Magnetic Motion Capture System Measuring Movements of Hands and a Body Simultaneously.

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1 Introduction

The motion capture (MoCap) has become a premiere technique for measuring the human movements. The MoCap has been used to create computer animation for the cinema and video games, and to measure a dance performance. As for measurement of the hand the various systems exist, but they cannot measure the movement accurately, because the hand moves complicatedly. Hence, we have developed the highly accurate 'Hand MoCap system' by using the electromagnetic tracker (LIBERTY™ 16 system, Polhemus) that used small and light receivers [Mitobe et al. 2006].

In this paper, we explain the method of measuring movements of hands and a body simultaneously by combining our developed 'Hand MoCap system' with an existing system (MotionStar Wireless™, Ascension Technology).

2 System Design

Figure 1 shows the configuration of this MoCap system. We use two LIBERTY™ systems for measuring a movement of hands, and one MotionStar Wireless™ system for a movement of a body except hands. The positions where magnetic sensors are attached are also shown in Figure 1. The transmitter for a hand is placed at the same position as the one of a sensor attached on a forearm. A PC for capturing MoCap data is connected to two LIBERTY™ systems through USB interfaces, and to the MotionStar Wireless™ system via the ethernet cable.

The captured data of each hand (hand data) are represented in the local coordinate system on the basis of the transmitter attached on each forearm. On the other hand, the captured data of the body (body data) are represented in the global coordinate system on the basis of the transmitter for a body. To transform the form of the hand data (position: $\boldsymbol{p}'_H = [\, x'_H\ y'_H\ z'_H]$, orientation: $\boldsymbol{R}'_H\ (\ \theta'_{Hx}, \theta'_{Hy}, \theta'_{Hz})$) to the one of the global coordinate system (position: $\boldsymbol{p}_H$, orientation: $\boldsymbol{R}_H$), the following equations are used:

$$\begin{cases} \boldsymbol{p}_H = \boldsymbol{R}_{FA}\,\boldsymbol{p}'_H + \boldsymbol{p}_{FA} \\ \boldsymbol{R}_H = \boldsymbol{R}_{FA}\,\boldsymbol{R}'_H \end{cases} \qquad (1)$$

where $\boldsymbol{p}_{FA}$ and $\boldsymbol{R}_{FA}$ are the position and orientation of the captured data of forearm respectively.

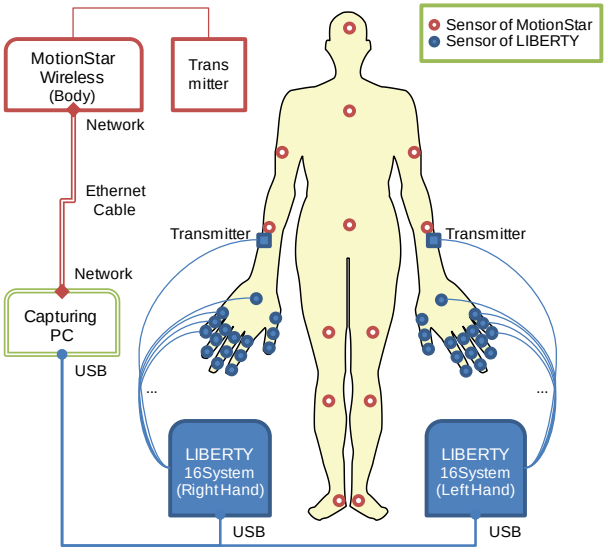

Figure 1: Configuration of MoCap system.

3 Result

In order to evaluate this MoCap system, we measured a Japanese folk dance whose name is "Nishimonai Bon Dancing (Ondo)". This dance has peculiar features in the graceful movement of the hands. This MoCap system can capture the hand data at the rate of 240Hz, and the body data at the rate of 70.9Hz. Since the sampling rate of body data is lower than the one of hand data, the body data are synchronized to the hand data by the capturing PC. In order to obtain the entire body data, these hand data and the body data are calculated using Eq.(1). Then the format of the entire body data is converted to the BVA format. These entire body data are imported into the MoCap software FiLMBOX®. A model of a human character is prepared beforehand and is read into the FiLMBOX®. This model is characterized by the entire body data. Figure 2 shows the scene when measuring the folk dance and its CG animation. We confirmed that the CG animation closely resembled the video image taken by a video camera. This shows that this MoCap system can digitize the hands and the body movements accurately.

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Mitobe, K., et al. 2006. Development of a Motion Capture System for a Hand Using a Magnetic Three Dimensional Position Sensor, *ACM SIGGRAPH2006, Research Posters*, 115

Figure 2: Measuring the dance and the CG animation. (5 sec. intervals)

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