5 A new wave of applications in Piraeus University of Applied Sciences (PUAS) concerning modern research areas

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5.1 Abstract

A sample of the ongoing Projects is presented below. In some of these Projects Piraeus University of Applied Sciences is the Leader of the consortiums that have undertaken these Projects. The sample shows the research and development activity of the scientific staff of the University and the domains that some research groups are engaged.

5.2 Introduction

Piraeus University of Applied Sciences (PUAS) is engaged in several research and development programs. The main aim of this activity is synergy in research and development with several partners (Universities, Enterprises, Economic Champers, ...) that are active in solving problems by using novel method that are based on the modern technology. This process gives to PUAS the possibility to gain new knowledge in several domains and funds that may enforce research and development procedure. PUAs submits many proposals every year and collaborates with many universities from many countries (EU and non EU) and organizations that have improved knowledge in the specific subjects.
Some of the ongoing projects are presented below. The main characteristic of these projects are that they have an interdisciplinary nature giving advantage to the researchers to have a holistic view of the problems and face challenges and opportunities.

Some of the national programs that are presented below are focused on the improvement of the infrastructure of PUAS and the national databank for e- learning in the technological education.
Also, activities of the students of PUAS in the research and development area presented in this paper. The two activities gave advantages to the students to participate in international contests and gain special experience in a very demanding context.

5.3 EU Funded Projects

5.3.1 UNITE - TEMPUS PROJECT [3]

Title: UNIVERSITY AND INDUSTRY FOR THE MODERNISATION OF THE TEXTILE MANUFACTURING SECTOR IN BELARUS (UNITE)
UNITE projects brings together the major players of the textile manufacturing sector in Belarus with partners from European Union countries and aims to build a cooperation framework between Industry and Academia in Belarus, transferring experience and knowhow from Greece, Spain, Portugal Belgium and Lithuania. It is based on three pillars:

- The development of UNITE Council, bring together all major stakeholders of the textile sector in Belarus, with the aim to facilitate cooperation between Industry and Academia.
- The development of Liaison Offices in the Belarusian Universities as connection points between Academia and Industry.
- The establishment of continuing professional development of on-line courses for the textile sector.

The total budget of the project is about 680K, the duration 2.5 years and now is in the final procedure.

5.3.2 PROJECT TILOS [4]

Title: Technology Innovation for the Local Scale, Optimum Integration of Battery Energy Storage (TILOS)
TILOS aims to demonstrate the optimal integration of **local scale energy storage** in a fully-operated, **smart island microgrid** that will be developed on the island of Tilos (South-eastern Aegean Sea) and that will also communicate with a **main electricity grid** through **cable interconnection.**

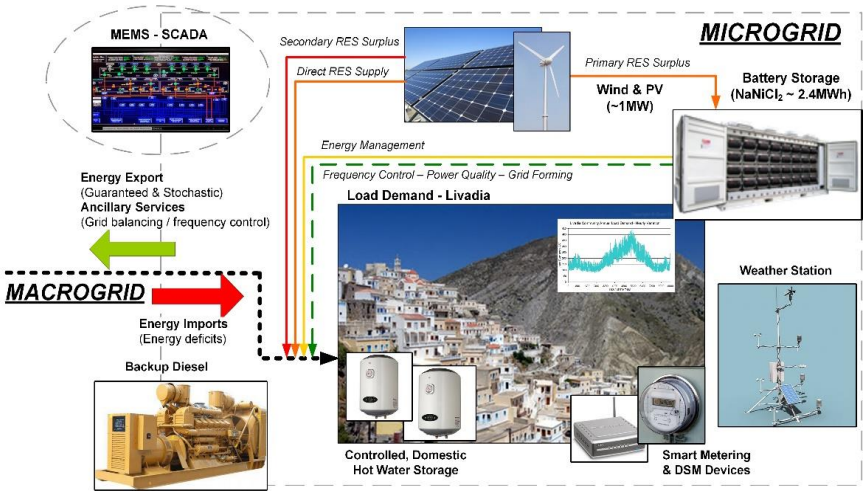

Fig. 1. General diagram of the Project TILOS

In the project consortium industrial and academic partners in cooperation with distribution system operators and nongovernmental organizations are engaged.
The main objective of TILOS will be the development and operation of a prototype battery system based on ZEBRA batteries supporting multiple tasks, including:

- Synergy with wind and PV power,
- Microgrid energy management,
- Maximization of RES penetration,
- Grid stability,
- Export of guaranteed energy,
- Ancillary services to the main grid,
- Synergy with DSM.

The battery will support both stand-alone and grid-connected operation, while proving its interoperability with the rest of microgrid components, such as smart meters, demand side management devices and distributed, residential heat storage.

5.3.3 PROJECT TRILLION - E.C. HORIZON 2020, FCT-14-2014 [2]

Title: TRILLION - TRusted, CItizen-LEA colLaboratIon over sOcial Networks
TRILLION proposes an open, flexible, secure and resilient socio-technical platform to foster effective collaboration of citizens and law enforcement officers. Using the TRILLION platform citizens will be able to report crimes, suspicious behaviour and incidents, identify hazards and assist law enforcement agents through active participation for achieving better urban security management. On the other hand, Law Enforcement Agencies (LEAs) will be able to detect incidents in a more efficient, content and context aware manner, locate onsite citizens, other LEA representatives and first responders communicate with them, request more information and assign them specific actions to address on-going incidents.

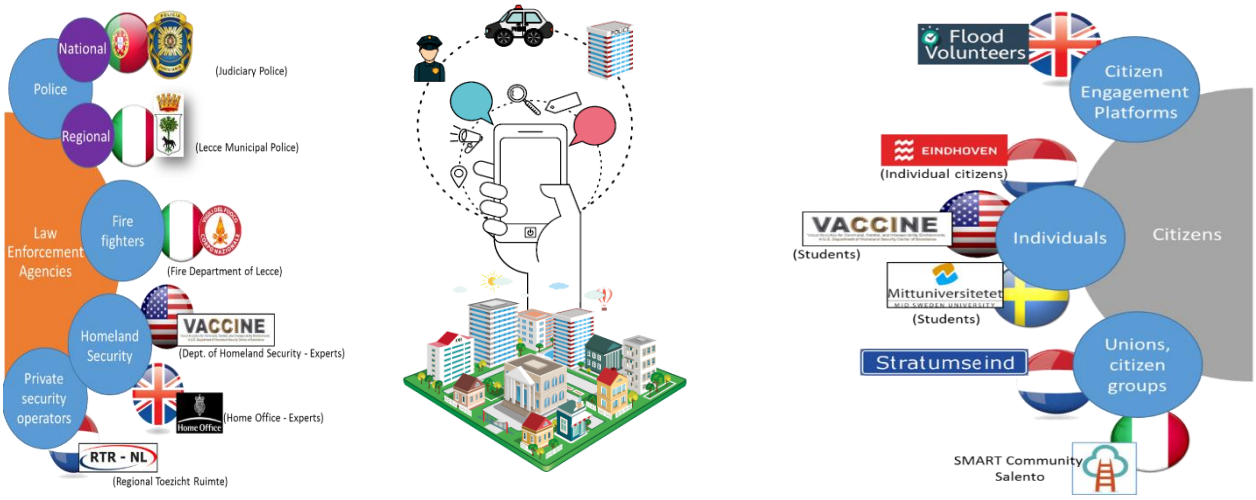

Fig. 2. TRILLION interoperability

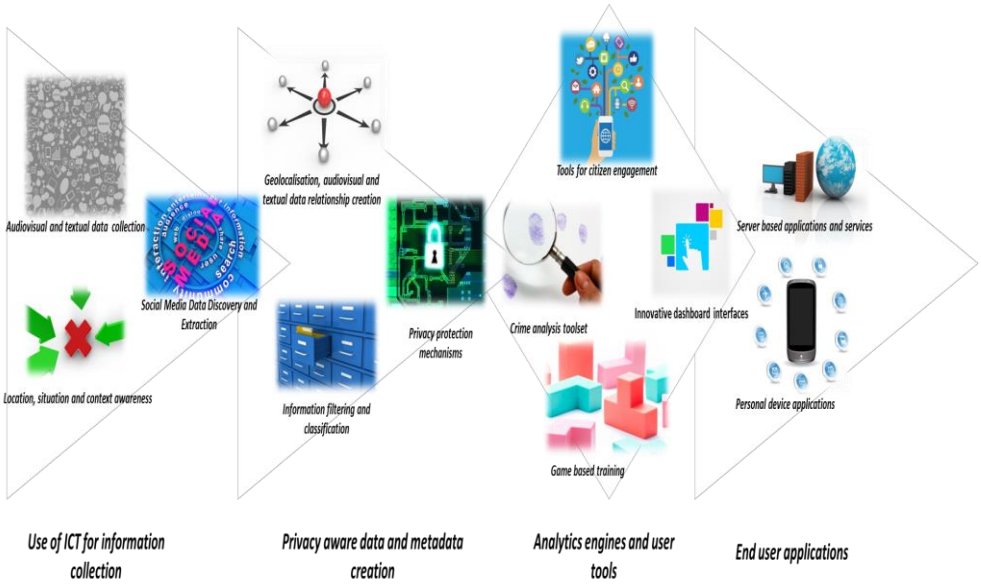

Fig. 3. Operation details of the TRILLION network

5.3.4 PROJECT STORM - E.C. HORIZON 2020, DRS-11-2015, no 700191 [2]

Title: STORM - Safeguarding Cultural Heritage through Technical and Organisational Resources Management.
STORM plans to introduce an integrated framework and a platform providing tools and services both at macro level to give a global view of the entire value chain and at specific level to promote the improvement of specific processes for protection and prevention. A novelty of STORM is to promote both views in the same framework; STORM will allow users to address each single issue within a simple process supported by the related technology. The STORM integrated framework will manage those modules to give a view that can be drilled down to give stakeholders the possibility to improve it. To support this, STORM will introduce a system to identify existing processes adding critical relationship management automation to improve the process itself. STORM aims to provide critical decision making tools to all European Cultural Heritage stakeholders affected by climate change and natural hazards. This will be a new innovative capability to improve existing processes related to three identified areas: Prevention, Intervention and Policies, planning and processes.

The total budget is about 7.297.875 € and the duration is 36 months.

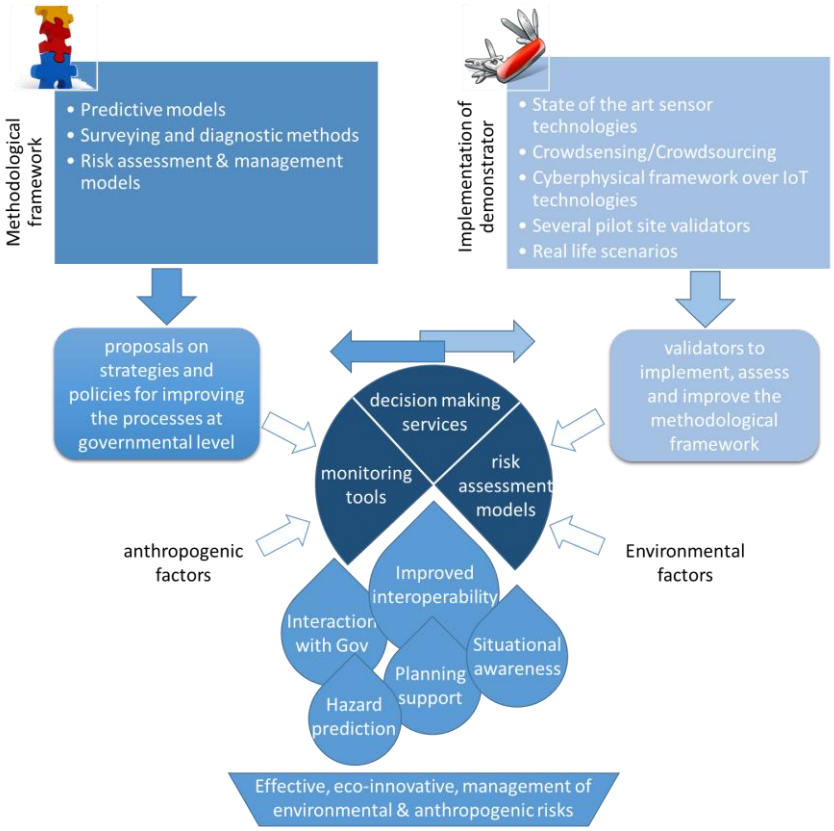

Fig. 4. General diagram of STORM Project

Pilot site	Historical period (*)						Material
	Pre-history (... – 3600 BC)	Ancient history (3600 BC – 500 AD)	Postclassical era (500 AD – 1500 AD)	Early modern period (1500 AD – 1750 AD)	Mid modern period (1750 AC – 1914 AD)	Contemporary period (1914 AD – present)	
MELLOR	 Cairn (3500 BC)	 Hillfort (800 BC)	 Medieval Church (1200 AD)		 Mill (1790)		• Wood • Bricks • Stone
BATHS OF DIOCLETEAN		 Roman Baths (298-306 AD)		 Cloisters (1565-1650 AD)		 Museum building (~ 1920)	• Wood • Bricks • Stone • Marble • Mortars • Concrete
HISTORICAL CENTRE OF RETHYMNO		 Hellenistic shipyards – Neoria (3rd-2nd BC)		 Fortezza fortress (late 16th century)	 Buildings in the old city (~1850)	 Minister (1955)	• Bricks • Stone • Mortars • Iron • Renders • Wood
TROIA		 Roman settlement (1st-5th c. AD)	 Early Christian Basilica (5th c. AD)				• Stone • Bricks • Marble • Stucco • Mortars
EPHESUS		 Ephesus Great Theater (3rd BC)					• Stone • Bricks • Marble • Iron • Mortars

* Stearns P.N., Adas M., Schwartz S.B., (1996), World Civilizations: The Global Experience (Vol.2), HarperCollins College Publishers

Fig. 5. Application domains of STORM Project

5.4 NATIONAL PROJECTS:

5.4.1 PHAROS PROJECT [5]

Title: An integrated planning tool for meeting the energy and water needs of Aegean sea islands using optimum renewable energy sources hybrid systems (PHAROS)

In this program participate OSMO (Developer & Supplier of RO Desalination Units). The total budget is about 300.000 € and the duration is 21 months.

Fig. 6. Pharos Project Environment

5.4.2 Developing Open Courses in Piraeus University of Applied Sciences

Open Courses or Open Course Ware (OCW) are courses / course lessons created at universities and published for free via the Internet. In PUAS 90 open courses with organized digital material available to both students and general public with creative commons licenses through asynchronous learning platform and 32 open courses which will include full video lectures synchronized with slides, were produced.
The infrastructure includes: Portable Video Recording Equipment, Specialized Equipment for Video Mixing & Broadcasting (Telestream wirecast), Authoring Tools for Interactive Multimedia Content - Articulate Studio 2013, Articulate StoryLine, Adobe Audition, Sony Vegas, VMix HD , Video on demand Server (Wowza Media Streaming Server Software)

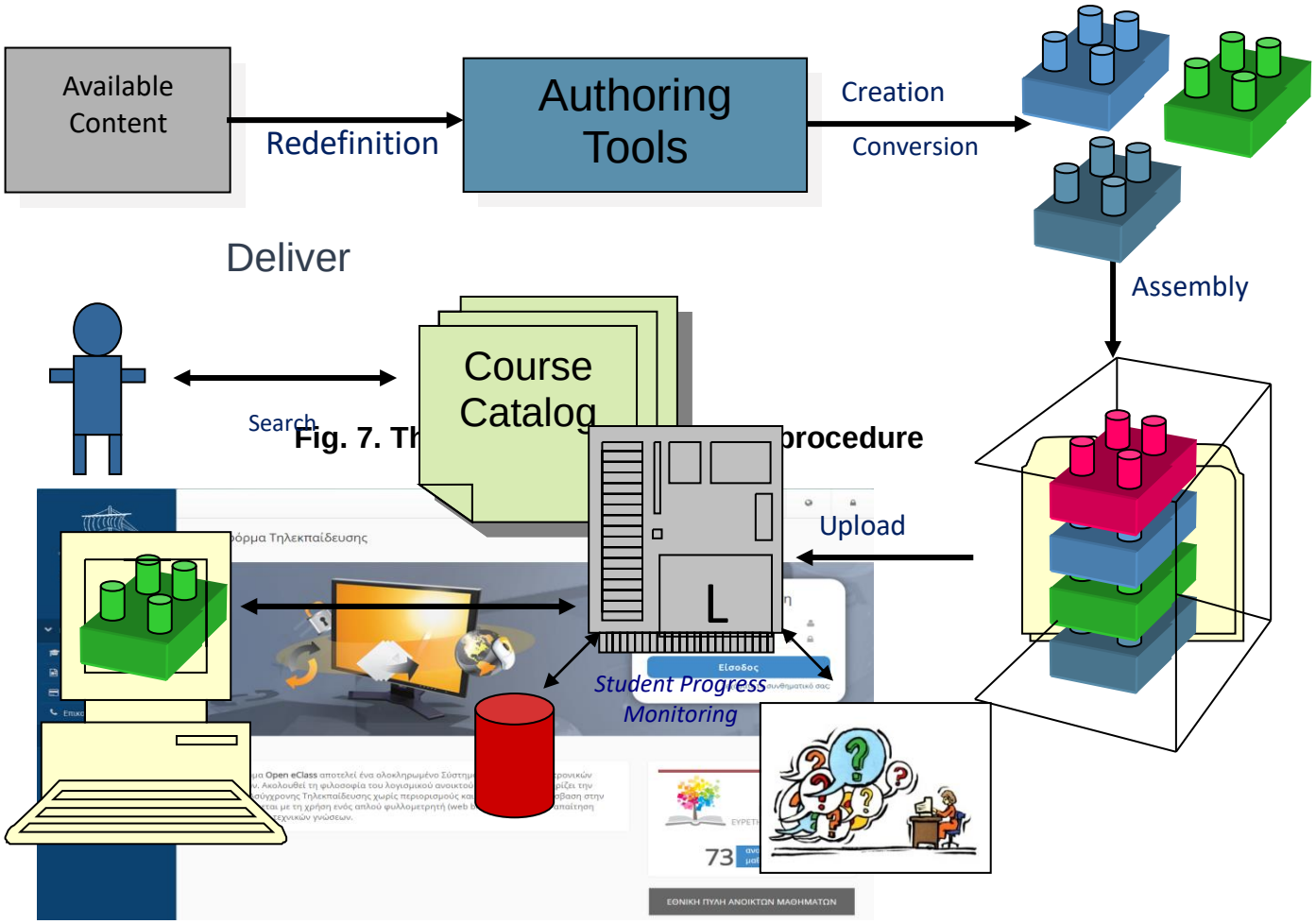

Fig. 7. The initial page of the PUAS Open Courses Platform

5.4.3 THE CHP OF THE RIRAEUS UNIVERSITY OF APPLIED SCIENCES

Some of the major problems of the times we live are the dramatic impact on the environment, the reduction in stocks of conventional fuels, growing energy demands. For this reason, the global research community has fueled interest in the exploitation of renewable energy sources and efforts to increase efficiency in existing energy systems. An attempt to increase efficiency in existing technologies is the Cogeneration. Cogeneration is the production of two or more useful forms of energy in one process. The chemical energy of a fuel (typically natural gas) is converted into mechanical and thermal energy. The mechanical energy used to produce electricity and heat is typically used to produce steam, hot air / water or cooling. The main advantage and incentive to implement the cogeneration system is the improved performance compared to conventional separate heat and power generation systems.

The advantages resulting from the use of CHP technologies Heat and Power is summarized below:

- Fuel savings,
- Energy autonomy,

- Higher efficiency compared to conventional separate production of electricity and heat technologies,
- Flexibility and minimization of losses due to lack of transmission lines,
- Reduction of pollutant emissions to the environment.
  The total budget of the project is about 3M and the duration about 3 years. Now is able for full operation.

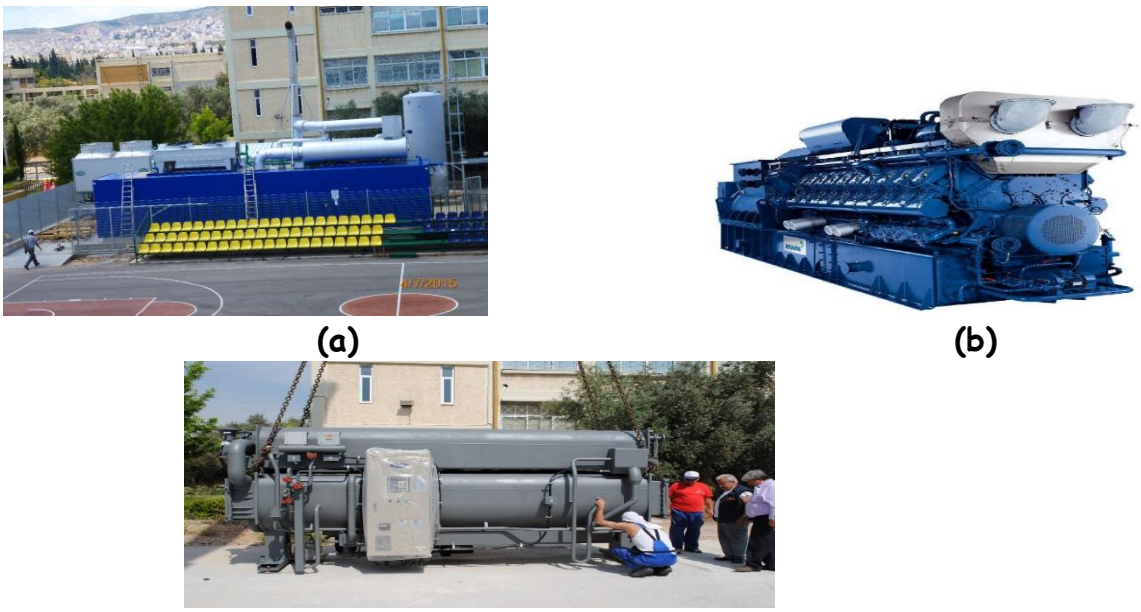

Fig. 8. The general view of the plant (a), the power couple(b) and the absorption chiller (c)

5.4.4 PV-BATTERY EV CARPORT

Self-funded, stand-alone & grid connected solar-based EV charging station was constructed, with the contribution of Greek and foreign industrial partners. The main characteristics of the station are about 3kW of PVs and about 18kWh of battery storage. Station upgrade will welcome the introduction of an integrated hydrogen unit and a wind turbine along with smart interaction with the local grid.

Fig. 9. PV-battery ev carport

5.5 STUDENTS ACTIVITIES

5.5.1 "POSEIDON"

is a student team representing Piraeus University of Applied Sciences in Shell Eco Marathon. Students are challenged to design, build and optimize ultra-energy efficient vehicles. The main goal is to reduce energy losses to a minimum. The projects are supported by sponsors and research funds of PUAS. Members of the team are 15 Mechanical Engineers, 9 Electrical Engineers, 10 Electronics and Automation Engineers. Trireme Project focuses firstly on a worthy representation of *Piraeus University of Applied Sciences and secondly on a better result that will place trireme project the highest possible in the rankings.* This year, the focus is on a much better result for PUAS and Greece, by enriching the team with a complete set of electrical, computer, automation and mechanical engineering students. Big national and multinational companies may offer a set of sponsorship collaboration, to enable a proper preparation.

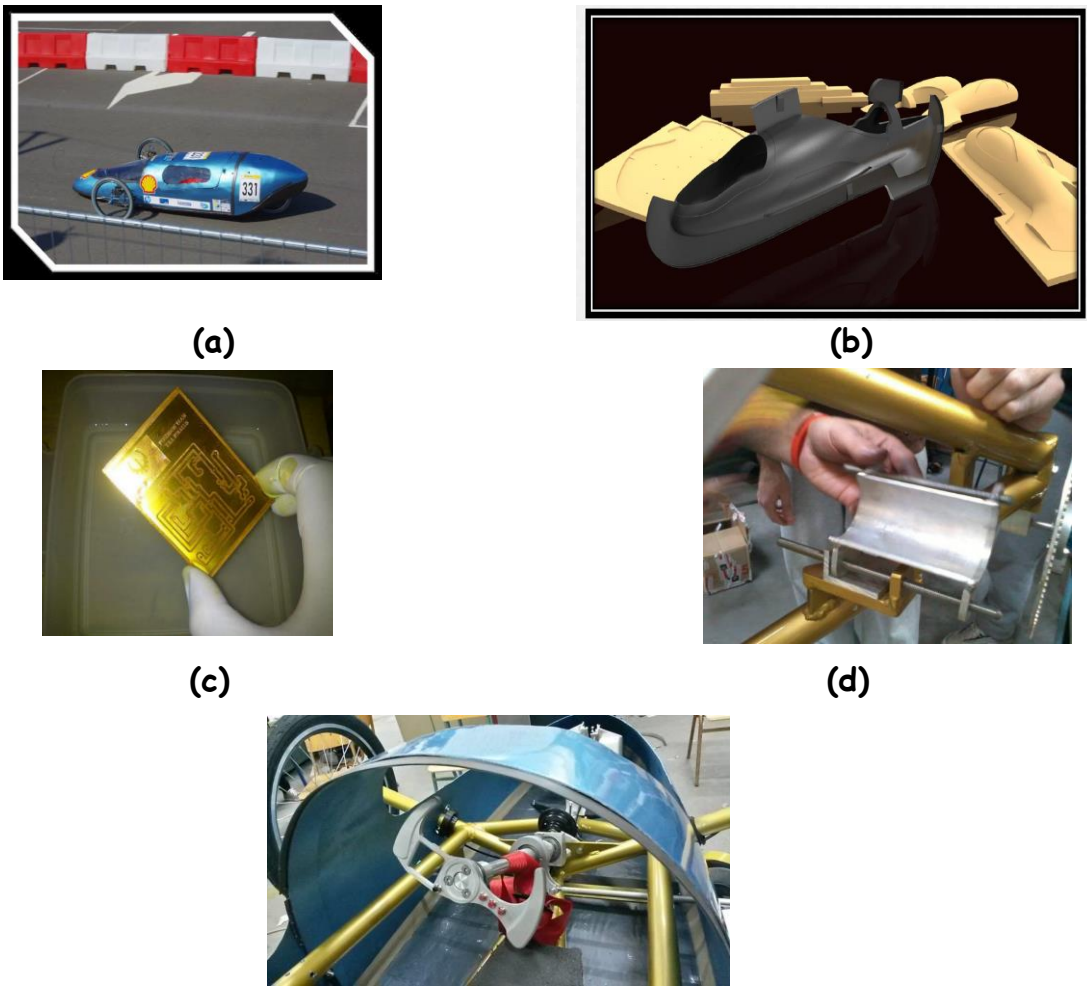

Fig. 10. The trireme vehicle (a) the improved parts designed by a CAD station (b), real parts of the ensemble (c), (d) and details of the steering mechanism (e)

5.5.2 The Freescale Cup - Intelligent Car Racing

Two groups of students were engaged in the Freescale Cup. The activity was proven successful and many other students contributed in the appropriate construction of the car for the racing. Innovative software tools have been used to develop the software for the autonomous (self-guided) car and special hardware was organized for the car development.

Fig. 11. The Freescale Cup car parts: (a) the base, (b) the servo motor, (c) the DC motor, (d) the battery, (e) FRDM-KL25Z , (f) the camera, (g) the speedway and (h) the motor drivers

5.6 Contributing Laboratories

There are 25 Laboratories [1] for research and development in Piraeus University of Applied Sciences. Some of contributing laboratories in the above projects are presented below.

5.6.1 The Laboratory of Non-destructive Techniques

The Laboratory gives emphasis to the following research topics: Characterization of nano-materials, non-destructive characterization of artifacts, analysis and identification of pigments and paintings, material characterization with applications in solar cells.
Have the possibility to do in-situ measurements using portable instruments, Raman, XRF, FTIR, VIS/NIR, Hall Effect. Identification and provenance of semiprecious stones. The partners are Universities, Museums, Libraries etc. from Greece, Cyprus, Germany, Belgium, Slovakia, Czech Republic, Croatia, and Saudi Arabia. Specific seminars in the specific area of “Applications of Non-destructive techniques in cultural heritage” are offered.

A Scientific Conference with the title “Conference on Digital Heritage” in cooperation with Cyprus Technical University and University of Thessaly has been organized on September 2015 in Volos. Now prepares the 6th International Conference on Digital Heritage- EUROMED 2016 (31/10 - 5/11/2016 Cyprus).

5.6.2 Soft Energy Applications & Environmental Protection Laboratory - SEALAB

Provides **education** and carries out **applied research** within the context of national and EU funded projects, in collaboration with public and private entities, for the last 25 years.
The main research interests are Wind and Solar Energy, Energy Storage, Green Island / Smart Grid Concept, Building energy Efficiency, Integrated Energy & Water Schemes, Electric Vehicles [6].

5.6.3 The Laboratory of Computer Control and Telematics

The Laboratory gives emphasis to the following research topics such as Telematics, Measurements – Data Acquisition, Computer Control Systems – Computer Networks and Artificial Intelligence – Swarm Intelligence [7].

5.6.4 The Laboratory of Design of Innovative Textiles

The Laboratory gives emphasis to the following research topics Design of innovative textiles and garments, Quality Control of textiles manufacturing processes, new technologies and materials for textiles production.

5.6.5 The Laboratory of Open Courses

The Laboratory includes Video Recording Team (6 members), Multimedia Content Development Team (10 members), Learning Management Administration Team (4 members), Content Certification Team (3 members).

5.6.6 The Laboratory of Mechanical Engineering Design

The Laboratory gives emphasis to the following research topics: 3D Printing, Manufacturing, CAD/ CAM/ CAE, Advanced Materials, CNC.

5.6.7 CONSERT: COmputer Networks and SErvices Research Team (Part of the Communications and Networks Lab Dept. of Electronics Engineering PUAS)

The research interests lay in the areas of Computer Networks and Applications, Internet of Things, Smart Environments, Machine Learning, ICT in Education, Games design and development. Members of CONSERT have been long involved in related research activities in the context of research projects at national and international level. The CONSERT faculty members in research activities at international level is a long one, starting from the early 90's, and involving participation in more than 30 research projects, in many of which involvement has been at technical coordination level.
The expertise at teaching level is similar, counting more than 20 years of teaching experience of CONSERT faculty members on Computer and Network related courses at many Universities. Since 2013, CONSERT has been accepting applications from international students for intern positions at the Communications and Networks Lab. Several projects have been completed successfully in the context of local and international student internships, on topics including Computer Networks, Internet of Things, smart homes, STEM education, game based learning, as well as the support of Computer network courses at laboratory level and the preparation of student exercises. CONSERT is welcoming applications from students in order to be part of our research team, and work with us on topics involving: Internet of Things, Smart environments, Cloud computing, Use of ICT in education or participate in the improvement of our courses on Computer Networks, Broadband Networks, Computer Programming.

5.7 Conclusion

The sample of the ongoing research programs of PUAS that were presented in this paper prove that the scientific staff of PUAS is active and collaborates with many researchers of other Universities, Institutions, enterprises and authorities in the EU context and worldwide. The results of cooperation are very significant and the social impact is very important and measurable in most cases.

5.8 References

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2. Department of Electronics Engineering (PUAS) http://www.electronics.teipir.gr/index.php/en/research/2016-02-01-11-01-57/research-programs
3. UNITE http://unite-tempus.eu/
4. TILOS http://www.tiloshorizon.eu/
5. PHAROS http://aristeia.sealab.gr/tag/renewable-energy-sources/
6. SEALAB http://www.sealab.gr
7. Department of Automation Engineering (PUAS) **http://auto.teipir.gr**