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Digital Routes in Greek History's Paths

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Abstract: In this paper, we present the development of a virtual reality application, namely "Roots in Greek History" or RoGH, which provides the user with a unique experiential travel or transfer back in time to specific historical periods and historical places which are part of the Greek history and its cultural heritage. The tool is a multi-purpose one which is mainly addressed to tourists, teachers, or researchers. The users are facilitated in deriving historical data, challenged to connect with the past, and are invited to explore the history and the time period, archaeological ruins, and monuments of the past through virtual reality. In order to achieve this goal, the system exploits a dynamically designed and organised chronology, which can provide historical content for various places and cities in different times of their history. Users are given the freedom to choose "place" and "time" and consequently to have access to a variety of content (including 2D or 3D models, text, photos, multimedia, etc.), in an entertaining and educational procedure that creates a personalised information path and leads to empowering knowledge.

Keywords: virtual reality serious games; cultural heritage; 3D applications; technological implementation

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1. Introduction

Academic interest in digital games in general dates back to the early 1980s, when Hemnes [1] examined the need of intellectual property protection concerning the creativity in the digital game industry. Accordingly, there have been other studies [2] that have explored the development of social inclusion of people with learning disabilities through programming in digital games. The first occurrence of the notion of "digital skills" was in 1983, in a book by D. Sudnow [3] called "Pilgrim in the Microworld", which provides evidence that researchers responded swiftly to these emerging technologies [4].

It is worth noting that there have been older sources that refer to the history of digital games, mainly in magazines about computers and games. More recently, digital games (their history, their themes, their impact on modern culture, and their educational and cultural value) are presented in books or book chapters (as in Baer [5]), in publications for game exhibitions [6], and in studies on specific culture issues entailed in digital games [7].

As far as the field of Historical Game Studies is concerned, it was particularly developed during the last decade [8,9]. However, its origins can be traced back to the middle of the previous decade, during which scholars started envisaging a new potential of digital games; that of a creative industry that brought an educational and cultural perspective [10]. To illustrate this, we refer to a couple of milestones in Historic Game Studies, as well as in the wider field of digital games addressing learning and culture. The first one is Kurt Squire's [11] dissertation "Replaying History: Learning World History through Playing Civilization III", which presents the use of Sid Meier's Civilization digital game for teaching History in schools. Another milestone is Uricchio's [12] article in 2005, which establishes

the foundations for the development of the new field of Historical Game Studies, focusing not only on individual historic games or their application in other fields such as education, but also examines digital games per se, as a constituent of a historical form with variations and patterns. Furthermore, Uricchio [12] predicted that the exploration of the relationship between history and games will become the future research questions that will preoccupy scholars in the near future [10]. Since then, the field of Historical Game Studies has become a distinct research area (part of the game studies area) gathering its own research interest and forming a bibliography directly related with how history should be interpreted, represented, and played with [10]. The proposed use-case in the current article contribute towards this research area by implementing the aspect of Virtual Reality when teaching and presenting history in a gamified and more interactive way.

Currently, there are many publications on the representation of the past in digital games [13]; while Internet's dominance was a game changer by becoming an interactive memory machine for digital games. It is primarily the place for a variety of representations of the past, with the mixing of public, collective, individual, and private components of game stories including different historical and cultural motifs.

In the field of academic work, the study of the relationship between history and games, as well as the relationship between cultural and collective memory and games [14] attracts attention. Some researchers turned to the historical representations of individual or sub-types of historical games [15,16] while others focused on describing the properties of the form of historical games, examining the structures of its representation, the processes of narration, the possibilities, the predispositions, and the limitations, in the context of an analytical metalanguage for this description [17]. Other research focuses on the practices of historical game users, their online discussion, and goal setting [18].

Best practices and historical game design [19], use of games in historical conflict simulation [20], history education [21], and cultural heritage [22] have also been the concern of other researchers. Moreover, significant interest and development have been posed on the importance of the scientific veracity of the source, where there is an ongoing international regulation process [23]. In 2006, the London Charter (http://www.londoncharter.org, accessed on 23 March 2022) was conceived, aiming to set a series of recommendations and specific guidance related with the Computer-based Visualisation of Cultural Heritage. The whole process was based on extensive consultation alongside significant efforts for establishing best practices—widely accepted and under international consensus—in heritage visualization processes. The Principles of Seville followed as a means to increase applicability to the London Charter, specifically to archaeological heritage. Proposed principles include aspects currently implemented to all projects related with visualization of archaeological heritage, such as:

- Interdisciplinarity: professionals from different branches of knowledge.
- Purpose: clear purpose of the project's goals.
- Complementarity: digital archaeological heritage as a complementary and not as an alternative tool to more traditional forms of reaching cultural heritage.
- Authenticity: provide a clear distinguishment between what is real, genuine, or authentic and what is not.
- Historical rigour: historical and archaeological documentation should be provided alongside digital visualizations.
- Efficiency: achieve appropriate economic and technological sustainability.
- Scientific transparency: provide results ready to be confirmed or refuted by other experts in the field.
- Training and evaluation: virtual archaeology has its own specific language and techniques, requiring training among community members and constant evaluation.

A number of sub-genres of historical video games have been created, such as role-playing games that project alternative stories of World War II, more conventional depictions of the same war with users assuming the role of shooters, simulations of slave systems, and other action and adventure games [10]. This accordingly has motivated Historical

Game Studies to cover this wide variety of different types of historical games, contributing to the further development of this field. Even if only a small part of the game involves a representation of the past, the game falls under the category of historical games. For all the above reasons, it is anticipated that the field of Historical Game Studies is going to develop further especially in view of the incorporation of Virtual Reality, offering insight about the beneficial contribution of games in the educational, pedagogical, and historical field, and in culture in general.

Inevitably, Virtual Reality (VR) and its potentialities can become a "game changer" in terms of enriching users' experience [24] as far as cultural or historical content is concerned. It is obvious that VR is leading digital transformation of the cultural and historical sector [25,26] by making feasible "VR–time-travels" to buildings, places, and cities of the past. Through virtual reality, modern Greek cities are connected to the historical moment, as the user has the opportunity to become acquainted with and learn about the place and its history and to tour the archaeological remains and historical monuments of the past with the use of appropriate interpretive means.

The purpose of the current research is to present the RoGH project, which aims to create a digital platform for the promotion of important historical epochs and events of the Greek History in a journey through space and time. The platform accepts digitized content and multimedia material (2D, 3D, and holograms) and presents them through a system of virtual reality, both to the general and specialized public.

RoGH is an under-development research project aiming to deliver an application of Technology Readiness Level 6 (TRL-6), following the classification used by HORIZON 2020, by the middle of 2022. The proposed level of readiness implies that the application consists of technology capable of being demonstrated in a relevant environment and not a system complete and qualified or an actual system proven in an operational environment. Even though the application is not tested and fully operational, significant advances have been made in terms of software development, historical content, and 3D models, making it functional for demonstration.

The whole project is developed by three (3) agents including: (a) Cultural Technology Lab of the Department of Informatics and Telecommunications of National and Kapodistrian University of Athens (CulTech/EKPA), (b) National Hellenic Research Foundation (NHRF), and (c) Content Management in Culture P.C. (Comic), a private, software development company specialized in the field of culture. EKPA and Comic contribute to the field of the application's development, while NHRF provides rich historical content from its sources (e.g., from its own research, maps, documents, bibliography, etc.) as well as historical advice and architectural drawings for 3D modelling.

2. Materials and Methods

The "Digital Routes" project aims to help users have a lively experience through the steps of the Greek History, in a wide timeframe, from antiquity to modern times. Historical periods (e.g., ancient years, the roman period, etc.) and facts (e.g., construction of well-known monuments, no-longer existing defence buildings, etc.) are revived and connected with the Hellenic scenery through travel routes and virtual tours of important, historical cities. The project's goal is to create a platform unfolding important Greek, historical periods in a journey through time and location. The platform contains digital content of multiple types (2D and 3D etc) and processes it through virtual reality-enabled devices.

The platform is written by using Unity (Figure 1) as a result of its multiplatform capability, the exceptional rendering skills that Unity has, and the well-structured community willing to support developers and projects. Moreover, Unity has been used in a series of previous projects leading to the existence of significant knowledge skills among the members of the developers' team. The whole development put emphasis on providing users the capability of using almost any VR device types to make use of this application including HTC VIVE, HTC COSMOS, OCULUS QUEST 2, OCULUS QUEST, OCULUS RIFT, OCULUS RIFT S, VALVE INDEX, and VARJO VR-3. The proposed application is

currently (as long as the development is running) hosted in a Virtual Machine owned by the National and Kapodistrian University of Athens (CulTech/EKPA) while it is planned that end-users will have access to the application by either (a) downloading it from OCULUS store and STEAM store, or (b) by directly installing it to the VR headsets of the client, in the cases that the product will be implemented in a school or a museum.

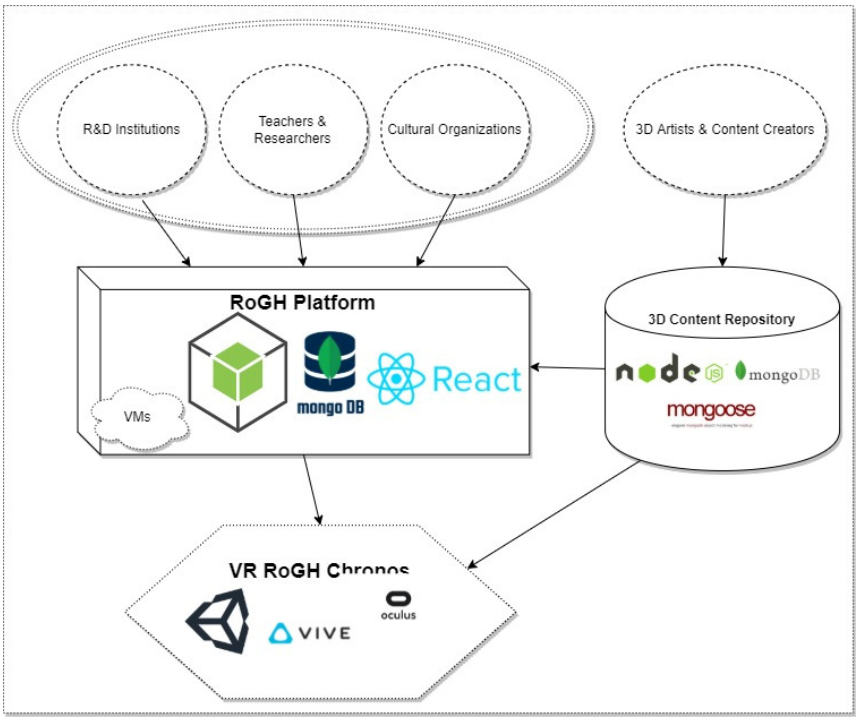

Figure 1. RoGH's overall design.

The user, with the help of an interactive timetable, is able to create personal routes through Greek History and learn about important events by visiting virtually important places and monuments and exploring significant content. All these occur by using a virtual reality mask (cardboard). The user can specify the historical period they wish to explore or the historical event, city, or object, based on lexicographical and chronological criteria.

The dynamic design method and the structure of the timetable will give the user the ability to browse freely and directly access rich and dynamic content, reaching a deeper understanding of some important milestones of the Hellenic history. With an interactive and easy to use browser tool, the user will have access to documents, images, videos, and 3D animations, learning about the Hellenic history from the ancient years to the more recent years.

The 3D animation contains representations of historical buildings and monuments with architectural detail and photorealistic renderings. The modelling is optimized for real time representation engines. The same models will be used for the animation. In the animation, the user will see and hear information regarding the construction of the buildings, the architectural details, the historical events connected to the building, etc.

The Project Team has been involved with the following (Table 1) time periods and cities (indicatively), while the platform includes information for more than 15 objects, 110 monuments, and 50 places. The experienced members of National Hellenic Research Foundation (NHRF) were involved in choosing the sites, monuments, and places included in the platform. The criteria used for the proposed selection included availability of rich and historically accurate content and information, according to their archives. It should be taken into account that NHRF provided a variety of content, from text and photos, up to architectural drawings and depictions of engravings. Most significantly, the team members took active part in choosing the historical buildings and monuments that were recreated

in VR technology and offered their expertise in order to implement historically accurate 3D modelling.

Table 1. Time Periods and Places / Monuments.

Ancient Years	Byzantine Period	Newer Years	Recent Years
Argos	Mount Athos	Mystras various churches	Argos: City Hall of Argos, Municipal Market of Argos, Kapodistrias' Barracks
Olynthos	Great Lavra	Mystras Otttoman Fountain	
Olynthos	Vatopedi monastery	Monemvasia	
Delos	More than 15 monasteries	Argos	Arnaia: church of Agios Stefanos, "Horostasi" square school
Dodona	Jasper Chalice	Nafplio Syntagma Square	
Thessaloniki	Miraculous icon of the Virgin Portaitissa	Nafplio Mosque	Thassos: Kalogeriko, Palataki
Monemvasia	City of Arta	Nafplio Fountain	Kavala: Town Hall of Kavala, Municipal Tobacco Warehouse, Club of the Greek Community of Kavala
Mycenae	Rotunda	In Patras: Castle–Mosque of Bayezid II	
Nafplio	Casilica of Agios Dimitrios	In Preveza: Saint George's Castle, Saint Andrew's Castle	Mykonos: monastery of Agios Panteleimon, monastery of the Virgin (Tourliani), Aegean Maritime Museum
Neapolis, Kavala	Basilica of Agios Dimitrios	In Ioannina: Castle of Ioannina, Mosque of the Conquest, Mosque of the Arslan Pasha	
Nekromanteion at Acheron River	Church of the Virgin Mary of Halkeon	Metsovo	Oinousses: Holy Monastery of the Annunciation of the Virgin, Maritime Museum of Oinousses
Nikopolis	Hagia Sophia	Chalkidiki, Arnaia, Stageira	
Patras	Triumphal Arch of Thessaloniki ("Kamara")	In Thessaloniki: The Seven-Tower Acropolis, White Tower, Mosque of Hamza Bey, Ottoman Idadiye School Kavala	Patras: Municipal Theatre "Apollo", Municipal Hospital "O Agios Andreas", old church of Agios Andreas
Sparta	Fort-town of Monemvasia		Preveza: Theophanios School
Stageira	Castle town of Mystras	Kavala	Sparta: Archaeological Museum of Sparta, Town Hall of Sparta, first Headquarters of Sparta (Old Courthouse)
Philippi	Church of Agios Dimitrios in Mystras	Thassos	
Chios	Ouranoupolis	Chios Island	
Ancient Agora of Thasos	Tower of Prosforion in Ouranoupolis	Psara	
Ancient Agora of Thessaloniki	Chios	Mykonos	Chios: Public Central Historical Library of Chios "Korais", the coastal fortress, the port, water bridge known as "Tis Koris To Gefyri" or "Tou Koufou
Ancient Theatre of Argos	New Monastery of Chios	Athos Mountain	
Lion Gate	Thessaloniki	Oinousses complex	
Sanctuary of Artemis Orthia			
Temple of Phanaios Apollo			Psara: Holy Monastery of the Assumption of the Virgin Mary
House with the Trident			
Roman Odeon of Nicopolis			Ouranoupolis and the tower of Prosforion
The ancient theatre of Phillipi			
Archaic sanctuary at Stageira			
The Victory Monument of Actium			

The proposed application includes a web platform developed as a means to upload and manage historical and multimedia content, for both content creators and end-users. Content creators can upload a variety of productions, including 2D or 3D models, photos, multimedia, etc. The intension is to create a community of independent developers who are familiar with the platform and are willing to upload their creations in order to achieve recognition and promotion or even be paid per view by end-users. The submitted resources

(e.g., the historical works and other resources) will not be published for others to use in their own games or guides, etc.

As far as end-users are concerned, the application includes a virtual reality implementation (presented in the next section) where historical place or time can be selected. More significantly, "Digital Routes" have a second, smaller, virtual reality application, called "Content Access Lab", out of which the user is placed in a futuristic laboratory where the historical data and multimedia productions may be visualised in VR.

The Digital Routes project's overall design is portrayed in Figure 1. In the upper layer, end-users and content creators are presented, while in the middle level the two main applications are presented alongside the technologies used for their development, namely: (a) RoGH platform and (b) the 3D Content Repository. Their interaction makes it feasible to provide to end-users the VR chronology (named VR RoGH Chronos by the Greek word "chronos" meaning time) where they can tour the Greek history by choosing place or time and chronological period.

RoGH is an application that has many characteristics resembling, "serious games" even if it does not fall exactly into this category. One of its characteristics is that it uses "serious games" techniques to bring the players in contact with the ancient and most recent history of Greece. Assuming the role of a researcher, end-users are placed in a room full of incomplete surveys. The players can choose any of them and try to finish it by completing some research questions. In order to achieve this, players have to find and use various tools located in the laboratory, to process objects of the past as well as to explore monuments and cities of antiquity.

Regarding the characters-players, once the game starts, the users are invited to choose between two characters, either a female scientist or a male one. The only substantial change in our world is the name of the researcher as well as the 3D models of the hands, the body of the character not being shown in the game.

The main goal of the game is to open an unfinished quest and fill in the missing fields (Figure 2). Taking into account the limited interaction time of some users with the application, the above goal will immediately offer a sense of satisfaction. However, in order to increase the interaction time with the application for more demanding and eager users, the application will be able to dynamically generate new challenging unfinished surveys until players complete them all.

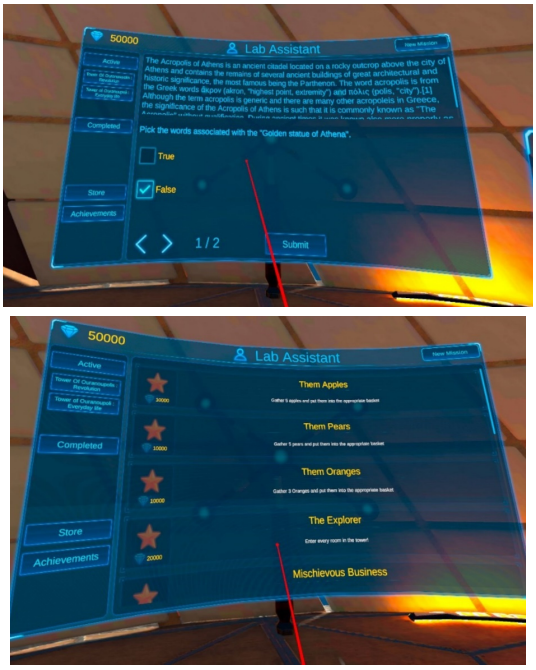

Figure 2. Gameplay including questions and budges' award system.

Overall, the gameplay loop includes (a) players visiting locations and learning about them in order to collect trophies, which they can then virtually 3D print and display, and (b) players collecting points by gaining and finishing achievements and campaigns; these points are exchanged with 3D souvenirs for their collection.

3. Results

3.1. Considerations and Goals

The application "Digital Routes" offers each user the opportunity to make an experiential journey following the steps of the timeless historical course of Hellenism from antiquity to modern times. The historical period and the historical event are revived and connected with the place and the Greek landscape, through travel routes and virtual tours in cities and stations of this timeless course through the centuries.

Through virtual reality, the cities are connected to the historical moment, as the user has the opportunity to become acquainted with the place and its history, to tour the archaeological remains of the past and the historical monuments of the city, and to enrich their knowledge, gaining an experience that unites the past with the present. The intensity of this personalized experience is increased through specific examples by utilizing the possibilities of the three-dimensional virtual reality, in order to offer the user the opportunity to tour by themselves, exploring and discovering the historical Greek city and its treasures.

The user can be guided—by activating the corresponding application and using a virtual reality mask (cardboard)—through an interactive timeline to chart individual paths in the course of Greek history and to understand important historical events, making iconic visits and tours to historical Greek cities and their landmarks. The user can select and dig deeper on the time points for which he wants further information (Figure 3). In addition, there is the option to search for and locate historical events and cities based on lexicographical or chronological criteria.

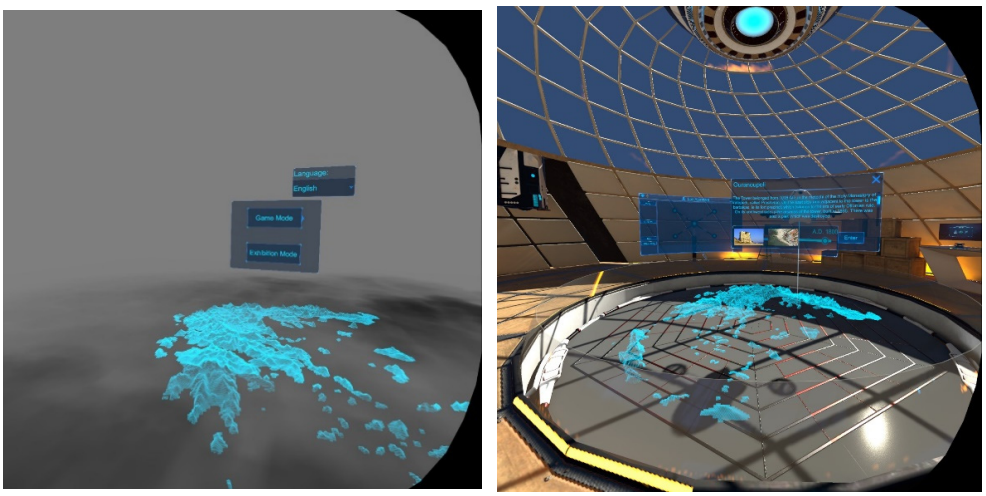

Figure 3. Introductory VR Scenes.

The dynamic way of designing and organizing the chronology will offer the visitors free tour but also direct access to the Greek cities that stood out in the course of Greek history, allowing them to learn about this timeless historical course in a direct and experiential way. Following an easy-to-use and interactive browsing tool, the users have access to historical texts, photos, videos, and 3D representations, discovering events in a wide chronological range from the Cycladic era to recent years, through their personal tour of Greek places and history.

The application integrates:

- One hundred (100) 3D models;

- Ten (10) two-minute animations;
- Two hundred (200) photos;
- Up to one hundred (100) 360º interaction photos.

There are two goals which are sought to be achieved through the platform. First, to acquire an entertaining aspect so that users of all ages can enjoy it. This will result in users continuing to engage themselves with it, not just for learning purposes but moreover for having fun.

Second, to maximize the knowledge that the users can gain from the information that is available through the media. In terms of dealing with the presentation of data through conventional media such as text, sound, animation, and non-images, this obstacle was overcome by allowing easy access and effective categorization. Furthermore, by means of 3D models, the presentation was made livelier and the user experience more immersive in this artificial world.

However, in order to achieve this, a series of extra challenges had to be overcome. First of all, the challenge to create an experience that is appealing to a wide range of age groups whose interest in the virtual reality device will be maintained beyond the initial enthusiasm and last over long periods of time (Figure 4). Another challenge is dealing with the intrinsic lack of interactivity of our primary content.

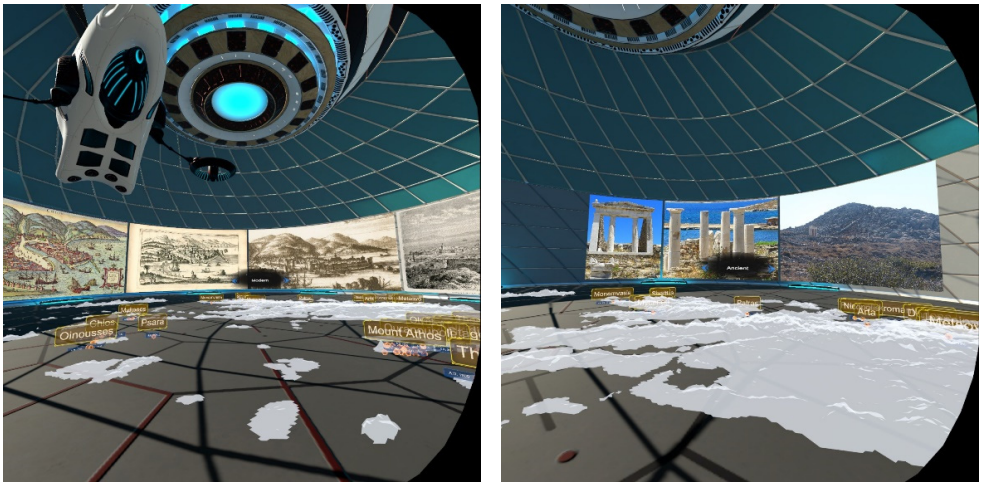

Figure 4. Choosing a Destination.

That is, the creation of a narrative that will lead the users to perform specific actions within the application based on their choices rather than being restricted to specific ones.

In order to meet the aforementioned challenges, we assign the role of a young archaeologist placed in a "laboratory of the future" and equipped with the latest technology. In there, players are initially urged to discover their identity and then to perform a series of actions that will help to conduct current research. Once the players become familiar with the environment and understand what all the available tools are intended for and their functionality, they can turn their research in any direction they prefer.

In the laboratory, users find objects that are encountered in our daily lives. The free and natural interaction with those will make users realise the range of possibilities in this digital world and make them feel more familiar. In addition, it will contribute to the persuasiveness of the whole narrative. At the same time, users can find a series of tools that allow them to explore and assimilate all the information that has been made available to them, from images and text to 3D models and faithful representations of ancient places.

This mode highlights the advantages of the application while reducing the disadvantages. The narrative (storytelling) of the laboratory and the freedom of movement in it create sufficient realism for the user to believe that the world in which they are in is fully functional while the way they interact with the machines and seek information create an interactive aspect to some originally passive media.

3.2. Historical Classifications and Tools

Historical content of all types (e.g., multimedia, text, etc.) has been categorized in four distinct classifications. Namely, these are:

- Time periods: Greek history's time periods, starting from ancient times and reaching the modern era.
- Places: Places (e.g., cities) have historical content that comes from different historical periods, as a result of continued history over the centuries (e.g., Athens from ancient to modern times).
- Monuments: Historic monuments that belong to specific places and time periods.
- Objects: Objects that are characteristic of a place and a time period (Figure 4).

The user has access to description and geolocation data for each kind of historical content, while implementing a new point of interest means entering to the web platform a series of information, such as the place and the time period it is connected to. The platform has been developed using a React frontend coupled with a Node.js backend which is connected to a MongoDB database that serves as a repository for all the content.

The proposed application includes elements such as:

- Navigation map.
- Big Map Room
- 3D printer (Figure 5) permitting to create a souvenir and historical footprint of the experience that end-users have had.
- Map controller.
- Drone.
- Exhibition Room (Figure 6).

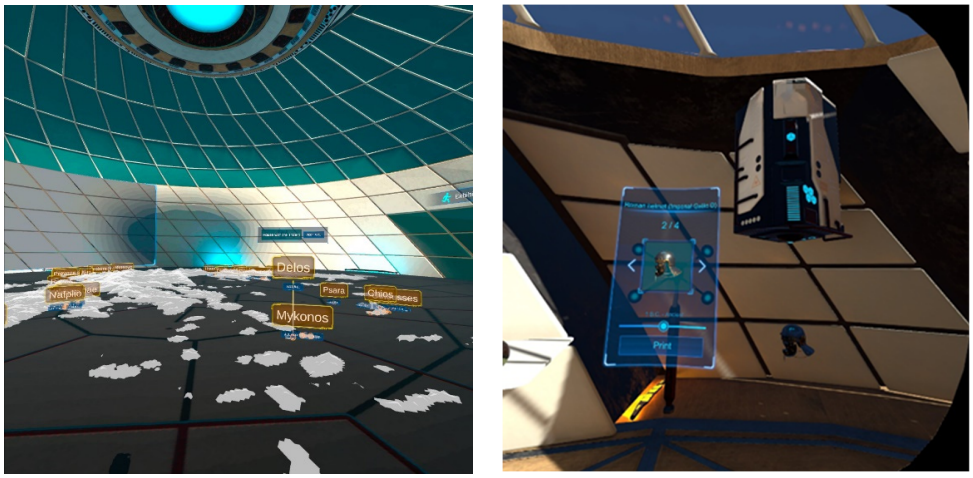

Figure 5. Navigation Map and 3D Printer capability.

The web authoring tool for collecting and organizing the content has been designed to be easily operated by people without any technical background. The project's modular design allows for perpetual content updating, because the creators of historical information and multimedia items may add to the database as frequently as they wish.

3.3. Design and Features of the Timeline

The chronology is an alternative way (compared to other conventional and static methodologies) of highlighting digital exhibits and multimedia material, as well as important events at the time scale. The user can browse the content, taking advantage of its chronological and semantic marking and categorization. The content of the application is fully dynamic, easily manageable, and adaptable both to the preferences of each user and to the potential of the units (smart devices, laptops, and desktops, etc.) through which the user accesses it.

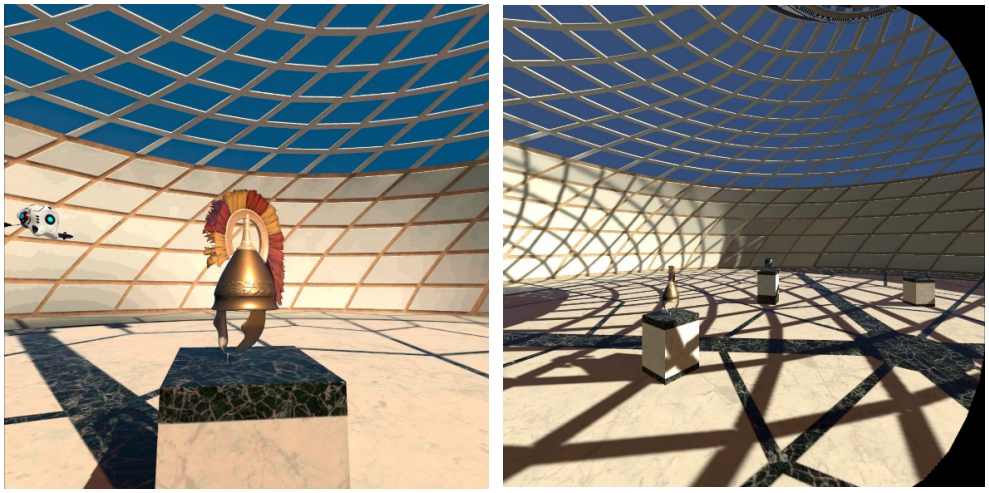

Figure 6. Objects Exhibition.

The specific, technical characteristics of the application include the following: (a) ability to scroll up and down the time field, which is displayed on the user's unit (zoom in/out), (b) ability to move in the time series forward–backward (via scroll up down), (c) automatic arrangement and configuration of the content so that it is visually comprehensible to the user (cases of coincidence of many displayed exhibits events), (d) parallel display of more than one different time series, (e) ability to comment on the content, and (f) ability to integrate user additional hardware (via verification process) on the platform.

3.4. Design and Features of the 3D Representations

The 3D representations include representations of buildings with full architectural detail and realistic photorealistic depictions (Figures 7 and 8). The 3D modelling used optimal techniques for real-time photorealistic imaging cameras. The same models have been used to produce illustrations. Another special feature of the three-dimensional content of the proposed platform is its high density for use in the production of animation (video), which is optimized in low-density models, but through materials that give it high fidelity for use on real-time content players. A sample of the tower of Prosforion in Ouranoupolis, a well-known historical place, is given in Figure 7 below.

Figure 7. The tower of Prosforion in Ouranoupolis.

Figure 8. Various shots from inside the tower of Prosforion in Ouranoupolis.

In other words, a large part of the complexity of the geometry has been replaced by geometric description images (Normal Maps), which provide high quality photorealism with a low number of vectors. The animations that were created all have as thematic content the implementation mode, the architectural dimension, the historical reference and presentation, and the narration of the events.

4. Discussion

According to what it was previously described, the RoGH application provides the following main aspects:

1. An open access internet platform has been developed, in which research centres, universities, museums, and independent researchers from Greece and abroad are able to submit their academic and historical works (text, sound, image, etc.), after appropriate authorization.
2. For the areas, cities, and time periods described below, the above two categories of data (content and 3D material) can be downloaded to the Digital Routes application.
3. Through a dynamic timeline, the end user enters the virtual application, moves on the time scale, and selects a period and city they wish to tour, receiving information and experiencing the virtual three-dimensional experience of the exploration.

Research on the above-described application concluded that there exist at least two main target groups in terms of the application's potential users, namely: entities providing educational services (all kind of schools) as well as organizations providing museum, historical, and archaeological services and content.

The first target group is students coming from a variety of levels in the educational system. From primary school students, up to upper-secondary school students, all can use the proposed application and find suitable educational and historical content. The proposed content includes classic forms such as text, images, audio-visual, etc., as well as more dynamic forms of content, such as 3D models. Depending on students age and educational needs, all level of students can be served.

Application is not expected to be immediately adopted (paid for or rented) at the end-users level (e.g., in the level of families that want to expand educational limits of their children) as a result of a significant (existing) cost required for hardware (even if the software application can be provided in an SaaS). A more realistic and viable approach involves "school units" (e.g., schools) as the entity that will provide required hardware and software. There already exists school units that provide access to Virtual Reality hardware to their students and their number is expected to grow in the next few years, developing a promising market. Of course, while the cost of hardware falls year by year, the proposed application (as well as similar ones) will penetrate rapidly at the "household level".

The second target group is cultural organizations in Greek territories but moreover at the pan-European level as well. Cultural organizations (e.g., museums and archaeological sites) already have digital content. A variety of cofounded programs run, targeting the digitalization of existing content and applications for free access to the public (internet audience). Even though these initiatives are useful, there exists a large variety of cultural organizations (e.g., smaller and regional organizations) that cannot reach larger audiences via digital applications, as a result of financial or technical reasons (e.g., in many cases cultural organization do not have an IT department). The proposed application can serve as a "gate" to the Internet, where digitized content exists.

The above-mentioned target groups of end-users have been recognized and accepted by the Greek agency General Secretariat for Research and Innovation (GSRI), which funded the project as a Smart Specialization Strategy Priority in the area of "Cultural and Creative industries". As a result of the on-going nature of the project, an evaluation of the proposed platform and its operation has not yet been conducted. The evaluation will be conducted by external experts coming from the field of VR in education, while the agents taking part in the project have decided to use the Greek educational system (e.g., upper-secondary education and university students) as the testing tube for the applications as a whole. After testing and evaluation, as well as after forthcoming adds-on, the platform will become available to a mass audience via the Oculus store and STEAM store. The features that most probably will be added in the first level (even before testing and evaluation) include areas of interest such as:

- Requirements:
  - Multiuser functionality;
  - Virtual avatar assistance;
  - Analytics of users' behaviour when using the platform.
- Implementation:
  - Implement new requirements;
  - Design and integrate extra historical sites;
  - Implementing new content (including 3D models).

5. Conclusions

The main goal of the proposed project is to highlight and promote the Greek cultural heritage to both the general and specialized public and visitors, utilizing the rich cultural reserve of the country through reliable historical documentation and the modern way of disseminating and interpreting Greek culture. RoGH offers each user the opportunity to make an experiential journey that is both entertaining and educational, following in the footsteps of the timeless historical course of Hellenism from antiquity to modern times.

The user has the opportunity to learn about the place and its history through the VR application, to tour the archaeological monuments of the past and the historical sites of the city, to enrich their knowledge, and to be entertained, through an experiential, personalized approach that unites the past with the present. The intensity of the experience is increased in specific examples by utilizing the possibilities of three-dimensional virtual reality in order to offer the user the opportunity to tour alone, exploring and learning about the history and treasures of each city, which were milestones in the history of Greece.

RoGH's platform contributes:

1. To the development of a Virtual Reality Travel Guide, available in a bilingual version (Greek and English languages at the beginning), which offers a unique digital experience whilst learning about Greek cultural heritage. Both cultural tourism and the cultural sector as a whole are important drivers of growth and development for the creative industries, which have been proved to be particularly resilient to the economic recession and can be further developed through creative initiatives such as the proposed. Through the innovative and dynamic design of the platform, an opportunity will be offered for an experiential approach to the Greek historical past, as well as specific historical periods and historical cities, providing stimuli that will raise interest for future visits to these places.
2. To the development of an innovative and pioneering educational and teaching tool, which enhances the educational process with the appropriate teaching (visual) aids and interpretive and interactive means that correspond to the needs of the modern digital age. The teaching of history courses needs to be supported by means that correspond to the current student, who becomes more and more attracted to digital reality, experiential teaching, and active participation. By utilizing and integrating the application in the educational process, the teaching of the history lesson is upgraded and responds to the needs of the modern digital age by utilizing technological means and teaching material that will contribute to and direct towards the integrated learning and the revival and assimilation of historical knowledge.
3. To develop a tool for historical research: as the innovative and pioneering design of the application makes it a valuable tool for historical research, thanks to the participation of important Greek research and education institutions (EKPA and NHRF). It promises to offer the researcher the opportunity to gain a direct overview of historical sites that have been the focus of different historical periods and historical events, to remotely study the historical data and remnants of the past, directly enhancing and enriching their historical knowledge and research with an experiential and personalized digital tour of the site, thus gaining impetus to advance the research process and the study of historical data over time.
4. To develop a multi-type digitized content automatic import platform: The platform is an innovative and pioneering tool for storing multiple types of information (photos, videos, animation, and 3D models) with the ability to chronologically sort events at their venue.
5. To develop a platform to be used by foreign educational institutions: The bilingual version of the platform, in Greek and English, makes it easy to teach Greek history and culture in foreign educational environments, while in the future, extra languages that seem to develop a particular interest in the Greek culture (Russian, Chinese, Spanish, or other) can be considered and integrated.

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