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A SCENARIO FOR APPLICATION OF INFORMATION TECHNOLOGIES IN REPRESENTATION OF ARCHAEOLOGICAL PARKS

Abstract. The chief purpose of application of information technologies in representation of archaeological parks is a well-studied subject and the corresponding conclusions are clearly formulated. It is however much less done in their concrete applications. In this paper, we propose a possible scenario for application of information technologies in representation of archaeological parks. This scenario is primarily based on a purposely designed electronic guide and specific projection systems realized by the ARhiMedia group of the Mathematical Institute in Belgrade that is working at the Faculty of Electronic Engineering in Niš. In the design of such projection systems a special attention has been paid to achieving a reduced production price which makes them affordable by archeological parks in Serbia.

In the proposed scenario, the data of interests for a visitor are presented in multimedia form including text, photos, drawings, audio and video records and computer generated 3D objects, which is of a particular interest for reconstruction purposes. A purposely designed electronic guide enables the visitor to be independent on the guided tour and allows him to explore the site individually. In this way, the visitor takes an active role in creating the exhibition contents depending his personal interests, previous knowledge, and available time.

Keywords. Information technologies, projection systems, elecronic guides.

1. Introduction

Building an archaeological park over an archaeological site is a very complex and responsible task requiring to take into account various aspects, starting from strictly preserving historical values, authenticity, and integrity, through feasibility and maintainability, to providing accessibility and inclusiveness. Such a task is usually performed through a multidisciplinary project involving experts from different areas. As a recent example, we refer to [4]
where building an archaeological park is elaborated on a concrete example. Converting an archaeological park into an attractive tourist destination offering an engaging and immersive approach to learning and at the same time enjoying experiencing of cultural and historical heritage is a particular aspect of the related requirements and tasks to be implemented [2]. Information technologies, and also advent of related hardware, offer an important and powerful support in achieving such goals. At the same time, in attempts towards their application at concrete locations they open challenging problems which usually has to be solved for each individual archaeological park separately. Universal solutions proposed in the literature have to be adapted to the various restrictions and demands coming from the situation at a concrete archaeological site. Various problems can appear starting from very basic, such as power supply at particular positions within the archaeological park due to unavoidably restrictions to electrical network distribution, through security of installations and devices, insulation

and amount of light during the visiting hours which particularly affects various projections, to the contribution of various information technologies based devices and related applications to the understanding and the interpretation of particular archaeological objects. These problems related to the engaging and implementation of new technologies into service of touristic industry and preservation and spreading information about historical and cultural heritages are a subject of intensive research usually carried out by multidisciplinary teams of researchers [9]. For example, this lastly mentioned problem of contribution in the case of the usage of 3D technologies for recording, processing, and presentation of archaeological data, is studied in [17].

Besides the main and most important goals as achieving interactive and immersive installations in presenting national historical heritage of Serbia, another issue that we are taking into account is proposing solutions that are inexpensive and therefore affordable for practical implementations presently. Thus, solutions proposed in this article are based on selected inexpensive hardware still providing high durability and simplicity in maintaining and easy handling by non-experts in information technologies employed at cultural institutions. This feature can be viewed as an important difference comparing to various other solutions proposed in the literature usually, if not primarily, aimed at implementation on archaeological parks supported by economically well-established touristic organisations and industry.

The software and hardware elements of the scenario proposed in this article are realized by the ARhiMedia group of the Mathematical Institute and verified as technical solutions within the project III 44006 supported by the Ministry of Science of Serbia and conducted by the Mathematical Institute of SASA. The group works at the Faculty of Electronic Engineering in Niš within the Laboratory for Computational Intelligence and Information Technologies (CIIT Lab).

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2. Application of Information Technologies at Archaeological Parks

Information technologies have an important role in the presentation of cultural heritage in order to provide an engaging content to the contemporary society. Different studies based on information technologies have been proposed to attract and enhance the visitor experience. Therefore, multimedia solutions such as projection systems, mobile applications, and interactive installations have been realized with the purpose to enlarge the presented amount of information and provide a more compelling content of exhibitions compared to classical presentations based on printed panels that are necessary limited in the available space for text and images [5], [8], [16], [18], [19].

Creating interactive installations for archeological parks is a challenging and demanding task. Visitors presently expect more and more multimedia material to be shown depending on their interest and also within the available time. Therefore, the provided multimedia information should be quickly displayed in such a manner that can immerse a visitor into an interactive storytelling. Accordingly, the dynamic content of presentations should be realized to provide concrete information that will correspond to the visitors possessing a different level of knowledge on the subject. This leads to an improved visual presentation and better informing solution than the usage of classical leaflets, booklets and brochures. Another advantage of interactive installations is that they offer to visitors a possibility to move from passive observers to active creators of the exhibition during the tour across an archeological park. By selecting topics of their

personal interest in interactive installations, visitors are able to create by themselves the content of the exhibition.

In summary, information technologies should be a tool to achieve several, in a way contradictory requirement, such as

1. Offering interactivity with possibility for individual selection of topics of personal interest,
2. Ensuring amount of information large enough to meet interest of visitors with different levels of previous knowledge,
3. Providing attractive and compelling presentations.

Further, all this should usually be provided in a restricted time a visitor can devote to an exhibition, make the task challenging. Another issue it that the information technologies can help to devote a special attention to visitor with special requirements [1].

To achieve these goals, we propose a possible scenario for application of information technologies in representation of archaeological parks. This scenario is conceptualized with aim to guide the visitor through different stages during the archaeological park visit. Each stage uses a different solution such as mobile electronic guides or specific projection systems [3], [10], [12]. The mobile electronic guide acts as an interactive part of the presentation where the visitor has an active role due to possibility to navigate across the content according his interests. Purposely designed projection systems as these discussed below are used to provide global presentations on the important spots of the archaeological park. Special attention is paid to the inexpensive design of these projection systems which makes them affordable for archeological parks in Serbia.

3. The System Elements

The elements of a system realizing the scenario that we propose for implementation of information technologies in archeological parks are:

- Info point,
- Inclined plane projection system,
- Projection pyramid,
- Rear projection planes,
- Electronic guide.

Info point (Figure 1) is a conveniently shaped glass panel equipped with QR codes [11]. The glass was selected to ensure transparency to avoid blocking the view at the archaeological park, while QR codes serves as information provider. It is assumed that visitor can scan QR codes with his mobile phone and get basics information which can be shown in the form of images, text, audio or video records.

Figure 1. Info point

Inclined plane projection system (Figure 2) is a custom designed projection system constructed to synchronize two video projections on a horizontal and an inclined projection plane [6], [7]. The inclined plane realizes a holographic effect and can be viewed as a digitalized version of the Pepper ghost effect. The holographic effect is achieved by a monitor that is used to project an especially prepared video content on an adequately selected glass covered with a thin transparent coating of metal oxides. The horizontal plane serves as a projection screen for the either rear or front projection from a different signal source. The orientation of the projection depends on the position of the projector with respect to the horizontal projection plane, below or above it. In the first case, the horizontal projection plane is implemented as a transparent material, glass or plexiglass, covered by purposely selected projection transparencies. Synchronization of two videos is realized by custom designed software running on two interconnected Raspberry Pi computers. This selection of hardware components makes the system inexpensive.

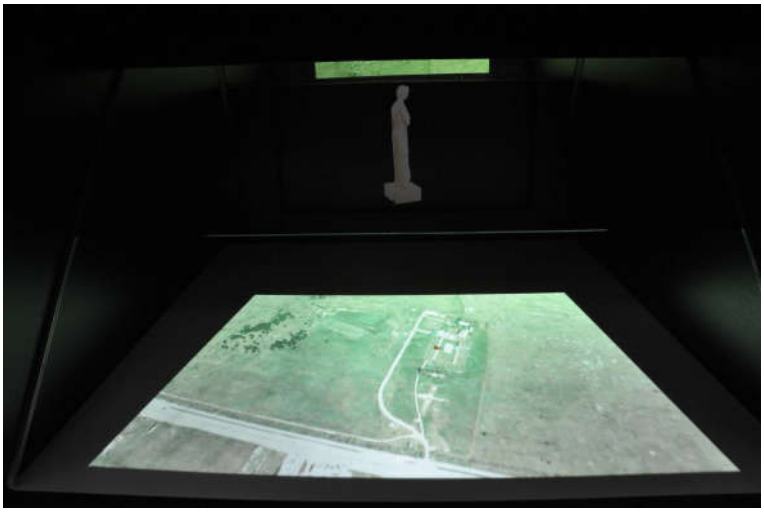

Figure 2. Inclined plane projection systems.

Projection pyramid (Figure 3) is a typical projection system aimed at producing the holographic effect when projecting 3D models. The proposed solution is specific compared to the commercially available projection pyramids, since a Raspberry Pi is used to run the video displayed on a simple monitor instead of usually applied classical computers or television screens. This makes the system inexpensive.

Figure 3. Projection pyramid

Rear projection planes (Figure 4) are aimed at projection of multimedia content on the custom designed shapes of transparent material which can be adapted to imitate a part on an enterior or exterior object. They are realized by using special projection transaprencies attached to a transparent surface such as glass or plexiglass. In the application on an archeological park, they can serve as reconstruction elements of ruins [5].

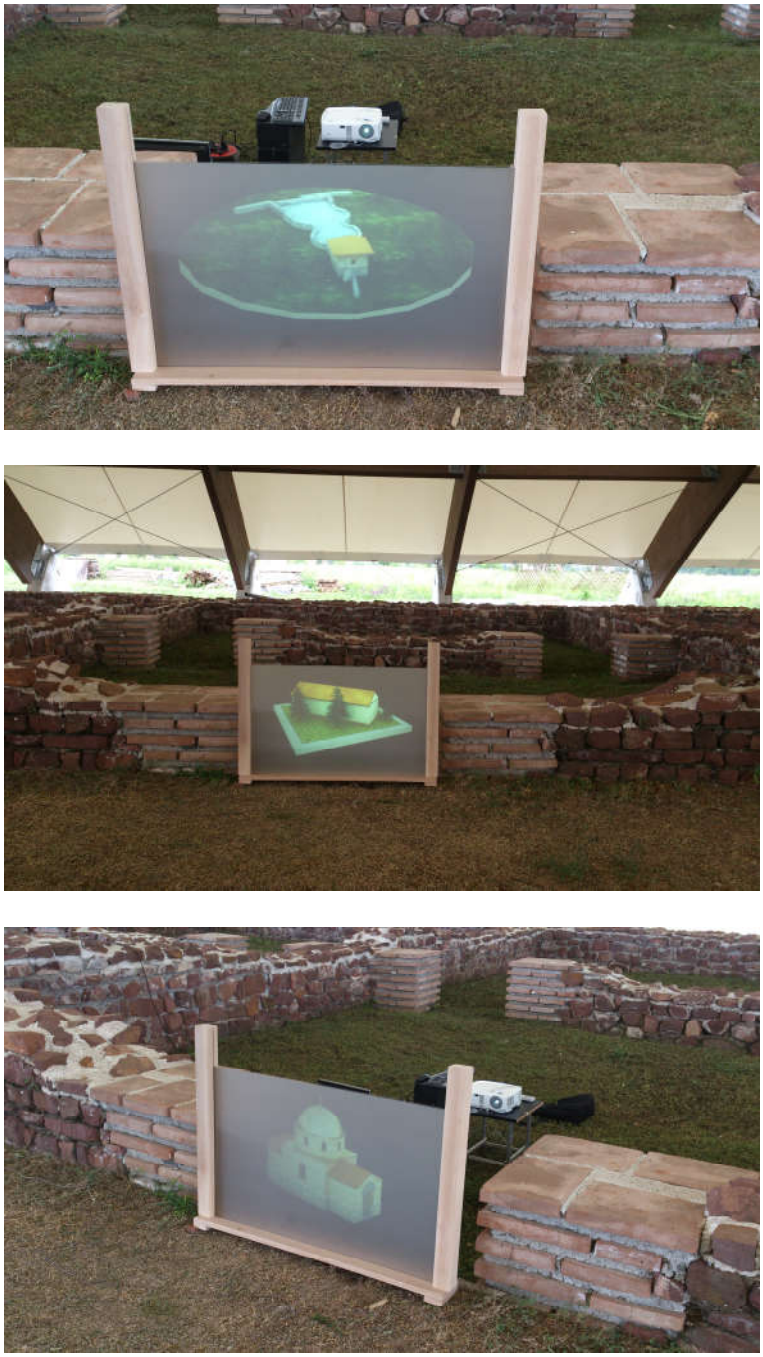

Figure 4. An illustration of application of rear projection planes

Electronic guide is designed as a mobile application for devices such as smartphones or tablet PCs to provide detailed information and enhance the presentation for the visitors [13], [14], [15]. Depending on personal interest and time they can devote to the visit, visitors can choose items presented in the electronic guide in various

multimedia formats. An electronic guide consists of several modules that will be described below.

Map module (Figure 5) is created to navigate the user to the archeological site from either their current location, bus station, train station, or the city center. Also, interactive points of interest are implemented to offer the visitor guidance or provide additional information about specific spots within the archeological park.

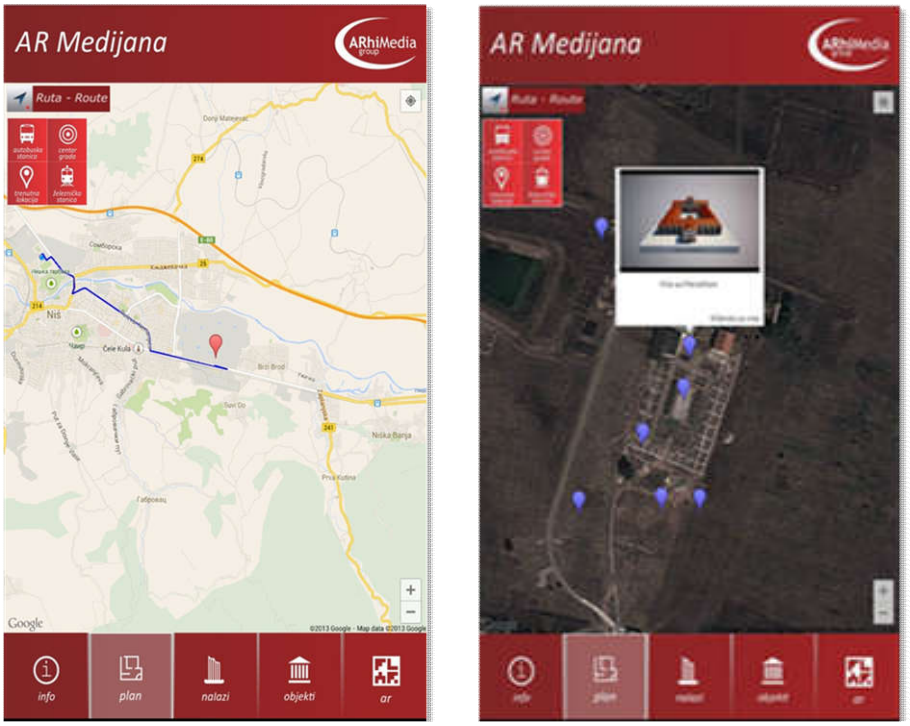

Figure 5. Electronic guide – Map module

List module (Figure 6) is made for a classification of archeological findings that are discovered on the site. For example, specific lists could be created for the archeological movable findings like coins, statues, and figures, or immovable findings such as palaces, churches or settlement areas. Interactive list elements with text and photos, 3D models, audio and video records, can provide additional information to the visitors.

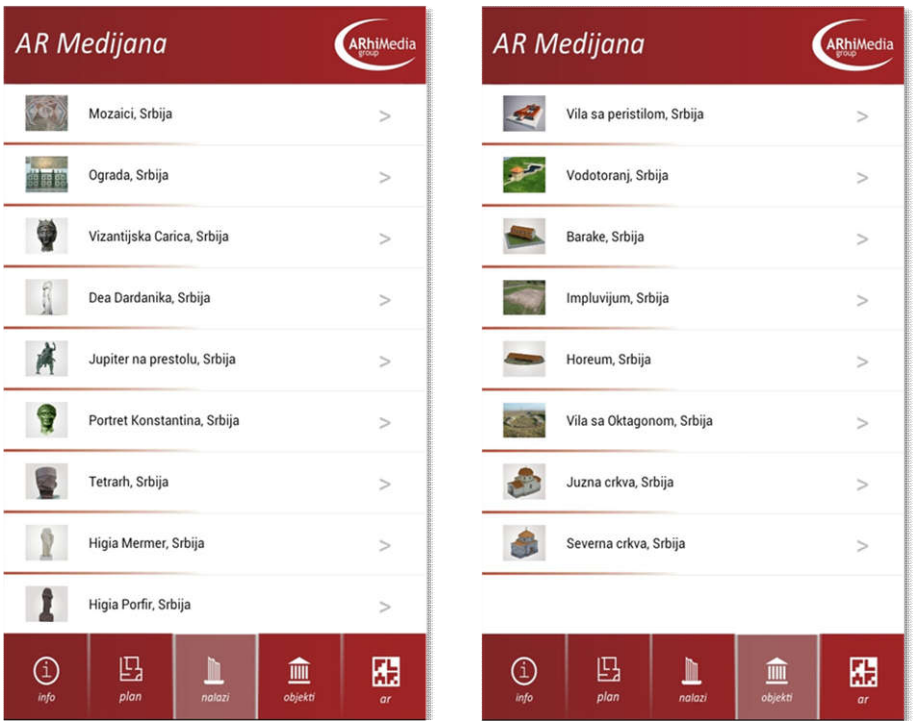

Figure 6. Electronic guide – List module

Info module (Figure 7) shows the information about archeological finding in the form of text or audio. Also, image gallery and video player are embedded. When a 3D model is available, it can be displayed as an interactive object to show the digital reconstruction of some finding or 3D scanned archeological artefact from the depo.

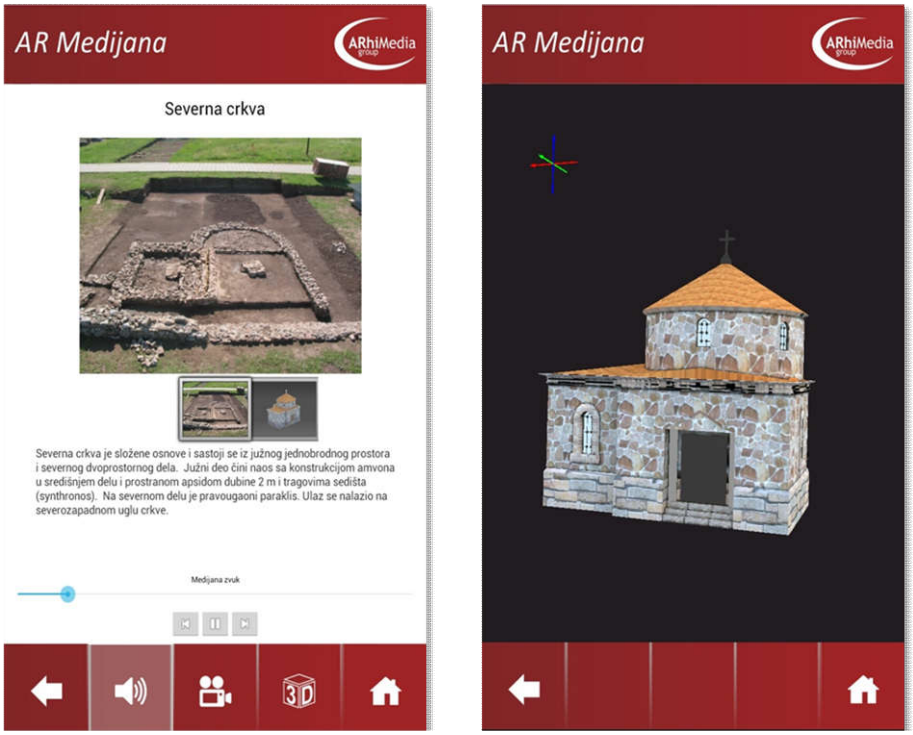

Figure 7. Electronic guide – Info module

AR module (Figure 8) by using camera of the mobile device enables to scan and recognize concrete marked pieces of objects in the archeological park and display virtual information to the visitor directly on the site. Pointing the camera towards the purposely marked places, the visitor can see various reconstructions and similar effects. This could be realized as 3D reconstructions which enables the visitor to virtually walk around the objects and observe from different angles findings that are physically unavailable or their physical reconstruction is expensive to be accomplished.

Figure 8. Electronic guide – AR module

4. The Scenario of Application

In this section, we propose a scenario for application of the information technology system described above for improvement of the presentation of archeological parks. Figure 9 illustrates and explains the proposed scenario.

We propose to use first an Info point located near the entrance to provide by QR-codes initial historical information about the archaeological park so that visitors can be informed and prepared what they are going to see and explore. It is also good to use QR-codes to inform the visitor about technical details and also available facilities like working hours, souvenir shop, restaurants, possible walking paths, etc. Also, there should be information about possibility to rent a PC tablet with the electronic guide installed or download the corresponding application by the personal smart mobile device from Google Play or App Store.

After entering the archeological park visitors are advised to watch a central presentation displayed on an Inclined plane projection system. This device can be also used to present brief information about the history of the archeological park. The contents should be realized as 3D projections with animations for an impressive and immersive visual presentation and with an ability to simulate holographic effect at the inclined plane. The horizontal plane can be used to project an animated map of the

archeological park with points of interests marked and accompanied with basic textual or audio explanations.

After watching the central presentation, the visitor is advised to activate his electronic guide on a personal or a rented mobile device. In this way, the visitor will navigate himself across the archeological park and use the electronic guide to get information about the objects of his personal interest. Also, the AR module embedded in the electronic guide enables interaction with objects at the archeological park. By recognition of various images at the site used as markers, such as patterns of mosaics or frescos, the visitor will get additional information in an appealing way. Furthermore, by using the AR module, it is possible to provide virtual reconstructions of objects how they have looked like in the past.

Rear projections planes located at the exact position where some objects existed in the past enable projecting 3D models to visualize the missing and destroyed parts. Alternatively, projection pyramids can be used to project 3D holographic simulation of destroyed objects, or artefacts which for various reasons are not exposed to the public.

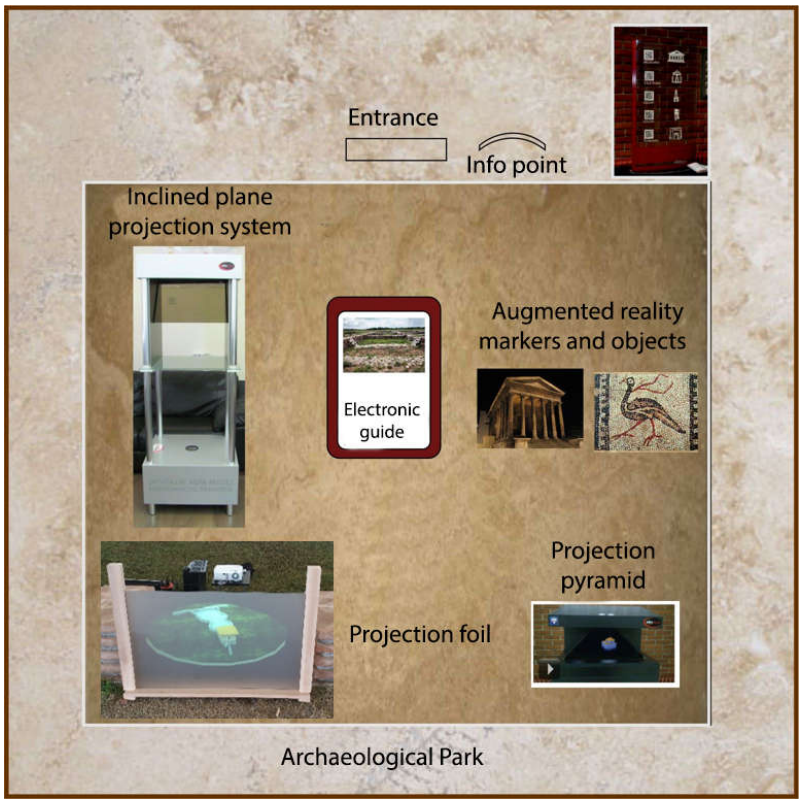

Figure 9. A possible scenario for application of information technologies in exhibitions at archaeological parks

5. Conclusion

Contemporary visitors of archaeological parks typically expect attractive multimedia installations and interactions at cultural heritage sites. Application of information technologies at archeological parks provides foundations for creating an engaging content and impressive visual presentation. The proposed hardware and software solutions and the scenario of their usage could immerse visitors into historical exhibitions. Also, by using the electronic guide a visitor takes an active role in creating his own way in exploring the exhibition according to his interests.

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