Studies on the Application of Virtual Reality Technology in Sports Training Under the Background of Internet

Hui Ye

Physical Education Department, Zhongyuan University of Technology, Zhengzhou 450007, China

Abstract

In recent years, thanks to the progress and development of science and technology, the virtual reality technology has emerged at the right moment, as a new technology, the virtual reality technology has been applied widely in all the fields, and also plays an important role more and more obviously. In traditional sports training, the colleges and universities need to purchase corresponding sports training devices, which not only increases the cost input of colleges and universities, the maintenance and management of infrastructures are also relatively difficult, furthermore, during the process of sports training, people are easily to be injured, and difficult to really master some highly difficult movements only through demonstration of coach. Thus it can be observed that, the effect of traditional sports training methods is also imaginable. Realizing the simulation of electronic training scenes through the combination of virtual reality technology and sports training will undoubtedly provide new thought for solving the above problems. Therefore, through analysis on the characteristics of virtual reality technology under the background of internet, this thesis clarifies the functions of the virtual reality technology and discusses the necessity of the applications of the virtual reality technology in sports training in depth, analyzes relevant key technology of the application of virtual reality technology in sports training, and carries out studies on the application of virtual reality technology in related fields of sports training.

Keywords: Internet, Virtual Reality Technology, Pe Major, Sports Training.

1. Background of studies

1.1 Overview of studies

The virtual reality technology is also named as VR technology, VR is abbreviation of Virtual Reality, it is a new technology developed gradually with the core of computer technology, by means of the software and hardware of computer and sensing device, it can build artificial virtual environment of three-dimensional information with lifelike effect. Through multi-functional sensor technology, 3D computer graphics technology, high definition display technology and interactive product technology, it utilizes position tracing devices, display equipment, computers and other equipment to achieve man-machine interaction functionally, and thus enables users to have the experience of being personally on the scene, to carry out sports training under such virtual environment and to observe and understand the internal changes and law of motion more visually and systemically, and also assists users to master and apply the key points and various skilled movements in sports training more deeply (Wu, 2017). In this way, it can not only solve disadvantages of traditional sports training methods, and also bring more newfangled experience to users, increase users’ interest in sports training and realize the integration of physical education and training with computer technology actually, which will certainly become the future development trend of college physical education and optimize the training effect of students at the greatest extent.

1.2 Purpose of studies
The purpose of studies of the thesis lies in carrying out in-depth studies on relevant application of virtual reality technology in sports training under the background of internet, enabling students to master the key points of sports training more scientifically by means of virtual reality technology through the integration of virtual reality technology and sports training, reducing the risk in sports training, solving the disadvantages in traditional sports training and improving the students’ interest and experience feeling in sports training, in order to optimize the training effect of students and cultivate more sports elites for colleges and universities. Therefore, this thesis clarifies the characteristics and functions of virtual reality technology under the background of internet, discusses the necessity of the application of virtual reality technology in sports training, and deeply analyzes the key technology of virtual reality system, in which virtual reality technology is taken as the core, that applied in sports training; and on this basis, the thesis carries out studies on specific application of virtual reality technology in relevant fields of sports training in depth.

2. Characteristics and functions of virtual reality technology under background of internet

2.1 Characteristics of virtual reality technology

The improvement of science and technology level enables people to research and develop a virtual reality system through the combination of virtual reality technology with computer technology, internet technology, sensor technology and many other kinds of modern information technology, such system is mainly composed of four major subsystems, which are respectively subsystem of auditory sense, subsystem of visual sense, subsystem of information feedback and subsystem of body dimension tracking (Qian, 2017). The virtual reality technology has lots of characteristics, in which four characteristics are the most outstanding, i.e. multi-sensory, interactivity, immersive and imagination. In regard of the characteristic of multi-sensory, the virtual reality technology not only possesses visual perception characteristic, and also owns the perceptibility of auditory sense, the perceptibility of smell sense, the perceptibility of force sense, the perceptibility of touch sense, the perceptibility of taste sense and the perceptibility of sports, at present, although the functions of virtual technology become more and more rich and powerful, due to the restriction of technology, the current virtual reality technology only possesses the perception characteristics of force sense, sports, auditory sense and visual sense (Liu, 2017). While the interactivity changes the mode that users receive information, enables users to realize the interaction and contact between man-machine and objects by means of virtual reality technology according to practical demand, and greatly improve the sense of reality of users. The characteristic of immersive is reflected as the immediate feeling of users, the users are even able to has the same feeling as what they feel in the real world through the application of virtual reality technology, such technology brings users a strong feeling of placing themselves in the scene. The characteristic of imagination is reflected as the powerful expansion function of such technology, it can be said that the virtual reality technology brings limitless imaginary space to humans and changes peoples’ perceptions greatly; the things that cannot be realized in real life also come true through the application of virtual reality technology (Xu, 2016).

2.2 Functions of virtual reality technology

The virtual reality system with the core of virtual reality technology has a very important function in sports training, can record, analyze and output data during the entire process of sports training, and also owns the functions of planning, aid decision making, prediction and control. It runs through the whole process of sports training, can not only assist relevant personnel to collect, store and organize information and data through the control system of virtual reality informatization, and also provide various data in sports training for reference, and then helps relevant personnel to analyze and predict the effect of sports training and make more reasonable training plan (Feng and Zhang, 2016). The control system of virtual reality informatization is as shown in Figure 1.
Through the application of the control system of virtual reality informatization, it is able to simulate the digital model of human body of simulation movement, and carry out the stimulation building of virtual model of human body according to the method of three types of nodes, i.e. gravity center of human body, joints and skeleton of human body. Based on overall analysis, the virtual human model is built by dividing into two parts, i.e. surface model and skeleton model, which can imitate various systems according to the degree of freedom of joints, and calculates the movement direction and position of models through computer graphics and kinematics of the human body, in order to make the virtual model of human body more standard during the process of sports training, improve the visual degree and reality degree of the motion of the model, and then make sports training become more standardized (Wang, 2016).

In addition, the virtual reality system is also able to compare the virtual and real skilled movements, utilizes 3D human body animation to display these sports data through collection of sports movement data, and form virtual movements, and then makes video record of the actual movements of sports persons during the process of sports training to form the real movements, and make the viewpoint and visual angle of the display of virtual and real movements become consistent, and thus help people observe virtual and real movements more visually. Finally, the virtual reality system is able to acquire three-dimensional information of sportspersons, the contents that it acquires mainly include three-dimensional coordinates and the information of gestures of human body during the process of sports training, the system will sort out and analyze the information scientifically, and track and capture the movements of sport persons in real time from various angles during the whole process of sports training, and then start the technical processing for these data acquired, which can also provide data support for the studies on subsequent 3D simulation human motion correspondingly (Yu, 2015).

3. Necessity of the application of virtual reality technology in sports training

There are lots of sports items requiring fighting skills in traditional sports training, such as, kick boxing and taekwondo; people will be injured inevitably during the practical training process, through the application of virtual reality technology, the students are able to participate in training in simulation environment, with no need for worrying about bodily injury (Cui, 2015). And meanwhile, the virtual reality technology can also be used to evaluate the practical movements of students during training process, and help student to correct the deficiencies of training movements. During the sports training process, the difficulty of many movements is quite larger, which causes that students get injured easily when they make highly difficult movements, while the virtual reality technology can assist students to
imitate these movements, and thus avoid sport injury of students caused by these highly difficult movements. And finally, the application of the virtual reality technology does not need schools to purchase equipment or build training ground, which effectively breaks through the restriction of expenditures. Therefore, the application of the virtual reality technology in sports training is very necessary (Shen et al., 2015).

4. Key technology for the application of virtual reality system in sports

4.1 Virtual animation technology

In sports training, the virtual animation technology is a key technology of virtual reality system, which is able to build the model of virtual human according to three-dimensional motion and other information collected in the system, and make three-dimensional virtual human reshow the sports training movement. In order to ensure the animation of virtual human model to be more lifelike, the virtual animation technology mainly includes key-frame animation technology, motion capture technology and process animation technology (Du and Zhang, 2014). The parameterized key-frame technology is the animation generation technology most commonly used in virtual reality system, can utilize interpolation to affect movement, the interpolated value is inserted through the adoption of interpolating algorithm, in key frame of animation, the interpolated values are mainly divided into two types, one is the interpolated value of position, and the other is the interpolated value of orientation, the interpolated value of position can be done through velocity curve interpolation and spline interpolation methods, and the interpolated value of orientation needs to be done by using quaternion interpolation method (Du, 2014). The definition of quaternion is to assume the four-dimensional space in the real number field $\mathbb{R}$ to be $\mathbb{R}$, and the orthogonal basis of $\mathbb{R}$ include $(1,0,0,0)$, $(0,1,0,0)$, $(0,0,1,0)$ and $(0,0,0,1)$, which are respectively represented by $i,j,k,l$, and all elements in $\mathbb{R}$ can be expressed in the following formula, i.e. $R=[S,V]=[a^0+a^1i+a^2j+a^3l]$, in this formula, the scalar quantity is $s=a^0$, and $V=(a_1,a_2,a_3)$ represents vector quantity, at this moment, $R$ is quaternion, during the quaternion calculation process, it shall meet the commutative law of addition, however, as the quaternion is not applicable for commutative law in multiplication, especially when it rotates around axis $m$ at angle $\alpha$, therefore, it can be represented through the following formula, i.e. $r=[\cos\frac{\alpha}{2},\sin\frac{\alpha}{2}]$. The motion capture technology is to record the motion information of the sportspersons during sports training process through utilizing tracking sensor, and generates animation, but such kind of method also has many disadvantages, such as shifting and distortion of program (Du, 2014). The process animation technology is to control the animation of objects through corresponding process, and achieve the control of movement and geometrical shape of objects through mathematic model, its advantage lies in the potential of interactive behaviors; and it also has some restrictions, such technology is only applicable for some specific types of training, and its effect on the control of details is not good.

4.2 Motion editing technology

The motion editing technology is also a key technology in virtual reality system, which achieves motion editing through two algorithms, i.e. curve adjustment of articulation points and self-similarity, such kind of technology can not only edit a single movement, but also multiple movements (Liu and Zhang, 2014). When the moving posture of human body is changed at some point, there are two key aspects to be considered, on one hand, after the adjustment of the position of a certain point, it needs to consider the position changes of other points in the movement locus of such articulation point; on the other hand, when the curves of other points are adjusted in the changed movement curve of articulation points, it needs to consider how to get correct reflection of the motion features of human body through adjustment. For the first key aspect, it can be solved through the algorithms of curve adjustment of articulation points and self-similarity; for the second one, it can be solved through the method of inverse dynamics.

5. Studies on the application of virtual reality technology in sports training
The application of virtual reality technology in sports training will undoubtedly change sports field fundamentally, and change sports training to be the comprehensive training mode from traditional single training mode, and the physical education training mode is also changed to be high-tech training from teachers imparting knowledge to students. The application of virtual reality technology in sports training is mainly reflected in the following aspects, as shown in Figure 2.

**Figure 2.** Application of virtual reality technology in various fields of sports training

### 5.1 Application in aerobics training

The aerobics is a kind of sport item integrated with music, gymnastics and dance, and owns very strong artistry, which can not only make the movements of students more coordinative and flexible, and also train and expand the students’ ability of thinking during the aerobics training process. During the traditional aerobics training process, it is difficult for teachers to express some training contents through language, which causes student to have difficulties to understand and master these training contents (Fu et al., 2013). Through the application of virtual reality technology in aerobics training, the contents in aerobics which is difficult to be expressed through language can be converted to be corresponding video information, and there are also corresponding annotations to these contents, the training contents and movements can be played and explained repeatedly with the combination of practical teaching demands, and then the teachers will make correct demonstration actions, which enables students to understand these skilled movements more clearly and completely, and helps students to quickly master these training contents and training movement, and can also assists students to timely find and correct mistakes during the training process, and improves the effect of aerobics training greatly.

### 5.2 Application in volleyball training

During the process of traditional volleyball training, the teachers usually explain and demonstrate the volleyball movements, as different students have different learning ability and comprehensive ability, there exists lots of differences when they learn and understand volleyball movements, while the teachers can only observe the training effect of students by naked eyes, which is not only very subjective and will have great impact on teaching effect. The application of virtual reality technology is able to solve the above problems effectively (Bai and Gao, 2013). For example, during the training process of overhead serve movement, the students can observe such movement through virtual reality technology, and communicate and imitate body movements by using virtual model of human body, which enables students to observe the strength of exerting force, movement range and sequence more visually and helps students to master the movement faster.

### 5.3 Application in basketball training

Basketball is a kind of sport very popular among young people, during previous basketball training, the teachers explain and demonstrate the movements, through virtual reality technology, the teachers are
able to train and guide students by making courseware without demonstration and explanation by themselves, which can not only enable students master basketball knowledge more quickly, and also let them complete corresponding training of movements and skills independently, the whole training process is monitored by computers, the students are able to adjust training speed and progress according to practical situation, and then the individualized training of students will be achieved.

6. Conclusion

In conclusion, the application of virtual reality technology in sports training can convert the training movements and training contents to be corresponding video information and explain and play the teaching contents repeatedly according to practical situations through the coordination of annotation, which not only enable students to master the training knowledge faster, and also complete corresponding movements and skill training better. Relying on these advantages, the virtual reality technology has become the important development tendency of sports training in future, and plays a more and more important role in sports training at present.

REFERENCES


Cui B. (2015). Design of motion system based on virtual reality technology, Electronic design engineering, 23(21), 42-44.


