Research on Sports Demonstration Teaching System Based on Kinect

ZHOU LI[1, a]

[1]Physical Education, Jiangxi Science and Technology Normal University, Nanchang 330013, China

[a]zhoulijx@163.com

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Abstract. With the pace of modern life continues to accelerate, it will allocate more time to work, while ignoring the importance of physical exercise, which virtually led to a decline in physical fitness. The best way to solve this problem is to develop a set of easy-to-install, inexpensive sports teaching system, so that people can get better movement guide in his spare time, such a system will be developed to improve public physical fitness important. Based on the Kinect somatosensory equipment as motion capture equipment, effectively tracking and recording three-dimensional human motion, real-time motion capture not only increases the human-computer interaction, but also for the sports model education provides a new idea.

Introduction

With the improvement of people's living standards, people no longer meet the basic material needs, more demand for people with physical, mental and spiritual aspects. Physical activity can not only exercise, stimulate the fighting spirit, but also to promote communication, the majority of people's favorite. Along with the birth of sports training is also much attention, traditional sports training are one or many coaches face to face training, not only by the limitations of time and place, and the high cost of training, coaching resource constraints [1-2]. To solve this problem, a growing number of professional sports teams or National Training Team training began Kinect motion capture used in sports training. Sports computer simulation can be used to analyze athletes in the completion of the course of action, the variation of the various parts of the body displacement, velocity and acceleration kinematics parameter changes, as well as power, torque and other kinetic parameters, to understand the mechanical characteristics of sports the quantitative relationship between movement of technical movements; optimize the athlete's movement technology, the design of new technologies (action) and predict its effects. In addition, sports simulation can also study the mechanical mechanism of sports injuries, athletes in action research on how and sports equipment phase coordination [3].

Motion capture system to assist training experts from multiple angles observation trainer sports action, and obtaining a plurality of motion parameters and physiological parameters trainer indicators provide a reliable basis for scientific training. Training experts through the training data acquisition, customized for each training scientific personnel training program, targeted to guide training, so as to reduce the exercise intensity trainers, but also improve the efficiency of training and sports training out of purely human experience training status into digital, parameterization, scientific era. Kinect motion capture based training aid can be widely used in running, jumping, weightlifting, shooting, golf and other sports teaching demonstration projects.

Kinect Technology Overview

Microsoft released the XBOX360 game console peripherals, will be named Kinect. With the emergence of Kinect, Microsoft also introduced a variety of dance games, pet games, racing games and adventure games. Kinect completely changed the original game's single mode of operation, but more emphasis on the concept of human-computer interaction, and it has real-time motion capture, voice recognition, community interaction, image recognition and other features. The basic technical architecture shown in Figure 1. Kinect as a sensor, in essence, is just an input device. It provides

three main types of raw data, including data stream depth, color video stream, the original audio data, respectively, while the corresponding skeletal tracking, identification, voice recognition and other three functions. Skeleton track is the foundation of Kinect somatosensory operation, which requires the system within the allowed time delay range, to quickly build bone joints according to the player's torso, limbs, head or finger [4-5].
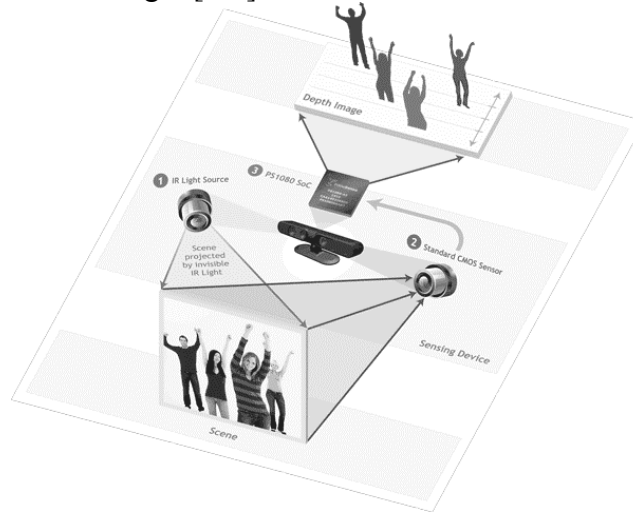

Figure 1. The principle of the Kinect

Equipment package includes a phone-sized USB input devices (Figure below black object) and corresponding software platform. The device is via an infrared LED and camera motion control technology different from other ways to complete the finger motion capture. The company also claims that its small sensors within four cubic meters to create interactive 3D space, real-time tracking the spatial location and orientation of each finger and the tip of its data precision up to one hundredth of a millimeter, and can simultaneously track hundreds of thousands the goal [6-7]. This technological breakthrough does not come from a high-resolution sensor, but a series of efficient mathematical algorithms.

Kinect can get deep reflection data, voice signals generated by three kinds of information, ordinary camera, infrared three-dimensional color images. A total of three shots on Kinect machine, located in the middle of the ordinary RGB color camera lens on both sides of three-dimensional depth sensor, the main role of the Kinect respectively, by an infrared transmitter and an infrared CMOS imaging device.

RGB color camera center is used to identify the user identity, using face recognition or numeric characters. In addition, it can also be used to enhance reality games, and video capabilities. And motion tracking mode, to follow the target object automatically rotates the camera position, automatically find the most appropriate focus position.

Kinect's core technology is the most important of the three-dimensional depth of information processing technology, infrared transmitter and receiver depth information from the infrared camera to determine the distance of the object. Microsoft uses a three-dimensional depth IT from 'feeling. The main significance provides motion detection technology and testing chips PS1080 and use code patented technology. Kinect data acquisition process is shown as Figure 2.
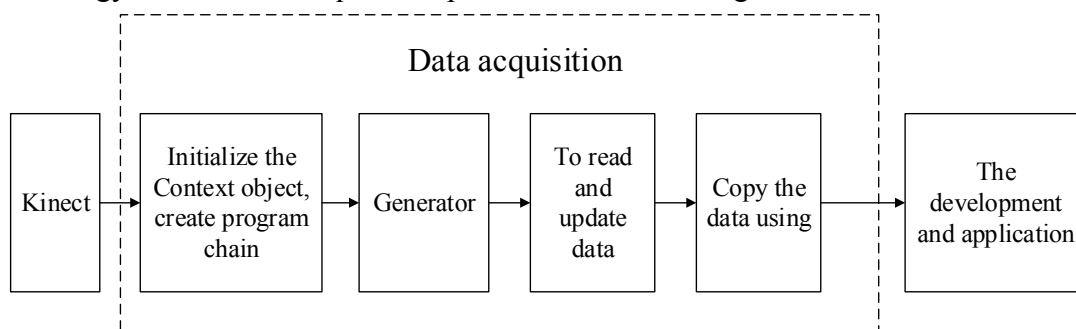

Figure 2. Kinect data acquisition process

Requirement analysis for sport demonstration teaching system based on Kinect

With the continuous improvement of China's rapid economic development, people's living standards, people's life pressure is also increasing, physical and mental health has become a problem can not be ignored. Numerous scientific studies have shown that physical exercise is the most effective for enhancing physical health, reduce stress means and methods. Physical exercise can promote bone enhanced to improve cardiovascular function and immune system, fully activating the cerebral cortex nerve cell excitability and flexibility, faster body reaction also from the point of view of human activity, showing clever, agile, It is a natural reflection of the body's efficient functioning of the brain, so that learning and work can keep focused, efficient, and other acts in good condition, and can persist for a long time.

Most of the existing system used is based on human motion measurement and analysis of high-definition video capture and analysis methods based on human motion simulation of human motion. Such a system, the function is not well observe student's own actions and conduct comparative analysis and target action; the price, set at every turn hundreds of thousands of high-definition video capture system determines the education systems of these movements only It can be applied in competitive sports, but can not promote mass sports fields. Therefore, we propose a model education system Kinect Sports is based, its frame as shown in Figure 3.
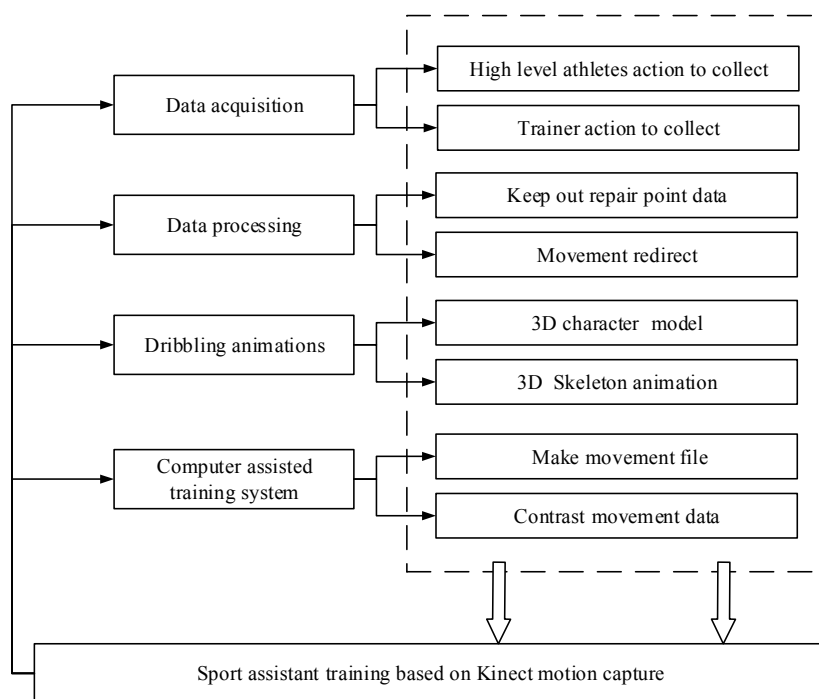

Figure3. Framework of sport demonstration teaching system based on Kinect

In order to meet people's needs, idealized mass sports education system should have from the complex environment and human body and other factors, student movements accurately perceive and be analyzed, appropriate improvements. Consider the user cognitive ability is uneven, hardware and software design of the system should have a good interaction, and easy to learn. Popular Sports universality determines the entire system is only to ensure that the lower price, every family can really play its due role.

Sports demonstration based teaching system design based on Kinect

In this paper, based on the development of Kinect motion capture sports model education system, through real-time data capture swing trainer, the movement acquired motion data and data for comparison athletes to give suggestions for training; but also the real-time access assigned to the data it has been built characters, animation reproduction trainer. So get rid of the traditional experience of training, to enter a new stage of digital training; visual teaching but also to training more interesting. The system consists of motion data acquisition, motion data processing, data

analysis and animated motion a total of four modules. Among them, the motion data collection includes collecting data collection and trainers standard motion data. Acquisition trainer motion information, establish a standard action databases; collection of data trainer is to provide a basis for the aid training. Motion data processing including restoration occlusion joint information campaign redirection. Data analysis is mainly the trainer of motion information and a high level of action than the right, according to the comparison results are given coaching recommendations to quickly raise the level of trainers. Animation playback data produced by the movement of the motion capture file, the virtual drive body, thereby reproducing operation system frame body shown in Figure 4.
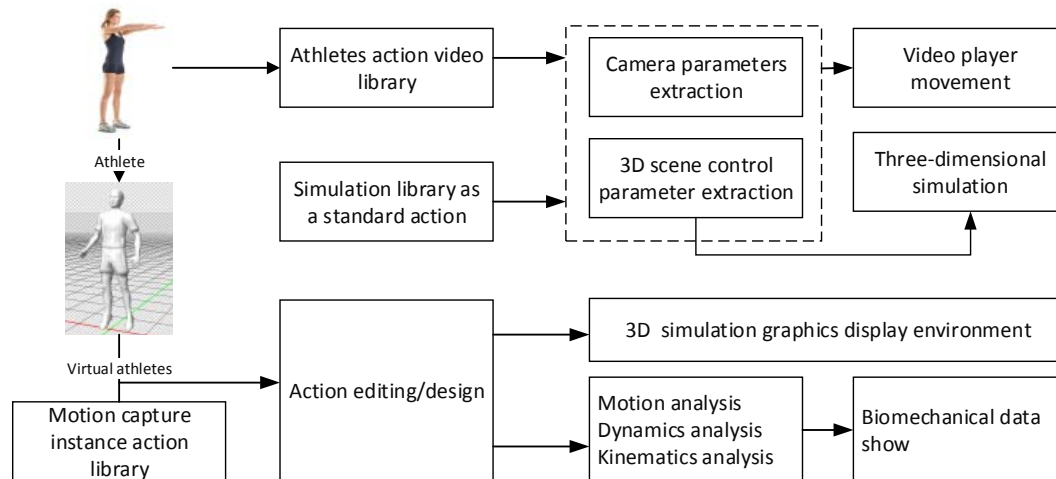

Figure 4. Kinect-based sports model education system structure

Conclusion

It was known as computer numerical computer simulation or modeling, based on mathematical theory, similar principles, information technology, system control and related professional and technical applications as the basis for computer equipment and a variety of physical effects as a tool, using the system model actual or contemplated systems experimental studies a comprehensive technology. It is with high-speed, large storage capacity of computers and related technology, or the state of motion of complex real systems imitate digitizing technology, it is also known as a digital simulation. With the lowering motion capture technology continues to develop hardware costs, optimize the algorithm to improve the accuracy of the capture, capture real-time. Applications motion capture is also expanding its application in addition to the traditional film and television production, animation, also applies to somatosensory game, natural human-computer interaction, sports training aid, rehabilitation training. This paper developed a sports model education system is based on motion capture, the system directly from the body of each joint motion to obtain information, to meet the real-time and accuracy requirements, given the results of the analysis can be assisted in training degree.

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