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2nd **iMARECULTURE** Newsletter

EDITORIAL

Dear reader,

We are pleased to welcome you to the second issue of the iMARECULTURE newsletter. Started on 1st November 2016, iMARECULTURE is a three-year EU project, funded by the European Commission under the H2020 research and innovation program under grant agreement No 727153 and it involves 11 partners from 7 EU member states and one associated country.

It's been a year already since the project started and several developments have taken place; both internal and external! Since the beginning of the project, new AR toolkits have been released from Apple and Google, new VR headsets have appeared in market and researchers are starting to present various implementations of dry visits in underwater shipwreck sites. Such developments, highlight the attention new technologies attract to the community and the impact iMARECULTURE will have. Nevertheless, at the same time, they also increase the expectations from it!

This period, was devoted in data gathering, pilot applications and intellectual property rights investigation. Several archaeological and historical data, geospatial data, 3D models have been gathered, created or re-created. Pilot applications helped to establish common grounds among our interdisciplinary group and cooperate to built upon and improve the initial idea. Two serious games are starting to emerge based on gathered data. Storytelling, which will facilitate the educational aspect of our applications, is ongoing, along with several other 'background' tasks.

Within this newsletter, you will find more information about data gathering, pilot applications, communication and dissemination activities, as well as forthcoming events. Enjoy and don't forget to follow us in social media!

Dimitrios Sharlatos iMARECULTURE Project Coordinator On behalf of the iMARECULTURE Consortium Advanced VR, iMmersive serious games and Augmented REality as tools to raise awareness and access to European underwater CULTURal heritagE

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3D Reproduction of Kyrenia

Kyrenia II vessel is a life size exact replica of the ancient ship of Kyrenia of the Classical period (400 B.C.), Displayed at Thalassa museum. It was built in 1985 for scientific experimental purposes by the Hellenic Institute for the Preservation of Nautical Tradition under the supervision of Harry Tzalas and the active support of Michael Katzev, Richard Steffy and Susan Katzev, who they were the leaders of underwater excavations and preservations of the Kerynia old shipwreck.

For the needs of the project the Kyrenia ship needed to be reconstructed in 3D. In order to reproduce the 3D model, data regarding the vessel where gathered using terrestrial laser scanning in Thalassa Museum. The acquired data where then processed along with the geometric plans, suite plans and other drawings produced by Richard Steffy and Michael and Susan Katzev and the models shown in the figures where produced.



Kyrenia II 3D model



Kyrenia II scanned model

Amphorae automatic detection

Another tool being developed for the project is a new method based on pixel prediction for detecting objects/pattern into a large image. This proposed layer is evaluated on real data in order to detect amphorae on the Mazatos underwater archaeological site.

This method integrates the Weighted Error Layer (WEL) in a Convolution Neuronal Network (CNN) architecture in order to weight the error during the backpropagation and to reduce the impact of the borders. To train our method, we used the Xlendi database using an auto-encoder process. Then, we do fine-tuning on the CNN and we consider around 25% of the Mazotos image as the ground truth. We define 3 classes in the database : the head which is the rim, the neck and the handles of the amphora; the body of the amphora; and all others objects such as rock, sand, piece of amphora. First experiment on the Mazatos database shows good performance, i.e. we detect around 90.3 percent of amphorae. The main issue in the data is that amphorae are too close to each other and so some amphorae are just ignored during the blob detection. A more costly alternative would be to repeat all the steps and to remove true amphorae detected and fitted. Therefore, it will be interesting to optimize this fitting step for future work. Moreover as this work is done using only the orthophoto, the adaptation of the network to take into account the 3D information could improve the detection step.









Xlendi site

Underwater Excavation Virtual Reality Serious Game

The underwater VR serious game, aims in familiarizing and educating young archaeologists, with the underwater tasks of excavation. For that reason an immersive virtual environment has been created focusing in graphic effects, such as fog, lighting conditions, light absorption according to depth, etc

- Schools of fish movement and their behaviour
- Caustics, depending to depth
- Sand emulation during air lift use, according to law of physics
- Stratigraphy in different sand layers
- Procedural environmental content, such as weeds
- Procedural recreation of the site, so that the user does not get accustomed to the site and the finds themselves

The game will be designed in a modular way, so that the user can search for finds, tag them, survey them and finally dig and extract them.

The game allows collaboration. The users will be able

to team up with a buddy (or tutor) remotely, and learn proper methods on how to excavate and collect the artifacts without the limitations that exist in a real underwater excavation and the danger of destroying valuable artifacts. One of the main targets is, to provide the opportunity to experience Instruments that are used, like airlift before even attempting underwater excavation, using this training tool that the project will provide. The progress of the tool is ongoing and very soon will be tested on real scenarios to examine the effectiveness and productivity that such a prediving training will provide.



Using the airlift in Underwater Excavation game

Dehazing and Image Enhancement Tools

The vision under the water is degraded by several factors. The most common is the absorption of the light and turbidity. To tackle this problem underwater image enhancement and dehazing tool is being developed. A platform developed for the correction of the underwater imagery, by implementing five selected algorithms that seem to perform well and that employ different approaches for the enhancement of underwater image such as image dehazing, nonuniform illumination correction and color correction. The processing tool will be distributed to the public through the i-MARECULTURE website as a Win32/64 standalone executable. It will allow users to automatically process a set of images with all the selected algorithms.

Based on the image enhancement the dehazing tool is being developed, enabling the divers to observe clearly the surrounding environment. This gives them the opportunity to experience the underwater world like never before. Moreover, the Augmented Reality Interface will also provide information about the site they are visiting. In particular, it gives them the opportunity to observe the conceptual 3D in reality, which is reconstructed in three dimensional morph, thus giving them the insights of how the side use to be.



Image enhancement evaluation. Baia site



Augmented Reality Dehasing application

Seafaring Serious Game

Currently at it's second version, the Seafaring game aims to provide better insight and understanding of the ancient seafaring trade in Eastern Mediterranean, during Classical period. Specifically it provides a realistic experience regarding the routes and the hardships that a captain faced during the Classical period.

The user will take the place of the Captain and will travel the routes that are believed were used, in an educational and fun way. The highlight of the game especially for the young people, is that they are being educated, in an innovating and not traditional way without getting bored. The game is evolving as it goes revealing insights about the ports and the merchandise that can be obtained. Using the trade system coins and goods that are gathered, the user gets the opportunity to buy more ships and become the main player in the region.

Sophisticated algorithms where used to recreate the voyages hardships that where faced by the merchants and sailors. Static and dynamic weather conditions are implemented increasing the difficulty of the game and at the same time giving to the player insights of the conditions that a vessel faced during the journey.

more work and development will be put in place for a version 3 release. The new version will be an upgrade to this version providing more control to the user increasing the difficulty factor.



This is not the final version of the game;

"Play is the highest form of research." – Albert Einstein

Calculating time and course from port to port

Going from one place to another is not always straight forward- most of the times the fastest route from point A to point B is not a straight line. For the realistic playing effect a service is developed using an algorithm for the routes to be calculated in real time. Weather and fastest sailing diagram are the factors considered to calculate the route that the ship should follow.

Therefore, the experts employed realistic weather conditions from real data provided for the area. Moreover, it is planned to incorporate knowledge from naval engineers, regarding the achieved ship speeds related to wind speed and sea currents making the game more realistic.

The developed algorithm, is planned to be released also as a standalone version, available to the public and experts, as a web service. Requiring minimal GIS knowledge to use and extract valuable results providing the developed algorithms and collected data that are already used in the Seafaring Serious Game. Using this service, one may calculate all possible routes from any Mediterranean port to every other destination on static or dynamic weather.





3D Libraries

The main inspiration of the work is to merge the se- The second contribution for the iMARECULTURE proknowledge for better cultural heritage understanding.

A tool is going to be developed that will display data stored in ontologies as a virtual relational database in As work in progress in this project, currently the develorder to have a simplified view of the stored data. The opment of further GUI tools that bring the wealth of tool will be as a GUI ontology editor which displays ontology uses and aiming to offer better datamining classes, instances and properties present in the ABox solutions for the archeological community: Knowledge part of the ontology as if the data were structured by inference for more sophisticated queries, Amphorae's table in a relational database. The main functionalities clustering by typologies, etc of the editor will be to display the classes present in the ontology, all their instances and offers a simple and dynamic way to display data properties as normal fields of these instances and the possibility to modify them. Finally, this tool will provide a static point of view on these ontologies and allow simple manipulations for archeologists..

mantic web technologies with the archeological ject consists of modeling an ontology that profiles archeological amphorae in term of their typologies, photogrammetry process and the geospatial location.

iMARECULTURE project 12 month meeting

General Assembly 12 month meeting of the H2020 iMSRECULTURE project was held from 30-31.10.2017 in Cyprus University of Technology based in Limassol, Cyprus.

During the meeting, partners have presented the work they have completed in the first year of the project, as well as future plans for the following year.

The first year was about gathering all the necessary data to enable the team to progress into developing the required apps. After acquiring the necessary data the development began producing the: Digital storytelling, Seafaring game, Dry visits, Underwater Excavation Virtual Reality Serious Game, Augmented Reality Dehasing tool, Underwater image enhancement tool, Automatic amphorae detection tool etc.

During the meeting, partners had the opportunity to use Virtual Reality equipment for an immersive dry visit experience. The underwater environment they experienced gave them insights for the upcoming releases of the project.



iMARECULTURE 12 month meeting





Testing dry visits from

Dissemination Activities

• 12 month meeting of Bluemed Sustainable Tourism project

The coordinator of H2020 iMARECULTURE, Ass.Prof. Dimitrios Skarlatos has presented the project goals and activities during the General Assembly meeting of the Bluemed Sustainable Tourism project funded by Interreg MED Programme. Synergies between the two projects have been discussed.

• EVA/Minerva 2017 Conference

XIVth Annual International Conference for Professionals in Cultural Heritage Monday-Tuesday, 13-14th November 2017

The coordinator of iMARECULTURE, Ass.Prof. Dimitrios Skarlatos was invited to present the iMA-RECULTURE project to the conference participants and attentants.

• JPI - 17.11.2017

Ass.Prof. Dimitrios Skarlatos was invited to present the iMARECULTURE project at the Innovative Educational Programs and Activities in Museums, Research Institutions and Other Cultural Institutions conference that was held at University of Cyprus

Presentations in Related Events & Conferences

• 9th International Conference on Virtual Worlds and Games for Serious Applications

VS-Games 2017,6-8 September, 2017 - Athens, Greece

Workshop in VS-Games 2017 Serious Games and Cultural Heritage Workshop is organized in cooperation with the H2020 project iMARECULTURE in the context of the 9th International Conference on Virtual Worlds and Games for Serious Applications

• 15th EUROGRAPHICS Workshop on Graphics and Cultural Heritage

September 27-29, 2017- Graz, Austria,

Dr. Selma Rizvic of University of Sarajevo presented the paper entitled "Kyrenia:

a pilot hyper-storytelling application"

• Opening conference VirtualArch

27-28 November 2017, Dresden, Germany

iMARECULTURE project presented at Best practices in visualization and virtual reconstruction of hidden archaeological heritage

For more information about project's scientific publications click here



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