

제스처와 자세를 이용한 가속도센서 기반 모바일 게임

백종훈*, 장익진**, 윤병주***

*경북대학교 정보통신학과

**삼성전기

***경북대학교 전자전기컴퓨터학부

Accelerometer-based Mobile Game Using the Gestures and Postures

Jonghun Baek*, Ik-Jin Jang**, Byoung-Ju Yun***

*Dept. of Information and Communications, Kyungpook National University

**Samsung Electro-Mechanics

***School of Electrical Engineering and Computer Science, Kyungpook National University

E-mail : *afqb@korea.com

Abstract

As a result of growth sensor-enabled mobile devices such as PDA, cellular phone and other computing devices, in recent years, users can utilize the diverse digital contents everywhere and anytime. However, the interfaces of mobile applications are often unnatural due to limited resources and miniaturized input/output. Especially, users may feel this problem in some applications such as the mobile game. Therefore, Novel interaction forms have been developed in order to complement the poor user interface of the mobile device and to increase the interest for the mobile game. In this paper, we describe the demonstration of the gesture and posture input supported by an accelerometer. The application example we created are AM-Fishing game on the mobile device that employs the accelerometer as the main interaction modality. The demos show the usability for the gesture and posture interaction.

I. Introduction

Advances in mobile computing and micro electro mechanical systems (MEMS) enable the development of games which lead about user's interest on the mobile devices.

Traditional desktop-based user interfaces have been developed on the basis that user's activities are static states. User interface design for desktop devices can use all of its

visual resources. The representative desktop-based interaction mechanisms are keyboard, mouse and joystick. In general, these are very graphical and still more detailed for desktop-based applications. In contrast, interaction mechanisms of the mobile devices can not utilize all or any of their visual resources by reasons not only that activities of users are dynamic states [1] but also the mobile devices have the limited resource and the small LCD display. Games on the mobile devices rely on key-pad, stylus-pen and input-panel. When using these mechanisms to manipulate mobile devices, it may lead to the time delay and the difficult operation because the small button may be manipulated repeatedly. So, it may make the users to lose their interests in the games [2].

In this paper, to supplement lacking the user interface of the mobile devices, we propose the novel user interface that recognizes user's gestures such as swing and tilt, and estimates the user's posture. The application example we created is a fishing game. To improve efficiency that is expected by applying the accelerometer, with considering many restriction elements such as processing capacity, we propose the structure of the system that embedded in the accelerometer and the algorithm of the signal processing of the accelerometer for the mobile devices.

II. Main

In the game of the existing mobile devices, control of the direction and action of a character is done by using the key-pad. In our hand gesture- and posture-based mobile interaction technique, we show the usability for the use of the accelerometer that is embedded in the mobile device and the effect of the input.

An experiment was conducted to assess the usability of the accelerometer as interaction technique for the mobile games. Thirty subjects (27 males and 3 females, ages 23 to 33, all were colleagues who volunteered for the study) participated in this study. First, we observed the output patterns of the accelerometer for the fishing action. Though the amplitudes are different each other for their action, the all output patterns are almost similar in all the experiments. To analysis the acceleration signal of the gestures for the fishing action, we considered the typical signal type for the fishing action.

To estimate user's posture carrying the mobile device, we calculated θ for each state. To determine a range of the θ for the user's posture, with the various postures of the thirty participants, we collected data a two-dimensional time series for about three seconds at the sampling rate of the 140 samples/s from the outputs of the accelerometer. Through the experiment mentioned above, the angle of the mobile device for each user's posture is estimated: it is about -90° for attention, about $39.5^\circ \sim 46.8^\circ$ for watching the mobile device, about $-16^\circ \sim 7^\circ$ for ready, about $35.5^\circ \sim 54^\circ$ for waiting the bite, and about $37.6^\circ \sim 40^\circ$ for watching the mobile device after tilting gesture.

The gestures used in the fishing game are the throwing, snatching, and tilt; the throwing gesture is expressed as the movement distance and the velocity of the fishing rod by measuring the acceleration for the user's throwing gesture, the path-direction of the fishing rod is expressed by X-axis of the accelerometer when user throw the fishing rod. We consider the range of the power and the tilt in the throwing stage in order to determine the movement distance, the velocity, and the path-direction of the fishing rod. Because it is difficult to distinguish between the dynamic acceleration like the throwing and the static acceleration like the posture, and the noises as the unnecessary user's action and hand tremble have to be removed, the state machine is needed. The state machine for the mobile

fishing game recognizes and processes the user's action by the designed scenario by treating only valid gesture or posture in each state.



Fig. 1 AM-Fishing game; (a) throwing mode, (b) snatching mode, and (c) tilting mode on the mobile device.

To demonstrate our application in games we have developed the mobile game called AM-Fishing game (see Fig. 1). In the game the user has to throwing the mobile device with his real arm into a virtual fishing site.

III. Conclusion

We implemented the new interaction by estimating and detecting the context information as user's various gestures and postures with 2-axis accelerometer. We considered the typical fishing action by the output type of the accelerometer for 30 participants. Because it is difficult to distinguish between the dynamic acceleration and the static acceleration, and the noises as the unnecessary user's action and hand tremble have to be removed, the state machine is needed. The state machine for the mobile fishing game recognizes and processes the user's action by the designed scenario by treating only valid gesture or posture in each state. As a result, this will enhance not only the convenience to use but also the interest and realism for the mobile game.

References

- [1] M. Ehreumann, T. Lutticke and R. Dillmann, "Dynamic Gestures as an Input Device for Direction a Mobile Platform", IEEE International Conference on Robotics and Automation, vol. 3, pp. 2596-2601, 2001
- [2] V. Paelke, C. Reimann and D. Stichling, "Foot-bafsed mobile Interaction with Games", ACM SIGCHI International Conference on Advances in Computer Entertainment Techology, pp. 321-324, 2004.