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December 2019

CUSTOMIZABLE FLASH FOR COMPUTING DEVICES

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CUSTOMIZABLE FLASH FOR COMPUTING DEVICES

ABSTRACT

A computing device (e.g., a mobile phone, a camera, a tablet computer, etc.) may include a camera for capturing images (including a sequence of images that form videos). The camera may also include a flash or other light emitting element. As image processing has advanced and camera processors have become more powerful (in terms of processing cycles per given unit of time), the camera may capture images and perform image processing to generate processed images of relatively high quality even in low light conditions without necessarily requiring use of the flash. However, the flash may provide additional functionalities that may be unrelated to image capture (e.g., operating as a flashlight). Techniques described in this disclosure may provide an interface by which to configure the flash for use in providing the additional functionalities, allowing configuration of brightness, color temperature, strobe settings, etc.

DESCRIPTION

Cameras have become increasingly flexible and portable. Mobile devices may be equipped with cameras that can capture images in low light conditions and perform image processing to generate processed images of relatively high quality without using a flash. Given the ability of mobile devices to produce high quality images without using a flash (and possibly even in low light conditions), a user may use the flash for purposes unrelated to image capture, such as tuning instrument or operating as a flashlight. As such, it would be desirable to provide an interface by which to configure the flash for use in providing the additional functionalities, allowing configuration of brightness, color temperature, strobe settings, etc.

The example computing device shown in Figure 1 provides an interface by which to configure the flash for use in providing the additional functionalities, allowing configuration of brightness, color temperature, strobe settings, and the like. For example, the computing device may output a graphical user interface (GUI) that includes sliders for adjusting brightness, color temperature, strobe light on-time and strobe frequency. Although described below with respect to sliders, other types of user interface elements may be employed to configure the flash for use in providing the additional functionalities, such as buttons, dials, click boxes, pull-down menus, etc.

```
┌─────────────────────────────┐
│      COMPUTING              │
│      DEVICE                 │
│  ┌───────────────────────┐  │
│  │      USER             │  │
│  │   INTERFACE           │  │
│  │     DEVICE            │  │
│  └───────────────────────┘  │
│  ┌───────────────────────┐  │
│  │      CAMERA           │  │
│  └───────────────────────┘  │
│  ┌───────────────────────┐  │
│  │      FLASH            │  │
│  └───────────────────────┘  │
│    ╭───────────────────╮    │
│    │      FLASH         │   │
│    │    CONTROL         │   │
│    │    MODULE          │   │
│    ╰───────────────────╯    │
└─────────────────────────────┘
```
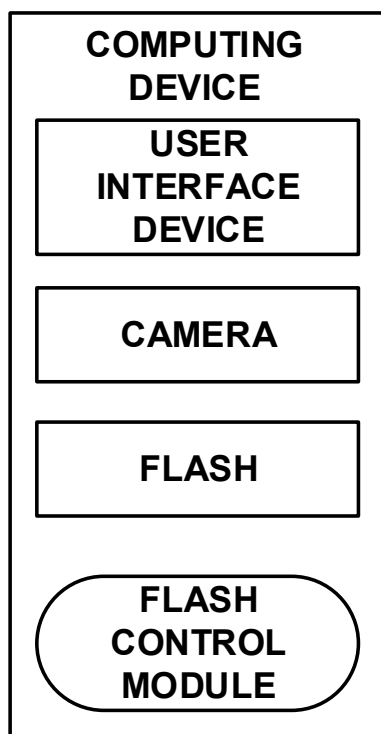
Figure 1

The computing device of Figure 1 includes a user interface device (UID), a camera, a flash, and a flash control module. The computing device may represent any type of computing device that includes or controls a flash. Examples of the computing device includes a mobile phone (including a so-called "smartphone"), a tablet computer, a digital camera, a laptop

computer, a gaming system, an e-book reader, a television (including so-called "smart televisions"), a wearable computing device (such as a so-called "smartwatch," "smart glass," and the like), or any other type of mobile or non-mobile 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, radar, or another presence-sensitive display technology. 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), a dot matrix display, a light emitting diode (LED) display, an organic light-emitting diode (OLED) display, an e-ink, or similar monochrome or color display capable of outputting visible information to a user.

The camera may capture still images and/or videos. The camera may represent a digital camera in which sensors capture a digital representation of a scene. The camera may be a built-in to (or in other words, integrated within) a housing or casing of the computing device and/or an external component of the computing device, which the computing device may utilize to capture or generate still images and/or videos.

The flash may represent a light emitting unit configured to illuminate a dark scene using a flash of artificial light. When used for image and/or video capture, the flash may produce light having a color temperature of about 5500 K. The flash may include a light emitting diode (LED) capable of producing light at other color temperatures, which may also be dimmed and/or strobed.

The flash control module is a combination of software, hardware, and/or firmware and provides the computing device with functionality for controlling the flash. For example, the

flash control module may cause the computing device to turn the flash on or off, and control particular settings (e.g., brightness, color temperature, strobe light on time, strobe frequency, light focus, etc.) of the flash based on inputs received at the UID. Responsive to the inputs received at the UID, the flash control module may adjust the brightness, color temperature, strobe light on time, strobe frequency, and light focus of the flash. In some examples, the flash control module may adjust one or more settings of the flash based on ambient lighting conditions, subject framing and distance.

The flash control module may cause the UID to present user interfaces to facilitate interactions between users and the computing device. For example, when the camera is not capturing an image, the flash control module may cause the UID to present the GUI shown below in Figure 2.
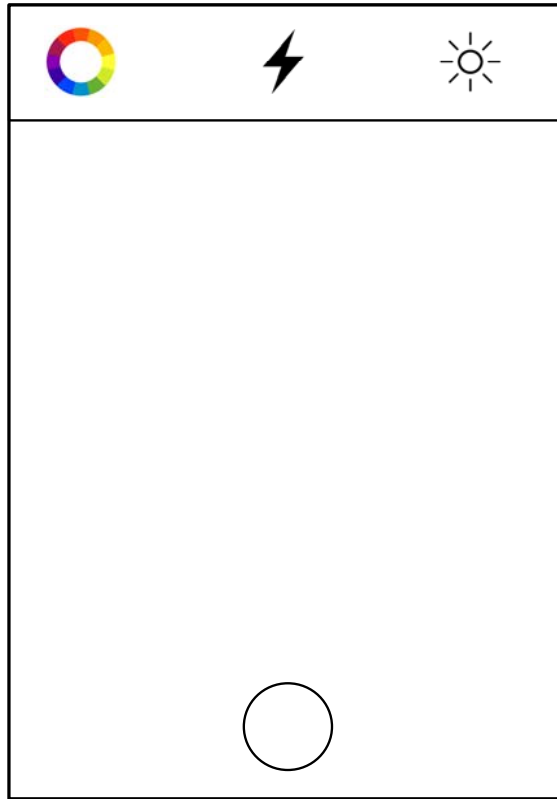
Figure 2

The GUI displayed may include various controls for adjusting one or more flash settings. As shown at the top of Figure 2 (from left to right), the GUI may include a control for adjusting color temperature (shown in Figure 2 as a color circle), a control for adjusting strobe settings (shown in Figure 2 as a lightning bolt icon), and a control for adjusting brightness (shown in Figure 2 as a brightness icon). The GUI may include additional controls, such as a control for adjusting focus, a control for activating a save our ship (SOS) Morse code mode (in which the flash blinks according to the Morse code for "S" followed by the Morse code for "O" and followed by the Morse code for "S") or an instrument tuning mode.

The brightness control may allow the user to raise or lower brightness of the flash. To adjust brightness of the flash, a user may tap or otherwise select the brightness control shown in

Figure 2. In response to the user selecting the brightness control shown in Figure 2, the flash

control module may cause the UID to present the GUI shown below in Figure 3 that includes a

slider from which the user may select a desired brightness level. Example brightness levels

include, but are not limited to 0, 20, 40, 60, 80, 100. Adjusting the brightness level will cause the

flash control module to raise or lower the current of the flash LEDs, which will tune the

brightness of the flash. In some examples, the flash control module could also adjust the

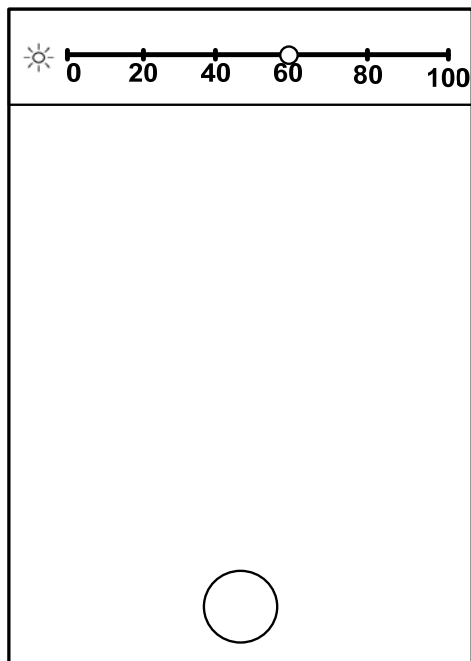brightness of the flash based on ambient lighting conditions.
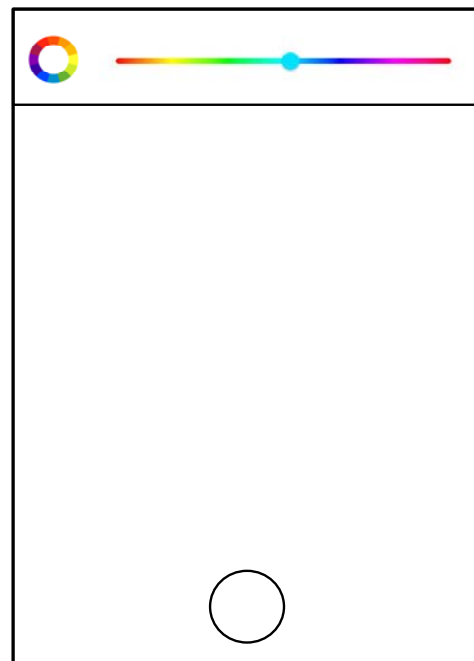

Figure 3

Figure 4

The color temperature control may allow the user to adjust color temperature of the flash.

To adjust color temperature of the flash, the user may tap or otherwise select the color

temperature control shown above in Figure 2. In response to the user selecting the brightness

control shown in Figure 2, the flash control module may cause the UID to present the GUI

shown above in Figure 4, which includes a slider from which the user may select a desired color

temperature for the flash. An example color temperature range includes, but not limited to 2000K (e.g., soft white) to 6500K (e.g., daylight). In some examples, the flash control module could also adjust the color temperature of the flash based on ambient lighting conditions.

The strobe control may allow the user to adjust strobe light on-time and strobe frequency of the flash. To adjust strobe on-time and strobe frequency, the user may tap or otherwise select the strobe control shown in Figure 2. In response to the user selecting the strobe control shown in Figure 2, the flash control module may cause the UID to present a GUI similar to that shown below in Figure 5, which includes two sliders from which the user may select a strobe light on-time and a strobe light flashing frequency. Example strobe light on-times include, but are not limited to 2, 4, 6, 8, 10 seconds. Example strobe light flashing frequency may include, but not limited to 100, 80, 60, 40, 20 strobes per second.
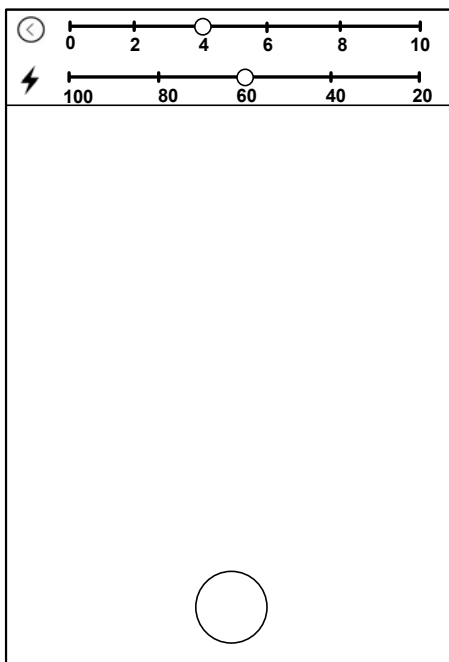

Figure 5

The strobe control may allow the user to activate an SOS mode or an instrument tuning mode. As one example, under the SOS mode, the flash control module may cause the computing

device to flash out SOS in Morse code. As another example, under the instrument tuning mode, the flash control module may cause the computing device to flash the LEDs cyclically under a given speed (or in other words, at a given frequency) to simulate a tuner. The given frequency may match a frequency of a desired tone, such as the low E string of a guitar. The flashes may illuminate the low E string of the guitar and the string will appear motionless when the frequency of the string matches the frequency of the flashes, thereby permitting a musician to tune the low E string until the low E string appears motionless (and thereby vibrating at the proper low E Hertz).

The GUI displayed may further include a light focus control for adjusting light focus. To adjust light focus, the user may tap or otherwise select the light focus control. In response to the user selecting the light focus control, the flash control module may cause the UID to present a GUI includes a slider from which the user may use to adjust the light with a characteristic feature of a reflector, such as a parabolic reflector. For example, the user may use the slider to rotate the parabolic reflector to axially translate the light along the parabolic reflector axis until a desired light beam is observed, which adjusts the focus of the light beam. Additionally, the flash control module could also adjust the light focus based on subject framing and distance.

By providing an interface by which to configure the flash for use in providing additional functionalities, allowing configuration of brightness, color temperature, strobe settings, the interface may enable a user to adjust various flash settings. Although described for use in the context of additional functionalities, such as a flashlight, various aspects of the techniques may also be utilized in conjunction with the camera functionality itself, where different color temperatures, flash brightness, etc., may enable different artistic effects during image capture.

It is noted that the techniques of this disclosure may be combined with any other suitable technique or combination of techniques. As one example, the techniques of this disclosure may be combined with the techniques of U.S. Patent Application Publication 2019/0098731 A1. As another example, the techniques of this disclosure may be combined with the techniques of U.S. Patent Application Publication 2015/0347738 A1. As another example, the techniques of this disclosure may be combined with the techniques described by Apkpure "Free mobile flashlight" available at https://apkpure.com/free-mobile-flashlight/com.wkapp.linterna. As another example, the techniques of this disclosure may be combined with the techniques described by Colorful Flashlight "Multicolor Flashlight 1.0.9 APK" available at https://www.apksum.com/app/multicolor-flashlight/com.color.flashlight.hd.torch.