Tangible Media Aided Design System

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Abstract: Tangible user interfaces have attracted strong attention in the HCI(Human and Computer Interface) community for their ability to take advantage of skills humans develop in the real world. We are developing "tangible media aided design system" which employs physical objects i.e., brick as interfacing media for 3D graphic modeling. This system is targeting for persons who are afraid of experiencing 3D graphic modeling and virtual space, or have a sense of reluctance in approaching to them. Our approach suggests the easiest way for people to experience computer system and virtual space carefree while developing and improving their space sense. This work is one of initial explorations of media aided design system using tangible user interfaces.

1. Introduction

People have developed sophisticated skills for sensing and manipulating our physical environments[1]. However, most of these skills have not been employed by traditional GUI (Graphical User Interface). Tangible user interfaces have attracted strong attention in the HCI community for their ability to take advantage of skills humans develop in the real world. Some people are afraid of experiencing virtual reality. One of the main reason is that they are not used to the concept of transfering their idea and/or viewpoints from real to virtual world and virtual to real world. In other words they have some difficulty in undestanding and matching what is happening in the real world with what is happening in the virtual world. Another reason can be found at people's reluctantcy or frustration to computer system, which may come from the undesirable interfacing system or their previous failure experience. One of the representative examples will be CAD (Computer Aided Design) system. Though there are many different types of CAD systems they are very hard for people to understand and learn how to use them. Usually people don't feel to use these systems in their daily lifes. However, when there is something that they want to create or experience according to necessity or by chance in their computer system virtually they should have some hard time with a 3D modeling or editing system to learn how to use it. In the most cases, people come to experience their first virtual world through computer games. It is necessary to note the fact that people are experiencing their first virtual world in a passive position. They rarely have a chance to build or create a virtual world actively according to their intention. With this, people happens to be placed in a passive position after then. This research started from the idea that makes an efficient and creative authoring tool for general people to use without learning process.

2. CAD vs. Tangible Media Aided Design System

To make highly use of sophisticated skills of human in building 3D objects in virtual space we are developing "tangible media aided design system" which employs physical objects i.e., brick as interfacing media for building 3D graphics models. This system is targeting for persons who are afraid of experiencing 3D graphic modeling and virtual space, or have a sense of reluctance and frustration in approaching to them. If these persons have a chance to learn them easily at the beginning of experiencing they would not have that much concern.

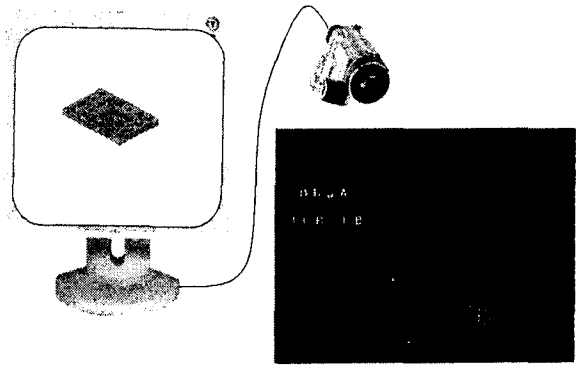

Figure 1. General description of tangible media aided design system. A brick on the workspace board is recognized and its corresponding brick is selected from the graphic model database.

Figure 1 and 2 represent the general description of tangible media aided design system. Our system is designed to help these people to learn and experience 3D graphic modeling in virtual space easily. The main difference between typical CAD system and tangible media aided design system lies mainly on the interfacing approach. In CAD system, people use icon and mouse to build a 3D model in the computer system. However, in tangible media aided design system,

people just put the bricks together according to their idea in real space. Then, the computer system recognizes the bricks as elements, which consist of a 3D graphic model, from the data base that is already set up before the constructing or assembling process. And also it recognizes the position of them in the work space area. Though brick is employed as one of typical tangible media in this paper many different types of tangible media can exist according to the ideas, definitions and applications. Many persons might have an experience that they played with brick as a plaything when they were children. They therefore can handle it without spending much time on learning how to play with. From this point of view brick is employed in this paper for interfacing or representing people's idea with the graphic modeling in the computer system.

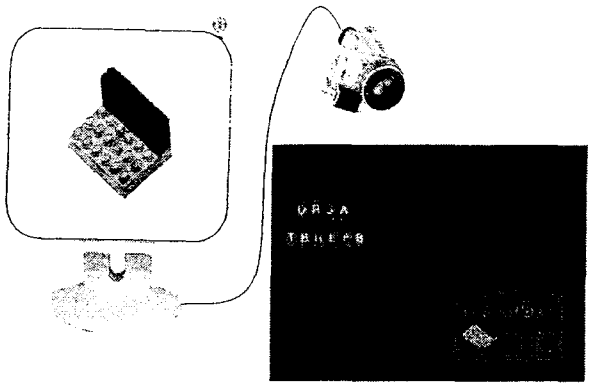

Figure 2. 3D graphic model is assembled through switching and assembling operations interactively.

3. 3D Modeling in Real and Virtual Space

3D modeling in real space is transferred into virtual space. To improve the efficiency of the modeling process in real space, we designed a workspace board where some switches and assembling area are drawn as shown in figure 1 and 2. Camera senses brick types, switching and assembling operations interactively with the user. To present, designed graphic models have a limitation to their shapes and complexity according to the sensing limitation and the characteristics of using brick for building a 3D model. However, this approach suggests the easiest way for people to experience computer system and virtual space carefree while developing and improving their space sense. This work is one of our initial explorations of media aided design system using tangible user interfaces.

4. Experimental Results

During the assembling process user should give some information on brick types to make a 3D model so that the design system recognizes the length, width and height of each brick. Color information is also employed to distinguish a brick from the others. This process is carried out just by putting a brick down on the workspace. Then camera measures the size and color the brick. Data base, which has informaton on color, length, width and height, for each brick, is already set up before the assembling process. Data base related information is appeared at the LEGO[1] web site[2-6]. With this pre-stored informaton each brick is easily recognized by the computer system. Computer system recognizes the position of the brick after measuring and recognizing process. To give some fuction on the workspace board we put some switches. "D", "R", "S" and "A" in figure 1 and 2 stands for "delete", "recognize", "save" and "assemble" respectively. They play a role of switches. They have no currents and sensors in them. Camera as a passive sensing device is employed to recognize the switching process. As one of the assembling condition bricks should be properly clipped without any gap due to mislocation. Figure 3 describes an assembling process and of virtual block and the corresponding real brick is shown in fiure 4.

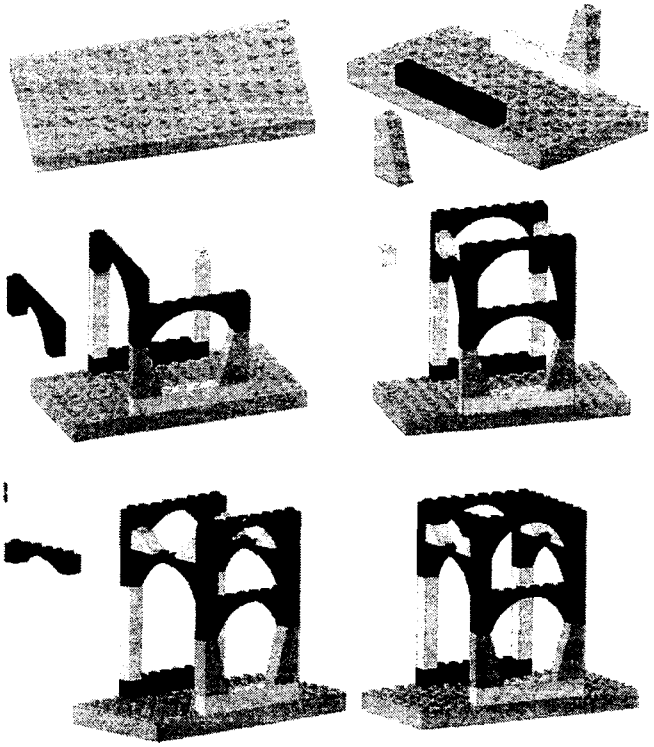

Figure 3. Virtual bricks are assembled into a 3D graphic model according to the progress of the real brick assembling in the workspace board.

5. Conclusion

This paper suggests the easiest way for people to experience computer system and virtual space carefree while develping and improving their space sense. 3D modeling work in real space is transferred into the virtual space. To improve the efficiency of the modeling process in real space, we designed a workspace board where some switches and assembling area exit. Through image processing camera senses brick types, switching and assembling operations interactively with the user. Though we still have some limitations to the shapes and complexity

[1]LEGO is a registered trademark of the LEGO Group

of models which are cased by the sensing inaccuracy and the characteristics of using brick these problems will be studied further as our future works. This work is one of initial explorations of media aided design system using tangible user interfaces.

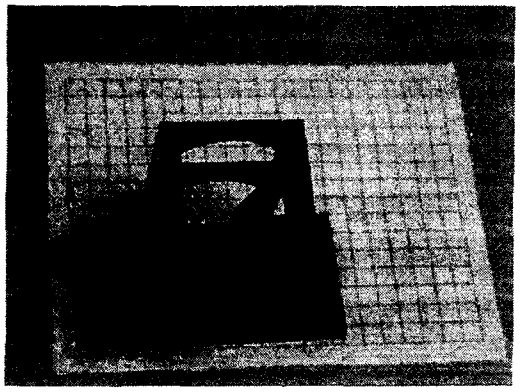

Figure 4. An assembled brick model using real bricks as tangible media.

6. References

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