iSphere: A Proximity-based 3D Input Device

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INTRODUCTION

iSphere is a hand-held device for modeling 3d geometry. Physical interfaces can simplify processes of manipulation by mapping functions to physical settings [1]. iSphere simplifies the mappings between low-level manipulation commands and modeling concepts. The modeling functions have built into the physical configurations. The system consists of a dodecahedron made by acrylic pentagons and a microcomputer connecting to twelve proximity sensors on the surfaces. Proximity sensors can be capable to understand user's action and provide feedback interactively.

INTERACTION TECHNIQUES

In most 3D modeling systems, keyboards and mice are essential for inputting 3D commands. However, it still can't allow us to perform an editing command by only one action. It still cost a large amount of time to do a series of commands. Low-level operations are time-consuming and costing extra efforts to complete a task in a 3D environment. The fragmented metal views and visual representation should be mapped in order to reduce the cognitive load of 3D manipulation. iSphere collects how a user interact with the device in order to adapt the desired action. It can be both one-handed or two handed input device.

This device will be made by capacitive surfaces which can sense four levels of proximity, including no hand around, hands nearby, touching and pushing the surface. The viewpoint control mechanism can interact with users to zoom-out the scene by pushing the facets in front of the user or zoom-in by pushing the surfaces behind. If a hand is approach the surface without contact, a user can virtually rotate the viewpoint by moving hands around the device.

The iSphere has an edit mode for 3D geometries and an inspect mode for navigating 3D scenes. Natural hand actions are used as metaphors to map the modeling commands, such as pushing on the top surface to squeeze the 3D model on that direction or pushing the bottom surfaces to pull 3D surface. Visual feedback is provided in responding the warp effect on the surface of interest.

In inspecting mode, a user can touch the surface to zoom-out or zoom-in 3D scenes by pushing the surfaces in front of the user or pushing the surfaces behind. iSphere can also act as a proximity sensor which can detect the hand position and rotate the corresponded camera viewpoint when a hand approaches the surface. It can automatically get oriented when a user touches anyone of the surface.

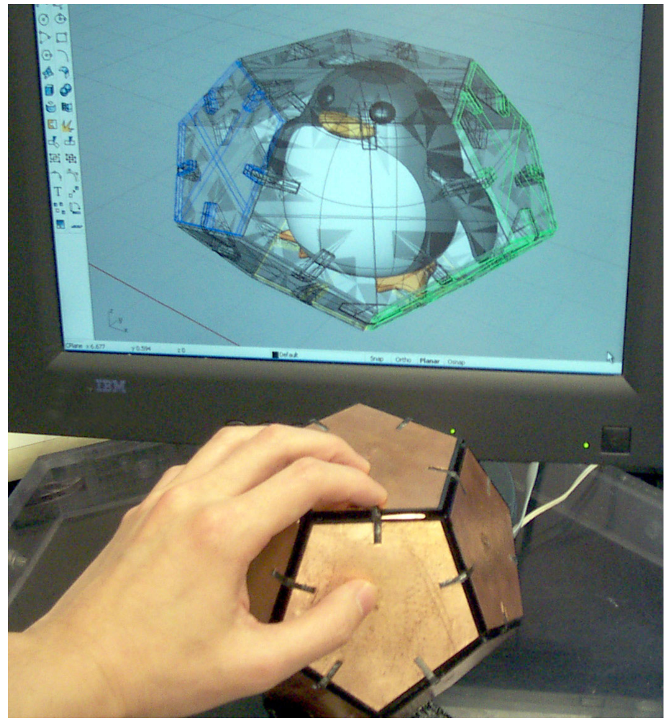

Figure 1: iSphere is a dodecahedron using for manipulating 3D geometry. Each facet is a capacitive sensor. It can sense the hand position, touching, pushing and human body in order to execute modeling commands proactively.

DISCUSSION

By manipulating the physical interface, the user can see the virtual 3D model deformed. This dodecahedron interface has 12 facets with 4 levels of touch mode and free-rotation sensing. It gives us new control mechanism for 3D modeling. Users are allowed to deform the 3D geometry and adjust viewpoints in intuitive ways. To have better user interface and user experience of 3D modeling, the system has to be aware of its user's action. In our approach, making a device aware of user's action can simplify the processes of 3D modeling. Proximity sensors are deployed to gather information from user's behavior. The 3D modeling environment can interactively adapt to a user's actions. In the future, we suggest adding new ways of sensing to gather detail information about what the user may do next and using soft materials for modeling with textile feedbacks.

REFERENCE

1. Ishii, H., B. Ullmer, Tangible Bits: Towards Seamless Interfaces between People, Bits, and Atoms., in *Proceedings of CHI 97*, ACM Press, pp. 234-241, 1997.