Design of Remote Real-time Sharing System Based on Virtual Reality Technology

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Abstract. Virtual reality technology is a kind of high-end science and technology which integrates computer graphics technology, computer simulation technology, sensor technology and display technology. It creates a virtual information environment in multidimensional information space and makes users feel immersive. Based on virtual reality technology, this paper studies the real-time panoramic image and virtual character data transmission with WiFi network as information transmission carrier and puts forward the development and application of remote real-time sharing system.

Keywords: Virtual Technology, Wireless Network, Data Transmission, Remote Real-Time Sharing

1. Introduction

VR the header display is a prerecorded scene, this paper puts forward the idea of whether wireless network can be used as the carrier to realize the immersive experience of remote real-time scene [1]. On the basis of this operation, in order for the experiencer immersed in the virtual world to make accurate action judgment in the virtual environment, this paper proposes that we can build a third D of characters again. The virtual character can be controlled by a carrier and operated in VR head instead of the accuracy of our experimental action. Based on this, in order to realize the immersive experience of 3D virtual world and 3D characters, this paper proposes a remote real-time sharing system. The system consists of three parts: 360-degree panoramic camera guide helmet, VR head display, angle APP.

2. Remote Real-time Sharing System Based on Virtual Reality Technology

2.1. Virtual Reality Technology

VR technology is the abbreviation of the Virtual Reality initials in English, which means virtual reality technology, which was translated into spiritual technology and illusion technology in the early days of our country. It is a comprehensive technology that combines computer technology (including software technology and hardware technology), communication technology, remote sensing technology, artificial intelligence technology, robot technology and behavioral and psychological technology [2].
Virtual 3D projection display system is the most important 3D/VR graphic display output system in the whole virtual reality system. Its core part is the high-brightness projector and related components [3]. It displays the high-resolution 3D/VR scene generated by the VR workstation in a large stereo projection way, which makes the interactive 3D virtual world appear in front of the participants highly realistic, thus providing a group participation, group viewing and highly field-oriented virtual reality environment for VR users, and combined with the necessary virtual peripherals (such as data gloves, degree of freedom position tracking system or other interactive devices), participants can freely interact and manipulate from different angles and orientations to realize real-time interaction and real-time roaming in the 3D virtual world [4-8].

Using 3D model real-time display, 3D location tracking, tactile sensing technology, Internet of things tactile sensing technology, high-speed computing and parallel computing technology to make 3D of characters, so that the animation and interactive 3D virtual world appear in the VR head display together.

2.2. Remote Real-time Sharing System
With 360-degree panoramic camera helmet connected applications, the use of WiFi network or data network real-time video sharing, APP, for network transmission carrier, generated in the APP and drive three virtual image, free to define the image style, exclusive key driver, then the APP and head of VR in the show with the network connection, real-time image and virtual image transmission to VR head show, implement interactive experience. HBase database as image data repository, Real-time panoramic image transmission is realized (see Table 1 for specific operational process implementation). HBase is Google Bigtable open-source implementation, Similar to Google Bigtable using GFS as their file storage system, HBase use Hadoop HDFS as its file storage system; Google run MapReduce to process the massive amounts of data in the Bigtable, HBase also use Hadoop MapReduce to process massive amounts of data in HBase; Google Bigtable use Chubby as a collaborative service, HBase use Zookeeper as correspondence [9].

| Table 1. Operation of remote real-time sharing system |
|-------------------------------------------------------|
| Remote real-time sharing system | The method by which the sharer and the sharer add friends on the mobile APP and open the device's mobile network to connect with the device at the same time |
| Sharer | Share this moment with the person you're sharing it with |
| By distributors | Wearing glasses, you can experience the viewer's vision and see your own virtual model |

3. Design of Application Software in Remote Real-time Sharing System

3.1. Technical Difficulties of VR Delays
VR "delay" refers to the total waiting time for optical signals from the head movement to the head display device (HMD) to map to the human eye.

Delay will affect the player's attention. The principle is that the visual acceptance of its own body state is inconsistent with the middle ear vestibular organ responsible for perceiving the body state. The feedback of the central nervous system to this state is nausea to remind the abnormal state of the body. Simply put, when wearing a VR head to move the head, due to delay, visual changes are observed slower than the body feels, resulting in conflict and dizziness [10].

According to the study, this delay is limited to 20 ms, the human body will not have rejection. And, of course, more than 20 ms doesn't necessarily cause dizziness and nausea [11].

VR equipment delay mainly depends on four factors: display delay, calculation delay, transmission delay and sensor delay.(see figure 1) Display delay and transmission delay are the main factors
causing VR equipment delay. This paper mainly studies and analyzes the data delay of 360-degree panoramic image real-time transmission.

### 3.2. Software Design and Technical Difficulty Solving

Technical DVI and HDMI, of Digital Video Interface at Resolution 2048×1. Taking the high-definition video stream of 152 as an example, 3 colors of red, green, and blue make up one pixel and each color is quantized by 8 bit. If 60 frames are played per second, the amount of data \( s \) will be over 23 Gbyte. In order to realize long distance transmission, it is necessary to achieve lossless real-time transmission through optical fiber network interface, which is very expensive. And through the ordinary 100-megabit network transmission, there is a large delay, video definition is not high.

To solve the problem of remote high-definition video transmission delay, the development of 5 G technology makes it possible to transmit information in real time and without delay. The WiFi network and 5 G network are used as information transmission carriers. Mobile phone applications as data transmission and storage media to realize low delay real-time data transmission. Cell phone application development using java programming (see Figure 2).

![Figure 1. Pie chart of VR delay factor distribution](image1)

![Figure 2. APP Programming JAVA Flowchart](image2)
Compile the source file into a binary intermediate code, stored in a class file, then run class files by running Java virtual machines corresponding to the operating system platform environment. Compiled bytecode, the method implemented in the class file is called to meet the Java API call of the program. Open the GPS location, App click the connection, the helmet press the start button, the phone and helmet and VR glasses to connect, on the App can choose a number of different features of the 3D model characters real-time transmission. App click share can be seen through the helmet and VR glasses and the previous selection of 3 model characters D real-time transmission to friends.

Table 2. Data transmission performance under different networks

| Operating frequency(GHz) | 2.4/5 GHz | 2.4GHz | 0.9GHz licen free |
|-------------------------|-----------|--------|-------------------|
| **Power (Rx)(mW)**      | 125       | 14     | 38                |
| **Power(tx)(mW)**       | 650       | 32     | 300               |
| **Data rate(kbps)**     | 10000to32000 | 250   | 0.3to9           |
| **Range(m)**            | 40to90    | 300    | 1000to15000      |
| **Network size devices/radios** | 10  | 500    | 1                |

Different network environments have some influence on video transmission and signal transmission, because the transmission rate is also different under different networks. (Data transmission performance under different networks is shown in Table 2) The software mentioned in this paper supports 5G network connection wireless connection and so on, which adds more guarantee to solve the problem of video transmission delay. For various reasons, the Wi-Fi, 5G, 4G network in the region cannot be used temporarily, the opportunity communication is adopted, the routing scheduling algorithm which can realize the gradual receiving video block is used, the block shortage model is established, and the block tends to distribute evenly in the target node [12].

Table 3. APP system testing of remote real-time sharing system

| Functional | login check |
|------------|-------------|
| **Test purpose** | Verify that legitimate information is entered |
| **Test data** | Membership ID:1111 Password :1111 |
| **Test mode** | Same as expected |
| **Test items** | One | Two | Three | Four |
| **Operational description** | Enter ID, press the login button. | Enter the password and press the login button. | Enter the ID and password and press the login button. | Enter the ID and password and press the login button. |
| **Record** | ID:1111, The password is empty | ID is empty, password :1111 | ID:1, Password :1 | Username:1111, password:1111 |
| **Expected result** | Display warning message "User Name or Password Error !" | Display warning message "User Name or Password Error !" | Display warning message "User Name or Password Error !" | Log in correctly to member interface |
Actual result | Display warning message "User Name or Password Error !" | Display warning message "username or password error" | Log in correctly to member interface
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And complete user interface test, function test, interrupt test, compatibility test, performance test, hardware configuration requirement test for APP. The first generation of APP installation package memory about 10 MB, system hardware requirements, if 100000 users at the same time online, considering real-time video sharing and 3 D model control, it needs to achieve running speed of about 200 K per person per second, User video storage space is expected to be 20 G. The software in this article has passed the system test, the system test shows that this method can realize efficient video data preview and transmission in bad communication environment and can provide support for wireless mobile transmission of related video content (see table 3).

4. Design of Real-time Video Recording And Transmission Equipment in the System

For VR real-time scene experience, a device must be used for real-time video camera. Based on the data calculation, a 360 degree guide rail camera helmet is designed by using CATIA to solve the problem of wearing comfort and video shooting smoothness. A guide rail is arranged in the upper half ring of the helmet shell. The guide rail is connected with the fixed frame and the connecting plate is located on the upper side of the fixed frame, and the connecting plate is connected with the connecting shaft through the turntable, and the camera body is rotated by connecting plate and turntable. In order to achieve the camera can rotate parallel and three-dimensional space on the guide rail, complete multi-angle, multi-directional, no dead angle shooting. The helmet design is shown in Figure 3.

**Figure 3. Remote Real-time Sharing Helmet design**

The utility model relates to a helmet with camera function, comprising a cap body and a protective body, which is positioned on the inside of the cap body, a top lamp, a camera, a guide rail and a switch are arranged on the outside of the cap body, a circuit board is arranged on the inside of the cap body, the top lamp is located on the top of the cap body, the top lamp is connected with the switch and the circuit board respectively, the camera is located on the guide rail of the cap body, the cap body comprises a shell, a buffer layer and an inner lining, the circuit board is located between the shell and the buffer layer, the inner lining includes a sweat and a breathable layer, and the sweat absorption layer is located on the inside of the breathable layer.

The three-dimensional position tracker installed in the helmet (the special hardware device used in virtual reality technology to measure real-time changes in the position and direction of
three-dimensional objects is the tracker, Control observation direction and control object in virtual reality application) and roaming and manipulation interface (allow interactive change of virtual environment and view during exploration by selecting and manipulating interested virtual objects) is connected with mobile phone wifi or Bluetooth to convert digital signal of helmet shot scene into electrical signal to mobile phone angle App, which will realize real-time transmission of VR scene.

The camera body is connected with the guide rail through the connecting frame, and the two ends of the connecting rod are rotated and connected to the guide rail. Realize the free rotation of the camera body, expand the shooting range of the camera body, and reach 360-degree panoramic shooting. After shooting, the sloshing is very small, and the later stage is added to the stabilization treatment, when watching the VR video, it will not produce vertigo; according to adjusting the motion track of the camera along the guide rail, Control the position and number of cameras. The helmet is designed and installed with Bluetooth circuit board, which is responsible for APP wireless connection with mobile phone, realizing wireless data transmission, transmitting video to mobile phone application, then connecting glasses to mobile phone Application, thus transmitting video to VR head display. A small portion of the application code and the helmet display section are shown below (see Table 4).

| Table 4. Partially intercepted code for presentation |
|---------------------------------------------------|
| A small portion of software code intercepted       |
| <manifest platformBuildVersionName="9" platformBuildVersionCode="28" package="appinventor.ai_test.Vview" xmlns:android="http://schemas.android.com/apk/res/android"> |
| Helmet Display Code                                |
| <div style="max-width: 1707px; max-height: 902px;"> |
|     <div style="left: 0px; width: 100%; height: 0px; position: relative; padding-bottom: 52.8412%;" style="top: 0px; left: 0px; width: 100%; height: 100%;"> |
|         <iframe src="2622_VR.50.html" allowfullscreen style="top: 0px; left: 0px; width: 100%; height: 100%;" position: absolute;" frameborder="0" scrolling="no"> |
|     </div> |
| </div> |

5. Conclusion
This paper aims at the real-time scene of virtual technology and the transmission 3D virtual characters, establishes the video data optimization block method which accords with the wireless network communication ability and the video compression rule, and combines the actual application need of image transmission. This paper analyzes the VR delay, camera quality and equipment problems in real-time transmission, and puts forward the solution of the problem and the development and operation of real-time image transmission system.

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