grid with intelligent models of storage and reload;
- smart home energy systems, including sensors and controllers interconnected and integrated through the web, for an intelligent monitoring of the system;
- simulators of reload networks for electric vehicles, using the IoE technology to interconnect the charging stations and vehicles and to manage in an intelligent way the system.

During the design phase, these topics may be changed or integrated if new trends emerges or other topics of interest are identified in the analysis of the IoE technologies (O1/A3) or in the choice of the qualifications (O2/A1).

The implemented demonstrators will be fully controllable. This means that the student will be able to analyse data, program the controllers, take decisions of the management of the systems and observe in practice the effects of his decisions. A proper management system will control the demonstrators, ensure the secured access of the students and will collect data on the use of the devices.

The activities’ leader will be UNED, the co-led will be CEDEL and all the partners will provide different kinds of
contributions.

The realization of this output will be achieved through three activities.

O3/A1 - Design of the technological infrastructures
At the beginning, the partners will have to agree about the common characteristics of demonstrators in terms of hardware and software to adopt/implement, communication protocols, IoE technologies. Although different solutions may be adopted in different demonstrators, a preliminary analysis of the possible solution and a joint discussion will facilitate the next implementation and use of the equipment. At this stage, UNED will provide guidelines on the design and implementation of the demonstrators and on the methodologies to implement their remote control. It will also propose solutions for the proper choice of a Remote Lab Management System, to be adopted and integrated both with the demonstrators and the web-platform. Open-source solutions will be considered preliminary. For the remote labs, taking into account the hardware already available in their laboratories and the software that it reasonably possible to develop, the partnership will have to design the details of the laboratories to be implemented in terms of mechanical parts, electronics and software, as well as controls and functionalities.

UNED will provide guidelines and inputs for the design phase, will design its own demonstrator and will supervise the design of the other ones. CNR-IM, FHM, MAG and CEDEL will design their own demonstrators. The other partners will provide inputs for the choice of the applications and of the technologies.

O3/A2 - Implementation and testing of the demonstrators
This activity includes the implementation of the laboratories in terms of software in case of virtual labs and both hardware and software in case of remote labs. The implementation phase will strictly follow the previously performed design. A good coordination among the partners will be ensured by the IO coordinator. A testing phase will be planned, in order to identify technical problems and bugs. UNED will provide inputs for organizing the testing phase. To enhance the efficiency, each partner should independently test all the demonstrators. This will allow to collect data independently.

CNR-IM, UNED, FHM, MAG and CEDEL will implement and test their own demonstrators under the supervision of UNED. All the other partners will take part to the testing phase.

O3/A3 - Delivery of the activities
This activity will be performed in correspondence of the delivery of the VET courses. At this stage, the students attending the training courses will have also to perform practical activities on the demonstrators. The activities, already identified in the implementation phase, are available in the didactic web-space. The partners holding the demonstrators have to ensure their functionality during the delivery phase, properly acting in case of malfunctioning or in case some implementation bugs emerge. They have also to analyze the feedbacks provided by the users of the demonstrators, in order to evaluate possible modifications/upgrades to the hardware or to the software.

CNR-IM, UNED, FHM, MAG and CEDEL, will maintain and ensure the functionality of the demonstrators during the delivery phase, monitor the performed activities and collect data.

Methodological approach
The O1 and O2 will be a starting point for the design of the demonstrators. The analysis of the existing and foreseen IoE technologies and trends and the specific topics of the qualifications will be essential to identify the topics for the demonstrators.

According to the experiments to be realized and their feasibility, each partner will decide if to implement virtual or remote lab. Globally, a mix of them will be realized to offer to the students different learning experiences. UNED has a wide expertise in the realization of remote labs, gained in practical activities in its facilities and in several EU projects, above all the FP7 Go-Lab project. UNED will turn the acquired competences into guidelines for the partnership, in order to define the common approach to be adopted for the design and implementation phase. The use of a common implementation approach and compatible technologies will allow a sharing of information among the partnership, facilitating the implementation