다양한 상호작용 어플리케이션을 위한 이종 센서 NUI/NUX 프레임워크

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Multi-sensor based NUI/NUX framework for various interactive applications

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Abstract

In this study, we implement a natural user interface/experience framework using multi-sensors: Microsoft Kinect, Leap Motion, and Myo Armband. The framework is designed for customers to use in various types of interactive applications. We integrate the functions of three sensors into an application and provide an interface for customers, who can use it to interact with a computer easily. The framework can track body information in real-time, and accurately recognize the motion of different body parts.

1. Introduction

Human-computer interfaces (HCIs) are greatly promoted by the field of application using interactive devices. By using such devices, we can record body and/or hand movement information, which contains skeleton data, as well as the movements of different body parts and hand states. In this way, it becomes easy to recognize poses or hand gestures. In previous research, single devices have generally been used to recognize gestures, but the accuracy of results may differ according to the device used. It is thus preferable to use an appropriate device to recognize specific gestures. Therefore, we have designed a natural user interface/experience (NUI/NUX) to select the most suitable device for distinguishing different body part gestures. In our framework, we use the sensors of the Microsoft Kinect, Leap Motion, and Myo Armband devices to replace traditional input devices such as keyboard and mouse. Because different devices use different libraries, we integrate all the libraries into one application to realize the recognition function. Then, we define certain policies for using the recognition results in complex situations, as application input data. Finally, using this application, we provide customers with an intuitive interface.

2. Related Work

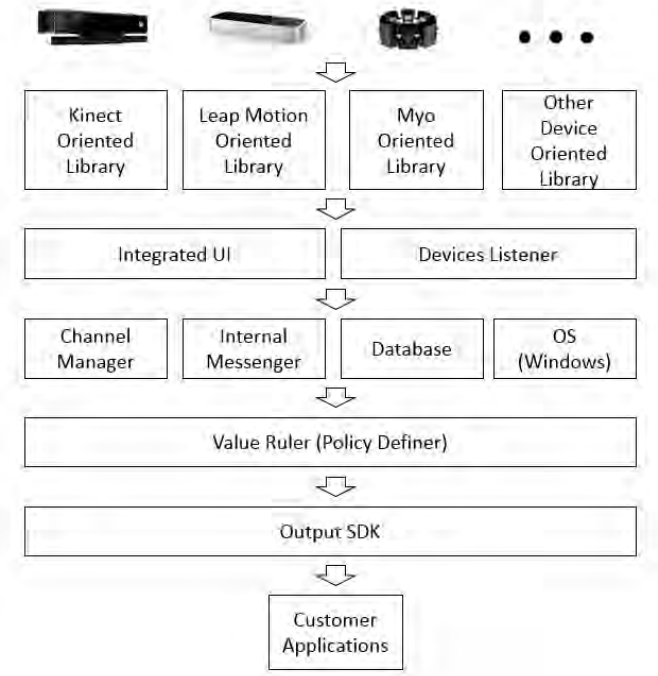
There have been several studies on NUI/NUX frameworks. Lee [1] proposed a NUI/NUX framework for controlling body motion and facial expression; however, accurate recognition was not achieved. Qamar [2] presented a multi-sensory gesture-based occupational environment to control home appliances with the Kinect, Leap Motion, and Myo Armband devices. Matos [3] created a solution for applying motion sensors and merging their data into a protocol. Certain researchers have put forward opinions on using a single sensor to recognize gestures [4-5]. However, none of the works have integrated all devices into a complete framework, and body motion tracking has been restricted. In our work, we combine interactive sensors into a NUI/NUX framework, which can provide effective recognition results and can be used directly in various interactive applications.

3. Multi-sensor Framework

Fig. 1 shows the structure of our multi-sensor framework. The framework first obtains all of the initial data from the three devices, and stores it into separate libraries. Then, the UI is integrated into three parts for the three different sensors. Thereafter, we create devices listener to obtain the real-time data required to use through the library of each sensor and deal with the data preliminarily. We also create the gesture database, which is defined at the beginning of the framework. Moreover, we need to define a policy for guiding the user on how to use the gesture data previously stored in the database. Finally, we combine all of our development into an output (Software Development Kit) SDK, which can be used in various types of customer applications.

Each sensor has its unique advantages. We can easily obtain skeleton data by using the Kinect sensor, and it is also convenient for tracking users' body motions. Hence, we use this sensor to obtain body gesture information, such as raising the hands and bending the knees. However, it is difficult to determine complex hand gestures; therefore, we use the Myo Armband to monitor hand states. Furthermore, if we wish to obtain more details about hand state, we can use Leap Motion for determining the data of every hand joint. Therefore, we realize that we can use different sensors in

different situations to achieve superior user experience and enhance the accuracy of gesture recognition.



(Fig. 1) Multi-sensor framework structure.

4. Experiments

For implementation of our method, we used the framework to test three different games using the three sensors. In (a), we used the Kinect to determine body gestures as previously defined in the database. In (b), we used Leap Motion to monitor the position of each hand. According to the recognition results, players show different actions such as moving hand and flipping hand. We selected a shooting game for testing the Myo Armband sensor in (c), which can control a mouse as the arm points in different directions. Therefore, we used the Myo Armband to control the mouse, and other hand gestures such as double tap, wave left, and spread fingers to realize other functions.

(a) (b) (c)

(Fig. 2) Experiments with three sensors.

5. Conclusion

This paper has proposed a novel NUI/NUX framework based on the cooperation of three interactive sensors. The Kinect is able to recognize body gestures, the Myo Armband can provide feedback of hand gestures in real-time, and Leap Motion can reveal more hand gesture details, such as swipe hand left and turn hand upside-down. The experimental results show that the framework can recognize gestures accurately and provide a user friendly interface. In further research, we will attempt to implement multi-sensors simultaneously: while Kinect tracks body motion, the Myo Armband can monitor hand gestures, and Leap Motion can show more hand information.

Acknowledgements

This research was supported by the MSIP(Ministry of Science, ICT and Future Planning), Korea, under the ITRC(Information Technology Research Center) support program (IITP-2017-2013-0-00684) and ICT R&D Voucher support program (2016-0-00225(R7317-16-0011)) supervised by the IITP(Institute for Information & communications Technology Promotion). And this work (Grants No.C0397384) was supported by Business for Cooperative R&D between Industry, Academy, and Research Institute funded Korea Small and Medium Business Administration in 2016.

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