Phantom-X

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Abstract. This paper presents the HapticX project whose goal is to create a freeware tool that would allow to embed haptic elements (such as haptic scenes and virtual environment) inside various media types. More specifically in this paper we present PhantomX, an ActiveX control that allows to embed haptic scenes in various types of documents, such as HTML or Microsoft Power Point formats, and interact with them using a commercial haptic device. PhantomX currently supports haptic scenes featuring static VRML objects and can be used using a Phantom haptic device. Work is in progress to extend HapticX to support more complex scenes as well as Delta haptic devices. HapticX is freely available online from http://www.hapticx.org/.

1   Introduction

Embedding haptic elements inside different media types may be one of the most promising, and yet conceptually simplest, applications of force-feedback. Letting users touch a product before they purchase it online, creating e-books where readers can interact with the main characters, embedding haptic scenes inside haptic-related scientific publications in electronic form so that anyone can interact with innovative algorithms - all these simple ideas would allow haptics to become a more common and useful everyday tool.

Embedding haptic elements inside other media forms is not a new idea. In their pioneer work [1] T. Liu and K. Salisbury developed a plugin that allowed to embed haptic objects in HTML documents. Unfortunately to the authors' knowledge the plug-in was never available for download and thus never became a tool in the hands of the haptic community (this was in part due to the scarce quantity of haptic devices

that were available when the project finished). At the MIT media Lab Europe Sile O'Modhrain and Ian Oakley have been studying the possibility of adding haptic feedback to broadcast media such as cartoons and sport events [2].

In more recent years Immersion Corporation developed and patented its Immersion Web Plugin (The Immersion Web ActiveX Control and Immersion Web Netscape Plugin), which allows users to create touch-enabled content in Microsoft Internet Explorer and Netscape Navigator browsers. Such libraries were developed for two degree of freedom devices, such as the Wingman mouse developed by Immersion and commercialized by Logitech. Being the libraries proprietary, no other haptic devices are supported, i.e. no extension to three degree of freedom devices is known.

The goal of the HapticX project is to create a tool that

− can be embedded inside various types of media files   (HTML for web applications, PPT for oral presentations, PDF for written presentations);
− supports a variety of commercial devices with three or more degrees of freedom (SensAble's Phantom and Forcedimension's Delta for instance);
− is freely available to the haptics community.

The result of the first phase of the HapticX project is called PhantomX, an active-X control, described in the following, developed specifically for Phantom devices. Extensions to the Delta devices are currently being designed. Phantom-X allows users to embed simple haptic scenes (rigid objects described using VRML files) inside web pages or Microsoft Word and Power Point presentations. Phantom-X is freely available for download from http://www.hapticx.org. Its usage will be presented during the demo session at Eurohaptics 2003.
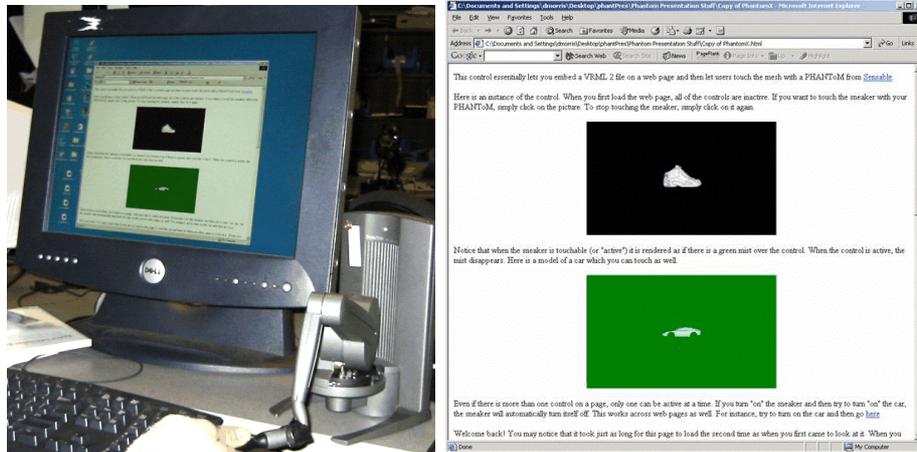
Fig. 1. Touching haptic objects embedded inside a web page using Phantom-X. (a) PhantomX at work . (b) A web page with two haptic scenes (the green one is foggy while the black one is active.

2   Technical details on current implementation

In this section we will describe the basic characteristics of Phantom-X.

2.1   Why ActiveX?

The idea of this project was to come up with a way to display haptic content inside different media types. Three alternatives were considered: Netscape-style plug-ins, java applets and ActiveX controls. The two former solutions have the advantage of being very portable and easy to write. However given the Microsoft-centered nature of current commercial haptic devices portability is currently not a great advantage (SensAble has only recently started supporting the Phantom under Linux while Delta devices are still Windows dependent). Moreover Microsoft will stop supporting these formats inside their Internet Explorer browser. ActiveX controls are not portable across platforms (they only run on Windows), but they are very portable across applications. ActiveX controls can be inserted into a web page, an MS Word document or a Power Point presentation.

ActiveX is a Microsoft technology that allows programs to be embedded within one another. An ActiveX control does not run by itself, but rather only from inside

what is called a container application. Internet Explorer and Power Point are two examples of container applications. While the choice of ActiveX has proved to work out well it is not compatible with Adobe's pdf format, which is a standard for scientific publications. Future extensions to the HapticX project, based on different technologies, are currently being considered.

2.2   How to use PhantomX

PhantomX allows users to embed several (we've tested ten at a time but a higher number should be handled correctly) haptic scenes inside a web page, a MS Word or MS power point documents. The user can normally browse through their document using a mouse while the scenes are all inactive (which is graphically represented by a fog effect over the haptic scene, see Fig. 1). Any scene can be activated by simply clicking the left button of the mouse over it. in such case the fog effect disappears, a proxy appears and the user can touch the object using a Phantom device. When another scene is activated the current scene is automatically brought back to its inactive "foggy" state. Each scene can contain one rigid object represented by a mesh of triangles contained in a VRML file. Such object can be downloaded from a specific web site. However the haptic interaction starts only when the object is completely loaded in the system's local RAM and therefore no haptic instabilities can take place due to delays in the web communication.

In order to embed a PhantomX control to its web page a user must simply add the following lines to the web page HTML file

```
<OBJECT ID="PhantomX1" WIDTH=137 HEIGHT=93
 CLASSID="CLSID:01A6E14D-793A-426D-80B0-46C860006E95">
 <PARAM NAME="FileName" VALUE="http://URL/HapticObject.wrl">
 <PARAM NAME="FogColor" VALUE="16776960">
 </OBJECT>
```

The object tag states that you want to insert an object called PhantomX1 and that its CLSID is 01A6E14D-793A-426D-80B0-46C860006E95. This CLSID is a unique identifier for the control. When Internet Explorer gets to this point, it checks the local computer's registry to see the PhantomX control is installed and registered. If not, the control is downloaded from the location designated as the CODEBASE and will be automatically registered on the local machine. The PARAM tags set the properties of

the control. Using these a user can specify the URL of the VRML model to be loaded into the haptic scene. Furthermore the user can set the scene's background color and fog color.

Embedding PhantomX controls in a power point presentation is even easier. Once the control is registered on the local machine a user can add a haptic scene to the current slide by clicking on Insert→Object→PhantomX. By visualizing the properties of the PhantomX box on the current slide (by right-clicking on such box) a user can then specify the haptic scene properties (VRML file and location, background and fog color).

An important note: in its current stage of development PhantomX is Ghost based and thus will only work machines where ghost is installed.

3 Conclusions and Future work

PhantomX is still limited in its usage. It can allow users with a Phantom device to touch online objects inside a browser or a power point presentation. However the haptic scenes that are currently supported are simple static environments populated by rigid objects that can strictly specified by VRML files.

The next step in the HapticX project is to extend PhantomX to be usable with a delta device. After this simple step our goal is to make HapticX compatible with the largest possible number of media formats. Furthermore our ultimate goal is to make HapticX a more general tool capable of displaying generic haptic scenes developed by the user. In such a context HapticX would simply be a tool that allows any haptic scene to be tested by other users while not adding any constraints to its structure.

References

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3. Immersion Corporation, www.immersion.com