Demo Abstract: Supporting Posture-free Gameplay for Motion-based Mobile Games

Taiwoo Park  
Computer Science, KAIST  
Daejeon, Korea  
twpark@nclab.kaist.ac.kr

Bupjae Lee  
Computer Science, KAIST  
Daejeon, Korea  
bupjae@nclab.kaist.ac.kr

Seokyoung Song  
Computer Science, KAIST  
Daejeon, Korea  
sysong@nclab.kaist.ac.kr

Uichin Lee  
Knowledge Service Engineering, KAIST  
Daejeon, Korea  
uclee@kaist.edu

Junehwa Song  
Computer Science, KAIST  
Daejeon, Korea  
junesong@nclab.kaist.ac.kr

Abstract

We demonstrate PosFree, a platform supporting posture-free motion-based mobile games. It allows the developers to support diverse postural gameplay contexts in the motion-based mobile games, without much knowledge on the specific characteristics of motion sensors with respect to posture changes. It detects orientation of mobile devices at runtime and automatically converts motion sensor data as if the devices are manipulated in the standard posture, as well as provides an intuitive user interface to help players understand their postural gameplay contexts. The platform prototype is currently implemented inside the Android Framework, and thereby off-the-shelf motion-based mobile games can utilize the feature of PosFree without modifying their original source codes.

Categories and Subject Descriptors

C.5.3 [Computer System Implementation]: Microcomputers—Portable devices

General Terms

Algorithms, Design, Human Factors

Keywords

posture, motion sensors, mobile gaming, smartphones

1. Introduction

As mobile games become popular, a class of mobile games utilizing players’ motion have been developed and successfully instantiated so far. The development of these motion-based mobile games is facilitated by embedded motion sensors in mobile devices such as accelerometer, gyroscope and electric compasses—mobile operating systems such as Android and iOS support standard programming interfaces for these sensors. User interactions in these motion-based mobile games are very intuitive and thus provide natural and immersive game experiences.

However, most of the motion-based mobile games do not consider diverse postural context1 of players in gameplay. As shown in Figure 1c, these games require strictly designated orientation of mobile devices, e.g., upright or parallel to the ground, thereby restricting players’ posture while playing. As a result, these motion-based mobile games lose opportunities of game plays with the rest of postures (e.g., lying down). Moreover, this restrictive posture increases danger of physical injury such as tendinitis, which are already a severe and widespread problem while using mobile devices.

The postural limitation, however, has not been sufficiently addressed in motion-based mobile games so far.

Figure 1 Examples of postural gameplay contexts

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1 In this paper, the postural context denotes players’ body and hand-arm posture and grip on mobile devices.
It is mainly because (1) game mechanics are tightly-coupled with the designated postures, e.g., gravity-based ball control game (see Figure 1d), and (2) game developers have little understanding on the specific characteristics of motion sensors with respect to posture changes. Similarly, we demonstrate PosFree, a framework that supports posture-free motion-based mobile gaming. PosFree detects players’ postural game play context and provides posture-adaptive motion data transformation to motion-based mobile games.

2. Architecture Overview

PosFree allows the developers to support diverse postural gameplay contexts in the motion-based mobile games. It detects orientation of mobile devices at runtime and automatically converts motion sensor data as if the devices are manipulated in the standard posture. Also, it provides an intuitive user interface that helps players to understand their motion changes even in non-designated postures. PosFree consists of three key components: the Posture Detector, the Motion Data Converter and the Motion Status User Interface.

1. The Posture Detector is responsible for inferring postural context of a game player. By utilizing game status and users’ direct calibration input, it detects and stores the current posture information. The posture information is represented as orientation information of a mobile device, obtained through motion sensors such as accelerometer, compass and gyroscope.

2. The Motion Data Converter calculates relative motion data with regard to the stored orientation information and provides the converted motion data to the game applications. To calculate relative motion data, we utilized Quaternion-based vector rotation algorithm to get the relative difference between the stored and the current orientation of the mobile device.

3. The Motion Status User Interface provides players with their current motion data to help them intuitively understand their movement and to easily adapt themselves to their current posture.

3. Implementation Detail

We have implemented a PosFree prototype inside the Android Framework version 2.3.4. The current PosFree prototype operates as follows: (1) it hooks SensorEvent from SensorManager to get the current motion data, (2) transforms the original data to the standardized motion data, and (3) delivers the resulting data to game applications. Also the Motion Status UI is placed on top of the game screen (see Figure 2b). Through this prototype, off-the-shelf motion-based mobile games can utilize the feature of PosFree without modifying their original source codes.

4. Demonstration Setup

We demonstrate PosFree with two Google Nexus S smartphones, one with PosFree and one without it, to help players experience the usefulness of the framework. As stated earlier, we employ off-the-shelf motion-based mobile games currently available in mobile app markets, to demonstrate the functionality of the framework. To instantiate various gameplay postures, we utilize couches or chairs if possible.