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An Eye Tracking System For Smart Devices

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AN EYE TRACKING SYSTEM FOR SMART DEVICES

ABSTRACT

A system and method is disclosed to track user's eye gaze on a lockscreen and infer whether a user has read each message on the screen. An incoming message is initially marked as unread. The system presents the message to the user on a lockscreen. Eye tracking software uses the camera's video stream to detect that the user's gaze is directed at the message on screen. When the user's gaze is detected on the message for a sufficient duration, the system may tentatively mark that message as read. The system may notify and request confirmation from the user before marking the message as read. The system may then scroll the read message offscreen, making room for new messages to be displayed. Using this method, a user may be able to read through an entire set of unread messages without touching the device.

BACKGROUND

Text messaging, or texting, is the act of composing and sending electronic messages, typically consisting of alphabetic and numeric characters, between two or more users of mobile phones. Short Message Service (SMS) is a text messaging service component for sending short messages to mobile devices. Users often accumulate dozens of unread messages on their mobile device, for example a series of incoming SMS or chat messages. These contents of unread messages can typically be presented on a lockscreen, but the lockscreen often may not fit large numbers of messages. Phones may not manage to maintain an accurate notion of whether or not users have read each of their incoming messages. In theory, users swipe away any message that is read from the lockscreen using a swipe gesture. But in practice, users often read a message on their phone's screen without reaching for the phone at that moment to swipe and dismiss the message. As a result, users may end up with bad information when they later see an unread

message badge on the messaging app on their phone, only to discover it's a message that is already read on the lockscreen. In smart home device applications, the model where users are expected to dismiss notifications from their lockscreen physically with a swipe, or even via a voice command, may become undesirable.

DESCRIPTION

A system and method are disclosed to track a user's eye gaze on a lockscreen and infer whether the user has read each message on the screen. The system may be a device such as a smartphone, a tablet or other device equipped with a camera or a mechanism for tracking a user's eye movement. The method as shown in FIG. 1 involves the following steps. In step A, the system receives the incoming message. Incoming messages are initially assumed to be unread and are marked unread.

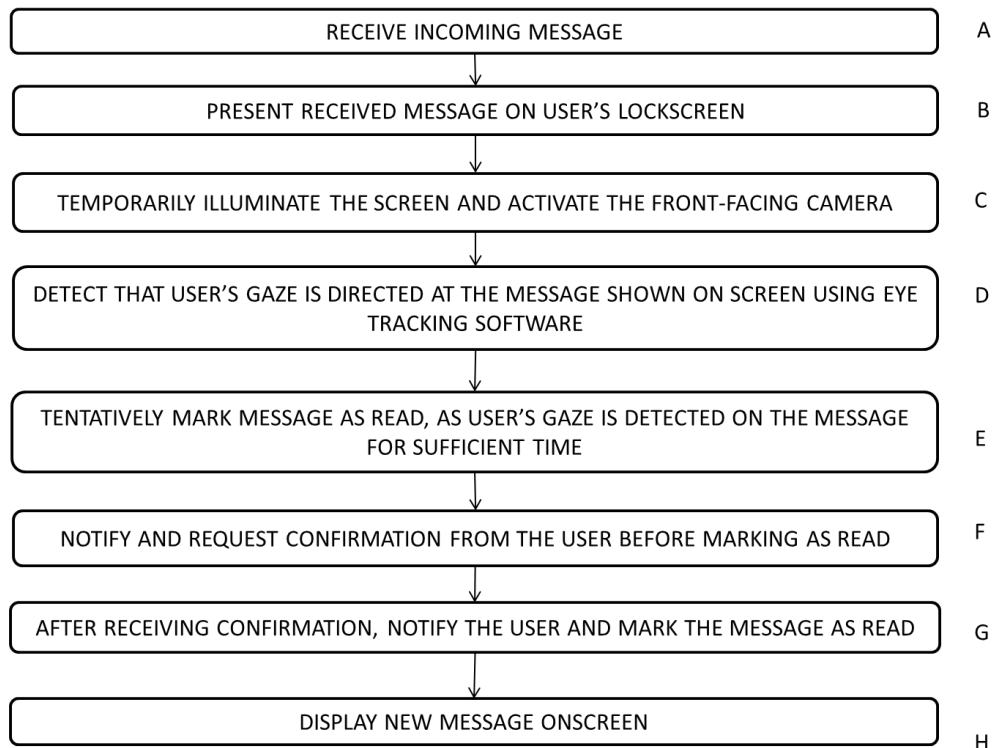|	
RECEIVE INCOMING MESSAGE	A
PRESENT RECEIVED MESSAGE ON USER'S LOCKSCREEN	B
TEMPORARILY ILLUMINATE THE SCREEN AND ACTIVATE THE FRONT-FACING CAMERA	C
DETECT THAT USER'S GAZE IS DIRECTED AT THE MESSAGE SHOWN ON SCREEN USING EYE TRACKING SOFTWARE	D
TENTATIVELY MARK MESSAGE AS READ, AS USER'S GAZE IS DETECTED ON THE MESSAGE FOR SUFFICIENT TIME	E
NOTIFY AND REQUEST CONFIRMATION FROM THE USER BEFORE MARKING AS READ	F
AFTER RECEIVING CONFIRMATION, NOTIFY THE USER AND MARK THE MESSAGE AS READ	G
DISPLAY NEW MESSAGE ONSCREEN	H

FIG. 1: Method to infer the read/unread status of message in smart devices

In step B, the system presents the message to the user on the lockscreen. In the simplest implementation, the system presents only one message to the user at a time (it may be the most recent message, or alternatively the oldest still-unread message). In other implementations, where the fidelity of eye tracking is sufficient, it may be possible to display multiple messages on screen and detect with a degree of confidence that a particular message has been read. In step C, the system temporarily illuminates the phone screen to allow reading of the received message and the system temporarily activates the phone's front-facing camera. The lockscreen may automatically illuminate from an otherwise-darkened state for a length of time after the newest message has arrived, to allow the message to be read.

The eye tracking software uses the camera's video stream to detect that the user's gaze is directed at the message on screen in step D. The eye tracking model may detect the roundness of a user's iris to know that the iris is oriented directly at the camera, or may detect a certain amount of white eyeball on each side of the iris. Likewise, it may detect a centered position of the pupil within the iris using similar techniques. When the user's gaze is detected on the message for a sufficient duration, the system may tentatively mark that message as read in step E. In some implementations, the system may scroll through an unread message that is too long to fit on screen to allow the user to read the entire message before tentatively marking the message as read. In step F, the system may notify the user and get confirmation before marking the message as read. In some implementations, in order to confirm that the message has been read, the system may display an onscreen message "Nod if done reading this message" and wait for camera to detect the user nodding before moving the message offscreen. In step G, as the message is detected as read, the system may notify that the message is detected as read, with a tone, vibration, audio prompt, flash of highlighting or color onscreen, or other means and go offscreen

shortly. If the user does not intervene, the message is marked as read. In step H, the read message may then scroll offscreen, making room for new message(s) to be displayed. Additional unread messages or notifications may then flow on screen. If no unread messages remain, the system may present opportunistic information like news stories on screen, in some implementations.

Many devices have large screens in the home that may be read from a distance. Eye tracking may be used in such devices to detect and display unread messages to the user. By determining that the messages are read, users may then rotate read messages off the lockscreen to make room for other unread messages. Using this method, a user may be able to read through an entire set of unread messages without touching the device. A user is also saved from the frequent problem of seeing incorrect "unread" tags on messages that they have, in fact, already read.