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Dynamically Programmable Haptic Keys for Extending Standard Keyboard Layouts

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ABSTRACT

Many physical keyboards include non-standard additional keys, placed at arbitrary keyboard locations. Not having such keys in standard and predictable locations in relation to the other keys diminishes the ability for users to use them efficiently. This disclosure describes a physical keyboard layout that provides such additional keys on a physical keyboard in fixed locations relative to the home row of typing keys, e.g., to the left and right of the standard keyboard rows. Optionally, the keys can be made dynamically programmable by constructing them using active haptic displays. The keyboard layout is suitable for implementation in any suitable physical keyboard or device. The layout can make it easier to employ such keys to provide enhanced user experiences for various application functions.

KEYWORDS

- Keyboard
- Laptop
- Text entry
- Dynamic keys
- Modifier keys
- Programmable keys
- Media buttons
- Haptic feedback
- Tactile feedback
- Bezel

BACKGROUND

Many physical keyboards contain keys beyond the set of standard keys that are common to all keyboards. Such additional keys can be used for different purposes, such as providing shortcuts to common functions, modifying the operation of the existing keys, controlling media playback, etc.

There is no single standard regarding the inclusion of such additional keys on a keyboard. Moreover, the physical space available for inclusion of additional keys is often limited, especially on laptops and small form factor devices. As a result, when such additional keys are present on a device keyboard, these keys are different for different devices. Further, the locations of the additional keys can differ across keyboard manufacturers and/or devices. Such keys are often placed at arbitrary locations, such as above the top row of the standard set of keys, in a device bezel, etc. Not having such keys in standard and predictable locations in relation to the other keys diminishes the ability for users to make use of such keys in an efficient manner. In addition, physical constraints often result in the keys having unusual sizes, which adds to the difficulty of using them.

Recent advances in technology enable a physical keyboard to be manufactured using haptics incorporated within an active display. An active display allows keys to be modified at any time as needed, thus making it possible to determine the presence, location, and labels of keys dynamically. For example, keys and controls relevant for a currently active application can be created and shown dynamically in a specific area of the haptic keyboard display. Such dynamically set keys can be placed anywhere in the active area of the haptic keyboard display. This enables the keys in the standard layout to be stretched or moved to make space for the additional non-standard keys. However, providing additional keys via a haptic keyboard still requires the user to learn the layout of the additional keys which can differ from device to device or from manufacturer to manufacturer.

Another approach to providing additional non-standard keys involves dynamically changing certain input mechanisms, such as a touchpad, to provide the ability to generate key input. For instance, a fixed area of the touchpad on a laptop can be dynamically changed into a

number pad. However, such an approach prevents the touchpad or other existing input mechanism from being used for its intended function while being used for key input. Moreover, the approach lacks haptic feedback and does not provide a fixed spatial relationship between existing and additional keys.

DESCRIPTION

This disclosure describes a physical keyboard with non-standard keys placed in fixed locations relative to the home row of typing keys. The addition of such keys requires no changes to the size and position of the existing standard set of keys, thus not interfering with already-learned typing practices. On laptops, placement of the additional keys can use space that is otherwise unused. The positions of the additional keys are extensions of the existing rows of keys in a standard keyboard layout.

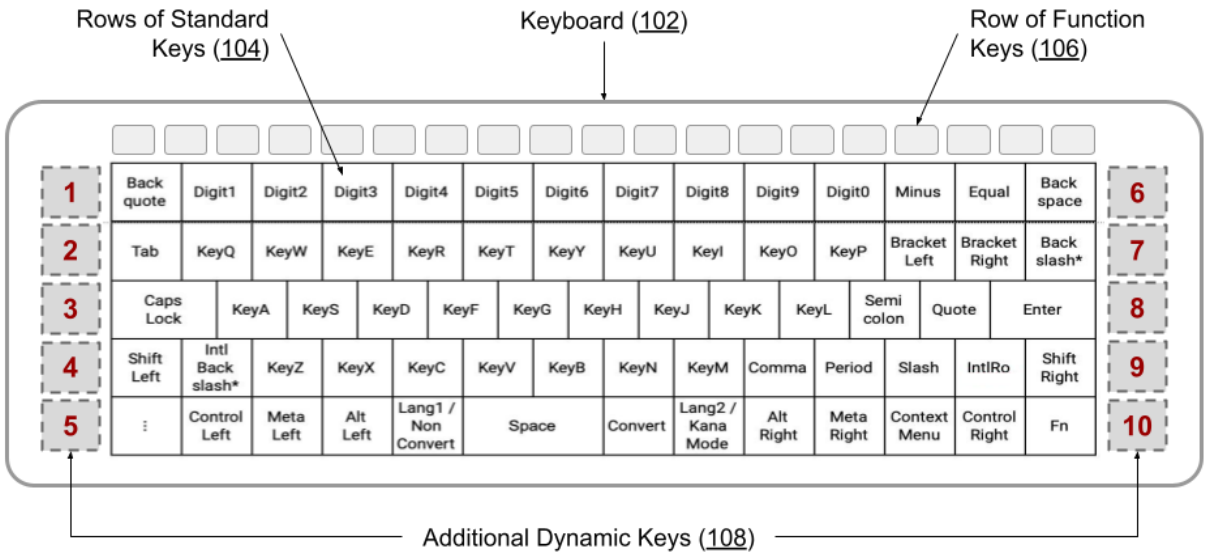

Fig. 1: Placing additional keys on either side of the rows of standard keys on a keyboard

Fig. 1 shows a visual depiction of the keys placed as described above. Specifically, ten additional keys (labeled “1” through “10”, 108) are placed in the border areas with inactive

bezels to the left and right ends of the rows of keys in a standard layout (104) of a keyboard (102). Locating the keys in such a manner places them in a common location in relation to the rest of the keys on the keyboard, particularly the home row and the home alphabet keys. As a result, the additional keys are easier to locate compared to keys placed in arbitrary locations, such as within or above function keys (106). Moreover, such placement makes it possible to refer to the locations of the additional keys in relation to the standard keys (e.g., “left of the Tab key”), thus making the reference consistent across all keyboards.

The additional keys as shown in Fig. 1 can employ haptic technology in combination with an active display. This makes it possible to dynamically program and relabel the keys. The haptic substrate provides appropriate actuation feedback. Moreover, the keys can be visible within the active display only when they are needed, such as when relevant applications are active. The functionality can be realized with only the border areas of the keyboard being composed of an active haptic display.

The primary invariable characteristics of the additional keys placed as described above are their location on the left and right of the keyboard in relation to the rows of the standard keys and the gap from the edge of the standard row. Other parameters, such as the width of the keys, can be chosen to accommodate physical constraints across keyboards and devices.

if the additional keys are provided as fixed keys, they can be labeled with their function similar to the standard keys on the keyboard. If implemented with active haptic display, a label can be dynamically assigned by choosing from a wide set of possible keys and/or arbitrary manual specification for arbitrarily programmed keys. Such labels can be textual and/or visual, such as icons for media functions, representations of dynamic states (e.g., volume level), thumbnails for a photograph, strip of clips for a video, etc.

The keyboard design with additional keys as described in this disclosure is suited for implementation in any suitable physical keyboard or other device. The additional keys can allow touch typists to locate the keys easily by feel as well as by sight, making them easier to use and learn. Such a keyboard can make it easier to employ such keys and provides enhanced user experiences for various functions within applications, such as multi-language support, menu customization, typing emojis, etc.

CONCLUSION

This disclosure describes a physical keyboard layout that provides such additional keys on a physical keyboard in fixed locations relative to the home row of typing keys, e.g., to the left and right of the standard keyboard rows. Optionally, the keys can be made dynamically programmable by constructing them using active haptic displays. The keyboard layout is suitable for implementation in any suitable physical keyboard or device. The layout can make it easier to employ such keys to provide enhanced user experiences for various application functions.