Research on Motion Capture System of Equestrians Based on Nine-Axis Inertial Sensor

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Abstract. The mechanical, optical and acoustic modes of traditional motion capture and analysis are bulky, expensive, and extremely complex. Micro inertial sensing action capture system is economical, convenient and is not affected by the location and the weather factors and other advantages of this study will be based on inertial sensing technology and human science combined with human abstracts and 17 points, 17 points through the acquisition of human body movement data, and then will be collected the data through WiFi sent to PC, and then the collected data on the PC, can get the attitude data driven model of the human body movement, so as to control the movement of the virtual model performers show the same motion capture system composition. The system realizes the real-time acquisition and analysis of human motion, and makes the training more scientific and efficient.

Introduction

Motion capture refers to the use of mechanical devices, optics or sensors and other equipment to obtain the movement of the human body or other objects and the movement of these technologies to reproduce the attitude of the technology [1]. In our daily life is more common in the application of motion capture technology is in animated movies and somatosensory games, in general, the performer is the first to wear on the acquisition of sports data-related equipment, and then use the software to model and combine before The resulting athletic data will enable the model to be set in motion synchronously with the performer or to show the pre-performer's performance. Today's mainstream motion capture techniques are categorized into five categories.

System Design

Design Framework

A complete motion capture system can be divided into three main parts, the first part is the data acquisition module, the module is the basis of the entire motion capture system, and then all the other modules will need to use the sensor acquisition Body posture data, if the data collected is not accurate will make the final virtual mannequin display greatly reduced. The second part is how to send out the data, if the data sent a large number of packet loss phenomenon, this will undoubtedly have a fatal impact on the accuracy of motion capture. In the third part, we need to establish a standard human skeleton model and bind the collected data of each performer of the performer to the corresponding nodes of the human model. In addition, in the positive and negative kinematics method (FK / IK) With the help of the 3D model of the movement closer to the real human movement [3].

According to the realization of the design framework can be divided into two parts of the hardware and software framework. The overall system diagram is as follows:
The human body is mainly composed of the body trunk, left and right upper extremities, left and right lower extremities, and head and neck. Therefore, in order to obtain all the information of a person's exercise, an appropriate number of sensors must be placed in these several places to obtain all the information of the human body. Because many bones in a human body are rigid and cannot be tortuous, it is only necessary to place a sensor at the joint point connecting the rigid bones. After simple abstraction of the human skeleton model, 17 joint points can be abstracted from the human body and passed. The data of 17 joints can basically collect all the main data of a human body movement, and then send the collected data to the PC via WiFi, and then process the collected data on the PC. Get the attitude data that drives the manikin to control the virtual model performer to show the same movement. In addition, you can save the body movement of the data for other software or platform to use.

The hardware system framework mainly includes three parts. The first is the hardware part of the sensor. The function of the part is mainly to collect data. The second part is the data collection and sending part. The purpose of this part is to collect the data of each node before and pack the data Send; The third is the power supply section, for each chip power supply to ensure the normal operation of the system. In summary, the system's hardware framework is shown in Figure 2-2:

**Specific Programs**

From the hardware and software frameworks provided in the previous section, the entire system implementation is available. The specific implementation plan is shown in Figure 2-4.
It can be seen from the figure above that firstly, 17 sensors need to be designed. Each sensor is first collected by the JY901 module motion data, and then through the serial communication to the STM32, STM32 and half-duplex transceiver SP3485 also use the serial communication between. Then the SP3485 and then connected in series, and by the last SP3485 before the data is transferred to the serial port to send WiFi module. In order to make the frame concise and clear in the picture, the sensors 1 to 17 are all string together. In fact, if too many devices are mounted on a single line, data cannot be received, so in the end, there are actually five Line, each line were mounted 4,4,4,3,2 sensors. These sensors will be fixed at the core of 17 joints affecting the body movement. When the data collection and sending module receives the data, the data is packaged by the WiFi module and then sent to the PC via the router. The 3D model software on the PC calls the program to get the data coming in, bind the collected node data with the corresponding nodes of the 3D model and control the virtual human body model to be used as the driving data after a series of fusion calculations [5]. Each time the exercise data can be saved after the performance is completed, it can be used as data backup or for other CG (Computer Graphics) software.

Conclusion

This paper introduces the basic principles of motion capture using sensors, and then designs the overall scheme of the system, including the design framework of the entire system and the detailed program of hardware and software implementation, taking into account the data acquisition, transmission, processing and image display. The data acquisition and processing module, the selection of JY901 module as the core of data acquisition, and based on it to complete a collection, can send, acceptable single sensor node. After that, we designed and implemented the sensor connection and how to arrange the sensors on the human body. For data collection and sending module, each sensor and sink node are connected via RS-485 serial bus, SP3485 in the convergence module is taken as "master" and SP3485 in each sensor node is taken as "slave". After the main SP3485 connects to the UART to WiFi module, the data is packaged inside the module and sent to the 3D model software, and the software uses the Socket to receive the data. To the realization of 3D model software, the overall framework is designed first, and then the detailed design is carried out. The main functions of establishing the skeleton, data acquisition and data binding are completed, and then the basic principles of the kinematics algorithm A brief explanation. In this paper, the mainstream of the current motion capture technology and its development, implementation and advantages and disadvantages of the form of comparison and analysis, and now the set of programs has taken shape, the next step will be more accurate chip, code optimization and other means, Enhance the performance of verification platform and conduct more data experiments. I believe that with the development of science and technology and the continuous development of related fields, motion capture technology will be more and more in-depth research and extensive application.

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