Research on MR navigation design based on double diamond model: A case of South China Botanical Garden

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ABSTRACT

The South China Botanical Garden is the largest South Subtropical Botanical Garden in China, but it is still in traditional browsing mode. In the botanical garden, there are problems such as confusion of route guidance, single botanical form, and dullness. The rapid development of MR (Mixed Reality) technology brings new opportunities to the tourism industry, and MR technology can bring more interactive and interesting experiences to tourists. Therefore, based on the method of the double diamond model, this study designs a MR navigation system for the South China Botanical Garden to optimize visitors' experience and improve the service quality of the botanical garden. The research results have reference value for the digital transformation of services in large botanical garden and the improvement of the service quality.

Keywords: Double diamond model, user experience, mixed reality technology, botanical garden navigation

1. INTRODUCTION

With the growth of China's tourism market and the continuous improvement of science and technology, people are not merely satisfied with seeing the beautiful scenery in the process of travel, but an interesting and comfortable travel experience has emerged as another important pursuit of users. As a public place with integrating functions of scientific research, popular science, entertainment and leisure, botanical gardens have become more and more popular in recent years[1]. As many cities in China have built botanical gardens., there have been many studies on botanical gardens in recent years. However, most of study focus on the development history and current situation analysis. And there are relatively few studies on how to improve the tourist service experience[2]. At present, the tour of the botanical garden is still in a traditional way of browsing, and there are still problems such as unclear routes in the garden, confusing signs, and homogeneous scenic spots. This paper takes the South China Botanical Garden as the main research object, discusses its real pain points based on the double diamond model, and uses modern scientific and technological means to design a navigation system for the South China Botanical Garden, so as to improve its tourists' experience satisfaction.

2. METHODS

2.1 The concept of the double diamond model

The double diamond model is a framework formed by the British Design Council in 2005 by summarizing the design outputs of eleven companies around the world. The double diamond model clearly and intuitively communicates the complete design process of a project to people[3]. The design strategy in this "continuous" and "smooth" design framework has similarities with the usability heuristic proposed by Nielsen[4]. The two large diamonds in the double diamond model symbolize the divergent and convergent phases of the design process, representing different modes of thinking. Overall, this is not a linear process. The double-diamond model can help designers explore more potential problems, which can bring them back to where the design started. By crafting and testing very early ideas, you can become part of the discovery and iterate on products that fit the user and the market.

2.2 Double diamond model design process framework

Since the concept of the double diamond model was proposed by the British design organization in 2005, this model is considered to be one of the most effective and persuasive design thinking process models at present[5]. The double diamond design model presents four main stages spanning two adjacent diamonds, representing problem seeking and its solution.

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In each rhombus, a diverging phase that expands the space is followed by a converging phase that shrinks the space (Figure 1). The four phases of discover, definition, development, and delivery are integral in the two-diamond model[6].

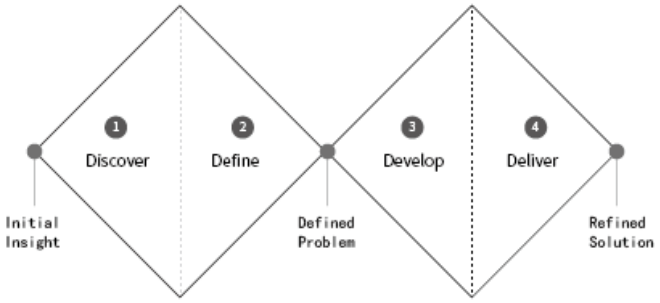

Figure 1. Double diamond model.

The first stage explores and discovers problems, which is the initial stage of a design project. This stage can take many different forms, including user-reported usability issues, new product ideas, or improvements to existing products. The first stage is usually devoted to user research, and market research to understand the problem that needs to be solved. It's a diverging process in which as much information as possible about the topic is gathered and talking to all potential target groups.

The second stage defines the problem to be solved. Data collection is followed by sorting feedback, identifying common problems, and creating initial hypotheses that defines the problems. It may be discovered at this stage that the feedback will have more problems than the problems defined at the beginning. It is critical that other issues that may be discovered along the way are more conducive to improve the user experience.

The third phase develops possible solutions. Once a well-defined problem has been found, the search for possible solutions can begin. Brainstorming, ideation, and workshops within the design team will help generate a variety of possible ideas as potential solutions and build preliminary solutions.

The fourth stage delivers the product. This represents the final step in the design process and should therefore result in a concrete solution. After refining the solution in the previous stage, the best solution is obtaining the feedback of the evaluation and rapid user testing, and it is iterated or developed. The optimized product gets new insights through market feedback, which becomes the basis for a new round of iterations.

2.2 Introduction of MR technology and its application in tourism scenarios

Mixed reality technology (MR) is an upgrade of virtual reality (VR) technology and augmented reality (AR) technology. It combines the advantages of the two technologies and can better reflect the effect of combining virtual and real scenes. Mixed Reality (MR) is implemented in an environment that interacts with everything in the real world. If the things in the environment are virtual, it is virtual reality (VR)[7]. For example, the simple superposition of displayed virtual information on real things is called augmented reality (AR). Mixed reality emphasizes the complete integration of real objects into the virtual environment, which not only allows users to maintain contact with the real world, but also interacts well with the virtual information in front of them. Users can choose to interact with virtual reality applications by configuring different professional auxiliary equipment, so as to achieve different immersive experiences and smart effects[8]. The application of virtual reality MR technology will provide users with a better sense of participation and experience. The application of these technologies will greatly subvert the experience brought by traditional forms of tourism.

2.3 Current situation and pain points of South China Botanical Garden

South China Botanical Garden has become the first choice of many tourists because of its advantages of resource and location. However, there are still some unresolved pain points for tourists visiting the Botanical Garden. For example, the area of the botanical garden is huge, but the planning of the route and the guide system of the park are not clear, and tourists are easy to get lost in the huge botanical garden. Additionally, the introduction of plant in the form of traditional pictures and texts can hardly be understood by the majority of tourists. To bridge this gap, contemporary technology has emerged as a better information carrier. For example, the emerging AR, VR, MR technology has brought vivid images for tourists to recognize the plants, the routes, and the information behind. achieve better presentation. Digitalization is another

important future trend in the development of botanical gardens[9], which largely promote the tour experience of the botanical garden by integrating big data to do numerical analysis. All in all, combining scientific and technological means in traditional botanical garden tours makes the tour process more interesting and interactive for tourists. Therefore, considering the combination of MR technology and traditional botanical garden tours is a breakthrough for improving the quality of botanical garden tour services.

3. MR BOTANICAL GARDEN NAVIGATION DESIGN PRACTICE

3.1 Discover

In the discovery phase, firstly, through literature collection and on-site research, the current development status of the South China Botanical Garden and the existing pain points in experience were obtained. The research theme is determined to bring a better guide experience to the visitors of the South China Botanical Garden through technological means such as MR technology. Next,the internal and external competitive environment of the South China Botanical Garden through desktop research will be determined , and the SWOT model to analyze the risks and challenges brought by the addition of MR technology to the Botanical Garden will be used, as shown in Figure 2. Then, through user tracking and user interviews, we can intuitively and deeply observe the user's behavior and related pain points in the botanical garden. The organized information is used to build the user journey map, analyze the user's contact points as well as emotional fluctuation, and obtain the design opportunity points according to the survey results. This result is shown in Figure 3.

According to the survey results, the main pain points of users visiting the South China Botanical Garden are: (1) The park is too large, but the distribution of guide maps and indication signs is sporadic and unclear, so tourists are easily lost in the botanical garden, (2) The tour time and route of tourists do not match the flowering period of some plants, so the surprise of the tour is low, (3) The display form of popular science information in the botanical garden is too standard , which cannot provide interactive information to users, (4) The homogeneity of related products is serious; the interactivity and usability are not high; the user viscosity is low; and the application of scientific and technological means is lacking.

Figure 2. SWOT analysis.

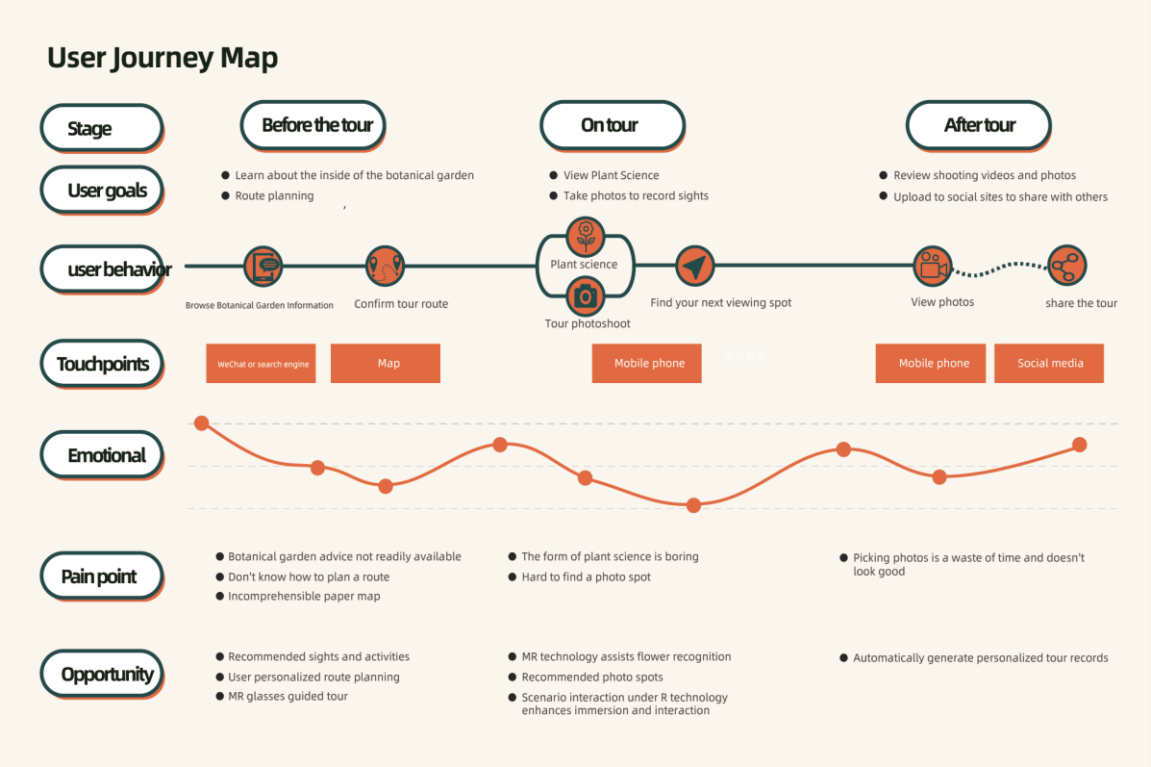

Figure 3. User journey map.

3.2 Definition

In the definition stage, the problems found in the first stage have been considered and summarized, and these problems are concentrated and solved. In this phase, we focus on the solutions that users care about and need most, weigh against available resources, and focus on core pain points. Through the user portrait (Figure 4), we identify the most important and secondary target users, and summarize the user's goals and pain points. Then, we focus on the problems to be solved through the method of How Might We (HMW), so as to determine the functional architecture.

The main users who need navigation guidance in the botanical garden are visitors who are interested in plants. The user segments can be mainly divided into plant lovers, first-time visitors, and children who are curious about plants. Plant lovers are keen on photographing plants and like to collect photos of blooming flowers. The pain point is that the tour time does not match the flowering period, and it is necessary to formulate a route according to the flowering period of the plants. For tourists who come to the Botanical Garden for the first time, reasonable route planning is important, and their goal is to visit their favorite attractions within the estimated time. For children, the monotony of plants in the botanical garden degrades the tour experience, which is their biggest pain point. Three set HMW design challenges are therefore presented based on the user model. First, "How to provide better directional guidance for tourists in the botanical garden?". Secondly, "How to provide the tourists with route planning that meets their needs?". Thirdly, "How to make the botanical information vivid and interesting?".

3.3 Develop

In the development stage, according to the pain points and goals of the user portrait, the product positioning of the navigation system of the South China Botanical Garden is constructed, and the solution of the system is designed through a low-fidelity prototype, as shown in Figure 5. The two main carriers of botanical garden navigation are the mobile WeChat applet and AR glasses. The two devices can be intelligently interconnected, giving full play to the portability of mobile phones and the immersion of MR glasses, and bringing users the best interactive experience. The main functions of the WeChat applet include route planning and selection, collection of plant illustrations, and generation of tour records. The process of planning a botanical garden tour route in the applet is shown in Figure 6. MR glasses are the main interaction carriers for tourists during their tour of the botanical garden. Users can wear MR glasses to use MR real scene navigation,

flower recognition, photography, and virtual interaction with plants, as shown in Figure 7. The addition of MR glasses greatly increases the interactivity and interest of tourists during the tour of the botanical garden.

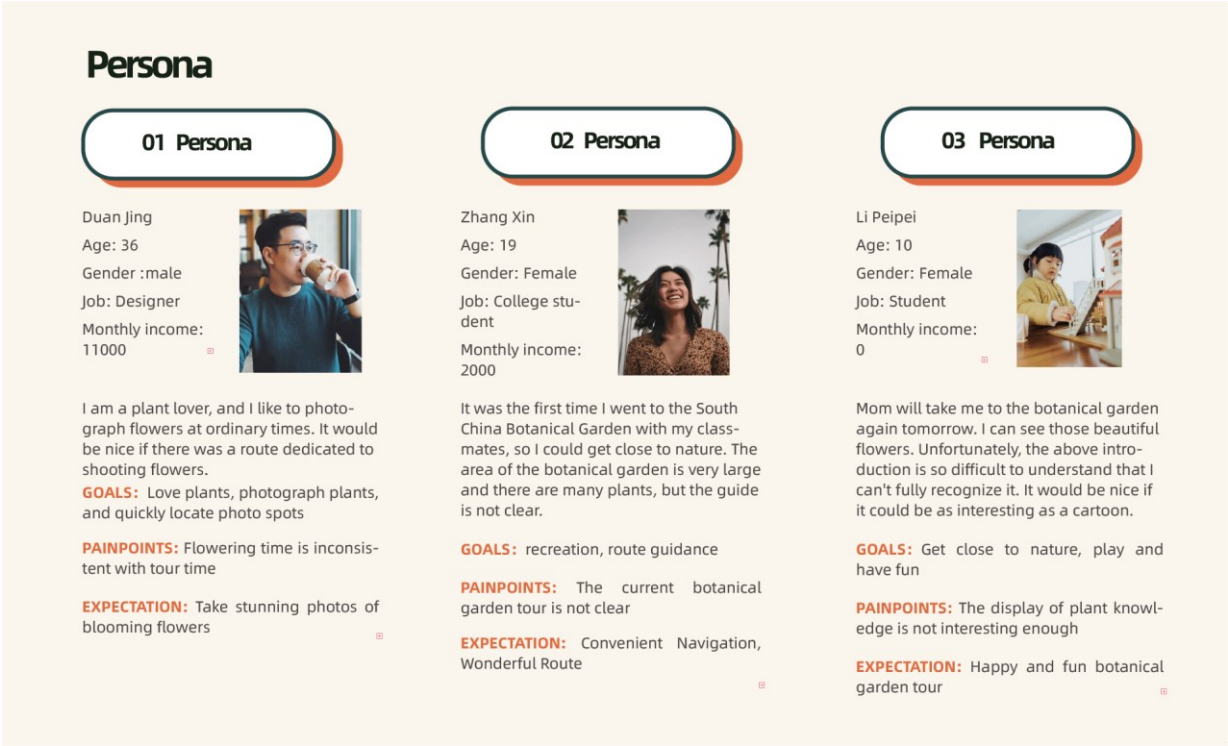

Figure 4. Persona.

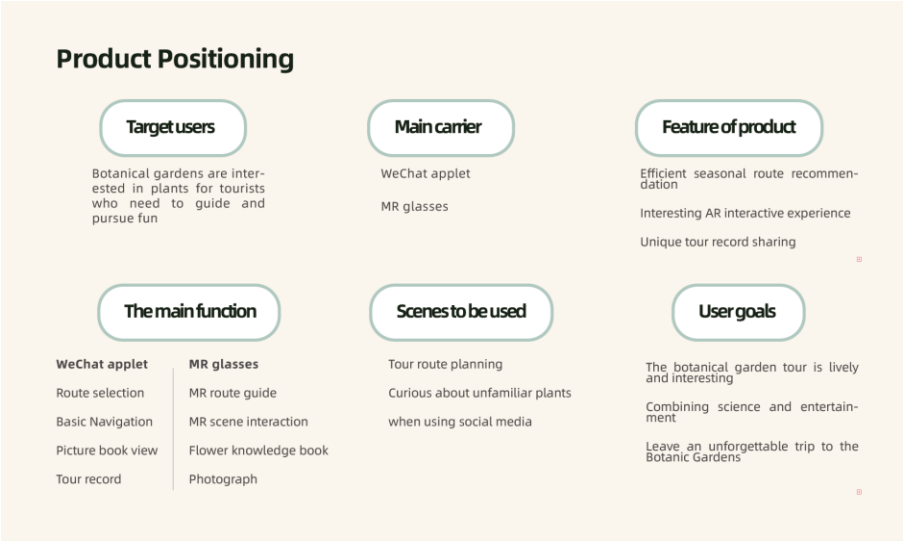

Figure 5. Product positioning.

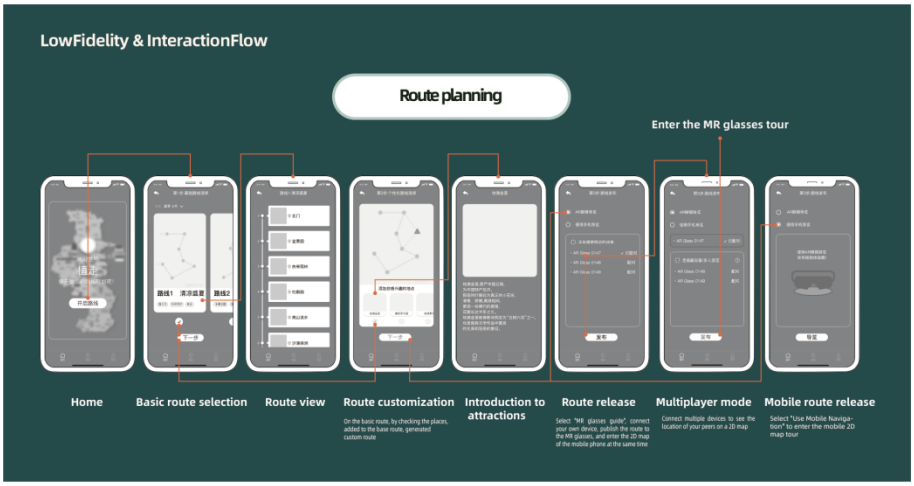

Figure 6. Route planning on mobile.

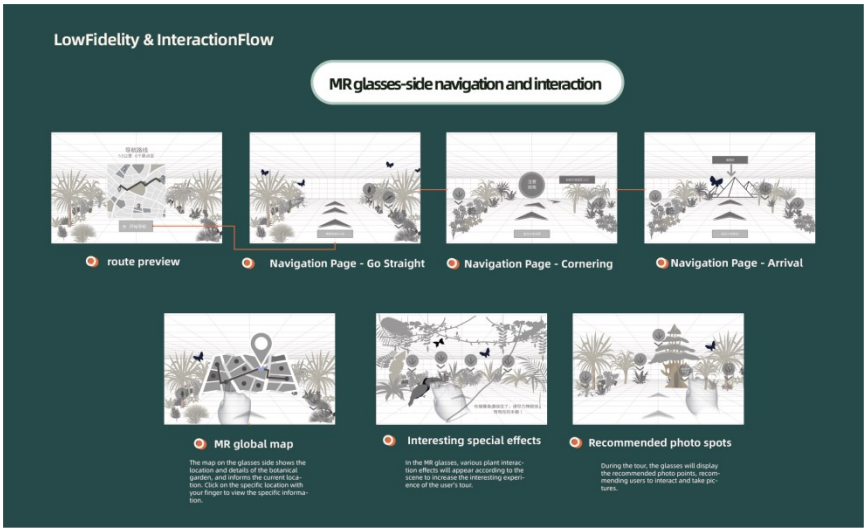

Figure 7. Glasses-end interactive experience.

3.4 Deliver

During the delivery phase, the design of the low-fidelity prototype is verified and problems are identified through usability testing and satisfaction surveys. The test selected 10 target users as subjects, and conducted four important operational tasks in the navigation system. The four tasks are: (1) The user enters the mobile applet for route selection and planning, (2) Users view plant science information with glasses, and add plants to the plant illustration, (3) Users check their location in the applet and find restaurants, (4) Users view tour reports in the applet and share them on social media. After testing, it is found that the steps of the route planning function are relatively cumbersome, and some users cannot plan a personalized route through this function, so the satisfaction of this function is low. The form of plant science in the navigation and the function to view the location are well accepted by users. However, the function of sharing excursion reports is deeply layered and causes problems for some users. To remedy this, we design a high-fidelity page for navigation based on feedback from usability testing (Figure 8). Then, the feasibility of the design results and business model is demonstrated by constructing a business canvas, as shown in Figure 9.

With the rapid development of virtual reality and augmented reality technology, MR equipment is constantly being introduced. Companies such as Facebook, HTC, and Microsoft have all launched smart devices such as VR, AR, and MR. This provides feasibility for the application of MR technology in botanical garden tours[10]. MR glasses are an experience value-added activity, so MR glasses need to be leased by users, which can become one of the revenue sources of the botanical garden. In addition, the application of MR glasses Botanical Garden can cooperate with advertisers to realize the

realization of traffic. There is also a two-dimensional plane navigation on the mobile phone to provide services for users who do not rent MR glasses equipment to solve the pain points in the tour. This makes the interests of users and commercial interests reach a balance.

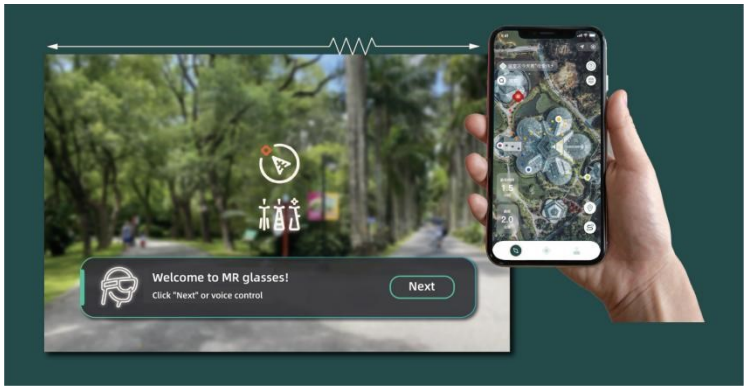

Figure 8. High-fidelity display.

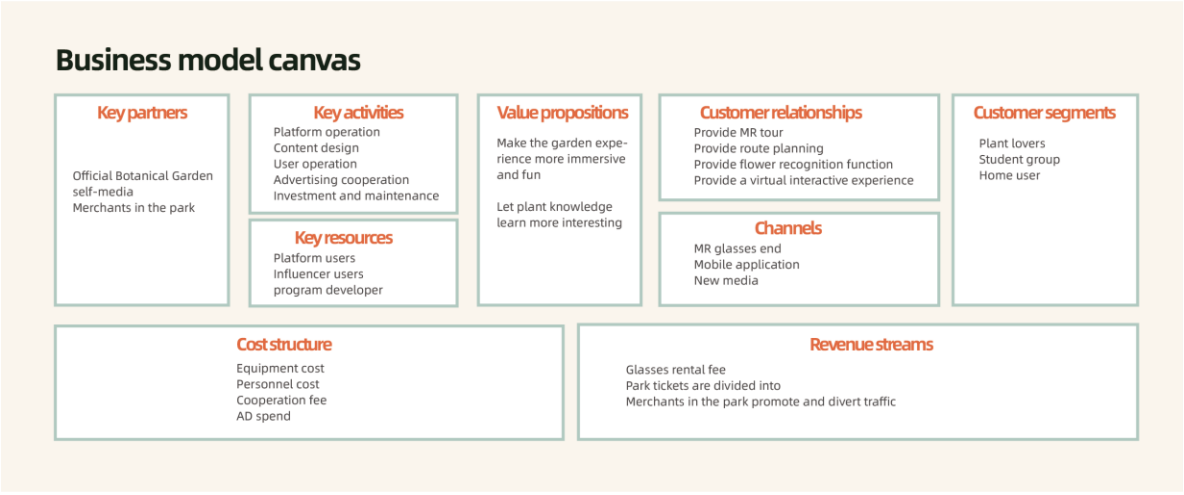

Figure 9. Business canvas.

4. CONCLUSION

Digitalization has penetrated all walks of life, and tourism is no exception. In this paper, from the perspective of service design, we use double diamond model and MR technology to optimize the design of the traditional botanical garden tour experience. This attempt provides theoretical basis and reference for the upgrade of future experience in large botanical gardens. After four stages of research on double diamond model, i.e., exploration, definition, development and delivery, a navigation design scheme that satisfies tourists' pain points has been proposed. At present, the development and construction of the South China Botanical Garden mainly focuses on the upgrading of hardware equipment and promoting research on plant science, but the research on user experience is still in the preliminary stage. Specifically, scenic navigation products are still in the stage of voice explanation and graphic explanation, but their usability and interactivity are not satisfactory. The integration of human-centered design and equipment carrier to the design of the botanical garden tour brings a promising solution to existing problems. Admittedly, the existing AR, VR, MR and other equipment are still in a development stage, so their prices and operating costs are relatively high, which hinders these advanced equipments from truly entering people's lives. However, with the rapid progress of related technologies and the deepening of theoretical research, it is believed that these problems can be solved in the near future, and AR, VR, MR devices will play a bigger role in our lives.

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