Video Game that Uses Skin Contact as Controller Input

Tetsuaki BABA*
Graduate School of Design / ADCDU,
Kyushu University

Taketoshi USHIAMA †
Faculty of Design,
Kyushu University

Reiji TSURUNO ‡
Faculty of Design,
Kyushu University

Kiyoshi TOMIMATSU §
Faculty of Design,
Kyushu University

Figure 1: Snapshot of playing Freqtric Game.

Abstract

In this paper, we present the first stage of our video game proto-
type which treats skin contact as controller input. Skin contact is
communication which has special emotion. Video game also has
elements of communication, for instance, Family Computer [Nin-
tendo 1983] has two controllers in order that family or friends can
play the game together. We use these two features and propose the
interaction that players can enjoy video games with skin contact.
We implemented the game controller and two video games. The
controller has the mechanism which enables to detect skin contact.
One of games of our prototype is a shoot-em-up game. Another
is a rhythm action game. Our goal of this research is to show the
increase of enjoyment and intimacy at the game with using skin
contact.

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Input devices and strategies—Prototyping;

Keywords: interaction design, game controller, skin contact,
video game, communication, interpersonal communication

1 INTRODUCTION

Today the telecommunication penetrates our daily life, like tele-
phone, e-mail, chat on Internet, etc. Certainly it is convenient and
necessary to use these electronic way of communication, which of-
fers certain proximity in distance. However, face-to-face, moreover,
body-to-body communication is also necessary for human life to re-
cover its inherent sensitivity. Especially, skin contact have its origi-
nal power of communication. This kind of primordial communica-
tion is characterized by its corporal presence of each other and an
interaction of bodies through skin contact, which are absent from a
virtual space communication. In close personal relationships, such
as family and friends, touch is particularly important as a commu-
nicator of affection. we play the game with our friends or family
at multi player game mode. This has an interesting opportunity to
experience communication in both virtual and real space.

From the view of game devices, recent game controllers have not
only key buttons but also various sensors in it. These efforts to
improve game controller encourage to create new type of games.
For instance, by Wii controller[Nintendo 2006], we came to be able
to enjoy a new type of games that was not before. It is important
to make unprecedented controller in order to create a new type of
games.

We presented implementation and performance of a musical instru-

ment "Freqtric Drums" which treats a human skin contact as a musical interface [Baba and Tomimatsu 2006]. In this paper we applied this technique to video games. By adding the mechanism of skin contact detection to a game, A player comes to be able to communicate with another player in the real and virtual (game) space (Figure 1). Our goal of this research is to show increase of the degree of enjoyment in the game which has skin contact input. We present the game controller device and two video games which treat skin contact as controller input. We call our prototype of this video game system "Freqtric Game". Freqtric Game is a 2-player game system which has the mechanism of skin contact detection.

2 RELATED WORK

There are many types of a game device, such as Joysticks, gloves, foot controller, Wii controller and so on.

In the case of applying part of human body to game control input, Shou et al. proposed a face-tracking as game controller input[Wang et al. 2006]. And J.David et al. proposed the eye-tracking for video game control[Smith and Graham 2006]. Their devices are unique and intuitive one, but also are high cost and big one to install. Our sensing module is so small and easy to implement to other game devices at low cost.

Scott et al. and BJ Fogg et al. proposed a haptic device as interpersonal communication and entertainment[Brave and Dahley 1997][Fogg et al. 1998]. They used haptic feedback technology in it. Their Concept is similar to us, but our approch differs in using human body as a interface from theirs.

3 SENSING TECHNIQUES

We propose a game system that is enable to treat human skin contact as controller input. In order to do so, we need the sensor device which can detect skin contact. Then, we investigated two method for sensing. One method is human body transmissions. Another is Electro Dermal Activity(EDA).

3.1 Human body transmission

Human body transmission uses a human body as a transmission medium allows wireless communication without using airborne radio waves. Zimmerman proposed human body transmission first[Zimmerman 1996] . There are some implementation for data communication[Hachisuka et al. 2003][Fukumoto and Tonomura 1997].

To apply this technique to our skin contact sensing, we have the following two restrictions: (1)taking several time to detect a skin contact, (2)can not detect the intensity of touching. When we do skin contact, there is not always enough time for data communication. And human body transmission could not detect a intensity of touching.

3.2 EDA

EDA(Electro Dermal Activity)is a term used to describe changes in the skin's ability to conduct electricity. Amount of electric current in the inside of the body is measured. EDA technique is used as
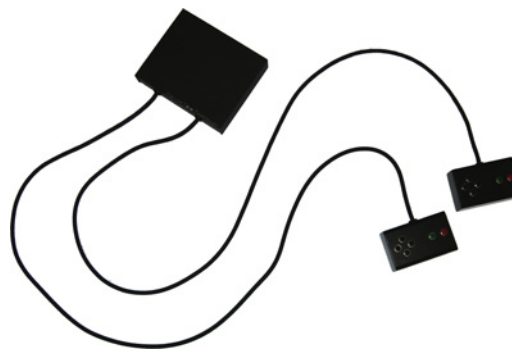

Figure 2: Freqtric Game controller device.

Figure 3: Using Controller (up: normal operation, down:skin contact input)

polygraph and so on. Changes in the skin's ability to conduct electricity is mainly related to internal body resistance and skin resistance. Especialy human skin resistance(100-4000 Kohm)is enough larger than internal body resistance (25-120 Kohm) to ignore internal body resistance. Skin resistance is related to the degree of touch intensity and size of a touch surface. In order to sense the degree of touch intensity, we use human skin resistance and subtle direct current.

We implement the device that can detect not only skin contact but also the intensity of skin contact. It is important to detect the intensity of skin contact, because softer touching has different meanings from harder touching at touch communication. We use EDA for implementation in order to express players delicate nuance.

4 IMPLEMENTATION

4.1 Hardware

Our device called "Freqtric Game Controller Device (FG controller device)" looks like a regular game controller (Figure 2), but it contains our original sensor to detect skin contact. The looks of FG controller device shows that we can easily apply "Freqtric Game Sytem" to existing games. Handling FG controllers, two players can do skin contact input by touching each other. There is a stainless steel plate on the back of each controller. Players are connected to the sensor of FG Controller to handle their FG controller (figure 4). Figure 3 shows snapshots of skin contact input. In order to detect the degree of skin contact intensity, we use analog photocoupler (MI0202CL) as a part of the circuit. When we treat human
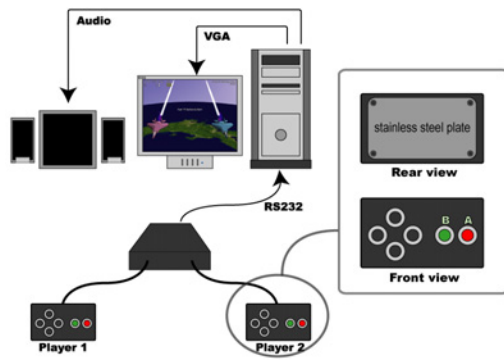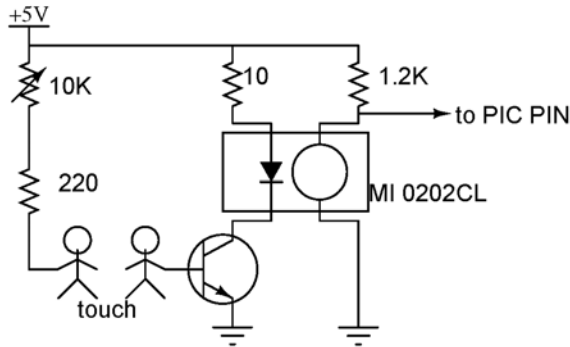
Figure 4: The overview of Freqtric Game system.

Figure 5: The circuit of FG controller sensor module.

Figure 6: Sample data of our sensor. Repeatedly one player touches another hardly, then softly.

Figure 7: Screenshots of Freqtric Shooting

bodies as a leading wire, we must take consideration of the noise from human ground. We can ignore the noise by using analog photocoupler, because analog photocoupler need some milli seconds to be turned on. Responce time of analog photocoupler is about 6-10 [ms]. [1] It is so small to find latency for players. Figure 6 shows sample data when players touch each other repeatedly. The value of voltage takes from 0.9 to 5.0[V]. If players are not touching each other, value of voltage indicates about 5[V]. The harder, the lower voltage become. The softer, the higher voltage become. 5 is the circuit of our sensor module.

FG controller device has Microchip[2] (PIC18F425) in it. FG controller device is connected to the computer through RS232 communication. Figure 4 shows the overview of our system.

4.2 Software

We made shoot-em-up game which is called "Freqtric Shooting", rhythm action game which is called "Freqtric Dance" and simple competitive fighting game called "Freqtric Robot Battle" to show examples of video games using FG controller.

Freqtric Shooting: shoot-em-up game

Figure 7 shows screenshots of Freqtric Shooting. Freqtric Shooting is a type of shoot-em-up games. A shoot-em-up is a computer and
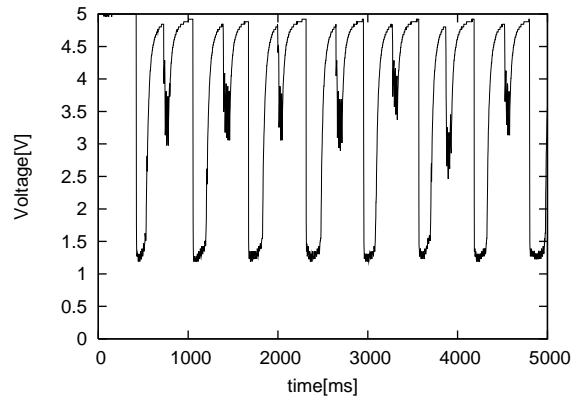
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[1] From MI0202CL data sheet.
[2] MICROCHIP: http://www.microchip.com/

video game genre where the player has limited control of their character or machine (usually a jet fighter or spaceship) and the focus is almost entirely on annihilation of their enemies.

Normal operation

Players move own jet fighter to press arrow keys on the FG controller. They can shoot missiles from their fighters to press B button. A missile has four degrees of power and four types. Players can change a missile type to get a colored (red, green, blue, white: default) star object. Their fighters explode to collide with enemies or enemies' missile.

Special operation with skin contact input

By doing special operation, "skin contact with other player" in the real world comes to become corporation in the game world. We think that this encourages enjoyment or intimacy at corporative work between 1-player and 2-player.

Bomb: clearing enemies and enemies' missle on the screen
Pressing both A and B button, players can destroy all enemies and enemies' missle on the screen by touching another player. They can increase stocks of the bomb up to three by getting a yellow star object.

Unit: power up own fighter
Players' fighter is united by touching each other when a player is near by another on the screen. Players can shot "energy shot" and move fighters is the twice as quick as single fighter while fighters are united.(figure 7)

Revival of own jet fighter
Each player has only one life. After explosion of own jet fighter,
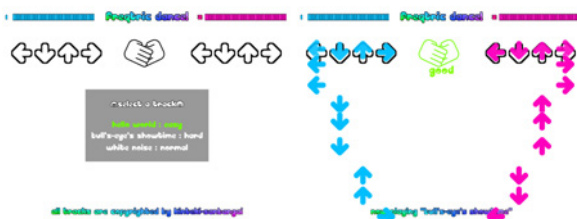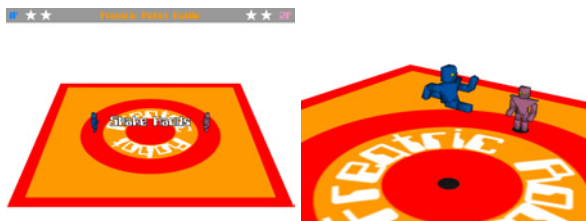
Figure 8: Screenshots of Freqtric Dance

Figure 9: Screenshots of Freqtric Robot Battle

player can't rejoin to the game by himself. But if one player doesn't lose his/her life, another player can join to the game again by touching other player 100 times.

Freqtric Dance: rhythm action game

In a rhythm action game, the player must press specific buttons, or activate controls on a specialized game controller, in time with the game's music. We made this type of game called "Freqtric Dance". 8 shows screenshots of "Freqtric Dance".

The gametype features the following gameplay: as arrows and hand marks scroll upwards on the screen, they will meet with a stationary set of target arrows and hand mark. When they meet the targets, the player should press the proper arrow button or touch the other. The moving arrows and hand mark will meet the targets based on the beat of the song. The message (perfect, good, bad, miss) is displayed based upon how accurately players can trigger the arrows or hand marks in time to the beat of the song. Players' efforts are awarded by letter grades that tell him/her how well the player has done; A is the highest award and D is total failure.

Freqtric Robot Battle

Players can move own robot to press arrow keys on the controller. They can shoot missiles from their robots to press B button. A player is fallen from the stage first will be a loser. Players also can use skin contact input. Players can attack the other robot by slapping the other player. Players also can stick to the other robot by grabbing the other player. To start or end the game, player must do " shake hands " as the manner of sportsmanship. Figure 9 shows screenshots.

5 FUTURE WORK

We made two types of video game using FG controller device. Our goal of this research is to show the increase of the degree of enjoyment and intimacy at the video game with skin contact detection. In order to do that, we need three - four types of the video game. Now

we are considering and making other type of video games, such as action, puzzle, sport game and so on.

As Shou et al. evaluated whether the interest or enjoyment of the game changes as a result of the type of input device, by the subjectivity evaluation method and the user observation method, etc[Wang et al. 2006]. After making a few more games, we shall experiment and investigate about enjoyment and intimacy at our game which treats a skin contact as controller input.

6 ACKNOWLEDGEMENT

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