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(54) Title: MODULAR DESKS

(57) Abstract: Example modular desks are described herein. An example desk includes a first desk surface and a second desk surface coupled to the first desk surface. The second desk surface is moveable relative to the first desk surface between a first position in which the first desk surface and the second desk surface lie in a first plane and a second position in which the second desk surface is disposed in a second plane which is non-parallel to the first plane. The example desk includes a touchscreen coupled to the second desk surface. The touchscreen is exposed when the second desk surface is in the first position and when the second desk surface is in the second position. The example desk includes a processor operatively coupled to the touchscreen. The processor is to control a presentation of data via the touchscreen.

MODULAR DESKS

BACKGROUND

[0001] A collaborative work environment, such as a conference room, typically includes desks to provide users with work surfaces while in the conference room. User devices such as laptops that may be used by the users while in the conference room to access content are typically separate from the desks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIG. 1 is a rear, right perspective view of an example desk constructed in accordance with the teachings of this disclosure, the desk in a first use position.

[0003] FIG. 2 is a rear, right perspective view of the example desk of FIG. 1 in a second use position.

[0004] FIG. 3 is a front, right perspective view of the example desk of FIG. 1 in accordance with the teachings of this disclosure.

[0005] FIG. 4 is a front, right perspective view of the example desk of FIG. 1 including a projector in accordance with the teachings of this disclosure.

[0006] FIG. 5 illustrates example desks in accordance with the teachings of this disclosure in an example environment of use.

[0007] FIG. 6 is a block diagram of an example implementation of the example desk manager of FIGS. 3–5.

[0008] FIG. 7 is a flowchart representative of machine readable instructions that may be executed to implement the example desks of FIGS. 1–6.

[0009] FIG. 8 is a flowchart representative of an example process for providing a desk with a display screen in accordance with the teachings of this disclosure.

[0010] FIG. 9 is a processor platform that may execute the example instructions of FIG. 7 to implement the example desk of FIG. 6.

[0011] The figures are not to scale. Wherever possible, the same reference numbers will be used throughout the drawing(s) and accompanying written description to refer to the same or like parts. While the drawings illustrate examples of desks, other examples may be employed to implement the examples disclosed herein.

DETAILED DESCRIPTION

[0012] Disclosed herein are example desks including integrated display screens. Examples of desks disclosed herein may be used in a work environment such as a conference room. In examples disclosed herein, display screen(s) are coupled to, or integrated in, surface(s) of the desk. In examples disclosed herein, a user can selectively access data stored remotely (e.g., in a cloud-computing environments) via the display screen(s) of the desk. In some examples disclosed herein, data can be shared between two or more desks via wireless communication between the desk(s). In some examples disclosed herein, data can be shared between the desk(s) and user device(s) (e.g., an electronic whiteboard) via wireless communication between the desk(s) and the user device(s).

[0013] In some desks, user devices such as laptops or electronic tablets are separate from the desk and typically rest on a surface of the desk while the user is sitting or standing at the desk. Other desks include display screens coupled to a surface of the desk. However, such desks often have large form factors and/or a reduced a work surface area to accommodate the screens. For example, some desks include an opening or cutout formed in a top surface of the desk to house a laptop or other computing device, which reduces a surface area of the desk available for the user write on, place files on, etc. In other examples, a display screen (e.g., a computer monitor) is disposed in a housing coupled to the desk, however, the housing may protrude into the space under the desk and, thus, interfere with the user's leg room while sitting at the desk. Further, sharing data such as documents between users at two or more desks may require each user to separately open, edit, and/or save the documents, to

email the documents between one another, etc., which can be time-consuming and hinder collaboration between users.

[0014] Disclosed herein are example desks including a first surface, or a work surface, that supports item(s) placed on the work surface, such as a laptop, a coffee cup, a user's arms, etc., and a second surface that is hingedly coupled to the first surface. In example desks disclosed herein, the second surface defines a housing in which display screen(s) are disposed. In some disclosed examples, the display screen(s) are substantially integrated with the second surface such that the display screen(s) do not protrude relative to the second surface. In examples disclosed herein, the second surface can be selectively moved from a first position, or a substantially flat position, to a second position, or a substantially raised position, to enable a user to view the display screen(s) (e.g., while sitting at the desk). In some disclosed examples, the desk includes camera(s), projector(s), speaker(s), and/or sensor(s) coupled to (e.g., integrated in) the first surface and/or the second surface of the desk. Thus, examples disclosed herein provide for integration of display screen(s) with a desk without substantially increasing a form factor of the desk.

[0015] In some examples disclosed herein, a processor is operatively coupled to the display screen(s). The processor enables data stored remotely (e.g., in a cloud) to be accessed and presented or displayed via the display screen(s). In some disclosed examples, the processor implements user authentication software to control user access to the data stored in the cloud. In some such examples, user authentication data (e.g., biometric data) is collected via the camera(s) of the desk.

[0016] In some examples, two or more desks are communicatively coupled via wired or wireless connection(s) between the desks. The communicative coupling between the desks and the cloud environment enable data (e.g., documents) to be efficiently shared via the display screen(s) of the desks. In some examples, the desk(s) are communicatively coupled with other user device(s), such as an electronic white board disposed in a room in which the desk(s) are located (e.g., a conference room), to enable data sharing between the desk(s) and the user device(s). Example desks disclosed herein

provide for efficient and enhanced collaboration between users in an environment such as a conference room.

[0017] FIG. 1 is a rear, right perspective view of an example desk 100 constructed in accordance with the teachings of this disclosure. In the example of FIG. 1, the desk 100 in a first use position. The example desk 100 of FIG. 1 includes a first surface 102. In some examples, the first surface 102 is a work surface that supports item(s) placed on the first surface 102, such as papers, a mobile phone, a coffee cup, a user's arms, etc. The first surface 102 of the example desk 100 can include wood, glass, and/or other material(s). In operation, a user sitting or standing at the desk 100 may be located proximate to a first edge 104 of the first surface 102.

[0018] The example desk 100 of FIG. 1 includes a second surface 106. In the example of FIG. 1, the second surface 106 is coupled to a second edge 108 of the first surface 102, or an edge opposite the first edge 104. The second surface 106 can be coupled to the first surface 102 via mechanical fastener(s) such as hinges. For example, the second surface 106 of FIG. 1 is coupled to the second edge 108 of the first surface 102 via a torque hinge 110 at a first or right side 112 of the desk 100 and a torque hinge at a second or left side 114 of the desk 100. For illustrative purposes, the torque hinge 110 is shown in FIG. 1 on the first side 112 of the desk 100 with the understanding that the torque hinge used to couple the second surface 106 to the second side 114 of the desk 100 is identical or substantially identical to the torque hinge 110. As discussed below, the second surface 106 can move relative to the first surface 102 via the torque hinges 110. As also discussed below, the second surface 106 defines a housing in which electric component(s) (e.g., display screens, processors, sensors) of the example desk 100 are stored. The example first surface 102 and/or the example second surface 106 of the desk 100 can have different shapes and/or sizes than illustrated in FIG. 1.

[0019] The example desk 100 includes a first leg 116 and a second leg 118 to support the first and second surfaces 102, 106. In some examples, the legs 116, 118 are substantially C-shaped. The legs 116, 118 can have other shapes than illustrated in FIG. 1. In the example of FIG. 1, a height of the legs

116, 118 can be adjusted, as represented by arrow 117 of FIG. 1. The height of the legs 116, 118 can be adjusted via actuator(s) 121 operatively coupled to the legs 116, 118. The actuator(s) 121 can include, for example, a manual hand crank to be operated by a user. In other examples, the actuator(s) 121 include electric motor(s) that move the legs 116, 118 based on user input(s) at the desk 100 (e.g., via a switch, a gesture, an input via a display screen). Thus, a height of the example desk 100 can be adjusted while the user is sitting or standing relative to the desk.

[0020] In the example of FIG. 1, the second surface 106 defines a housing 119. In the example of FIG. 1, display screen(s) are disposed in the housing 119 of the second surface 106. For example, the second surface 106 includes a first display screen 120 and a second display screen 122. The second surface 106 can include additional or fewer display screens coupled thereto. Also, a size, shape, and/or position of the display screens 120, 122 relative to the second surface 106 can differ from example screens of FIG. 1. For example, the second surface 106 can include one screen that extends substantially along a length of the second surface 106.

[0021] In the example of FIG.1, the display screens 120, 122 are disposed in the housing 119 (e.g., integrated into the second surface 106) such that, in operation, the display screens 120, 122 are visible to a user via a top portion 124 of the second surface 106 but do not protrude relative to the top portion 124. Put another way, the top portion 124 is a substantially flat surface. The display screens 120, 122 can include, for example, liquid crystals displays. In some examples, the display screen(s) 120, 122 are touchscreens and/or gesture controlled screens. The example displays screens 120, 122 of FIG. 1 include protective glass disposed over the liquid crystal displays. In some examples, portion(s) of the top portion 124 of the second surface 106 include protective glass to substantially integrate the screens 120, 122 with the top portion 124 of the second surface 106. For example, when the display screens 120, 122 are turned off, the user may not see the screens 120, 122 and/or an outline of the screens when looking at the second surface 106 based on materials of the second surface 106.

[0022] In the first use position of the example desk 100 shown in FIG. 1, the second surface 106 lies substantially flat relative to the first surface 102. Put another way, when the second surface 106 is in a first position relative to the first surface 102, the first surface 102 and the second surface 106 lie in a first plane. In some examples, a user uses the example desk 100 in the first use position shown in FIG. 1 when the user does not wish to view the display screen(s) 120, 122.

[0023] In some examples, the user wishes to view content via the display screen(s) 120, 122 while sitting or standing at the desk 100. The second surface 106 of the example desk 100 of FIG. 1 can be raised from the substantially flat position shown in FIG. 1 to a substantially upright or angled position via the hinges 110 to enable the user to view the display screen(s) 120, 122. The example desk 100 of FIG. 1 provides for selective positioning of the second surface 106 relative to the first surface 102 to facilitate viewing of content by the user via the display screen(s) 120, 122 (e.g., without glare or distortion).

[0024] FIG. 2 is a rear, right perspective view of the example desk 100 in a second use position. In the example of FIG. 2, the second surface 106 is positioned at an angle relative to the first surface 102 of the desk 100 to enable the user to view the content via the display screen(s) 120, 122 while sitting or standing at the desk 100 (e.g., proximate to the first edge 104 of the first surface 102). For example, the second surface 106 can be positioned at an angle greater than 0 degrees and less than or equal to 90 degrees relative to the first surface 102, as represented by arrows 200 in FIG. 2. Thus, when the second surface 106 is in a second position relative to the first surface 106 as shown in FIG. 2, the second surface 106 is disposed in a second plane that is non-parallel to the plane in which the first and second surfaces 102, 106 lie when the second surface is in the first position shown in FIG. 1.

[0025] In some examples, the second surface 106 is manually moved by a user from the first position illustrated in FIG. 1 to the second position illustrated in FIG. 2 via the torque hinges 110. For example, a user can grasp one more edges of the second surface 106 to raise the second surface 106

from the first position of FIG. 1 to the second position of FIG. 2 and to adjust the angle of the second surface 106 relative to the first surface 102.

[0026] In other examples, the torque hinges 110 are operatively coupled to hinge motor(s) 202 that control the movement of the second surface 106. The example hinge motor(s) 202 can be disposed in the housing 119 of the second surface 106. As discussed herein, the hinge motor(s) 202 can be controlled by a processor of the desk 100 that is communicatively coupled to the hinge motor(s) 202.

[0027] The example hinge motor(s) 202 can actuate the hinges 110 based on user input(s) received at the desk 100. In some examples, the example desk 100 includes display control(s) 204 that receive and/or detect user input(s) for the motor(s) 202. The display control(s) 204 can include, for example, a button or switch that can be pressed by the user to activate the motor(s) 202 to raise the second surface 106 to a desired angle relative to the first surface 102. In other examples, the display control(s) 204 include sensor(s) that detect gesture(s) of a user (e.g., a predefined gesture such as a hand wave). Based on the detected gesture(s), the processor instructs the motor(s) 202 to automatically actuate the hinges 110 to raise the second surface to a particular (e.g., preset) angle relative to the first surface 102. In some other examples, the display control(s) 204 include sensor(s) that automatically detect particular trigger(s), such as a presence of a user in proximity to the example desk 100 or a change in an amount of light in an environment in which the desk 100 is located (e.g., indicative of a light switch being turned on). In such examples, the motor(s) 202 adjust the position of the second surface 106 based on the sensed triggers. The motor(s) 202 and/or the display control(s) 204 can be coupled to the desk 100 at different positions than shown in FIG. 2.

[0028] The second surface 106 can be returned to the first or substantially flat position when the user is done viewing the display screen(s) 120, 122. In examples where the position of the second surface 106 is manually adjusted, the user can grasp edge(s) of the second surface 106 to return the second surface 106 to the first position shown in FIG. 1 (e.g., a position in which the first and second surfaces 102, 106 lie in the same or

substantially the same plane). In examples where the position of the second surface 106 is controlled by the motor(s) 202, the second surface 106 can be returned to the first position of FIG. 1 in response to trigger(s) detected by the display control(s) 204, such as a hand gesture or a user input received via button or switch indicating that the second surface 106 should be lowered.

[0029] In the example of FIGS. 1 and 2, the display screen(s) 120, 122 are exposed via the second surface 106 when the second surface 106 is in the first positon shown in FIG. 1 or the second position shown in FIG. 2. Put another way, when the user wishes to view the display screen(s) 120, 122, the user does not have to uncover the screens, open a laptop-like cover, etc. Rather, in the examples of FIGS. 1 and 2, the user selectively adjusts the angle of the second surface 106 relative to the first surface 102 to position the screen(s) 120, 122 for viewing.

[0030] FIG. 3 is a front, right perspective view of the example desk 100 of FIGS. 1 and 2. In the example of FIG. 3, the second surface 106 is in the second or raised position relative to the first surface 102 as discussed in connection with FIG. 2. As illustrated in FIG. 3, content (e.g., documents, presentations, videos, etc.) can be displayed via the first and/or second display screens 120, 122. The example desk 100 includes a desk manager 300 to control the data displayed via the display screen(s) 120, 122. As illustrated in FIG. 3, the example desk manager 300 can be implemented by software executed on a processor 301 coupled (e.g., mounted) to the desk 100. In the example of FIG. 3, the processor 301 is coupled to the second surface 106 of the desk 100 (e.g. disposed in the housing 119 defined by the second surface 106). However, the example processor 301 could be coupled to other portions of the example desk 100 (e.g., the first surface 102, one of the legs 116, 118). In other examples, the processor 301 is located separate from the desk 100 and is operatively coupled to component(s) of the desk such as the display screens 120, 122 via wired or wireless connections. In some examples, a position of the processor 301 relative to the desk 100 is selected to enable the processor 301 to couple to a power source.

[0031] In some examples, the desk manager 300 of FIG. 3 is implemented via a cloud-computing device or environment 302. In some examples, some components of the example desk manager 300 are implemented by the on-board processor 301 of the desk 100 and some other component(s) of the desk manager 300 are implemented by the cloud-computing environment 302. The dotted lines extending from the desk manager 300 in FIG. 3 demarcate the different locations for the desk manager 300 (e.g., the on-board processor 301, in the cloud 302). Appropriate communication paths can be established with the desk manager 300 via, for example, WiFi, cellular, Bluetooth and/or other communication protocols supported by the locations of the desk manager 300.

[0032] The example desk 100 of FIG. 3 enables the user to access the Internet via the desk manager 300 of the desk 100. In the example of FIG. 3, the desk manager 300 (which, in this example, may be implemented by the on-board processor 301 of the desk 100), is in communication (e.g., wireless communication) with the cloud-computing environment 302, as represented by the dotted line 304 of FIG. 3. As discussed below, the desk manager 300 communicates with the cloud-computing environment 302 to retrieve data for access by the user via the example desk 100.

[0033] In the example of FIG. 3, the desk manager 300 authenticates or verifies an identity of the user to permit or deny access to, for example, user application(s) executed by the desk manager 300 at the desk 100 and/or data stored in the cloud-computing environment 302. In some examples, the desk manager 300 verifies a password entered by the user via the display screen(s) 120, 122 (e.g., via touchscreen keyboard).

[0034] In some examples, the desk manager 300 verifies the identity of the user based on biometric factor(s). For example, the desk 100 of FIG. 3 includes camera(s) 310. The example camera(s) 310 of FIG. 3 can capture image data representative of, for example, the user's face. The example desk manager 300 analyzes the image data captured by the camera(s) 310 relative to known facial recognition data for the user to verify the identity of the user. In some examples, the facial recognition data is stored in the cloud-computing

environment 302. For example, a user account or profile for the user can be stored in the cloud-computing environment 302 and include biometric data such as facial image data. In such examples, the desk manager 300 communicates with the cloud-computing environment 302 to authenticate the user.

[0035] When the desk manager 300 has verified the identity of the user, the user can interact with user application(s) executed by the desk manager 300 via the display screen(s) 120, 122, can access data stored in the cloud-computing environment 302 at the desk 100, etc. For example, the desk manager 300 implements a first graphical user interface (GUI) 314 displayed via the first display screen 120 and/or a second GUI 316 displayed via the second display screen 122. The user can provide inputs via the GUI(s) 314, 316 that are processed by the desk manager 300. For example, based on user input(s) via the GUI(s) 314, 316, the desk manager 300 communicates with the cloud-computing environment 302 to retrieve user-requested data for display via the display screen(s) 120, 122.

[0036] For example, the user can access data such as documents or images stored in the cloud-computing environment 302 via the display screen(s) 120, 122. In some examples, the data includes music files or video files. The example desk 100 of FIG. 3 includes speaker(s) 318 communicatively coupled to the desk manager 300 to enable audio files to be played via the desk 100.

[0037] In some examples, the content presented via the first display screen 120 differs from the content presented via the second display screen 122. For example, the first display screen 120 can serve as a working screen through which the user can access data stored in the cloud-computing environment 302, such as documents or presentations. The second display screen 122 can show particular (e.g., predefined or preselected) content such as a calendar, a clock, stock prices, an audio playlist, etc. The predefined content displayed via the second display can be substantially static (e.g., only a calendar is shown while the second display screen 122 is in use) or can vary. In some examples, the content displayed via the first and/or second display screen(s) 120, 122 is based on user setting(s) processed by the desk manager

300 and/or associated with a user account stored in the cloud-computing environment 302.

[0038] In some examples, the example desk 100 includes microphone(s) 320. The microphone(s) 320 can be used to record audio data via the desk 100. In some such examples, the desk manager 300 processes and/or transmits the audio data to the cloud-computing environment 302. In some examples, the microphone(s) 320, the speaker(s) 318, the camera(s) 310, and/or the display screen(s) 120, 122 enable the user to conduct video conferences or chats at the desk 100 via web-based communication service(s).

[0039] In some examples, the camera(s) 310 can scan paper document(s) placed on, for example, the first surface 102 of the desk 100 within a field of view of the camera(s) 310. The scanned image data can be processed and/or stored by the desk manager 300. In some examples, the desk manager 300 transmits the scanned image data generated by the camera 310 to the cloud-computing environment 302. Thus, the example desk 100 provides for digitalization of documents via the camera(s) 310.

[0040] The example desk 100 of FIG. 3 includes projector(s) 322 that project image(s) onto the first surface 102 for viewing by the user at the desk 100. In some examples, the projector(s) 322 are handheld or pico projector(s). As discussed below, the projector(s) 322 enable a user to interact with, for example, the digital documents by editing or signing the documents via the projection(s) generated by the projector(s) 322.

[0041] FIG. 4 is a front, right perspective view of the example desk 100 of FIGS. 1 and 2 including the projector 322. As illustrated in FIG. 4, projection(s) 400 generated by the projector 322 can be presented via the first surface 102. In some examples, the projection(s) 400 correspond to image data and/or video data access by the user via the first and/or second display screen(s) 120, 122 (e.g., from the cloud-computing environment 302). In some examples, the projector 322 generates the projection(s) 400 based on user input(s) received via the GUI(s) 314, 316 of the display screen(s) 120, 122. In some examples, the display screen(s) 120, 122 display the same data visible via the projection(s) 400. In other examples, the display screen(s) 120, 122 display different data

than the data presented via the projection(s) 400. For example, the user can view the projection(s) 400 while participating in a video conference with another person using the camera 310 and the display screen(s) 120, 122.

[0042] The example desk 100 of FIG. 1 provides for communication with other user device(s), such as a smartphone, a digital or smart pen, a personal computing device such as a laptop or tablet, wireless headphones, an electronic whiteboard, etc. In the example of FIG. 1, communication links can be established between the desk manager 300 of the example desk 100 and the user device(s) via wireless communication protocol(s) such as, WiFi, Bluetooth®, or near field communication (NFC). In other examples, communication links can be established via wired connections at the desk 100 (e.g., USB connections).

[0043] For example, a first user device 402 such as a smartphone may be placed on the first surface 102. A communication link may be established between the first user device 402 and the desk manager 300 of the example desk 100 via, for example, WiFi, Bluetooth®, or NFC, as represented by arrow 404 of FIG. 4. When the first user device 402 and the example desk manager 300 are communicatively coupled, data stored on the first user device 402 can be accessed by the user via the example desk 100. For example, image data stored on the first user device 402 can be displayed via the display screen(s) 120, 122. In some examples, the first user device 402 can be used provide user input(s) to the desk manager 300 to control component(s) of the desk 100, to adjust user setting(s), etc. For example, a user can adjust an angle of the second surface 106 relative to the first surface 102, control audio content and/or audio volume output by the speaker(s) 318 by entering user input(s) into a user application that is installed on the first user device 402 and is in communication with the desk manager 300 via the communication link 404. In some examples, the first user device 402 emulates or serves as a keyboard or touch pad for providing user inputs to the desk manager 300 to control component(s) of the desk, modify document(s) displayed via the display screen(s) 120, 122 of the desk, etc.

[0044] In some examples, the desk 100 includes proximity sensor(s) 406 that detect the presence of the first user device 402 when the first user device 402 is placed on the first surface 102 and/or is in within a particular range of proximity of the desk 100. For example, the proximity sensor(s) 406 can detect changes in electromagnetic fields emitted by the sensors when the first user device 402 is disposed near the sensors. Based on the detection of the first user device 402 by the proximity sensor(s) 406, the desk manager 300 can generate a prompt to be displayed via the display screen(s) 120, 122 and/or via the speaker(s) 318 asking the user if he or she would like to establish a wireless communication link between the first user device 402 and the desk 100.

[0045] In some examples, the desk 100 includes wireless communication transmitters such as WiFi and/or Bluetooth® transmitters that broadcast signal(s) (e.g., WiFi beacon(s), Bluetooth® inquires) to detect user device(s), such as the first user device 402, in proximity to the desk 100 to facilitate communicative coupling(s) between the user device(s) and the desk 100. In some examples, the user device(s) broadcast signal(s) to prompt the desk manager 300 to establish communication link(s) between the desk 100 and the user device(s) based on wireless communication protocol(s) (and, in some examples, based on user input(s) provided via the user device(s) and/or the desk to authorize the wireless connection(s)).

[0046] In some examples, the desk manager 300 detects content (e.g., video content) being broadcast via the first user device 402 (e.g., displayed via the display screen(s) 120, 122, output via the speaker(s) 318). In such examples, the desk manager 300 can generate a prompt asking the user if he or she would like to broadcast the content via the display screen(s) 120, 122 of the desk 100. In some examples, a user application installed on the first user device 402 can detect content being broadcast by the desk manager 300 (e.g., via the first or second display screens) and generate a prompt asking the user whether he or she would like to broadcast the content via the first user device 402.

[0047] In some examples the desk 100 includes induction coil(s) 408 that provide for wireless charging of the first user device 402 when the first user

device 402 is placed on the desk (e.g., the first surface 102). For example, the induction coil(s) 408 can charge the user device 402 via inductive coupling between the induction coil(s) 408 and the first user device 402 when the first user device 402 is placed near (e.g., over) the induction coil(s) 408. In some examples, the induction coil(s) 408 serve as proximity sensor(s) to detect a presence of the first user device and to automatically charge the device 402 based on the proximity detection.

[0048] A second example user device 410 that can be communicatively coupled to the desk manager 300 of the example desk 100 of FIGS. 1–4 includes a digital pen or a smart pen. A wireless communication link can be established (e.g., via WiFi, Bluetooth®, NFC) between the example desk manager 300 and the pen 410, as represented by the arrow 412 of FIG. 4. The wireless communication link between the desk manager 300 and the pen 410 enables user markups on, for example, a document made with the pen to be transferred to the desk manager 300. The desk manager 300 records the markups relative to the data retrieved from the cloud-computing environment 302 such that the cloud data is modified by the desk manager 300 based on the data received from the pen 410. In some examples, the document corresponds to a projection 400 generated by the projector 322 of the desk 100. For example, the user can sign a document (e.g., a paper document, a projected document) using the pen 410 at the desk 100. The data representative of the user's signature (e.g., image data) recorded by the pen 410 is transmitted to the desk manager 300. In some examples, the desk manager 300 processes the data received from the pen 410 to interpret the user's handwriting. In other examples, the desk manager 300 transmits the digital pen data to another server or the cloud-computing environment 302 for processing and/or storage. In the example of FIG. 1, the user's signature or other markups can be authenticated via the authentication of the user's identity by the desk manager 300 based on, for example, facial image data generated by the camera 310.

[0049] In some examples, the pen 410 can be used to provide user input(s) to the desk manager 300 to control component(s) of the desk 100, to adjust user setting(s), etc. For example, the pen 410 can be used to control a

position of a cursor displayed via the display screen(s) 120, 122 of the desk 100. As another example, the pen 410 can be used to provide user input(s) via touch screen controls of the display screen(s) 120, 122. In some examples, the user can provide gestures (e.g., mimic handwriting gestures) using the pen 410 to provide command(s) to the desk manager 300 to control component(s) of the desk 100 (e.g., to raise the volume output by the speaker(s) 318, to start and/or stop recording via the microphone(s) 320).

[0050] In some examples, the user device(s) that are communicatively coupled to the desk manager 300 include wireless headphones that can be used in addition to or as an alternative to the speaker(s) 318 and/or the microphone(s) 320. Thus, the example desk 100 of FIGS. 1–4 provides for user device(s) to be communicatively coupled to the example desk 100, including user devices placed on the surface of the desk 100 (e.g., a smartphone, a laptop) and/or carried by the user of the desk 100 (e.g., a digital pen, wireless headphones). In some examples, the desk 100 includes a holder (e.g., a carrier, a slot) defined in the first surface 102 and/or the second surface 106 of the desk 100 to receive the pen 410 for storage when not in use. In some examples, the pen 410 may be coupled to the first surface 102 and/or the second surface 106 of the desk 100 via a wire or other mechanical fastener. As discussed below, in other examples, the desk manager 300 of the example desk 100 communicates with other device(s) that are located within an environment in which the desk is located but are substantially separate from the desk and/or the user.

[0051] FIG. 5 illustrates an example environment of use 500 in which example desks disclosed herein, such as the example desk 100 of FIGS. 1–4, may be used. The example environment of use 500 can include, for example, a conference room, a classroom, etc. The example environment 500 includes a first desk 502, a second desk 504, a third desk 506, and a fourth desk 508. In the example of FIG. 5, each of the first, second, third, and fourth desks 502, 504, 506, 508 are substantially identical to the example desk 100 of FIGS. 1–4. For example, each of the desk(s) 502, 504, 506, 508 include a first surface 102 and a second surface 106 substantially identical to the first surface 102 and the

second surface 106 of the example desk 100 of FIGS. 1–4. Each of the first, second third, and fourth desks 502, 504, 506, 508 includes the display screen(s) 120, 122, the on-board processor 301 (e.g., disposed in a housing defined by the second surface 106) to implement component(s) of the desk manager 300, etc. For illustrative purposes, the display screen(s) 120, 122 and the processor 301 are shown in FIG. 5 in connection with the first desk 502 with the understanding that the second, third, and fourth desks 504, 506, 508 also include the display screen(s) 120, 122, the processor 301, and any other components of the first desk 502.

[0052] The example environment 500 can include additional or fewer desks than illustrated in FIG. 5. In other examples, not all of the desks in the example environment 500 include the processor 301 and/or the display screen(s) 120, 122. Put another way, in some examples, some of the desks in the example environment 500 are smart desks and some of the desks are not smart desks.

[0053] In the example of FIG. 5, each of the desks 502, 504, 506, 508 is communicatively coupled to a cloud-computing environment 510 (e.g., the cloud-computing environment 302 of FIG. 3) via the desk manager 300 implemented by the respective processor(s) 301 of the desks, as represented by arrows 512, 514, 516, 518 of FIG. 5. In the example of FIG. 5, data can be shared between two or more of the desks 502, 504, 506, 508 via the cloud-computing environment 510 substantially as discussed above in connection with the example desk 100 of FIGS. 1–4. As mentioned above in connection with FIG. 3, in some examples, component(s) of the desk manager 300 are implemented via the cloud-computing environment 510.

[0054] For example, a user of the first desk 502 can access a document stored in a cloud account for the user in the cloud-computing environment 510 via the display screen 120 of the first desk 502. The user can select to share the document with a user at the fourth desk 508 by, for example, giving permission for the document to be shared via input(s) at the display screen(s) 120, 122 of the first desk 502. The desk manager 300 of the fourth desk 508

can access the document via the cloud-computing environment 510 for display via the display screen(s) 120, 122 of the fourth desk 508.

[0055] In some examples, the document shared between the first and fourth desks 502, 508 includes modifications by the user of the first desk 502 that are recorded via a digital pen (e.g., the pen 410 of FIG. 4) and transmitted to the cloud-computing environment 510 via the desk manager 300 of the first desk 502. In some examples, the document is scanned by the camera 310 of the first desk 502 and the scanned image data is stored in the cloud-computing environment 510 for access via the fourth desk 508. In some examples, the document is transferred from a user device 520 such as laptop disposed on, for example, a surface of the fourth desk 508 to the cloud-computing environment 510 via the processor of the fourth desk 508 (e.g., via the communication link between the user device 520 and the processor of the fourth desk 508). Thus, in the example environment 500 of FIG. 5, data can be exchanged between the example desks 502, 504, 506, 508 via the communicative coupling of the desks to the cloud-computing environment 510.

[0056] The example desk(s) 502, 504, 506, 508 of FIG. 5 can be communicatively coupled to other user device(s) located in the environment 500. For example, an electronic whiteboard 522 can be located in the environment 500. A communication link can be established between the desk manager 300 of the first desk 502 (and/or any of the other desks 504, 506, 508) and the electronic whiteboard 522 (e.g., via wireless communication protocols such as WiFi, Bluetooth®, NFC), as represented by arrow 524 of FIG. 5. A user of the first desk 502 can share data retrieved from the cloud-computing environment 510 via the desk manager 300 of the first desk 502 with other user(s) in the environment 500 via the electronic whiteboard 522. For example, the user can select to share content via the electronic whiteboard 522 by entering input(s) at the display screen(s) 120, 122 of the first desk 502. In some examples, the user controls feature(s) of the electronic whiteboard 522 via inputs at the first desk 502, such as a resolution of a display screen of the electronic whiteboard 522, a volume level of speakers associated with the electronic whiteboard 522, etc.

[0057] In the example of FIG. 5, the desk manager 300 of the desk(s) 502, 504, 506, 508 can be communicatively coupled to other devices or systems in the environment 500 that are, for instance, wireless-enabled. For example, any of the desk(s) 502, 504, 506, 508 can establish a communication link (e.g., via Bluetooth®) with wireless-enabled light source(s) 526 located in the environment 500 (e.g., overhead lights). A user can control the light source(s) 526 by providing user input(s) via the display screen(s) 120, 122 and/or the speakers of the desk(s) 502, 504, 506, 508. For example, a user of the fourth desk 508 may select to dim the light source(s) 526 by providing a user input at the fourth desk 508 while one of the desks is sharing data with the electronic whiteboard 522.

[0058] As another example, the desk manager(s) 300 of the desk(s) 502, 504, 506, 508 can be communicatively coupled to a wireless-enabled HVAC system 528 (e.g., an air conditioner, a heater) in the environment 500. The desk(s) 502, 504, 506, 508 can be used to control a temperature of the environment 500. In some examples, the desk(s) 502, 504, 506, 508 include temperature sensor(s) 530 to detect a temperature of the ambient environment 500. The temperature data generated by the temperature sensor(s) 530 can be processed by the desk manager 300 of the desk(s) 502, 504, 506, 508 and presented via the display screen(s) 120, 122 of the desk(s). In some examples, the desk manager 300 of the desk(s) 502, 504, 506, 508 automatically generates instructions for the HVAC system based on the temperature sensor data and user settings (e.g., if the ambient temperature falls below or above a predefined threshold).

[0059] As illustrated in FIG. 5, the second desk 504 and the third desk 506 are in the first use position, or a position in which the respective second surfaces 106 of the desks 504, 506 are substantially flat or lie in the same plane as the first surfaces 102 of the desks 504, 506. As also illustrated in FIG. 5, the first desk 502 and the fourth desk 508 are in the second use position in which the respective second surfaces 106 of the desks 502, 508 are at an angle relative to the first surfaces 102 of the desks 502, 508. As discussed above, the position of the second surface(s) 106 of any the desk(s) 502, 504, 506, 508 can

be selectively adjusted based on, for example, whether a user would like to view the display screen(s) 120, 122 of a particular desk.

[0060] Thus, in the example of FIG. 5, each of the desks 502, 504, 506, 508 is a module that is capable of retrieving and presenting data from the cloud-computing environment 510 and communicating with other desk(s) and/or device(s) in the environment 500. As illustrated in FIG. 5, in some examples, two or more of the desk(s) 502, 504, 506, 508 are coupled together to form, for example, a modular conference table 532. In some examples, the legs of two or more desk(s) couple (e.g., snap) together to form the table 532. For example, as illustrated in FIG. 5, a leg 534 of the third desk 506 can be coupled to a leg 536 of the fourth desk 508. In some examples, a power cable can be routed from a power source to two or more of the desks 502, 504, 506, 508 via, for example, the legs of the desks. For example, power cable 538 can be routed from a power outlet 540 in the environment 500 to the second surfaces 106 of the third and fourth desks 506, 508 via the legs 534, 536. In some examples, the coupling of two or more of the desks 502, 504, 506, 508 (e.g., via the desk legs) reduces a number of power cables in the environment 500.

[0061] Thus, the example desk(s) 100, 502, 504, 506, 508 of FIGS. 1–5 provide for communication between the desk(s) and a cloud-computing environment (the cloud-computing environments 302, 510 of FIGS. 3–5), user device(s) (e.g., the user devices 402, 410, 520, 522 of FIGS. 4 and 5), and/or other device(s) in an environment (e.g., the light source(s) 526, the HVAC system 528). The example desk(s) 100, 502, 504, 506, 508 of FIGS. 1–5 facilitate sharing of cloud data between user(s) via the desk(s) without requiring transfer of data via cables and without requiring users to bring user devices such as laptops into an environment such as a conference room to share data. The example desks 100, 502, 504, 506, 508 of FIGS. 1–5 promote efficient collaboration between users as compared to a desk or conference table that does not include the smart features of the desks of FIGS. 1–5.

[0062] Although in FIGS. 1–5, component(s) of the desk(s) 100, 502, 504, 506, 508 such as the display screen(s) 120, 122, the processor(s) 301, the speaker(s) 318, and/or the microphone(s) 320 are illustrated as coupled to the

second surface 106 (e.g., disposed in the housing 119 defined by the second surface 106), in other examples, the display screen(s) 120, 122, the processor(s) 301, the speaker(s) 318, and/or the microphone(s) 320 are coupled to the first surface 102. In other examples, the first surface 102 is a passive surface in that the display screen(s) 120, 122, the desk processor(s) 301, the speaker(s) 318, the microphone(s) 320, the proximity sensor(s) 406, the temperature sensor(s) 530, etc. are located at the second surface 106 and the first surface 102 does not include any electronic components.

[0063] For example, the second surface 106 including the display screen(s) 120, 122, the processor(s) 301, the speaker(s) 318, the microphone(s) 320, the proximity sensor(s) 406, the temperature sensor(s) 530, etc. can be coupled to surface of a desk (e.g., a desk already in use) to convert the desk into a smart desk. The second surface 106 can be coupled to the existing desk surface via mechanical fastener(s), such as the torque hinges 110 of FIG. 1. Thus, in some examples, the second surface 106 can be coupled to a surface of a desk, table, etc. to convert or retrofit the desk or table into a smart work tool.

[0064] FIG. 6 is a block diagram of an example implementation of the example desk manager 300 of FIGS. 3–5. As mentioned above, the example desk manager 300 is constructed to control data accessed, captured by, and/or presented via the example desk(s) 100, 502, 504, 506, 508 of FIGS. 1–5. In the example of FIG. 6, the desk manager 300 is implemented by the respective processor(s) 301 of the desk(s) and/or via the cloud-based environments(s) 302, 510.

[0065] In some examples, the desk manager 300 includes a desk height adjuster 600 to control the leg actuator(s) 121 of the legs 116, 118 of the desk based on user input(s) received a the desk (e.g., via an actuator switch, via an input at the display screen(s) 120, 122, etc.). Based on the user inputs, the desk height adjuster 600 generates instructions to control operation of the leg actuator(s) 121 to adjust a height of the legs 116, 118.

[0066] In some examples, the desk manager 300 includes a hinge motor controller 602. The example hinge motor controller 602 receives and analyzes

data from the display control(s) 204 to interpret trigger(s) (e.g., user gestures) indicating that the second surface 106 of the desk should be raised at an angle relative to the first surface 102 of the desk (e.g., as illustrated in FIGS. 2–4 and in FIG. 5 for the first and fourth example desks 502, 508). The example hinge motor controller 602 receives and analyzes data from the display control(s) 204 to interpret trigger(s) indicating that the second surface 106 should be lowered so as to lie in the same plane as the first surface 102 (e.g., as illustrated in FIG. 1 and FIG. 5 for the second and third example desks 504, 506). Based on the data from the display control(s) 204, the hinge motor controller 602 generates instructions to control the operation of the hinge motor(s) 202.

[0067] The example desk manager 300 includes a display screen manager 604. The example display screen manager 604 controls operation of the display screen(s) 120, 122. For example, the display screen manager 604 controls operation or activation of the display screen(s) 120, 122. In some examples, the display screen manager 604 activates the display screen(s) 120, 122 based on user input(s) indicating that the displays screen(s) 120, 122 should be turned on (e.g., via a power button). In some examples, the display screen manager 604 controls the display screen(s) 120, 122 based on display screen rule(s) 606 stored in a database 608. For example, the display screen rule(s) 606 can include a rule that the display screen(s) should be automatically turned on when the second surface 106 is raised to the second or substantially upright position. The example display screen manager 604 can control other features of the display screen(s) 120, 122, such as a resolution of the screen(s) 120, 122, sleep mode settings, powering down of the screens, etc.

[0068] The example desk manager 300 includes an application manager 610. The example application manager 610 controls execution of user application(s) 612 at the desk that may be accessed by the user via the display screen(s) 120, 122. The user application(s) 612, which may be pre-installed, are stored in the database 608. For example, the application manager 610 controls the display of the GUI(s) 314, 316 associated with the user application(s) 612 via the respective display screen(s) 120, 122. The example application manager 610 controls the content displayed on each display screen 120, 122.

For example, the application manager 610 can control execution of some user applications 612, such as a clock application or a calendar application, via one of the first display screen 120 or the second display screen 122. The application manager 610 can control execution of other user applications 612, such as a telecommunication user application, a document viewer application, an application for searching data stored in the cloud-computing environment, etc. via the other of the first display screen 120 or the second display screen 122.

[0069] The example desk manager 300 includes a communicator 614. As discussed herein, the communicator 614 establishes and manages communication links (e.g., wireless communication connections) between the desk manager 300 and the cloud-computing environment 302, 510, other desks, user devices, etc.

[0070] The example desk manager 300 includes a user authentication manager 616. The user authentication manager 616 verifies an identity of a user attempting to access the cloud-computing environment 302, 510 via the desk 100, 502, 504, 506, 508. For example, in some instances, the user authentication manager 616 compares a password entered via the display screen(s) 120, 122 to user authentication data 618 stored in the database 608 of the desk manager 300. In such examples, the user authentication data 618 includes previously stored password data (e.g., previously set by the user). In other examples, the user authentication data 618 is stored in the cloud-computing environment 302, 510 and the user authentication manager 616 communicates with the cloud-computing environment 302, 510 (e.g., via the communicator 614) to verify the password.

[0071] In some examples, the user authentication data 618 includes biometric data, such as facial image data. In some examples, the user authentication manager 616 analyzes image data 619 generated by the camera(s) 310 corresponding to feature(s) of the user, such as facial image data. In some examples, the image data 619 generated by the camera(s) 310 is stored in the database 608. The user authentication manager 616 compares the

(e.g., facial) image data to known image data for the user to verify an identity of the user.

[0072] The example desk manager 300 of FIG. 6 includes a cloud access regulator 620. The example cloud access regulator 620 sends and/or retrieves data from the cloud-computing environment 302, 510 via the communication link established between the cloud-computing environment 302, 510 and the desk manager 300. For example, based on user input(s) received via the GUI(s) 314, 316 at the display screen(s) 120, 122, the cloud access regulator 620 sends requests to the cloud-computing environment 302, 510 for data to be presented via the display screen(s) 120, 122, the speaker(s) 318, etc.. In some examples, the requests generated by the cloud access regulator 620 at a desk 100, 502, 504, 506, 508 include requests for data stored in the cloud-computing environment 302, 510 to be shared with other desk(s) 100, 502, 504, 506, 508. Upon receipt of the requested data from the cloud-computing environment 302, 510, the cloud access regulator 620 communicates with the display screen manager 604 and/or the application manager 610 to display the data via the display screen(s) 120, 122.

[0073] The example desk manager 300 of FIG. 6 includes a camera manager 622. The example camera manager 622 controls operation of the camera(s) 310. For example, based on user input(s) received via the GUI(s) 314, 316, the camera manager 622 generates instructions for the camera(s) 310 to capture image data (e.g., during a video conference), to scan a document on the first surface 102 of the desk, etc.

[0074] The example desk manager 300 of FIG. 6 includes a projector manager 624. The example projector manager 624 controls operation of the projector(s) 322. For example, the projector manager 624 generates instructions for the projector(s) 322 to generate the projection(s) 400 for display via the desk (e.g., via the first surface 102 of the desk) based on user inputs received via the GUI(s) 316, 314.

[0075] The example desk manager 300 of FIG. 6 includes an audio manager 626. The example audio manager 626 controls operation of the speaker(s) 318 and/or the microphone(s) 320. For example, the audio manager

626 activates the speaker(s) 318 and the microphone(s) 320 based on user input(s) indicating that the user wishes to conduct a video conference via the display screen(s) 120, 122.

[0076] The example desk manager 300 includes a user device manager 628. The user device manager 628 receives and analyzes data from the proximity sensor(s) 406 indicative of the presence of a user device (e.g., a smartphone, the digital pen 410, a laptop) within a predefined range of the proximity sensor(s) 406. Based on the analysis of the proximity sensor data, the user device manager 628 generates prompt(s) to be displayed via the display screen(s) 120, 122 asking whether the user would like to communicatively couple the user device(s) to the desk manager 300. Based on the user input(s), the user device manager 628 and/or the communicator 614 establish communication link(s) between the desk manager 300 and the user device(s). In some examples, the user device manager 628 manages the broadcast of communication signals (e.g., WiFi beacon(s), Bluetooth® inquires, etc. via wireless transmitter(s) of the desk) to establish wireless communication link(s) with user device(s) in proximity to the desk.

[0077] In some examples, the user device manager 628 generates instructions for content to be exchanged between the desk(s) 100, 502, 504, 506, 508 and/or between the desk(s) 100, 502, 504, 506, 508 and other user devices (e.g., the electronic whiteboard 522) in an environment (e.g., the environment 500 of FIG. 5). For example, the user device manager 628 enables content retrieved from the cloud-computing environment 302, 510 at the desk 100,502, 504, 506, 508 to be shared via the electronic whiteboard 522. In some examples, the user device manager 628 receives data from a user device (e.g., handwriting data from the digital pen 410) and processes the data and/or transmits the data to the cloud-computing environment 302, 510 (e.g., records modifications to the data made by the user with the digital pen 410).

[0078] In some examples, the user device manager 628 generates instructions based on user device rule(s) 630 stored in the database 608. For example, the user device rule(s) 630 can include rules as to the types of instructions the user device manager 628 should generate based on the type of

user device(s) (e.g., enable screen sharing via the electronic whiteboard 522, analyze handwriting data received via the digital pen 410).

[0079] The example desk manager 300 of FIG. 6 includes a device charging manager 632. The example device charging manager 632 controls the induction coil(s) 408 based on, for example, data from the proximity sensor(s) 406. For example, the device charging manager 632 can control a current flowing through the induction coil(s) 408 based on an indication that a user device is proximate to the induction coil(s) 408.

[0080] The example desk manager 300 of FIG. 6 includes an ambient environment manager 634. The example ambient environment manager 634 enables user control of device(s) and/or system(s) in the ambient environment, such as the light source(s) 526 and/or the HVAC system 528, at the desk 100, 502, 504, 506, 508 via communicative couplings between the ambient environment devices and/or systems and the desk manager 300 (e.g., via the communicator 614). The example ambient environment manager 634 generates instructions to be transmitted to the devices and/or systems in the ambient environment based on user input(s) received via the GUI(s) 314, 316, indicating, for example that the lights should be dimmed, the room temperature raised, etc. In some examples, the ambient environment manager 634 processes data received from the temperature sensor(s) 530 corresponding to a temperature of an environment in which the desk is located 100, 502, 504, 506, 508 (e.g., a conference room) and generates instructions based on the temperature data.

[0081] While an example manner of implementing the example desk manager 300 is illustrated in FIG. 6, any one the elements, processes and/or devices illustrated in FIG. 6 may be combined, divided, re-arranged, omitted, eliminated and/or implemented in any other way. Further, the example desk height adjuster 600, the example hinge motor controller 602, the example display screen manager 604, the example database 608, the application manager 610, the example communicator 614, the example user authentication manager 616, the example cloud access regulator 620, the example camera manager 622, the example projector manager 624, the example audio manager

626, the example user device manager 628, the example device charging manager 632, the example ambient environment manager 634, and/or, more generally, the example desk manager 300 of FIG. 3–6 may be implemented by hardware, software, firmware and/or any combination of hardware, software and/or firmware. Thus, for example, any of the example desk height adjuster 600, the example hinge motor controller 602, the example display screen manager 604, the example database 608, the application manager 610, the example communicator 614, the example user authentication manager 616, the example cloud access regulator 620, the example camera manager 622, the example projector manager 624, the example audio manager 626, the example user device manager 628, the example device charging manager 632, the example ambient environment manager 634, and/or, more generally, the example desk manager 300 of FIG. 3–6 could be implemented by analog or digital circuit(s), logic circuits, programmable processor(s), application specific integrated circuit(s) (ASIC(s)), programmable logic device(s) (PLD(s)) and/or field programmable logic device(s) (FPLD(s)). When reading any of the apparatus or system claims of this patent to cover a purely software and/or firmware implementation, at least one of the example desk height adjuster 600, the example hinge motor controller 602, the example display screen manager 604, the example database 608, the application manager 610, the example communicator 614, the example user authentication manager 616, the example cloud access regulator 620, the example camera manager 622, the example projector manager 624, the example audio manager 626, the example user device manager 628, the example device charging manager 632, the example ambient environment manager 634, and/or, more generally, the example desk manager 300 of FIG. 3–6 is/are hereby expressly defined to include a non-transitory computer readable storage device or storage disk such as a memory, a digital versatile disk (DVD), a compact disk (CD), a Blu-ray disk, etc. including the software and/or firmware. Further still, the example desk manager 300 of FIG. 3–6may include element(s), process(es) and/or device(s) in addition to, or instead of, those illustrated in FIGS. 3–6 and/or may include more than one of any or all of the illustrated elements, processes and devices.

[0082] A flowchart representative of example machine readable instructions for implementing the example desk 100, 502, 504, 506, 508 of FIGS. 1–6 and/or components thereof is shown in FIG. 7. In this example, the machine readable instructions comprise a program for execution by a processor such as the processor 912 shown in the example processor platform 900 discussed below in connection with FIG. 9. The program may be embodied in software stored on a non-transitory computer readable storage medium such as a CD-ROM, a floppy disk, a hard drive, a digital versatile disk (DVD), a Blu-ray disk, or a memory associated with the processor 912, but the entire program and/or parts thereof could alternatively be executed by a device other than the processor 912 and/or embodied in firmware or dedicated hardware. Further, although the example program is described with reference to the flowchart illustrated in FIG. 7, many other methods of implementing the example desk 100, 502, 504, 506, 508 and/or components thereof may alternatively be used. For example, the order of execution of the blocks may be changed, and/or some of the blocks described may be changed, eliminated, or combined. Additionally or alternatively, any or all of the blocks may be implemented by hardware circuit(s) (e.g., discrete and/or integrated analog and/or digital circuitry, a Field Programmable Gate Array (FPGA), an Application Specific Integrated circuit (ASIC), a comparator, an operational-amplifier (op-amp), a logic circuit, etc.) structured to perform the corresponding operation without executing software or firmware.

[0083] As mentioned above, the example process of FIG. 7 may be implemented using coded instructions (e.g., computer and/or machine readable instructions) stored on a non-transitory computer and/or machine readable medium such as a hard disk drive, a flash memory, a read-only memory, a compact disk, a digital versatile disk, a cache, a random-access memory and/or any other storage device or storage disk in which information is stored for any duration (e.g., for extended time periods, permanently, for brief instances, for temporarily buffering, and/or for caching of the information). As used herein, the term non-transitory computer readable medium is expressly defined to include any type of computer readable storage device and/or storage disk and to

exclude propagating signals and to exclude transmission media. "Including" and "comprising" (and all forms and tenses thereof) are used herein to be open ended terms. Thus, whenever a claim lists anything following any form of "include" or "comprise" (e.g., comprises, includes, comprising, including, etc.), it is to be understood that additional elements, terms, etc. may be present without falling outside the scope of the corresponding claim. As used herein, when the phrase "at least" is used as the transition term in a preamble of a claim, it is open-ended in the same manner as the term "comprising" and "including" are open ended.

[0084] FIG. 7 is a flowchart representative of example machine readable instructions that, when executed, cause the example desk manager 300 of FIGS. 3–6 to provide data to viewing at the desk(s) 100, 502, 504, 506, 508 and/or sharing with other user devices via the desk(s) (e.g., via the display screen(s) 120, 122).

[0085] In the example of FIG. 7, the desk manager 300 of FIGS. 3–6 receives a request to activate (e.g., power on) the display screen(s) 120, 122 (block 700). The request can be detected by the display control(s) 204 in the form of, for example, a gesture by a user indicating that the user wishes to raise the second surface 106 relative to the first surface 102 of the desk 100, 502, 504, 506, 508 to view the display screen(s) 120, 122. In other examples, the request includes a user input such as an input at a power button, a touch or gesture relative to the display screen(s), etc. In such examples, data from the display control(s) 204 is processed by the hinge motor controller 602 of the example desk manager 300 of FIG. 6. The display screen manager 604 activates the display screen(s) 120, 122 based on the request (block 702). In some examples, the display screen manager 604 activates the display screen(s) 120, 122 based on the movement of the second surface 106 relative to the first surface 102 of the desk by the motor(s) 202. In other examples, the display screen manager 604 activates the display screen(s) 120, 122 based on user input(s).

[0086] In the example of FIG. 7, the user authentication manager 616 of the example desk manager 300 of FIG. 6 authenticates the user based on user

authentication data received via the GUIs 314, 316 (e.g., a password) and/or the camera(s) 310 (e.g., biometric image data such as facial image data) (block 704). The user authentication manager 616 compares the user data to known user authentication data 618 stored in the database 608.

[0087] If the user authentication manager 616 verifies the identity of the user (block 706), the application manager 610 executes the user application(s) 312 for access by the user via the display screen(s) 120, 122 (block 708). For example, the application manager 610 can execute a calendar application via the second display screen 122 and a cloud access application via the first display screen 120. The application manager 610 implements the GUI(s) 314, 316 for display via the screen(s) 120, 122.

[0088] The example cloud access regulator 620 of the example desk manager 300 of FIG. 6 determines whether the user has requested data stored in the cloud-computing environment 302, 510 (block 710). If a request has been received (e.g., via the GUI(s) 314, 316), the cloud access regulator 620 and/or the communicator 614 communicate with the cloud-computing environment 302, 510 to retrieve the data from the cloud for presentation at the desk (e.g., via the display screen(s) 120, 122, the speaker(s) 318) (block 712).

[0089] In the example of FIG. 7, the user device manager 628 determines whether communication link(s) are to be established between the desk manager 300 and other user device(s) (block 714). The user devices can include a laptop, a digital pen 410, an electronic whiteboard 522 located in the environment 500 with the desk, etc. In some examples, the device(s) include other desks located in the environment 500. In some examples, the user device manager 628 determines that communication link(s) should be established with the user device(s) based on data from the proximity sensor(s) 406 indicating that the user device(s) are proximate to the desk and/or user input(s) indicating that the user device(s) should be communicatively coupled to the desk manager 300.

[0090] Also, in the example of FIG. 7, the ambient environment manager 634 determines whether communication link(s) are to be established between the desk manager 300 and device(s) in the ambient environment (block 714). In

some examples, the ambient environment element(s) include the light source(s) 526 and/or the HVAC system 528 of the environment 500 of FIG. 5.

[0091] In the example of FIG. 7, the communicator 614 of the desk manager 300 establishes communication link(s) with the user device(s) and/or the ambient environment device(s) (block 716). The communicator can establish the communication link(s) using wireless protocol(s) such as WiFi, Bluetooth® or NFC.

[0092] In the example of FIG. 7, the desk manager 300 communicates with the user device(s) and/or the ambient environment devices(s) (block 718). For example, the user device manager 628 can communicate with the electronic whiteboard 522 to enable data retrieved from the cloud-computing environment 302, 510 at the desk 100, 502, 504, 506, 508 to be presented via the electronic whiteboard 522. In some examples, the user device manager 628 of a desk 100, 502, 504, 506, 508 generates instructions for data from the cloud-computing environment 302, 510 to be shared with another one of the desks 100, 502, 504, 506, 508. In some examples, the user device manager 628 receives data from the user device (e.g., handwriting data from the digital pen 410) to be stored and/or processed by the desk manager 300.

[0093] As another example, the ambient environment manager 634 communicates with the ambient environment device(s) (e.g., the light source(s) 526, the HVAC system 528) based on, for example, user input(s) received via the GUI(s) 314, 316. For example, the ambient environment manager 634 can generate instructions for the light source(s) 526 to dim based on user input(s) at the desk. In some examples, the ambient environment manager 634 generates instructions for the HVAC system 528 based on, for example, ambient environment temperature data generated by the temperature sensor(s) 530.

[0094] In the example of FIG. 7, the desk manager 300 continues to execute user application(s) 312, retrieve data from the cloud-computing environment 302, 510, and/or communicate with user device(s) and/or ambient environment device(s) until the desk manager 300 receives a request to deactivate (e.g., turn off) the display screen(s) 120, 122 (block 720). The request can include, for example, a user input processed by the display screen

manager 604. In some examples, the request is received via the display control(s) 204 indicating that the second surface 106 of the desk 100, 502, 504, 506, 508, including the display screen(s) 120, 122 should be lowered relative to the first surface 102.

[0095] The example instructions of FIG. 7 end when the display screen manager 604 deactivates (e.g., powers down) the display screen(s) 120, 122 (block 722). In some examples, the hinge motor controller 602 lowers the second surface 106 as part of the turning off the display screen(s) 120, 122.

[0096] FIG. 8 is a flowchart illustrating an example process for providing a desk including a movable surface having display screens(s) integrated with the surface, such as the example desk 100, 502, 504, 506, 508 of FIGS. 1–5. In some examples, the process of FIG. 8 can be used to convert a desk already in use to a smart desk including display screen(s) operatively coupled to a processor.

[0097] The example process of FIG. 8 includes aligning a surface including display screen(s) coupled thereto relative to an edge of a work surface of a desk (block 800). For example, the second surface 106 of the desk(s) 100, 502, 504, 506, 508 including the display screen(s) 120, 122 disposed in the housing 119 can be aligned relative to the second edge 108 of the first surface 102 of the example desk 100 of FIG. 1. The second edge 108 can be an edge opposite an edge of the desk at which, for example, a user sits at the desk when the desk is in use (e.g., the first edge 104). For example, the second surface 106 is coupled to an edge 108 of the first surface 102 via fastener(s), which can include the hinges 110.

[0098] The example process of FIG. 8 includes coupling the surface including the display screen(s) to the work surface of the desk proximate to the edge of the desk to enable the surface including the display screen(s) to move relative to the work surface (block 802). For example, the second surface 106 of the desk(s) 100, 502, 504, 506, 508 including the display screen(s) 120, 122 disposed in the housing 119 can be coupled to the first surface 102 of the desk(s) via fastener(s) at the right and left sides 112, 114 of the desk(s). In some examples, the second surface 106 is coupled to the first surface 102 via

torque hinges 110. In some examples, the hinges 110 enable a user to manually adjust an angle of the second surface 106 relative to the first surface 102 when the desk 100, 502, 504, 506, 508. In some examples, the second surface 106 includes motor(s) 202 to provide for automatic adjustment of the angle of the second surface 106 relative to the first surface 102 via the hinge(s) 110 when the second surface 106 is coupled to the first surface 102 based on, for example, user input(s) received via the display screen(s) 120, 122 of the second surface 106.

[0099] FIG. 9 is a block diagram of an example processor platform 900 capable of executing the instructions of FIG. 7 to implement the example desk manager 300 of FIGS. 3–6.. The processor platform 900 can be, for example, a server, a personal computer, a mobile device (e.g., a cell phone, a smart phone, a tablet such as an iPad™), a personal digital assistant (PDA), an Internet appliance, or any other type of computing device.

[00100] The processor platform 900 of the illustrated example includes a processor 912 (e.g., the on-board processor 301 of the desk(s)). The processor 912 of the illustrated example is hardware. For example, the processor 912 can be implemented by integrated circuit(s), logic circuit(s), microprocessor(s) or controller(s) from any desired family or manufacturer. The hardware processor may be a semiconductor based (e.g., silicon based) device. In this example, the processor 912 implements the example desk manager 300, which includes the example desk height adjuster 600, the example hinge motor controller 602, the example display screen manager 604, the example application manager 610, the example communicator 614, the example user authentication manager 616, the example cloud access regulator 620, the example camera manager 622, the example projector manager 624, the example audio manager 626, the example user device manager 628, the example device charging manager 632, and the example ambient environment manager 634.

[00101] The processor 912 of the illustrated example includes a local memory 913 (e.g., a cache). The processor 912 of the illustrated example is in communication with a main memory including a volatile memory 914 and a

non-volatile memory 916 via a bus 918. The volatile memory 914 may be implemented by Synchronous Dynamic Random Access Memory (SDRAM), Dynamic Random Access Memory (DRAM), RAMBUS Dynamic Random Access Memory (RDRAM) and/or any other type of random access memory device. The non-volatile memory 916 may be implemented by flash memory and/or any other desired type of memory device. Access to the main memory 914, 916 is controlled by a memory controller.

[00102] The processor platform 900 of the illustrated example also includes an interface circuit 920. The interface circuit 920 may be implemented by any type of interface standard, such as an Ethernet interface, a universal serial bus (USB), and/or a PCI express interface.

[00103] In the illustrated example, input device(s) 922 are connected to the interface circuit 920. The input device(s) 922 permit(s) a user to enter data and/or commands into the processor 912. The input device(s) can be implemented by, for example, an audio sensor, a microphone 320, a camera (still or video) 310, a keyboard, a button, a mouse, a touchscreen, a track-pad, a trackball, isopoint and/or a voice recognition system.

[00104] Output device(s) 924 are also connected to the interface circuit 920 of the illustrated example. The output device(s) 924 can be implemented, for example, by display devices (e.g., a light emitting diode (LED), an organic light emitting diode (OLED), a liquid crystal display, a cathode ray tube display (CRT), a touchscreen, a tactile output device, a printer and/or speakers). The interface circuit 920 of the illustrated example, thus, may include a graphics driver card, a graphics driver chip and/or a graphics driver processor.

[00105] The interface circuit 920 of the illustrated example also includes a communication device such as a transmitter, a receiver, a transceiver, a modem and/or network interface card to facilitate exchange of data with external machines (e.g., computing devices of any kind) via a network 926 (e.g., an Ethernet connection, a digital subscriber line (DSL), a telephone line, coaxial cable, a cellular telephone system, etc.). In this example, the communicator 614 is implemented by the interface circuit 920.

[00106] The processor platform 900 of the illustrated example also includes mass storage device(s) 928 for storing software and/or data. Examples of such mass storage devices 928 include floppy disk drives, hard drive disks, compact disk drives, Blu-ray disk drives, RAID systems, and digital versatile disk (DVD) drives. Some or all of the database 608 may be stored in mass storage 928.

[00107] The coded instructions 932 of FIG. 7 may be stored in the mass storage device 928, in the volatile memory 914, in the non-volatile memory 916, and/or on a removable tangible computer readable storage medium such as a CD or DVD.

[00108] From the foregoing, it will be appreciated that example apparatus, methods, and articles of manufacture have been disclosed to provide desks having display screen(s) integrated in surface(s) of desks. Some example desks disclosed herein include a processor to communicate with a cloud-computing environment to retrieve data to be presented via the display screen(s) of the desks. In some examples disclosed herein, user devices such as laptops, electronic whiteboards, other desks including processors, etc. can be communicatively coupled to the processor of a desk to enable data to be shared between the desk and the devices. In some examples disclosed herein, the surface of the desk including the display screen(s) can be selectively adjusted with respect to a viewing angle of the display screen(s) and to enable the desk to be used in different use positions with or without activation of the display screen(s). Example desks disclosed herein facilitate efficient collaboration between users in environments such as conference rooms.

[00109] Although certain example methods, apparatus and articles of manufacture have been disclosed herein, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all methods, apparatus and articles of manufacture fairly falling within the scope of the claims of this patent.

What Is Claimed Is:

1. A desk comprising:

a first desk surface;

a second desk surface coupled to the first desk surface, the second desk surface moveable relative to the first desk surface between a first position in which the first desk surface and the second desk surface lie in a first plane and a second position in which the second desk surface is disposed in a second plane which is non-parallel to the first plane;

a touchscreen coupled to the second desk surface, the touchscreen exposed when the second desk surface is in the first position and when the second desk surface is in the second position; and

a processor operatively coupled to the touchscreen, the processor to control a presentation of data via the touchscreen.

2. The desk of claim 1, further including a camera coupled to the second desk surface.

3. The desk of claim 2, wherein the processor is to verify an identity of a user based on image data generated by the camera.

4. The desk of claim 1, wherein the desk is a first desk and the processor is a first processor, the first processor to generate an instruction to enable a second processor of a second desk to present the data via a touchscreen of the second desk.

5. The desk of claim 1, further including a projector coupled to the second desk surface, the projector to generate a projection for presentation via the first desk surface.

6. The desk of claim 1, further including a proximity sensor to detect a user device relative to the first desk surface or the second desk surface.

7. An apparatus comprising:

a housing;

a display screen disposed in the housing;

a processor disposed in the housing and operatively coupled to the display screen, the processor to control a presentation of data via the display screen; and

a hinge coupled to the housing, the hinge to enable the housing to be movably coupled to a surface of a desk to adjust an angle of the display screen relative to the desk surface.

8. The apparatus of claim 7, further including a motor disposed in the housing and operatively coupled to the processor, the motor to move the housing relative to the desk surface based on an instruction from the processor.

9. The apparatus of claim 8, wherein the processor is to activate the display screen based on the movement of the housing.

10. The apparatus of claim 8, further including a sensor coupled to the housing to detect a gesture, the instruction to move the housing based on gesture data generated by the sensor.

11. An apparatus comprising:

a display screen manager to detect that a first surface of a desk including a display screen is disposed in a raised position relative to a second surface of the desk;

a user authentication manager to verify an identify of a user of a desk;

a cloud access regulator to retrieve data for presentation via the display screen of the desk based on the verification; and

a user device manager to establish a communication link with a user device to enable the data to be accessed via the display screen of the desk and the user device.

12. The apparatus of claim 11, wherein the user authentication manager is to verify the user based on image data generated by a camera of the desk.

13. The apparatus of claim 11, further including an ambient environment manager to establish a communication link with a light source in an environment in which the desk is located, the ambient environment manager to generate an instruction to control the light source based on a user input received via the display screen of the desk.

14. The apparatus of claim 11, wherein the desk is a first desk and the user device is a second desk in an environment in which the desk is located.

15. The apparatus of claim 11, wherein the user device is a first user device and the user device manager is to establish a communication link with a second user device, the user device manager to modify the data based on an input received via the second user device.

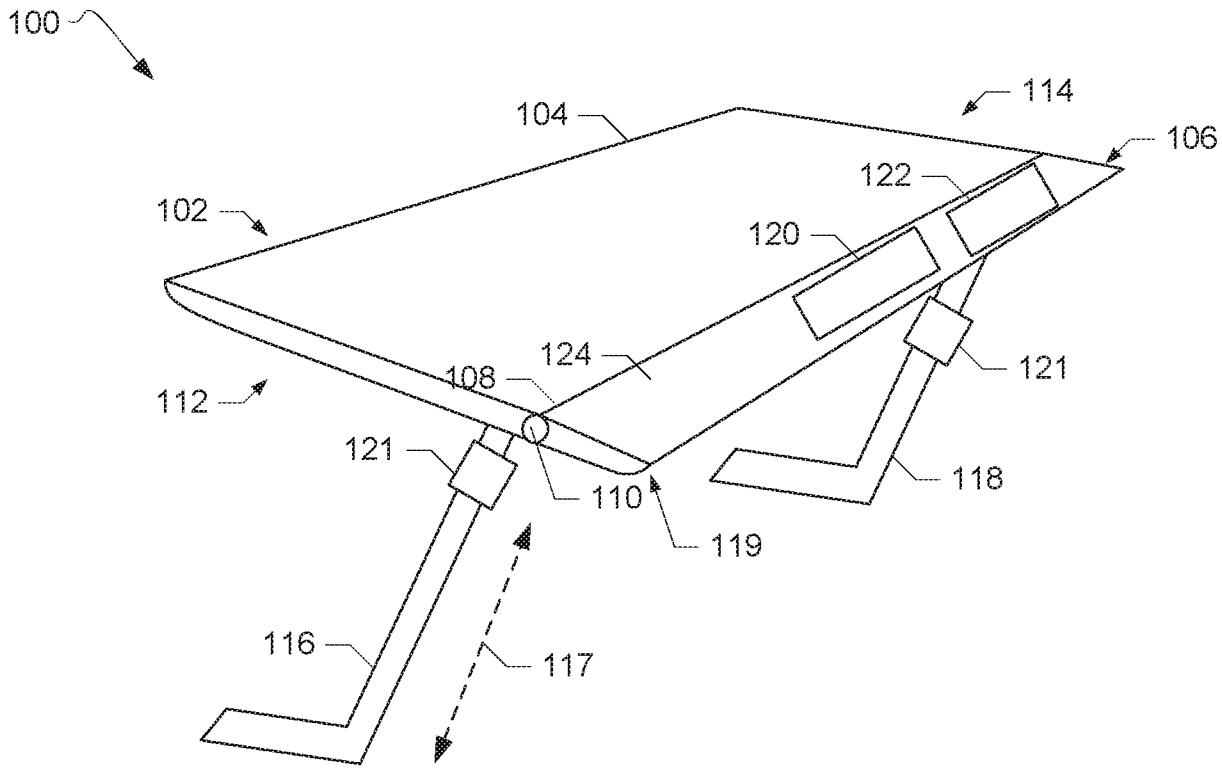
100
104
114
106
122
102
120
124
121
108
112
121
118
110
119
116
117

FIG. 1

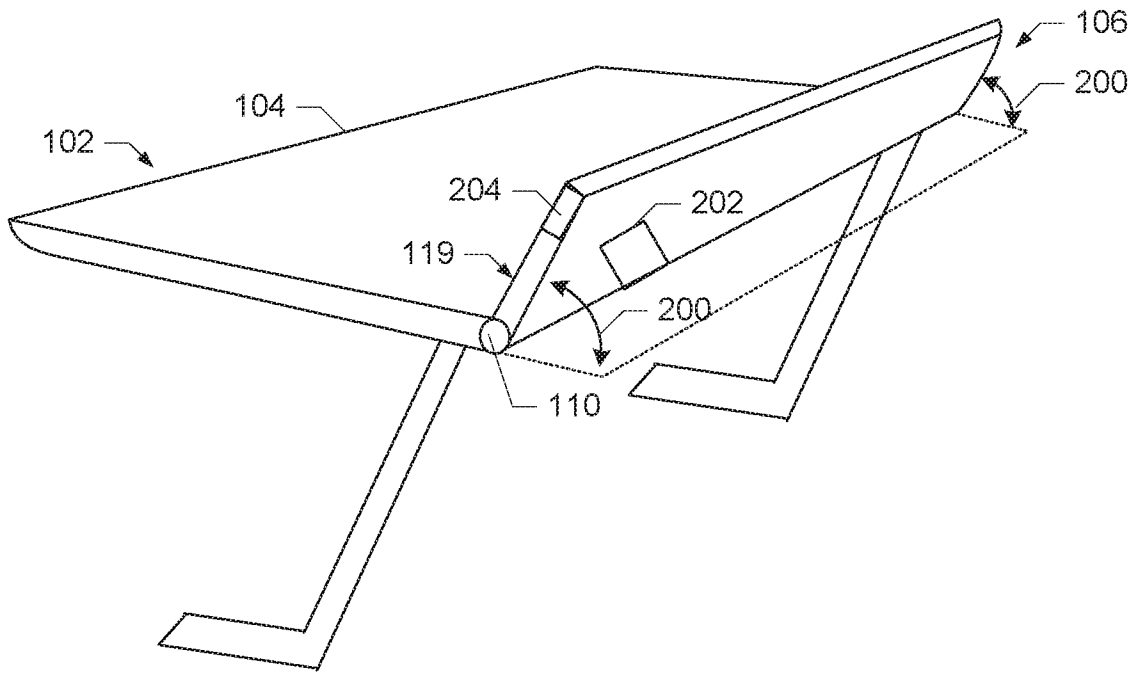
106
200
104
102
204
202
119
200
110

FIG. 2

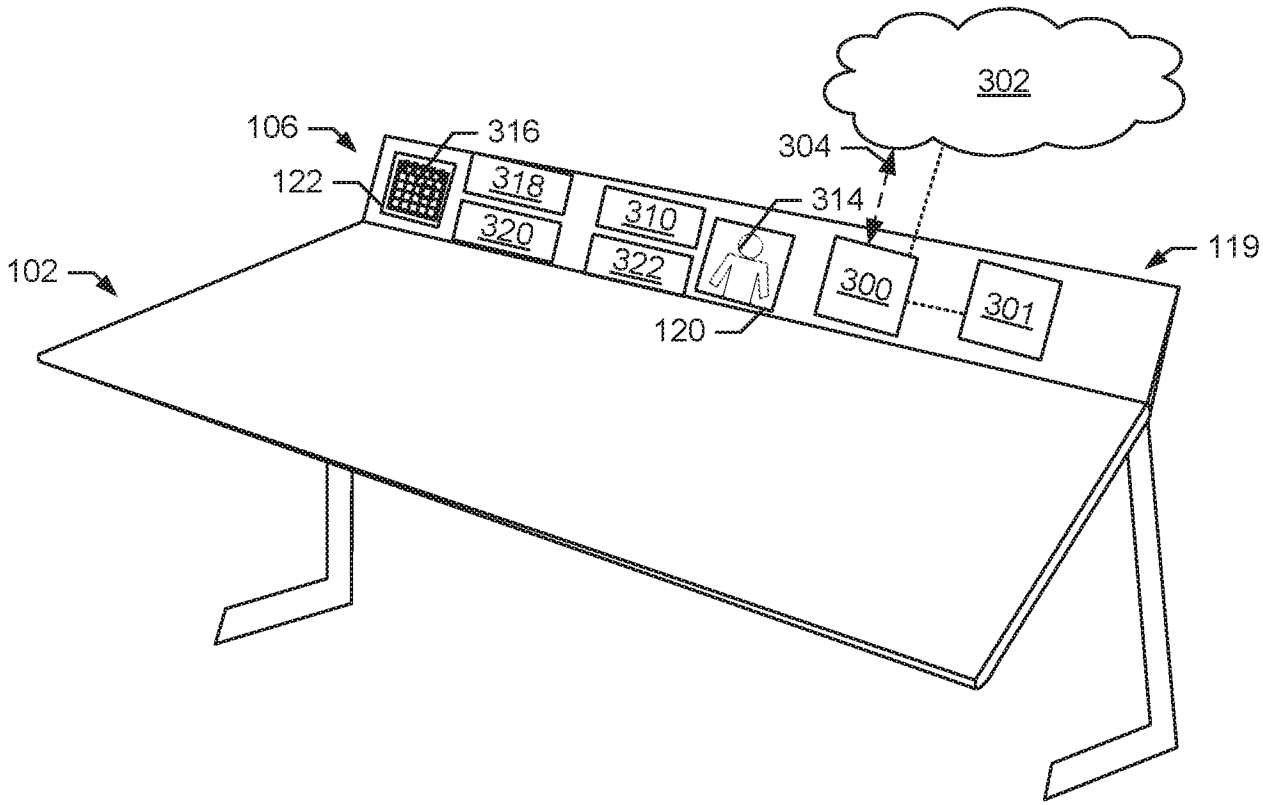
302
106
316
304
122
318
314
320
310
322
119
102
300
301
120

FIG. 3

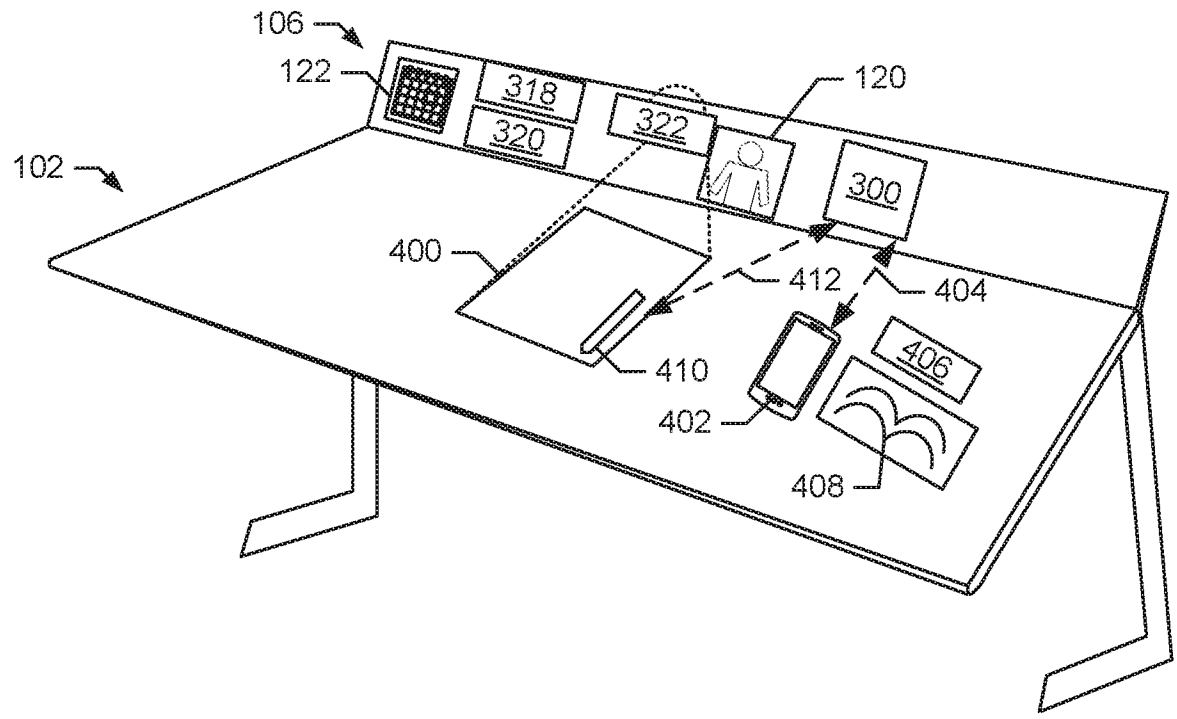
106
122
318
320
322
120
102
300
400
412
404
410
406
402
408

FIG. 4

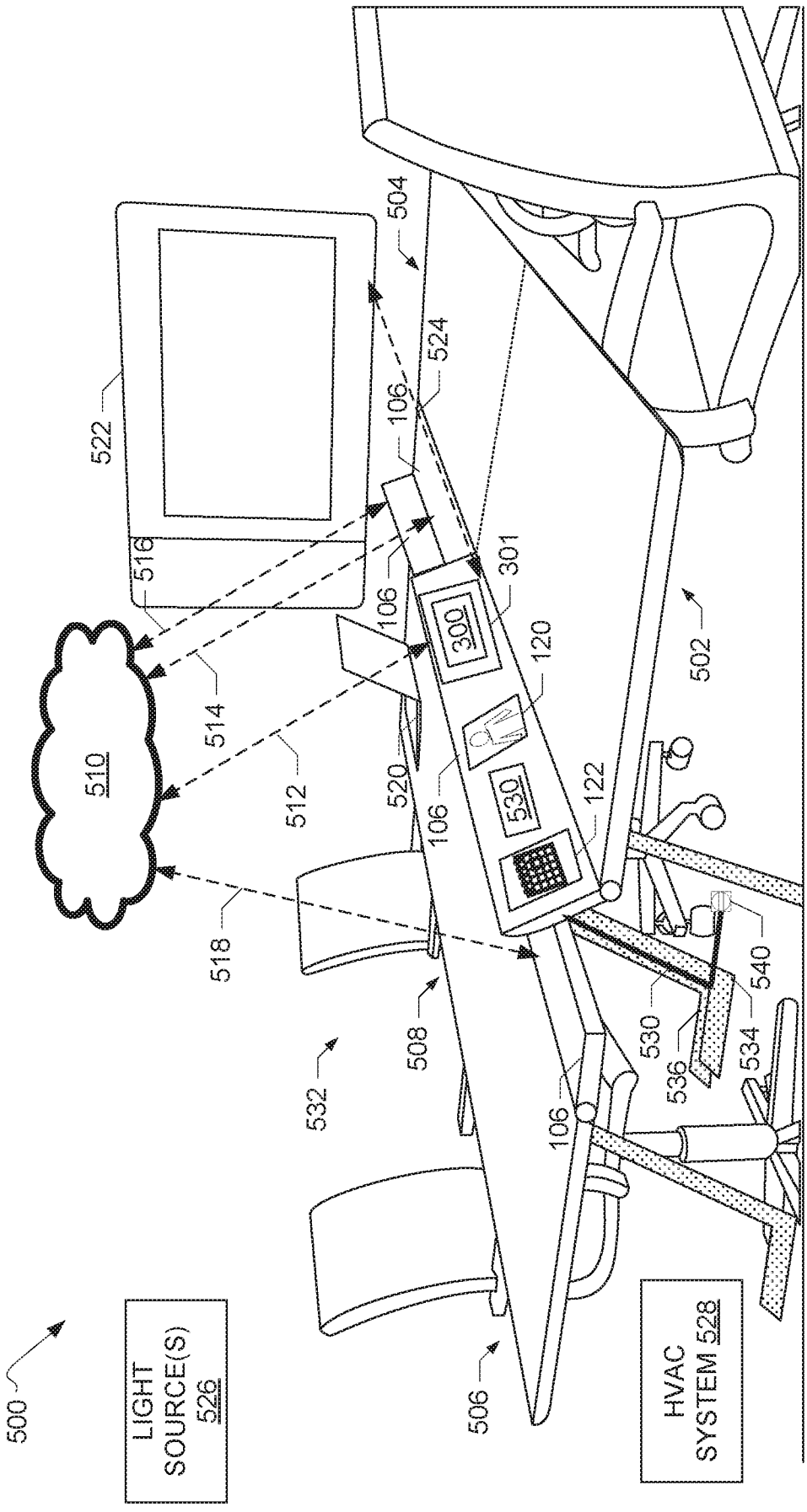
500
LIGHT SOURCE(S) 526
HVAC SYSTEM 528
502
504
506
508
510
512
514
516
518
520
522
524
530
532
534
536
540
106
120
122
300
301

FIG. 5

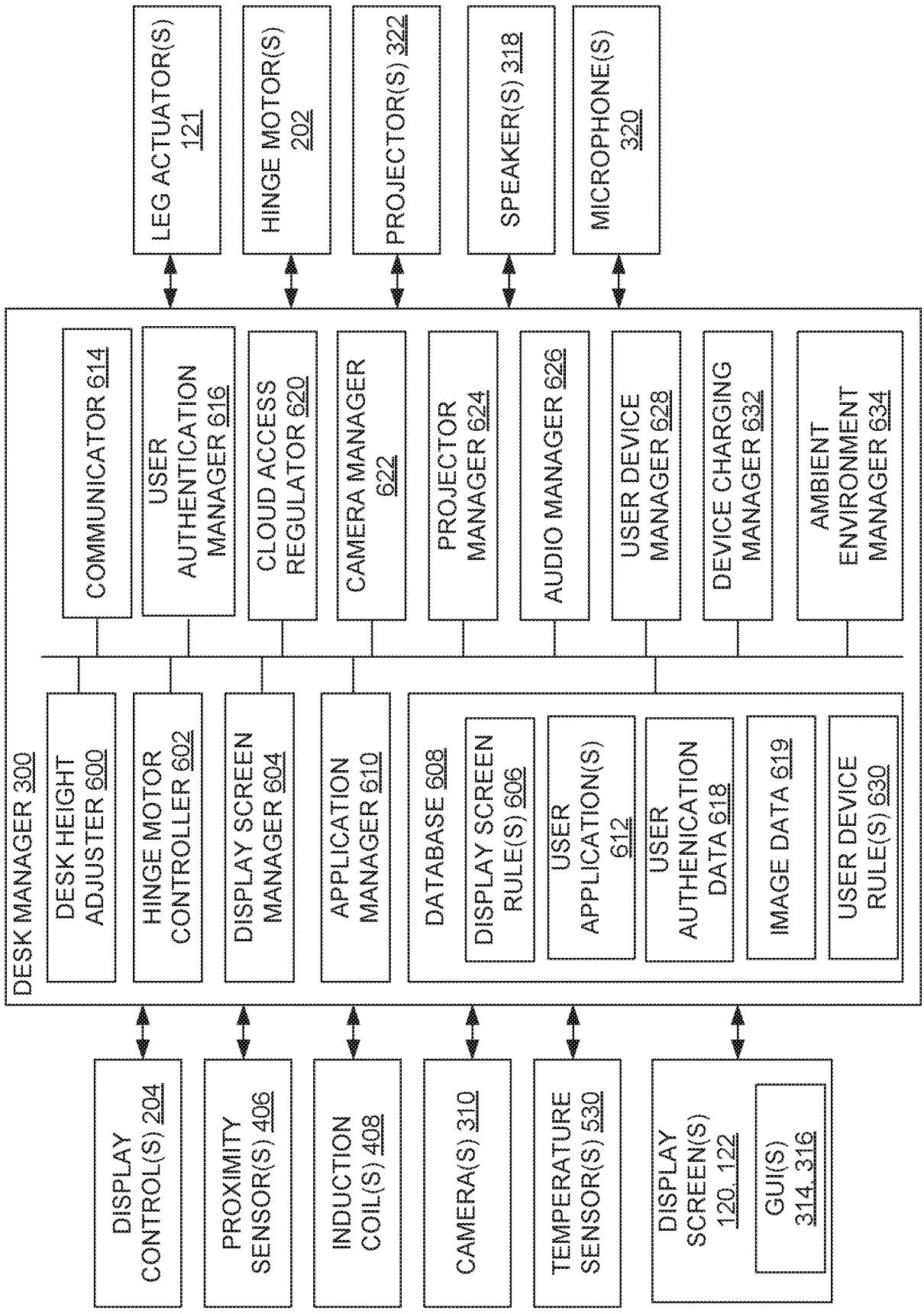
DESK MANAGER 300
DESK HEIGHT ADJUSTER 600
HINGE MOTOR CONTROLLER 602
DISPLAY SCREEN MANAGER 604
APPLICATION MANAGER 610
DATABASE 608
DISPLAY SCREEN RULE(S) 606
USER APPLICATION(S) 612
USER AUTHENICATION DATA 618
IMAGE DATA 619
USER DEVICE RULE(S) 630
COMMUNICATOR 614
USER AUTHENTICATION MANAGER 616
CLOUD ACCESS REGULATOR 620
CAMERA MANAGER 622
PROJECTOR MANAGER 624
AUDIO MANAGER 626
USER DEVICE MANAGER 628
DEVICE CHARGING MANAGER 632
AMBIENT ENVIRONMENT MANAGER 634
LEG ACTUATOR(S) 121
HINGE MOTOR(S) 202
PROJECTOR(S) 322
SPEAKER(S) 318
MICROPHONE(S) 320
DISPLAY CONTROL(S) 204
PROXIMITY SENSOR(S) 406
INDUCTION COIL(S) 408
CAMERA(S) 310
TEMPERATURE SENSOR(S) 530
DISPLAY SCREEN(S) 120, 122
GUI(S) 314, 316

FIG. 6

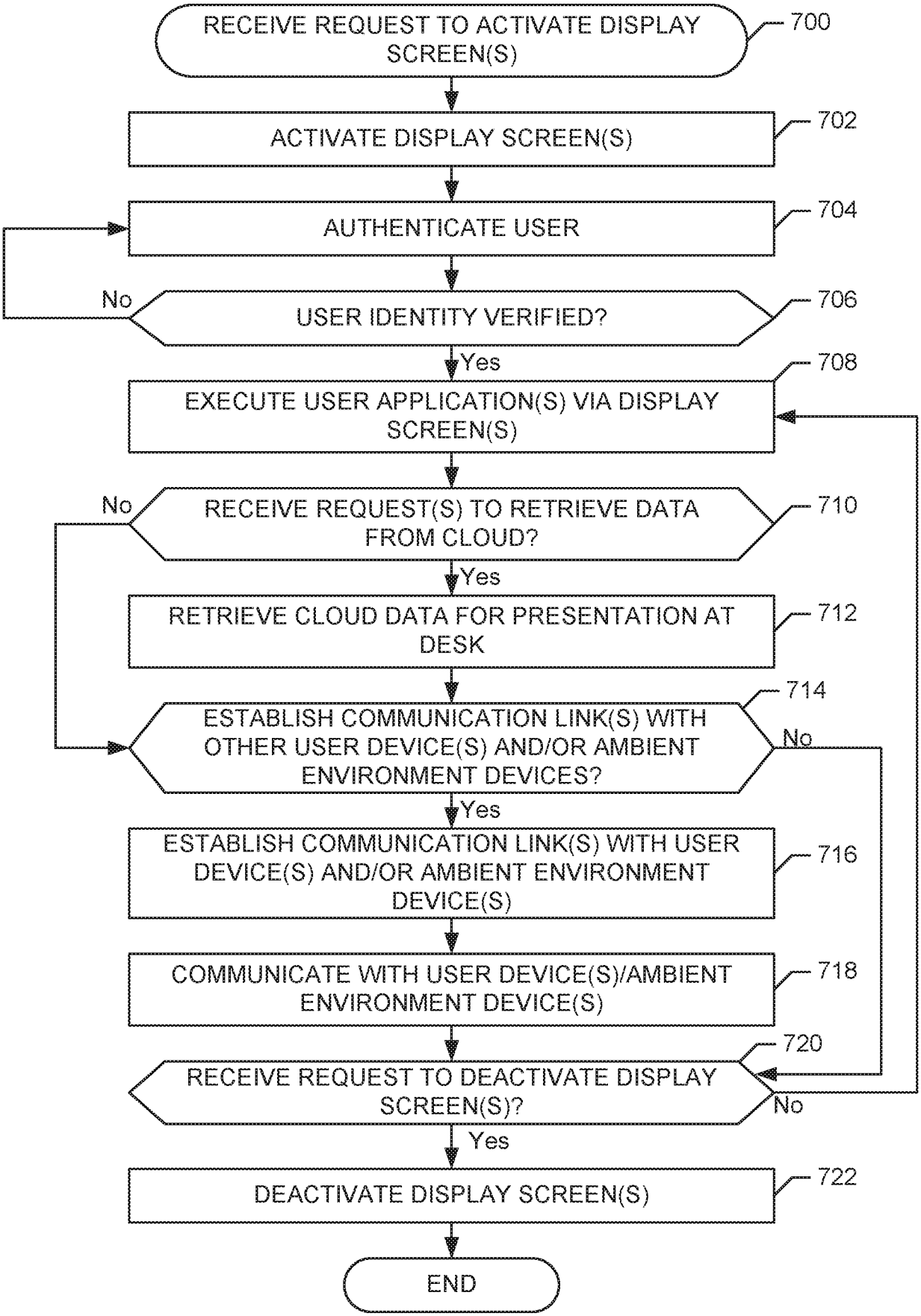
RECEIVE REQUEST TO ACTIVATE DISPLAY SCREEN(S)
700
ACTIVATE DISPLAY SCREEN(S)
702
AUTHENTICATE USER
704
No
USER IDENTITY VERIFIED?
706
Yes
EXECUTE USER APPLICATION(S) VIA DISPLAY SCREEN(S)
708
No
RECEIVE REQUEST(S) TO RETRIEVE DATA FROM CLOUD?
710
Yes
RETRIEVE CLOUD DATA FOR PRESENTATION AT DESK
712
ESTABLISH COMMUNICATION LINK(S) WITH OTHER USER DEVICE(S) AND/OR AMBIENT ENVIRONMENT DEVICES?
714
No
Yes
ESTABLISH COMMUNICATION LINK(S) WITH USER DEVICE(S) AND/OR AMBIENT ENVIRONMENT DEVICE(S)
716
COMMUNICATE WITH USER DEVICE(S)/AMBIENT ENVIRONMENT DEVICE(S)
718
RECEIVE REQUEST TO DEACTIVATE DISPLAY SCREEN(S)?
720
No
Yes
DEACTIVATE DISPLAY SCREEN(S)
722
END

FIG. 7

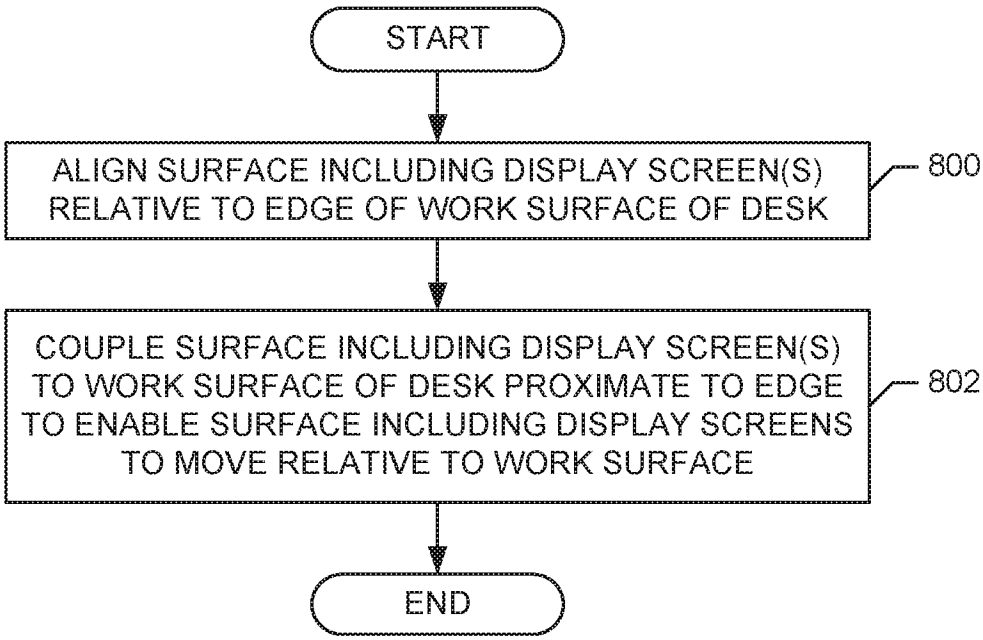
START
ALIGN SURFACE INCLUDING DISPLAY SCREEN(S) RELATIVE TO EDGE OF WORK SURFACE OF DESK
800
COUPLE SURFACE INCLUDING DISPLAY SCREEN(S) TO WORK SURFACE OF DESK PROXIMATE TO EDGE TO ENABLE SURFACE INCLUDING DISPLAY SCREENS TO MOVE RELATIVE TO WORK SURFACE
802
END

FIG. 8

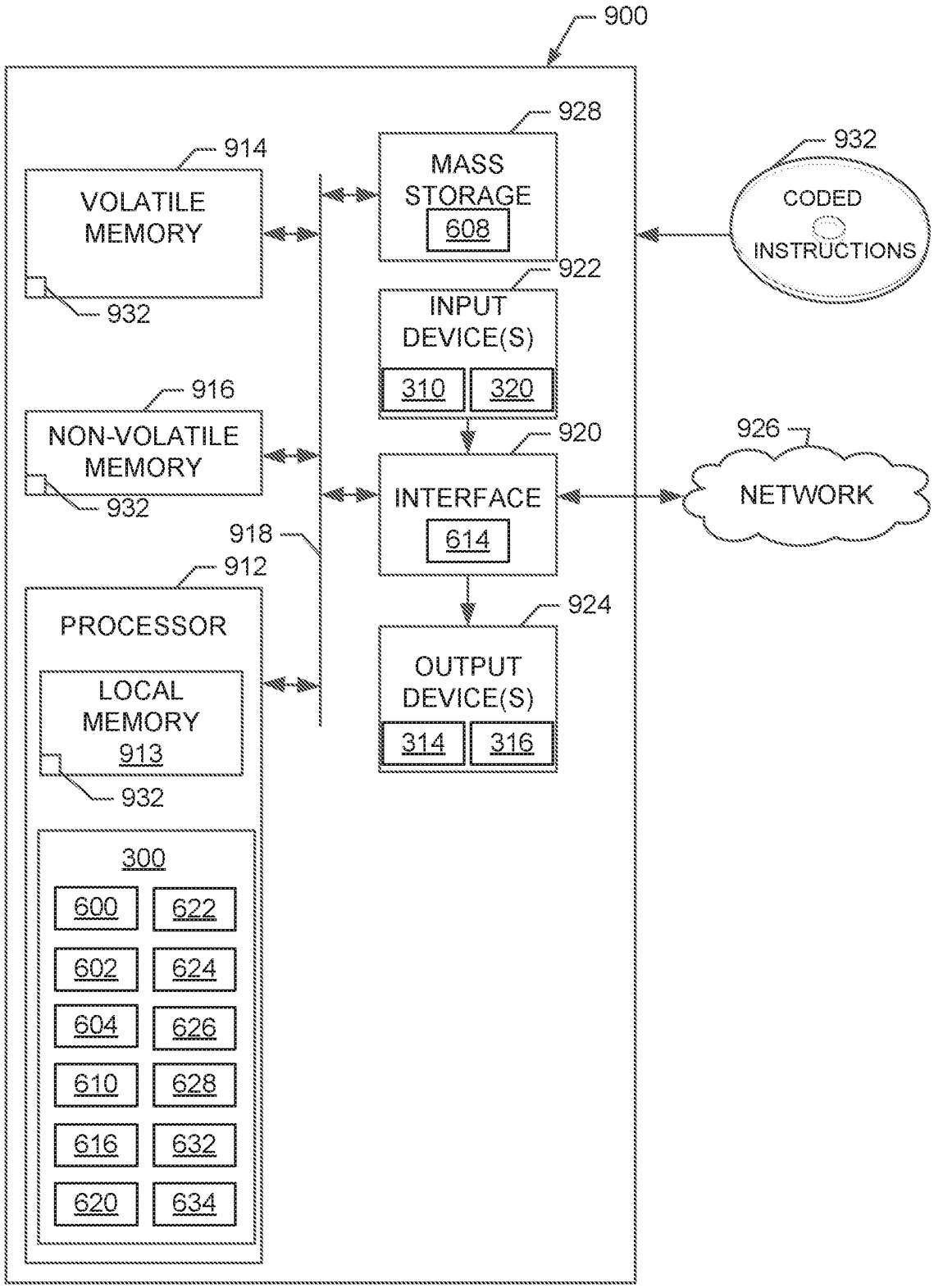
900
928
914
MASS STORAGE
608
932
VOLATILE MEMORY
932
CODED INSTRUCTIONS
922
INPUT DEVICE(S)
310
320
916
NON-VOLATILE MEMORY
932
920
926
INTERFACE
614
NETWORK
918
912
924
PROCESSOR
OUTPUT DEVICE(S)
LOCAL MEMORY
913
314
316
932
300
600
622
602
624
604
626
610
628
616
632
620
634

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2017/061531

A. CLASSIFICATION OF SUBJECT MATTER

A47B 21/013 *(2006.01)*
H05K 7/16 *(2006.01)*
H04W 92/10 *(2009.01)*
H04W 84/12 *(2009.01)*

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47B 21/00-21/013, 27/00-27/18, H05K 7/16, H04W 92/10, 84/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatSearch (RUPTO internal), Esp@cenet, PAJ, USPTO, Information Retrieval System of FIPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	RU 2519904 C1 (ZAKRYTOE AKTSIONERNOE OBSCHESTVO "FORSAZH") 20.06.2014, p. 7-8	7 1-6
Y	CN 106530859 A (WU KEYI) 22.03.2017, paragraphs [0011], [0019], [0023], fig. 2	1-6, 11-15
Y	US 2016/0260019 A1 (CARLOS RIQUELME RUIZ et al.) 08.09.2016, paragraph [0055]	2, 3, 11-15
Y	KR 101369933 B1 (BRONET CO LTD) 06.03.2014, paragraphs [0042], [0068] – [0071], [0074] - [0078], [0088], [0095] - [0098]	4-6, 8-15

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

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"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 July 2018 (19.07.2018)	02 August 2018 (02.08.2018)

Name and mailing address of the ISA/RU:
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