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Mixed Reality Interaction With Physical Keyboard

ABSTRACT

Performing certain operations when viewing an application via virtual reality devices, such as VR glasses, can be cumbersome. This disclosure utilizes a mixed reality display to provide application-specific virtual overlays for a physical keyboard. User interface elements of the application currently active are identified and displayed as virtual overlays atop a physical keyboard. The overlay matches the UI elements displayed by the application icons and allows the user to activate a UI element by simply pressing a physical key. The virtual overlay provides a contextual keyboard and can be utilized for fast navigation, accessing system functions, setting up shortcuts, playing games, and other functions.

KEYWORDS

Mixed reality; virtual reality; contextual keyboard; keyboard overlay; shortcut keyboard; UI element; usability; menu navigation; VR controller

BACKGROUND

Physical keyboards have a fixed set of keys that are mapped to specific input functions, e.g., the “A” key corresponds to the letter A. Virtual keyboards, such as those implemented via a touchscreen, offer programmability but lack the tactile feedback of physical keys. Some keyboards include programmable physical keys (e.g., function keys) or physical keys and a touchscreen integrated with the keyboard that can be configured with specific functionality [1].

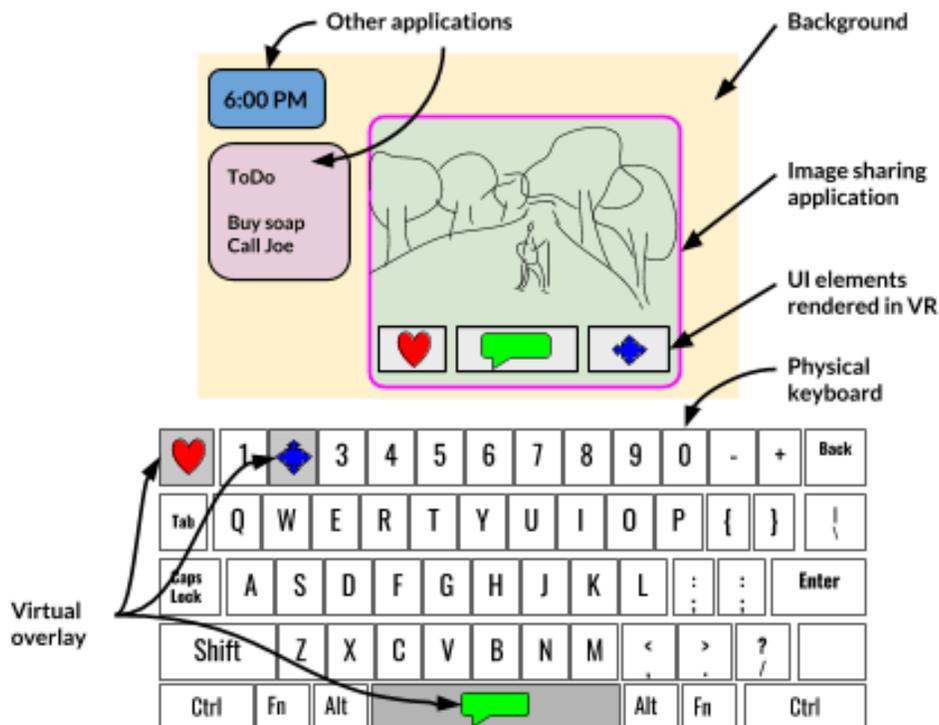
New types of user interactions have been made possible by virtual reality technologies. For example, a user can wear virtual reality (VR) glasses to view entirely virtual worlds with an immersive interface, or to view mixed reality, e.g., where portions of the user’s physical surroundings are merged together with virtual objects. For example, VR glasses can be utilized

by a user at a desk, where the user views a virtual desktop via VR while simultaneously being able to view their desk and objects on the desk. VR glasses can be controlled via a VR controller; however, data entry and selection of commands using such a controller can be cumbersome.

For example, a user that is viewing an image sharing application and desires to add a comment on a particular image currently has to perform multiple steps to complete this task. The user needs to (a) pick up the VR controller; (b) point to and select a user interface element that activates “comment” functionality; (c) put the VR controller down; (d) use a physical keyboard to type the comment text; (e) pick up the controller and choose the UI element to submit the comment.

DESCRIPTION

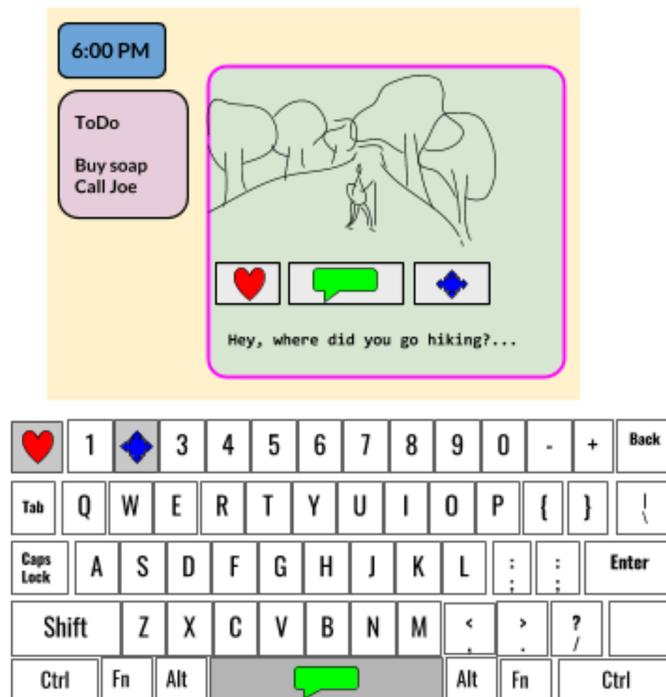
For quicker and easier data and command entry while using a mixed-reality interface, this disclosure provides a virtual overlay that augments a physical keyboard. The overlay is automatically updated based on the current interaction context of the user, e.g., the application that the user is currently interacting with. The contextual keyboard enables users to perform actions that are triggered by selecting user interface elements in the application.



The figure above shows a mixed reality user interface. A user wearing VR glasses views a user interface, e.g., a virtual desktop against a background such as a wall. In this example, the virtual desktop includes three applications - a clock and a to-do list that are not the current application in focus, and an image sharing application that the user is currently using. The applications are displayed as panels.

Upon detection that the user is currently using the image sharing application, user interface elements within the application are identified. For example, the application shown in the figure above includes three icons that let users perform actions such as reacting to an image (red icon), providing text comments (green icon), and sending the image to other users (blue icon). A virtual overlay that includes the icons is generated and is displayed atop the physical keyboard. The icons are mapped to different keys of the physical keyboard.

The user sees the overlay via the VR glasses, while the rest of the physical space (other portions of the keyboard and surrounding areas) are simply passed through. When the user presses the corresponding key, e.g., the spacebar, the functionality of the application is activated, e.g., the text comment functionality. The user can then enter text via the physical keyboard, which is rendered in the application user interface, as shown in the figure below.



When the user puts on the VR glasses, the user sees their surroundings through the camera of the glasses. When the user glances at the keyboard, the virtual keys are overlaid on the real keys. When the user switches to a different application, the virtual overlay is updated based on the UI elements of that application. The virtual overlay on the keyboard matches the specific colors, characters, text, and icons of respective different applications. The contextual keyboard acts as an input device with a large number of keys that trigger different application-specific functions.

Some examples of use of the virtual overlay are listed below:

- **Fast navigation and interaction:** A user has pinned on the virtual desk a number of applications. For example, each application is displayed as a virtual panel, as illustrated in the figures above. The user can choose a key combination on the physical keyboard to switch between panels. As the user switches between applications, the virtual overlay on the keyboard is automatically updated to show the UI elements of the new application. The user can select the text entry option by using a VR controller, or by pressing the corresponding physical key on the keyboard. In text entry mode, the virtual overlay is updated to show letters.
- **Shortcuts overlay:** A user is writing a document in a word processor application. The keyboard overlay shows the standard layout. When the user selects text and presses the “control” key, the virtual overlay is updated to show specific commands, e.g., cut, copy, and paste icons, on the corresponding keys (e.g., X, C, and V keys, respectively). The overlay is thus activated and available at a time it is relevant to the user’s task.
- **Accessing system functions:** A user writing a document desires to lower the volume of music playback from another application. The virtual overlay provides a shortcut key to activate a volume control overlay, allowing the user to adjust volume of music playback, and return to the document, e.g., by pressing the “Esc” key. Such operation is easier than navigating system menus via a VR controller.
- **Keyboard customization:** The virtual overlay can be used to change the color or style of the physical keys, e.g., the color of keys, font styles of keys, etc.
- **Games/ education:** Virtual overlays can be provided with different colors or characters or configured to trigger different special effects or sounds in augmented reality games. Virtual overlays can also be used to enable learning music, e.g., by showing different colors on different keys that are to be pressed in synchronization with music.

CONCLUSION

This disclosure utilizes mixed reality display to provide application-specific virtual overlays for a physical keyboard. User interface elements of the application currently active are identified and displayed as virtual overlays atop a physical keyboard. The overlay matches the UI elements displayed by the application icons and allows the user to activate a UI element by simply pressing a physical key. The virtual overlay provides a contextual keyboard and can be utilized for fast navigation, accessing system functions, setting up shortcuts, playing games, and other functions.

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