Intelligent Verification/Validation for XR Based Systems

Research and Innovation Action

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D6.4 – 2nd Dissemination & Exploitation Plan

iv4XR – WP6 – D6.4

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1 Executive Summary

This deliverable details the second dissemination and exploitation plan adopted by the iv4XR project. It summarises the consortium's overall strategy in the dissemination and exploitation of results and concrete actions performed so far in order to communicate and disseminate the foreground generated by the project. This deliverable will also serve as a guideline to the consortium for the dissemination and exploitation activities to be carried out in the coming months of the project.

The current report and its content are structured following the online manual describing the guideline and recommendation in the Dissemination & Exploitation of results under Horizon 2020 [1]. The next section details the plans and activities undertaken related to dissemination and communication, while exploitation plans are detailed in the subsequent section.

2 Dissemination Activities

2.1 Aims & Objectives

Our dissemination strategy/plan is aimed at making the project results reach the wider public as much as possible, as well as the right stakeholders. Together with the communication actions, they are aimed to create public awareness of the project's potential and to facilitate effective transfer of the knowledge produced in the project to academia and stakeholders. The objectives for all dissemination and communication actions are consistent with the relevant EU policy and are as follows:

- Create awareness about the project, promote the innovative and unique characteristics of the project.
- Maximize the impact of project activities and ensure that all the derived outcomes will be widely spread among the appropriate stakeholders.
- Promote project ideas, concepts and results in scientific research and applied research communities, and get feedback from relevant stakeholders in these communities.
- Disseminate consolidated project results on the effective automated testing of Extended Reality (XR) based applications.

2.2 Target Group

The target audiences of iv4XR project are:

- Research communities working in the areas of software engineering, automated game testing, human-computer interaction, artificial intelligence, affective computing, and other related fields.

- Stakeholders, including parties we expect to benefit from our results, such as the XR Industry, companies that build their own XR-based systems to support their business (e.g., to train personnel), or ICT tech companies offering quality assurance services.
- Other H2020 projects working on closely related topics.
- End-users, for their awareness in the access to the new ICT services.

2.3 Planned dissemination activities

To support the project to make a real impact by reaching the target audiences, we will carry out various dissemination and communication actions aimed at creating public and industry awareness of the project and engaging them to explore collaboration and exploitation of the project's results. This section presents our plan towards maximizing the project's impact. Table 1 gives an overview of the planned dissemination and communication actions across the lifespan of the project. Details are presented in subsequent subsections.

Table 1 : overview of iv4XR dissemination and communication actions over the project lifespan

Dissemination & communication actions	Year 1		Year 2		Year 3	
Industry dissemination						
● industry articles						
● industry presentation						
● proactive participation in industry events						
Academic publication						
● conferences						
● journals						
Organizing workshops						
General public dissemination						
● website						
● social media						
● conventional media						
● video clips						

2.3.1 Dissemination actions

2.3.1.1 Academic publications – Conferences & Scientific journals

We will disseminate our results in leading journals and conferences (e.g., Interact, CHI, ICSE, AAMAS, ICST, QUATIC, TOSEM, ESEM, STVR), not only in the fields of interaction technology or verification/validation, but also for cross-fertilisation in the broader fields of software engineering and artificial intelligence.

We will also consider other sectors that could potentially benefit from our results, e.g., health, education & manufacturing. Initial ideas and preliminary results have already been sent to and

accepted at different venues. Furthermore, the iv4XR consortium has compiled a plan for year 3 of the project containing publications that are intended to be presented at international conferences. These publications are listed in Table 2 below, containing a short description of the planned content of the publication, the target venue, and the (expected) presentation/submission date expressed as project month.

Table 2: List of publications (to be) presented at conferences and journals

Description	**Leading partners**	**Conference/Journal**	**Tentative submission date (project month)**
Empirical assessment of solutions for model based game play testing	FBK	TBD	30
Reinforcement learning for coverage testing of XR based systems	FBK	TBD	26
Comparative study on the effectiveness of algorithms for automated XR testing	UU, UPV	TBD	30
Solving test goals through online search and leveraging on-the-fly model construction.	UU	TBD	28
Automated user experience evaluation by leveraging functional behavior model.	UU, FBK	TBD	28
How to define coverage when dealing with the testing of user experience	INESC-ID, FBK	TBD	29
A solution to generate “human like” behaviour for UX testing	INESC-ID	TBD	30

Results from the first user study on using machine learning to train a UX prediction model	INESC-ID	TBD	32
A mapping of the several areas that contribute to the development of automated UX testing	INESC-ID	TBD	28
Assessing Players' Cognitive Load in Games	INESC-ID	International Journal of Human-Computer Studies	30
Towards a comprehensive model of user experience	INESC-ID	TBD	36

2.3.1.2 Industry dissemination

To make the XR Industry as well as the broader ICT Industry aware of our results, we will publish articles in the relevant trade press, such as, software developers' magazines and magazines on interaction technologies. We will engage in discussions and give presentations in industrial or industry-related platforms and venues, such as national special interest groups (SIGs) and European industrial conferences such as EuroVR, EuroSTAR and TestExpo. We also plan to make targeted presentations as described in Section 2.3.2.1 below. Our project will participate in technical events organized by the European Commission, by other EU projects, or by the Technological Platforms, in order to announce and make our results available to other ICT-related sectors in Europe.

2.3.1.3 Workshops

We will organize two editions of the A-TEST workshop in the light of the iv4XR project. This workshop has been set-up by some of the researchers in this project in 2009 within the context of another EU project (FITTEST). We have kept the workshop running successfully for more than ten editions. The idea is to use this workshop as a platform for both sharing and promoting our results as well as for attracting academia and industry practitioners/developers from related areas to exchange results, to foster discussions and collaborations, and to promote interdisciplinary collaborations.

A-TEST is co-located with the major FSE conference which maximizes the dissemination impact. The workshops are planned for the second halves of the second and third year of the project, as shown in Table 1.

2.3.1.4 Collaboration with other projects

The iv4XR consortium intends to identify synergies with other European projects and establish contact and cooperation with these projects, e.g. joint activities for exchange, dissemination and workshops. The cooperation aims at exploiting synergies between the projects and increasing the impact of the ICT initiative.

We have already identified a number of related projects to reach out to: DECODER, TESTOMAT, IVVES, STAMP, AI4EU, XR4ALL. Work has already started on establishing contacts with some of these projects.

2.3.2 Communication actions

General public dissemination is covered under the following planned communication measures. These are the activities to promote the project and its results.

2.3.2.1 Targeted industry presentations

To further promote the project to the industry, we will give presentations and distribute promotional materials at potential outlets, such as venues with industry agendas and business networks with potential interest in our project. Table 3 below shows the different targets we have identified so far. We will assess and improve these targets as the project progresses.

Table 3: List of potential industry presentation targets

	Industry promotion targets
Conferences	● Industry conferences, e.g. EuroVR and EuroSTAR (quality assurance). ● Academic conferences with industry tracks e.g. Interact, ICSE, AAMAS. ● Conferences organized by the EU, e.g. EU ICT conference. ● National industry conferences with strong industry presence, e.g. Dutch ICT Open ● Developer conferences for the videogame industry, e.g GDC, EGX, Game Design Expo
Partner networks	● GWE's business networks of UK and international media/games creative industries; and similarly, UU's networks of Dutch creative industry, e.g. the Dutch Game Garden, and GA's networks of Czech Republic's creative industry. ● Spanish Software Testing Innovation Alliance, members of which would be quite interested in accessing iv4XR results to expand their services. Similarly, FBK's networks in the quality assurance and software engineering community in Italy.

	● THA's international business networks, in particular in the area of training simulation for mission critical tasks.
Other projects	● Other EU projects with related themes, e.g. REPLICATE, ARIES, and STAMP. ● National projects with related themes, e.g. Golden Agent (NL)

2.3.2.2 Social Media

Social networks enable a direct communication channel with citizens, professionals, EU institutions or anyone interested in the project. The iv4XR consortium is aware that a successful communication through social media is only possible if social media channels are regularly updated with events, news and general information about progress made in the project. We will communicate project activities as status updates on popular social media platforms, such as Twitter and Facebook, to regularly inform the broader public of our progress and results, and encourage wider debate (e.g., regarding the impact of using AI to assure the correctness of virtual environments).

2.3.2.3 Newsletter

A newsletter is an efficient medium to build a network of followers (XR Industry, companies that build their own XR based systems to support their business) eager to get our results for their own application scenarios and deployments. A secondary goal of a newsletter is to collect experiences and lessons learned and share these with the software engineering community. To this end, the iv4XR consortium plans to publish a newsletter regularly every 4 months after the project starts. In total 9 editions of the newsletter are planned to be published in the project duration. The newsletters will be published and distributed through the consortium's professional networks, and to the press, as well as being made available on the project website. These newsletters will include more detailed descriptions of the activities performed and the results of the project, as well as other activities, such as project adoption and alliances with external entities.

2.3.2.4 Video media

Video clips are useful tools to effectively communicate various aspects of our project. For instance, they could be used to communicate a compelling introduction to the principles of smart test agents, or to show a short but thought-provoking interview with our researchers, or to give an exciting presentation of our major results. Video clips have been shown to be a very effective way of communicating with the general public and they can be easily made public through the project website and social media channels. The videos will make the general public aware that the project is working on techniques and tools that can help to improve the quality of the applications they use daily. This greater awareness will help to stimulate user demand and to promote socio-economic acceptance.

2.3.2.5 Website

The project website is a useful platform that allows us to provide basic information about the project and its consortium, as well as communicate the various outcomes of the project. It is an important part of the project's digital presence. It also holds appropriate links to resources and results of the project such as source code, publications, deliverables, etc. The information on the website is regularly updated.

2.3.3 Pilots showcasing

The project includes three industrial pilots which, in addition to their use in validating solutions produced in the project, will also be used as showcases to promote the project. The pilots are developed in parallel with the project's research activities. The development and integration with the iv4XR framework starts early, enabling us to produce showcases early in the project which we can show in various industry events and other dissemination actions throughout the project's duration. Of course in the first year, these showcases will only have minimal features. Despite this, showing off concrete, lively, and interactable demonstrators is often a much more effective way to promote an idea and spark people's interest than just giving a traditional presentation about it. As the project progresses, the showcases will also grow in features. Towards the end of the project, we will be able to show them off as instances of minimum viable product (MVP) to the industry, demonstrating the viability of the full spectrum of iv4XR approach.

These demonstrators will also be publicly available (within reason - the iv4XR framework specific code will be public, but the proprietary code will remain unpublished) in order to facilitate adoption by those who have seen the demonstrations live and wish to attempt to incorporate the framework into their workflow. Two major barriers to the adoption of a new technology into an existing workflow are 1) Application to personal use-cases, and 2) Ease of adoption. Our two-pronged approach of using the demonstrators and making salient parts of them available to those interested are intended to tackle both of these issues.

2.3.4 Knowledge management - open knowledge sharing

Our knowledge management strategy is to make all results public, except when doing so is not possible due to property rights or privacy reasons, as we believe this is how their impact would be maximized. The strategy for each type of results is shown in Table 4 below. Within the consortium, access to, and exploitation of, project results is regulated by the terms of the Grant Agreement Contract and the Consortium Agreement. This will respect the legitimate IP rights and interests of all partners while enabling them to pursue market opportunities that arise from the project. Regardless of partners' exploitation, all project results (minus proprietary background) remain publicly open.

Table 4: Open knowledge sharing strategy

Result type	Knowledge management strategy
Software	All our software, excluding proprietary background provided by the partners, will be made available in a **publicly accessible repository** in the project's github repository: https://github.com/iv4xr-project
Research paper	All published research will be made available to the public via the project's community space on Zenodo: https://zenodo.org/communities/iv4xr-project
Research data	We will participate in the EU Pilot on Open Research Data (**OpenAIRE**). Data generated and maintained by the project as well as how it will be made available to the general public is described in the project data management plan deliverable [2].

Concrete details regarding the storage, discoverability, and accessibility of results will be governed by the FAIR principles as described in our data management plan deliverable [2].

2.3.4.1 Project deliverables

The project will deliver 26 deliverables[1] (listed in Table 5 below), all of which will be publicly available. Out of these, deliverables D6.1, D6.2, D5.1, D1.1, D2.1, D3.1, D3.2, D4.1, D6.3, D5.2, and D5.3 have already been submitted on time. Preparation of deliverables D1.2, D2.2, D3.3, D4.2, D6.5 and D6.4 (the current deliverable) is underway and on track for on time submission.

Table 5: Project deliverables

Nr	Deliverable name	WP	Lead	Type	Dissem level	Due
D6.1	Project website	6	THA-AVS	DEC	PU	1
D6.2	Data Management Plan	6	THA-AVS	R	PU	6
D5.1	Basic integration of the pilots	5	GA	OTHER	PU	12
D1.1	1st project report	1	INESC	R	PU	15
D2.1	1st prototype of iv4XR Framework	2	UU	OTHER	PU	15
D3.1	Test Specification Language	3	UPV	OTHER	PU	15
D3.2	1st prototype of functional test agents (FTAs)	3	UPV	OTHER	PU	15
D4.1	1st prototype of SETAs	4	INESC	OTHER	PU	15

[1] We do not include deliverable D7.1 - "POPD - Requirement No. 1", on Ethics, as it is confidential.

D6.3	1st Dissemination & Exploitation Plan	6	UPV	R	PU	15
D5.2	Intermediate integration of the pilots	5	GA	OTHER	PU	15
D5.3	Full integration of the pilots	5	GA	OTHER	PU	24
D1.2	2nd project report	1	INESC	R	PU	27
D2.2	2nd prototype of iv4XR Framework	2	UU	OTHER	PU	27
D3.3	2nd prototype of functional test agents (FTAs)	3	UPV	OTHER	PU	27
D4.2	2nd prototype of SETAs	4	INESC	OTHER	PU	27
D6.4	2nd Dissemination & Exploitation Plan	6	UPV	R	PU	27
D6.5	Market Research Report	6	THA-SIX	R	PU	27
D1.3	Final Project Report	1	INESC	R	PU	39
D2.3	Final version of iv4XR Framework	2	UU	OTHER	PU	39
D2.4	Report describing iv4XR Framework	2	UU	R	PU	39
D3.4	Final version of functional test agents (FTAs)	3	UPV	OTHER	PU	39
D3.5	Report describing FTAs	3	UPV	R	PU	39
D4.3	Final version of SETAs	4	INESC	OTHER	PU	39
D4.4	Report describing SETAs	3	INESC	R	PU	39
D5.4	Project validation report	5	GA	R	PU	39
D6.6	3rd Dissemination & Exploitation Plan	6	UPV	R	PU	39

2.4 Already undertaken dissemination activities

In this section, we report dissemination and communication activities that have already been undertaken, in line with the dissemination and communication plan outlined in the previous section and in the previous year of the project.

2.4.1 Publications

In line with the project's publication plan, so far there have already been publications sent and accepted to different venues in which we presented the problem addressed in the project, the proposed solution, as well as initial activities as well as practical early results. These publications are listed in Table 6 below. The complete list and full details available from the project website (https://iv4xr-project.eu/publications/) as well as from the project's Zenodo community (https://zenodo.org/communities/iv4xr-project).

Table 6: List of publications

No	Title & Authors	Venue
1	"iv4XR – Intelligent Verification/Validation for Extended Reality Based System" Wishnu Prasetya, Rui Prada, Tanja E. J. Vos, Fitsum Kifetew, Frank Dignum, Jason Lander, Jean-Yves Donnart, Alexandre Kazmierowski, Joseph Davidson, Fernando Pastor Ricos	RCIS'2020 – The 14th International Conference on Research Challenges in Information Science
2	"Tactical Agents for Testing Computer Games" I. S. W. B. Prasetya, Mehdi Dastani, Rui Prada, Tanja E. J. Vos, Frank Dignum, Fitsum Kifetew	EMAS'2020 – Engineering Multi-Agent Systems workshop
3	"Adoption Dynamics and Societal Impact of AI Systems in Complex Networks" Pedro M. Fernandes, Francisco C. Santos, Manuel Lopes	AIES'2020 – AAAI/ACM Conference on AI, Ethics, and Society
4	"Agent-based Testing of Extended Reality Systems" Rui Prada, I. S. W. B. Prasetya, Fitsum Kifetew, Frank Dignum, Tanja E. J. Vos, Jason Lander, Jean-yves Donnart, Alexandre Kazmierowski, Joseph Davidson, Pedro M. Fernandes	ICST-2020 – IEEE Conference on Software Testing, Validation and Verification
5	"Navigation and Exploration in 3D-Game Automated Play Testing" I.S.W.B. Prasetya, Maurin Voshol, Tom Tanis, Adam Smits, Bram Smit, Jacco van Mourik, Menno Klunder, Frank Hoogmoed, Stijn Hinlopen, August van Casteren, Jesse van	International Workshop on Automating Test case Design, Selection and Evaluation, co-located with ESEC.FSE (ATEST), 9 November, 2020
6	"Aplib: An Agent Programming Library for Testing Games" Wishnu Prasetya, Mehdi Dastani	International Conference on Autonomous Agents and Multiagent Systems (AAMAS), Auckland, New Zealand, 9-13 May, 2020
7	"Toward Automated Assessment of User Experience in Extended Reality" Saba Ansari	ICST-2020 – IEEE Conference on Software Testing, Validation and Verification
8	"Deploying TESTAR to Enable Remote Testing in an Industrial CI Pipeline: A Case-Based Evaluation" Pastor Ricos, Fernando; Aho, Pekka; Vos, Tanja; Torres Boigues, Ismael; Calas Blasco, Ernesto; Martinez Martinez, Hector	ISOLA 2020- International Symposium On Leveraging Applications of Formal Methods, Verification and Validation, LNCS 12476, pp. 543–557, 2020
9	"Validating the plot of interactive Narrative games"	COG 2021 - Conference on

	Carolina Veloso, Rui Prada	Games,Copenhagen 978-1-6654-3886-5/21/$31.00 ©2021 IEEE
10	“Search-based Automated Play Testing of Computer Games: a model-based approach” Ferdous, Raihana; Kifetew, Fitsum; Prandi, Davide; Prasetya, I. S. W. B; Shirzadehhajimahmood, Samira; Susi, Angelo	13th International Symposium on Search-Based Software Engineering, Bari, Italy, October 11-12, 2021
11	“Using an Agent-Based Approach for Robust Automated Testing of Computer Games” Shirzadehhajimahmood, Samira; Prasetya, I. S. W. B.; Dignum, Frank; Dastani, Mehdi; Keller, Gabriele	12th International Workshop on Automating TEST Case Design, Selection, and Evaluation (A-TEST ’21), August 23–24, 2021
12	“A taxonomy of social roles for agents in games” Diogo Rato, Rui Prada	20th IFIP TC 14 International Conference, ICEC 2021, Coimbra, Portugal, November 2-5, 2021
13	“Evaluating TESTAR's effectiveness through code coverage”Aaron van der Brugge, Fernando Pastor Ricos, Pekka Aho, Beatriz Marín, and Tanja E.J. Vos	XXV Jornadas de Ingeniería del Software y Bases de Datos (JISBD 2021)
14	“TESTAR - scriptless testing through graphical user interface” Tanja E. J. Vos, Pekka Aho, Fernando Pastor Ricós, Olivia Rodriguez Valdes, Ad Mulders	Softw. Test. Verification Reliab.31(3) (2021)
15	“30 Years of Automated GUI Testing: A Bibliometric Analysis” Olivia Rodríguez-Valdés, Tanja Vos, Pekka Aho, Beatriz Marín	14th International Conference on the Quality of Information and Communications Technology (QUATIC 2021)
16	“An Agent-based Architecture for AI-Enhanced Automated Testing for XR Systems”. Prasetya, Shirzadehhajimahmood, Ansari, Fernandes, Prada.	Int. Workshop on Artificial Intelligence in Software Testing 2021.
17	“Tool Demonstration: iv4XR Agent-based Testing Framework”. Prasetya, Shirzadehhajimahmood, Ansari.	ICST-2021 – IEEE Conference on Software Testing, Validation and Verification
18	“Navigation and Exploration in 3D-Game Automated Play Testing.” Prasetya et al.	11th International Workshop on Automating TEST Case Design, Selection, and Evaluation (A-TEST ’20).
19	“Adapting Procedural Content Generation to Player Personas Through Evolution”. Fernandes et al.	IEEE Symposium Series on Computational Intelligence (IEEE SSCI 2021)

Similarly, planned deliverables of the project have been completed and submitted in a timely manner. Work on some of the deliverables has been affected by the lockdowns imposed in the countries in which consortium members are located. However, such delay will not affect the overall project progress since an official request has been made to the European Commission in order to extend the duration of the project and has been granted. With such an extension, all deliverables will be completed and submitted as planned.

2.4.2 A-TEST Workshop

iv4XR has co-organized the 12th edition of the A-Test workshop. The A-Test workshop is a venue for researchers and industry partners to exchange and discuss trending views, ideas, state of the art, work in progress, and scientific results on automated test case design, selection, and evaluation. This year's edition was held with a theme focusing on testing of eXtended Reality (XR) based systems. The workshop was Co-located with ESEC/FSE 2021, held virtually on 23 of August, 2021.

To encourage students' (bachelor, master, or PhD) interest and involvement in themes around automated testing of XR based systems, this year's edition of A-Test had a student competition where participants were challenged to come up with their own algorithms to solve a set of managed testing problems in the domain of 3D computer games. iv4XR provided the challenge problem and an appropriate environment (JLabGym) that enables participants to easily integrate their solutions to the provided system under test. Winners of the competition were awarded prizes.

The workshop received six technical paper submissions, out of which five were accepted for presentation at the workshop. The program featured presentations by the authors of the accepted papers, a hands-on session on the CrashScope Tool, and a panel discussion on Expanding Software Testing to XR Systems.

For more details on the event and the works presented, please visit the the A-Test workshop website https://a-test.org

2.4.3 Presentations and participation in events

We have participated in different workshops and conferences where we presented iv4XR's proposed approach, namely:

- **Intelligent Verification/Validation for XR Based Systems**
  Rui Prada
  Research Seminar at the Helmut Prendinger Lab
  National Institute of Informatics, Tokyo
  https://www.nii.ac.jp/en/
  http://research.nii.ac.jp/~prendinger/#

- **Teaching and Research on Games at Técnico**
  Rui Prada
  Keynote at Sinfo 27
  Instituto Superior Técnico, Universidade de Lisboa
  https://sinfo.org/
  https://sinfo.org/speakers/rui-prada

- **How AI can help games fulfil their purpose**
  Rui Prada
  Keynote at EAI ICIDM 2021 - 7th EAI International Conference on Interactive Digital Media
  https://icidm.eai-conferences.org/2021/keynotes/

- We participated in a European Researcher's night in Portugal where we presented a video of the project (https://www.youtube.com/watch?v=UOdwZX2h11o&t=12s)

- Various European Commission DG Connect Workshops, e.g., Workshop on Interactive Technologies; Workshop on Awareness, Adoption, and Acceptance of Augmented and Virtual Reality; and Workshop on Standards and Interoperability for Augmented and Virtual Reality.

- **Keynote at Eurostar 2020: GUI testing: from developing scripts to creating AI-enabled agents.**
  Tanja Vos
  https://conference.eurostarsoftwaretesting.com/event/2020/gui-testing-from-developing-scripts-to-creating-ai-enabled-agents/

- **Keynote at RTC 2020: How to make software testing more sexy**
  Tanja Vos
  https://romaniatesting.ro/speakers/tanja-vos/

- **Teaser video for ICST 2020**
  https://www.youtube.com/watch?v=1BzLSfsvruA

- **Keynote at JCC 2021: Intelligent Testing for Industry 4.0 (in spanish).**
  Tanja Vos
  https://jcc2021.cl

- **We present iv4xr in the tool demonstration session at ICST 2021.** Prasetya. Video: https://zenodo.org/record/4661123#.YHVAsxMzZsM

- **Presentation of Search-Based Automated Play Testing of Computer Games: A Model-Based Approach at International Symposium on Search Based Software Engineering (SSBSE'21)**
  Fitsum Kifetew

- **Using an Agent-based Approach for Robust Automated Testing of Computer Games.** Presentation by Samira Shirzadeh at the *Seminar AI meets Software Engineering* 2021, organized by VERSEN, the Netherlands.

- **An Appraisal Transition System for Event-driven Emotions in Agent-based Player Experience Testing.** Presentation by Saba Ansari at the *Seminar AI meets Software Engineering* 2021, organized by VERSEN, the Netherlands.

- Presenting the project at the 7th **VRDays Europe Immersive Tech Week** 2021. We also have a stand representing the project there. VRDays is a renown event for connecting XR professionals, governments representatives, corporations, researchers, and artists around the world See here for the website of the event: https://vrdays.co/

2.4.4 Collaboration with other projects

We have launched efforts to establish collaboration with other projects working in related areas. In particular:

- we have established a collaboration with ARTwin: https://artwin-project.eu/index.php/relevant-initiatives/. In this informal collaboration, both projects help each other with dissemination and communication activities.

- we have contributed towards a green paper with VRInsight: https://www.enter-network.eu/3d-flip-book/focus-europe-vrinsight-greenpaper/. ERASMUS+ project VRinSight, produced a magazine presenting EU projects working on the challenges and chances of VR/AR/XR in the economy, society, research and education; which included our green paper (on page 77).

- we are registered in the VAMrealities website: https://vam-realities.eu/iv4xr/. The VAM realities project aims to build Europe's largest community on VR/AR/MR projects creating long-term sustainable project dissemination at a European level.

- We are in contact with:
  - TACTILITY (Rosa.Banos@uv.es),
  - V4Design (vividrig@iti.gr),
  - ARETE (eleni.mangina@ucd.ie)
  - NEWTON (ended but still interested, gabriel.muntean@dcu.ie)
  - AI4EU (long.pham@insight-centre.org)
  - XR4AL network

- awesomeIT
- AR4CUP (barbara.piga@polimi.it)

We also participated in the Workshop on Interactive Technologies alongside other European funded projects.

> **Intelligent Verification/Validation for XR Based Systems**
> Rui Prada, Wishnu Prasetya
> Project pitch at Workshop on Interactive Technologies, EC DG CONNECT.G2
> June 26, 2020
> WebEx
> https://pt.slideshare.net/ruiprada/intelligent-verificationvalidation-for-xr-based-systems

The iv4XR and ARETE projects have organized a workshop: **The future of XR: Current ecosystem and upcoming opportunities on May 27th, 2021.** The workshop was a successful one with the participation of various EU projects on the field of XR, such as, VR4RehabProject, TactilityP, AI4EU, PRIME-VR2, HOLOBALANCE, AbleGames, AR4CUP, Mindtooth, VAM realitites, FátimaToolkit, Virtual Reality Ireland. It was an enriching experience and a wonderful opportunity to learn about the ongoing activities in the field of XR. A vibrant discussion session was held to discuss and share the possible dissemination plans, research interests within XR and ideas for future collaboration.

2.4.5 Social media

Social media channels have been set up to effectively communicate to a wide range of audience the activities and results of iv4XR. In particular, a Twitter handle has been created (https://twitter.com/iv4xr) at the official launching of the project. Furthermore, a Facebook page (https://www.facebook.com/iv4xr/) has also been created at the same time. These two social media platforms together constitute a significant portion of the research community as well as the general public. The Twitter feed is also integrated with the project website via Twitter API so that the tweets from the project as well as tweets referring to the project and re-tweets appear on the project website automatically. Twitter in particular is intensively used by the research community for sharing information and iv4XR has started integrating itself in this community and communicating results. We also use LinkedIn's professional network (https://www.linkedin.com/company/iv4xr-project) to maximise the project's presence and increase reachability of project output.

Furthermore, we also communicate information about the project through the individual researchers and partners along their respective social media platforms and networks, such as LinkedIn, YouTube, etc.

2.4.6 Website

The iv4XR project website (https://iv4xr-project.eu) was created at the official launch of the project and made immediately operational by providing basic information about the project, the consortium, the objective of the project and proposed solution, as well as the industrial use cases. The details about the structure and content of the website are documented in the deliverable D6.1 [3], released at the end of the first month of the project.

The website is continuously updated and maintained by incorporating information about ongoing activities as well as dissemination and communication of project results, such as, published articles and releases of different prototypes and code. Furthermore, it includes a multimedia gallery where different multimedia content is presented, documenting the various activities undertaken as part of the project.

The website keeps track of visitors. Since the tracking functionality was set up (August 2020), there were more than 2950 unique visitors with over 3900 visits, from different geographical locations. Figure 1 shows a snapshot of the overall growth of visitors and visits over the entire period the website has been active.

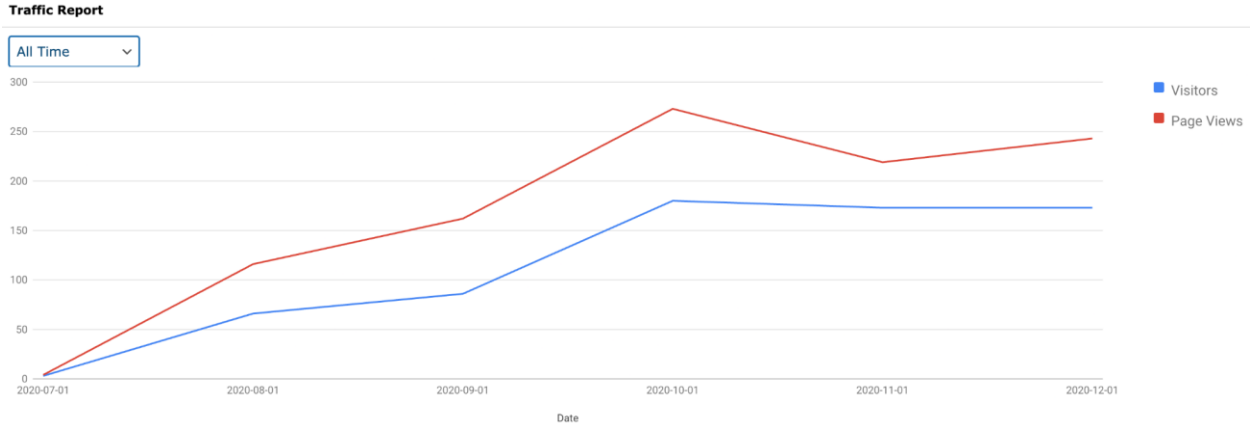


Figure 1: Website traffic growth over the period August, 2020 - December, 2021

Website traffic for each section of the website is also shown in Figure 2.

Rank	Title	Hits	Percent
1	Home	2717	69.83%
2	Consortium	245	6.30%
3	Use cases	224	5.76%
4	Publications	208	5.35%
5	Downloads	116	2.99%
6	News	113	2.91%
7	Newsletter	93	2.40%
8	Media Gallery	92	2.37%
9	Contact	73	1.88%
10	Privacy Policy	10	0.26%

Figure 2: Overall website traffic share for each section of the website

2.4.7 Newsletter & Press Releases

The fourth edition of the newsletter has been released, and subsequent editions are in preparation. As we explained in the previous plan, the timeline has been shifted by a few months because of the interruption caused by the Covid-19 pandemic. During this year, we have striven to adhere to the initially planned schedule and number of editions, publishing the fourth newsletter in October 2021.

We also made a press release and translated it into three languages to share in different media outlets and within our institutions. New press releases will be created when we have more news to share with the general public.

The project had a media appearance in an interview for the Portuguese national radio station Antena 1 in the program “90 seconds of science”.
https://www.90segundosdeciencia.pt/episodes/ep-969-rui-prada/

2.4.7 Video media

Videos documenting project meetings as well as prototype demonstrations and conference presentations have been produced and made available via the project website (https://iv4xr-project.eu/media-gallery/).

We have created a short video of the project (https://www.youtube.com/watch?v=1BzLSfsvruA) and plan to make a series of videos in the upcoming months. Our access to the studio is limited

at the moment, but as soon as possible we will start recording more polimedia videos to disseminate the project.

2.4.8 Dissemination materials

2.4.8.1 Templates

In order to harmonize the graphical and presentation aspects of all produced online and print material, templates for project deliverables and presentations have been created and made available and are adopted for project wide use.

2.4.8.2 Logo

One of the first activities of the iv4XR project was the creation of a project logo as part of establishing the project's digital identity. After brainstorming at the project kick-off meeting and different iterations, the following logo has been adopted for the project, as also documented in the deliverable D6.1 [3].

2.4.8.3 Leaflet

The design of a leaflet (brochure) for project-wide use is in progress and we have an initial draft. However, the efforts have been delayed partly due to the fact that physical presence at conferences and workshops as well as other venues where leaflets are typically distributed were no longer possible because of the Covid-19 pandemic. The leaflet will be finalized and be put to action as soon as possible.

2.5 Dissemination and Communication KPIs

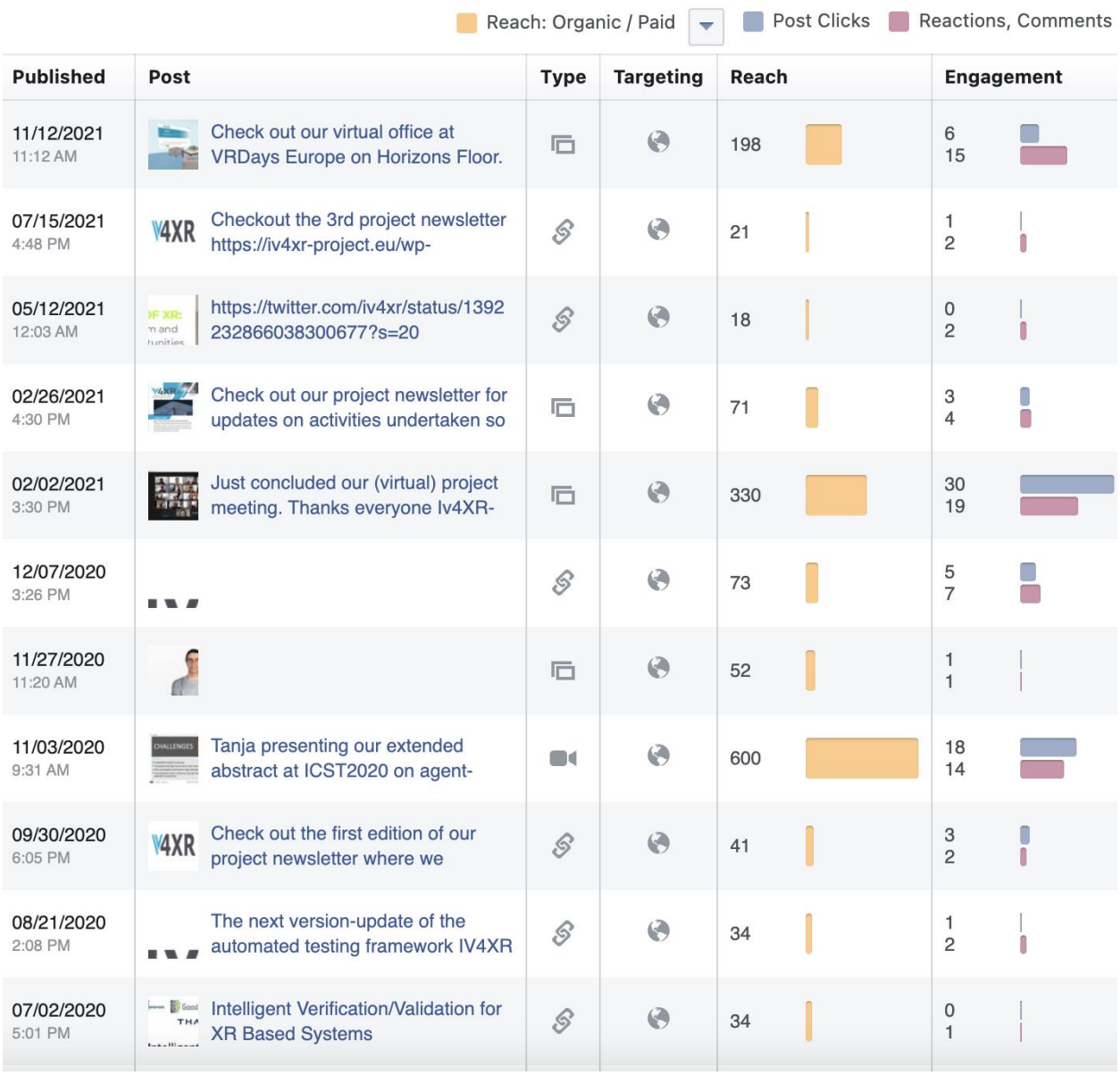
To audit our proposed dissemination and communication activities we have identified several KPIs that will help us in tracking progress. Some of the targets for the KPIs are ambitious and may not be fully achieved, however they will help us to strive to achieve the best possible results. Table 7 below presents the KPIs along with the expected final goals as well as the current values.

Table 7: Dissemination and communication KPIs and progress so far

Key Performance Indicators (KPIs)	
Best paper and presentations prizes	1/2
Likes on dedicated Facebook page	84/350
Followers on Twitter	106/2000
Posts on Facebook	13/36
Tweets	92/36

Visits on the project website	3904/1500
Project Newsletter editions	4/9
Project video clips	1/3
Dissemination & Exploitation plan (number of iterative versions)	2/3
Conference publications in target conferences	19/20
Journal peer reviewed articles	1/6
Dedicated events (workshop)	2/2
Presentations at trade events/industrial conferences	2/3

While the KPIs capture important indicators regarding dissemination and communication actions, they do not necessarily capture all the impact generated by the activities undertaken. For instance, even though the number of likes on our Facebook page is low, the number of people reached from our posts and the number of interactions generated is far more greater, as can be seen from the screenshot in Figure 3 below:



Published	Post	Type	Targeting	Reach	Engagement
11/12/2021 11:12 AM	Check out our virtual office at VRDays Europe on Horizons Floor.			198	6 15
07/15/2021 4:48 PM	Checkout the 3rd project newsletter https://iv4xr-project.eu/wp-			21	1 2
05/12/2021 12:03 AM	https://twitter.com/iv4xr/status/1392232866038300677?s=20			18	0 2
02/26/2021 4:30 PM	Check out our project newsletter for updates on activities undertaken so			71	3 4
02/02/2021 3:30 PM	Just concluded our (virtual) project meeting. Thanks everyone Iv4XR-			330	30 19
12/07/2020 3:26 PM				73	5 7
11/27/2020 11:20 AM				52	1 1
11/03/2020 9:31 AM	Tanja presenting our extended abstract at ICST2020 on agent-			600	18 14
09/30/2020 6:05 PM	Check out the first edition of our project newsletter where we			41	3 2
08/21/2020 2:08 PM	The next version-update of the automated testing framework IV4XR			34	1 2
07/02/2020 5:01 PM	Intelligent Verification/Validation for XR Based Systems			34	0 1

Figure 3: Facebook posts and their reachability

3 Exploitation Activities

3.1 Aims and objectives

Our exploitation plan aims at maximizing the post-project exploitation of iv4XR results within and outside the consortium.

Inside the consortium, the project results can be exploited directly by the partners with different objectives depending on their respective missions: Higher education, Professional Training & Public Service; Research & Valorization; Adoption.

Industrial actors outside the consortium may also be interested in the project results to devise new ways to improve the quality of their software and the experience of their users for extended reality applications. The objective of the consortium will be to identify categories of potential users of the iv4XR results, and to sketch the corresponding business models.

A third way to exploit the project results is through cross project collaborations. The consortium partners will target specific European or National projects and define common actions to further leverage the iv4XR results.

3.2 Planned exploitation activities

3.2.1 Exploitation inside the consortium

To measure the direct impact of iv4XR on the consortium partners, we will record the actual efforts made by the partners to prepare post-project exploitation of the project results in relation to:

- **Higher education, Professional Training & Public Service**

  Activities of consortium partners to exploit the project results in the context of an educative missions for the benefits of students, professionals or the larger public (INESC, UU, UPV).

- **Research & Valorization**

  Activities of consortium partners to exploit the project results in order to test research ideas and demonstrate their effectiveness (INESC, UU, FBK, UPV, GA, THA-SIX).

- **Adoption**

  Activities of consortium partners to exploit the project results and improve the quality of their software or the experience of their users (GWE, GA, THA-AVS).

3.2.2 Exploitation outside the consortium

To maximize opportunities for exploitation of the results outside the consortium, we will take the following measures:

- **External actor identification**

  List industrial actors potentially interested to invest in further development and exploitation of iv4XR e.g. SMEs that develop XR systems or ICT tech companies that offer QA related tools to the market.

- **Market Analysis**

  Draft a White paper and do a market analysis with the participation of the industrial partners from the consortium, and possibly with the feedback from interested external actors, to describe the identified business opportunities along with the proposed business models.

- **Open Source and Online Demo**

  Make the whole iv4XR stack accessible to the public with an open source license so that parties interested in exploitation will have no impediment to do so. Deploy an instance of iv4XR online as a demo to let the public (developers, students, researchers) interactively try out the concept of declarative XR testing.

3.2.3 Exploitation through cross-project collaboration

In order to further exploit the results of iv4XR, we will try to work together with intersecting EU projects by:

- **Target Project Identification**

  Establish relationships with a selection of European or National projects relevant for a collaboration able to strengthen each other's scope.

- **Definition of Synergistic Activities**

  For each of the identified projects, identify opportunities to collaboratively address some aspects in verification and validation, which are less emphasized or left out from the iv4XR scope.

3.3 Already undertaken exploitation activities

Regarding the exploitation outside the consortium, we have identified key industrial sectors, such as automotive and avionics, game development, software design and testing, higher education, among others. We contact different companies in these sectors, and we briefly present the main objective of iv4XR as well as we ask about needs and possibilities that they use the technology of iv4XR. To do that, we created a questionnaire that was distributed to the key sectors during November-December 2021. The next steps will be the analysis of the answers in order to identify the business opportunities and write a white paper with our market analysis.

4 Conclusions

This deliverable presented the second version of the project dissemination and communication plan. Summary of central elements of the dissemination and exploitation plan:

- Explanation of the main dissemination & exploitation objectives of iv4XR, and target audiences identified.
- Details of the planned dissemination and exploitation activities for next year.
- List of all dissemination, communication and exploitation activities carried out in the first and second year of the project.

This is the second version of the dissemination and exploitation plan, and it will be updated in a future revision to address observed gaps and deviations from the initial plan.

5 References

[1] Dissemination & Exploitation of results H2020 Online Manual can be reach at:

https://ec.europa.eu/research/participants/docs/h2020-funding-guide/grants/grant-management/dissemination-of-results_en.htm

[2] Fitsum Kifetew, Marta Couto, D6.2 – Data Management Plan, iv4XR Project Deliverable, v1.3, March 2020

[3] Fitsum Kifetew, Jason Lander, D6.1 – Project website, iv4XR Project Deliverable, v1.3, October 2019