An Innovative Interface Design with Smart Phone for Interactive Computer Game Applications

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***Abstract*— In the latest electrical consuming generation, computers are still mainly tools for paperwork and game platforms, and tablet PC field and smart phone field are two new fields with powerfully market potential. With a high degree of integration and user friendly interfaces, smart phones have become very popular among the general public. Using various sensors, touch pad, and screen of a smart phone, and designing a friendly control interface with software on it, we can achieve the goal that the computer users can interact with a computer via a smart phone. Therefore, this paper discusses the experiment of using a smart phone as a game controller. Through this attempt, we can get some idea and experience from the experiment to simplify the design of smart phones and improve it to develop a controller mainly used with computers or a new game controller.**

Keywords: game interface, user experience, smart phone, computer game, speech recognition, accelerometer, touch pad, 3D game

I. INTRODUCTION

We have dedicated ourselves to explore a new type of game interface to create new experience in playing games by combining various input devices and output ones [1], such as touch pad, accelerometer, screen, microphone, vibratior, etc. We choose to use a smart phone to achieve this goal because of its high degree of integration system which makes it easy for us to use devices on it, and many kinds of its input and output devices help us design an interface with more options and fully develop our creation.

Since the popularization of computers, computer game interfaces have almost never changed. The reason is that mice, keyboards, audio devices, and screens can satisfy all the needs required for computer games and are also essential for general computer usage. So if you have a computer, you have almost all those accessories which reduce your desire to buy extra devices to play games. The reason why we want to develop a new type of interface is that we want to create different user experience [2]. Moreover, we want to develop a more immersive and control interface with more flexibility for players than the interface we used for computer games now.

Therefore, we think if we want to develop a new interface and make it popular, the interface we design must cover the functions of the original devices. Or, we may use another popularized product to implement it. The reason for the former is that if the interface possesses such functions, people who have computers may buy it as an interface for their computers instead. The reason for the latter is that using the product that is already popular in the market may also solve the problem, and, in addition, the corresponding research cost and time are less. Just like the method mentioned in the paper, we use a smart phone as an interface. By doing so, we can summarize users' experience and feeling quickly and use them as reference and basis to develop a new interface generation.

For the above reasons, we will develop a game interface using a smart phone, and this interface must cover the same functions that the original interface does. Through the experiment of players using the interface to operate a computer and play a computer game, we can explore the effect of the interface and the possibilities that the interface can bring us and figure out what can be improved, modified, or added. After that, we can use the achievement to construct a new type of interface just for computers which can be used not only for computer games, but also for other daily computer tasks.

II. SYSTEM DESCRIPTION

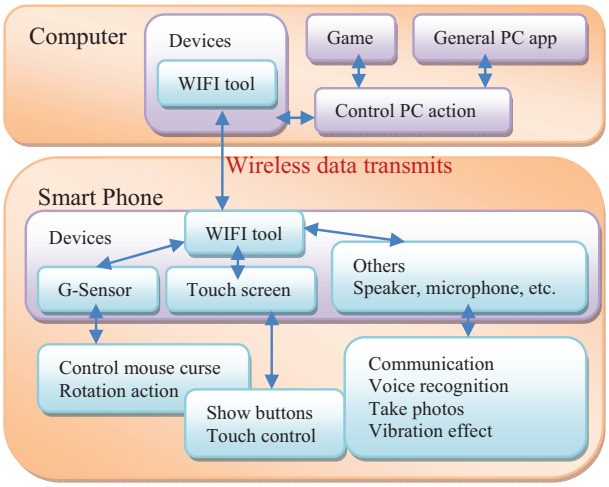

Fig. 1. System diagram. The system is composed of two subsystems. One is the computer and the other is the smart phone. Both subsystems have an application to communicate with each other via a WIFI tool so that the system may work normally.

We use a smart phone to implement our computer game interface. Therefore, the system can be considered as two subsystems. One is a computer, and the other is a smart phone. The two subsystems communicate with each other through a WIFI tool. The role the smart phone plays in the system is like a user controller. With the help of the android OS driver on smart phone, we can program an android application to operate the devices on the smart phone. In the Android

application, we use that device to obtain users' inputs, transmit them to the computer, receive commands from the computer or the user interface on the smart phone, and respond to users. We develop an application for the computer to analysis the data transmitted from the smart phone and the computer driver allows computers or computer games to perform corresponding actions. After that, according to the requirements from the computer or the computer games, the computer application transmits a control commend to the smart phone so that it may present corresponding responses to users.

III. INTERFACE DESIGN

Fig. 2. The schematic of the system. The PC screen displays an executing PC-based FPS game. The smart phone is the controller of the PC game in this system.

We use the devices on the smart phone to implement the interface. Other than the basic functions, key-in, and mouse control, we will include different functions into the design of the game control interface by combining several devices on the smart phone according to the game. In our experiment, we use a first person shooting game (FPS) and a massive multiplayer online role-player game (MMORPG) as the test PC games. The devices may be used and their functions are as below:

A. G-sensor

Generally, we can use it to control the mouse cursor on the PC screen.

In a game, we can use it to control motions such as moving forward, moving backward, and rotation as a player wishes, so that an analog joystick is not required.

B. Touch screen

Generally, we use it to input words and present some buttons with functions corresponding to the buttons on a normal mouse. Besides, we use it to manipulate pages on a PC screen.

In a game, it can display some buttons to execute commands such as attacking, reloading, and others. And also a menu can be displayed on it. [3]

C. Speaker

The speaker can play some sound effects, such as sounds of control or item actions.

D. Microphone

The microphone can be used for voice recognition, so some game commands will be given orally by players. It also works as a communicating radio. [4]

E. Camera

The front camera of the smart phone provides the function of video communication in a multiplayer game. It can also be used to take players' photos so that they can use these photos in the game as their avatars.

F. Vibrator

The vibrator is triggered by certain actions or events, such as firing or getting hit.

IV. EXPERIMENT

A. Generally manipulating

There are many completed programs on the Internet which can manipulate a computer by a smart phone directly and use WIFI tool as wireless connection solution between the computer and the smart phone, just like *RemoteDroid, TeamViewer,* etc. We can use the touch screen on the smart phone to control the mouse curser on the computer screen and use the virtual keyboard built-in the android system on the smart phone to replace the function of the original physical keyboard. That programs show that use a smart phone for general manipulating a computer is possible.

After generally manipulating, manipulating games on a computer by a smart phone is the main idea of our research.

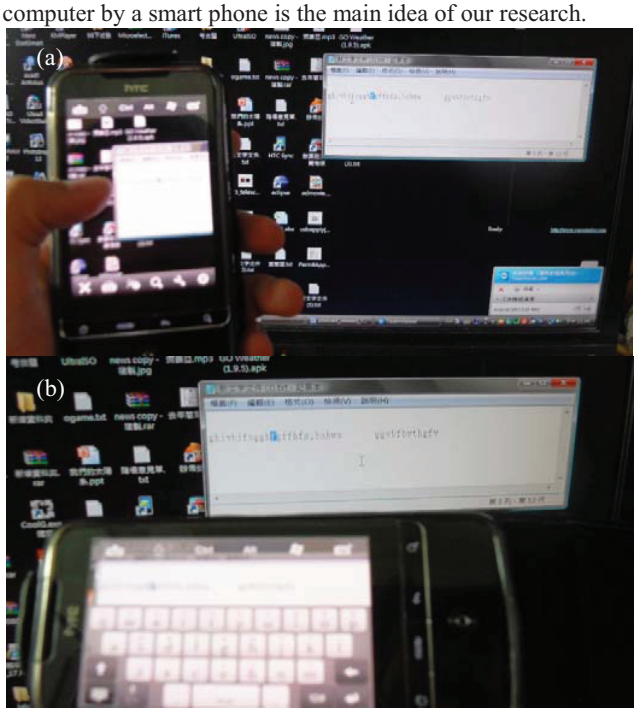

Fig. 3. The schematic of the TeamViewer. (a) Slide finger on the smart phone screen can control the mouse curser on computer screen. (b) Using the virtual keyboard built-in the smart phone to key words can replace the function of physical keyboards.

B. Game manipulating

We use a computer FPS game, *Counter-Strike*, also called *CS* and a MMORPG game, *Perfect World*, for the PC game platform in our research. What we are want to prove is that for different PC games, the program flexibility of smart phone can give it various manipulating interfaces. And we can design the specific interfaces according to the needs of different computer games, creating the most suitable computer game manipulating mode.

1) Counter-Strike

In the CS, we use the accelerometers on the smart phone to determine the dip angle of it and use this data to control the role's movement in the game. With the method, players can use the smart phone as rockers to manipulate the motion of the game role. When a player tilts the smart phone forward, the game role will move forward. Similarly, as a player tilts the smart phone backward, the game role will also move backward. On the other hand, if the smart phone is tilted left or right, the game role will turn left or right. For jumping motion of the game role, what a player need to do is shaking the smart phone up and down quickly. With these methods, players can control most basic moving motions of the game role intuitively.

In addition to the moving motions, the shooting, recharging bullets, throwing grenades, collimation and buying weapons are the other important manipulations in the game. Our method is using the touch screen on the smart phone to implement several virtual buttons and touch pad and controlling those motions of game roles by them. For collimation, players can glide their finger on the touch pad, controlling the aiming point. For shooting, players can use their finger to tap the touch pad or "Fighting" button. For the other motions, there are corresponding buttons for player to do these controlling. With the suitable buttons' locations on the smart phone, players can manipulate the game role more easily.

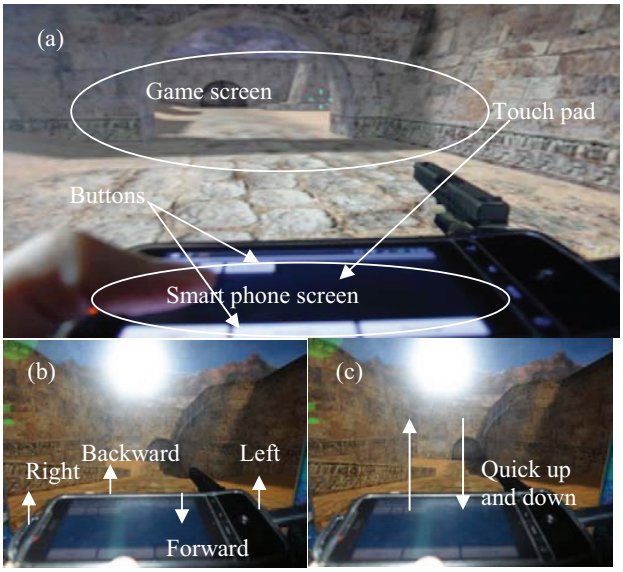

Fig. 4. The schematic of the CS interface design. (a) The system disposes. (b) Tilt the smart phone can let the game role move forward or backward and turn left or right. The angles symbolize the dip direction. (c) Quick up and down the smart phone can control the jumping motion of the game role.

There is another function we are trying to combine which is showing the CS game screen on the smart phone's screen, and the aiming point on the game screen will move into the point where the player tap on the smart phone's screen. It can decrease the aiming difficulty significantly. Just like fig. 2.

Compared with the original hard devices of the game, keyboard and mouse, using a smart phone to control game roles is much intuitive, like a rocker. And with virtual buttons, we can display them dynamically according to our need. Not like the physical keyboard, the word on the virtual buttons is also changeable. It lets players can be familiar with the game manipulating environment quickly.

2) Perfect World

The movement motion control of the game role is similarly with the CS. On the other hand, we try to change the shortcuts which implement by keyboard originally into virtual buttons on the smart phone's touch screen. And we change the words on the virtual buttons to let players easily know the functions of these buttons. The advantage is that players can easily know the functions of these buttons and tap them without keeping the shortcuts on the keyboard in mind first. It increases the rate of familiar the game, and decreases the difficulty of manipulating game.

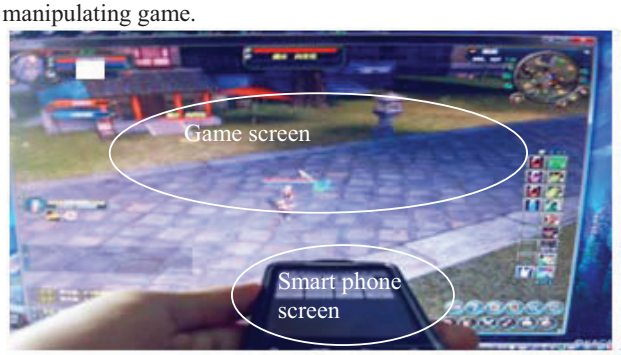

Fig. 5. The schematic of the Perfect world interface design. Using virtual buttons on a smart phone marked with suitable words for shortcuts can be easier familiar by players then using a physical keyboard.

In this part, the virtual buttons' position and function can be changed according to the game roles and players need. Therefore it is much more flexible then using a physical keyboard. But the problem here is that there may be too many virtual buttons to occupy the most area of the touch screen on the smart phone, we cannot use the touch screen as a touch pad to control the mouse curser. So we still need a physical mouse to satisfy the need. However, our design still takes players different game experience from using a physical keyboard.

V. CONCLUSION

The research is still on-going. There are many devices on smart phone mentioned in the paragraph "Interface design"

that we can add into the game interface and the corresponding functions just like we mention in it. On the other hand, in the two games, it is not enough to full represent all the original games interfaces function of a keyboard and a mouse by a smart phone. And expect for the two games, there are many other kinds of games, like RPG, ACT, ARPG, etc., that we can discuss the effect of using smart phones for game interface. But at least in the research, we prove that using the smart phones for computer games is possible and can let players get different game experience from getting by the keyboards and mousses.

VI. ACKNOWLEDGMENT

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