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ALWAYS-ON LOCK SCREEN FOR MOBILE COMPUTERS

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Always-On Lock Screen for Mobile Computers

Abstract: A touch controller of a mobile computer drives an OLED screen to display an active lock screen whenever the clamshell of the computer is open.

This disclosure relates to the field of mobile computers.

A technique is disclosed that enables mobile computers (e.g. tablets and notebooks) to take advantage of the power saving benefits of OLED displays while providing new, additional content to users.

A typical PC puts its display to sleep when locked, leaving it blank and devoid of information. The operating system on PCs is currently not suitable for always-on content, being restricted to full-screen controls and power-consuming operations. Vibrant and colorful lock screens use up too much power to be used all of the time in a notebook PC.

Previously, Windows has allowed the display to show an active lock screen, with notifications and clock displayed on the wallpaper. However, this requires the PC to always be on, risks burn-in for an OLED screen, and uses up extra power. The lock screen could be left on for notebook PCs, but this would use an excessive amount of power.

According to the present disclosure, a touch controller (TCON) drives the OLED screen to always show content, even when the notebook is asleep. There are multiple possible operating modes, including the ability to have the TCON drive data to the panel directly, or to use a converted version of the operating system standard lock screen. These techniques consume only a very minimum amount of power.

The touch controller (TCON) is connected to an OLED panel in a conventional manner. The TCON controls all of the pixels on the panel and can individually turn them on and off. When the operating system enters a sleep state, it triggers the TCON. The trigger could be a state change on a power rail, a specific trigger on a GPIO pin, or another mechanism.

The following two modes of data input can be used:

1) Independent control via TCON: Here, some operations are driven by the TCON directly. All of the information and drawing data is either coming directly from the TCON, via operations on its embedded firmware, or from an additional microcontroller or FPGA; it has no connection or communication with the operating system. Some independent firmware on the system drives data to the TCON and defines what pixels are illuminated. Some examples of data that can be driven to the display completely independently of the operating system include company logos, business card designs, clock / calendar data, etc.

2) Operating system lock screen conversion: Here, the naturally output lock screen from the operating system is converted to a low-power, always-on version. For instance, the normal OS lock screen could have a full-color, vibrant display as its background. However, in this conversion mode, the power consumption is minimized either by

parsing the important data and displaying only that information, or by creating a low power version of the full image.

With either technique, the notebook PC is configured to run in a lock mode when left open, at all times, as opposed to going to sleep as in prior techniques. The display output is captured by the TCON (or an assisting microcontroller or FPGA) and then that video output is alternated or converted. The actual video output from the main processor is discarded, and only the altered version is displayed.

For parsing important data, object recognition is used across the entire image to identify and select the important data. This may include information such as notifications, clock data, or other information. Once the TCON (or MCU or FPGA) detects these pieces of information, it can re-utilize the data and display it in a much smaller area of the screen.

For converting full-screen data, the video output is taken from the operating system / main processor and converted to a low-power version of such video. The low power version may utilize lower contrast, dimmer values, black-and-white, faded, and/or lower refresh rates. These techniques allow the TCON to draw a version of the lock screen that consumes less power.

When the PC is left open, it shows a display at all times on the panel. As long as the notebook is left open, some kind of content is displayed on the screen.

Having content on the screen at all times advantageously makes the PCs more interactive and dynamic. Useful information can be provided to the user. Additional display content can be shown on the screen without compromising the low power needs of a lock state.

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