

## Design of Spot Introduction and User Interaction System Based on AR Augmented Reality Technology

Wenjun Tang, Qihang Ge, Lei Zhou, Quanyin Zhu\*

Faculty of Computer & Software Engineering, Huaiyin Institute of Technology, Huaian, China

\*Corresponding author's email: hyitzqy@126.com

**Abstract** —In order to construct a convenient, interesting attraction introduction and user interaction system, based on AR enhanced display technology, a life application system is development. The system integrates AR interactive service module, mobile user terminal module, Web communication service module, and information recording module. The user turns on the mobile user terminal and obtains functional services such as AR interactive mode and navigation area introduction. The service information is enter into the information-recording module, and the user selects and records the information via the Web to exchange and share. Experiments display that the application system is convenient and interesting. The results display that the application of the proposed system can satisfy the daily needs of users.

**Keywords**—AR, Attractions introduction, User interaction system, AR interaction service module.

### I. INTRODUCTION

The advent of AR technology has brought the real world into a virtual world. AR technology refers to the superposition of virtual images generated by computers and target objects in the real world, thus enhancing users' understanding and experience of the real world [1]. The combination of virtual reality, the construction of "reality - virtual continuous system" [2] has become a new topic. Combining the increasingly mature AR technology with Attractions technology, the real environmental effect and virtual graphics are superimpose on the same visual or perceptual space [3], so that people experience a new attractive display and attractions awareness. It is a new direction of thinking for the application of AR technology [4]. 2016 is known as VR/AR first year [5]. In recent years, several Head-Mounted Displays (HMDs) have set off on the market. However, HMD devices are still very heavy and huge, which has a negative impact on user experience.[6] Therefore, the future evolution of AR products will tend to be simplistic and life saving, so that even an inexperienced novice can learn to quickly operate procedures, greatly reducing training time, and improving operational efficiency and accuracy. [7] Realizing the application of AR technology to life, how to solve the space-time modeling of photogrammetry and computer graphics [8] is an important breakthrough point. On the AR interaction module, there are various ways of modeling. Reference can make to [9] [10]. There are many types of interactive systems where are the most important. For example, the IntelliSense interaction model [11] [12], which recognizes human behavioral intent based on bioelectrical signals and translates the recognition results into machine instructions, is a current hotspot

resolution direction. For example, reference is made to the environmental awareness and information proposed in [13] Modeling of Complex OIOT Control Systems from a Security Perspective.

Based on the previous work, we combined the AR application of augmented reality technology with the interactive system under the framework of the Internet of Things [12] to establish a convenient, fast, and interesting attraction introduction and user interaction system. The second part introduces the system architecture. The third part introduces the AR interactive service module. The fourth part gives the mobile user terminal module. The fifth part gives the Web communication service module. The sixth part introduces the information-recording module. The seventh part is the conclusion.

### II. SYSTEM ARCHITECTURE

The proposed system divides into four modules: AR interactive service module, mobile user terminal module, Web communication service module, and information recording module. The AR interactive service module is divided into an AR augmented reality module, a user interaction system, a basic service integration module, and an external application program interface module. The purpose of the mobile user terminal module is to provide the user with a service item and AR character image selection, record the user use information, and log the user information into the Web server. The function of the Web communication service module is to provide a service framework for the function development of the mobile user terminal module, provide a platform for users to communicate and share experiences. The information record module plays an important role in the proposed system. This module provides information records for the mobile user terminal module, obtains service records from the Network communication service module, and provides visualization services for the administrator.

The proposed system is an innovative system that includes two key components. The first key part focuses on providing AR interactive services, attractions introduction services, and creating user communication sharing platforms. The second key section focuses on providing service visualization for administrators. Figure 1 shows its architecture.

### III. AR INTERACTIVE SERVICE MODULE E

The AR interactive service module is the core of this proposed system. In this section, we will discuss the AR augmented reality module, user interaction system and other

functions. AR augmented reality module architecture is shown in Figure 2.

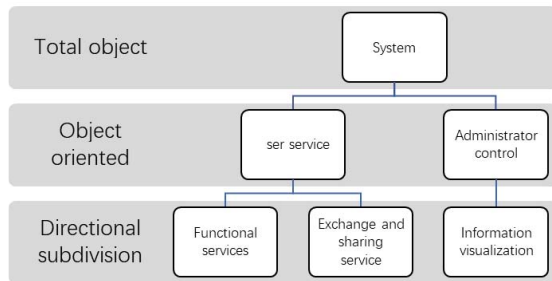


Figure 1. System Architecture

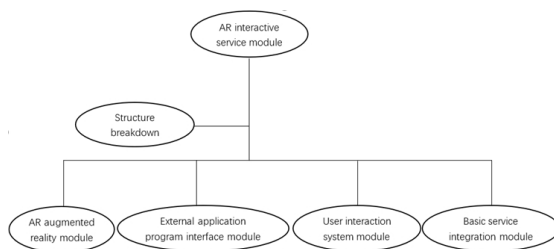


Figure 2. AR augmented reality module architecture

As shown in the above figure, the check-in workflow module can be divided into the following four sections:

- **AR augmented reality module:** This module provides corresponding AR services based on the character image selected by the user. The user's AR augmented reality module: This module provides corresponding AR services based on the character image selected by the user. The user's mobile phone camera is employ by the mobile user terminal module to present the AR augmented reality technology to the user.
- **External Application program interface module:** This module provides service interfaces such as mobile sign-in terminal interface, administrator interface, service selection interface, and exchange sharing interface.
- **User Interaction system module:** This module is used to control the movement of AR character image, ensure that the AR image responds after user interaction, and ensure the smooth operation of AR augmented reality module.
- **Basic service integration module:** In this module, the basic service required by the user are integrated, and the services such as the scenic spot introduction, navigation area navigation and AR image selection is arranged and arranged, and the external

application program interface module is connected to the mobile terminal module, to support their work. Figure 3 shows the working model of the AR augmented reality module. Figure 4 shows the functionality of the basic service integration module.

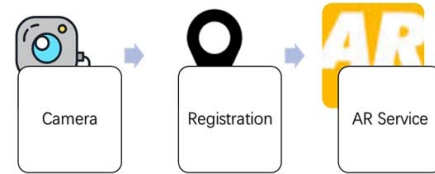


Figure 3. Working model

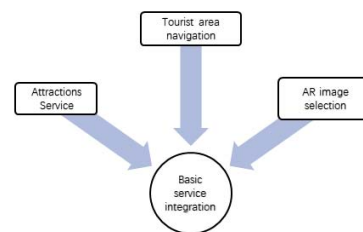


Figure 4. Basic service integration module functions

In the overall operation of the AR interactive service module, each part plays an important role. Figure 5 shows the linkage of the entire module. Figure 6 shows the conditions required for the operation of the AR interactive service module. Figure 7 shows the role of the AR interactive service module in the overall system.

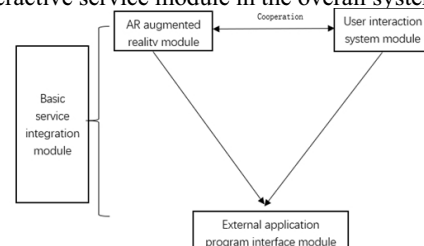


Figure 5. Relations between parts

In order to provide users with a more intuitive and convenient user experience, we have developed a mobile application. The mobile user terminal module is composed of various functional modules such as user login, AR image selection, sight location, navigation mode selection, and interactive system acquisition.

In the process of system use, the user carries a mobile user terminal to select and use various services. The specific process is display in Figure 8 and divides into the following ten steps:

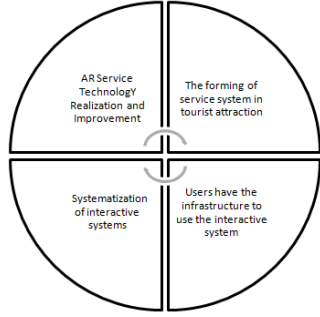


Figure 6. Conditions required for the operation of the AR interactive service module



Figure 7. Expected result

- 1) The user logs in to the account to verify the identity. If the login account is successful, goes to step2, otherwise go to step 10.
- 2) Apply to the Web server, go to step3 for service settings, go to step4 for sharing and exchange, and go to step6 to enter the AR interactive service system.
- 3) AR image settings, scenic spot mode settings, Web server response, go to step2.
- 4) Enter the information-recording module, select the required information, select and go to step5.
- 5) Enter the Web communication service module to share and communicate with other users. After use, go to step2.
- 6) The Web server sends a request to start the camera capturing and positioning function of the user's mobile phone to the mobile user terminal, and the request passes to step7 but fails to go to step2.
- 7) Get service information from the Web server; provide attractions, navigation, AR interaction and other services. After use, go to step8.
- 8) Use information record to transfer to information record module, go to step9.
- 9) The user filters the content of the activity, chooses whether to share, share goes to step5, not share go to step2.
- 10) Re-login, modify or register account.

The function of this module is to visualize the functions of each module and connect the functions of each module to make the proposed system more intuitive to display in front of the user, so that the linkage between different modules

can be simplify. Figure 9 shows the important role of the mobile user terminal module.

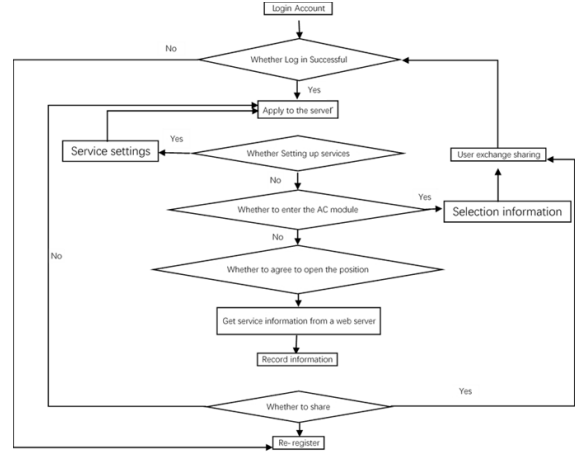


Figure 8. Flow View

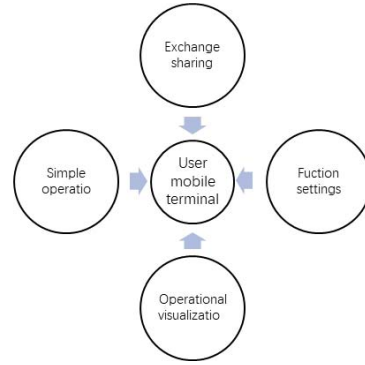


Figure 9. Mobile user terminal module function

#### IV. WEB COMMUNICATION SERVICE MODULE

In order to provide Web communication services, provide users with a free exchange of the site, allowing users to share travel history. It provides record sharing services for other modules such as AR interactive service modules and the mobile user terminal modules provide a display platform for the information-recording module. We met this requirement by implementing a Web server and used LAMP to build a Web page to implement this module. The architecture of this module is display in Figure 10.

Web servers provide users with a place to share. After the user logs in, different options that the user can select are display. According to the different needs of the user, the user can select different options to operate. In addition to the channels for users, administrators can also log in behind the scenes to manage users according to different levels of administrator privileges.

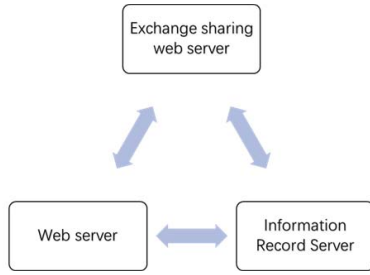


Figure 10. Web communication service module structure

## V. INFORMATION RECORDING MODULE

In order to facilitate user sharing, the proposed system completed the information-recording module. The module is base on the Android mobile phone platform and connected to the mobile user terminal in APP mode. The user requests a Web exchange server, and the application displays the query result in the form of a picture that the user autonomously photographs on the Web server. Users with different identities can obtain different levels of results. For example, the top administrator can only obtain the total results such as total usage, but cannot obtain detailed information, and the mobile terminal user can obtain detailed information. As shown in Figure 11.

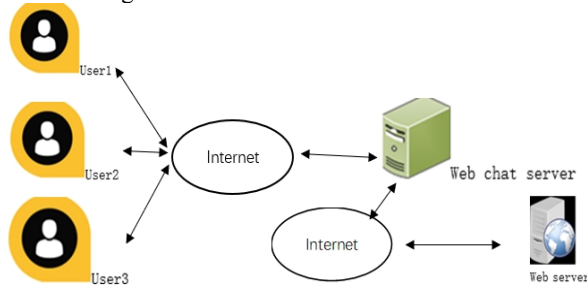


Figure 11. Information recording module

## VI. CONCLUSIONS

This paper uses AR interactive service module, mobile user terminal module, Web communication service module and information recording module to construct a convenient and interesting Attractions introduction and user interaction system based on AR augmented reality technology. Through the application in daily work, it finds that the proposed

system can achieve higher working efficiency, and the application of the proposed system can meet the needs of users' daily travel.

## ACKNOWLEDGMENTS

The work in this paper is supported by The National Undergraduate Innovation and Entrepreneurship Training Program (201811049109X) and The Provincial Key Research and Development Program of Jiangsu (BE2015127).

## REFERENCES

- [1] Billinghamurst, M., Clark, A., & Lee, G. (2015). A survey of augmented reality. *Foundations and Trends® Human-Computer Interaction*, 8(2-3), 73-272.
- [2] Liao Yufeng. Research on the Application of Augmented Reality (AR) Technology in Library[J]. *Information and Documentation Services*, 2017, 38(1):62-66.
- [3] Yang Guoqiang. The design and implementation of Card game on mobile phone based on AR technology. [J]. *Jilin University*, 2016.
- [4] Li Taizhao; Liu Zhifeng; Zhu Jianyun 2017 International Conference on Smart City and Systems Engineering (ICSCSE) [J]. 2017, 216 - 219
- [5] Li Zhigang. In VR/AR YeAR One, see how the industry chain giant layout - GTIC 2016 China (Beijing) VR/AR industry summit side note [J]. *Electronics*, 2016, (05) : 32.
- [6] Xueshi Hou; Yao Lu; Wireless VR/AR with Edge/Cloud Computing[J].Sujit Dey 2017 26th International Conference on Computer Communication and Networks (ICCCN), 2015, 1-7.
- [7] Anonymous. Rookie Network External Display "AR intelligent logistics system"[J]. *Logistics Technology and Application*, 2016(11):118-118.
- [8] P. Tutzauer, M. Klein, D. Fritsch, "The 4D-CH Calw Project - Spatio-temporal Modeling of Photogrammetry and Computer Graphics" in *Photogrammetric Week '15*, Berlin & Offenbach: Wichmann & VDE, pp. 207-2011, 2015.
- [9] D. Fritsch, M. Klein, M. Ioannides, "Design of 3D and 4D Apps for Cultural Heritage Preservation-3D Documentation of 500 Impo" in *Digital Heritage, Lecture Notes Computer Science*, Berlin:Springer, vol. 10650, no. 2017.
- [10] D. Fritsch, M. Klein, "3D Preservation of Buildings - Reconstructiong the Past", *Multimed. Tools Appl*, 2017.
- [11] Gu Xiaonan, Lan Feifei, "Intelligent home system based on the body sense interaction technology under the Internet of things [J]", *Science and Technology*, vol. 35, 2016.
- [12] Liu Xiaohui, "Information perception and interaction technology of the Internet of things [J]", *China Computer & Communication*, vol. 16, 2017.
- [13] Y. Ge, X. Zhang, B. Han, "Complex OIoT Control System Modeling from Perspectives of Environment Perception and Information Security[J]", *Mobile Networks & Applications*, vol. 22, no. 3, pp. 1-9, 201711..