Research and Application of Sports Demonstration Teaching System Based on Kinect

Ning Wenjing

College of Physical Education, Heihe University, Heihe164300, China

Keywords: Demonstration Teaching; Sports Teaching; Kinect Technology

Abstract: With the accelerating pace of modern life, it will allocate more time to work, while ignoring the importance of physical exercise, which can lead to physical decline. The best way to solve this problem is to develop a set of easy installation, low price of the PE teaching system, so that people could get better exercise in their spare time, such a system is developed to improve the national fitness ability plays an important role. Based on the Kinect somatosensory equipment as a motion capture device, which can effectively track and record the three-dimensional motion of human body, the real-time motion capture not only increases the human-computer interaction, but also provides a new way for the education of sports model.

1. Introduction

With the improvement of people's living standard, people are no longer satisfied with the basic material needs, more people's physical, psychological and spiritual needs. Sports can not only exercise the body, stimulate morale, but also to promote communication, loved by the majority of people. With the birth of sports training is also of concern, traditional training is one or more coaches face-to-face training, not only limited by time and place, and the high cost of training, the coach resource constraints. In order to solve this problem, more and more professional sports teams or national training team began to train Kinect motion capture for sports training. The simulation can be used to analyze the displacement changes of athletes in the process to complete the action in the movement of the computer, change the kinematic parameters of velocity and acceleration, torque and power, and the kinetic parameters to understand the mechanical characteristics of the quantitative relationship between the sports action movement; optimization of sport technique of athletes, the design of new technology (action) and effect prediction. In addition, the movement simulation can also study the mechanics mechanism of sports injury, how to coordinate with the sports equipment in the research of the movement [3].

The expert system of the motion capture system helps to observe the movement of the coaches from multiple angles, and obtains the parameters of the training parameters and physiological parameters. The training of experts through training data collection, for each training scientific personnel training plan, targeted training, so as to reduce the intensity of exercise training, but also improve the digitalization, and scientific training efficiency and training parameters for the human experience training time. Kinect based motion capture training aids, can be widely used in running, jumping, weightlifting, shooting, golf and other sports teaching demonstration projects.

2. Kinect Technology Overview

Microsoft released Xbox360 game console peripherals, Kinect. With the advent of Kinect, Microsoft has launched a variety of dance games, pet games, racing games and adventure games. Kinect completely changed the original single mode of operation of the game, but more emphasis on the concept of human-computer interaction, which has real-time motion capture, voice recognition, community interaction, image recognition and other functions. The basic technical architecture is shown in figure 1. As a sensor, Kinect is essentially an input device. It provides three kinds of main types of raw data, including data flow depth, color video stream, the original audio data, corresponding to the corresponding skeletal tracking, recognition, speech recognition and

other three functions. Bone trajectory is the basis of Kinect somatosensory operation, which requires the system to build the bone joints in the time delay, according to the player's torso, limbs, head or fingers [4-5].

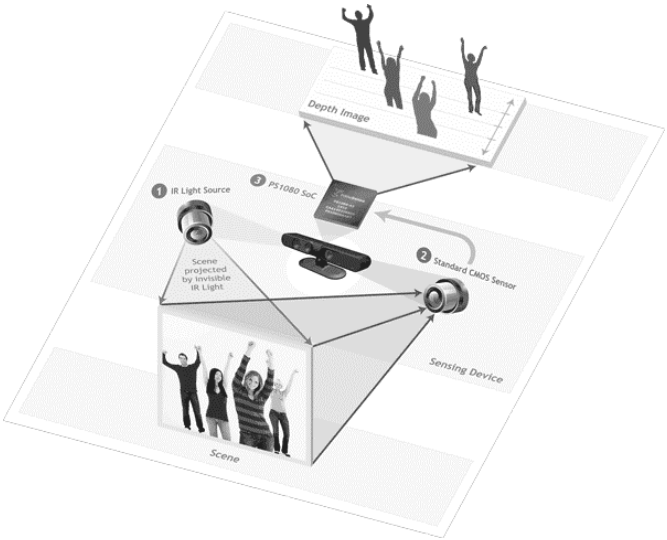

Figure 1. The principle of the Kinect

The device package includes a phone sized USB input device (the following black object) and the corresponding software platform. The device is accomplished by infrared light emitting diode and camera motion control technology in different ways. The company also says it's four cubic meters of small sensors to create a 3D interactive, real-time tracking the spatial position and orientation of each finger tip and the data accuracy is 1/100 mm, and hundreds of thousands of target tracking [6-7]. This technical breakthrough is not from the high resolution sensor, but a series of efficient mathematical algorithms.

Kinect can get the depth reflection data, three kinds of information produced by the speech signal, the ordinary camera, infrared stereo color image. There are three lenses in the Kinect machine, located on both sides of the ordinary RGB color lens depth sensor, the main functions are Kinect, infrared emitters and infrared CMOS imaging devices.

The RGB color camera center is used to identify user identities using face recognition or numeric characters. In addition, it can also be used to enhance the reality of the game and video features. And motion tracking mode, follow the target object automatically rotate the camera position, automatically find the most suitable focus position.

The core technology of Kinect is the most important three-dimensional depth information processing technology, infrared transmitter and receiver depth information from the infrared camera to determine the distance of objects. Microsoft uses 3D depth from feeling. The main significance of the motion detection technology and the test chip ps1080 and the use of patented technology code. Kinect data acquisition program shown in Figure 2.

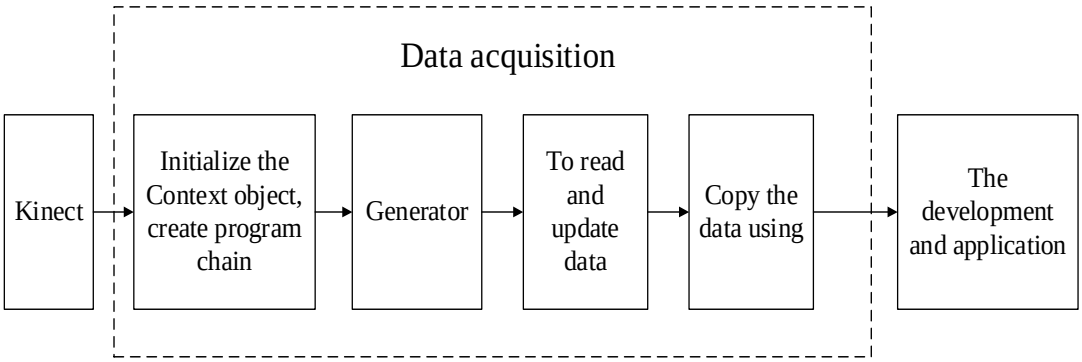

Figure 2. Kinect data acquisition process

3. Requirement analysis for sport demonstration teaching system based on Kinect

With the rapid development of China's economy and the improvement of people's living standards, people's life pressure is also growing, physical and mental health has become a problem that can not be ignored. Many scientific studies have shown that physical exercise is the most effective means of strengthening health and reducing stress. Physical exercise can promote bone and enhance cardiovascular function and immune system, fully activate the nerve cells in the cerebral cortex excitability and body flexibility, faster reaction from the aspect of human action shows that smart, agile, this is a natural reaction to the efficient operation of the brain, to study and work to stay focused, efficient, and good conditions, and can last for a long time.

Most of the existing systems are based on human motion measurement and analysis of high-definition video acquisition and analysis methods, based on human motion simulation of human motion. Such a system, function is not good to observe students' own actions and conduct comparative analysis and target action; prices of hundreds of hundreds of thousands of high-definition video capture system determines the educational system in these sports can not only be used in competitive sports, but did not promote mass sports field. Therefore, we propose a Kinect based sports education system model, the framework is shown in Figure 3.

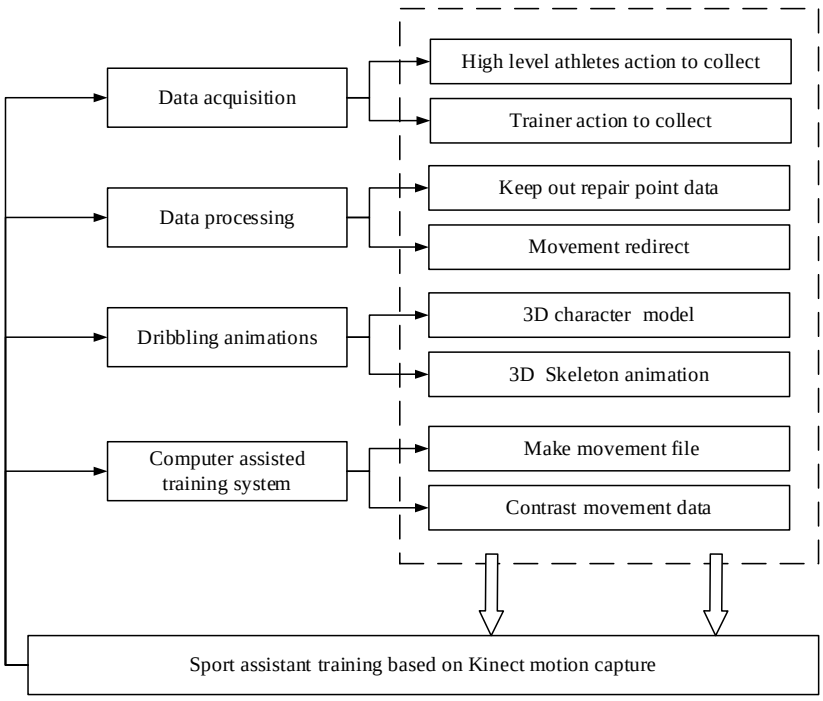

Figure3. Framework of sport demonstration teaching system based on Kinect

In order to meet the needs of people, the ideal system of public physical education should have a clear understanding and analysis of the students' movement from the complex environment and human factors. Considering the user's cognitive ability is uneven, the hardware and software design of the system should have good interaction, and easy to learn. The universality of mass sports determines that the whole system can only guarantee a lower price, and every family can really play its due role.

4. Sports demonstration based teaching system design based on Kinect

In this paper, the development of the education system Kinect motion model based on motion capture, capture the swing coach through the real-time data, comparing the motion data and data obtained by the motion of athlete training; and assigned to the real-time access to character data has been built, animation reproduction coach. So we should get rid of the traditional training experience and enter the new stage of digital training. The system consists of four modules: motion data acquisition, motion data processing, data analysis and animation. Among them, the motion data

acquisition includes collecting data acquisition and training standard motion data. Collect the coaches' movement information, set up the standard action database, collect the data trainer, and provide the basis for the first aid training. Motion data processing includes restoration of occlusion joint information activity redirection. Data analysis is mainly the coaches of the movement of information and the level of action than the right, according to the results of the coaches to give advice to quickly improve the level of coaches. The animation data is generated by the motion capture file, the virtual drive body, and thus the operating system frame is displayed in Figure 4.

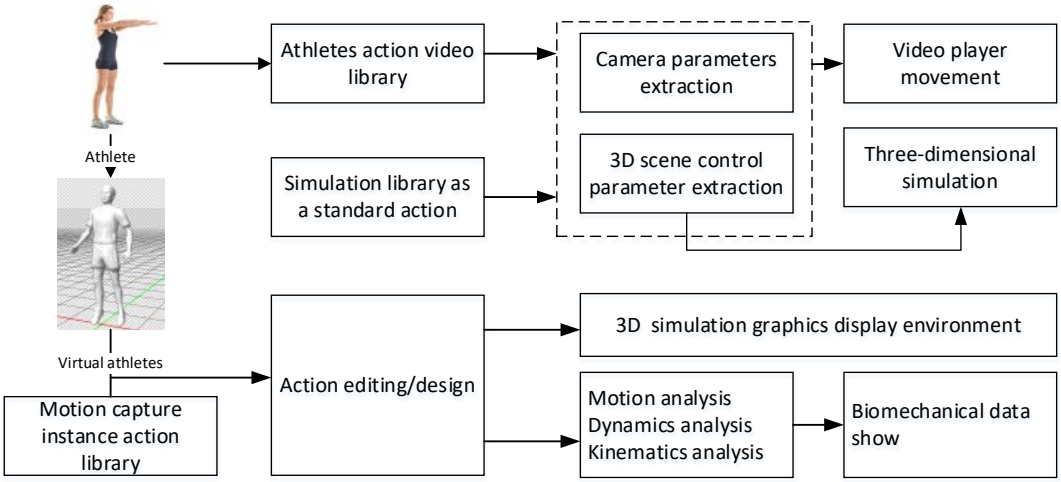

Figure 4. Kinect-based sports model education system structure

5. Conclusion

It is called numerical simulation and modeling of computer, the application of mathematical theory, similarity principle, information technology, control system and related technology based on computer based and various physical effects as a tool, experiment system comprehensive utilization technology system model of real or imagined. It has high speed and large capacity of computer storage and related technology, or complex real state of motion simulation of digital technology, also known as digital simulation. With the continuous reduction of motion capture technology, the development of hardware cost, optimization algorithm, improve the accuracy of capture, real-time capture. The application of motion capture is also expanding its application, in addition to the traditional film and television production, animation, but also suitable for somatosensory games, natural human-computer interaction, exercise training, rehabilitation training, etc.. A motion model of teaching system developed in this paper is based on the motion capture system, direct access to information from the motion information of each joint, in order to meet the real-time and accuracy requirements, the analysis results are given, can help the training level.

Acknowledgment

Heilongjiang Higher Education Reform Project: The Optional Course Setup of Social Physical Education in the Background of Sino-Russian Cooperation (SJGY0211).

References

[1] Gubbi J, Buyya R, Marusic S, et al. Internet of Things (IoT): A vision, architectural elements, and future directions[J]. Future Generation Computer Systems, 2013, 29(7): 1645-1660.

[2] DePriest D, Barilovits K. LIVE: Xbox Kinect© s virtual realities to learning games[C]//TCC Worldwide Online Conference. 2011, 2011(1): 48-54.

[3] Kandroudi M, Bratitsis T. Exploring the educational perspectives of XBOX kinect based video games[J]. Proc. ECGBL 2012, 2012: 219-227.

[4]Vaghetti C A O, Duarte M A, Ribeiro P O, et al. Using exergames as social networks: testing the flow theory in the teaching of physical education[J]. Anais do XI Simpósio Brasileiro de Jogos e Entretenimento Digital, 2012, 23(1): 1-9.

[5]Chye C, Nakajima T. Game based approach to learn Martial Arts for beginners[C]//Embedded and Real-Time Computing Systems and Applications (RTCSA), 2012 IEEE 18th International Conference on. IEEE, 2012: 482-485.

Poole E S, Miller A D, Xu Y, et al. The place for ubiquitous computing in schools: lessons learned from a school-based intervention for youth physical activity[C]//Proceedings of the 13th international conference on Ubiquitous computing. ACM, 2011: 395-404.

[6]Yang H Y, Zhang H, Xu W, et al. The Application of KINECT Motion Sensing Technology in Game-Oriented Study[J]. International Journal of Emerging Technologies in Learning (iJET), 2014, 9(2): pp. 59-63.