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NOTIFICATION OUTPUT VIA WATCH BEZEL

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ABSTRACT

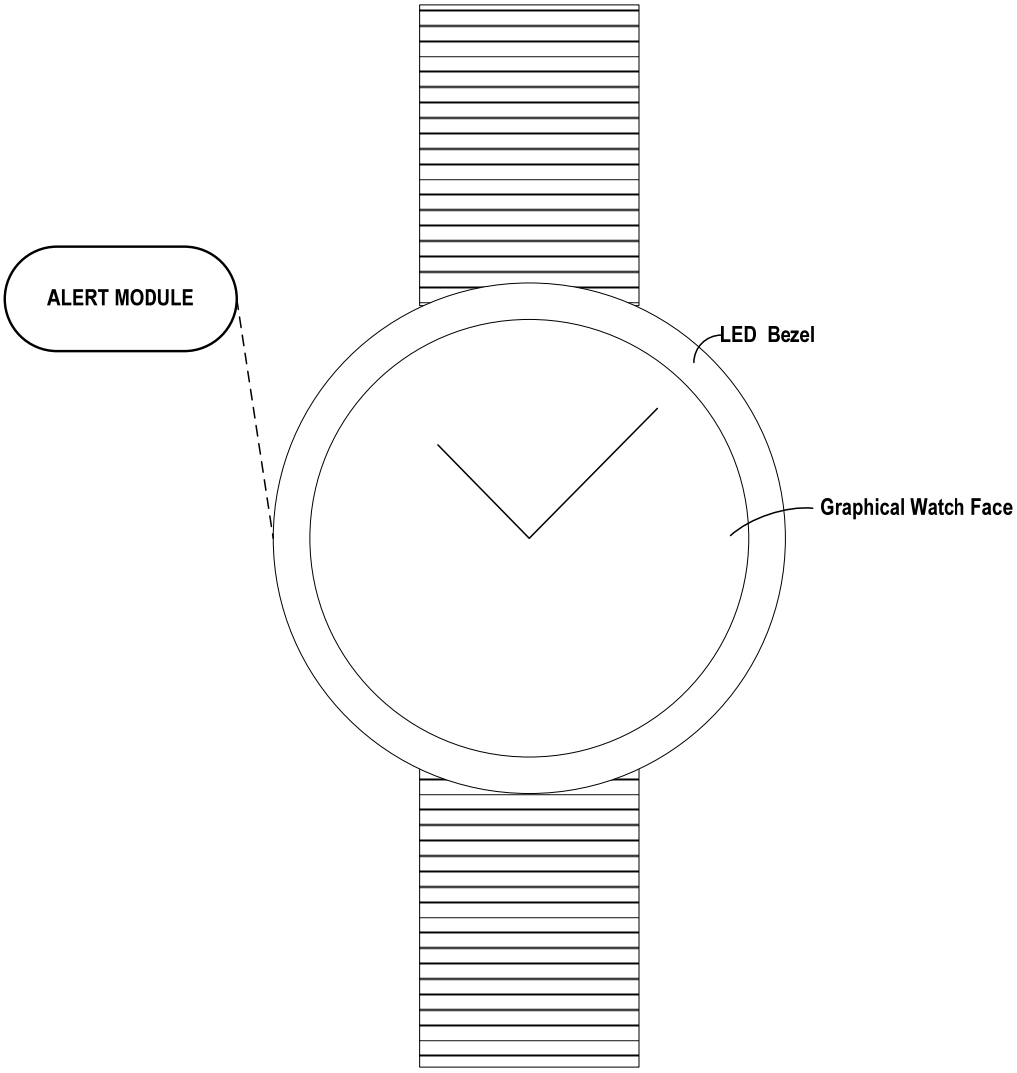
Rather than requiring a user to view the face of a wearable computing device (e.g., a smartwatch), in order to ascertain information about a notification received at the wearable computing device, the wearable computing device may include a bezel with one or more lights, such as light emitting diodes ("LEDs"), which illuminate upon the wearable computing device receiving a notification. That is, a wearable computing device may include one or more LEDs that provide the user with an indication that the computing device has received notification data associated with one or more applications executing on the wearable computing device. In some instances, the wearable computing device may include only a single LED and a structure that disseminates the light from the single LED throughout the entire bezel. In other instances, the wearable computing device may include multiple LEDs placed throughout the bezel. In some instances, a color and/or pattern of the illuminated LEDs may provide further information as to the specific notification received.

DESCRIPTION

Modern computing devices, such as mobile phones, counter-top devices, automobiles, and many other types of computing devices, can be incredibly powerful tools. Wearable computing devices, such as smartwatches, have become a bridge device of sorts, receiving notification data from multiple other devices to display the notifications to a user in a single, easily accessible place. Watches can also store and execute applications directly, meaning that the watch is becoming the hub for notifications received on any number of devices.

While haptic notifications are possible on a watch, the vibrations could be intrusive and distracting, especially when the user is performing some other action with their hands. Regardless of whether haptic notifications are received, in order to distinguish the actual received notification, the user must typically raise and rotate the watch, such that the face of the watch is facing the user, so that the user may view a visual representation of the notification. When the user is in the middle of a conversation or some other activity, raising the watch could be distracting and rude to others involved in the conversation or activity. The other parties involved in the conversation or activity may not be aware that the user received a notification on the watch, and may think that the user is checking the time or otherwise not willing to pay attention to their joint activity.

Rather than requiring a user to process haptic output from the watch or explicitly look at the face of the watch to understand what notifications are being received at the watch, a notification management service may control one or more LEDs embedded in a bezel of the watch face. For example, a wearable computing device (e.g., a smartwatch) may have a circular or polygon-shaped face. In such examples, an "edge-to-edge" display is currently not affordably possible due to the physical limitations of presence-sensitive displays. As such, a bezel is typically present, but the bezel's only function is that of holding the device together. As described herein, the bezel may include one or more LEDs controllable by an alert module that illuminates upon receiving a notification, thereby informing the user of a received notification in a non-intrusive manner, as well as informing others around the user that the user has received a notification via the watch.



The computing system of FIG. 1 includes a wearable computing device, such as a watch, which includes an alert module to handle notifications received directly by the watch or received by the watch via a secondary device (e.g., smartphone). The watch of FIG. 1 also includes a substantially circular-shaped graphical watch face, which may comprise a presence-sensitive display device. The watch may also include a bezel surrounding the graphical watch face that includes one or more LEDs controllable by the alert module to provide an indication of notifications received by the watch. The watch may be configured to operate over a network, which includes a combination of any one or more public or private communication networks, for

instance, television broadcast networks, short-wavelength wireless networks, cable or satellite networks, cellular networks, Wi-Fi networks, broadband networks, and/or other type of network for transmitting data (e.g., telecommunications and/or media data) between various computing devices, systems, and other communications and media equipment.

In some examples, the LED bezel may include multiple LEDs spaced throughout the bezel. In other examples, the LED bezel may include only a single LED. In some examples where only a single LED is included in the LED bezel, only the area of the bezel with the LED may appear illuminated when the wearable computing device turns the LED on. In other examples, the LED bezel may leverage Snell's Law of refraction by including an etched channel into the glass portion of the bezel around the edge. This would cause the light from the single LED to bounce around the entirety of the LED bezel, illuminating the entire bezel as if multiple LEDs were present.

The wearable computing device may be associated with a single user. In some examples, the wearable computing device may be associated with a single same user account. For example, a user may enter a username and password on the wearable computing device to access various features of the respective user computing devices. In some examples, a cloud computing platform includes user account data (e.g., in a database or other data structure) associating the user account with each of any number of user computing devices, such as a vehicle, a smartphone, a tablet computer, countertop computing devices, home automation computing devices, laptop computers, desktop computers, televisions, or stereos, among other things. For example, the cloud computing platform may include a device identifier for each device associated with the user account. In some examples, the wearable computing device may include

data associated each user computing device with the user. For example, the wearable computing device may include a device identifier for each user computing device.

In the system of computing devices, each user computing device may be configured to receive and output notifications. For example, a smartphone may receive messages (e.g., text messages, emails, etc.) from the cloud computing platform or another computing devices and may output the notification via a user interface device. In some examples, multiple user computing devices may receive the same message (e.g., email, text message, etc.) from the cloud computing platform and may each output a notification in response to receiving the message. For example, the cloud computing platform may output a message to multiple devices associated the same user account. As another example, applications executing at the user computing devices may output notifications. The wearable computing device may receive notifications for applications executing on the wearable computing device itself, or may receive indications of notifications intended for other computing devices associated with the same user account as the wearable computing device.

The graphical watch face of the wearable computing device shown in FIG. 1 may be output by at least one user interface device (UID). The UID may function as an input device and output device for the wearable computing device. The UID may function as an input device using a presence-sensitive input screen, such as a resistive touchscreen, a surface acoustic wave touchscreen, a capacitive touchscreen, a projective capacitance touchscreen, a pressure sensitive screen, an acoustic pulse recognition touchscreen, or another presence-sensitive display technology. In some examples, the UID may function as an input device using a microphone, mouse, remote control (sometimes referred to a “clicker”), or other input device. The UID may function as an output (e.g., display) device using any one or more display devices, such as a

liquid crystal display (LCD), dot matrix display, light emitting diode (LED) display, organic light-emitting diode (OLED) display, e-ink, or similar monochrome or color display capable of outputting visible information to a user. In some examples, the UID may function as an output device using a speaker, haptic device, or other output device.

The wearable computing device includes an alert module, such as shown in the example of FIG. 1, which may act as a notification manager. The alert module may enable the wearable computing device to control the LED bezel based on notifications for the wearable computing device and any other computing device that pushes notifications to the wearable computing device. In some examples, the alert module merely illuminates the LEDs in the LED bezel upon receiving a notification. In other examples, the alert module determines details of the notification (e.g., an application associated with the notification, a device associated with the notification, and/or a source of the notification), matches the details of the notification with a particular notification policy, and illuminates the LED bezel using a particular color or pattern based on the notification policy.

A notification policy may define how the alert module may activate the LED bezel to output a notification, or may define instances (e.g., days, times, locations, etc.) when the wearable computing device may output notifications, or when it is restricted from outputting notifications. Notification policies may be preprogrammed or set by a user of the user computing devices. In some examples, the wearable computing device may dynamically determine notification policies, for example, using machine learning. For example, the notification manager may learn what notifications the wearable computing device routinely receives and may define a notification policy based on the learned scenarios to activate the LED

bezel in a manner commensurate to the frequency the wearable computing device receives those notifications.

For instance, using machine learning, the wearable computing device may determine that the notification received at the wearable computing device relates to a text message received from a party that the user contacts often, such as a spouse or a friend. As such, the alert module may illuminate the LEDs in the LED bezel in a way that is more likely to get the attention of the user, such as with a brighter setting, an attention-grabbing pattern, or with a color that is more likely to garner attention. Conversely, if the wearable computing device determines that the notification received at the wearable computing device is a re-engagement notification for a seldomly used application, the alert module may illuminate the LEDs in the LED bezel in a way that is less likely to be intrusive, such as with a simmer setting, without a pattern, or with a color that is less likely to garner attention. Similar techniques may be implemented for a number of notifications, with the LEDs being illuminated in a less intrusive manner when only a single notification is received, gradually shifting to a more attention-garnering setting as additional notifications are received and not interacted with.

In some examples, the alert module may activate the LED bezel in the same way for every received notification. For instance, when the wearable computing device receives a notification, the alert module may turn on the LED bezel. In some instances, a user may program the wearable computing device such that the LED bezel illuminates in a certain color (e.g., the LEDs in the LED bezel may illuminate in any one of a different number of colors) or pattern (e.g., if the LED bezel includes multiple LEDs, different LEDs of the LED bezel may illuminate at different times, or the various LEDS within the LED bezel may flicker on and off

according to a predetermined pattern). The combination of color and/or pattern in which the LED bezel illuminates upon receipt of a notification may be called "an illumination effect."

In other examples, the alert module may reference the notification policies when activating the LED bezel to output a notification. These notification policies may be application based. For instance, if the wearable computing device receives a notification from a text messaging application, then the alert module may activate the LED bezel in accordance with a first illumination effect (e.g., with a first color and/or pattern). Later, if the wearable computing device receives a notification from a social media application, then the alert module may activate the LED bezel in accordance with a second illumination effect (e.g., with a second color and/or pattern).

In other instances, the notification policies may be based on a type of notification received from a particular application. For instance, within the social media application, if the user receives a message from a first party, then the alert module may activate the LED bezel in accordance with a first illumination effect (e.g., with a first color and/or pattern). Later, if the user receives a message from a different party, then the alert module may activate the LED bezel in accordance with a second illumination effect (e.g., with a second color and/or pattern). Even further, if yet another different party interacts with a message that the user publicly posted within the social media application, then the alert module may activate the LED bezel in accordance with a third illumination effect (e.g., with a third color and/or pattern).

In some examples, the pattern with which the LED bezel illuminates may mirror a haptic vibration on the wearable computing device. For instance, the LED bezel may illuminate while the wearable computing device vibrates, and turn off during the breaks in the vibration. The illumination may be for every LED in the LED bezel, or the illumination may cascade through

the LEDs in the LED bezel (e.g., the LED located at the top of the watch face may illuminate, cascading down to the neighboring LEDs until it reaches the LED located at the bottom of the watch face and every LED is illuminated, with the same effect occurring as the lights turn off).

In some instances, the wearable computing device may remain illuminated so long as the user has not interacted with the notification. LEDs typically consume a very low amount of electrical energy, so keeping the LEDs illuminated for an extended period of time would not be a hindrance to battery life for the wearable computing device. This also allows the user to be aware of the pending notification at a time later than when the notification is received, as opposed to a haptic or audible alert that may be missed if the user is distracted with other activities.

In this way, the alert module may provide a public yet non-invasive way to output notifications on a wearable computing device. By utilizing one or more LEDs embedded in a bezel of the wearable computing device to output the notification indications, the alert module may have an energy-efficient alternative to audible and haptic alerts, which may reduce power (e.g., battery power) consumed by the wearable computing device. Further, outputting notifications in this manner may improve social interactions that the user participates in, potentially reducing confusion by others if the user looks at the wearable computing device.

Incorporating LEDs into the bezel of the wearable computing device may enable other features, as well. For instance, as described above, it is difficult to implement an edge-to-edge display on a circular graphical watch face in a cost-effective manner. With the LED bezel, the wearable computing device may illuminate the LED bezel with a particular color that adds a glow effect to the graphical watch face, giving the illusion of an edge-to-edge display. For instance, the wearable computing device may determine a color that is most commonly used in

the graphical user interface and illuminate the LED bezel to match that color. In other instances, the wearable computing device may determine a color that is most commonly used in the edge portion of the graphical user interface displayed on the graphical watch face and illuminate the LED bezel to match that color. In still other instances, the wearable computing device may sample a pixel that is located closest to each individual LED in the bezel and illuminate each LED with a color that matches the respective pixel sampled.