INPUT DEVICE FOR CONTROLLING A VIDEO DISPLAY, INCORPORATING CONTENT-BASED HAPTIC FEEDBACK

This application is a continuation of prior application Ser. No. 08/728,102, filed Oct. 9, 1996, now U.S. Pat. No. 5,816,823, which is, in turn, a continuation of prior application Ser. No. 08/292,396, filed Aug. 18, 1994, now abandoned.

FIELD OF THE INVENTION

The present invention relates to haptic devices and more particularly, to an apparatus and method for providing the viewer of prerecorded visual data a way in which to receive a sensory response which is correlated to and dependent on the prerecorded visual data, through an input device which the viewer uses to browse the prerecorded visual data.

BACKGROUND OF THE INVENTION

Since the first motion pictures there have been devices which provide viewers of movies the ability to advance the individual frames of images, thus causing the motion pictures. Originally, crank arms were used to advance the frames. Early motion pictures were typically "hand-cranked" at 16–18 frames per second (fps); today's motion pictures run at 24 or 25 fps; various "special venue" film formats run at 48 and 60 fps; and video runs at 50 or 60 fps. In all cases, the playback frame rate is held constant and equal to the recorded frame rate to convey the sense of real-time motion.

On the other hand, in the editing process, control over the frame rate is desirable. In an editing application, knobs are commonly used as input devices to advance the images an cause the variable frame rate. During the course of movie editing, the editor needs to move back and forth through the film or video material to determine the exact locations to cut, or edit. The better control that the editor has over this back and forth motion, the more effective the editing process. Several examples of this control ranges from hand-cranking film on open reels to sophisticated electronic controllers for video.

The use of tactile or haptic feedback is advantageous in video tape recording and editing equipment to provide the user with a "feel" representative of the type of control or operation being effected. Force-feedback circuitry is used to provide the operator with tactile feedback. Force-feedback may be created by a computer-controlled rate of friction or movement of an object. In the case of a rotary knob, force-feedback may be created with an on-off brake, a variable brake, or a motor.

In video editing systems, two fundamentally different modes of edit control exist: "shuttle" and "jog." A shuttle control is typically a spring-loaded rotary knob which controls frame rate (i.e. each unique position of the knob corresponds to a unique frame rate). A jog control is typically a free-turning rotary knob which controls frame position (i.e. progressive turning of the knob progressively moves backwards or forwards from one frame to the next). One functional distinction is that a shuttle knob may be held in a non-zero static position which results in a non-zero frame rate while a jog knob must be moving to result in a non-zero frame rate. In other words, a shuttle controls the frame rate while a jog controls the frame position.

Editing, in all cases, is interactive only for the editor. Once the editing is completed, the viewer is a non-interactive recipient of the completed linear program. Other

than the ability to vary the frame rate using jog or shuttle controls, currently there is no system or method which provides tactile interactivity between the viewer and the movie.

In viewing movies while varying the fiame rate, it would be advantageous to provide the viewer with haptic responses to his or her input which are dependent on the content of the movie. These haptic responses may be refereed to as content-dependent, content-based, content-triggered and/or content-driven responses. For example, the viewer could then experience boundary constraints, textures and hills in combination with speed. While content-dependent tactile heptic response may not be particularly desirable with respect to conventional movies, those movies made for end-user frame rate control or "browsing" would be well suited to be viewed on a system which was capable of providing content-dependent haptic responses to viewer input.

The types of movies which are particularly suited to providing content-dependent haptic responses to viewer input include those movies made for surrogate travel, virtual travel, "moviemaps", "broweseable movies", and "navigable movies". Also, broweseable video exists and includes collections of stillframes, such as slide libraries, which are stored on videotape or disc. Since the stillframers are stored in a one-dimensional sequence, they also have no correct viewing rate, but rather demand user-control for getting from one frame to another.

SUMMARY OF THE INVENTION

In contrast to the available systems described above, the present invention provides a system and method for taking into account various aspects of the medium's content, such as edit points and other boundaries. Moreover, the quality of the "route" through which one "travels," such as rockiness or uphill/downhll grades, are also movie content for which the present invention accounts. According to the present invention, content-dependent data is composed and stored on a data storage device. The content-dependent data can either be manually entered or machine detectable and therefore entered automatically.

In setting up the system in the manual context, an operator views the prerecorded image data on a visual data display at either its real-time speed or a slower or faster frame rate. Using commands, the operator, through a content input device, sends content signals to a content data storage device where they are stored for use during a viewer's use of the apparatus.

When a viewer views the prerecorded image data on the visual data display, the viewer is able to advance the frames by turning, for example, a knob which is the viewer input device. The viewer input device communicates with a processor which is in turn in communication with the content data storage device.

According to the present invention, the viewer input device substantially and immediately responds to the viewer's input in a haptic manner, based on content-dependent data stored in the content data storage device which corresponds to the prerecorded visual data displayed on said visual data display at a particular time.

Other objects, features and advantages of the invention will become apparent from a reading of the specification, when taken in conjunction with the drawings, in which like reference numerals refer to like elements in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic showing some of the features of the present invention;