December 08, 2017

Dynamic Slider Scaling

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Abstract:

Techniques are described that enable dynamic slider scaling. In a VR user interface with dynamic slider scaling, the slider control expands when the user selects the control. The expanded control offers better control to adjust the slider and may include additional information that is not available with conventional slider controls. When the user has completed the adjustment and releases the slider control, it reverts to its original size and shape to conserve space in the VR user interface.

Keywords:

Virtual reality, slider interface, slider control, virtual reality control, user interface,

Background:

Virtual reality (VR) environments rely on display, tracking, and VR-content systems. Through these systems, realistic images, sounds, and sometimes other sensations simulate a user's physical presence in an artificial environment. Each of these three systems are illustrated below in Fig. 1.

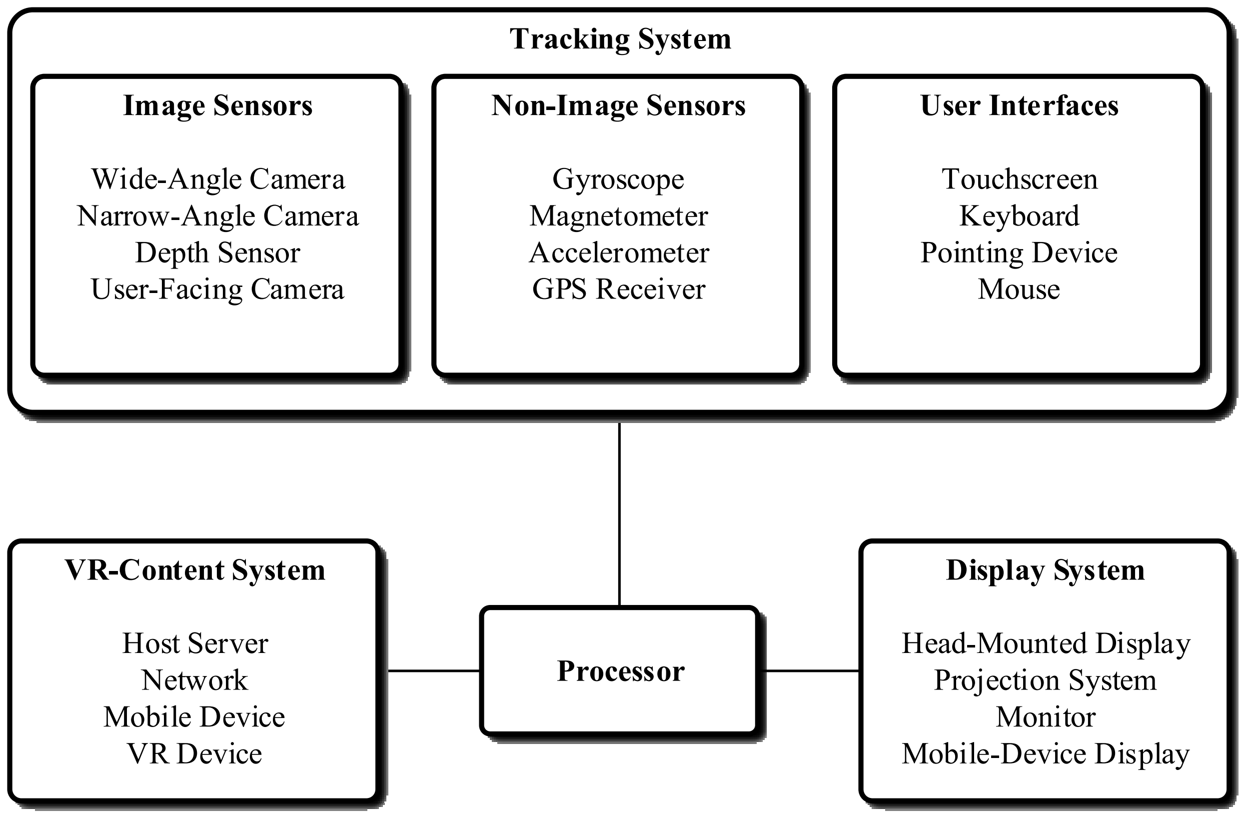


Fig. 1

The systems described in Fig. 1 may be implemented in one or more of various computing devices that can support VR applications, such as servers, desktop computers, VR goggles, computing spectacles, laptops, or mobile devices. These devices include a processor that can manage, control, and coordinate operations of the display, tracking, and VR-content systems. The devices also include memory and interfaces. These interfaces connect the memory with the systems using various buses and other connection methods as appropriate.

The display system enables a user to "look around" within the virtual world. The display system can include a head-mounted display, a projection system within a virtual-reality room, a monitor, or a mobile device's display, either held by a user or placed in a head-mounted device.

The VR-content system provides content that defines the VR environment, such as images and sounds. The VR-content system provides the content using a host server, a network-based device, a mobile device, or a dedicated virtual reality device, to name a few.

The tracking system enables the user to interact with and navigate through the VR environment, using sensors and user interfaces. The sensors may include image sensors such as a wide-angle camera, a narrow-angle camera, a user-facing camera, and a depth sensor. Non-image sensors may also be used, including gyroscopes, magnetometers, accelerometers, GPS sensors, retina/pupil detectors, pressure sensors, biometric sensors, temperature sensors, humidity sensors, optical or radio-frequency sensors that track the user's location or movement (*e.g.*, user's fingers, arms, or body), and ambient light sensors. The sensors can be used to create and maintain virtual environments, integrate "real world" features into the virtual environment, properly orient virtual objects (including those that represent real objects, such as a mouse or pointing device) in the virtual environment, and account for the user's body position and motion.

The user interfaces may be integrated with or connected to the computing device and enable the user to interact with the VR environment. The user interfaces may include a touchscreen, a keyboard, a pointing device, a mouse or trackball device, a joystick or other game controller, a camera, a microphone, or an audio device with user controls. The user interfaces allow a user to interact with the virtual environment by performing an action, which causes a corresponding action in the VR environment (*e.g.,* raising an arm, walking, or speaking).

The tracking system may also include output devices that provide visual, audio, or tactile feedback to the user (*e.g.*, vibration motors or coils, piezoelectric devices, electrostatic devices, LEDs, strobes, and speakers). For example, output devices may provide feedback in the form of blinking and/or flashing lights or strobes, audible alarms or other sounds, songs or other audio files, increased or decreased resistance of a control on a user interface device, or vibration of a physical component, such as a head-mounted display, a pointing device, or another user interface device.

Fig. 1 illustrates the display, tracking, and VR-content systems as disparate entities in part to show the communications between them, though they may be integrated, *e.g.*, a smartphone mounted in VR goggles, or operate separately in communication with other systems. These communications can be internal, wireless, or wired. Through these illustrated systems, a user can be immersed in a VR environment. While these illustrated systems are described in the VR context, they can be used, in whole or in part, to augment the physical world. This augmentation, called “augmented reality” or AR, includes audio, video, or images that overlay or are presented in combination with the real world or images of the real world. Examples include visual or audio overlays to computing spectacles (*e.g.,* some real world-VR world video games or information overlays to a real-time image on a mobile device) or an automobile’s windshield (*e.g.,* a heads-up display) to name just a few possibilities.

A particular configuration of the systems of Fig. 1 presents the user with a VR environment that includes a user interface (UI) that allows the user to adjust properties and parameters of the VR environment that is running. For example, the user may be able to adjust a variety of volumes in the VR environment (*e.g.*, sound effects, a soundtrack, or background music), adjust the brightness of the environment, or adjust the difficulty level of a game environment. To adjust a property using controls on the UI, a user may speak, gesture, or use a controller (*e.g.*, a device such as the pointing device described with reference to the tracking system of Fig. 1) to select the desired control and then adjust the property. The adjustments are often accomplished via a flat (two-dimensional or 2D) control that operates within the plane of the UI, such as slider. An illustration of a slider control from a conventional UI is presented in Fig. 2 below. In the example illustrated in Fig. 2, the UI control is a slider for adjusting a difficulty level using a laser pointer, but it could be a control for any of a variety of functions. In Fig. 2, the laser pointer emits a ray (depicted as a blue dashed-line arrow) to control the slider.

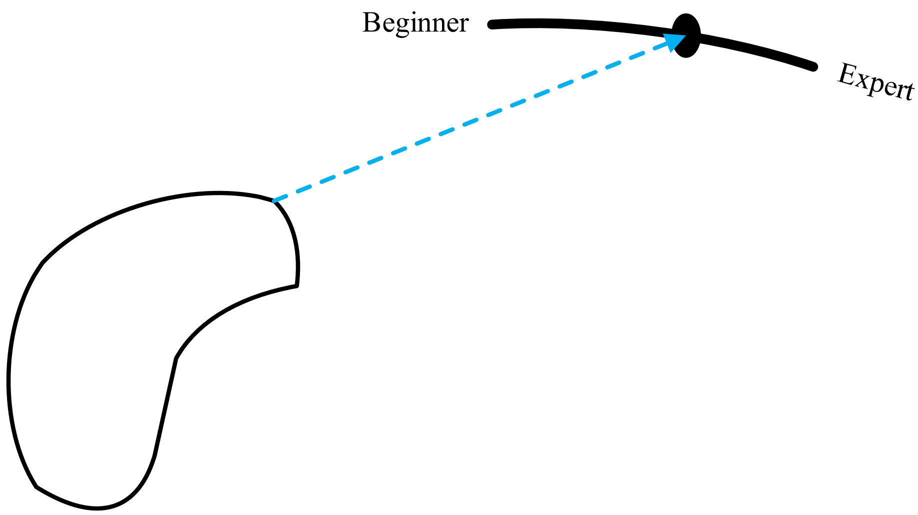


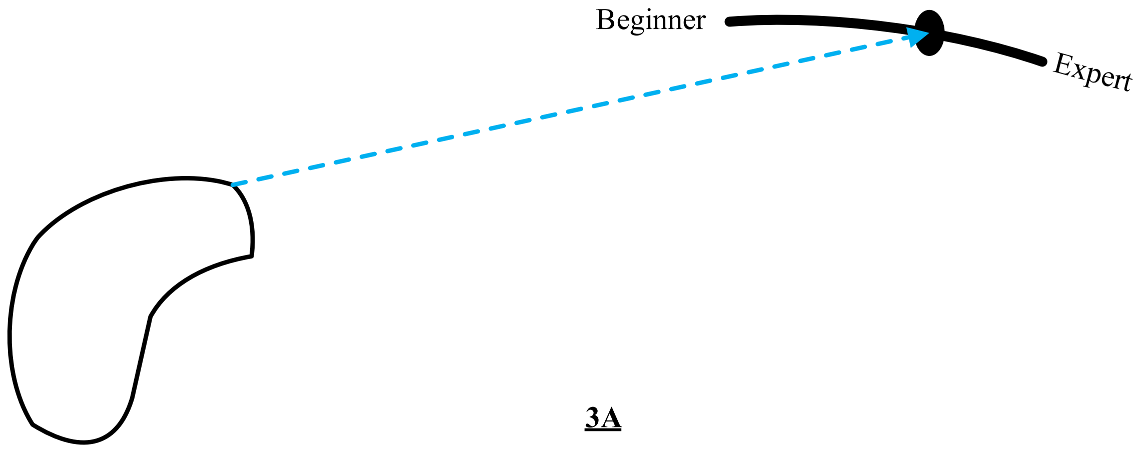
Fig. 2

While the controller shown in Fig. 2 is reasonably intuitive and does not take up a large amount of space in the VR user interface, it can be difficult to use for some tasks. For instance, fine adjustments are susceptible to a kind of input "noise" related to the sensors that track the user's motion or to the user's ability to hold the VR controller still while trying to slide to a particular value. This problem can be particularly pronounced when making adjustments from a large virtual "distance" or when adjusting an analog property, such as volume or brightness. The lack of fine control may cause the user to take extra time to make these kinds of adjustments, or have to bring up the UI multiple times to dial in the appropriate level, which can reduce the quality of the VR experience.

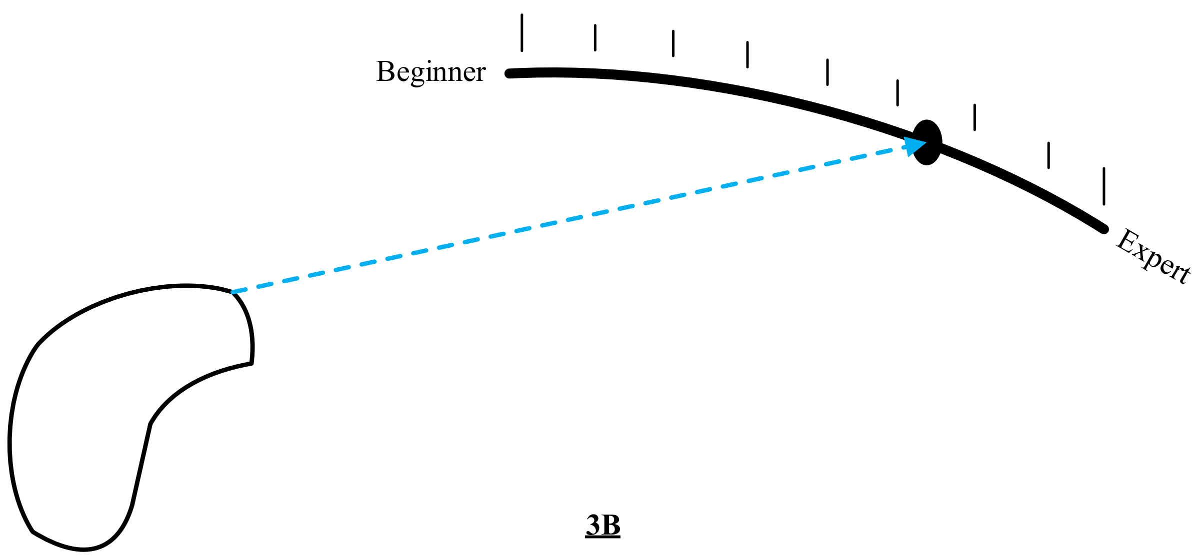
Description:

To address these problems, techniques are described that enable dynamic slider scaling. In a VR user interface with dynamic slider scaling, the slider control expands when the user selects the control. The expanded control offers better control to adjust the slider and may include additional information that is not available with conventional slider controls. When the user has completed the adjustment and releases the slider control, it reverts to its original size and shape to conserve space in the VR user interface.

Fig. 3 illustrates an example implementation of a slider control with dynamic slider scaling. In the example implementation, the slider control is used for adjusting a difficulty level (*e.g.*, for a game environment). For comparison, Fig. 3 includes view 3A, which shows the conventional slider control of Fig. 2, and view 3B, which illustrates a slider control with dynamic slider scaling. In view 3B, a selectable region of the slider control object has expanded to improve accuracy and enable finer resolution for adjustments. Additionally, the slider path includes not only a description of the scale (Beginner and Expert), but also graduation marks to aid the user in selecting a difficulty level. Other information can also be included in the expanded slider control, as shown in Fig. 4 and Fig. 5.



3A



3B

Fig. 3

Fig. 4 illustrates the slider control of Fig. 3 with additional information related to the average difficulty level at which the user plays and the highest difficulty level the user has selected.

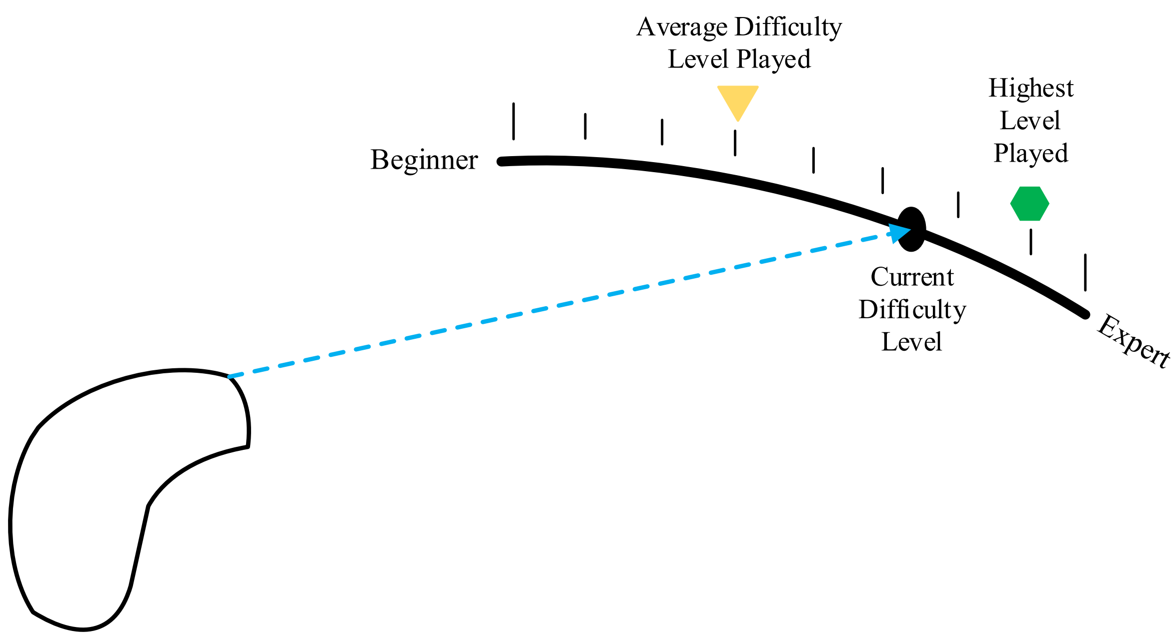


Fig. 4

Fig. 5 illustrates another slider control implemented with dynamic slider scaling. The slider control in Fig. 5 is a slider control for adjusting a brightness level, which includes pre-set brightness levels, for gaming, movies, and general use.

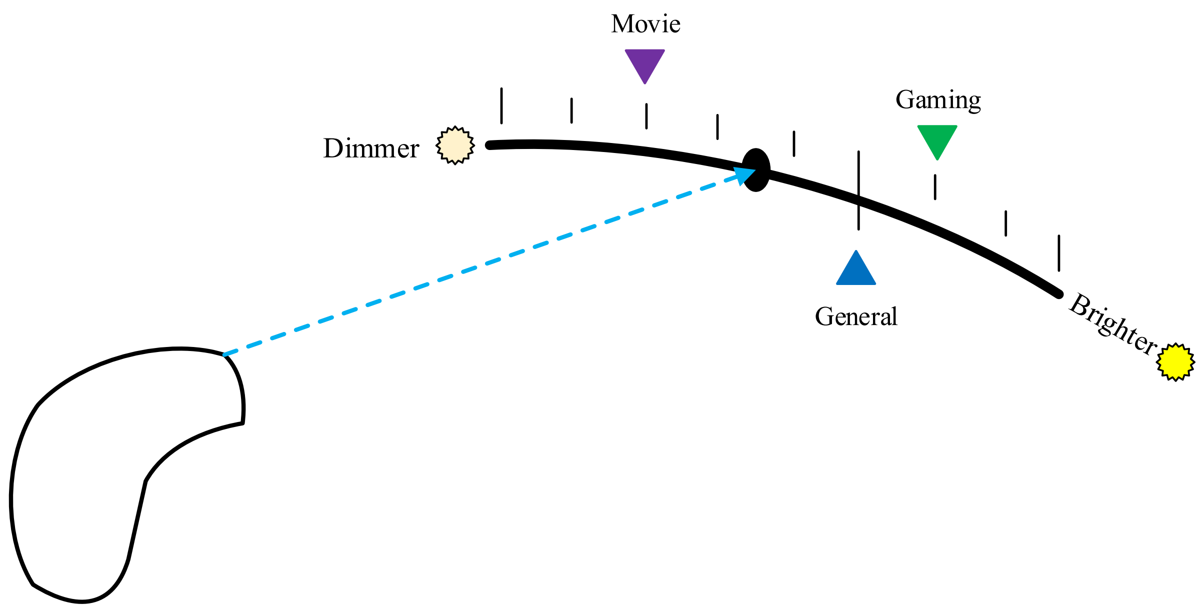


Fig. 5

As noted, slider controls implemented with dynamic slider scaling offer an improved VR experience by providing better control and accuracy to make fine adjustments to the slider, and may include additional information to make the user's VR experience more enjoyable.