BYU-BYU-View
~A Wind Communication Interface~

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1 Introduction

BYU-BYU-View is a novel interface realized with the symbiosis of the input/output of wind and the computer graphics. "BYU-BYU" is a japanese onomatopoeia for a howling wind. It adds a new element, that is, “wind”, to the direct interaction with a user and a virtual environment, and the communication through a network, by integrating the graphic presentation with the input and output of wind on a special screen.

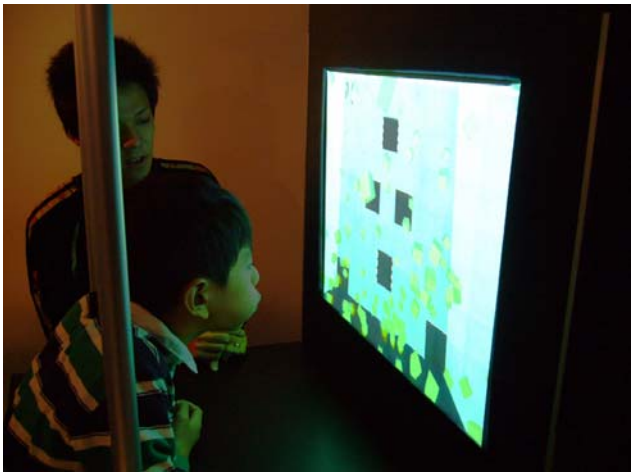

Figure 1 : BYU-BYU-View system. Application is virtual breakout.

This system brings the new communication medium of "wind" into the bidirectional interaction between the virtual environment and the real environment. Player can interact with the virtual environment in the screen through his/her breath and the wind emission from the device. Conversely, actions from the virtual environment to an experient are performed by wind changing dynamically. A single screen is used for both sensing and presentation of wind. As a result, the experient can share not only sights and sounds but also the cutaneous sensation by wind with the system, and interact with the virtual environment feeling a nonconventional deep relationship.

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BYU-BYU-View uses “wind”, the new communication medium to bring the different information from the acoustic or visual one. We aim at the establishment of the totally new interface that uses a communication medium of wind as an interaction system connecting people of distant places with the cutaneous sensation or as an interaction device with the virtual world.

2 Exposition

2.1. The core technology of BBV system

This system has three core techniques.

1. Synchronization of graphics and wind with the wind-permeable screen

2. Two-dimensional sensing and presentation of wind

3. A bidirectional interaction of wind

1. The screen of this device uses a special wind-permeable material. This screen, which Teijin Nestex limited developed, has 4 fibers in 1mm width and 150μm gaps among fibers so that it can breathe. Simultaneously, it can display as beautiful image as a normal movie screen. With this screen, we can integrate the input/output of wind and the projected image naturally.

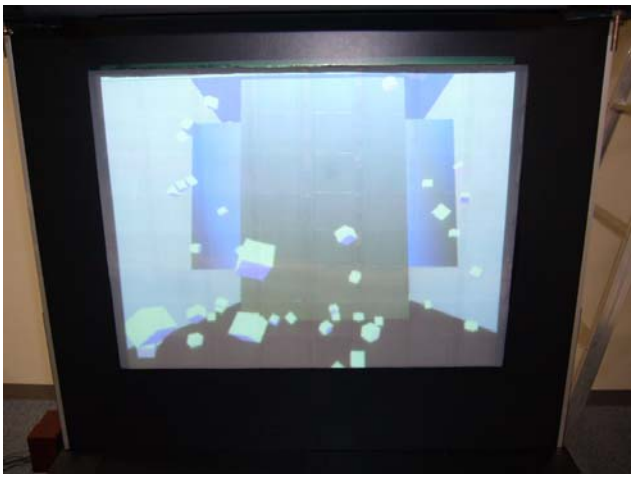

Figure 2 : Graphics on the screen

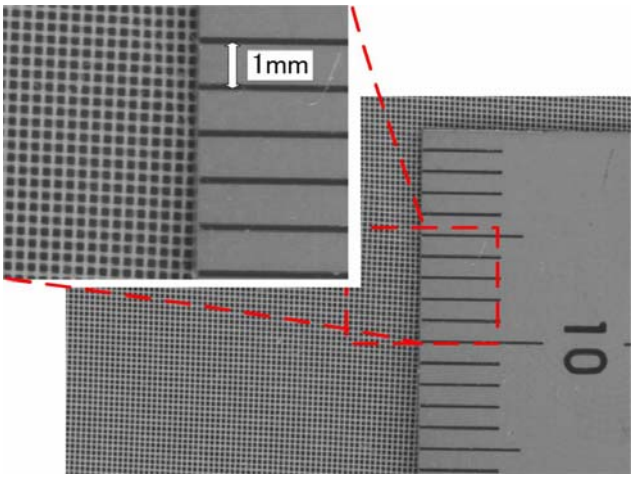

Figure 3 : A special wind-permeable material. 4 fibers in 1mm width and 150μm gaps among fibers.

2. Behind the screen, we install the array of wind-input detection sensors and wind-output mechanisms. Therefore, it is capable to detect the location which the wind hits properly, and output wind from an arbitrary place.

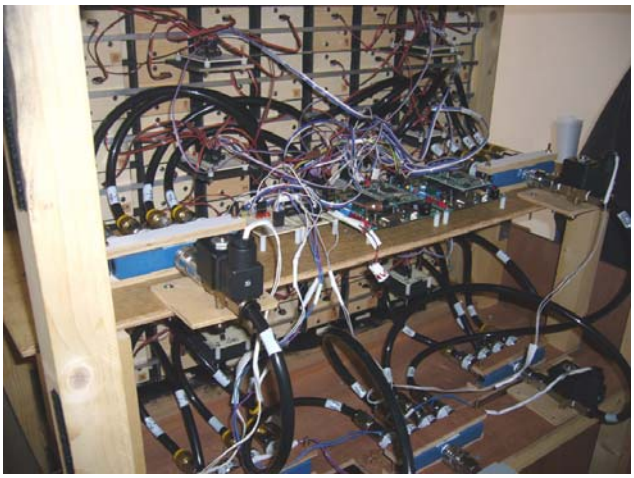

Figure 4 : Array of wind-input detection sensors and wind-output mechanisms (back view of this system)

The input sensor has a mechanism that front plates incline backward when they catch wind. A retroreflector is affixed to the backside of each plate, and reflects the light from the photo-interrupter. The reflected light changes according to the inclination of plate. The wind-input is detected with reading this change. The rear array of the screen consists of 64 wind sensor cells. For the wind output, we use the compressed air generated by an air compressor. The outlets of wind are installed among the wind sensor cells. This prototype system has been actually exhibited in the IVRC2006 contest of virtual reality and won the second prize.

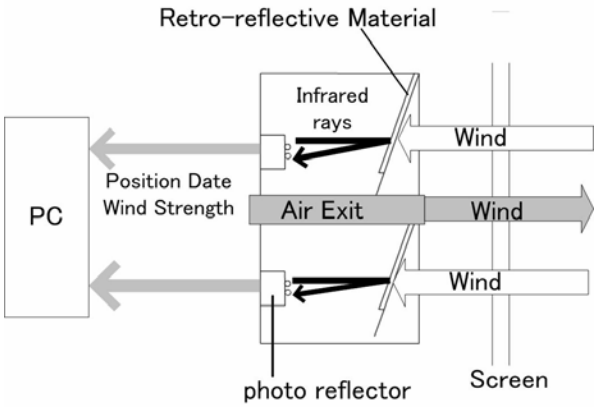

Figure 5 : System Configuration of current wind input/output system

Now we are revising this prototype to realized more dynamic wind-output using a blower array for the output.

3. In the BYU-BYU-View system, the screen is not only the graphical display, but also the wind interface of a virtual environment and the real world. With the features of 1 and 2, this system realizes both sensing and presentation on the boundary of the informational and the real worlds. As a result, it enables the direct wind interaction between users and a virtual environment and even realizes a wind telecommunication through network.

2.2. Related works

There are already various interfaces using wind or breath. Though, most systems use wind for only one of input or output and realize the other function with a different medium. In contrast, this BYU-BYU- VIEW system uses wind for both input and output: it can response to the wind input with the same information medium of wind through the very same screen as of the input.

Following prior works use wind as the input. “kirifuki” [Iga and Higuchi 2002] is a GUI operation environment applying breathing. “Jellyfish Party” [Asai et al. 2003] is a Mixed Reality installation, using HMD(Head Mount Display)to create CG of virtual soap bubbles and jellyfishes in the real space responding to the breath input. “The Dimension Book” [Hatano et al. 2003] has an application using breath for the input, too. This is a work which detects the breath input using a microphone and change the condition of the virtual candle graphics. “LivePic” [KATSURA and INAGE 2006] is a installation in which players draw pictures and control them by the blowing breath. All these precisely use the human breath as the input interface, but the outputs from virtual environment are limited to graphics and sounds.

On the other hand, there are some prior works using wind as the output. ”Untethered Force Feedback Interface That Uses Air Jets” [Suzuki et al. 2004] is an interface which makes player feel the sense of touch to virtual objects on a table, using the gush of wind from one of nozzles buried in the table and letting hit it on the wind receptor hold by the player. In this system, the player inputs the location

information with a cup, and is presented information with wind. However, it don't use wind for the input to virtual environment.

There is a system which performed input and output at the same time. "The Wind-Surround System" [Kosaka and Hattori 2006] is the system which uses the all courses fan installed around the experient. The experient blows breath into the air flow sensor. Then a fan corresponding to the position information provided by the position sensor outputs wind equivalent to the wind velocity provided by the air flow sensor. In this case both input and output is performed by wind, though, the input and the output are not performed at the same place but separate points. Our system can connect the virtual wind on a picture and the real wind because it can perform the input and output of wind on the same interface of screen.

Thus, the BYU-BYU-View is a novel system that realized the input and output of wind with the same screen for the first time ever.

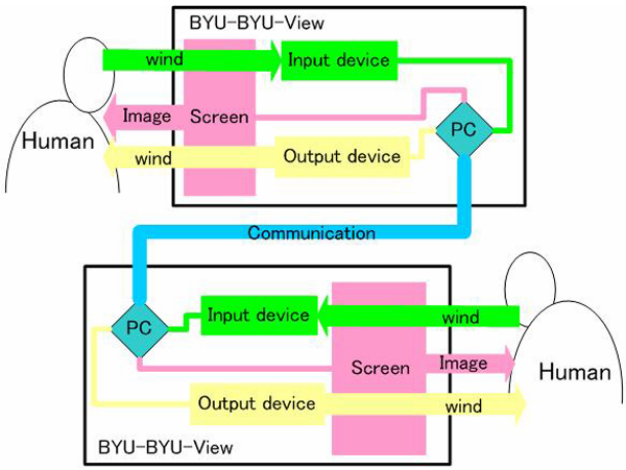

Figure 6 : Block diagram of BYU-BYU-View

2.3. This system changes our life style

With such an interface using wind as the information medium as the BYU-BYU-View near ourselves, our lifestyle will change radically.

The popular telecommunication tools have been telephone or video-phone which use the visual or sound Information. "RobotPhone" [Sekiguchi et at. 2001], which we have developed before, was to show the sense of force through the telecommunication. On the other hand, this system realizes the cutaneous sensation through wind.

This BYU-BYU-View realizes to send and receive the information about your beloved person at a remote location with not only the sight and the voice but the breathing and even the sigh of him/her. Thus you can feel the existence of him/her much closer. If you use it as an interface with the virtual environment, it is possible to input and output with the new information medium which stimulates the cutaneous sensation besides image and sound. It hereby realizes the new communication form between a person and a person or a person and a computer.

Figure 7 : Tele wind communication

2.4. Exhibition for SIGGRAPH 2007 attendees

We will prepare two devices. The experience is for one or two. The player sits down towards screen. In the case of two players, they will face each other across the system and screen. It will project one's face on the screen of the partner, and the other's face on one's screen. In this situation, players breathe on their screens each other and perform the communication using wind. We assume 2 concrete applications as follows:

1. An application using real video images

2. An application with real images and the physical simulation

1. It is the application to use this system for the telecommunication with the real photographic images.The player's face is projected on the screen of the partner sharing the system, and the player's own screen shows the partner's face. Players breathe towards the screens each other. The wind from the screen corresponding to the partner's action stimulates the cutaneous sensation of the player. It uses wind for communication. The player can communicate to stimulate the cutaneous sensation with the distant partner using wind as the medium.

2. It is the application using the physical simulation for one or two. In the case of one, the player interact with the virtual environment with the information medium of wind. When the player blows wind towards the virtual environment in the screen, it changes its own condition directly and shows the cutaneous sensation from the virtual environment to the player with the information medium of wind. In the case of two, the virtual environment intervenes between the players, and gives the interaction with the virtual environment and the communication using wind as the information medium. For example, we have applications as the virtual air hockey, the game to blow a pack each other in a virtual court in the screen, and the virtual breakout, the game to brush blocks off with breathe.

Figure 8 : Virtual air hockey

Each application can be played for one or two minutes, and preparation takes only around 30 minutes. This system has been actually exhibited in the IVRC2006 contest of virtual reality and won the second prize. More than 300 people experienced it in that event, and it worked very stable with no trouble of the system or no dangerous accidents at all. In the SIGGRAPH 2007 exhibition such a smooth exhibit should be possible.

We have exhibited this system before, and the mechanism of hardware has already completed. Now we update the system to gain the better sensing performance and the more dynamic wind output. Though, the current prototype system can be exhibited even just now if necessary.

3 Conclusions

With the BYU-BYU-View, the interaction using wind is enabled. Various things would be enabled by establishing this device as a new vehicle of information, wind, like television conveys sound and image.

As the telecommunication tool, it would be a system which is able to present the cutaneous sensation of sharing the same space by lovers who cannot actually be together.

Using as the interface with the virtual environment, it can realize a novel game which can show the cutaneous sensation by wind as well as the sight and the hearing. It can build the virtual environment between distant two people and enable the shared interaction of them with that virtual environment.

It would become a new input tool for people having obstacles of hand or foot, and a presentation method of information speaking to skin directly for blind of deaf people.

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