

XR TECHNOLOGIES FOR SELF-REGULATED STUDENT EXHIBITIONS IN ART EDUCATION: SURVEY AND FIRST DESIGN CONSIDERATIONS

D. Koukopoulos joint work with P. Dafiotis, S. Sylaiou, K. Koukoulis and C. Fidas

University of Patras – Aristotle University of Thessaloniki

IMET 2022

2nd International Conference on Interactive Media, Smart Systems and Emerging Technologies
October 4 – 7, Limassol, Cyprus



Co-funded by the
Erasmus+ Programme
of the European Union



STRUCTURE OF THE TALK

- Motivation- Objectives
- Related work
- System design
- Motivating scenarios
- Conclusions/Future work

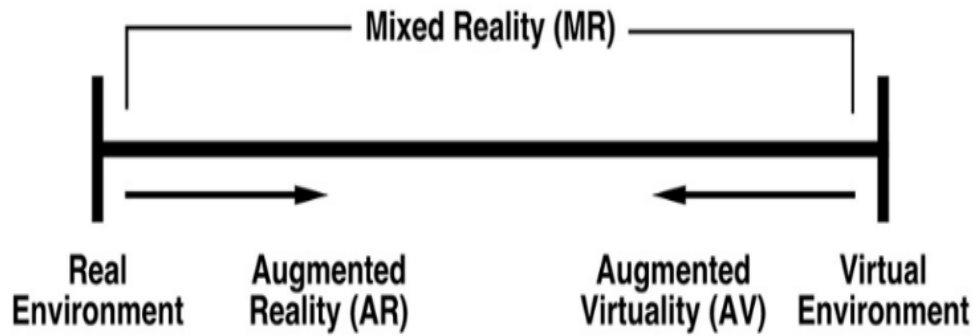
NEED FOR CREATIVE PRESENTATION OF ART STUDENTS' ARTWORKS IN HEIS

- Higher education institutions not only continuously seek to adopt and rely on ICT services and tools, but there is an urgent need to support this adaptation process through building the digital capacity of HEIs stakeholders in the context of creating educational material and implementing teaching, learning and training activities.
- Art-related HEIs try to create the infrastructure needed for their potential users coping with the growing demand for digitization, preservation, and presentation of various creations, i.e., sculptures, and paintings to a wider audience.
- One key issue and need of European HEIs is the absence of unified frameworks and tools addressing solutions that provide the opportunity for art students to present their work in a creative and educative way based on XR technologies.
- The COVID 19 pandemic demolished literally real-world exhibitions, a fact that pushed for developments, especially in education that would allow students and instructors to work remotely, while having a rich teaching and learning experience. Immersive technologies like Extended Reality (XR) has received a lot of attention in this light.

VIRTUAL EXHIBITIONS VS. ART STUDENTS REQUIREMENTS

- The recent literature reveals that the information about virtual exhibition creation is fragmentary, and entails several weaknesses and concerns related to the special requirements of art students.
- Their work may vary significantly in terms of appearance and form, as well as conceptual content and theoretical background.
- The material art students will incorporate is not envisaged as simple footnotes to their work but rather as an extension that enriches their presented artworks in ways that are not available in physical exhibition settings.

XR TECHNOLOGIES



Reality- Virtuality continuum [Milgram et al. 1995]

XR TECHNOLOGIES WORKING DEFINITIONS [BEKELE ET AL. 2018]

- **VR:** aims at enhancing our presence and interaction with a computer-generated environment without a means to interact with or see the real world.
- **AR:** aims at enhancing our perception and understanding of the real world by superimposing virtual information on our view of the real world.
- **MR:** aims at blending real and virtual environments
- **XR:** is the umbrella that encompasses all forms of immersion and interaction such as AR, MR, and VR.

XR TECHNOLOGIES VS. ART STUDENT VIRTUAL EXHIBITIONS

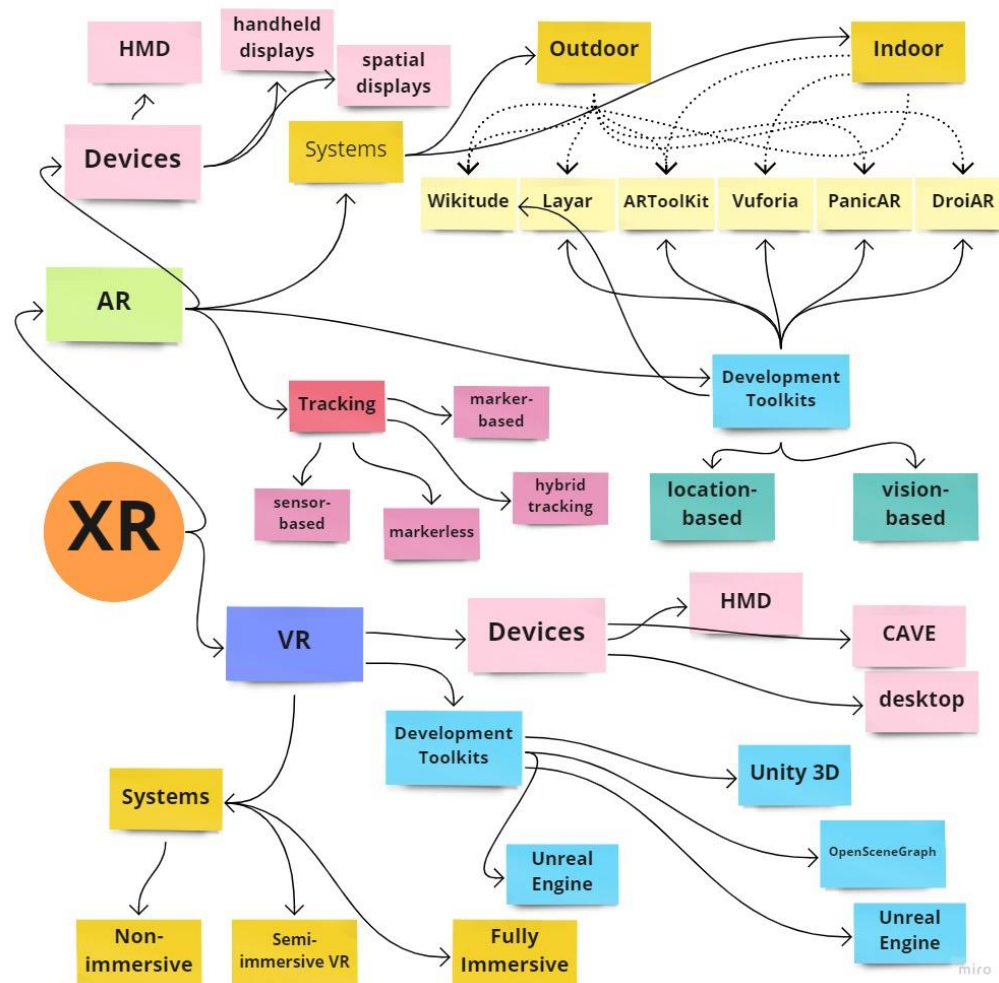
- How can a system providing presentation capabilities with the use of XR technologies foster the creativity of art students in HEIs' environments? What are the possibilities?

OBJECTIVES

- We are mainly interested in studying virtual exhibition learning environments that adapt XR technologies in order to provide rich, multi-layered and multimodal content.
- Specifically, we are interested in assisting art teachers to initiate art exhibitions for their students and assess them, students to create virtual exhibitions and visitors to have immersive and interactive experiences.
- We present a literature review concerning XR technologies in art education for exhibition purposes.
- We discuss a preliminary user requirement analysis based on the filtering of review findings by experts' feedback.
- We propose a conceptual design of a framework for VR/AR/MR exhibition creation which can be freely adopted by higher education institutions as an open-source solution.
- We present a set of motivating scenarios that thoroughly explain the usage of the envisioned system.
- The proposed framework is designed to meet the needs of art students, teachers, and visitors.
- This is the first step of a user-centered design methodology we aim to apply throughout the building of the CREAMS framework.

RELATED WORKS – XR TECHNOLOGIES

XR basic technology features [Ardiny and Khanmirza 2018; Bekele et al. 2018; Carmigniani and Furht 2011 ; Çöltekin et al. 2020; Kanade and Prasad 2021; Stanney et al.]



RELATED WORKS

COMMERCIAL VR SYSTEMS AND APPLICATIONS VS. ART

- Most VR applications are for artists that want to share their work with the public (Kunstmatrix, Artsteps, VR-All-Art, Ikonospace, ArtPlacer).
 - Kunstmatrix is a tool that enables user to create 3D showcases of art.
 - Artsteps provides tools for VR exhibitions enabling the user to create custom VR spaces, curation assistance and tools devoted to the diffusion of the exhibition.
 - ArtPlacer hosts VR exhibitions of artists that want to sell or recreate existing physical galleries.
- Some commercial sites offer virtual tours of real museums (V21 Artspace, theVOV).
- Some initiatives are focused on student artwork collections (Artsonia, ArtGate).
- Most VR applications related to art exhibitions are non-immersive, and thus are provided for desktop users. Most of the applications provide an authoring interface for creating the exhibitions, in many cases in 2D environments. However most applications are not created for educational purposes.

RELATED WORKS

COMMERCIAL AR SYSTEMS AND APPLICATIONS VS. ART

- There are many commercial AR apps that augment the space with art in an indoor or outdoor setting (ArtPlacer, Art Visualiser, Google Arts & Culture). But there is a number of apps that go beyond that (Artivive, hoverLay, Art of London, Museum of Stolen Art).
- In terms of presentation devices, they all use mobile displays.
- Indoor apps use marker-based solutions (QR codes or images as markers).
- Most of the outdoor apps are marker-less exploiting the sensors that a mobile device has.

RELATED WORKS

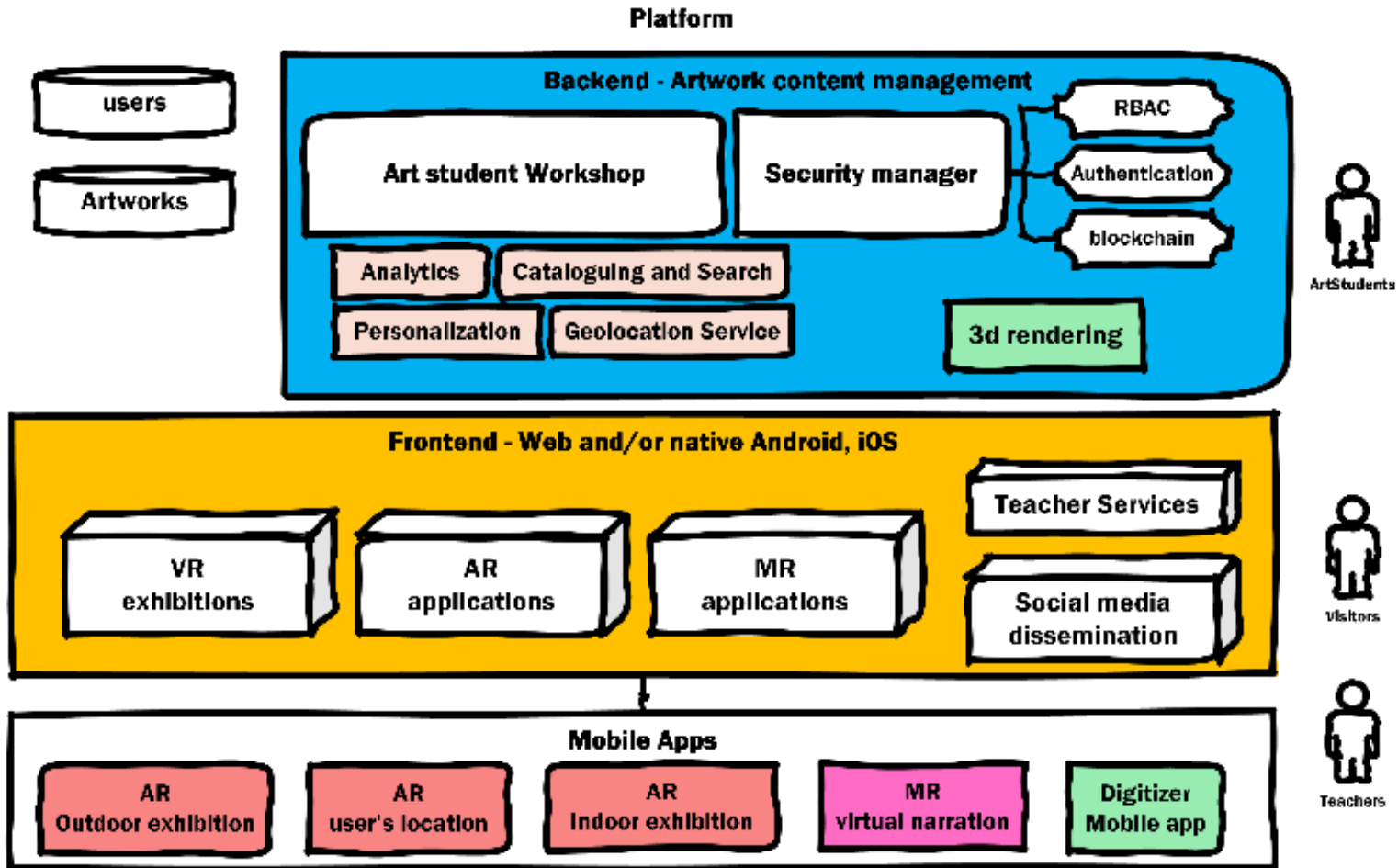
XR TECHNOLOGIES IN ART EDUCATION

- XR technology may benefit students increasing their motivations, engaging them more in learning and allowing them to have virtual experiences where traditional learning is impossible or expensive [Ardiny and Khanmirza 2018].
- VR use in higher art education has become a trend due to increased scientific production [González-Zamar and Abad-Segura 2020]. AR use also affects positively motivation [Nincarean et al. 2013].
- [Qiu et al. 2020] demonstrate the design of an online VR college student art exhibition.
- [Song and Li 2018] discuss the benefits of VR in relation to art design teaching.
- Looking into primary and secondary education there is a lot of work that indicates the benefits of VR in education [Sun and Peng 2020].
- VR has been used to support Art History teaching and studying [Casu et al. 2015].
- In [Pellas et al. 2020; Back et al. 2019] positive findings are shown for MR. However, there are challenges to implement such applications: student and faculty reluctance, lack of infrastructure, poor user experience, difficulty to use software/hardware and lack of educational content [Riman et al. 2020].

INDICATIVE USER REQUIREMENTS

Category	Requirements
Exhibition Context	What is the narrative of the exhibition?
	Why do I choose this idea?
	Who is the exhibition for?
	How do I choose the objects that are most appropriate to the narrative I want to present and the exhibition story?
Exhibition Space	How can I adjust the group of artworks and the narrative to the space in terms of scale, size and rhythm/flow?
	Could we change the lighting of the exhibition rooms?
	Could we have more than one room for the exhibition?
	Could we change the wall color in the exhibition rooms?
	How could we add the name of the exhibition?
	Where could we add a 100-word paragraph to describe the exhibition as a concept?
	Could we have various options for the students concerning the shape of the rooms? (e.g., long room, spiral room, round room, square room).
Exhibition assessment	Could we have a presentation of various types/shapes of well-known online museums, so that the students could understand the pros and the cons of each shape?
	Could we assess the exhibition in terms of the experience it offers for its visitors?
Exhibition functions	Could we assess the exhibition in terms of the text, context/story/the way the students chose the pieces for the exhibition and the narrative and the space?
	Will we use avatars? If yes, could we have a range of options to use as an avatar? (the avatar could be someone else and not the student that creates the exhibition?).
Artworks	How could we define the visitor movement? (e.g., how close can I go to the exhibits? Can I see them all around).
	Where could we place the labels for the artworks? (on the walls?). Selected artworks (of each artist) can feature interactive areas (e.g., a depicted object or a figure within a painting) that can reveal another layer of information, a narrative or/and further visual/multimodal material upon users' command. This may happen as a separate, interactive mode within a menu given for every artwork (and be available to a limited number of artworks).
Artworks context	Several layers of interpretative, contextual, or factual information about artworks can be embedded in virtual exhibitions, regarding addressed issues, influence, and short discussion of the creative process. This can draw inspiration from art sketchbooks where actual artworks are presented in juxtaposition with textual, visual and multimodal material.

SYSTEM OVERVIEW



USERS

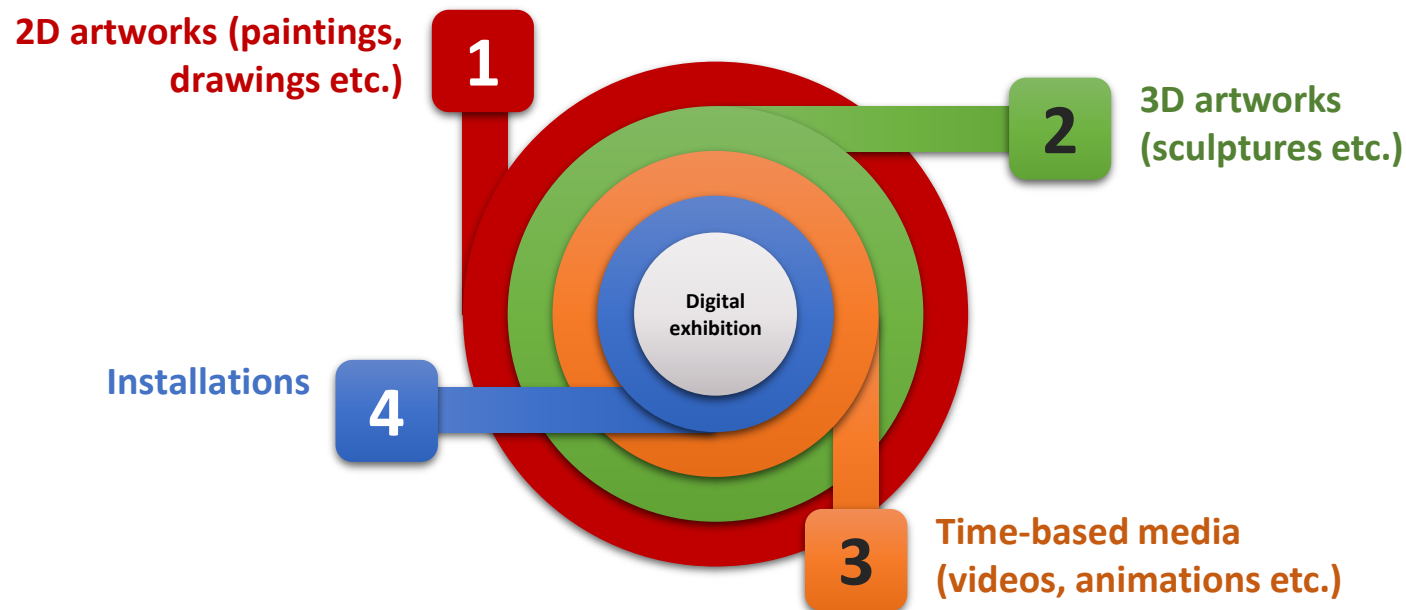
Art School
Teaching
Staff

Art
Students

Visitors

CONTENT – BASIC ENTITIES

- *Artwork*: 2D (paintings, drawings etc.), 3D (sculptures etc.), installations and time-based media (videos, animations etc.)
- *Exhibition*: can be indoor (VR) or outdoor (AR, MR)



CONTENT ATTRIBUTES

Content-Based Attributes:

- Texts, videos (time-based media, Installations), images (paintings, drawings), 3D objects (sculptures), geolocation data.

Context-Based Attributes:

- Video or audio describing exhibit or exhibition (narrations), texts that refer to the context of the exhibit or exhibition (widgets).

Model-Based Attributes:

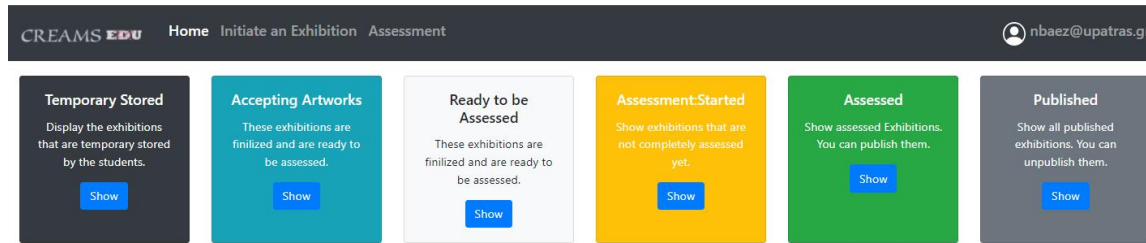
- These attributes derive from the model itself. In this case, model-based attributes are related to personalization and publishing on social media permission.

BASIC SYSTEM FUNCTIONALITIES

- Enable artists to employ 3D digital exhibitions to reach new audiences and promote their work
- Develop tools that empower artists to present contextual issues, ideas and personal thoughts about their artworks in an original way
- Creation of multimodal in-depth descriptions of selected artworks in the form of art sketchbooks
- Adaptability of the modalities employed to the aesthetic and conceptual character of the artworks
- 3D online virtual exhibitions
- Interactive features such as pop- up widgets with text, multimedia content and multimodal annotations
- Digital narratives, such as avatars as narrators

MOTIVATING SCENARIOS

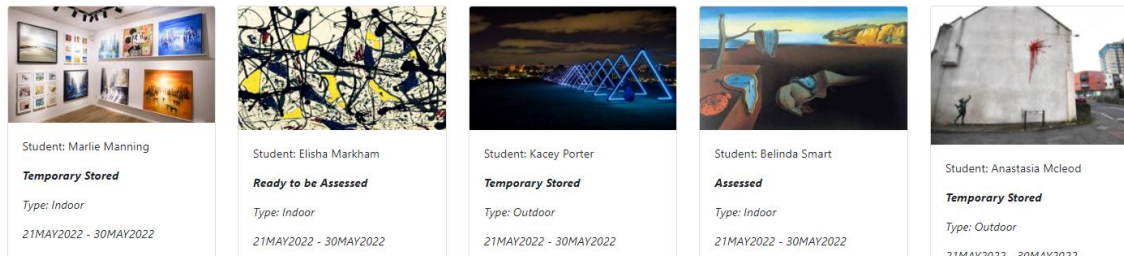
A. An art teacher initiates an exhibition



Teacher's dashboard.

Current Unpublished Exhibitions by students

Click on an exhibition to view the artworks in a 3d environment.



Initiate an exhibition

Save Cancel

Exhibition Title

Exhibition Title

Start date: 22/07/2022 End date: 22/07/2023

Type of the provided space

Select the type of the provided space

Description

Number of Participants: Maximum Artworks:

Any questions?

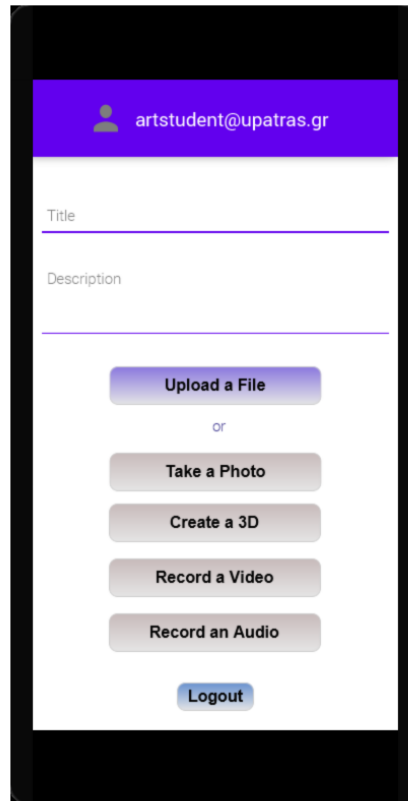
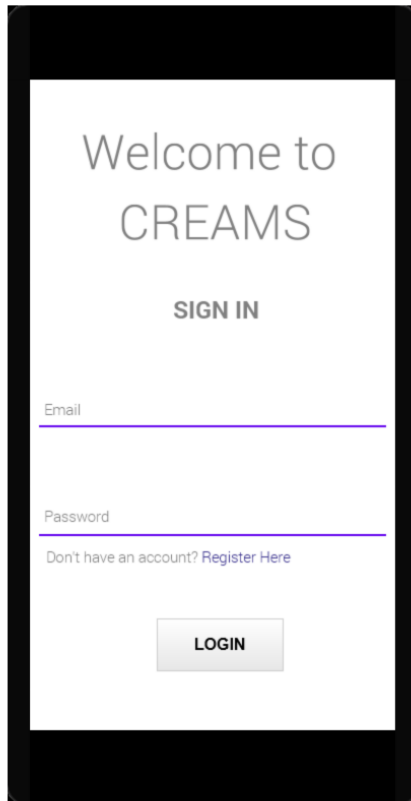


Watch this video to help you

Teacher initiates an exhibition.

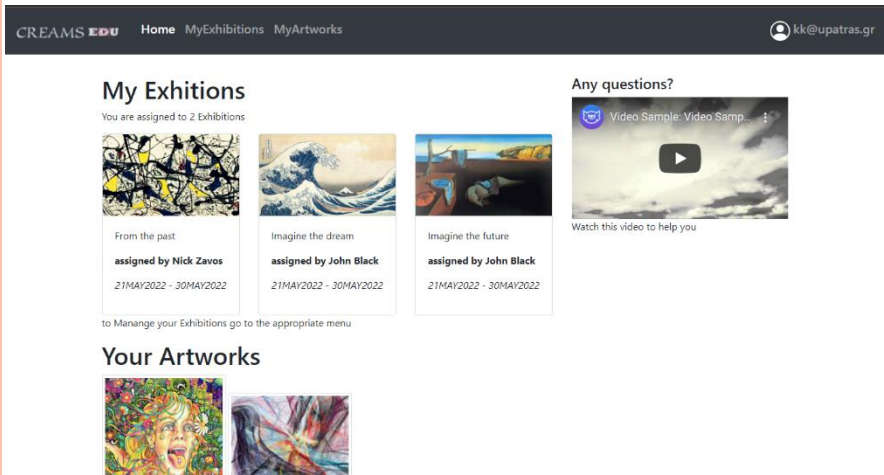
MOTIVATING SCENARIOS

B. A student digitizes artworks

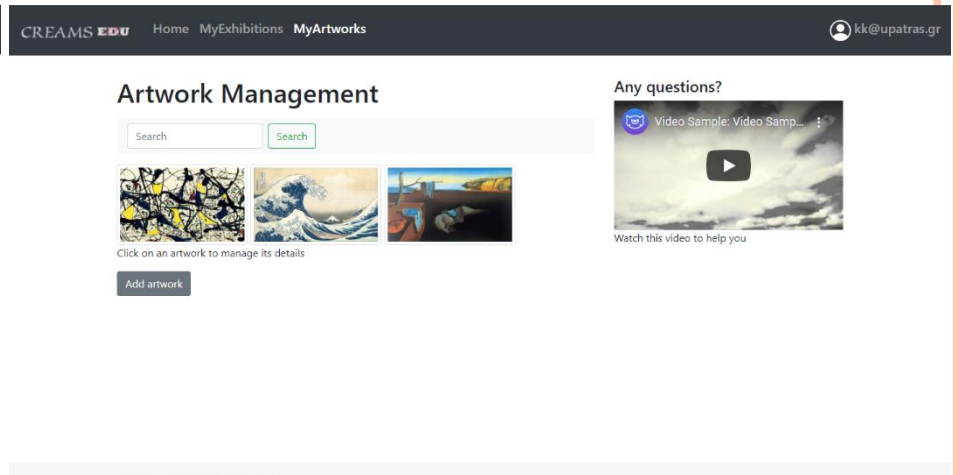


MOTIVATING SCENARIOS

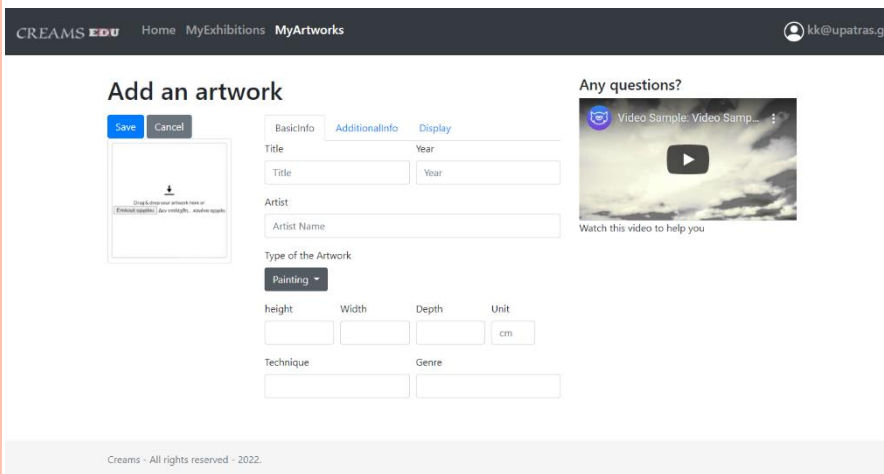
C. A student creates an exhibition



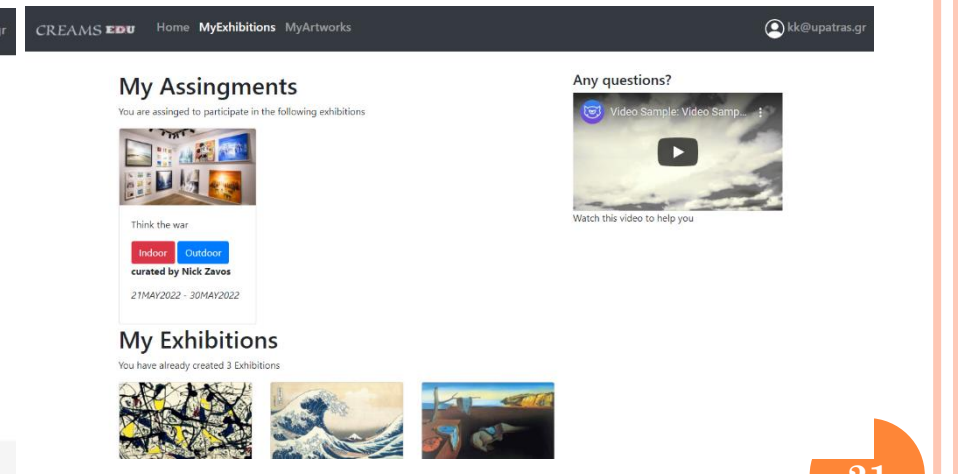
Student's dashboard.



A student manages artworks.



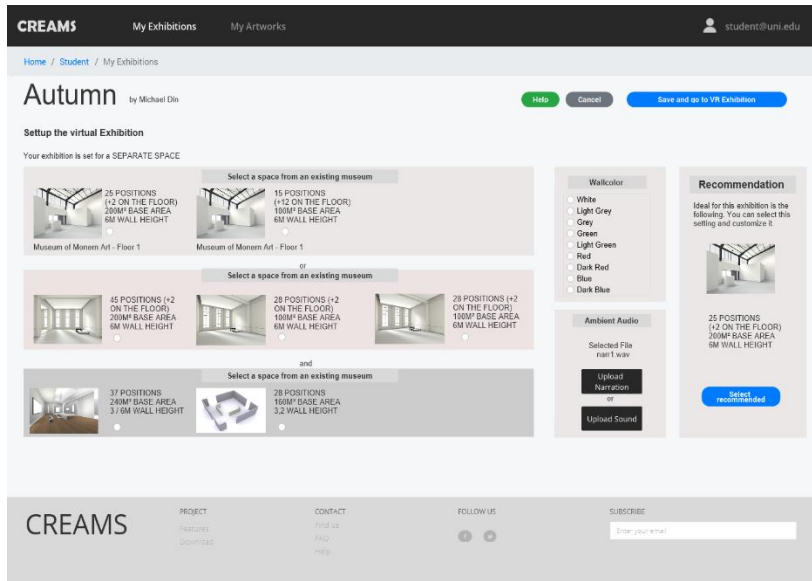
A student adds an artwork.



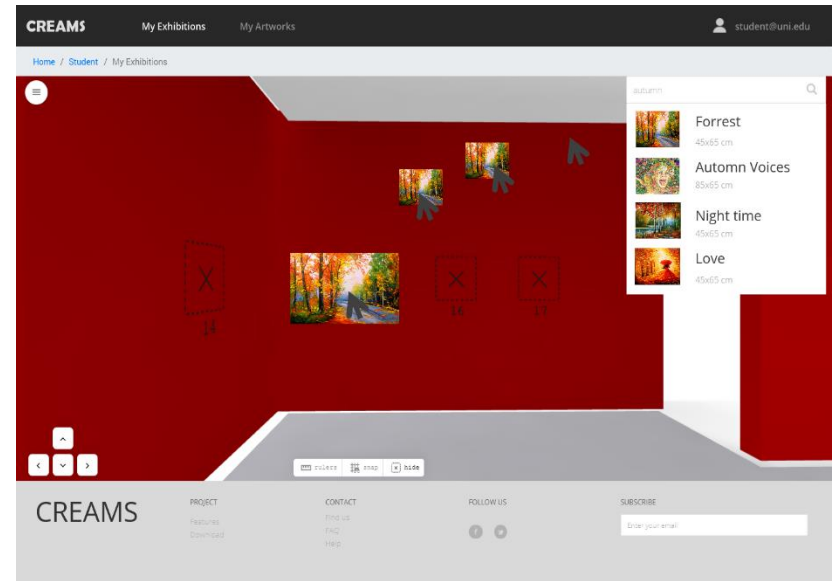
Student's "My Exhibitions" area.

MOTIVATING SCENARIOS

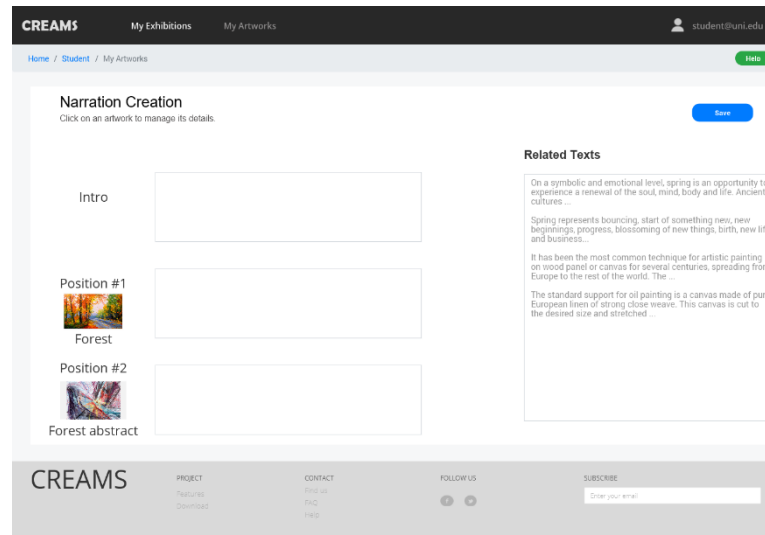
C. A student creates an exhibition



Student exhibition creation using predefined spaces.



Student places artworks in exhibition space.

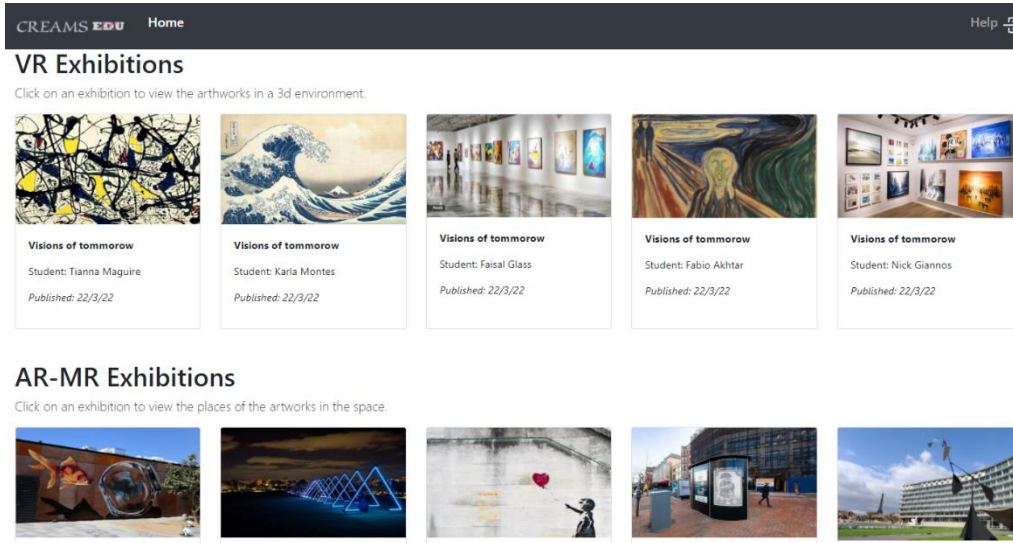


Student creates a narration for the exhibition.

MOTIVATING SCENARIOS

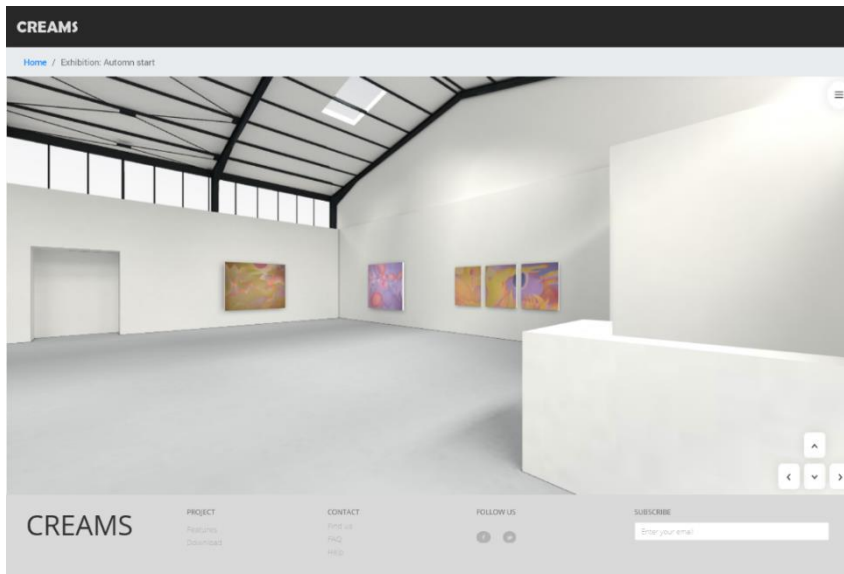
D. A visitor views an exhibition

Visitor accesses the portal.

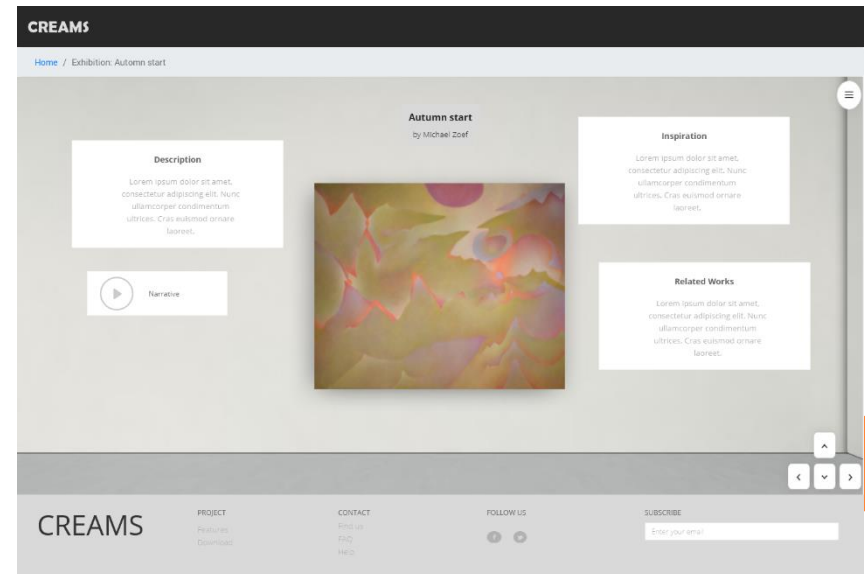


AR-MR Exhibitions

Click on an exhibition to view the places of the artworks in the space.



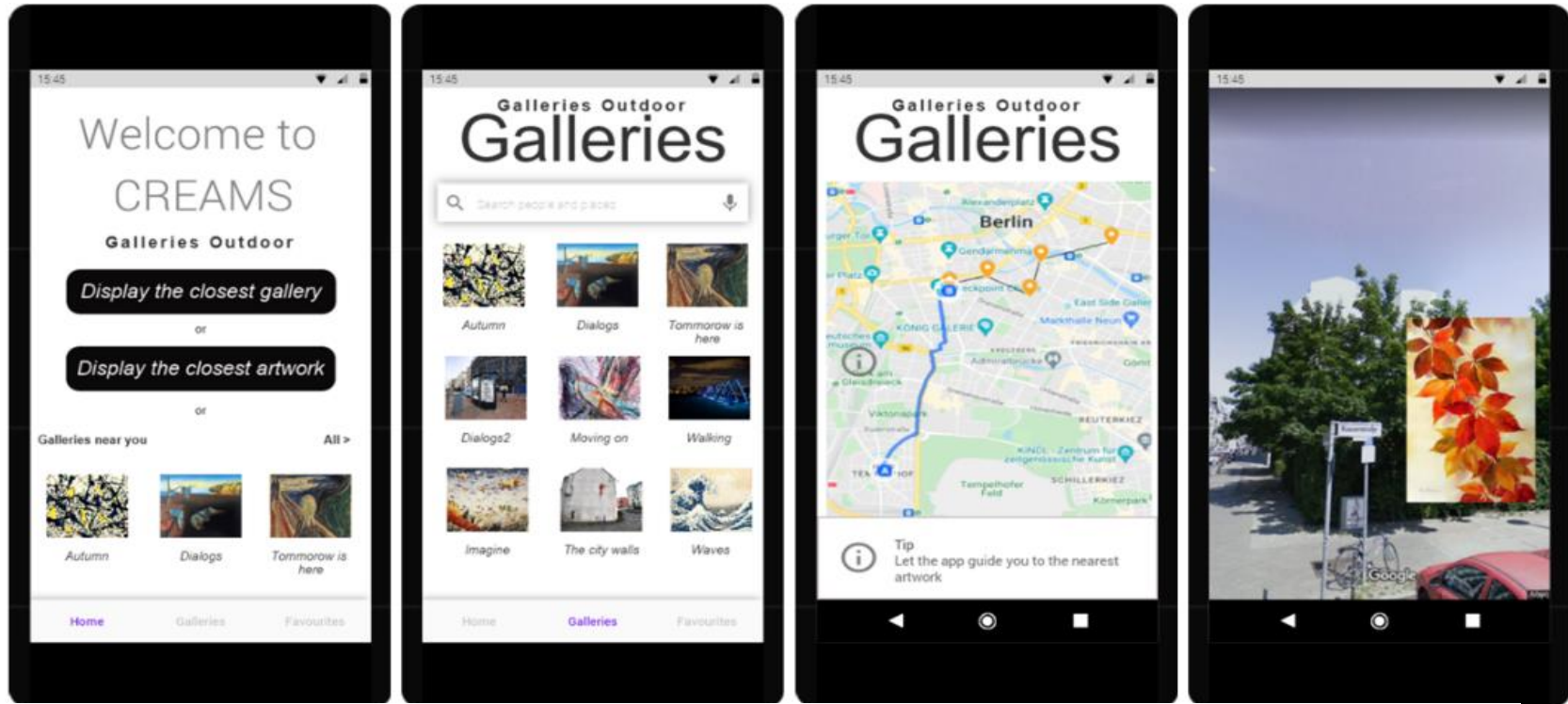
A visitor visits a virtual exhibition.



A visitor views an exhibit.

MOTIVATING SCENARIOS

D. A visitor views an AR outdoor exhibition



CONCLUSIONS-FUTURE WORK

- Discussion of XR technologies usage in art education for artworks exhibition.
 - Literature review concerning systems, technology and best practices
 - Framework specifications according to literature review findings filtered by expert opinions
 - Proposal of a conceptual design for a framework offering tools and services to all the actors of art education procedure
 - Discussion on motivating real-life stories corresponding to the basic scenarios the functionalities of the proposed system aspire to cover
- *Future work:*
 - we plan a series of semi-structured interviews, surveys, and focus groups with expert stakeholders aiming to verify the designed framework and current literature on the creation of virtual exhibitions and investigate how the users will react and what will be their impressions
 - fully implement all the described services and evaluate them in real situations.

Thank you!



This research has been financed by Erasmus+ CREAMS project (Project ID: KA220-HED-E06518FA) under the call KA220-HED - Cooperation partnerships in higher education (Greek State Scholarship's Foundation (IKY))



Co-funded by the
Erasmus+ Programme
of the European Union

