

Feasibility study on AR guided tours in the National Museum of China

Yu Tian

Shanghai Lida University, Shanghai songjiang 201608

Abstract: Cultural and museum tour are increasingly attractive to tourists, while traditional guided tour cannot meet the diverse tourism needs of tourists. Based on information technology and the Internet of Things, augmented reality (AR) technology provides a completely new way for guided tour. Within the National Museum of China, specific cultural relics are selected for AR tours, which could closer visitors and cultural relics. This article aims to investigate the feasibility of conducting AR guided tours within the National Museum of China.

Keywords: AR technology, National Museum of China, cultural relics tour

1. Introduction

Based on the development of electronic technology, the traditional forms of museum guide have failed to attract visitors. The development of intelligent and Internet of Things technologies has created conditions for the application of augmented reality (AR) technologies and provided a new opportunity for the intelligent navigation of museums. As a comprehensive technology integrated with multidisciplinary techniques, smart guided tour based on augmented reality technology could provide guidance, excursion, scene interactive experience, communication and data statistics services for intelligent guided tours of museums. Allowing users to interact with objects in the virtual world to create an immersive experience and enhance the image and interest of museum services. It also provides museums with personalized service modes.

On the other hand, based on the development of cultural heritage, some scholars claims that it is very important to let consumers take part in the process of cultural value and create rich experience. According to Jung and Tom Dieck, augmented reality was defined as an ideal technology to create personalized and enjoyable environment and information for visitors. In addition, AR could provide digital information in various forms though a wearable and small device.

This report would choose National Museum of China as an example, it is located in the city center of Beijing, could attract more than 7 million visitors each year. The development of AR technology guided tours in this museum is not only a good introduction and publicity to the cultural relics, but also could play a good role model for other museums to develop AR technology.

2. Aim

The project aims at attracting more visitors and building a scientific bridge to connect visitors and historical relics in National Museum though AR technology. This can be divided into three objectives:

- Attracting more visitors though absorbing AR technology, and it is possible to attracting public to go to museum;
- The conservation and display of collections which utilizes the AR technology as a platform for their interpretation, visitors could realize more cultural information though this exhibition due to additional information added by AR technology about historical relics;
- Extending this new exhibition model to involve other museums and exhibitions, because National Museum of China has demonstration effect to other museums.

3. Advantage of AR

Traditional museums need new technology to attract visitors. AR technology is a useful and effective way to achieve attracting visitors. AR technology refers to augmented reality which means that enhancement of the real environment by overlaying computer-generated content, such as video, images, animation and text information. According to recent research studies, AR, especially the form of 3D reconstruction of cultural objects, is attractive by older and younger adult. Therefore, AR should be developed in museum exhibitions.

AR is deemed to a variation of virtual reality (VR), and these two technologies could immerse users in a digital environment, in which information is responsive to user's actions. However, there are some differences between AR and VR, for example, VR emphasizes on immerses users completely in a virtual space, while AR refers to creates a sense that real and virtual objects coexist in the same space. It means that VR could separate virtual world from real world, while AR could connect virtual world and real one. AR technology could adjust visitors' sensory perception, including sight, smell, hearing and touch, though computer processor, input devices, sensors and a display to add or remove information from real world. For example, paintings or pictures could change their color and interact with visitors though AR. In term of museum exhibition, as Matuk claims, AR is an emerging technology with the potential to address issues of personalization and relevance in museum design.

It is thus high time that an action is taken to develop AR technology in museum exhibitions. There are rich collections, abundant antiques and enough visitors in National Museum of China. Developing AR exhibitions in National Museum of China could not only attract

visitors and spread civilization, but also extend AR technology to involve other museums.

4. The process of establishing AR

This project would divide into four phases. The phase 1 and phase 2 are the preparatory phase of this project, especially for technical preparations. Phase 3 is aimed at design exhibition, while phase 4 is focuses on feedback from visitors.

4.1 Phase 1: Choosing Cultural Relics

There are more than 1 million collections in Nation Museum of China, including bronze, carved stone, painting, calligraphy, porcelain, sculpture, jade, jewelry, crafts, furniture and foreign antiques. In an AR exhibition, it is needed to select a part of collections. According to online survey, there are more than 64% visitors are interested in painting and calligraphy, sculpture and foreign antiques are the second most interesting to visitors, both accounting for 37.5%. The next rankings respectively are porcelain, jewelry, jade and lacquer, accounting for 32%, 30%, 26% and 19%. Based on environment limitation and development of AR technology, thus selected cultural relics need follow below principles for this AR exhibition.

Representativeness. There are different types of cultural relics for different dynasties, for example, bronze antiques as sacrifice utensils are popular and common during Shang and Zhou dynasties, moreover, bronze's craftsmanship is sophisticated and exquisite during Shang and Zhou dynasties. Therefore, bronze antiques are the most representational cultural relics for Shang and Zhou dynasties. Houmuwu square cauldron is one of the most representational bronze antiques.

Valuable. Each cultural relic is a testimony of culture and history. However, some culture relics are more valuable than others due to sophisticated technology, exquisite design, precious material and scarce number. According to online survey result analysis, visitors are most interested in crafts process and material, collections value and related story and legend. Therefore, selected culture relics should pay more attention on high value, unique process and related history stories.

Entertaining. More interesting cultural relics could attract more visitors compare with uninteresting one. For example, there are two interesting points about this gold and silver sachet with flower and swallow pattern. First, the craftsmanship of the surface is a special and unique method. This process named Liu Jin, translation in English is distilled-gold method. Second, this sachet consists of two parts, the ball outside and the smeller ball inside. When users put spices in the smeller ball, based on mechanical principle and gravity, burning spices will keep level status rather than be spilled .

4.2 Phase 2: Establishing AR Models

The initial plan of establish AR models is to require two teams to work together and cooperate with each other. The first team named creative group, is responsible for content design of AR models according to selected cultural relics. For example, according to gold and silver sachet with flower and swallow pattern, distilled-gold method could be showed by production process video. Creative group is required make distilled-gold method video. In this video, it is not only contains production process, development of history and materials, but also contains application and inheritance of distilled-gold method.

In addition, creative group also needs to make video about its mechanical principle and use method. In this video, it mainly introduces how to use gravity and mechanical principle to keep level status of burning spices before one thousand years and development of science and technology during Tang dynasty. Another interesting story should be mentioned about this sachet's background. From sachet owner, narrating an appealing and romantic story of emperor and empress in Tang dynasty.

The second team named AR models group, specialize in establishing AR models according to content information about cultural relics made by creative group. In other words, this group is required to transform original content information into 3D information though AR models and develop AR APP on visitors' phone. In addition, the key point of achieving AR technology is high accuracy of camera. As Natkin and Dupire claim that it is very important for camera tracking in the implementation of AR, thus the stability and accuracy of camera poses are also important issues for AR technology.

4.3 Phase 3: Designing Exhibition

There are 48 exhibition halls in National Museum of China. Based on huge exhibition hall, abundant cultural relics and time limitation, it is difficult for visitors to visit all the exhibition halls and artifacts in one day. On the other hand, visitors will cause aesthetic fatigue for a long time stay in museum. In the entrance of Ancient China Exhibition, there is a download information and instruction of AR APP, they need to download this APP before they use AR guide. Then there is a map of selected cultural relic locations though augmented reality technology, visitors could select interested cultural relics of them and directly visit these cultural relics by AR guide. AR technology allows virtual real-time navigation information to be superimposed on the real scene to help visitors navigate through the real-time path.

When visitors arrive selected cultural relics by them according to AR guide, they could realize more information than context information though scan this cultural relic. For example, there is a sense of distance between the cultural relics in the glass showcase for audiences, however, we can make use of the data collected in National Museum as data-enhancing materials to create a spatial atmosphere that matches the historical actual scenes of cultural relics and enhances the display of cultural relics though AR technology. Therefore, the cultural relics in the historical actual life can be restored and the distance from the audience can be shortened.

4.4 Phase 4: Customer Satisfaction Survey

Satisfaction survey could increase awareness and acceptance of the importance of user requirements for a successful implementation of applications. Therefore, it is very important that we grasp user's advice and suggestion in time. When visitors finish their tour, they will

receive a customer satisfaction survey for AR Technology. According to survey result, we need to adjust AR information and exhibition design to meet visitors' requirements.

5. Management

This project will need two teams to developing AR model design, including creative group and AR models group, especially in its early stage. Creative group requires employ professionals to make video and collect information, while AR models group needs employ professionals who are specialized in computer model-making to establish models and design AR guide route. Leader and coordinator are needed between these two teams. After opening AR exhibition, this project needs assistants and helpers to assist visitors use AR technology. These assistants and helpers could rely on volunteers and internship students. The work force needed includes:

- Culture manager for manage creative group, choosing cultural relics and review culture information made by creative group, cooperate and communicate with media manager (Phase 1);
- Media manager to lead AR models group, cooperate and communicate with culture manager (Phases 2);
- AR exhibition curator for exhibition design, review the final work of creative group and AR models group and run the exhibition and its collection (Phases 1, 2 and 3);
- Volunteers and internship students to help visitors use AR technology during exhibition time;
- General maintenance, refurbishments, re-establish AR models, adjust AR guide route, etc. (Phases 4).

6. Marketing

According to online survey result, AR technology could attract young generation compare with other ages. There are more than 60% respondents are interested in AR exhibition, thus, the proposed project would attract more visitors by right marketing strategy. A market can be analysis by these four aspects:

- Place: National Museum of China located in the city center of Beijing, and transportation is convenient.
- Product: AR design is absorbing and attractive for most young generation and adults, thus, combining AR and cultural relics could attract more visitors than other form exhibition.
- Price: According to online survey result, near 50% respondents agree ticket price should be £10 to £20, and near 40% respondents think ticket price should below £10. Thus, it is suitable to afford approximately £10 for visitors.
- Promotion: In order to attract more visitors, family tickets should be considered, for example, visitors buy two tickets and could get two free children tickets. There are 80% discounts for students and elder visitors.

7. Conclusion

Developing AR technology in Ancient China Exhibition in National Museum of China is viable, rewarding and conducive to inherit traditional culture. Comparing with other traditional guide ways, AR contains a lot of advantages to enhance visitors experience and interaction. This report mentioned majority process of AR exhibition, including selecting cultural relics, establishing AR models, designing exhibition hall and management. The future plan of establishing more AR exhibitions are required funds and sponsorships, moreover, according to visitors' feedback, managers could adjust exhibition in time.

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