Haptic Mouse

A String-based Mice Interface with Haptic Ability

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Abstract

This paper presents a new haptic device, which can be used as ordinary mice as well as a 3D haptic interface in the same time. The novelty of the proposed system is its ability to be used as simple mice, 2D haptic mouse, or as a 3D haptic interface that can display various aspects of force feedback sensation related to weight, contact and inertia. Force feedback sensation are created through a set of 4 strings attached to the corner of an ordinary mouse. Strings can be attached or removed depending on the application. Once the mouse is stringed force feedback can be displayed. The proposed interface uses SPIDAR's controller to compute position and haptics.

Key words: mice, haptic interface, string-based techniques, 3D force feedback

1. Introduction

Since the introduction of mice by Alain –Xerox in 1967, engineers and research designed a wide variety of pointing devices that allow users to perform their required tasks in as much less time and as accurate as possible. Over the evolution of computer and related technologies optional feature have been added to certain pointing devices such as 3D spatial pointing, haptics and others. One feature of interest to our group is the display of force feedback sensation

SPIDAR and Phantom for instances are such pointing devices where users have the ability not only to control a pointer but to perceive some aspect of physical reactions that may occurs between the pointer and its environment. However, most haptic devices require a large space relatively to non-haptic pointing devices such as mice. Moreover haptic devices are not well fit to support users in office application. Wangman mice was a good interface that succeeded to combine both pointing and haptic feature within the same device but its haptic ability is too limited to physical contact feature. It can't for instance display the weight of an object, or allows 3D manipulation.

The failure to integrate the traditional feature of mice into newly designed haptic pointing devices encumbered user's working environment. Ideally, a haptic pointing device would be able to display various feature necessary to control 2D and 3D visual interaction with computers. Adopting such approach in a simple and compact way will capture and encourage ordinary people to use haptic devices extending therefore the contribution of such devices to wider usage.

This paper presents an extended mice device with haptic display ability. It keeps the same compact working space as an ordinary mouse but adding force feedback sensation through 4 tensioned strings based on SPIDAR system technology which was introduced first by Prof. Sato et al. for their SPIDAR system.

2. System Overview

The proposed device is illustrated in figure 1 and 2.

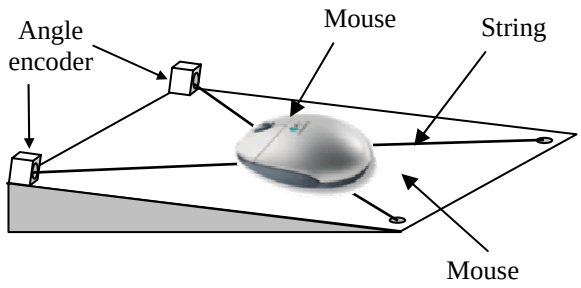

Fig.1 : 2D Manipulation

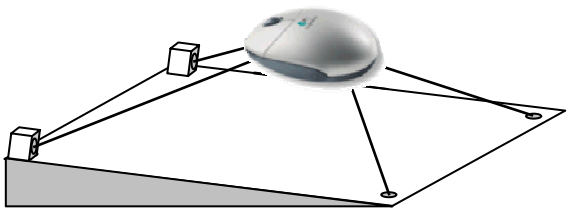

Fig. 2: 3D Manipulation

The haptic mouse is compose of three main parts

1. Mouse-Pad: a hard surface on top of which optical mice will be placed. The pad has a flat surface and inclined with a certain angle to make space to embed DC motors generating force feedback.

2. Mice: wireless optical mice with high resolution.

3. Haptic module: it is composed of a set of four DC motor, encoder, pulley, and string which is connected to the mouse. The string is winded around the pulley.

4. Angle encoders: which will be used to track the horizontal and vertical angles between the front 2 strings and the Mouse-Pad platform. These angles are necessary to compute the 3D position of the mice once is picked up for 3D manipulation. Otherwise, if the mice is not lifted, only α angle will be used to compute the translation on the platform.

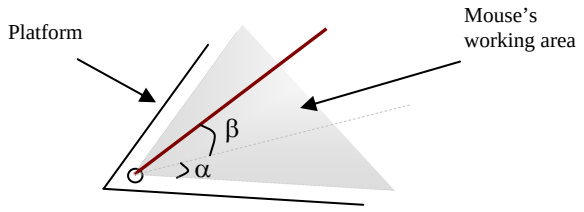

Fig. 4: hardware Set-up

Based on string's length and encoders' values, the system is able to compute mice position, either in 2D or 3D conditions, at an estimated rate of 1KHz. Force feedback is generated through the control of the tension applied to each string. Mice manipulation is performed in the same way as if users are using an ordinary mouse, except when it is picked up its behavior takes 3D nature. Moreover, the system was designed in such way that the mice can be replaced with a special pen or other possible tool that fits desired application as presented in figure 5.

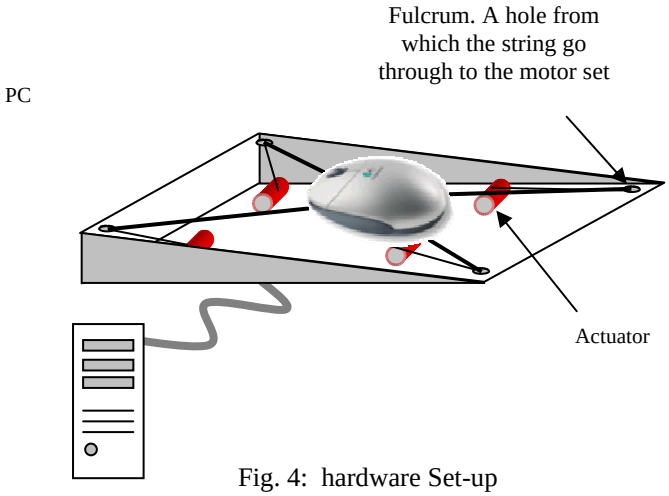

Fig. 4: hardware Set-up

3. Conclusion

The proposed interface distinguishes itself from other haptic devices with its multiple functionalities and its multi-purpose usage. Taking into account the popularity of mice, the interface can be familiar to ordinary users since it keeps almost same pointing functionality as normal mouse.

3. References

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