

Simple Method for 3D Planar Navigation with a Touchpad

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Abstract

The use of 3D techniques in a personal computer is increasing and several paradigms have been attempted to interact with 3D environment using 2D devices. We need more simple and intuitive paradigms, since it is difficult for common end users to navigate a virtual 3D space with 2D devices such a mouse and a keyboard. In this paper, we suggest a simple and intuitive approach of a real life metaphor for 3D planar navigation using a touchpad.

1. Introduction

Mouse and keyboard are the most successful devices in the 2D desktop environment. As the power of computer graphics increases, the 3D environment becomes familiar since it is used in many applications and games. To navigate 3D spaces, however, it is inevitable to use the existing 2D devices.

The behaviors of 2D devices have been redefined to control 3D environments and many paradigms have been suggested to manipulate and to navigate 3D objects and spaces. Most 3D environments use a mouse with some keyboard buttons as the main input control device. While the mouse is a successful interface tool for power users who are accustomed to control 3D environment, common end users have difficulty in interacting with 3D environment using 2D devices. They need a more simple and intuitive way.

2. Background

2.1 3D desktop environment

Three dimensional techniques as interface are widely used in 3D applications and games. Many tasks relating to interactive navigation and manipulation have been considered in a wide variety of contexts, ranging from viewing simple 3D objects to traveling and performing missions with other people in the virtual reality environments. Although it is not likely that 3D desktop environment will soon take place of today's 2D window system in personal computers, it is necessary to consider a 3D desktop environment that is more suitable for average users.

There are no specifications and standard 3D desktop models for common end users. However, some projects have been conducted in an attempt to integrate 3D environment into an existing 2D desktop environment [1][2]. Especially, the Croquet

[3] project shows the possibility of 3D technique as desktop environment.

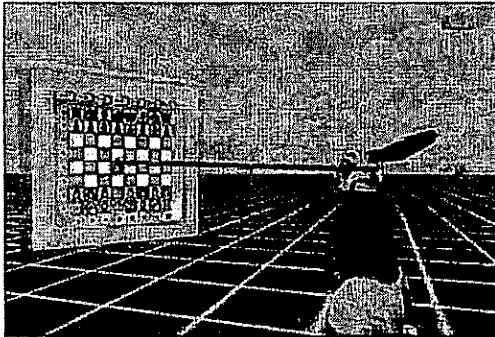


Fig 1. Croquet : 3D desktop environment

The Croquet is a collaborative 3D platform that allows users to work together to create and share ideas. Navigation metaphor of the Croquet is that of a virtual person, which is similar to the virtual character in FPS (First-Person-Shooter) games and 3D MMORPG (Massive Multiplayer Online Role Playing Games).

2.2 3D control with 2D devices

Various kinds of devices like Head Mounted Devices (HUD), data gloves and 3D tracking system have been invented to facilitate the control of 3D environment. However, most desktop computers have a mouse and a keyboard as main input devices to interact with the 3D environment. Several paradigms of mapping 2D mouse input onto 3D interactions exist [4]. And more complex interactions are possible with additional keyboard buttons.

In this paper, we consider a navigation in the 3D environments where the navigation is mainly planar as in the Croquet and FPS game system in which one can control movements with a mouse and a keyboard; for example, 'WASD' keys are used for 'forward, left, backward and right' walks

and a mouse for changing eye directions. This approach became the standard interface for 3D games, which is more fit for gamers. However, the interface is still not easy for common end users to adjust to as they need more simple way of operations.

2.3 Growing Touchpad

Touchpad is one of the most popular input devices for laptop computers. This device detects finger position based on capacitive sensing and can be also used as a mouse. The most recent touchpads have more features than a mouse: scrolling by moving finger on the side of the touchpad and sensing multi-finger taps. Redefining behaviors of touchpad by extending features might give touchpad a chance of becoming a new standard interface device for 3D environments.

3. Simple Metaphor for 3D Planar Navigation

3.1 Basic Actions in 3D Environment

There are basic operations for 3D planar navigation;

- Forward and backward walk
- Left and right walk
- Left and right turn
- Zoom in and zoom out
- Moving eye directions

This paper suggests a new paradigm for these operations using a touchpad with multi fingers except moving eye directions, which can be done with existing touchpad's one point input.

3.2 Metaphor

We suggest a new method for 3D planar navigation using a touchpad with two

fingers as shown in Fig 2.

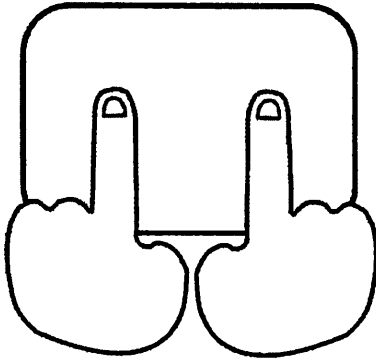


Fig 2. Using a touchpad with two fingers

The basic idea underlying our approach is the real life metaphor of moving an object with two hands. Using metaphors is a powerful way of simplifying interactive tasks and making them intuitive. The metaphor adopted for this study is represented in Fig 3.

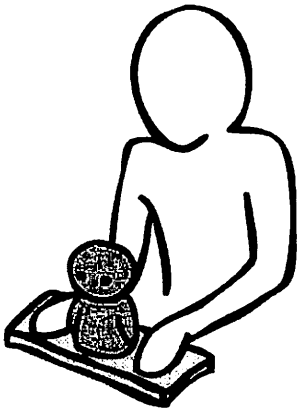


Fig 3. A real life metaphor to control an object with two hands

With this metaphor, users can control a virtual person in the 3D environment for navigation with two fingers. The details of operations for navigation is illustrated with real life metaphors in Fig 4, 5, 6.

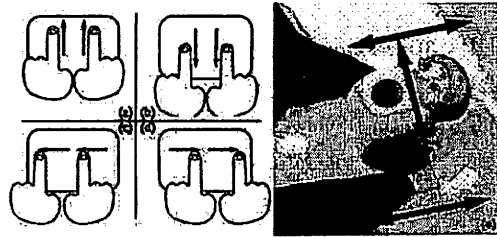


Fig 4. Basic navigations with a real life metaphor (a) forward walk (b) backward walk (c) left walk (d) right walk



Fig 5. Turn left and turn right with a real life metaphor. (a) turn left (c) turn right

To control zooming, we use an approach similar to the SmartSkin map viewer [5].

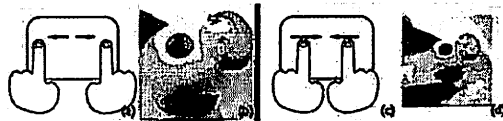


Fig 6. Zoom in and zoom out (a) zoom in, (c) zoom out

4. Conclusion

We suggest a new method for 3D planar navigation using a touchpad with two fingers. Based on such real life metaphor, this approach can make navigation more simple and intuitive for common end users than the existing method with a mouse and a keyboard. Moreover, we expect that touchpad, by redefining and extending its features, become a new standard interface device in the 3D environment.

References

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