MiSCon: A Hot Plugging Tool for Real-time Motion-based System Control

Jun Chen, Chaokun Wang, Lei Yang, Qingfu Wen and Xu Wang
School of Software, Tsinghua University, Beijing 100084, China
{chenjun12,yanglei11,wenqf11,xu-wang11}@mails.thu.edu.cn, chaokun@tsinghua.edu.cn

ABSTRACT

In this demonstration, we proposed a hot plugging tool for the real-time motion-based system control, which is more portable and application-independent than the existing commercial motion-based sensing devices such as Kinect, Wii and PlayStation Move. This tool captures and recognizes people’s real-time motions through the built-in camera of PCs, mobile phones or tablets, and automatically executes the system events which have been mapped with people’s customized body motion, e.g., the head and the fist. The tool relieves people from the conventional ways to play games and use applications, and enables them to customize their preferred ways to control the systems.

Categories and Subject Descriptors
I.4.1 [Image Processing and Computer Vision]: Digitization and Image Capture.

Keywords
Hot Plugging; Motion Detection; System Control; MiSCon.

1. INTRODUCTION

Most people’s daily works on computers are constrained by the positions and the operational ways of keyboard, mouse and other devices. Though the Bluetooth-based devices relieve people from working at a fixed position, the conventional ways to operate these devices, e.g., typing, clicking and scrolling, still limit the user experience. In recent years, as the motion sensing input devices — Kinect, Wii and PlayStation Move appear, many games and applications are developed based on these devices to facilitate human-computer interactions [1, 2, 3, 4]. However, there are still some limitations of these devices: (1) The games and applications are dependent on the device, and the users have to bring the device wherever they play the games or use the applications; (2) The device is not free, and not all people can afford it; (3) It is difficult to use these devices to control the other games and applications which are not developed based on them. In contrast, camera is much cheaper, more lightweight and portable, and cameras almost exist on every laptop, mobile phone and tablet device. Thus, the camera-based applications have the potential to be of high demands as a low-cost or even free substitute of the aforementioned devices for user entertainment or experience promotion.

In this demonstration, we bring forward a hot plugging tool, called MiSCon, for the real-time Motion-based System Control. MiSCon captures and recognizes people’s motion through the camera, and triggers the corresponding events which have been previously mapped to in the controlled system. This tool enables users to interact with the systems, e.g., PCs, mobile phones and tablets, with the body movement like the head and the fist as illustrated in Fig. 1. Compared with Kinect, Wii and PlayStation Move, MiSCon has the following advantages: (1) MiSCon does not require extra device besides the camera which is basically equipped on most PCs, mobile phones and tablets. Thus, MiSCon is more portable and convenient. (2) The users do not need to spend money since MiSCon can be installed on their existing electronic devices which have a built-in camera. (3) MiSCon is hot plugging and it can control many existing games or applications by mapping people’s motion to the events on the system, like the keyboard events, the mouse events and the screen-touching events.

2. SYSTEM OVERVIEW

The workflow of MiSCon is illustrated in Fig. 2. Basically, there are three stages: the detection training stage, the event mapping stage and the working stage.

The detection training stage. MiSCon supports the motion-based system control by many parts of human body, e.g., face, fist and palm, as long as the detection is properly...
trained offline. The object detection in MiSCon is conducted using the OpenCV library, and the detected target is determined by the type of the training samples. Thus, users can customize their controlling types according to their preferences. The training parameters of the detection model are stored for later real-time detection in the working stage.

The event mapping stage. MiSCon enables users to map their motions to the available events in the system, like the direction button events on the keyboard, and the left or right click event of the mouse. Users can configure event mapping in the main window of MiSCon as shown in Fig. 3. The mapping is recorded by directly conducting the target event in the focused textbox. For the body motion, MiSCon currently supports the recognition of four moving directions, i.e., upwards, downwards, left and right. It means users can map up to four different events at the same time in the current MiSCon, and more motion supports will be available by extending our current work.

The working stage. People use MiSCon to control their systems in the working stage. Firstly, the camera captures the consecutive frames of people’s motions in real time. The object detection component detects the target region of human body in the current scene and records the anchor point of each frame. The anchor point is usually chosen as the geometric center of the detected region. Secondly, the trajectory generation component analyzes the relative position of each anchor point in the consecutive frames and generates the motion trajectory. Thirdly, the direction generation component reduces the noise in the trajectory and computes its major direction. At last, the event query component finds the corresponding event among the pre-defined rules generated in the event mapping stage. The event will be executed once it is recognized. Thus, MiSCon completes the controlling procedure from the body motion to the system events.

3. DEMONSTRATION

MiSCon is developed to enable users to customize their preferred ways to control systems without the limitation of the motion sensing devices, the charges and the applications. As shown in Fig. 3, users can map system event to the motion directions and select the controlling types, e.g., face or fist, on the left panel. The real-time scene and the detected region is shown on the right panel. By clicking on the ‘Start’ button, MiSCon will be activated and users are allowed to control the system in the way they have configured.

Fig. 1 demonstrates the real-time control of the motorcycle and the car-racing games with the head and the fist using MiSCon. The motorcycle/car will move in the same direction as the player’s head/fist moves. Of course, the user can also map the moving direction of the motorcycle/car to the different moving directions of the head/fist, e.g., the opposite directions. Besides these games, MiSCon can also control other games and applications in different ways such as the Temple Run and the Flappy Bird games with the head control, or the slideshow of public speech and the demonstration of system prototype with the fist/palm control. Since only basic moving directions are recognized in the current MiSCon, the real-time performance is fast.

To some extent, MiSCon can be considered as the bridge between the body motion and the system events. As long as the games or applications can be controlled by the input devices such as the keyboard, the mouse and the touchscreen, they can also be controlled by MiSCon. In addition, MiSCon is also lightweight and easy to access. People can use MiSCon on their PCs, mobile phones and tablets without extra charges for the motion sensing devices.

4. ACKNOWLEDGEMENT

This work was supported by the National Natural Science Foundation of China (No. 61373023, No. 61170064) and the National High Technology Research and Development Program of China (No. 2013AA013204).

5. REFERENCES