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User Equipment (UE) Orientation-Dependent Visual Alerting

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Abstract:

This publication describes a user equipment (UE) that determines its orientation relation to a user and sends visual alerts tailored to this orientation. To determine the orientation of the UE in relation to the user, the UE may use a combination of different methods, such as proximity sensors, cameras, an array of microphones, a radar-based sensor, light sensors, accelerometers, gyroscopes, and other hardware devices. Depending on the UE's orientation relation to the user and in combination with user settings, the UE may send visual alerts using different elements, such as light emitting diode (LED), screen, or flash. The UE sends visual alerts using elements (e.g., LED, screen, flash) that are visible to the user, thereby, conserving power relative to using non-visible elements.

Keywords:

Light emitting diode (LED), flashing device, illuminating device, notification light, screen, display, user interface (UI), graphical user interface (GUI), touchscreen, monitor, visual display unit (VDU), front-facing, rear-facing, face-up, face-down, exposed, covered, revealed, hidden, accelerometer, gyroscope, sensing element, detecting element, detecting device, proximity sensor, camera sensor, user equipment (UE), smartphone, visual alerting.

Background:

Various user equipment (UE), such as smartphones, tablets, notebooks, and the like, have multiple functionalities, and a user uses them differently throughout the day, the week, or the year. The smartphone enables the user to make and receive calls, send and receive text messages, video conference, stay connected by using numerous social media platforms, read the news, search the internet, bank, use multiple email accounts, use various application software, and so forth.

UE manufacturers, operating system (OS) developers, and application software developers give the user the choice of receiving calls, messages, notifications, news alerts, reminders, and so forth through alerting tones (e.g., ring tones, beeps, message tones). The user, however, may choose to silence the smartphone in certain locations or times (e.g., during work-hours). In such locations or times, the user may configure the UE to display on the screen the incoming calls, text messages, notifications, news alerts, reminders, and so forth, without using audible alerting tones.

Figure 1 illustrates a series of visual alerts on a smartphone's front-screen.

Figure 1

Assume Jane works in an office environment. She wants to focus at work and help create a quiet atmosphere for herself and her colleagues, so she sets her personal smartphone on silent mode and sets it on her desk. She also makes sure that the smartphone is not on vibrate mode, because that also can cause a distraction, because the smartphone's vibration on the desk is still audible. As shown in Figure 1, throughout her work-hours, Jane receives calls, notifications, reminders, news alerts, social media alerts, bank alerts, and other various incoming messages. Jane's smartphone's front-screen turns on temporarily and displays these incoming messages. Jane can give them a quick glance, respond, or ignore them altogether without creating distractions in her office environment.

Furthermore, some users who are hearing impaired have no choice but to rely on visual alerting of the smartphone, because audible alerting is not useful to them. Even if the user is not hearing impaired, he or she may be in a loud location (e.g., concert, club) where visual alerting may be more useful than audible-alerting. Success, however, of traditional methods for visual alerting are dependent on the resting position of the smartphone.

To illustrate the visual-alerting's shortcomings, assume Jane is on a date with Tom, as illustrated in Figure 2.

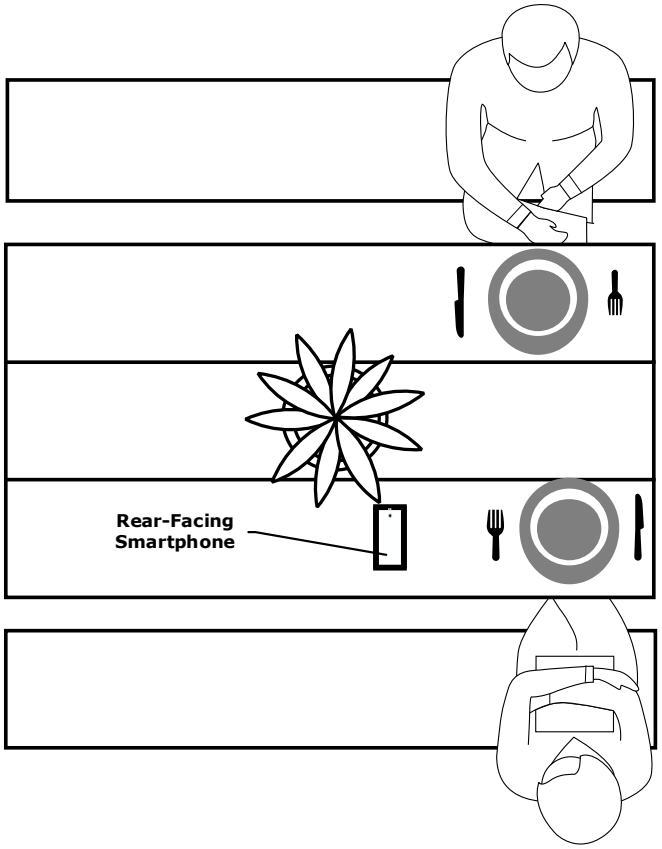


Figure 2

Tom has suggested they meet at a newly-opened barbeque restaurant. Jane agrees and she eagerly meets him there. To be respectful to Tom and to enjoy the date, she sets her smartphone on silent mode and lays it rear-facing on the table, as seen in Figure 2. Jane, however, works as a real estate agent. Although she does not mind forgoing alerts, notifications, and reminders, she

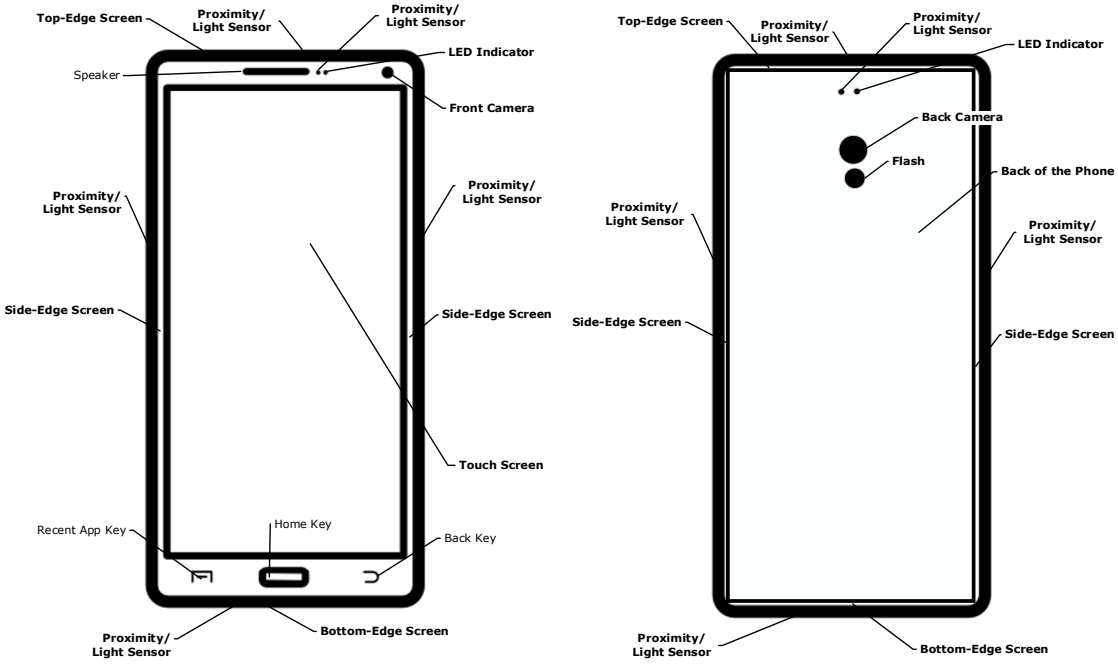
would still like to be able to see when a client calls her. That way, she can excuse herself for a moment, call back the client, and return to her date. In the example of Figure 2, Jane may as well turn off the smartphone and put it in her purse, because she has completely cut herself out of any alerts.

Some smartphones are equipped with a rear-facing light emitting diode (LED) and/or a front-facing LED, which may be used for visual alerting. Nevertheless, these smartphones do not differentiate when to use a rear-facing LED, a front-facing LED, a front-facing screen, an edge screen, a rear-facing screen, or a flash to send the visual alert. It is desirable for the UE to determine which part of the UE is visible to the user and use that part to send the visual alert. This way, the user receives visual alerting in all cases when part of the smartphone is visible to the user. In addition, the UE saves power by sending visual alerts using only the elements (e.g., LED, screen, flash) that are visible to the user.

Description:

This publication describes a user equipment (UE) that determines its orientation relation to a user and sends visual alerts tailored to this orientation. To determine the orientation of the UE in relation to the user, the UE may use a combination of different methods, such as proximity sensors, cameras, an array of microphones, a radar-based sensor, light sensors, accelerometers, gyroscopes, and other hardware devices.

Figure 3 illustrates how a smartphone manufacturer may embed sensors, cameras, screens, and LEDs on a smartphone.



a) Front-facing smartphone **b) Rear-facing smartphone**

Figure 3

Assume a smartphone manufacturer builds a smartphone with a front-facing screen, edge screens (two sides, top, and bottom), a front-facing LED indicator, a rear-facing LED indicator, and a rear-facing flash, as shown in Figure 3a) and in Figure 3b). The smartphone may use all these elements for visual alerting. In addition, the smartphone, depending on the orientation to the

user, may independently activate these visual-alerting elements, so that only a side-edge screen, the top-edge screen, the bottom-edge screen, the front-facing screen, the front-facing LED indicator, the rear-facing LED indicator, and/or the rear-facing flash are used to send visual alerts. To determine which element (e.g., LED, screen, flash) is visible to the user, the smartphone manufacturer may use front-facing, edge, top, bottom, and rear-facing proximity and/or light sensors. In addition, a front-facing and a back-facing camera may have a dual purpose — a primary image-capturing purpose (e.g., photo and video) and a secondary orientation-determination purpose.

Figure 3 is only an example illustration, because the UE manufacturer may use other hardware devices (not explicitly shown) and different embedding methods to decide which, if any, visual-alerting element is visible to the user. For example, in addition to what is shown in Figure 3, the smartphone manufacturer may also integrate a partial rear-facing screen, which can be used for visual-alerting.

The smartphone presents the user with visual-alerting options — for instance, at an "Accessibility" section of the smartphone. The options may be to light up only the front-facing LED, only the back-facing LED, only the front-facing screen, one of the edge screens (side, top, or bottom), all LEDs and screens, only the element that is unobscured, and so forth. The smartphone may have default settings, such as no visual alerting, activate all visual-alerting elements, activate only the visible element, or a combination of these options.

The smartphone may use the LEDs, the flash, and the screens in diverse ways to send visual alerts. For instance, the edge screen may flash red for incoming calls, yellow for incoming text messages, green for reminders, and so forth. Likewise, the LEDs and the flash may be used differently depending on the type of the visual alert. For example, the LEDs may flash five (5)

times for incoming calls, four (4) times for incoming text messages, three (3) times for reminders, and so on. In addition, the LEDs may flash in different colors (optical wavelengths) depending on the type of the visual alert.

Examples of user equipment (UE) orientation-dependent visual alerting may be:

- Revisiting the example in Figure 2 with the new smartphone, Jane lays the smartphone rear-facing on the table to avoid distractions and enjoy her date with Tom. She receives a call from her client. Jane sees the rear-facing LED light up, briefly answers the phone, and returns to her date with Tom.
- The user may put his or her smartphone in his or her shirt pocket. The only visible part of the phone may be a portion of the edge screen. In this case, only the top-edge screen or the bottom-edge screen flashes, because that is the only element visible to the user.
- The user may place the smartphone inside a bag (concealed). In this instance, the smartphone does not use visual alerting, thereby, conserving power.
- The user may lay the smartphone front-facing on the table. Depending on the selected setting, the user may see the LED flash five (5) times, the front-facing screen display the visual alert, the edge screen flash red, or no visual alert at all.

In summary, the described technique enables a user equipment to provide orientation-dependent visual alerting.