Technical Disclosure Commons

Defensive Publications Series

December 2019

DETECTION OF AND RESPONSE TO ACCESSIBILITY-RELATED BEHAVIORAL CUES

Collin Irwin

Rachel Hausmann

DETECTION OF AND RESPONSE TO ACCESSIBILITY-RELATED BEHAVIORAL CUES

ABSTRACT

A system is described that enables a computing device (e.g., a mobile phone, smart watch, tablet computer, etc.) to detect behavioral cues from a user and recommend relevant accessibility settings for the user based on the detected behavioral cues. The computing device may use various sensors to detect accessibility-related behavioral cues and analyze the detected behavioral cues to identify a relevant accessibility setting. For example, a computing device may use a radio detection and ranging (radar) system to detect behavioral cues from a user as inputs and may identify a relevant accessibility setting that benefits the user based on the detected behavioral cues. A behavioral cue input refers to any touch input or non-touch input detected by the computing device including, for example, any behavioral cues performed by a user using any finger, hand, body part, stylus, or any other object that may be detected by the computing device as described herein. In response to detecting a behavioral cue, the computing device may make the user aware of a relevant accessibility setting (e.g., identified based on the detected behavioral cue). For instance, the computing device may output a notification recommending activation of the identified relevant accessibility setting and/or may direct the user to an accessibility setting page of the identified relevant accessibility setting. In some examples, the accessibility setting page may contain a recommended setting determined based on the detected behavioral cue. In some examples, the accessibility setting page may contain a tutorial which may interact with the user to walk the user through the accessibility setting.

DESCRIPTION

Computing devices may include selectively enabled accessibility settings that are designed to help users interact with their computing devices. While a computing device may have many accessibility settings, a user of the computing device may be unfamiliar with these accessibility settings and/or may have difficulties identifying and accessing the desired accessibility settings. As such, it may be desirable to enable a computing device to automatically inform a user of accessibility settings based on the user's behavior. In accordance with one or more techniques of this disclosure, a computing device may detect accessibility-related behavioral cues from a user and identify, based on the detected cues, accessibility settings that may benefit the user.

Figure 1 below is a conceptual diagram illustrating an example computing device configured to detect a behavioral cue as input and identify a relevant accessibility setting based on the input. In the example of FIG. 1, computing device 100 represents an individual mobile or non-mobile computing device. Examples of computing devices 100 include a mobile phone, a tablet computer, a laptop computer, a desktop computer, a server, a mainframe, a set-top box, a television, a wearable device (e.g., a computerized watch, computerized eyewear, computerized gloves, etc.), a home automation device or system (e.g., an intelligent thermostat or home assistant device), a personal digital assistant (PDA), a gaming system, a media player, an e-book reader, a mobile television platform, an automobile navigation or infotainment system, or any other type of mobile, non-mobile, wearable, and non-wearable computing device that is configured to recognize one or more behavioral cues as inputs and identify a relevant accessibility setting based on the inputs.

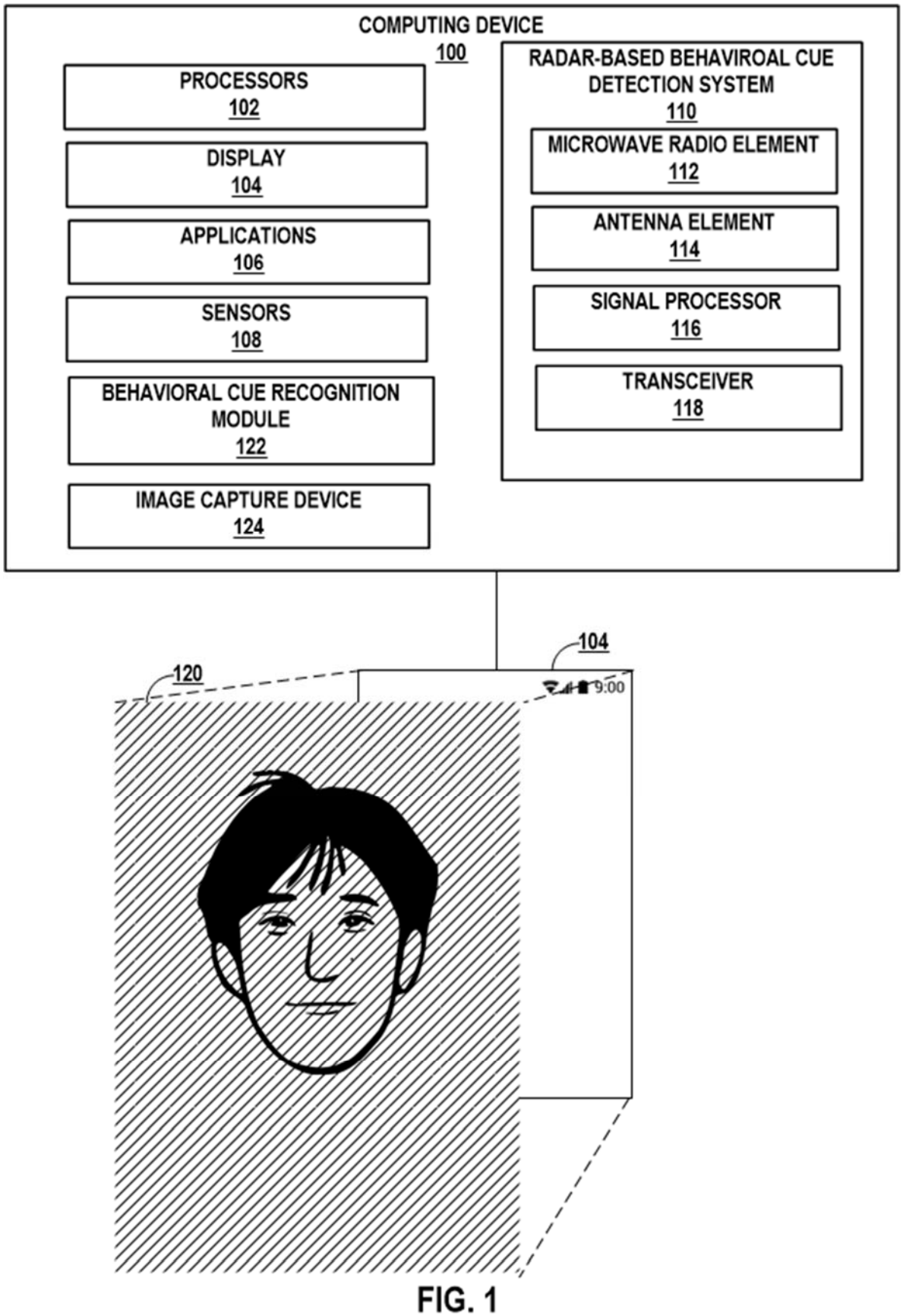
COMPUTING DEVICE
100
PROCESSORS
102
DISPLAY
104
APPLICATIONS
106
SENSORS
108
BEHAVIORAL CUE RECOGNITION MODULE
122
IMAGE CAPTURE DEVICE
124
RADAR-BASED BEHAVIROAL CUE DETECTION SYSTEM
110
MICROWAVE RADIO ELEMENT
112
ANTENNA ELEMENT
114
SIGNAL PROCESSOR
116
TRANSCEIVER
118
104
120
9:00

FIG. 1

Computing device 100 includes processors 102, applications 106, radar-based behavioral cue detection system 110, and behavioral cue recognition module 122. Applications 106 can be executed by processors 102 to provide various functionalities (e.g., magnify text, magnify keyboard letter, etc.). Computing device 100 also includes display 104 (e.g., a liquid crystal display (LCD), thin-film transistor display (TFT), organic light emitting diode display (OLED), etc.), sensors 108 (e.g., a touchscreen sensor, accelerometer, barometer, etc.), and image capture device 124 (e.g., a camera, etc.). Radar-based behavioral cue detection system 110 may provide localized radar field 120, which a user may interact with to provide input to computing device 100. As a result, radar-based behavioral cue detection system 110 may detect the size, shape, orientation, material, distance, and velocity of the object within localized radar field 120.

Behavioral cue detection system 110 includes microwave radio element 112, antenna element 114, signal processor 116, and transceiver 118. Microwave radio element 112 may emit continuously modulated radiation, ultra-wideband radiation, or sub-millimeter-frequency radiation to provide localized radar field 120. Antenna element 114 may detect interactions in localized radar field 120. Antenna element 114 can include one or many sensors, such as an array of radiation sensors, the number in the array based on a desired resolution, and whether the field is a surface, plane, or volume. Signal processor 116 may process the detected interactions in localized radar field 120 to provide behavioral cue data usable by behavioral cue recognition module 122, and determine a behavioral cue from the sensed interactions in localized radar field 120. Signal processor 116 may also identify a relevant accessibility setting based on the determined behavioral cue. Transceiver 118 may transmit the identified relevant accessibility setting to processors 102.

As a user enables radar-based behavioral cue recognition system 110, computing device 100 may detect behavioral cues based on interactions detected in localized radar field 120. For example, when a user holds computing device 110 close to the user, antenna element 114 may detect interactions in localized radar field 120 and signal processor 116 may process the sensed interactions in localized radar field 120 to provide usable behavior cue data to behavioral cue recognition module 122. Based on the behavioral cue data, behavioral cue recognition module 122 may identify a "holding device close" behavioral cue, which indicates the user may be nearsighted.

Computing device 100 may also detect behavioral cues using image capture device 124. Image capture device 124 may function as an input device (e.g., a camera) to capture still or video images. For example, image capture device 124 be configured to take a video of the current user of computing device 100 periodically, and processors 102 may process the video to provide usable behavioral cue data to behavioral cue recognition module 122. Various behavioral cues (e.g., squinting, adding glasses, removing glasses, lifting glasses, holding device away, etc.) may be detected by image capture device 124 and may be identified by behavioral cue recognition module 122. In some instances, prior to beginning to collect image data from the user, computing device 100 may request approval from a user to collect image data from the user. For example, computing device 100 may send a notification to the user to request authorization to capture a video each time before capturing a video. Absent the user's explicit authorization, computing device 100 will not collect image data from the user.

Computing device 100 may further detect behavioral cues based on interactions detected by sensors 108. Example sensors 108 may include a touchscreen sensor, accelerometer, barometer, or other suitable sensors. For example, sensors 108 may be a touchscreen sensor and

may detect the user frequently uses pinch-to-zoom functionality and frequently zooms to high magnification. Processor 102 may process the detected user behavior to provide usable behavioral cue data to behavioral cue recognition module 122. Based on the behavioral cue data received from processors 102, behavioral cue recognition module 122 may determine a frequently zooming behavioral cue, which indicates the user may be visually impaired. In addition, computing device 100 may compare the behavioral cue data with training data to more accurately identify behavioral cues. For example, sensors 108 may detect that the user zooms 30% of the time to a zoom level of 3X. Behavioral cue recognition module 122 may compare the detected data with training data (e.g., training data showing visually impaired users zoom 25% of the time to a zoom level of 2.5X on average.) to identify and validate the frequently zooming behavioral cue. Furthermore, behavioral cue recognition module 122 may use user information (e.g., user's age, user's health data, etc.) to identify behavioral cues only after receiving user consent for such use.

Computing device 100 may identify a relevant accessibility setting that may benefit the user based on one or more identified behavioral cues. For example, computing device 100 may identify that a zoom setting may benefit the user based on the frequently zooming behavioral cue or the holding close behavioral cue.

Computing device 100 may then prompt a notification to recommend the user to check out the identified relevant accessibility setting. Computing device 100 may set a limit of notifications the user may receive for a period of time (e.g., an hour, a day, a week, etc.). Computing device 100 may also use a timer to adjust notification frequency. For example, computing device 100 may send a notification to the user only after a period of time has passed

since the prior notification has been sent (e.g., an hour, a day, a week, etc.). In this way, computing device 100 may avoid annoying the user.

Computing device 100 may also direct the user to an accessibility setting page of the identified relevant accessibility setting. In some examples, the accessibility setting page may contain a recommended setting determined based on the detected behavioral cue. As shown in Figure 2 below, computing device 100 may recommend a relatively large font size in response to a holding the device close behavioral cue identified by radar-based behavioral cue recognition system 110. In some examples, the accessibility setting page may contain a message determined based on the detected behavioral cue. For example, in response to a holding the device far away behavioral cue identified by radar-based behavioral cue recognition system 110, the accessibility setting page may contain a message that indicates the user of the device may be farsighted.

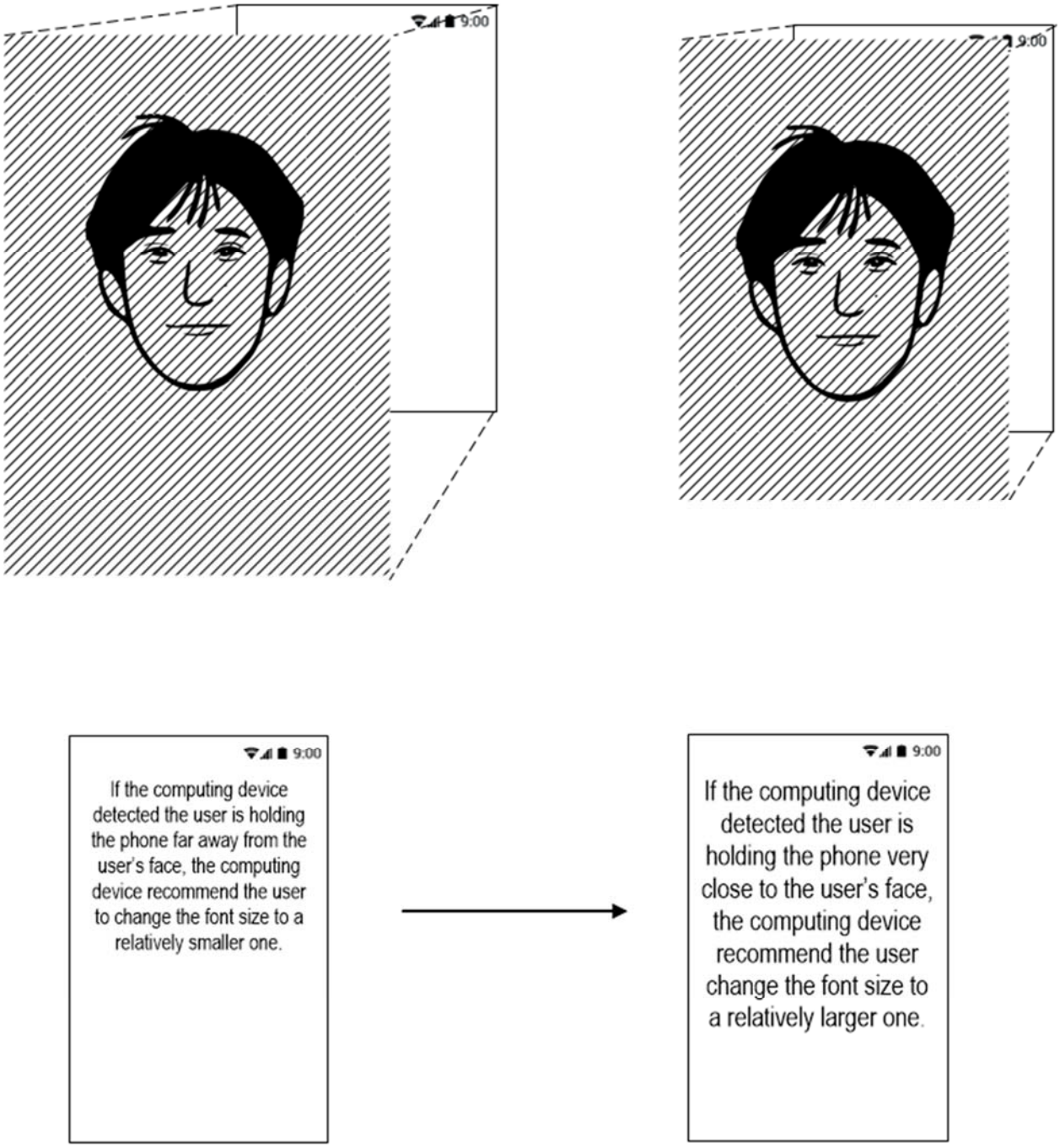

FIG. 2

In some examples, computing device 100 may also direct the user to an accessibility settings page that contains a tutorial which may interact with the user to walk the user through the identified relevant accessibility setting. The tutorial may start with an introduction page to

introduce the identified relevant accessibility setting to the user. The tutorial may then provide interactive assessments of the identified relevant accessibility setting to the user. For example, suppose zoom setting is the identified relevant accessibility setting, the tutorial may provide different font sizes for the user to select. The tutorial may also offer the user the option to skip the interactive assessment. Besides, the tutorial may automatically save the process, and the user may access the saved tutorial later without going over the whole tutorial from the beginning.

It is noted that the techniques of this disclosure may be combined with any other suitable technique or combination of techniques. Such a combination may be made for any suitable purpose, including, but not limited to, improving the accuracy of accessibility setting recommendations.