Design of Mobile Internet Platform and Information Visualization Based on Furniture Display and 3Dmax

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Abstract—Like other works of art in ancient China, furniture in the Ming and Qing Dynasties not only has profound cultural and artistic heritage of the Chinese nation, but also has elegant and practical functions, which makes people have endless aftertaste. It represents the peak of Chinese traditional furniture manufacturing. This paper designs a mobile Internet platform based on the furniture display culture of the Ming and Qing Dynasties, which displays the furniture culture of the Ming and Qing Dynasties from multiple angles and all directions from the aspects of technology, history and entertainment, and brings those furniture flowing all over the world together. In the implementation process, we mainly use Unity3d for Android development and 3Dmax for model production. Through this platform, we can understand the development of furniture in the Ming and Qing Dynasties and learn history and culture interestingly and cultivate humanistic feelings. We can not only appreciate the style of furniture in the Ming and Qing Dynasties, but also spread China's excellent traditional culture and contribute to the development of China's cultural industry.

Keywords—Furniture in the Ming and Qing Dynasties, Mobile Internet platform, Unity3D, 3Dmax, Traditional culture

I. Background

Since human entered civilization, clothing, food, housing and transport have often been the most direct and important aspects of living standards, of which furniture, which is closely related to life, is an important carrier of the civilization of human living rooms. In the people's long-term creative practice, the wisdom and ability of human beings have been fully demonstrated, accumulating the contents of social life and various concepts of religion, philosophy and science of different peoples, countries and regions, and different historical periods. Therefore, under the influence of many different political, economic and cultural factors, social folklore and the customs of the times, the furniture of various nationalities around the world has produced their own different morphological features and stylistic characteristics [1-3].

China is one of the four most ancient civilizations in the world, and the ancient furniture of the Chinese nation has evolved over the course of several thousand years to take on a variety of different historical aspects. In particular, after the derivation of the Tang and Song dynasties, the Ming and Qing dynasties quickly developed to their historical peak. The furniture of the Ming and Qing dynasties gradually became an artistic treasure of Chinese and foreign fame, reflecting the glory of unparalleled art and unique cultural charm. Furniture collecting began in the 1930s, when foreigners collected and acquired Chinese Ming and Qing furniture in large numbers and shipped it overseas. The Chinese furniture styles that emerged as early as the sixteenth century were, in a sense, long been models and precursors of the Western design revolution. In a time when awareness of heritage conservation has been repeatedly stressed, the culture of Ming and Qing furniture should be explored and passed on even more deeply [4-6].

II. Design purpose

This paper designs a mobile internet platform that allows people to experience the charm of Ming and Qing dynasty furniture more visually. Presented as a 3D model, the software brings together furniture from all over the world, starting from the five categories of furniture furnishing in the Ming and Qing dynasties - sleeping, sitting, bearing, cupboard and miscellaneous furniture - and allowing people to experience the evolution of furniture in both periods by learning about their materials and craftsmanship. Through an increasing awareness of classical furniture, people can expand the future of our lives at a higher level, presenting a wide field of scientific thinking and better contributing to the prosperity and flourishing of our arts and crafts.

III. Platform overview

A. Platform functionality

Ming and Qing Dynasty furniture, like other ancient Chinese artworks, not only has a profound Chinese cultural and artistic heritage, but also has elegant, practical and evocative functions, which represent the pinnacle of traditional Chinese furniture manufacturing. The platform is a multi-faceted display of Ming and Qing Dynasty furniture culture in terms of craftsmanship, history and entertainment through the use of patterns and 3D models, bringing together those pieces of furniture that have flowed around the world. The platform mainly uses Unity3D for Android development and 3Dmax for model making. Through this platform, people can learn about the development of Ming and Qing dynasty furniture, learn history and culture in an interesting way, cultivate humanistic feelings, not only appreciate the elegance of Ming and Qing dynasty furniture, but also spread the excellent Chinese traditional culture and contribute to the development of China's cultural industry. The detailed functional diagram of this platform is shown in Figure 1.
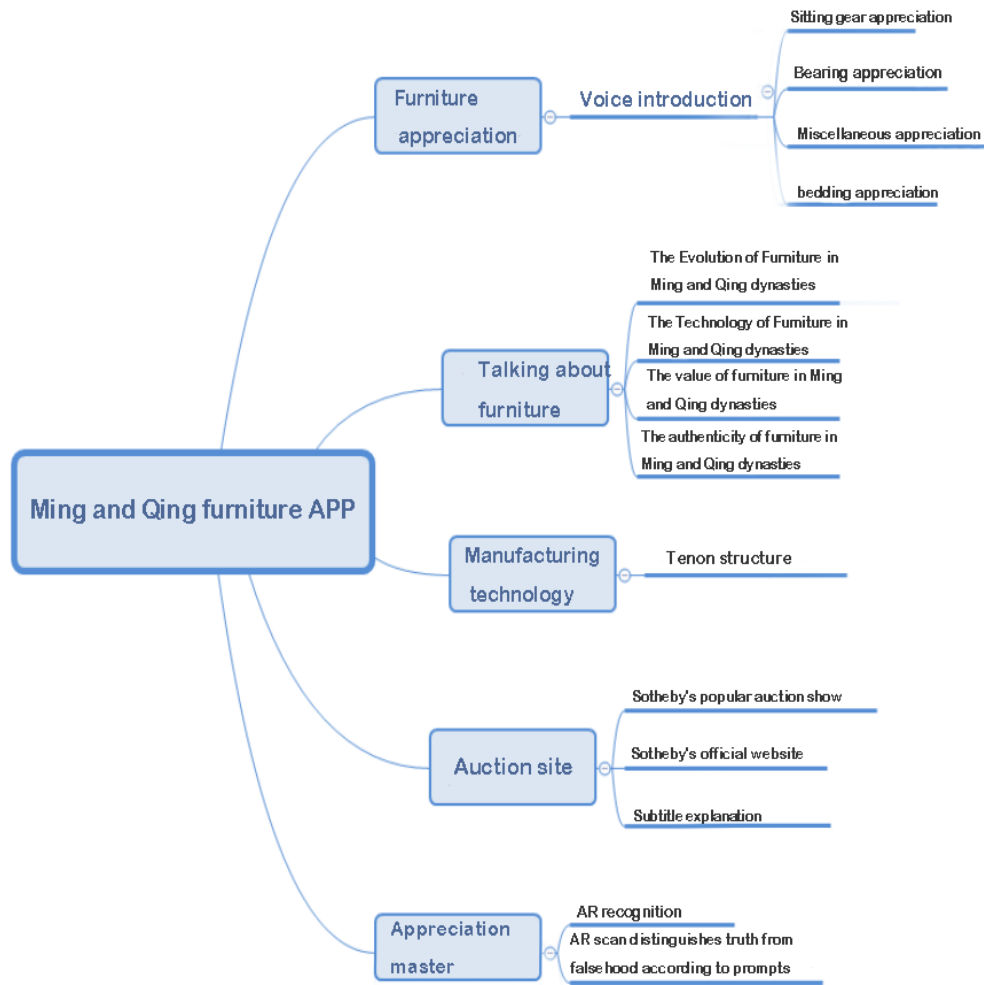
Fig.1 Functional diagram of the platform

B. Platform features

In a world where cultural soft power is repeatedly emphasized, traditional cultural elements have greater scope for dissemination. It is not as easy to collect as ancient coins, nor as valuable as pottery and porcelain, but it must be acknowledged that classical furniture is also an extremely important part of Chinese culture [7]. It is for this reason that our project proposes a better way of spreading culture than museum exhibitions or books. Through this platform, people can pick up their mobile phones at home and have the experience of visiting a museum with physical furniture.

From the point of view of consumers and usage scenarios, this software is mainly aimed at young students and adult groups interested in classical furniture. The software can be promoted to teaching venues as a teaching aid platform; it can also be promoted as a display tool through classical furniture cultural research organizations, youth palaces and libraries; it can also be promoted to historical transmission, especially cultural propaganda, as an aid platform for cultural exchange.

IV. DESIGN DETAILS

A. Platform application design

This platform uses Unity3D as the tool for application development. During the development process, business logic scripts were written in C#, interface styles were deployed using UGUI, and network modules were built using UNET.
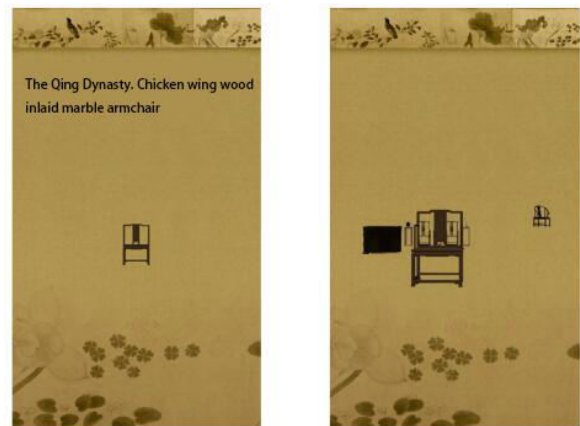
1) Furniture appreciation section

Fig. 2 Rendering of the furniture appreciation section

The furniture appreciation section involves gesture recognition technology and 3D modelling technology, using 3D modelling to construct various types of Ming and Qing dynasty furniture [8], such as a Ming dynasty pear four-headed official hat chair. The modelling is imported into Unity3D to provide the base objects for gesture recognition and construct a gallery of Ming and Qing dynasty furniture. The gesture recognition script is divided into two main blocks: single-finger gesture recognition and two-finger gesture recognition. The single finger recognizes the user's swipe and

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tap operations, while the two fingers recognize the user's zoom operations. Using the gesture recognition function, it is possible to display the Ming and Qing furniture models in front of people, while providing voice explanations to make the introduction process more three-dimensional [9-10]. The effect of the furniture appreciation panel is shown in Figure 2.
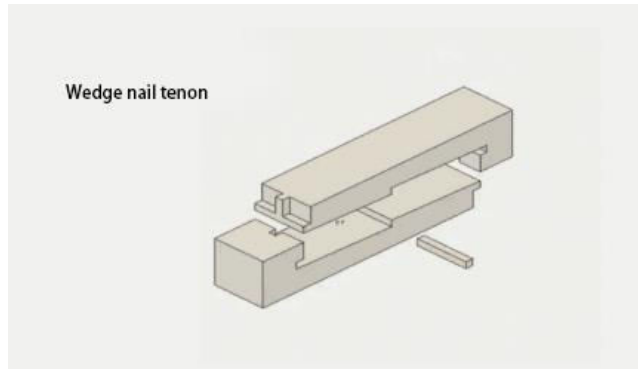
2) Production process boards

Fig. 3 Effect of making a craft panel

The Crafting section presents the various ancient Chinese mortise and tenon structures to the user, allowing them to experience the ingenuity of the ancient craftsmen through animation. The crafting animation is animated manually through Unity3D's animation system, writing frame animations to link the crafting process into a smooth demonstration animation in the form of frame animations. At the same time, the user is able to click and drag to participate in the whole process of making the animation. The effect of the production process panel is shown in Figure 3.

3) Rambling about the furniture segment

The Comic Furniture section contains the evolution and brief description of Ming and Qing furniture, forming a long scroll of history that immerses the user in the long history of Ming and Qing furniture. The section is laid out with UI and text, and gestures are recognized to move the content around the screen, so that the content is presented in a scroll-like manner. The effect of the Comic Furniture section is shown in Figure 4.

Fig 4. Rambling furniture panel rendering

4) The Masterpieces section

The Master Appraiser section utilizes Vuforia's AR SDK to enable the use of AR to scan images to show the furniture model corresponding to the image in real time, and then the user can identify the authenticity of the furniture based on the hints of the displayed model. This makes our application not only a cultural popularization software, but also an immersive one, truly integrated into the beauty of the Ming and Qing dynasties [11]. The effect of the Master Appraiser section is shown in Figure 5.
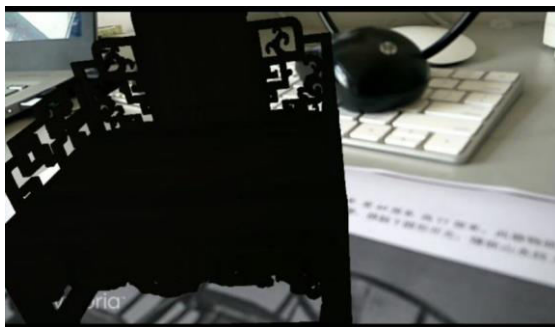

Fig. 5 Effect of the Master Appraiser section

5) The auction market segment

The Auction Market section uses the layout UI to display detailed information about Sotheby's popular auction items to users, allowing them to understand the market situation in real time. The effect of the Auction Market section is shown in Figure 6.

Fig. 6 Rendering of the auction market segment

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B. Model design

We use 3dmax as a modelling tool. The specific modelling process includes: 1. general wiring, 2. making details and smoothing the model, 3. making mapping. The following is a brief introduction to the modelling process, taking the Ming Dynasty pear four-headed official chair as an example.

1) Firstly, refer to the picture and use the [Plane] and [Tangent Rectangle] tools and the [Edit Polygon] modifier,

[Shell] modifier and [Mesh Smoothing] modifier to make the official chair cushion and chair leg models.

2) Next, use the [Line], [Circle] and [Rectangle] tools and the [Edit Polygon] modifier and [Mesh Smoothing] modifier to create the backrest and footrest models.

3) The effect is rendered again with v-Ray.

4) Finally, materials and textures were created by using VRayMtl. The model design mapping is shown in Figure 7.
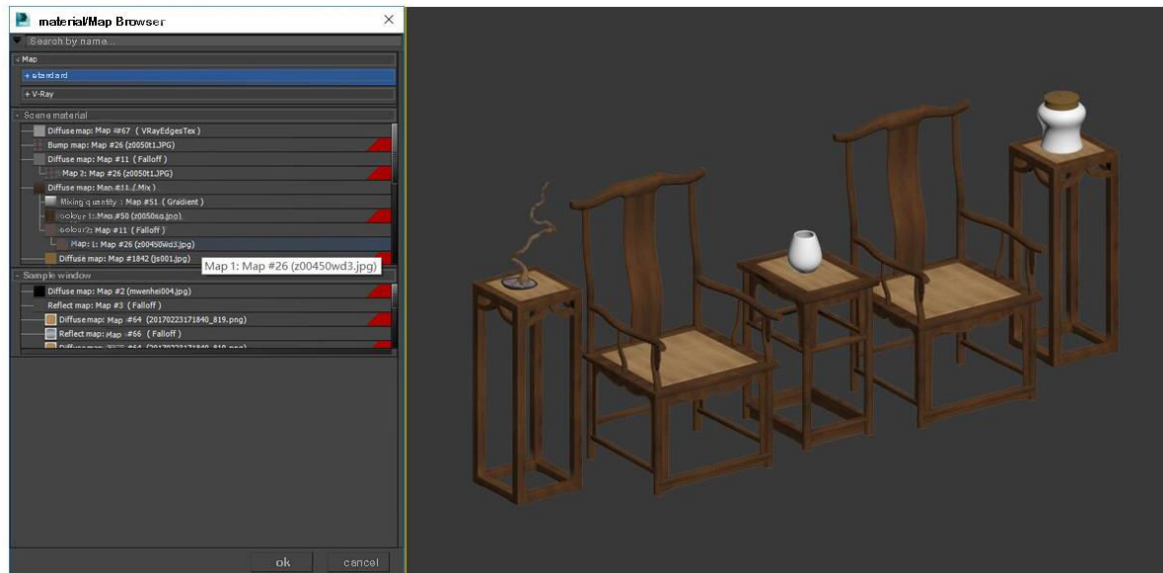

Fig. 7 Model decal of a four-headed official's hat chair in pear, Ming dynasty

V. CONCLUSION

All the models on this platform are based on real furniture and highly recreate the original historical appearance of the heyday of furniture development in the Ming and Qing Dynasties. Through this platform, people can view the collection in a three-dimensional virtual space, thousands of miles away, and the furniture that records the clothing, food, housing and transport of the people of the Ming and Qing Dynasties is as close as possible to their eyes. In a context where classical furniture culture is being gradually forgotten, the mobile internet platform we have designed and developed is thematic and introduces classical furniture culture from many angles, allowing users to gain a good understanding of the history of Chinese furniture during the Ming and Qing dynasties, and is suitable for a wide range of people, with a very positive effect on patriotic education, historical and cultural inculcation and cultural heritage for people of all ages.

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