Zenith Outdoor/Indoor Experience

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D5.2 Front-end web development

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Abstract	The present deliverable describes the design, development, and current implementation status of the front-end web environment of the ZOE project – Zenith Outdoor/Indoor Experience for Cultural Tours with AR Technology and 3D Platform. Developed within the framework of the Erasmus+ KA220-ADU programme, the front-end infrastructure serves as the primary digital interface through which end-users, stakeholders, and the wider public interact with the project and its outcomes. The deliverable presents the development of both the official ZOE project website and the user-facing components of the ZOE platform. Particular emphasis is placed on the design principles adopted during development, including usability, accessibility, responsiveness, intuitive navigation, and visual consistency. The website has been designed to support dissemination, communication, stakeholder engagement, and public access to project information, while the platform front-end provides the basis for user interaction with the project's digital cultural heritage experiences and pilot testing activities. Furthermore, the document outlines the information architecture, graphical user interface components, user experience considerations, and technical implementation approaches adopted throughout the development process. Screenshots and examples of the implemented interfaces are presented to demonstrate the current functionality and visual design of the system. As front-end development is a continuous activity throughout the project lifecycle, this deliverable also describes the planned future refinements and enhancements that will be implemented based on user feedback, pilot testing results, and the evolving requirements of the ZOE platform.

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GLOSSARY

GDPR	General Data Protection Regulation
AR/VR	Augmented Reality, Virtual Reality
KPI	Key Performance Indicator
UI/UX	User Interface / User Experience

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1. INTRODUCTION

A key component of the ZOE project is the development of a user-friendly and visually appealing digital environment that enables users to access project information, interact with platform functionalities, and participate in pilot activities. The front-end layer plays a critical role in achieving these objectives, as it represents the primary point of interaction between users and the project's digital ecosystem.

The present deliverable focuses on the development of the front-end web environment of the ZOE project. More specifically, it presents the design, implementation, and current status of both the public-facing project website and the user interface of the ZOE platform. **These two interconnected components serve complementary purposes: the website supports dissemination, communication, and stakeholder engagement activities, while the platform front-end enables user interaction with the project's cultural heritage experiences, pilot testing activities, and future digital services**.

The development process followed a user-centred approach, taking into consideration the requirements and expectations identified through the activities described in Deliverables D2.1 Pilot Test Procedure and Feedback Design and D2.2 User Requirements. Particular emphasis was placed on usability, accessibility, responsiveness, intuitive navigation, visual consistency, and compatibility across different devices and screen sizes. These design principles aim to ensure that the digital environment remains accessible to a diverse audience, including adult learners, educators, cultural heritage professionals, tourists, researchers, and other stakeholders.

As front-end development is an ongoing activity throughout the project lifecycle, the solutions presented in this deliverable should be considered as the current implementation status at the time of reporting. The interfaces and functionalities described herein will continue to evolve based on pilot testing results, user feedback, technological developments, and the overall progress of the project.

The remainder of this document presents the design objectives and requirements that guided the development process, the implementation of the ZOE website and platform front-end, the technical considerations adopted by the consortium, the current

achievements of the activity, and the planned future developments that will further enhance the user experience and functionality of the ZOE digital ecosystem.

2. DESIGN OBJECTIVES AND REQUIREMENTS

The development of the ZOE front-end environment was guided by a set of design objectives and technical requirements aimed at creating an accessible, intuitive, and engaging digital experience for all user groups. Given the interdisciplinary nature of the project and the diversity of its target audiences, particular emphasis was placed on usability, accessibility, visual consistency, responsiveness, and scalability.

The front-end environment was designed to support two complementary functions within the project ecosystem. Firstly, it provides a public communication interface through the official ZOE website, allowing visitors to access project information, news, events, and results. Secondly, it provides the user-facing layer of the ZOE platform, enabling interaction with project services, pilot activities, and future cultural heritage experiences.

The requirements that guided the development process were derived from multiple sources, including the project proposal, consortium discussions, dissemination needs, technical specifications, and user requirements gathered through the activities of WP2. The implementation therefore reflects both project-specific objectives and user-centred design principles.

2.1 User-Centered design approach

A user-centred design methodology was adopted throughout the development process. The objective was to ensure that the front-end environment remains intuitive and accessible for users with different levels of digital literacy, technological familiarity, and cultural backgrounds.

The design process was informed by the findings of the user requirements analysis and the pilot preparation activities carried out within WP2. Particular attention was given to user expectations regarding navigation simplicity, content discoverability, visual clarity, and ease of interaction.

The interface design prioritises:

- Clear and intuitive navigation paths
- Consistent visual hierarchy and content organisation
- Minimal learning curve for new users
- Readability and accessibility of information
- Responsive interaction across multiple devices
- Reduced cognitive load during navigation and content exploration.

These principles contribute to a positive user experience and facilitate the effective communication of project information and digital content.

2.2 Functional and non-functional requirements

Functional requirements describe the specific features, services, and capabilities that a system must provide in order to fulfil its intended purpose. They define what the system should do**. Non-functional requirements, on the other hand, describe the quality attributes and operational characteristics of the system**. They define how the system should perform rather than what functions it should provide. Both categories of requirements are essential for the successful development of a digital platform. While functional requirements ensure that the necessary services and features are available to users, non-functional requirements ensure that these services are delivered in an effective, reliable, and user-friendly manner.

Thus, the front-end environment was designed to satisfy a number of **functional requirements** related to both dissemination and platform interaction activities:

- Presentation of project information and results;
- Publication of news, events, and dissemination activities;
- Access to consortium information and project resources;
- Support for stakeholder engagement and communication;
- User authentication and access management for platform services;
- Integration with backend services and databases;
- Collection and presentation of user-generated information;

- Support for pilot testing and future user interaction activities;
- Compatibility with future integration of AR and immersive cultural heritage functionalities.

The implementation of these functionalities ensures that the front-end environment can support both the current and future needs of the project.

In addition to functional requirements, several **non-functional requirements** were considered during the development process to ensure quality, maintainability, and long-term sustainability.

The most important non-functional requirements include:

Usability: The interface should be easy to understand and navigate, enabling users to access information and services without requiring specialised training or technical knowledge.

Accessibility: The platform should provide an inclusive user experience that accommodates diverse user groups and supports broad accessibility principles.

Responsiveness: The front-end environment should adapt effectively to different screen sizes and device types, including desktop computers, tablets, and smartphones.

Performance: Web pages and user interfaces should load efficiently and provide smooth navigation and interaction experiences.

Scalability: The architecture should support future expansion of functionalities, additional content, and increased user activity as the project evolves.

Maintainability: The system should allow straightforward updates, content management, and future enhancements without requiring significant redevelopment effort.

Visual Consistency: A consistent visual identity should be maintained across all digital assets, ensuring alignment with the branding and communication strategy of the ZOE project.

By addressing both functional and non-functional requirements, the consortium has established a robust foundation for the continued development of the ZOE front-end environment throughout the project lifecycle. The resulting digital ecosystem supports

communication, dissemination, stakeholder engagement, and user interaction while remaining adaptable to future project developments and technological enhancements.

3. ZOE WEBSITE DEVELOPMENT

The official ZOE project website was developed as the primary public-facing component of the project's digital ecosystem. Its purpose is to provide a central online space where stakeholders, end-users, consortium partners, and the general public can access information about the project, its objectives, activities, results, and upcoming events. The website serves as a key dissemination and communication tool within the project, supporting visibility, stakeholder engagement, and long-term sustainability objectives. It provides continuous access to project-related information and facilitates communication between the consortium and external audiences throughout the project lifecycle. The website is available at:

https://project-zoe.eu/

The design and implementation of the website followed the communication objectives defined within WP5 and the user-centred principles identified during the early phases of the project in WP2. Particular emphasis was placed on simplicity, accessibility, visual consistency, responsiveness, and ease of content management.

3.1 Website Objectives

The ZOE website was developed to support several strategic objectives:

- Increase public awareness of the ZOE project and its activities
- Communicate project objectives, methodology, and expected results
- Promote dissemination activities and project achievements
- Provide stakeholders with access to project information and resources
- Act as the primary online communication channel of the consortium
- Contribute to the long-term visibility and sustainability of project results

By addressing these objectives, the website functions as both an information repository and a communication platform throughout the project's implementation period.

3.2 Information Architecture

The website structure was designed to provide users with clear navigation paths and easy access to information. Content is organised into thematic sections that reflect the main components of the project and its dissemination strategy.

The current website includes the following core sections:

Home: The homepage provides visitors with a concise overview of the project, highlighting its vision, objectives, expected impact, and latest developments. It serves as the main entry point for users and introduces the project's innovative approach to cultural heritage exploration through Augmented Reality and immersive technologies.

The Project+: This section presents detailed information about the ZOE project, comprising three sub-sections:

- **Description**: Project background, rationale, objectives, KPIs, and Innovation.
- **Project Results:** The results section provides access to public project outputs, deliverables, publications, and other materials that become available during the implementation of the project.
- **Consortium**: The consortium section introduces the project partners and their respective roles within the project, providing information about their expertise and contributions.

Events: This section serves as a dedicated area for the promotion and communication of public project activities, workshops, demonstrations, pilot testing sessions, multiplier events, conferences, and other dissemination-related initiatives organised throughout the project lifecycle.

News: This section is used to publish project news, meeting reports, dissemination activities, announcements, and other relevant developments. It ensures continuous communication with stakeholders and promotes project visibility.

Contact: The contact page enables visitors to communicate with the consortium and request additional information regarding the project and its activities.

Platform: A link that directs the user to the (currently) first prototype of the platform. This link will be updated as the project progresses

The information architecture was designed to remain scalable and flexible, allowing the addition of new content and functionalities as the project progresses.

3.3 Current status

At the time of writing this deliverable, the ZOE website is fully operational and actively supports the dissemination and communication activities of the project.

The platform currently serves as the central communication hub of the consortium and provides continuous updates regarding project progress, events, results, and stakeholder engagement activities. As the project evolves, additional content, dissemination materials, project outputs, and pilot testing information will be integrated into the website, further expanding its role within the overall ZOE digital ecosystem.

4. ZOE PLATFORM FRONT-END

While the ZOE website serves as the project's public communication and dissemination hub, the **ZOE platform represents the operational component of the project's digital ecosystem**. The platform has been developed to support user interaction, pilot testing activities, cultural heritage experiences, and the future deployment of the project's immersive educational services. The platform is accessible through the website or individually with the following link:

https://app.project-zoe.eu/

The development of the platform front-end focused on creating an intuitive and engaging user experience capable of supporting both current project activities and future technological integrations. Particular attention was given to usability, responsiveness, scalability, and ease of interaction, ensuring that users can access platform functionalities regardless of their level of technological expertise.

The platform serves as the primary interface through which end-users interact with project services, provide feedback, participate in pilot activities, and access digital cultural heritage experiences developed within the ZOE project.

4.1 Platform Objectives

The development of the ZOE platform front-end was guided by several strategic objectives.

The platform aims to:

- Support pilot testing and user evaluation activities
- Enable interaction with cultural heritage content and digital experiences
- Facilitate stakeholder participation throughout the project lifecycle
- Provide a scalable environment for future AR and 3D functionalities
- Support personalized user experiences

Through these objectives, the platform acts as the bridge between the project's technological developments and the end-user community.

4.2 User Interface Design

The platform interface was designed according to modern web application principles, prioritising simplicity, clarity, and ease of navigation. The graphical user interface (GUI) follows a structured approach that allows users to progress naturally through the available functionalities while minimizing complexity and cognitive load.

The interface incorporates:

- User authentication and login mechanisms
- Structured content presentation
- Visual guidance elements
- Responsive navigation components
- Future integration points for immersive content and AR functionalities.

4.3 User Experience (UX) Principles

The design of the platform follows a user-centred philosophy aimed at maximising engagement and accessibility. Several UX principles guided the development process:

Simplicity: Interfaces are designed to minimise unnecessary complexity and allow users to complete tasks efficiently.

Accessibility: The platform is intended to be usable by diverse audiences, including adult learners, cultural visitors, educators, and stakeholders with varying levels of digital experience.

Consistency: Visual elements, navigation structures, interaction patterns, and terminology remain consistent throughout the platform.

These principles contribute to a positive user experience and support the project's broader objectives related to participation, inclusion, and digital engagement.

4.4 Current Status

At the time of writing this deliverable, the platform front-end is fully operational and supports the use of the first integrated prototype of ZOE project. The current version reflects the first stages of the platform's evolution and has already been used for collecting user feedback, validating design concepts, and supporting the development of the project's first integrated prototype.

As foreseen in the project proposal, front-end development remains an ongoing activity. Future updates will incorporate additional functionalities, refined user interfaces, enhanced personalization mechanisms, integration with AR and 3D environments, and improvements derived from pilot testing feedback and user evaluations.

5. TECHNICAL IMPLEMENTATION

The technical implementation of the ZOE front-end environment was carried out with the objective of creating a reliable, scalable, and user-friendly digital ecosystem capable of supporting both project dissemination activities and the delivery of digital cultural heritage experiences. The implementation consists of two complementary components: the public-facing ZOE website and the ZOE platform application. Although

these components serve different purposes, they were developed following common design principles and are integrated within the broader technical architecture of the project.

5.1 Website Technical Environment

The official ZOE website has been developed in **WordPress** and is hosted on the server infrastructure of GEO. This hosting approach ensures direct control over website administration, content management, maintenance, updates, and long-term availability. The website design was implemented using **Elementor Page Builder**, enabling the creation of a visually appealing, flexible, and responsive interface without requiring extensive custom coding for each page. This approach supports efficient content updates and allows the consortium to adapt the website as the project evolves.

Several plugins have been integrated to support performance, visual presentation, and accessibility of information:

- **Image Optimizer** – Compress, Resize and Optimize Images, used to improve image loading performance and optimise visual content;
- **Slider Revolution**, used for the homepage banner and dynamic visual presentation of key project messages;
- **GTranslate**, used to provide translation functionality and support wider accessibility of website content for international audiences.

These tools contribute to the usability, maintainability, and dissemination capacity of the website.

5.2 Front-end Architecture

The front-end architecture follows a modular approach, allowing the website and the platform to operate as separate but complementary environments.

The **ZOE website** functions as the project's dissemination and communication portal, while the **ZOE platform** functions as the operational environment where users interact with project services, pilot activities, questionnaires, and future cultural heritage experiences.

This separation provides flexibility for future development while ensuring a clear distinction between public information services and platform functionalities.

5.3 User Authentication and Data Management

The ZOE platform incorporates user authentication mechanisms that enable secure access to platform functionalities and pilot testing activities. Authentication services support user identification, session management, access control mechanisms, and the secure association of user responses and interaction data. The implementation also supports the collection of user preferences, questionnaire responses, and demographic information required for pilot testing and evaluation activities.

5.4 Security and Privacy Considerations

Security and privacy considerations have been incorporated throughout the development process. The implemented solutions aim to ensure secure user authentication, controlled access to platform services, protection of user-generated data, reliable operation of web services, and compliance with GDPR principles and project ethical requirements. Special attention is given to safeguarding information collected during pilot testing activities and user evaluations, ensuring that data are processed responsibly and exclusively for project-related purposes.

5.5 Current Status and Further Development

At the time of writing this deliverable, the front-end environment has successfully progressed from the initial concept stage to a fully operational implementation supporting dissemination activities and platform interaction. The website is actively used for communication and dissemination purposes, while the platform supports user participation, feedback collection, and prototype evaluation activities.

Future technical developments will focus on:

- Integration of additional platform functionalities
- Support for future AR experiences and guided tours
- Integration with immersive 3D environments
- Continuous optimisation based on pilot testing results and user feedback.

6. SUMMARY, CONCLUSIONS AND FUTURE DEVELOPMENT

The present deliverable presented the design, development, and current implementation status of the front-end web environment of the ZOE project. The work carried out during the first project period has successfully established the digital foundation required to support dissemination activities, stakeholder engagement, pilot testing, and future deployment of the project's innovative cultural heritage experiences.

Two complementary digital environments have been developed within the framework of this activity. The first is the official ZOE project website, which serves as the project's primary dissemination and communication channel, providing public access to project information, news, events, consortium details, and project results. The second is the ZOE platform front-end, which enables user interaction with project services, pilot testing activities, questionnaires, and future immersive cultural heritage experiences.

Throughout the development process, particular emphasis was placed on adopting a user-centred design approach. The implemented interfaces were designed to be intuitive, accessible, responsive, and visually consistent, ensuring that users from different backgrounds and levels of digital literacy can easily navigate and interact with the system. The development was also guided by the requirements gathered through the project's user requirements analysis and pilot preparation activities, ensuring alignment with the needs and expectations of the identified target groups.

The front-end environment has successfully progressed beyond the conceptual stage and now represents an operational component of the broader ZOE ecosystem. The project website is actively supporting dissemination and communication activities, while the platform has already been utilized during pilot testing and prototype evaluation activities. These achievements demonstrate the successful implementation of the objectives initially defined for this activity and provide a solid basis for the subsequent development phases of the project.

The consortium considers the current implementation to be a significant milestone towards the realization of the overall ZOE vision. The developed interfaces establish the necessary infrastructure through which users will access and interact with

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innovative cultural heritage experiences that combine Augmented Reality, immersive 3D environments, digital storytelling, gamification, and personalized learning pathways.

At the same time, front-end development remains an ongoing activity throughout the project lifecycle. As foreseen in the project proposal, the platform and website will continue to evolve based on user feedback, pilot testing results, technological advancements, and the progressive implementation of additional project functionalities.

Future development activities will focus on several key areas:

- Further refinement of the graphical user interface based on pilot testing feedback
- Continuous improvement of user experience and accessibility
- Expansion of content and communication functionalities within the project website
- Integration of additional platform services and user interaction mechanisms
- Enhanced personalization capabilities based on user preferences and behaviour
- Integration of advanced Augmented Reality functionalities developed within Work Package 3
- Integration with the indoor 3D environment and other system components developed within Work Package 4
- Continuous optimisation of performance, responsiveness, and cross-platform compatibility.

In conclusion, the front-end web development activity has successfully achieved its objectives for the current reporting period and has established a robust, scalable, and user-oriented foundation for the continued evolution of the ZOE platform. The consortium remains committed to continuously improving the digital environment and ensuring that it effectively supports the project's long-term vision of transforming cultural heritage exploration through innovative digital technologies and immersive learning experiences.