가상세계와 현실세계 사이의 정보전달자에 관한 연구

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Study on a Connector between Virtual World and Real World

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Abstract

The concept of connector is introduced as mediator between virtual environment and real environment. A connector has interest on usefulness in real world while previous interfaces of virtual reality system have focus on virtual world. A functional connector among connectors gives solution of disorientation problem in virtual environment and helps user to take out the knowledge experienced through virtual reality system in real environment. An example of a functional connector is designed and developed. Evaluation of connector will be executed later.

1. Intorduction

Interface is indispensable element in VR system because VR system basically supports interactive medium between virtual world and real world. The term interface is defined as the technology that goes between the human and the functional elements of a machine. Interfaces include the hardware elements and include also the software modules and human factors considerations.[1] Interfaces of VR system move to multimodal interface, tangible bit, and so on.[2,3,4] Software structures and human factors are researched to support these interfaces.[3,5,6,7]

The virtual environment goes more complex and displays more information as large-scale virtual environment.[8,9,10] It is difficult to memorize much information exposed through interfaces of VR system and to utilize these huge data in real world. However, focus of previous interfaces of VR system is related to control and to display virtual environment and human factors for knowledge transfer. User of VR system was not needed to memorize information through virtual environment if there were a mediator to help memorizing information. Mediator plays a role to take out experience and information of VR system into real world. This mediator is defined as connector between virtual world and real world.

Connector is also located between virtual environment and real environment like previous interfaces, but it takes interest in real environment more then in virtual environment. Connector may control virtual environment but controlling virtual environment is not its main function. In the case of displaying virtual environment with connector, virtual environment is displayed with other format; text, 2D, and simple 3D. Connector is a backup system for virtual environment in real environment. Connector and previous interfaces are compared in table1.

Connector is described in detail and is compared with other technology in chapter 2. An example of connectors showed in chapter 3. Research is concluded in chapter 4.

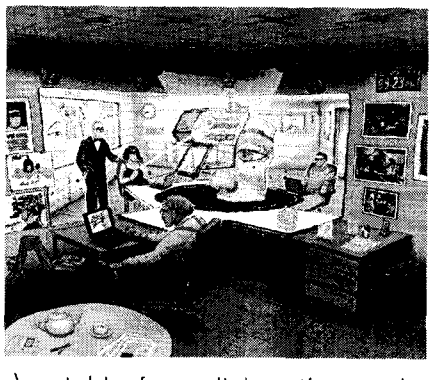
table 1. Comparing Interface and Connector

	Interface	Connector
View point	Virtual Environment	Virtual and Real Environment
Control VE	Yes	Yes or Not
Display VE	Yes	As other format
Use Place	Virtual Environment	Virtual and Real Environment

2. Connector

A Connector is used in real world between virtual environment and real environment as a mediator. There are two kind of connectors; simple connector and functional connector.

A simple connector plays a role to increase seamless environment between virtual world and real world. Simple connectors use fixed materials in a restrict area to make mediators between virtual environment and real environment. Examples of simple connectors are showed in fig. 1. A table is utilized to connect virtual world and real world for collaborative work.[11] A guardrail is used in real world for a psychical cure on phobia.[12] A simple connector may be a movable and light something like a model of cellular phone which is operated in virtual world but touchable material in real world. A simple connector is located in real world but does not have any functional mechanism in real world. A simple connector does not have logic.



(a) a table for collaborative work

(b) a guardrail for a psychical cure

Fig. 1. Examples of simple connector.

A functional connector is also been in real world but it has functional mechanism in real world. A functional connector assists users to pull out the knowledge and the information experienced in a virtual reality system. A user utilizes functional connector for making navigation route, then navigates virtual environment according to pre-decisive route. A user may not be in disorientation that often happened in virtual reality system because functional connector supports 2D map. After experiencing virtual environment in virtual reality system with functional connector, a user carries functional connector into real environment for reference on real space. A functional connector is used for pulling out the information from virtual environment. User does not need to memorize the virtual world. A conceptual diagram of a functional connector is showed in fig.2.

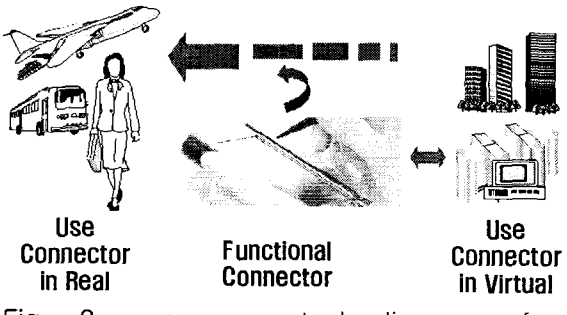


Fig. 2. a conceptual diagram of a functional connector

The transfer of spatial knowledge in virtual environment training is compared with other instruments in Waller's research.[13] Virtual environments can be an effective medium in which to train spatial knowledge compared on desktop,

map, real world, blind training. How the results were if experiments had been executedin multi-tool training: map added VE, map added real world, and so on? Experiments with multi-tool training will be heldlater to evaluate the effectiveness of functional connector.

A functional connector supports larger scale area than augmented reality. A simple connector, a function connector, interface of augmented reality, and previous interface of virtual reality are classified by scalability and functionality in fig.3. A functional connector is most portable mediator between virtual environment and real environment.

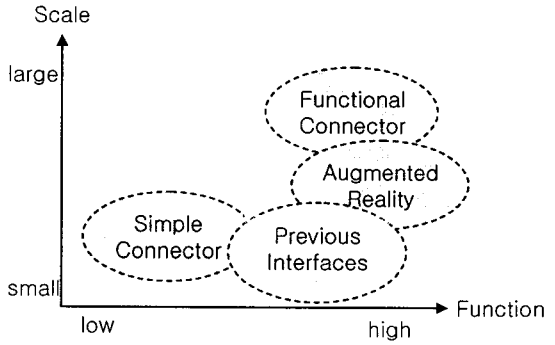


Fig. 3. Spectrum of mediators between virtual environment and real environment

3. An example of a functional connect

A handheldPC is used for connector between virtual environment and real environment. A user of connector makes a route plan on a handheldPC, and the route is transferred to virtual reality system, which displays the virtual environment according to the route. A user does not be in disorientation in virtual environment because connector gives information on virtual environment with2D map. After experiencing a virtual environment, a user finds path easily in real world because connector helps taking out the space knowledge trained with virtual reality system. A connector supports moving map, optimal path finding, path guide, information searching and so on. A connector system provides situational awareness and ability to preplan path and a virtual reality system gives chance to preview 3D virtual path. A user may carry digital map with connector after navigating the virtual environment. A client terminal service is a kind of connector that displays the part of PC screen through network.[14] However, it is not useful because of a narrow network bandwidth problem. A client terminal service will be also a useful connector in the case of wide network bandwidth environment.

3.1 System Design

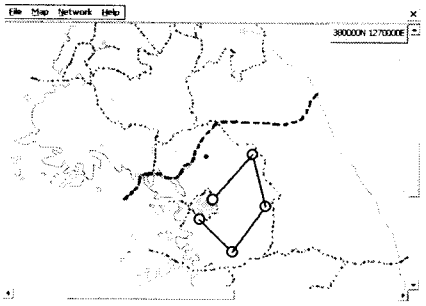
A connector has to be designed to work simply and to communicate a little transportation with a little data size. A connector is kept with essential load. A path is composed on connector, and the path is transferred to a virtual reality system. A 3D environment according to the path is displayed through the virtual reality system. At last, the path is carried with connector in real world.

A runtime navigating interface is not suitable for moving map and path finding because 3D navigation through runtime input device has many collisions with virtual buildings and difficulties in controlling input devices.[15] A path is drawn with linked turning points on a connector with pen then the path is transferred to virtual reality system.TCP/IP protocol is used between connector and virtual reality system because communication of connector needs reliable transmission.[16] UTM(Universal Transverse Mercator) and WGS84(World Geodetic System 1984) are supported in virtual reality system while WGS84 is only supported in a connector.

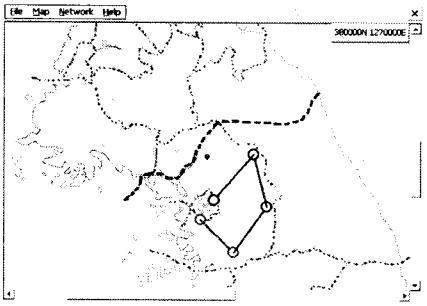
3.2 Development Results

A connector, handheldPC, module is developed on window CE base environment and emulated through a handheld PC Pro emulation. A virtual environment is generated in window based system; 866 dual CPU and wildCat4110 Graphic card. A path is composed with circles and links on the digital map. Circles are drawn to point

position and links are connected from circle (turning point) to circle automatically. A path can be saved and copied that it may be used later and passed to other users who want to follow the same path. A saved path may be used in moving map and modified easily.



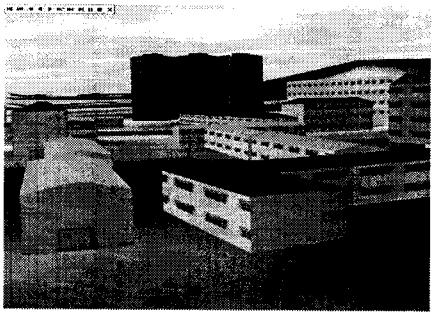
(a)



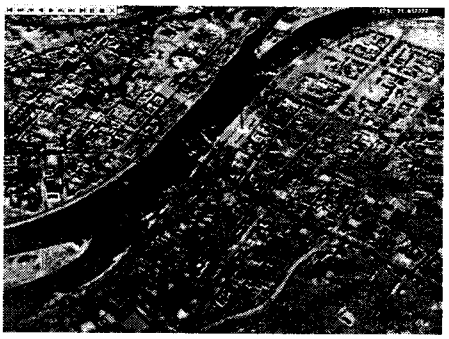
(b)

Fig. 4. An example of connector module: (a) an entire path, (b)processing one step.

A virtual environment is displayed according to the path that is transferred from the handheldPC system. The pathcan be skipped to the next turning point for faster rehearsal. A virtual environment goes forward and backward against the path. A virtual environment can be displayed several times repeatedly.



(a)



(b)

Fig. 5. An example of virtual environment module: (a) low elevation (b) high elevation

5. Conclusion

The technologies of virtual reality progress, but efforts for popularization of virtual reality and attemptson utilizing virtual reality system in real world are necessary. In this research, the concept of connector and an example of it are introduced which helps for user using the experiences of virtual reality system in real world. A connector supports users to pull out the experiences of virtual reality system in real world. Since all the experiences and information are not transferred from virtual world to real world, users of virtual reality system need connector between virtual world and real world. Users of a connector may not also be in disorientation in virtual world with help of connector. A connector has more interest in using the knowledge of virtual reality system in real world while previous interfaces of virtual reality system are interested in virtual world. A functional connector system has a difference compared with an augmented reality system in a view-point of supporting larger scale region.

A handheld PC system for navigation is presented as an example of a functional connector. An avigator is able to work through a virtual environment which navigator wants to experience. An environment is selected according to the path drawn on a connector. The pre-made path is also carried to real environment for connecting knowledge from virtual environment through connector.

Researches to evaluate the usefulness of connector are required later. Valuable cases have to be decided. Research is also needed on how much connector eliminates the disorientation of virtual reality system. Researches on design factors that enable connector to be valuable in real world have to be done in the more various field.

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