D1.3 - FINAL REPORT

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Abstract

This document concludes the VASCO project and presents the work carried during 36 months, from the 1st of March 2014 to the 28th of February 2017 A publishable summary is consolidating the work done, along with the results attained and the expected impact of the project. Then, dissemination activities and exploitable foreground are listed. The document finalizes with a report on the societal implications of the project.

The distribution of the European Union financial will be presented in a later version of this document.

Preparation Slip

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Contents

1 Final publishable summary report

1.1 Executive summary

VASCO aims to assist security professionals to visualize, define, and assess security concepts and measures for the protection of government buildings and critical infrastructure. This is achieved by the virtualisation of building and environment models which contain adequate geometric features to enable simulations and sufficient visual information to support location recognition. VASCO assists security experts and Law Enforcement Agencies (LEA) officers with a visual representation of the buildings to protect within their urban environment. This is combined with geographical details; such as roads, nearby buildings of potential relevance, critical infrastructures, and architectural information, such as a building lay-out , exits, windows, entrances, other access points, parking, garage, etc. These features provide security experts from different backgrounds with a shared picture of the building and its surroundings, facilitating the joint formulation of an integral approach.

The VASCO project offers a technical solution in three distinct but complementary tools: the 4DNSIDE suite, the VASCO framework, and the Natural User Interface.

The 4DNSIDE suite's objective is to enable any user to reconstruct DMUs of buildings without requiring the assistance of computer experts, 3D modellers, or CAD operators. Its architecture is composed of three modules, namely an acquisition module, a processing module, and a viewer module. These modules implement the pipeline which enables the end user to obtain a three dimensional representation that can be viewed inside a web browser starting from a set of panoramic pictures.

The VASCO framework aimed at researching, designing, and implementing the two main functionalities presented to the user, i.e. the DMU Editor and the Security Editor. The DMU Editor allows a user to construct a visual representation of his/her environment, as a visual reference, in two stages. The first stage is to create the surroundings of the desired facility, by aggregating satellite, planes, cadastral imagery, and other geographic information. On the second stage, the user can create the interiors and façade of the facility and insert it into its previously created surrounding environment.

The Security Editor enables a user to construct security concepts, measures, and strategies. It is based on an innovative simulation engine where a user can create security and safety situations thanks to the orchestration of virtual equipment, individuals, groups, crowds, events and threats, which are all managed in a dynamic and world scale environment. These two novel editors are linked thanks to the Knowledge Database which enables to store and share the created DMUs and security concepts.

The Natural User Interface (NUI) constitutes the interface between end-users and the VASCO Framework and offers the visualisation modality and effective interaction techniques that make the VASCO system intuitively usable by professional end-users without prior extensive training or explanation. The main NUI component is an interactive tabletop that eases the design process of security planning and the collaboration between all stakeholders during such sessions. The tabletop features a multi-windows environment hosting the collaboration session and the possibility of building bridges with personal devices.

Complementary tangible objects have been produced to facilitate the measurement on the map by imitating the real modus operandi of a ruler and a protractor. And, finally, a disruptive prototype based on an Augmented Reality Headset, namely the HoloLens, provides extended 3D visualization capabilities.

In order to bring the VASCO project to fruition, the consortium adopted an integration planning and strategy early on. The planning included 4 releases that, once evaluated, produced feedback included in the requirements of the following version. This allowed producing results with distinct boundaries, without technical overlap but rather a complete workflow, and integrating them into a unified system, including hardware, software, and user manual.

1.2 Project summary

The concentration of government buildings within urban environments has become a source of serious security vulnerability. Administrators and security experts face a variety of evolving threats that are hard to anticipate. To secure a government building against multiple threats while maintaining a minimal level of transparency and accessibility requires an integral security approach. It demands interdisciplinary collaboration between different experts from different domains. Currently, there is no efficient method or tool that allows the experts of different stripes to efficiently design, evaluate, and implement appropriate security concepts. Existing ones do not allow for the effective creation, analysis, assessment, and sharing of security concepts that will help government administrators provide a secure environment for personnel and citizens.

The VASCO project addressed two important objectives. First, it designed, implemented, and evaluated an innovative IT tool that enables security professionals and administrators to jointly formulate, test, and adjust security concepts and measures in a virtual environment. This provides a cost-effective and risk-free environment in which to conceive an evidence-based, all-risk approach for the protection of government buildings. Second, it produced a knowledge and best practice database, which captures dynamic and visual reference scenarios created with the VASCO system.

To accomplish these aims, the project adopted an iterative methodology enabling the constant involvement of its world-class security and crisis management experts, assisted by a solid and open user group, during the whole project. It made use of the latest advances in interactive visualisation, simulation, crisis management, and artificial intelligence to provide end-users with a new tool that significantly improves the way in which they collaborate to secure critical government assets both at home and abroad.

The main objectives of the VASCO project were the following:

- Produce a comprehensive analysis of current security concepts, measures and threats, working methods, tools, as well as relevant technologies and standards;
- Take into account end-user requirements during all phases of the project;
- Provision two releases of VASCO integrating all the project's components. Each release then entered an evaluation phase, carried out by end-users on real-world scenarios, which provided feedback for the next release of the system;
- Producing a knowledge base for integral security of government buildings as well as evaluating VASCO impact in real conditions;
- Communicate the research results to the scientific community;
- Establish the conditions for a successful commercialisation of the project's outcomes;
- Meet the project's deadlines and deliver high quality deliverables.

1.3 Description of main S&T results/foregrounds

1.3.1 User Requirements, Security Concepts, Scenarios & Functional Specifications

In order to define the VASCO project's orientation, definition work was conducted around 3 objectives:

- To gather end-user requirements from the user group members and the security experts;
- To perform working methods analysis;
- To specify the whole VASCO concepts and functionalities.

This work was done using an iterative process where the end-user requirements and the system specifications are refined thanks to the results analysis of validation tasks. During the first half of the project, this was focused on:

- Engage leading security professional and potential users from various countries, with diverse economical, ethical backgrounds, as diverse security orientation and operational duties.

- The latest developments in Government Asset Protection were captured and examined in detail. Then they were adapted to fit the VASCO solution innovative approach. The innovations and the enhancements of the VASCO studio were compared with similar work performed and similarities with other industry available solutions were noted.
- Based on interviews and expert panel sessions, the current security approaches in Government buildings and critical infrastructures were analysed. The outcome of this analysis has formed the project technical guidelines. The latter ensures the needs and wants of security end-users will be considered and materialised with the VASCO end product, leading to an innovative security solution.

During the second half, VASCO partners iteratively processed results, and focused their work on refining both the end-user requirements and the system specifications.

Specifically, the final user requirements were based on input obtained in the evaluation process at the Beta Release workshop (Stockholm, September 2015). After having interacted with the system, end users filled questionnaires which were analysed to confirm, validate, and expand the final list of user requirements. This list is the benchmark for the end-product of the VASCO project assessment.

A state-of-the-art on security concepts for government asset protection was produced to illustrate the security practises from EU countries applicable to government buildings/facilities protection, including critical infrastructure. Moreover, it includes a comparison of the aforementioned practices against National Protection Plans and National or Continental Directives and an in-depth literature review and an analysis of security decision maker's interviews.

This led to the creation of a final release refined scenarios & specifications document that presents four refined scenarios that will serve as guidelines to demonstrate the benefits of the VASCO system to the security industry. These scenarios highlight major features of the system, such as the creation of a virtual replica of a governmental facility, its surrounding, and the validation of the current security measures.

1.3.2 Reconstruction of a Digital Mock-Up

In order to enable study security concepts in a building, the VACO project needed to provide a reliable and cost effective solution to the problem of reconstructing and visualizing indoor scenes, to be used by people with no particular background on ICT and without requiring intensive, if any, training. The role of reconstruction and visualisation modules is to support security experts to visually define and assess concepts and measures for the protection of buildings.

Computer Vision techniques that mix image based reconstruction with Inertial Measurements Unit, implementing novel algorithms that allow a non-expert user to reconstruct a whole building floor with an off-the-shelf smartphone and then to inspect said floor within a web browser. The algorithm has been deployed in three main applications:

- Mobile Capture: An Android mobile application to acquire the geometry of an indoor floor plan and to create a navigable graph of the scene.
- 4DNSIDE Scene Processor: A complementary desktop tool to reconstruct the geometry of the acquired floor plan based only on images and positioning sensor data
- 4DNSIDE Net Viewer: Networked viewer for navigation inside the reconstructed scene.

The research has also been described in international peer reviewed conference papers [ABBCGKP16], [PGS16], [PGGS16], [PGGAG15], [PG14]. Further research has been carried out in the same topic, more specifically devising a new algorithm for the acquisition of indoor furniture [GPGGS16].

After evaluation at the end of the first period of the project, the work has been focused on several aspects of the 4DNSIDE pipeline, all revolving about robustness of the single parts of the pipeline, improvement of the usability for non-technical people, support for integration with the DMU Editor and meeting end user constraints that emerged during end user workshops. A special effort has been also put on disseminating the results of the research activities by publishing 4 more papers all in international peer reviewed conferences.

At the end of the project, the pipeline described above is fully functional and ready to be deployed either as a module of the VASCO system or on its own, as a complete tool for fast reconstruction and visualization of indoor environments, see the pipeline in Figure 1.

Figure 1 - 4DNside pipeline, from panoramic images to geometric model to be inspected on the web

1.3.3   The VASCO Framework

The VASCO Framework is the ground basis of the project's technical solution as it uses or is used by the other components. It includes a network layer, visualisation services, simulation engine, virtual equipments, and also the Software Development Kit for the NUI to control the Framework. Three tools have been developed with clear boundaries to enable end-users to elaborate security concepts and measures:

▪ The DMU Editor: enables users to create the indoor and outdoor digital representation, or mock up, of the targeted buildings along with their geographical environment, in much detail.

▪ The Security Editor: enables users to leverage the assets previously created with the DMU Editor that can furthermore be visually filtered to focus on desired elements. Users can elaborate security measures on top of these assets, then evaluate and assess the result with dedicated features. This is possible thanks to a custom simulation engine where virtual equipment, individuals, groups, crowds, events and threats are managed in a dynamic and world scale environment, see Figure 2.The Knowledge Database: the DMUs, the security concepts and measures including the virtual equipments, confronted against multiple threats, supported by documents such as law regulations or procedures, are all stored in a central repository and made easily accessible to collaborators. Furthermore, these stored results can be used for briefing or debriefing phases.
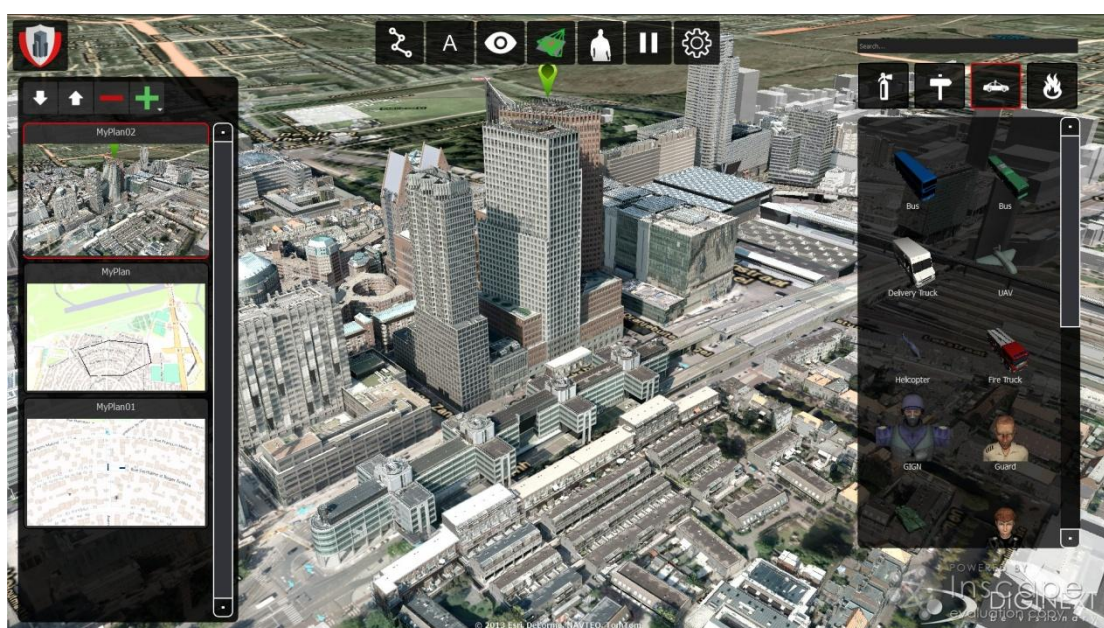
Figure 2 - The Security Editor

Both of the editors of the VASCO framework have been designed iteratively, quickly providing releases that were evaluated by end user, which provided precious feedback that was considered carefully for the following releases. Therefore, user satisfaction has been at the heart of the conception of these tools. As a result, the Final Release delivered near the end of the project fully satisfied the VASCO end users by providing a complete workflow from the DMU Editor to the Security Editor, all thanks to the integrated Knowledge Database.

In addition, project-custom APIs and exchange formats have been defined to enable the other technical components to communicate and exchange information. This set of features constitutes the VASCO Framework SDK.

1.3.4 The Natural User Interface

The natural user interface goal was to research, design, and implement interfaces and techniques ensuring efficient interaction with the VASCO framework but also a real commitment of users in the design of security plan with VASCO solutions. This embracement of users should have increased the commercial success of the VASCO outputs.

The result of this work is a clever mix of hardware and software solutions which enables to intuitively interact with the VASCO framework in a collaborative working environment. These solutions should meet challenges of contemporary collaborative areas: the interconnection of our modern-day world and the needs of cooperation between multiple experts.

The first half of the project has allowed the research and development of the primary component of the VASCO User Interface: the interactive surface for the collaboration with the VASCO Framework. Studies were followed by tests and evaluations to create a first set of prototypes of tangible objects.

Figure 3 - The VASCO collaborative device and tangible objects running the WP4 results.

After the validation of the first results during workshops, the second half of the project was focused on pushing forward the primary components of the VASCO User Interface considering user's feedbacks and technological progress. This led to the following main results:

- Enhancement of performance (integration, collaborative software, hardware);
- Delivery of tangible toolsets;
- Delivery of annotation application on windows tablet;
- Delivery of a HoloLens application in order to perceive 3D mock-up on the tabletop.
- Production of 3 toolkits software (Low Latency streaming, Annotation, HoloLens).

Figure 4 – Pictures of the workspace during End-User Workshops.

The mix of the VASCO Framework with the results of the User Interface will be an additional argument to convince future customers to invest in such a system designed to be consistent with their working processes. These components are modular and can be composed in a turnkey solution.

1.3.5   Project's integration

The technical work of the project has been overseen by a thorough integration of the technical components. This integration step was done in an iterative process planned around the two project's main milestones: the Beta Release and the Final Release. In order to meet these milestones on time, the consortium decided to add two internal releases, i.e. the Alpha and PreFinal Releases, to better track the progress of the project.

The main results of the work achieved in this work-package are as follows:

- A single and integrated system containing the research and development work of technical packages;
- A single comprehensive and integrated user manual;
- The installation of the VASCO system on the successive evaluation sites during three end user workshops.

Each integration phase lasted 4 months. However, much work prior to these phases was necessary to ensure a successful integration. Thanks to an early defined integration strategy, pre-integration meetings and to committed partners, the integration, validation, documentation, and on-site installation were effectively achieved for all the releases.

1.3.6   Integral Security Knowledge

This effort began since the start of the VASCO project and continued throughout the project's 3-year lifespan. It was focused on the creation and assessment of security concepts and measures developed by the VASCO consortium. Furthermore, it defined the structure of the Knowledge Database, which allows users to access valuable security concepts for government asset protection, to store, revise and improve past sessions, and draw from lessons learned.

The partners delivered two versions of a report on integral security concepts and the knowledge database. In the first version of this document, the three situations created to demonstrate the VASCO functionalities were analysed in light of the advantages VASCO brings over traditional approaches to securing critical buildings. Adopting a slightly different perspective, the second version portrays how the VASCO idea

evolved from its conceptualisation to the final release of the system, addressing the improvements made by the consortium in terms of technical solutions and mirroring the needs of security professionals.

Building on the valuable feedback provided by external end-users, this document discusses the uses of VASCO in the security domain.

1.4 Potential impact and main dissemination activities and exploitation of results

1.4.1 Expected impact

The final results of the VASCO project research and development work are an all forming one studio, from hardware to software solution, enabling security experts, non-technical and not necessarily trained persons, to capture the inside and outside of a facility, to design security concepts and measures on top of the digital environment. The proposed technical solution provides a collaborative, risk-safe, and user friendly environment which favours cooperative security design as well as means to store these security designs and to share this knowledge with collaborators. The potential impact is the ability to easily, quickly, and without costly specialized hardware and competences, acquire new facilities. Furthermore, the potential impact is to ease and speed up the design and assessment of security concepts by collaborating and sharing security knowledge.

The VASCO system adds value to the process of designing security for government buildings and other critical infrastructure sites. The ability to work within an accurate virtual 3D mock-up of a building allows users to fine-tune security in a way that was not previously possible. The work contributes to the creation of new security concepts, as well as the opportunity to store and reuse lessons learned through the Knowledge Database. After creating an exact replica of a specific building, users can consider various security aspects, both indoors and outdoors, thus taking into consideration the role of the surrounding environment, which likely includes additional critical buildings and/or a dense urban environment and population. More specifically, VASCO can be used for creating general building security, security related to a specific threat, evacuation plans, as well as for mission planning, briefings, after action reports, or risk assessments. The feedback received confirms the need for a solution like the one proposed by the VASCO consortium; in other words, a virtual platform which will be inherently linked to the end user's daily operations.

The VASCO project was end-user driven, striving to create a system that adds value to current approaches to security design and assessment, constant effort was dedicated to obtaining feedback from end-users and to find appropriate ways to implement it in order to ensure that the development of VASCO led towards an optimal end product. Presentations were done all along the project to end user in order to evaluate the system, see Figure 5. The deliverables produced offered transparency to this process by showing how end users impacted technical work and triggered improvements. Moreover, they offered guidelines on how VASCO can be used in the building security domain (down to details on specific functionalities), and are informative on the advantages the system brings when compared to traditional approached to security.

Figure 5 - Presentation of the VASCO project to End User at the third Workshop

VASCO has two primary audiences, both with different responsibilities: security teams (of the building) and interdisciplinary response teams. Current state of the art security approaches is that operators, asset managers, policy makers tend to identify threats and vulnerabilities within their domain of responsibility. Building security teams focus inward, becoming experts on the particular threats that pertain to their domain. They place and monitor the security cameras, ensure entrances are protected, consider evacuation routes, identify possible areas where security could be breached, among many other security related tasks. Thus, VASCO is able to accurately capture interdependencies across different environments and functions of buildings with a focus on resilience.

Interdisciplinary response teams, on the other hand, must consider wider public safety concerns. While their responsibilities may take them inside buildings during a crisis, the information they need may be limited to practical information such as the building layout. Response teams will benefit from familiarizing themselves with the inside of a building, but must also consider the area surrounding the building. For example, when a world leader visits premises, response teams must consider the best route for a motorcade, which streets should be blocked off, where snipers can be positioned, where protesters may gather, standby positions and possible routes for ambulances, and make such logistical decisions.

Possible scenario variations can be beneficial for end-users to gain almost real life expertise. Lessons learned from scenario rehearsals will provide knowledge added value to VASCO users. As such, enhanced police tactics are envisioned. Moreover, recommendations concerning police equipment and surveillance infrastructure can be made available based on the VASCO interactions.

Evacuation procedures can be optimised, thus saving time and effort. Only the final plan needs testing to verify the situation and check the simulation outcomes against the simulation results.

In addition, VASCO offers cost saving in the following manner; Using DMU, security experts can contribute to Government building and Critical infrastructure security without visiting the site (or) with one site visit. The creation (or validation) of a security plan can take place remotely (or with the minimum allowed site visits). Moreover, VASCO allows expert collaboration from diverse fields to contribute or validate the plans.

Finally, VASCO will have contributed to further new projects and applications by providing a state of the art system and publish scientific research work for indoor digitisation, indoor exploration and IT collaborative design systems that extend beyond the scope of security.

The 4DNside pipeline has proven to be a simple and powerful tool which can be expected to impact positively on the usability and utility of fast reconstruction and visualization of indoor environments. A straightforward example may be for real estate agencies to present houses to the clients. The result of 4DNside can also be seen as an enhancement of the standard cadastral maps which are currently used in public administrations, for example for including a 4DNside representation for museums and, more generally, places open to the public.

In the same way, the collaborative platform's components, by being modular and combinable in a turnkey solution, could be used to enhance collaboration and coordination in many domains, including but not limited to security and safety planning.

1.4.2 Dissemination and exploitation

The project's dissemination and exploitation work began with the planning of the dissemination and the exploitation activities steps for the three years of the project. Exhibitions and scientific conferences were targeted, while each consortium partner determined its exploitation intents. The detailed plans were described in two iterations of the dissemination and use plan.

In addition materials intended for the dissemination activities were designed:

- VASCO project logo: included in all project dissemination materials;

- VASCO Illustrations: a schematic representation of the expected technical results to be used for dissemination purposes;

- VASCO Flyer: overviews the project objectives, the features and targeted use cases;

- VASCO Notebook: given to external end-users to take notes during workshops, respecting the VASCO graphical chart;

- VASCO Project Presentation: slides enabling consortium members to present the project with a common language and point of view;

- VASCO YouTube channel to spread all videos produced during the project

- VASCO "Brief your intervention" video: presents in animation the key features of the VASCO Framework (https://youtu.be/6n3g5qYkWxc);

- VASCO project presentation roll up, an attractive poster putting forward the main concepts of the project;

- VASCO presentation video, illustrating the project functionalities and objectives (https://youtu.be/Fl-gEK58a6w).

Figure 6 - Screenshots of the presentation video.

These materials defined a ground basis for the consortium to prepare workshops with external end-users and introduce the whole range of functionalities available in the successive releases of the VASCO project. During the project's lifespan, four workshops were organised to evaluate and communicate on its progress. As the last one of the project, the End User Workshop #4 was focused on dissemination; all the partners were set on presenting the final release of VASCO.

Throughout the entire project a strong focus was put on scientific dissemination where thirteen articles were published in high quality conferences and journals, including two consortium joint papers.

1.5   Public website and contact

The public website is up to date and accessible at the following address http://vasco.diginext.fr/. Any inquiry can be addressed to the coordinator of the project, Diginext. If needed, it will be dispatched to the corresponding consortium member. The mail address for these inquiries is: vasco@diginext.fr

2 Use and dissemination of foreground

2.1 Section A – Publications & dissemination

No.	DOI	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Date of publication	Relevant pages	Is open access(4) provided to this publication?	Type
1	10.1111/cgf.12334	ExploreMaps: Efficient construction and ubiquitous exploration of panoramic view graphs of complex 3D environments	M. Di Benedetto , F. Ganovelli , M. Balsa Rodriguez , A. Jaspe Villanueva , R. Scopigno , E. Gobbetti	Computer Graphics Forum	Vol. 33/Issue 2	Blackwell Publishing	United Kingdom	01/05/2014	459-468	No	Peer reviewed publication
2	10.1007/s00371-014-0947-0	Effective mobile mapping of multi-room indoor structures	Giovanni Pintore , Enrico Gobbetti	Visual Computer	Vol. 30/Issue 6-8	Springer Verlag	Germany	01/06/2014	707-716	No	Peer reviewed publication
	10.1007/978-3-319-48881-3_10	Mobile Mapping and Visualization of Indoor Structures to Simplify Scene Understanding and Location Awareness	Giovanni Pintore , Fabio Ganovelli , Enrico Gobbetti , Roberto Scopigno	Computer Vision – ECCV 2016 Workshops	Vol. 9914	Springer International Publishing	Cham	01/01/2016	130	No	Article/Section in an edited book or book series
	10.1007/978-3-319-47093-1_13	Towards Integral Security Concepts for Government Buildings Through Virtual Facility Reconstruction	Georgios Leventakis , George Kokkinis , Athanasios Sfetsos	Information Systems for Crisis Response and Management in Mediterranean Countries	Vol. 265	Springer International Publishing	Cham	01/01/2016	143	No	Article/Section in an edited book or book series
		Exploring Emerging Technologies for Training Strategic Leaders	Arjen Boin, Fredrik Bynander, Garth Jensen, Rebecka Law, Rodrigo Nieto-Gomez, Wendy Walsh, and U.S. EMI	Designing Crisis Management Training and Exercise for Strategic Leaders	42	Elanders	Stockholm	01/06/2014	41-59	Yes	Article/Section in an edited book or book series

	Multitouch and Connected Displays for the Future Interactive and Collaborative Display Systems	Jean-Baptiste de la Riviére, Julien Castet	SID Symposium Digest of Technical Papers Book 1: Session 21: Mixed Reality Applications	Volume 47, Issue 1, San Francisco, CA, May 22–May 27, 2016	John Wiley & Sons	United States	25/05/2016	248-250	No	Paper in Proceedings of a Conference/Workshop
10.1109/WiM OB.2014.6962 144	Building an IT platform for strategic crisis management preparation	Arjen Boin , Fredrik Bynander , Giovanni Pintore , Fabio Ganovelli , George Leventakis , Alexandre Ahmad , Olivier Balet	2014 IEEE 10th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob)		IEEE		01/10/2014	20-27	No	Paper in Proceedings of a Conference/Workshop
	Stereo-browsing from Calibrated Cameras	Andrea Baldacci and Fabio Ganovelli and Massimiliano Corsini and Roberto Scopigno	Smart Tools and Apps for Graphics - Eurographics Italian Chapter Conference		The Eurographics Association		15/11/2014	53--62	No	Paper in Proceedings of a Conference/Workshop
10.1109/3DV.2 014.40	Interactive Mapping of Indoor Building Structures through Mobile Devices	Giovanni Pintore , Marco Agus , Enrico Gobbetti	2014 2nd International Conference on 3D Vision		IEEE		01/12/2014	103-110	No	Paper in Proceedings of a Conference/Workshop
10.1109/WAC V.2016.747763 1	Omnidirectional image capture on mobile devices for fast automatic generation of 2.5D indoor maps	Giovanni Pintore , Valeria Garro , Fabio Ganovelli , Enrico Gobbetti , Marco Agus	2016 IEEE Winter Conference on Applications of Computer Vision (WACV)		IEEE		01/03/2016	1-9	No	Paper in Proceedings of a Conference/Workshop

	Assessing the Security of Buildings: A Virtual Studio Solution	Alexandre Ahmad, Olivier Balet, Arjen Boin, Julien Castet, Maureen Donnelley, Fabio Ganovelli, George Kokkinis, Giovanni Pintore	13th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2016)	Federal University of Rio de Janeiro	Rio de Janeiro, Brasil	22/05/2016	Yes	Paper in Proceedings of a Conference/Workshop
10.1145/2999 508.2999526	Mobile reconstruction and exploration of indoor structures exploiting omnidirectional images	Giovanni Pintore , Fabio Ganovelli , Enrico Gobbetti , Roberto Scopigno	SIGGRAPH ASIA 2016 Mobile Graphics and Interactive Applications on - SA '16	ACM Press	New York, New York, USA	01/01/2016 1-4	No	Paper in Proceedings of a Conference/Workshop
	Fast Metric Acquisition with Mobile Devices	Valeria Garro,Gianni Pintore,Fabio Ganovelli,Enrico Gobbetti,Roberto Scopigno	Vision, Modeling & Visualization 2016	The Eurographics Association		10/10/2016 29-36	No	Paper in Proceedings of a Conference/Workshop

			LIST OF DISSEMINATION ACTIVITIES					
No.	Type of activities	Main leader	Title	Date	Place	Type of audience	Size of audience	Countries addressed
1	Organisation of Workshops	CENTER FOR SECURITY STUDIES	End User Workshop #1	20/06/2014	Athens	Civil society - Policy makers	30	Greece, Netherlands, Sweden
2	Organisation of Workshops	Crisisplan B.V.	End User Workshop #2	18/09/2015	Stockholm, Sweden	Civil society - Policy makers	20	Greece, Netherlands, Sweden
3	Flyers	DIGINEXT SARL	Project Presentation Flyer	10/10/2014	France	Industry - Civil society - Policy makers - Medias		Europe
4	Web sites/Applications	DIGINEXT SARL	VASCO Project Website	15/04/2015	France	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		Europe
5	Videos	DIGINEXT SARL	Security Editor Demonstration Video	31/08/2015	France	Industry - Civil society - Policy makers - Medias		Europe
6	Oral presentation to a scientific event	CENTER FOR SECURITY STUDIES	IEEE WiMob 2014 Workshop: Building an IT Platform for Strategic Crisis Management Preparation	09/10/2014	Larnaca, Cyprus	Scientific community (higher education, Research)	50	World
7	Press releases	DIGINEXT SARL	SECURITY RESEARCH PROJECTS CATALOGUE	01/05/2014	Europe	Scientific community (higher education, Research) - Industry - Civil society - Medias	5000	Europe
8	Oral presentation to a scientific event	CONSIGLIO NAZIONALE DELLE RICERCHE	Eurographics 2014: ExploreMaps: Efficient Construction and Ubiquitous Exploration of Panoramic View Graphs of Complex 3D Environments	10/04/2014	Strasbourg, France	Scientific community (higher education, Research)	300	EU/World
9	Oral presentation to a scientific event	CENTRO DI RICERCA, SVILUPPO E STUDI SUPERIORI IN SARDEGNA	CGI 2014: Effective Mobile Mapping of Multi-room Indoor Structures	12/06/2014	Sydney (AU)	Scientific community (higher education, Research)	150	World
10	Oral presentation to a scientific event	CONSIGLIO NAZIONALE DELLE RICERCHE	STAG 2014: Stereo-Browsing from Calibrated Camera	22/09/2014	Cagliari (IT)	Scientific community (higher education, Research)	50	Italy/EU

11	Oral presentation to a scientific event	CENTRO DI RICERCA, SVILUPPO E STUDI SUPERIORI IN SARDEGNA	IEEE 3DV Workshop on 3D Computer Vision in the Built Environment: Interactive mapping of indoor building structures through mobile devices	08/12/2014	Tokyo, Japan	Scientific community (higher education, Research)		World
12	Oral presentation to a scientific event	CENTRO DI RICERCA, SVILUPPO E STUDI SUPERIORI IN SARDEGNA	IEEE Winter Conference on Applications of Computer Vision (WACV): Omnidirectional image capture on mobile devices for fast automatic generation of 2.5D indoor maps	07/03/2016	Lake Placid, NY, USA	Scientific community (higher education, Research)		World
13	Oral presentation to a scientific event	DIGINEXT SARL	3th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2016): Assessing the Security of Buildings: A Virtual Studio Solution	22/05/2016	Rio de Janeiro, Brazil	Scientific community (higher education, Research)		World
14	Oral presentation to a scientific event	IMMERSION SAS	Display Week 2016: Multitouch and Connected Displays for the Future Interactive and Collaborative Display Systems	22/05/2016	San Francisco, CA	Scientific community (higher education, Research)		World
15	Oral presentation to a scientific event	CENTER FOR SECURITY STUDIES	3rd International Conference on Information Systems for Crisis Response And Management in Mediterranean Countries (ISCRAM-Med 2016): Towards Integral Security Concepts for Government Buildings Through Virtual Facility Reconstruction	02/10/2016	Madrid, Spain	Scientific community (higher education, Research)		Europe
16	Oral presentation to a scientific event	CENTRO DI RICERCA, SVILUPPO E STUDI SUPERIORI IN SARDEGNA	14th European Conference on Computer Vision (ECCV 2016): Mobile Mapping and Visualization of Indoor Structures to Simplify Scene Understanding and Location Awareness	03/11/2016	Amsterdam, The Netherlands	Scientific community (higher education, Research)		Europe
17	Oral presentation to a scientific event	CENTRO DI RICERCA, SVILUPPO E STUDI SUPERIORI IN SARDEGNA	Siggraph Asia 2016: Mobile reconstruction and exploration of indoor structures exploiting omnidirectional images	08/12/2016	Macao, China	Scientific community (higher education, Research)		World
18	Oral presentation to a scientific event	CONSIGLIO NAZIONALE DELLE RICERCHE	VMV 2016: Fast Metric Acquisition with Mobile Devices	10/10/2016	Bayeruth, Germany	Scientific community (higher education, Research)	80	World
19	Organisation of Workshops	CENTER FOR SECURITY STUDIES	Critical Infrastructure Protection Workshop	14/12/2015	Athens, Greece	Civil society - Policy makers	160	World
20	Organisation of Workshops	Crisisplan B.V.	End-User Workshop #3	18/11/2016	Leiden, The Netherlands	Civil society - Policy makers		Europe
21	Exhibitions	DIGINEXT SARL	International Exhibition for National Security & Resilience 2016	15/03/2016	Abu Dhabi, The Emirate	Civil society - Policy makers	18000	World
22	Exhibitions	DIGINEXT SARL	SIMulation OPerationelle (SIMOPS) exhibition 2016	01/04/2017	Saumur, France	Civil society	200	France

23	Exhibitions	DIGINEXT SARL	Eurosatory 2016	13/06/2016	Paris, France	Civil society	55000	World
24	Oral presentation to a wider public	DIGINEXT SARL	Virtual Geo conference in Nanjing, China	25/11/2016	Nanjing China	Industry	100	China
25	Oral presentation to a wider public	Crisisplan B.V.	Technical University of Delft	14/04/2016	Delft, The Netherlands	Scientific community (higher education, Research)		The Netherlands
26	Oral presentation to a wider public	CENTER FOR SECURITY STUDIES	2nd ICT forum in Athens	25/05/2016	Athens, Greece	Industry	250	Greece
27	Oral presentation to a wider public	CENTER FOR SECURITY STUDIES	KEMEA's FP7 and H2020 projects	21/12/2016	Athens, Greece	Scientific community (higher education, Research) - Industry - Civil society	450	Greece
28	Oral presentation to a wider public	DIGINEXT SARL	Presentation to the French Defence and National Security Department	26/04/2016	Paris, France	Civil society		France
29	Organisation of Workshops	CENTER FOR SECURITY STUDIES	End-User Workshop #4	22/02/2017	Athens, Greece	Civil society - Policy makers		Greece
30	Videos	IMMERSION SAS	VASCO Leiden	23/06/2016	Internet	Industry - Medias		World
31	Videos	IMMERSION SAS	VASCO HololensOverMap Demo	06/09/2016	Internet	Industry - Medias		World
32	Videos	IMMERSION SAS	Update - VASCO HololensOverMap Demo	14/09/2016	Internet	Industry - Medias		World
33	Articles published in the popular press	IMMERSION SAS	Tangible User Interface for digital map on LinkedIn	06/10/2016	Internet	Industry - Medias		World
34	Posters	DIGINEXT SARL	Project Presentation Roll up	08/11/2016	Toulouse, France	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		World
35	Videos	IMMERSION SAS	Hololens and urban visualisation	09/12/2016	Internet	Industry - Medias		World
36	Articles published in the popular press	IMMERSION SAS	HoloLens and urban visualisation on LinkedIn	09/12/2016	Internet	Industry - Medias		World
37	Videos	DIGINEXT SARL	VASCO professional presentation video	15/02/2017	Internet	Industry - Civil society - Medias		World

2.2 Section B – Exploitation (confidential)

LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS,UTILITY MODELS, ETC.					
Type of IP Rights	Confidential	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant(s) (as on the application)
Registered designs	Yes	12/01/2016	002942540-0001	Table interactive	Immersion SAS

OVERVIEW TABLE WITH EXPLOITABLE FOREGROUND								
Type of Exploitable Foreground	Description of Exploitable Foreground	Confidential	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use or any other use	Patents or other IPR exploitation (licences)	Owner and Other Beneficiary(s) involved
Commercial exploitation of R&D results	VASCO: a modular distributed framework for the visualisation of geographic and architectural environments and the simulation and management of crisis situations taking place within and around buildings.	Yes		VASCO framework	N80, J58	2017		DIGINEXT(owner)
Commercial exploitation of R&D results	This mobile interactive tabletop has been designed to provide an ergonomic solution for comfortable meetings. The integrated touchscreen ensures an efficient interaction with the digital environment. Its mechanical design enables users to easily switch between vertical and horizontal configurations.	Yes		Tilting touch table	N80, F41, F42, G46.5, J58	2017		IMMERSION(owner)
Commercial exploitation of R&D results	The 4DNSide Generator and Viewer to capture building interior and produce a visualisation to easily visit the building.	Yes		4DNSide	N80, J58	2017		CNR, CRS4 (owner)
General advancement of knowledge	A Box of tangible tools compatible with projected capacitive touchscreen. These tangible tools are provided with their windows driver. Inside, a ruler and protractor are available.	Yes		Tangible toolset for capacitive projected screen	N80, F41, F42, G46.5, J58	2017		IMMERSION(owner)
General advancement of knowledge	Low Latency Streaming toolkit enables developers to easily integrate any application in Shariiing (a collaborative environment designed by Immersion)	Yes		Toolkit	N80, C26	2017		IMMERSION(owner)

OVERVIEW TABLE WITH EXPLOITABLE FOREGROUND([1])	
Description of Exploitable Foreground	**Explain of the Exploitable Foreground**
VASCO: a modular distributed framework for the visualisation of geographic and architectural environments and the simulation and management of crisis situations taking place within and around buildings.	The VASCO framework is composed of the Digital Mock Up Editor and the Security Editor. The security planning takes place in the Security Editor, allowing organising, preparing and sharing security concepts. DIGINEXT is commercialising CRIMSON, a solution for operational crisis management and training. In this perspective the Security Editor will be taking its place in this crisis solution by giving tools for mission planning. The Digital Mock Up Editor will be used and commercialised in the same function as in the VASCO framework, to prepare the virtual environment where the mission planning or operational crisis is focused.
This mobile interactive tabletop has been designed to provide an ergonomic solution for comfortable meetings. The integrated touchscreen ensures an efficient interaction with the digital environment. Its mechanical design enables users to easily switch between vertical and horizontal configurations.	The tilting touch table has been designed to provide an ergonomic, mobile and stable solution for meetings, allowing switching between vertical and horizontal position. Its large dimension enables users to have comfortable sessions and supports the use of office furniture and traditional personal equipment. In addition, this table eases the accessibility of digital elements on a large capacitive touch screen.
The 4DNSide Generator and Viewer to capture building interior and produce a visualisation to easily visit the building.	4DNSide Generator and viewer. An image-based method to capture the building data and a specialized photorealistic rendering plug-in to visualize the acquired model.(CNR) A fast, automated and cost-effective method to produce 2D/3D representation of the buildings, focusing on indoor areas, from a series of panoramic images acquired with the aid of modern mobile devices. (CRS4).
A Box of tangible tools compatible with projected capacitive touchscreen. These tangible tools are provided with their windows driver. Inside, a ruler and protractor are available.	The box of tangible tools is composed of a ruler and a protractor compatible with capacitive touch screen. The windows driver enables users to detect such tangible objects. Their user Interfaces provide different user modes of measurement on maps.
Low Latency Streaming toolkit enables developers to easily integrate any application in Shariiing (a collaborative environment designed by Immersion)	The Low Latency Streaming toolkit provides a generic solution enabling developers to initiate a remote connection from a computer to an OpenGL application by keeping the essentials interaction with the initial app. This solution will be an additional value in the products of Immersion, such as Shariiing, but it could also be sold as toolkit for expert.

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[1] In the table, for each row, please provide a text to explain the exploitable foreground, in particular: - Its purpose - How the foreground might be exploited, when and by whom - IPR exploitable measures taken or intended - Further research necessary, if any - Potential/expected impact (quantify where possible)

3   Report on societal implications

3.1   B. Ethics

1. Did your project undergo an Ethics Review (and/or Screening)?	Yes
If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final reports?	No

3.1.1   Research on humans

Did the project involve children?	No
Did the project involve patients?	No
Did the project involve persons not able to consent?	No
Did the project involve adult healthy volunteers?	No
Did the project involve Human genetic material?	No
Did the project involve Human biological samples?	No
Did the project involve Human data collection?	No

3.1.2   Research on human embryo/foetus

Did the project involve Human Embryos?	No
Did the project involve Human Foetal Tissue / Cells?	No
Did the project involve Human Embryonic Stem Cells (hESCs)?	No
Did the project on human Embryonic Stem Cells involve cells in culture?	No
Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	No

3.1.3   Privacy

Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	No
Did the project involve tracking the location or observation of people?	No
Did the project involve research on animals?	No
Were those animals transgenic small laboratory animals?	No
Were those animals transgenic farm animals?	No
Were those animals cloned farm animals?	No
Were those animals non-human primates?	No

3.1.4   Research involving developing countries

Did the project involve the use of local resources (genetic, animal, plant etc)?	No
Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	No
DUAL USE	
Research having direct military use	No
Research having potential for terrorist abuse	No

3.2   Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).		
Type of Position	Number of Women	Number of Men
Scientific Coordinator	0	1
Work package leaders	4	5
Experienced researchers (i.e. PhD holders)	2	19
PhD student	0	0
Other	10	19
4. How many additional researchers (in companies and universities) were recruited specifically for this project?	6	
Of which, indicate the number of men:	6	

3.3   Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project ?	No
6. Which of the following actions did you carry out and how effective were they?	
Design and implement an equal opportunity policy	Not Applicable
Set targets to achieve a gender balance in the workforce	Not Applicable
Organise conferences and workshops on gender	Not Applicable
Actions to improve work-life balance	Not Applicable
Other:	
7. Was there a gender dimension associated with the research content - i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?	No
If yes, please specify:	

3.4   Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?	No
If yes, please specify:	
9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?	No
If yes, please specify:	

3.5 Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?	
Main discipline:	1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]
Associated discipline:	2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)

3.6 Engaging with Civil society and policy makers

11a. Did your project engage with societal actors beyond the research community? (if 'No', go to Question 14)	No
11b. If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?	
11c. In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	
12. Did you engage with government / public bodies or policy makers (including international organisations)	
13a. Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?	
13b. If Yes, in which fields?	
13c. If Yes, at which level?	

3.7 Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	13
To how many of these is open access provided?	2
How many of these are published in open access journals?	0
How many of these are published in open repositories?	2
To how many of these is open access not provided?	11
Please check all applicable reasons for not providing open access:	
publisher's licensing agreement would not permit publishing in a repository	Yes
no suitable repository available	No
no suitable open access journal available	No
no funds available to publish in an open access journal	No
lack of time and resources	No
lack of information on open access	No
If other - please specify	
15. How many new patent applications ('priority filings') have been made? ("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).	0
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	
Trademark	0
Registered design	1

Other	0
17. How many spin-off companies were created / are planned as a direct result of the project?	0
Indicate the approximate number of additional jobs in these companies:	0
18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:	Difficult to estimate / not possible to quantify, None of the above / not relevant to the project
19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (FTE = one person working fulltime for a year) jobs:	Difficult to estimate / not possible to quantify

3.8 Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?	Yes
21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?	No
22. Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?	
Press Release	Yes
Media briefing	No
TV coverage / report	No
Radio coverage / report	No
Brochures /posters / flyers	Yes
DVD /Film /Multimedia	Yes
Coverage in specialist press	Yes
Coverage in general (non-specialist) press	No
Coverage in national press	No
Coverage in international press	No
Website for the general public / internet	Yes
Event targeting general public (festival, conference, exhibition, science café)	Yes
23. In which languages are the information products for the general public produced?	
Language of the coordinator	Yes
Other language(s)	Yes
English	Yes

4 Final report on the distribution of the European Union financial contribution between beneficiaries

This report will be submitted later to the Commission. Within 30 days after receipt of the final payment of the European Union financial contribution.

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