# Serious Games and Mixed Reality for Promoting and Preserving Cultural Heritage in Mountain Villages of Western Macedonia

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## Introduction: Serious Games and Mixed Reality in Tourism and Cultural Heritage

Virtual and augmented reality can enhance the importance of serious games in tourism and cultural heritage attractions as they can intensify the "presence" of the visitor at the destination (Champion, 2016), create memorable tourism experience through game elements such as challenges, rewards, competition, role-playing and fantasy (Xu et al., 2017), increase visitor knowledge and awareness about the destination (Lacka, 2020) as well the tangible and intangible cultural heritage (Mortara et al., 2014). Consequently, visitor satisfaction and loyalty towards the destination is multiplied (Prakasa and Emanouel, 2019) leading to an increase in destination's sustainability (Yoo et al., 2017). Moreover, technologies such as augmented reality with the combination of serious games incorporating educational objectives, offer the potential to support the experiencing of cultural heritage by the large public and offer an important tool to learn cultural content in an engaging way (Mortara et. al. 2014). Moreover, mobile devices in combination with the use of augmented reality and digital storytelling based on the location of the destination (location-based storytelling) can help organizations of tourism destinations to interact with visitors and create new and unique experience that can engage users (Garcia et al., 2019). Serious games can be seen as a basis for differentiation of destinations for tourism, while the creation of innovative mechanisms for the interpretation of heritage can be seen as an opportunity to promote and preserve the patrimony of culture (Cunha et. al., 2018). The present study will contribute to the field of gamification by providing new methods and concepts in a serious game with AR and VR (mixed reality) approaches for the promotion and preservation of cultural heritage that will in turn result in the creation of a model of sustainable tourism in mountain villages.

## Aim and Methods

The aim of the present study is to outline the benefits of using serious games and technologies of both VR and AR (mixed reality technologies) for tourism and for the promotion and preservation of

cultural heritage. The goal of the study is the creation of a model of sustainable tourism in mountain villages of the region of Western Macedonia through the use of serious games and mixed reality technologies. Mountain villages of Western Macedonia compared to well-known destinations in close distance in the area, such as the municipalities' capital cities of Kastoria, Florina, Kozani and Grevena may be missed as target destinations by tourists or at least have not the privilege to be equally favoured by tourists. Thus, the project's mission is the enhancement of sustainable and alternative tourism for the mountain villages of the region of Western Macedonia and the promotion and preservation of the cultural heritage of the corresponding areas. The project has four phases: Phase 1) Identifying the candidate mountain villages and the historical, cultural, natural or other interesting elements of the places that can be part of serious games scenarios, Phase 2) identifying application functionalities needs and user needs for the development of the serious game with AR technologies application that will intrigue users to visit the places, learn important information about the areas and collect a number of virtual objects related to the previous identified elements of the attractions,  Phase 3) implementing an award strategy that will furthermore motivate users to complete tasks of the serious game, offering an entrance to a University VR-lab for a great experience of a Western Macedonia Region virtual tour, that will be created for the project purposes, and Phase 4) Evaluation of the approach with qualitative and quantitative approaches for identifying level of user experience and collect user feedback about the serious game. This study will shed light on the methodology used in the project for identifying the mountain villages, cultural attractions, and the elements that will be incorporated in the serious game scenario.

Western Macedonia region is a large region consisting of 4 prefectures with overall 486 cities, towns, and villages. Thus, the tasks and criteria for identifying candidate mountain villages, cultural attractions, and digital objects related to historical, cultural, natural, or other related elements to be collected as part of a feasible one- or a weekend time to complete serious game scenario, need to be methodically determined. One route for the serious game targeting a weekend time will cover 2 destinations from each prefecture, thus 8 villages to be visited, and another route, targeting a one-day route will cover destinations in the prefecture of Kastoria, due to the proximity of the area to the VR-lab for the award experience. For the mountain villages selection, a ranking method is developed that is based on data extracted from the corresponding Wikipedia page articles for each of the 486 destinations (i.e. cities, towns and villages), that are related to available volume of information in Wikipedia for each destination (bytes of the Wikipedia article for the destination) and an indication of attractiveness of the destination denoted by the number of page views of the article during a period of approximately a month time (3rd of February 2022 till 2nd of March). Additional data related to altitude, population, and type of destination (city, town, village) was collected for each destination. The method provided an initial selection of mountain villages that are in the top ranks of the 486 destinations.

Various solutions are encountered in the literature regarding the authoring tools for developing AR applications. Specifically for tourism AR location-based applications have become a trend. Tourists can obtain knowledge while visiting places through informative digital content that is activated on their mobile devices when specific locations are reached within the physical environment. The digital content can be in various multimedia forms such as text, images, videos, 3D models, 2D and 3D animations. Furthermore, location based AR games are also used to enhance the tourism experience by adding a gaming dimension. AR location-based applications have attracted the interest of

many tourism researchers (e.g., Lacka 2020; Nóbrega et al., 2017; Weber 2017; J. Weber & Dickinson 2018).

In the current study, the literature has been investigated in the search for appropriate tools for developing AR location-based applications. Two popular platforms have been spotted in literature: Taleblazer and Metaverse studio. The platforms have become popular because they can be learned fast and don't require advanced programming skills. The two platforms have been examined thoroughly in order to select the most suitable one for developing an AR tourism experience for Western Macedonia's mountain villages and sights. Two prototype applications have also been developed in order to examine in depth the features of both platforms.

TaleBlazer is an online software platform for creating mobile Augmented reality location-based experiences. Taleblazer is developed by the MIT Scheller Teacher Education Program (STEP) lab. The Taleblazer development environment relies on a visual block-based scripting language which is very similar to Scratch, another popular product of MIT. Figures 1 and 2 display some of the functionality features for the serious game approach.

Metaverse Studio is a platform created by GoMeta an American software company headquartered in San Diego. Metaverse is a popular platform that requires no programming knowledge and thus a platform that is user-friendly for many novice designers that wish to create AR applications.

In order to decide on which tool to use a comparative analysis was carried out focusing on issues such as the designer environment of both platforms and the available functionality, the game mechanics that are supported, as well as the end-user's environment.

The platform selected after the analysis was Taleblazer mainly because of the better quality of map images and the ability to create custom maps. Both applications use dynamic maps downloaded from applications servers and updated as the player changes location. Taleblazer platform has more detailed maps when compared to the Metaverse platform, and this option is better for mountainous areas. Furthermore, the designer can upload custom maps and use these instead of dynamic maps. This option is also useful when the designer wants to develop a game that evolves in an area that is not covered by the Google Map API such as paths in nature (hills, forests, and mountains). In this case, custom map images can be created with editing software or obtained from other resources and used in the Taleblazer application. This option will be particularly useful in the case of monuments that are located in nature and can only be reached by paths.

The project is ongoing and currently on phase 2 and the full paper will present the designed game application. Figures 1 and 2 display some of the functionality features for the serious game approach.
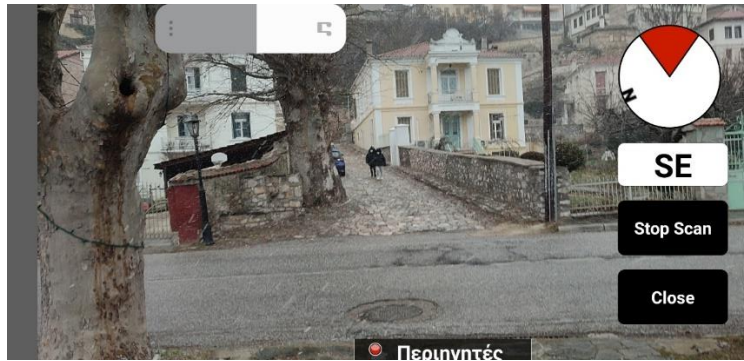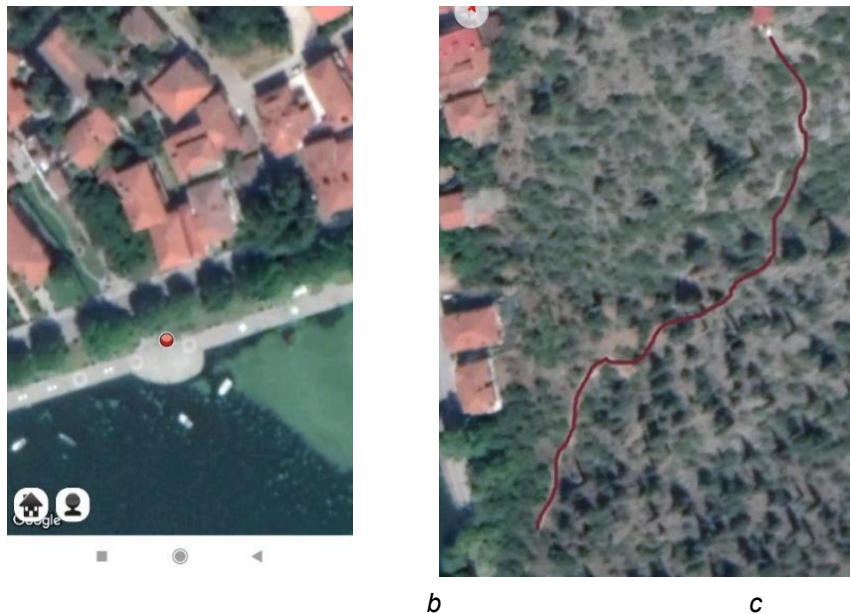
Fig. 1. Head Up navigation snapshot



a                                    b                                    c

Fig. 2. Snapshots of serious game with a) A starting point in the game; b) Depicting a path in nature using a custom map

## Funding

## Author Contributions

Please list the contributions of the project participants here, according to the CRediT system. See specific descriptions of the role here: (http://credit.niso.org/). **Please omit non-applicable roles**.

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**Formal Analysis:** <Amalia Triantafillidou>
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**Writing – original draft:** <Georgios Lappas, Amalia Triantafillidou>

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