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Device-To-Device Charging Through The Display Screen With Seamless User Interface

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ABSTRACT

Battery life for electronic devices is limited and users do not always have easy access to fixed or mobile power sources to recharge. The location of a power source may also limit the user's ability to easily use their device. Users may start a task on an application on one device, but then want to switch to another device to continue the task as they change context.

This disclosure describes technology that enables a first device to be placed on the display screen of a second device to charge the first device wirelessly. A wireless charging transmission coil is provided on the same side as the display screen of the second device. The second device senses that the first device has been placed and in response, content on the display screen of the second device is automatically mapped seamlessly to the first device or otherwise rearranged. The described techniques also enable touch input from the first device to be mapped to the second device.

KEYWORDS

- Wireless charging
- Device-to-device charging
- Device pairing
- Pixel mapping
- Integrated display and charger
- User context
- User interface rearrangement
- Touch input

BACKGROUND

Consumers have more and more devices that they use daily for different contexts. For example, a user may use a laptop for work, tablet for surfing in the bedroom, smartphone for on the go, and a car display while in an automobile, etc. Battery life on many devices is limited and users do not always have easy access to fixed or mobile power sources to recharge. Further, the location of a power source may limit a user's ability to easily use their device.

Users may start a task on an application on one device, but then want to switch to another device to continue the task as they change context, e.g., from using a smartphone while in transit to a laptop upon reaching a work desk. Transferring context seamlessly between devices is a challenge.

DESCRIPTION

This disclosure describes technology that enables a first device to be placed on the display screen of a second device to charge the first device wirelessly. For example, the first device may be a smartphone that can be charged wirelessly and the second device may be a tablet, laptop, television, interactive whiteboard, or any other device with a display. A wireless charging transmission coil, controllers, and other necessary circuitry to drive wireless charge through the display screen, combined with other circuits/ components of the display screen, is provided on the same side as the display screen of the second device.

The coil can be combined with other circuits or components that exist on the display side of the second device, e.g., a tablet. The coil enables another device that is placed on the display to charge wirelessly. The second device is configured to sense that the first device has been placed and in response, content on the display screen of the second device is automatically

mapped seamlessly to the first device or otherwise rearranged. The described techniques also enable touch input from the first device to be mapped to the second device.

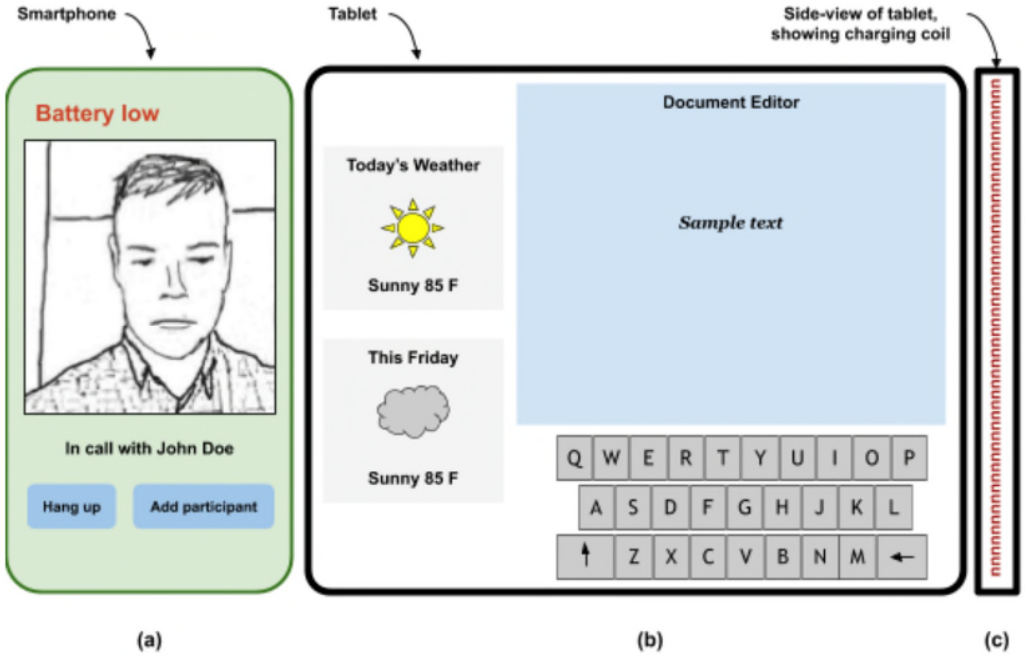

Fig. 1: (a) smartphone with an ongoing call; (b) tablet with open apps; (c) side-view of tablet showing charging coil

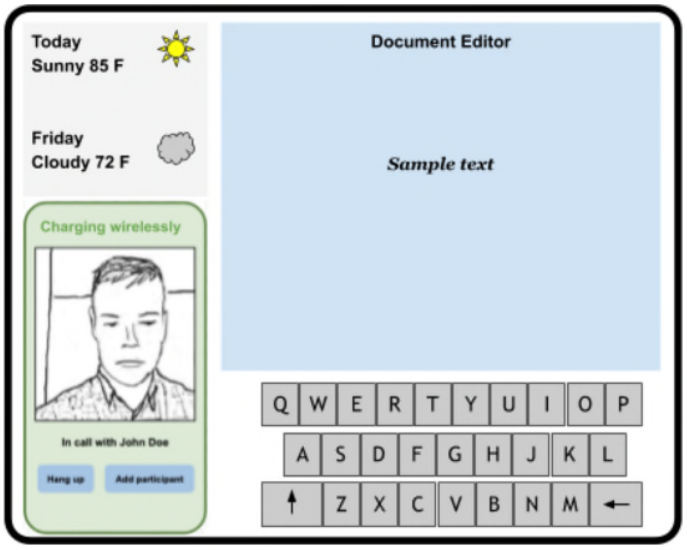

Fig. 2: Smartphone being charged by tablet; tablet UI automatically adjusted

Fig. 1 and 2 together illustrate the use of the techniques described herein. As illustrated in Fig. 1(a), the user is using a smartphone (first device) to conduct a video call. The smartphone indicates that it is running low on battery ("battery low"). Fig. 1(b) illustrates a tablet (second device) on which a document editor application is in use and a weather widget is also part of the user interface. The tablet includes a wireless charging coil on the same side as the display screen, as illustrated in Fig. 1(c).

As illustrated in Fig. 2, when the smartphone is placed on the tablet, the tablet detects the presence of the smartphone and automatically activates the charging coil to provide charge to the smartphone. In response to receiving charging current, the smartphone indicates that it is charging ("charging wirelessly") while continuing to conduct the video call. Further, the user interface of the tablet is adjusted automatically based on detecting the presence of the smartphone, by shrinking the weather widget to show a condensed view.

As illustrated above, the techniques described herein enable a charging device to sense that a device to be charged has been placed on its display screen, and automatically adjust its user interface. If the device being charged is not in active use, the display content of the charging device (e.g., the weather widget in the example shown above) is automatically displayed on the display screen of the device being charged. In this manner, the content of the display screen of each device is automatically adjusted.

Further, the touchscreen display of the smartphone of the example above is configured to receive touch input corresponding to the displayed UI. For example, if the call interface is displayed on the smartphone, the user can continue to access call functionality, while if the weather widget is displayed on the smartphone, the user can interact with the weather widget via touch. If the charging device is placed at a different location or is moved, the displays of

both devices are adjusted automatically. Pixel to pixel mapping between displays of the two devices is used to generate a seamless single UI for the user without impact to the charging functionality.

The charging device can automatically detect the make and model of the device being charged and rearrange the UI to accommodate the particular make and model. While the example above illustrates the video call being continue via the smartphone, another possible implementation switches the call process from the smartphone to the tablet without interruption when the smartphone is positioned on the tablet for charging.

In another example, if a foldable smartphone is placed against a tablet, the foldable smartphone is automatically made available for use as a trackpad for the tablet while also charging the foldable smartphone at the same time.

Enabling wireless charging from the display side of devices allows users to seamlessly charge a device with no interruptions. For example, if the wireless coil were provided on the back side of a laptop, the laptop lid would have to be closed to initiate charging another device which interrupts the user's work in progress on the laptop. The integration of the display of two devices as described herein enables comfortable carefree pairing of devices while keeping important content visible.

CONCLUSION

This disclosure describes technology that enables a first device to be placed on the display screen of a second device to charge the first device wirelessly. A wireless charging transmission coil is provided on the same side as the display screen of the second device. The second device senses that the first device has been placed and in response, content on the display screen of the second device is automatically mapped seamlessly to the first device or

otherwise rearranged. The described techniques also enable touch input from the first device to be mapped to the second device.