D8.3 EXPLOITATION PLAN

WP8: IMPACT, DISSEMINATION AND EXPLOITATION

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EXECUTIVE SUMMARY

D8.3 presents DigiArt's exploitation plan as produced by the consortium partners of this project and which will eventually be able to recommend hardware, software and additional technologies that will allow organisations directly and in-directly involved with historical, cultural and archaeological environments to display their curated findings in an immersive and interactive environment that is both cost effective and user friendly to deploy.

As this document is initially being presented 1/3rd of the way into the project it is sparse in many area's as the partners are still working on their solutions and technologies, therefore this document is classified as a "living Document" and will be updated throughout the next 24 months with input from all the partners to eventually be submitted as part of the final work packages.

INTRODUCTION

DigiArt seeks to provide a new, cost efficient solution to the capture, processing and display of cultural artefacts. It offers innovative 3D capture systems and methodologies, including aerial capture via drones, automatic registration and modelling techniques to speed up post-capture processing (which is a major bottleneck), semantic image analysis to extract features from digital 3D representations, a "story telling engine" offering a pathway to a deeper understanding of art, and also augmented/virtual reality technologies offering advanced abilities for viewing, or interacting with the 3D models. The 3D data captured by the scanners and drones, using techniques such as laser detection and ranging (LIDAR), are processed through robust features that cope with imperfect data. Semantic analysis by automatic feature extraction is used to form hyper-links between artefacts. These links are employed to connect the artefacts in what the project terms "the internet of historical things", available anywhere, at any time, on any web-enabled device. The contextual view of art is very much enhanced by the "story telling engine" that is being developed within the project. The system presents the artefact, linked to its context, in an immersive display with virtual and/or with augmented reality. Linkages and information are superimposed over the view of the item itself.

The major output of the project is the toolset that will be used by museums to create such a revolutionary way of viewing and experiencing artefacts. These tools leverage the interdisciplinary skill sets of the partners to cover the complete process, namely data capture, data processing, story building, 3D visualization and 3D interaction, offering new pathways to deeper understanding of European culture. Via its three demonstration activities, the project establishes the viability of the approach in three different museum settings, offering a range of artefacts posing different challenges to the system.

The object of this paper is to explore and identify the opportunities to exploit the technology that has been created and developed from this project.

This document will be a living document throughout the following 24 months and will be submitted as a finalized paper on completion of the project.

DIGIART EXPLOITABLE ASSETS

MODULES

Identify the modules, e.g. libraries, tools, applications that will be produced by DigiArt

- Turntable object scanner
  - Hardware
  - Software module for Pix4Dmapper
  - How-To documentation and workshop presentation on the hard- and software by (Scladina, Pix4D)
- DigiArt Static Desktop Scanner
  - Whilst not commercially exploitable, because the entire purpose is to make it Open Source and accessible, this can certainly be considered to be an intellectually exploitable asset of the project.
- Registration module inside Pix4Dmapper to register aerial and terrestrial photogrammetric scans (Pix4D)
- Fly Through VR experience system for museums
- Large Area visualisation and measurement systems
  - Using Drones
    - Fixed wing
    - Multirotor
  - LIDAR
- Story Telling Engine Modules
  - The story telling engine will be distributed in 3 versions:
    1. Open source platform including a set of low level functionalities. This version targets the technical community, e.g. developers, and will provide the necessary low-level functionalities so that they can create their own templates and games. This will increase the visibility and the potential uptake of the developed technology.
    2. Basic engine: An extended version of the open source code, which will include additionally high level functionalities so that non-technological stakeholders (e.g. archaeologists) can easily create a virtual tour, an augmented reality tour, or a game. The basic engine includes two basic storyline-templates (upon these templates the archaeologist can build their own game without having to deal with unnecessary tech stuff, such as the surrounding territory), one for indoors (e.g. museum) and one for outdoors. This version will also support a limited set of data formats and devices (Oculus rift).
    3. Premium engine: This version also targets the non-technological stakeholders and, compared to the basic engine, it unlocks the full potential of the engine, including all the storyline-templates, support for all the data formats and devices (Oculus rift, Google cardboard, Samsung gear VR, etc.).

- We would propose that a fee/year as the monetization approach for the Basic and Premium engines. The open source version will be free.

SERVICES

Identify potential services (e.g. consulting, customization) that can be built on-top of these modules

Story Telling engine related services:

- Template design: On demand design of additional template(s) that fits the needs of the archaeologists (monetization approach: one-time-fee/template).
- Game design: On demand creation of a new game/virtual tour/augmented tour based on the engine (monetization approach: one-time-fee /game)
- Training the archaeologists to use the developed game engine. Materials (e.g. webinars) will be included in the basic and premium engine packages. In addition, on-site training will be offered for an additional fee/seminar on demand.

INCREMENTAL LICENSING OPPORTUNITIES

The desktop scanner should allow highly detailed 'analysis grade' scans of the objects in the project database. This potentially means that variations in the resolution of the scan could allow for fund generation through access rights. A scan with a limited level of detail may be available free, but a full resolution scan could be chargeable in some way either on a view by view / PAYG or subscription model. This needs to be performed in accordance with our Data Management Policy and provision for the cooperative use of scanned data between museums and other institutions.

MARKET ANALYSIS AND TRENDS

WORLDWIDE PENETRATION

To be completed deeper into the project

SPENDING FORECAST

To be completed deeper into the project

EMERGING TECHNOLOGIES AND TRENDS

Photogrammetry with cameras that are carried by drones are now widely used and the initial ideas of the project originally to be performed by Autodesk can be considered as being solved (Pix4D has sold a commercial solution for 5 years). However, significantly more interest is now being shown in reliable and more accurate software solutions that produce 3D models with images taken by **consumer drones, although they have limited ability to carry high quality cameras and therefore in certain environments and situations professional drones, as manufactured by Vulcan are required.**

The affordable price of consumer & prosumer drones come with the limitation of lower quality cameras, which typically causes **rolling shutter effects** which is one of their limitations.

Small **lightweight LIDAR system**s are emerging as a viable payload on professional and prosumer drones, although the cost for these is still quite high, mainly due to the high cost of the LIDAR scanner heads. Unsolved as yet is the registration of the laser scans which should become one of the outcomes of this project.

MARKET FOR CULTURAL 3D WORLDS

As yet, still to be addressed deeper into the project.

MARKET FOR DRONES IN CULTURAL HERITAGE

Drone usage in the professional market globally is growing at a fast rate and governments, along with regulators, are working hard to find legal and practical frameworks for the professional use of drones.

In the UK the regulator has a well-defined set of regulations and takes a light and positive approach in an attempt to support this new industry and the UK is now seen as one of the leading countries for commercial drone use, with over 2000 CAA approved professional operators, whereas up until very recently the equivalent national regulatory body in the USA, the FAA, has struggled to find a sensible framework, which has been inhibiting the market growth. However, they have just started to relax some of the rules, which will help projects like this one to offer better advice and support.

Other countries like Canada and Australia have also created an environment that is supportive of commercial drone operations, but unfortunately across Europe there is still very poor cohesion amongst the different countries, however it is hoped that within the lifetime of this project this situation will improve.

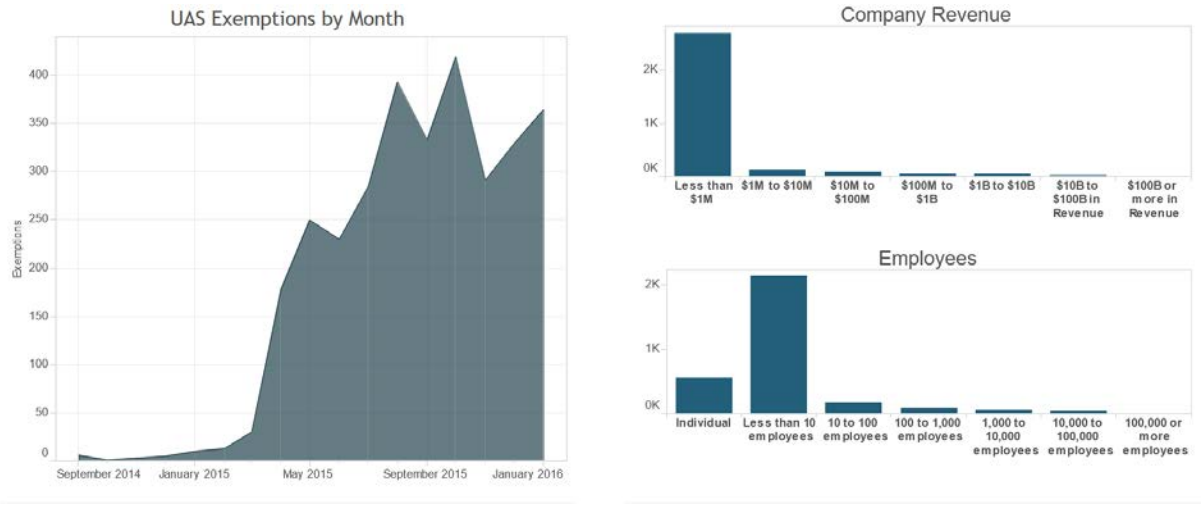

FIGURE 3. LEFT: NUMBER OF COMPANIES THAT APPLIED AND RECEIVED AN FAA EXEMPTION FOR PROFESSIONAL USE OF DRONES. RIGHT: REVENUE AND THE NUMBER OF EMPLOYEES FOR THOSE COMPANIES (SOURCE AUVSI APRIL 23TH 2016]

Although drones are becoming well established for general purpose photography and videoing purposes within archaeology, their use for archaeological mapping and 3D modelling is much less well established.

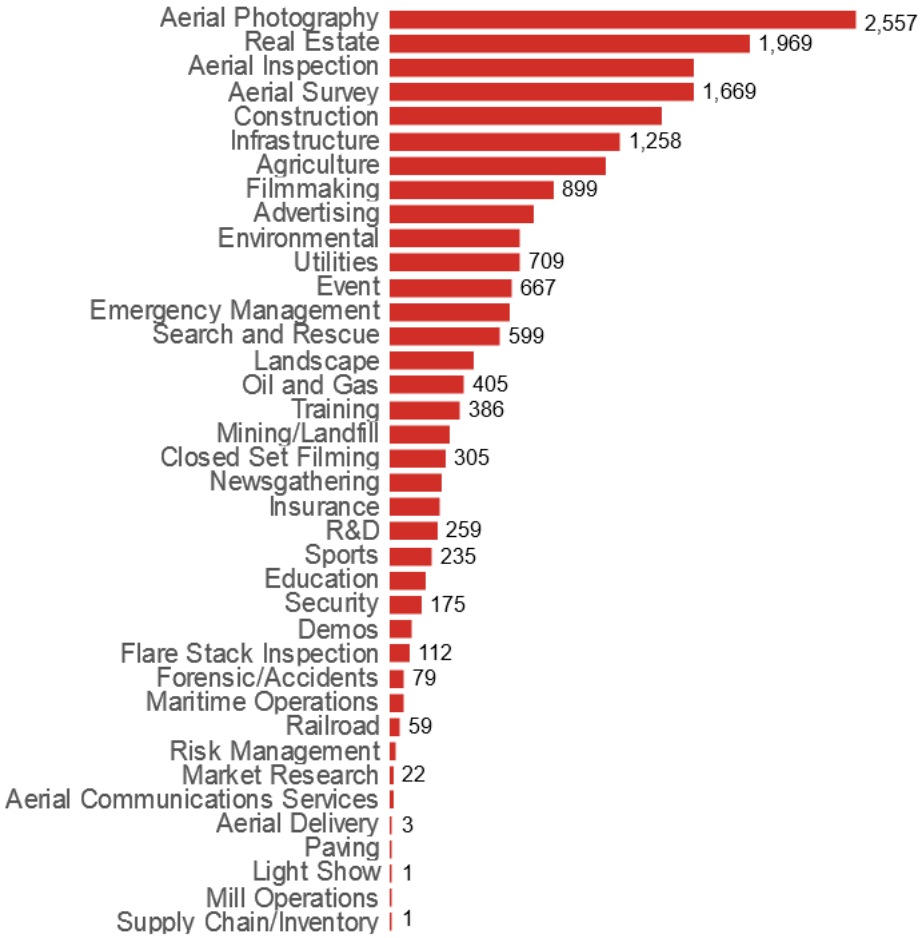

FIGURE 4: FAA EXEMPTIONS GIVEN FOR SPECIFIC INDUSTRIES OR APPLICATION (SOURCE AUVSI APRIL 23TH 2016]

MARKET FOR STORY TELLING ENGINES IN CULTURAL CONTEXT

As yet, still to be addressed deeper into the project.

Conclusions

T.B.C

TARGET MARKETS AND DOMAINS

DIGIART PRIMARY MARKET SECTOR

TARGET STAKEHOLDERS:

Design teams: DigiArt's story telling/game engine will provide designers with a means to break the "design-fail-guess-redesign" cycle and obtain a "design-test-redesign" cycle, which is a more cost-effective, less risky and more mature strategy.

Developing teams: Using the basic functionalities of the story telling engine, they will be able to create new games for the cultural heritage and other domains. In addition, they can contribute to the open source version of the engine, by adding additional functionalities.

Archaeologists: They will be the main end-users of the story telling engine and through it they will be able to modify the captured 3D models of the archaeological site and create their own virtual tours.

DIGIART SECONDARY MARKET SECTOR

Academic organisations at multiple levels.

As yet, still to be addressed deeper into the project.

COMPETITORS LANDSCAPE

TOOLS AND SERVICES FOR 3D MODELLING AND REPRESENTATION

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TOOLS AND SERVICES FOR THE USE OF DRONES IN A CULTURAL CONTEXT

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TOOLS AND SERVICES FOR STORY-TELLING IN CULTURAL CONTEXT

We can categorize the story telling engines based on where they run in two types; a) the desktop based engines (desktop-game makers) and b) the cloud based engines (web-game makers). Briefly, desktop-game makers consist of the GUI and the compiler, where the former helps into making a game project by using mouse drag-n-drop functionalities, or input widgets in a certain format, e.g. YAML for Unity3D, a sort of XML, and the latter compiles the game project into a binary format. Web-game makers consist of the framework library and the web-GUI. The framework library is a JavaScript file that contains high level commands that are a bundle of low-level WebGL commands, giving the capability for easily making 3D games and saving them in a supported format. The web-GUI is the interface for making a game, based on the framework library, with drag-n-drop functionalities and other input widgets.

The pros of desktop-game makers, such as Unity3D, are a) the high quality of the produced games achieved by providing a high number of parameters and realistic graphics; b) the wide user community that provides or sells components for adding new functionalities (Myo, Leap, Kinect, Oculus Rift etc.); and c) the support of multiple output formats such as Android, Windows, iOS, Playstation, Xbox, and Web. Their cons is primarily the difficulty to learn how to use them, as they require special skills in 3D graphics and secondarily the knowledge of a scripting language for indicating items' behaviours. A list of the existing desktop-game makers can be found in Table 1. On the other hand, web-game makers is an emerging area of the game industry due to the relatively new WebGL feature of HTML5. The benefit of web-game makers is that they are easily accessible through the web, are easier to learn, and are almost as fast as desktop-game makers because the rendering is performed at clients' side by exploiting the available graphics card. However, as a new software area, web-game makers have limited gaming features, inferior graphics and limited game export formats.

Table 1: Game makers for making 3D games.

Gamemaker	Compiler/ framework	GUI	License	Export game	Features	Url	#
Desktop-gamemakers							
Unity3D	Unity	Unity	Open but Proprietary if earnings > $100k	Desktop, Mobile, Web, Consoles	Leap, Kinect, Oculus ++	unity3d.com	1
Unreal Engine	Unreal	Unreal	Open but Proprietary if earnings >$12k	Desktop, Mobile, Web, Consoles	Leap, Kinect, Oculus ++	unrealengine.com	2

Torgue3D	GFX	Torgue3D	MIT	Desktop, Web	LEAP, Oculus, RazerHydra	garagegames.com	3
Blender	Blender	Blender	GPL	Desktop	Incomplete	blender.org	4
Blend4Web	Blender	Blender	Proprietary	Web	Plug-in for blender	Blend4web.com	5
Godot	Godot	Godot	MIT	Desktop, Mobile, Web	Lightweight	godotengine.org	6
Copperlicht	Copperlicht	Copperlicht	GPL	Web	No plug-ins for third party software	ambiera.com/copperlicht	7
Web-gamemakers							
Threejs	Three.js	Three.js Editor	MIT	Web	-	threejs.org/editor/	1
Babylon	Babylon	Babylon Editor	ASL 2	Web	-	babylon.js	2
Superpowers Html5	Three.js	Superpowers HTML5	ISC (GPL like)	Web, Desktop	Real-time collaboration		3
XeoEngine	XeoEngine (SceneJS)	No	MIT	Web	-	www.biodigital.com	4
Turbulenz	Turbulenz	No	MIT	Web	-	www.ga.me	5
PlayCanvas	Playcanvas	PlayCanvas	Proprietary	Web, iOS	Real-time collaboration	playcanvas.com	6
Goo	Goo	Goo Create	Proprietary	Web	-	goocreate.com	7
Cyberix3D	Cyberix3D	Cyberix3D	Proprietary	Web, Android	-	gamemaker3d.com	8

RELEVANT PROJECTS

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SWOT ANALYSIS

Still much too early in this project to consider SWOT

STRENGTHS

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WEAKNESSES

…….

OPPORTUNITIES

…….

THREATS

…….

PARTNER'S EXPLOITATION PLANS

LJMU

T.B.C deeper into the project

CERTH

CERTH participates in DigiArt as a Research institution and technology provider. Its primary interest is in the research results that will arise from the research on 3D signal processing and machine learning algorithms (e.g. 3D reconstruction, 3D object segmentation, classification and retrieval), 3D dataset benchmarking, virtual museum development and game engine generation. Furthermore, CERTH has participated in many projects and research collaborations related to digital cultural heritage (e.g. i-Treasures, PERICLES, REACH, etc.). DigiArt will produce a set of 3D content analysis algorithms, as well as the technological know-how on virtual museums and game development, which, with minimum effort, may be adjusted to be re-used for other related applications.

The research results and implemented software modules developed within DigiArt will further increase the expertise level of CERTH in these areas and will ease the way for addressing even more complicated research problems. Furthermore, CERTH will take advantage of the software tools developed within the project by integrating them into its current tool portfolio to be re-used in future projects. In addition, CERTH will gain in expertise since the collaboration with the partners of the consortium gives the ability to gain knowledge in new scientific fields, such as photogrammetry. Finally, CERTH intends to exploit project results through the recently founded spin-off company INFALIA by incorporating the virtual museum and game related technologies and products into its business model.

The technology targeted in the project and the competence developed will improve CERTH's abilities to serve EU society and increase the competitiveness of EU and national industries. CERTH will exploit the results and knowledge from this project by generating research papers in order to increase its competiveness and its high visibility among national research centres. Furthermore, this work will extend the ability of the institution to generate new research funding from other sources, such as Greek Government and industry.

CNRS

T.B.C deeper into the project

PIX4D

Pix4D has already a worldwide penetration of its general mapping software. The modules and documentation that will be developed within DigiArt, will increase the potential applications of our software. We plan to market those applications in cultural heritage and for the ability to scan small objects within a project. The focus with is on user education, documentation and the organization of workshops to promote and market the developed solutions.

VULCAN

Vulcan UAV, working with the project partners will work on the design of small but capable professional UAV's to allow academic and cultural organisations to source UAV's that are affordable, practical and easy to configure, deploy and operate in multiple environments and situations. For the collection data from the air. Over the next 24 months they will analyse the feedback from the partners and use this information to enhance the designs and concepts.

AIGAI

T.B.C deeper into the project

SCLADINA

T.B.C deeper into the project

JOINT EXPLOITATION PLAN

T.B.C deeper into the project

LICENSING

At this stage it is too early in the project to make any predictions on licensing options.

CONCLUSIONS

Although only 12 months into a 36 month project, we are already seeing the huge benefits that this multidisciplinary approach is bringing.

Whilst still far too early to make any formal predictions of the conclusions, the results we have seen so far are very encouraging and with some of the technological advancements in Virtual Reality (VR) and Augmented Reality (AR) that are predicted to happen of the next 12 months, this should put the project in an ideal position to be seen as both technology & thought leaders in this type of affordable and deployable interactive visualisation.

REFERENCES

To be completed for final 36 month submission version.