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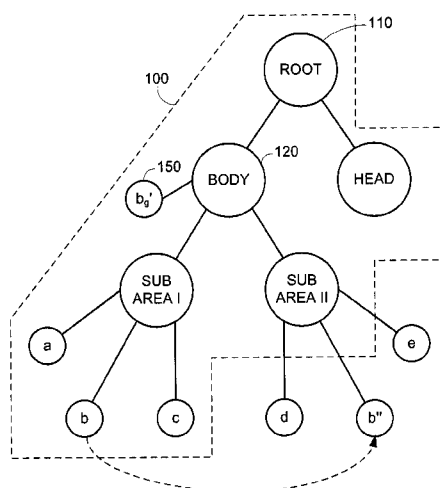
(54) **Title:** ANIMATING MOVEMENT OF A GRAPHICAL REPRESENTATION ON A DISPLAY

FIG. 1

(57) **Abstract:** A ghost graphical representation may be used to animate a transition between displayed arrangements, views, or both, having an associated document object model (DOM) tree. Graphical representations shared between the arrangements may be overlaid with ghost graphical representation, which are associated with nodes directly descending from a common ancestor node of the DOM tree. The overlaid graphical representation, from the old arrangement, can then be removed from the display without the user noticing, and the ghost graphical representation may undergo an animated movement on the display screen. Hidden graphical representation corresponding to the new arrangement may be generated, and displayed during or after the animation. Accordingly, the transition maintains visual context that the user can more easily follow. Also, graphical representations of the old arrangement may be faded out from view, and graphical representations of the new arrangement may be faded in to view, to soften the transition.

5

10 ANIMATING MOVEMENT OF A GRAPHICAL REPRESENTATION ON A
DISPLAY

15 The present disclosure relates to causing a movement of a graphical representation to be animated on a display, the graphical representation being represented in a document object model (DOM).

20 Background

A web browser presents an arrangement of visual elements to a user. Typically, if the user wishes to view another arrangement of graphical representations corresponding to visual elements, the browser first
25 clears the old arrangement, and then loads and renders the new arrangement. This process breaks the relationship between the two arrangements and causes the user to lose visual context. One challenge of implementing the transition from one arrangement of
30 graphical representations corresponding to visual elements to another in a web browser having a hierarchical user interface framework such as hypertext markup language (html) document object model (DOM) trees, for example, is that the first arrangement and
35 second arrangement are associated with different branches of the DOM tree. This structure prevents a simple implementation of an animated transition.

Summary

A technique for animating a movement of at least one graphical representation displayed in a first area of an electronic display screen to a second area of the electronic display screen may include maintaining a document object model (DOM) tree having an initial hierarchy relative to a root node. The first area is associated with a first child node in the DOM tree, the second area is associated with a second child node of the DOM tree, and the at least one graphical representation is associated with a first descendant node of the first child node. In response to an indication to move the at least one graphical representation, the technique may include causing to be generated for each of the at least one graphical representation at least one ghost node as a direct child node of the root node of the DOM tree in response to the indication, and causing to be associated each of the at least one ghost node with a ghost graphical representation. Each ghost visual element may be caused to be overlayed on the corresponding at least one graphical representation in the first area. The at least one graphical representation from the first area may be caused to be removed after the overlay. The technique may include causing to be generated at least one second descendant node of the DOM tree associated with a hidden graphical representation at a target position in the second area for each of the at least one graphical representation. The second area may be associated with the at least one second child node and the at least one second descendant node may be a descendant of the respective at least one second child node. The technique may include causing to be animated a movement of the at least one ghost graphical

representation from the first area to the respective target position in the second area.

A system for animating a movement of at least one graphical representation displayed in a first area to a second area may include one or more computers. The one or more computers may be configured to maintain a DOM tree having an initial hierarchy relative to a root node. The first area is associated with a first child node in the DOM tree, the second area is associated with a second child node of the DOM tree, and the at least one graphical representation is associated with a first descendant node of the first child node. In response to an indication to move the at least one graphical representation, the one or more computers may be configured to cause to be generated for each of the at least one graphical representation at least one ghost node as a direct child node of the root node of the DOM tree in response to the indication, and cause to be associated each of the at least one ghost node with a ghost graphical representation. The one or more computers may be configured to cause to be overlayed each ghost graphical representation on the corresponding at least one graphical representation in the first area. The one or more computers may be configured to cause to be removed the at least one graphical representation from the first area after the overlay. The one or more computers may be configured to cause to be generated at least one second descendant node of the DOM tree associated with a hidden graphical representation at a target position in the second area for each of the at least one graphical representation. The second area may be associated with the at least one second child node and the at least one second descendant node may be a descendant of the respective

at least one second child node. The one or more computers may be configured to cause to be animated a movement of the at least one ghost graphical representation from the first area to the respective
5 target position in the second area.

Brief Description of the Figures

The above and other features of the present disclosure, its nature and various advantages will be
10 more apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings in which:

FIG. 1 shows an illustrative document object model (DOM) tree having two subareas;

15 **FIG. 2** shows an illustrative webpage corresponding to the DOM tree of **FIG. 1**;

FIG. 3 shows an illustrative webpage, including an arrangement of US Presidents;

FIG. 4 shows an illustrative webpage, including an
20 arrangement of Republican US Presidents filtered from the webpage of **FIG. 3**;

FIG. 5 shows an illustrative webpage, including an alternate view of a particular US President selected from the webpage of **FIG. 3**;

25 **FIG. 6** is a flow diagram of illustrative steps for animating a movement of a graphical representation of a visual element, from a first position to a second position;

FIG. 7 shows an illustrative display of a first
30 arrangement and a corresponding initial DOM tree;

FIG. 8 shows an illustrative display of the first arrangement of **FIG. 7** and a corresponding modified DOM tree having nodes associated with ghost graphical

representations and nodes associated with hidden graphical representations;

FIG. 9 shows an illustrative display of the ghost graphical representations of **FIG. 8**, overlaid on corresponding graphical representations of the visual elements of the first arrangement, after fading-out of the graphical representations of the visual elements of the first arrangement;

FIG. 10 shows an illustrative display of the ghost graphical representations after an animated movement and re-sizing along respective paths;

FIG. 11 shows an illustrative display of the graphical representations of the visual elements of the second arrangement associated with the hidden graphical representations and a corresponding new DOM tree;

FIG. 12 shows an illustrative computer system; and

FIG. 13 is a block diagram of an illustrative device.

Detailed Description of the Figures

Animating a movement of graphical representations of visual elements included in a document object model (DOM) tree does not simply involve moving the graphical representations of visual elements of a first arrangement at original locations to destination locations, but rather facilitating the appearance of transitioning the visual elements from one branch of the DOM tree to another branch. The use of absolute positioning deep within DOM tree branches is relatively less flexible and efficient, and typically requires more complicated programming. The discussion that follows addresses some techniques for animating a movement of graphical representations of visual elements included in a DOM tree.

A DOM tree is a representation of the structure of a document. The DOM tree may include nodes that are elements of the document, connected via branches. For example, a DOM tree may describe a hierarchical structure of a webpage, specifying properties of the webpage, properties of sub-areas of the page, as well as including elements associated with the document, e.g., visual elements, hidden elements, structural elements, and/or other elements. For example, a root node may be arranged at the top of the hierarchy, and multiple descendent nodes may descend from the root node to form one or more branches. An ancestor node refers to a node relatively higher in the hierarchy, e.g., nearer the root node. Accordingly, referencing two nodes in a DOM tree, a common ancestor node is a node relatively higher in the hierarchy than both of the two nodes, having branches to each of the two nodes. A descendent node refers to a node relatively lower in hierarchy, e.g., further from the root node.

A web page, having an associated DOM tree, can display an arrangement of graphical representations of visual elements such as icons, images, or other graphics, corresponding to nodes. Nodes may also be structural elements, or other elements. For example, a webpage can show each graphical representation of a visual element as a thumbnail and an optional caption. A user can be allowed to perform one or more actions to the whole arrangement, e.g., sort, filter, switch to another style of view, or other action, thus causing a transition to a new arrangement of visual elements. The new arrangement may contain some or all of the visual elements from the old arrangement. The transition may include an animation or other graphical effect to maintain visual context between any shared

graphical representations of visual elements between the old and new arrangement. For example, a graphical representation of a visual element repeated in both arrangements may be moved to a new position using an animation along a path, rather than an abrupt switch. In a further example, the transition may include fading-in and fading-out of graphical representations of visual elements from view to soften the transition. Accordingly, a user may more easily follow and understand the transition, rather than experiencing an abrupt change in display. For example, if an arrangement of graphical representations of visual elements is sorted, the transition aids the user in understanding how the graphical representations are re-ordered. In a further example, if an arrangement of graphical representations of visual elements is filtered, the transition aids the user in understanding which graphical representations are filtered out and which remain. In a further example, if a view style of an arrangement of graphical representations of visual elements is switched, the transition aids the user in understanding how the graphical representations change position and/or size.

A transition among arrangements of visual elements may be implemented for a hierarchical user interface framework such as, for example, a DOM tree. In some implementations, the use of a ghost visual element aids in allowing the animation of the graphical representation of the visual element. The ghost visual element is a node in a DOM tree, arranged relatively less deeply in the DOM tree, and may accordingly be relatively less constrained, than the node associated with the original visual element.

The term ghost visual element, as used herein, shall refer to a visual element that can be overlaid on an original visual element, and has an absolute position defined. A ghost visual element may appear
5 identical to the original visual element, but may be moved about the display more easily based on the defined absolute position. For example, a graphical representation of a particular visual element may be displayed initially as part of a first arrangement of
10 graphical representations of visual elements in a first subarea of a display.

Another aspect of webpages having associated DOM trees are the presence of subareas, having associated div nodes in the DOM tree. Subareas may crop elements
15 descending from the div nodes, allowing scrolling within a subarea, for example. Cropping may also limit the display of a graphical representation of a visual element to a particular subarea. For example, background watermark images, or other background
20 graphics may be cropped within a particular subarea and scrolling may allow adjustment of the display within the subarea. Accordingly, graphical representations of visual elements included in the subarea may be visible or hidden based on the cropping, such that the
25 graphical representations are not displayed outside of the subarea. During a transition, however, cropping of a graphical representation within the subarea is likely not desired, because the graphical representation may be required to be displayed outside of the cropping
30 boundaries of the subarea. Without cropping, native scrolling support may likely not be available. The use of a ghost visual element may allow cropping functionality to be maintained, while still allowing for a graphical representation of a visual element to

be moved from one subarea to another subarea, across one or more cropping boundaries.

FIG. 1 shows an illustrative, initial DOM tree **100**, enclosed by the dashed line. **FIG. 2** shows an illustrative display **200** corresponding to the DOM tree of **FIG. 1**. An arrangement of graphical representations "A," "B," and "C" corresponding to respective nodes a, b, and c of initial DOM tree **100** are initially displayed in subarea I shown by dotted box **202** in **FIG. 2**. An indication may be received to display a second arrangement of graphical representations "D," "B," and "E" in a second subarea shown by box **252** in **FIG. 2**, which includes the graphical representation "B." The second arrangement of graphical representations may be represented by the second arrangement of nodes d, b", and e linked to subarea II, as shown in **FIG. 1**. Animating a movement of the graphical representation "B" associated with node b in subarea I and node b" in subarea II may be difficult since the transition must traverse multiple subareas. For example, the dashed arrow in **FIG. 1** shows a direct transition of node b from one branch of the DOM tree to node b" of another branch, which would be challenging to animate. The direct transition of node b from subarea I to subarea II presents a potential challenge. For example, removing node b from subarea I and inserting node b immediately into subarea II would require that the graphical representation associated with node b be cropped by subarea II while still within the boundary of subarea I.

A ghost visual element may be used to aid in the visual transition from the first arrangement to the second arrangement. Ghost node **150**, having an associated ghost graphical representation identical to

the repeated graphical representation "B," may be introduced as a child node, e.g., a direct descendant node as shown in **FIG. 1**, to body node **120** of DOM tree **100**. A child node refers to a node deeper within the DOM tree than a reference node, and connected to the reference node via one or more branches. A direct descendant node refers to a child node directly connected to a reference node. The ghost graphical representation represented by ghost node **150**, labeled b_g' in **FIG. 1**, may accordingly have an associated absolute position on the webpage corresponding to the pre-transition position of the graphical representation "B." The ghost graphical representation, identical to the original graphical representation "B," may be overlaid on the original graphical representation. The ghost graphical representation is more easily moved about the display, because of its absolute position rather than a position relative to subarea I. Accordingly, the first arrangement including the graphical representation "B" may be removed from the display, e.g., faded-out, leaving the identical ghost graphical representation displayed without the user experiencing a visual change of the graphical representation "B."

25 An arrangement of hidden graphical representations associated with the new arrangement, corresponding to nodes d, b, and e, may be generated for subarea II, although these hidden graphical representations may be hidden from the user, e.g., have an opacity of zero.

30 The term hidden graphical representation, as used herein, shall refer to a graphical representation, having an associated node in a DOM tree, that can be optionally made visual or substantially non-visible, e.g., invisible, to a user. The ghost graphical

representation "B," associated with node **150**, may be transitioned from the first position in subarea I to the second position in subarea II using an animated movement along a path in absolute coordinates, shown by the dashed arrow in **FIG. 2**. Following the animated movement, the ghost graphical representation "B" overlays the hidden graphical representation "B" in subarea II. The ghost graphical representation is now removed from the display, and the hidden graphical representation "D," "B," and "E" are displayed, e.g., faded-in, without the user experiencing an abrupt visual change from the old arrangement to the new arrangement. The result of the foregoing is the controlled transition of the repeated graphical representation "B," from a first position associated with a first arrangement to a second position associated with a second arrangement.

In an illustrative example, an arrangement of United States (US) Presidents, shown by graphical representations corresponding to nodes in a DOM tree, may be presented to a user, as shown in **FIG. 3**. The user may wish to filter the displayed arrangement of US Presidents shown in view **300** to only those presidents of the Republican party, as shown in view **400** of **FIG. 4**. Some graphical representations, such as those representing George W. Bush, Ronald Reagan, Abraham Lincoln, Theodore Roosevelt, etc., are shared among the two displayed arrangements, i.e., US Presidents and Republican US Presidents. Rather than abruptly switching between the displayed arrangements, ghost graphical representations and/or hidden graphical representations may be used to more smoothly transition between the displayed arrangements. For example, an animated movement of a ghost graphical representation

along a path may be used to move the graphical representation representing George W. Bush, e.g., an image icon, from position **304** in view **300** to position **302** in view **400**. In a further example, the graphical representation representing Barack Obama may be faded-out from view **300** to **400**. In a further example, the graphical representation representing Benjamin Harrison may be faded-in from view **300** to **400**. Accordingly, a user may experience a relatively smoother transition from view **300** to **400**.

In a further illustrative example, an arrangement of United States (US) Presidents may be presented to a user, as shown in **FIG. 3**. The user may wish to switch from the gallery view of presidents shown in view **300** to an alternate view, as shown in view **500** of **FIG. 5**. Graphical representations of elements Barack Obama, George W. Bush, Bill Clinton, Ronald Reagan, and Abraham Lincoln are shared among view **300** and area **510** of view **500**. Rather than abruptly switching between the views, ghost graphical representations and/or hidden graphical representations may be used to more smoothly transition between the views. For example, an animation may be used to change the position and size of the graphical representation representing Barack Obama from view **300** to area **520** of view **500**. In a further example, the graphical representations in the bottom two rows of US Presidents may be faded out from view **300** to **500**. In a further example, the information shown in area **520**, including "Biography," "Vice President," and "Date of Birth", may be faded-in from view **300** to **500**.

FIG. 6 is a flow diagram **600** of illustrative steps for animating a movement of a graphical representation, from a first position to a second position. The

illustrative steps of flow diagram **600** may be applied to any suitable number of graphical representations, simultaneously or sequentially, although the following discussion will be directed to a single graphical representation. The illustrative steps of flow diagram **600** will be discussed in the context of DOM trees, and associated webpages, although the disclosed techniques may be applied to any hierarchical construct.

Step **602** includes processing equipment receiving an indication to move a graphical representation from a first position, associated with a first descendent node in a DOM tree, to a second position, associated with a second descendent node in the DOM tree. In some implementations, the indication may be received from a user input device. For example, a user may view a current arrangement and may indicate a desire to view a different arrangement, and may accordingly select a corresponding command button. In a further example, a user may indicate a desire to view a difference view type, and may accordingly select a corresponding command button. In a further example, a user may indicate a desire to view a filtered arrangement, and may input one or more filter criteria to a user input device. In a further example, a user may indicate a desire to view a sorted arrangement, and may input one or more sorting criteria to a user input device.

Step **604** includes processing equipment generating a ghost node as a direct child node of any common ancestor node of the DOM tree relative to the first and second descendant nodes. By descending directly from the common ancestor node, the ghost node is not deeply arranged in any branch of the DOM tree. Accordingly, in some circumstances, any ghost graphical representation associated with the ghost node will be

relatively less restricted in placement and movement on the webpage. It will be understood that the ghost node may be made a child of any other suitable node that would allow an animated movement in any desired portion of the display. For example, the ghost node may be placed deeper within the DOM tree when the animated movement is not intended to take place across the entire display, but rather within just a portion of the display.

Step 606 includes processing equipment associating the ghost node of step 604 with a ghost graphical representation. The ghost graphical representation is substantially identical to the graphical representation at the first position in appearance. In some implementations, the ghost graphical representation may have an associated absolute position on the webpage. Because the absolute position is applicable to the entire page, and not only a subarea, the ghost graphical representation may be moved about the page more easily. In some implementations, absolute cascading style sheets (CSS) positioning may be used to position the ghost graphical representations.

Step 608 includes processing equipment overlaying the ghost graphical representation of step 606 over the graphical representation at the first position. In some implementations, the overlaying is not substantially detectable by a user, and thus does not affect the visual context. In some implementations, the ghost graphical representation may be displayed with some transparency, color variation relative to the graphical representation at the first position, or other non-identical property, although the appearance should be substantially the same as the graphical representations at the first position.

Step **610** includes processing equipment removing the graphical representation at the first position from display. The removal of the graphical representation at the first position leaves the ghost graphical
5 representation displayed at the first position, and accordingly the removal will not be visually evident to the user in a substantial way.

Step **612** includes processing equipment generating a second descendant node. The second descendant node
10 has an associated hidden graphical representation, not visually evident on the display to the user in a substantial way. In some implementations, the hidden graphical representation may have an associated opacity of substantially zero, rendering the hidden graphical
15 representation not visually detectable by the user.

Step **614** includes processing equipment animating movement of the ghost graphical representation to the second position, also referred to herein as the target position. In some implementations, the processing
20 equipment generates a path for each ghost graphical representation from the first position to the second position. For example, processing equipment can determine a straight line path between the first position and the second position. In a further
25 example, processing equipment can generate relatively more complex paths so multiple ghost graphical representations do not overlap during the animated movement, allowing users to see the transition more clearly. In some implementations, the processing
30 equipment re-sizes a ghost graphical representation from a first size to a second size. For example, if the sizes of the graphical representations of the old arrangement and the graphical representations of the new arrangement are not the same, processing equipment

can cause the ghost graphical representations to change in size before, during, or after the animated movement from the first position to the second position.

In addition to animating movement of a ghost graphical representation, other transition operations can be applied to maintain the visual context during the transition from the old arrangement and the new arrangement. For example, referencing step **616**, ghost elements can be removed from the display. In a further example, referencing step **618**, graphical representations associated with the entities included only in the old arrangement may be made to vanish, e.g., fade out. In a further example, referencing step **618**, graphical representations included only in the new arrangement may be made to appear, e.g., fade in. In a further example, referencing step **618**, graphical representations associated with other subareas may be made to vanish or appear.

The illustrative techniques of flow diagram **600** may be applied, for example, to any suitable user interface. For example, the techniques of flow diagram **600** may be applied to a user interface of an online music store to animate filtering of music selections. In a further example, the techniques of flow diagram **600** may be applied to an online photo service to animate transitions of photo grouping, e.g., into photo albums, or transitions in photo view style.

In an illustrative example, a new arrangement of entities and associated visual elements may be requested via Asynchronous JavaScript and Extensible Markup Language (AJAX). The user's experience may be improved if animation starts before an AJAX response is received. In some implementations, processing equipment pre-renders a relatively small template and

identifiers of the new arrangement in the HTML code transmitted to the user, along with the old arrangement.

FIGS. 7-11 provide an illustrative example of the use of ghost graphical representations to aid in transitioning between a first arrangement and a second arrangement.

FIG. 7 shows an illustrative display **700** of a first arrangement and a corresponding initial DOM tree **750**. Subarea I, as illustrated, corresponds to most of the entire area of display **700**. Shown in subarea I are six graphical representations representing six respective elements "Movie 1" - "Movie 6." Movie 3 is highlighted, as shown by highlight region **702**. A user selection of Movie 3 is an example of an indication that the displayed arrangements are to change, and that a transition between displayed arrangements may be desired. Initial DOM tree **750** includes root node **752**, body node **754**, div node **760** corresponding to subarea I, div node **770** corresponding to subarea II, and nodes **780**, including M1-M6, corresponding to the six displayed elements, including "Movie 1" - "Movie 6," in display **700**. As illustrated in **FIG. 7**, subareas I and II are arranged in different branches of initial DOM tree **750**. For example, subareas I and II may be associated with respective <div> nodes, descending from the <body> node of an <html> root node.

FIG. 8 shows an illustrative display **800** of the first arrangement of **FIG. 7** and a corresponding modified DOM tree **850**, derived from modifying DOM tree **750**, having ghost nodes **860** associated with ghost graphical representations and nodes **870** associated with hidden graphical representations. Ghost nodes **860**, including G1, G2, G3, and G4, correspond to ghost

graphical representations which overlay graphical representations corresponding to nodes **780**, including M1, M2, M3, and M4, respectively. Nodes **870**, including H1, H2, H3, and H4, represent hidden graphical representations which correspond to positions **802**, **804**, **806**, and **808**, respectively, which are hidden from display, e.g., the graphical representations can have an opacity of zero. The processing equipment may generate ghost nodes **860**, nodes **870**, or both, in response to the indication of a transition. Ghost nodes **860** are not located in as deep in the hierarchy of modified DOM tree **850**, as compared to div nodes **760** and **770**. Ghost graphical representations associated with nodes **860**, including G1, G2, G3, and G4, each may have associated absolute positions on display **800**.

FIG. 9 shows an illustrative display of the ghost graphical representations of **FIG. 8**, overlaid on the graphical representations of the first arrangement, after fading-out of the graphical representations of the first arrangement. The ghost graphical representations shown in **FIG. 9** are identical to the original corresponding graphical representations, e.g., as shown in **FIG. 7**. The graphical representations corresponding to elements "Movie 5" and "Movie 6" may be removed from display **800** in any suitable manner, before, during, or after the animated movement of the ghost graphical representations. **FIG. 10** shows an illustrative display **1000** of the ghost graphical representations of **FIG. 9**, after an animated movement and re-sizing along respective paths. Processing equipment may generate paths **1010**, **1012**, **1014**, and **1016** based on the initial positions and final positions. Because the ghost graphical representations' respective positions are defined in absolute coordinates, the

paths can also be defined in absolute coordinates, irrespective of subareas or DOM tree branching. The ghost graphical representations corresponding to elements "Movie 1" - "Movie 4" are moved and re-sized to positions **802, 804, 806, and 808**, respectively, thus overlaying the hidden graphical representations at the respective positions.

FIG. 11 shows an illustrative display **1100** of the second arrangement associated with the hidden graphical representations of **FIG. 10** now displayed, and a corresponding new DOM tree **1150**. New DOM tree **1150** shows nodes **1180**, corresponding to "Movie 1" - "Movie 4," for which the corresponding hidden graphical representations are no longer hidden but rather faded-in to the display. Additionally, display **1100** includes graphical representations **1102** and **1104** displayed in areas other than subarea II. Graphical representations such as graphical representations **1102** and **1104** may be faded in before, during or after the hidden graphical representations are shown in the display. The illustrative transition shown by **FIGS. 7-11** illustrates one example of how visual context can be maintained while transitioning between displayed arrangements.

The following **FIGS. 12-13** describe illustrative computer systems that may be used in some implementations of the present disclosure. It will be understood that the disclosed techniques may be implemented using any suitable computer or combination of computers. For example, the disclosed techniques may be implemented using a server, user device, any other suitable processing device, or any combination thereof.

FIG. 12 shows an illustrative computer system in accordance with some implementations of the present

disclosure. System **1200** may include one or more user device **1202**. In some implementations, user device **1202** may include a smartphone, tablet computer, desktop computer, laptop computer, personal digital assistant (PDA), portable audio player, portable video player, mobile gaming device, other suitable user device capable of providing content, or any combination thereof.

User device **1202** may be coupled to network **1204** directly through connection **1206**, through wireless repeater **1210**, by any other suitable way of coupling to network **1204**, or by any combination thereof. Network **1204** may include the Internet, a dispersed network of computers and servers, a local network, a public intranet, a private intranet, any other suitable coupled computing systems, or any combination thereof.

User device **1202** may be coupled to network **1204** by wired connection **1206**. Connection **1206** may include Ethernet hardware, coaxial cable hardware, DSL hardware, T-1 hardware, fiber optic hardware, analog phone line hardware, any other suitable wired hardware capable of communicating, or any combination thereof. Connection **1206** may include transmission techniques including TCP/IP transmission techniques, IEEE 802 transmission techniques, Ethernet transmission techniques, DSL transmission techniques, fiber optic transmission techniques, ITU-T transmission techniques, any other suitable transmission techniques, or any combination thereof.

User device **1202** may be wirelessly coupled to network **1204** via wireless connection **1208**. In some implementations, wireless repeater **1210** receives transmitted information from user device **1202** by wireless connection **1208** and communicates it with

network **1204** via connection **1212**. Wireless repeater **1210** receives information from network **1204** by connection **1212** and communicates it with user device **1202** by wireless connection **1208**. In some

5 implementations, wireless connection **1208** may include cellular phone transmission techniques, code division multiple access (CDMA) transmission techniques, global system for mobile communications (GSM) transmission techniques, general packet radio service (GPRS)

10 transmission techniques, satellite transmission techniques, infrared transmission techniques, Bluetooth transmission techniques, Wi-Fi transmission techniques, WiMax transmission techniques, any other suitable transmission techniques, or any combination thereof.

15 Connection **1212** may include Ethernet hardware, coaxial cable hardware, DSL hardware, T-1 hardware, fiber optic hardware, analog phone line hardware, wireless hardware, any other suitable hardware capable of communicating, or any combination thereof.

20 Connection **1212** may include wired transmission techniques including TCP/IP transmission techniques, IEEE 802 transmission techniques, Ethernet transmission techniques, DSL transmission techniques, fiber optic transmission techniques, ITU-T transmission techniques,

25 any other suitable transmission techniques, or any combination thereof. Connection **1212** may include may include wireless transmission techniques including cellular phone transmission techniques, code division multiple access (CDMA) transmission techniques, global

30 system for mobile communications (GSM) transmission techniques, general packet radio service (GPRS) transmission techniques, satellite transmission techniques, infrared transmission techniques, Bluetooth transmission techniques, Wi-Fi transmission techniques,

WiMax transmission techniques, any other suitable transmission techniques, or any combination thereof.

Wireless repeater **1210** may include any number of cellular phone transceivers, network routers, network switches, communication satellites, any other suitable devices for communicating information from user device **1202** to network **1204**, or any combination thereof. It will be understood that the arrangement of connection **1206**, wireless connection **1208** and connection **1212** is merely illustrative and that system **1200** may include any suitable number of any suitable devices coupling user device **1202** to network **1204**. It will also be understood that any user device **1202**, may be communicatively coupled with any user device, remote server, local server, any other suitable processing equipment, or any combination thereof, and may be coupled using any suitable technique as described above.

In some implementations, any suitable number of remote servers **1214** and **1220** may be coupled to network **1204**. Remote servers may be general-purpose, specific, or any combination thereof. One or more database servers **1224** may be coupled to network **1204**. It will be understood that the system may use any suitable number of general purpose, specific purpose, storage, processing, search, any other suitable server, or any combination.

FIG. 13 is a block diagram of device **1300** in accordance with some implementations of the present disclosure. Device **1300** may optionally include, or otherwise be communicatively coupled to, interface equipment **1302** (e.g., input/output equipment) and processing equipment **1304**. In some implementations, device **1300** need not include interface equipment **1302**.

For example, in some implementations, device **1300** may include a server configured to store and provide computer executable instructions to a user device that may include some or all of interface equipment **1302**.

- 5 Interface equipment **1302** may include display **1306**, button **1310**, keyboard **1340**, mouse **1342**, and audio equipment **1334** including speaker **1314** and microphone **1316**. In some implementations, the equipment illustrated in **FIG. 13** may be representative of
- 10 equipment included in a server. In some implementations, the equipment illustrated in **FIG. 13** may be representative of equipment included in a smartphone user device. It will be understood that the specific equipment included in the illustrative
- 15 computer system may depend on the type of user device. It will be understood that device **1300** may omit any suitable illustrated elements, and may include equipment not shown such as media drives, data storage, communication devices, display devices, processing
- 20 equipment, any other suitable equipment, or any combination thereof.

- In some implementations, display **1306** may include a liquid crystal display, light emitting diode display, organic light emitting diode display, amorphous organic
- 25 light emitting diode display, plasma display, cathode ray tube display, projector display, any other suitable type of display capable of displaying content, or any combination thereof. Display **1306** may be controlled by display controller **1318** or by processor **1324** in
- 30 processing equipment **1304**, by processing equipment internal to display **1306**, by other controlling equipment, or by any combination thereof. For example, display **1306** may be configured to display one or more webpages, having associated DOM trees.

Button **1310** may be one or more electromechanical push-button mechanism, slide mechanism, switch mechanism, rocker mechanism, toggle mechanism, other suitable mechanism, or any combination thereof. Button

5 **1310** may be included in a touchscreen as a predefined region of the touchscreen, such as soft keys, for example. Activation of button **1310** may send a signal to sensor controller **1320**, processor **1324**, display controller **1320**, any other suitable processing

10 equipment, or any combination thereof. Activation of button **1310** may include receiving from the user a pushing gesture, sliding gesture, touching gesture, pressing gesture, time-based gesture, e.g., based on the duration of a push, any other suitable gesture, or

15 any combination thereof. For example a user gesture may be received by button **1310**, indicating that a displayed arrangement is to be changed.

Audio equipment **1334** may include sensors and processing equipment for receiving and transmitting

20 information using acoustic or pressure waves. Speaker **1314** may include equipment to produce acoustic waves in response to a signal. In some implementations, speaker **1314** may include an electroacoustic transducer wherein an electromagnet is coupled to a diaphragm to produce

25 acoustic waves in response to an electrical signal. Microphone **1316** may include electroacoustic equipment to convert acoustic signals into electrical signals. In some implementations, a condenser-type microphone may use a diaphragm as a portion of a capacitor such

30 that acoustic waves induce a capacitance change in the device, which may be used as an input signal by device **1300**.

Speaker **1314** and microphone **1316** may be contained within device **1300**, may be remote devices coupled to

device **1300** by any suitable wired or wireless connection, or any combination thereof.

Speaker **1314** and microphone **1316** of audio equipment **1334** may be coupled to audio controller **1322**
5 in processing equipment **1304**. This controller may send and receive signals from audio equipment **1334** and perform pre-processing and filtering steps before transmitting signals related to the input signals to processor **1324**. Speaker **1314** and microphone **1316** may
10 be coupled directly to processor **1324**. Connections from audio equipment **1334** to processing equipment **1304** may be wired, wireless, other suitable arrangements for communicating information, or any combination thereof.

Processing equipment **1304** of device **1300** may
15 include display controller **1318**, sensor controller **1320**, audio controller **1322**, processor **1324**, memory **1326**, communication controller **1328**, and power supply **1332**.

Processor **1324** may include circuitry to interpret
20 signals input to device **1300** from, for example, microphone **1316**. Processor **1324** may include circuitry to control the output to display **1306** and speaker **1314**. Processor **1324** may include circuitry to execute instructions of a computer program. In some
25 implementations, processor **1324** may be an integrated electronic circuit based, capable of executing the instructions of a computer program and include a plurality of inputs and outputs.

Processor **1324** may be coupled to memory **1326**.
30 Memory **1326** may include random access memory (RAM), flash memory, programmable read only memory (PROM), erasable programmable read only memory (EPROM), magnetic hard disk drives, magnetic tape cassettes, magnetic floppy disks optical CD-ROM discs, CD-R discs,

CD-RW discs, DVD discs, DVD+R discs, DVD-R discs, any other suitable storage medium, or any combination thereof.

The functions of display controller **1318**, sensor
5 controller **1320**, and audio controller **1322**, as have been described above, may be fully or partially implemented as discrete components in device **1300**, fully or partially integrated into processor **1324**, combined in part or in full into combined control
10 units, or any combination thereof.

Communication interface **1328** may be coupled to processor **1324** of device **1300**. In some implementations, communication controller **1328** may communicate radio frequency signals using antenna **1330**.
15 In some implementations, communication controller **1328** may communicate signals using a wired connection (not shown). Wired and wireless communications communicated by communication interface **1328** may use Ethernet, amplitude modulation, frequency modulation, bitstream,
20 code division multiple access (CDMA), global system for mobile communications (GSM), general packet radio service (GPRS), satellite, infrared, Bluetooth, Wi-Fi, WiMax, any other suitable communication configuration, or any combination thereof. The functions of
25 communication controller **1328** may be fully or partially implemented as a discrete component in device **1300**, may be fully or partially included in processor **1324**, or any combination thereof.

Power supply **1332** may be coupled to processor **1324**
30 and to other components of device **1300**. Power supply **1332** may include a lithium-polymer battery, lithium-ion battery, NiMH battery, alkaline battery, lead-acid battery, fuel cell, solar panel, thermoelectric generator, any other suitable power source, or any

combination thereof. Power supply **1332** may include a hard wired connection to an electrical power source, and may include electrical equipment to convert the voltage, frequency, and phase of the electrical power source input to suitable power for device **1300**. In some implementations of power supply **1332**, a wall outlet may provide 120 volts, 60Hz alternating current (AC). A circuit of transformers, resistors, inductors, capacitors, transistors, and other suitable electronic components included in power supply **1332** may convert the 120V AC from a wall outlet power to 5 volts at 0 Hz, *i.e.*, direct current. In some implementations of power supply **1332**, a lithium-ion battery including a lithium metal oxide-based cathode and graphite-based anode may supply 3.7V to the components of device **1300**. Power supply **1332** may be fully or partially integrated into device **1300**, or may function as a stand-alone device. Power supply **1332** may power device **1300** directly, may power device **1300** by charging a battery, may provide power by any other suitable way, or any combination thereof.

The foregoing is merely illustrative of the principles of this disclosure and various modifications may be made by those skilled in the art without departing from the scope of this disclosure. The above described embodiments are presented for purposes of illustration and not of limitation. The present disclosure also can take many forms other than those explicitly described herein. Accordingly, it is emphasized that this disclosure is not limited to the explicitly disclosed methods, systems, and apparatuses, but is intended to include variations to and modifications thereof, which are within the spirit of the following claims.

What is claimed is:

1. A method for animating a movement of at least one
5 graphical representation displayed in a first area of
an electronic display screen to a second area of the
electronic display screen, the method comprising:
 - maintaining a document object model (DOM)
tree having an initial hierarchy relative to a root
10 node, wherein the first area is associated with a first
child node in the (DOM) tree, wherein the second area
is associated with a second child node of the (DOM)
tree, and wherein the at least one graphical
representation is associated with a first descendant
15 node of the first child node;
 - in response to an indication to move the at
least one graphical representation, causing to be
generated, using processing equipment, for each of the
at least one graphical representation at least one
20 ghost node as a direct child node of a common ancestor
node descending from the root node of the (DOM) tree;
 - causing to be associated, using processing
equipment, each of the at least one ghost node with a
ghost graphical representation, wherein each respective
25 ghost graphical representation is substantially
identical to one of the at least one graphical
representation;
 - causing each ghost graphical representation
to be overlayed on the substantially identical
30 graphical representation in the first area;
 - causing the at least one graphical
representation to be removed from the first area after
the overlay;

- causing to be generated, using processing equipment, at least one second descendant node of the DOM tree associated with a hidden graphical representation at a target position in the second area
- 5 for each of the at least one graphical representation, the second area associated with the at least one second child node and the at least one second descendant node being a descendant of the respective at least one second child node; and
- 10 causing to be animated a movement of the at least one ghost graphical representation from the first area to the respective target position in the second area.
- 15 2. The method of claim 1, wherein a first arrangement of visual elements is associated with the first area, wherein a second arrangement of graphical representations is associated with the second area, and wherein the at least one graphical representation
- 20 corresponds to both the first arrangement and the second arrangement.
3. The method of claim 2, wherein causing the at least one graphical representation to be removed from
- 25 the first area comprises causing each graphical representation of the first arrangement of graphical representations in the first area to be faded out.
4. The method of claim 2, further comprising causing
- 30 each graphical representation of the second arrangement of graphical representations in the second area to be faded in.

5. The method of claim 1, wherein causing to be animated the movement of the at least one ghost graphical representation from the first area to the respective target position in the second area comprises
5 causing to be animated the movement along a respective predetermined path.

6. The method of claim 5, wherein the at least one graphical representation comprises at least two
10 graphical representations, and wherein the respective predetermined paths do not cross.

7. The method of claim 1, wherein causing to be animated a movement of the at least one ghost graphical
15 representation from the first area to the respective target position in the second area comprises causing to be animated a size change of the at least one ghost graphical representation.

20 8. The method of claim 1, further comprising:
causing the at least one ghost graphical representation to be removed from the second area after causing to be animated the movement; and
causing the at least one ghost node to be
25 removed from the DOM tree after causing the respective at least one ghost graphical representation to be removed.

9. The method of claim 1, wherein the DOM tree is
30 associated with a webpage rendered from hypertext markup language.

10. The method of claim 1, wherein the indication to move the at least one graphical representation comprises a user indication.

5 11. A system for animating a movement of at least one graphical representation displayed in a first area to a second area, the system comprising:

one or more computers comprising a non-transitory computer readable medium storing computer

10 executable instructions for:

maintaining a document object model

(DOM) tree having an initial hierarchy relative to a root node, wherein the first area is associated with a first child node in the DOM tree, wherein
15 the second area is associated with a second child node of the (DOM) tree, and wherein the at least one graphical representation is associated with a first descendant node of the first child node;

in response to an indication to move the
20 at least one graphical representation, causing to be generated for each of the at least one graphical representation at least one ghost node as a direct child node of a common ancestor node of the (DOM) tree;

25 causing to be associated each of the at least one ghost node with a ghost graphical representation, wherein each respective ghost graphical representation is substantially identical to one of the at least one graphical
30 representation;

causing each ghost graphical representation to be overlayed on the corresponding substantially identical graphical representation in the first area;

causing to be removed the at least one graphical representation from the first area after causing the overlay;

causing to be generated at least one
5 second descendant node of the (DOM) tree associated with a hidden graphical representation at a target position in the second area for each of the at least one graphical representation, the second area associated with the at least one
10 second child node and the at least one second descendant node being a descendant of the respective at least one second child node; and
causing to be animated a movement of the
at least one ghost graphical representation from
15 the first area to the respective target position in the second area.

12. The system of claim 11, wherein a first arrangement of graphical representations is associated
20 with the first area, wherein a second arrangement of graphical representations is associated with the second area, and wherein the at least one graphical representation corresponds to both the first arrangement and the second arrangement.

25 13. The system of claim 12, wherein the computer executable instructions further comprise computer executable instructions for causing each graphical representation of the first arrangement of elements in
30 the first area to be faded out.

14. The system of claim 12, wherein the computer executable instructions further comprise computer executable instructions for causing each graphical

representation of the second arrangement of elements in the second area to be faded in.

15. The system of claim 11, wherein the computer
5 executable instructions further comprise computer executable instructions for causing to be animated the movement along a respective predetermined path.

16. The system of claim 15, wherein the at least one
10 visual element comprises at least two graphical representations, and wherein the respective predetermined paths do not cross.

17. The system of claim 11, wherein the computer
15 executable instructions further comprise computer executable instructions for causing to be animated a size change of the at least one ghost graphical representation.

20 18. The system of claim 11, wherein the computer executable instructions further comprise computer executable instructions for:
causing to be removed the at least one ghost graphical representation from the second area after the
25 animating the movement; and
causing to be removed the at least one ghost node from the DOM tree after causing to be removed the respective at least one ghost graphical representation.

30 19. The system of claim 11, wherein the DOM tree is associated with a webpage rendered from hypertext markup language.

20. The system of claim 11, wherein the indication is a user indication.



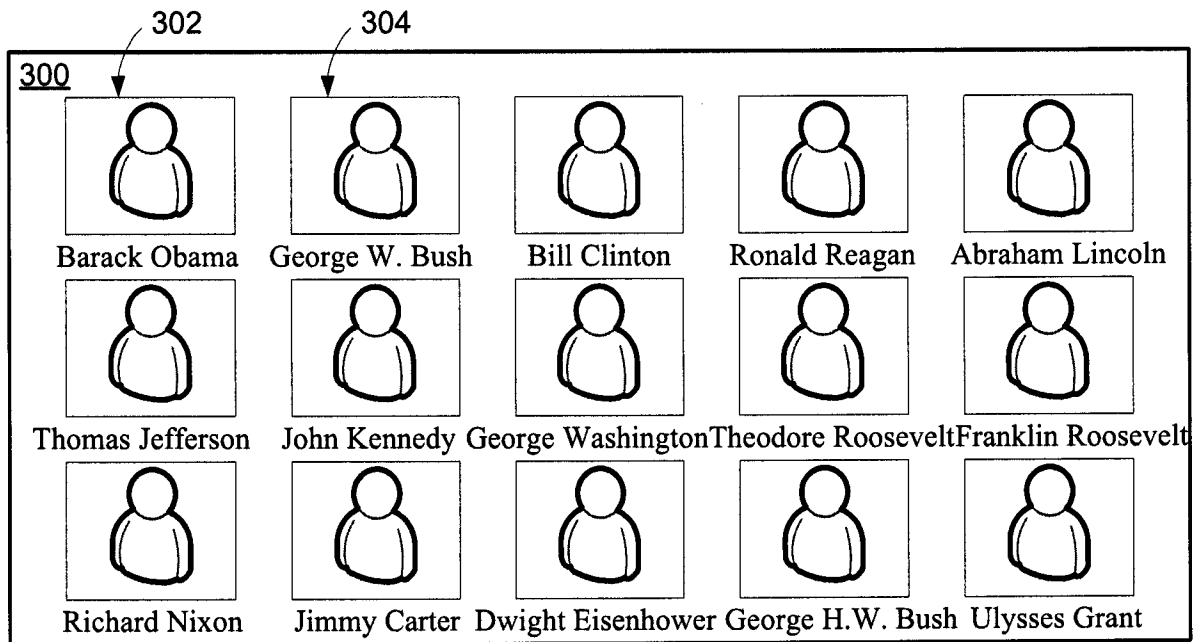


FIG. 3

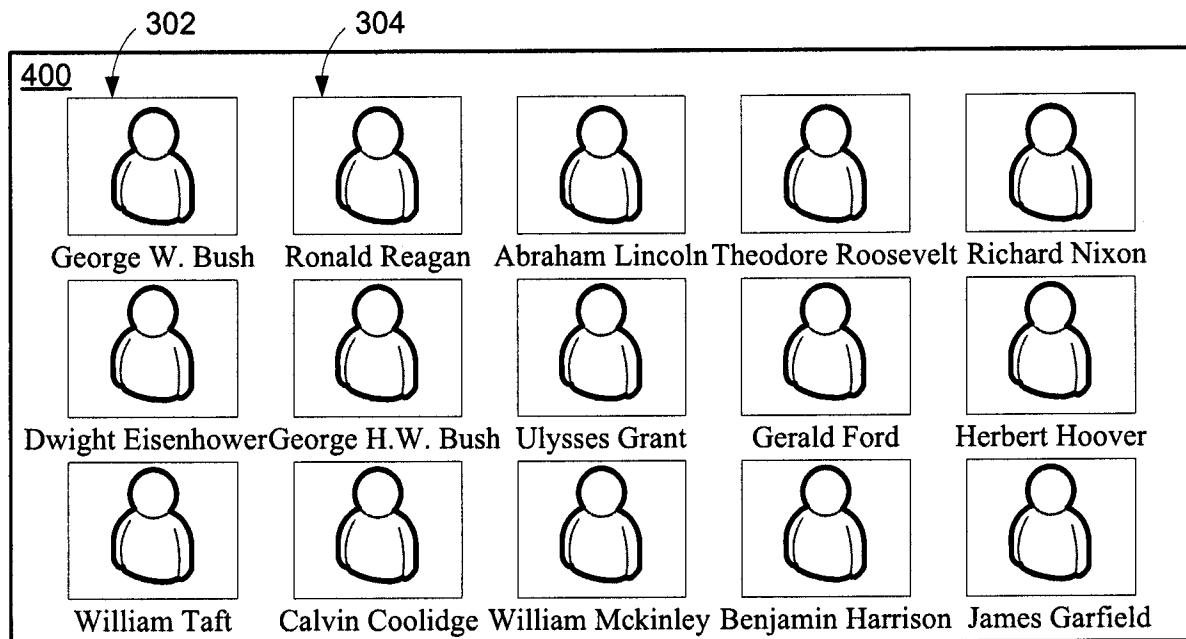
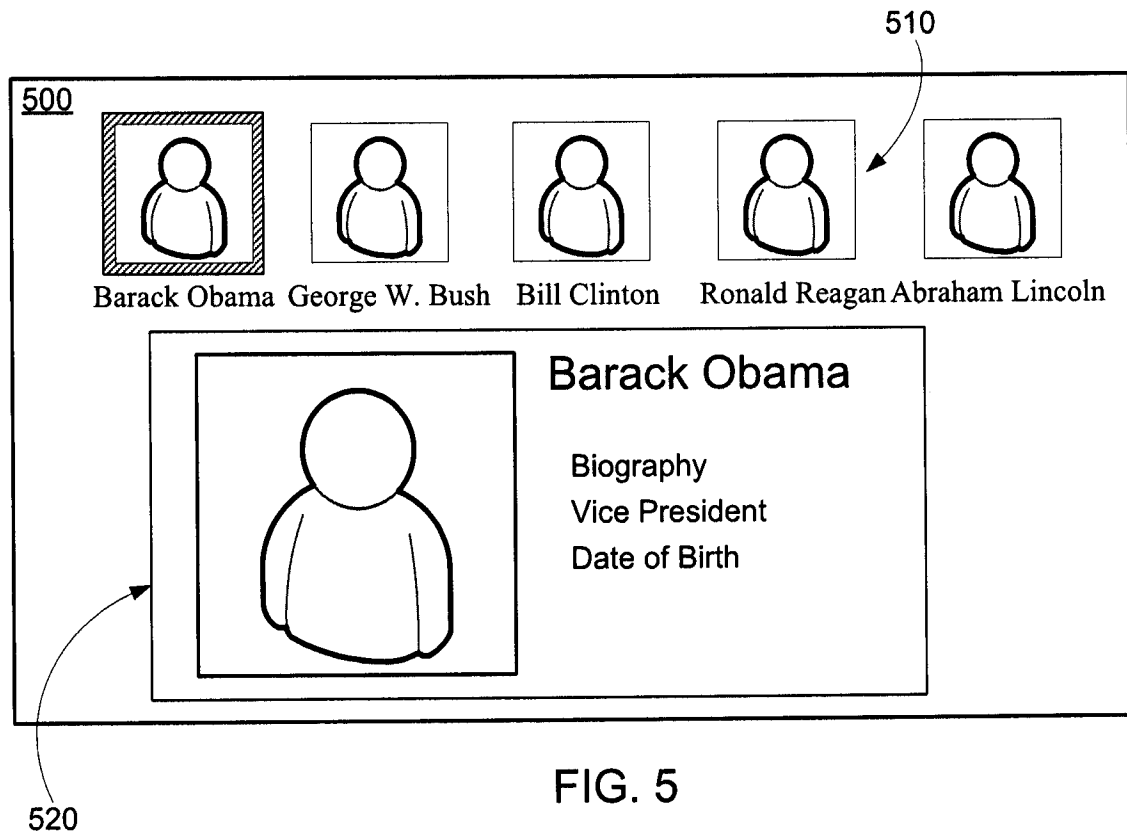
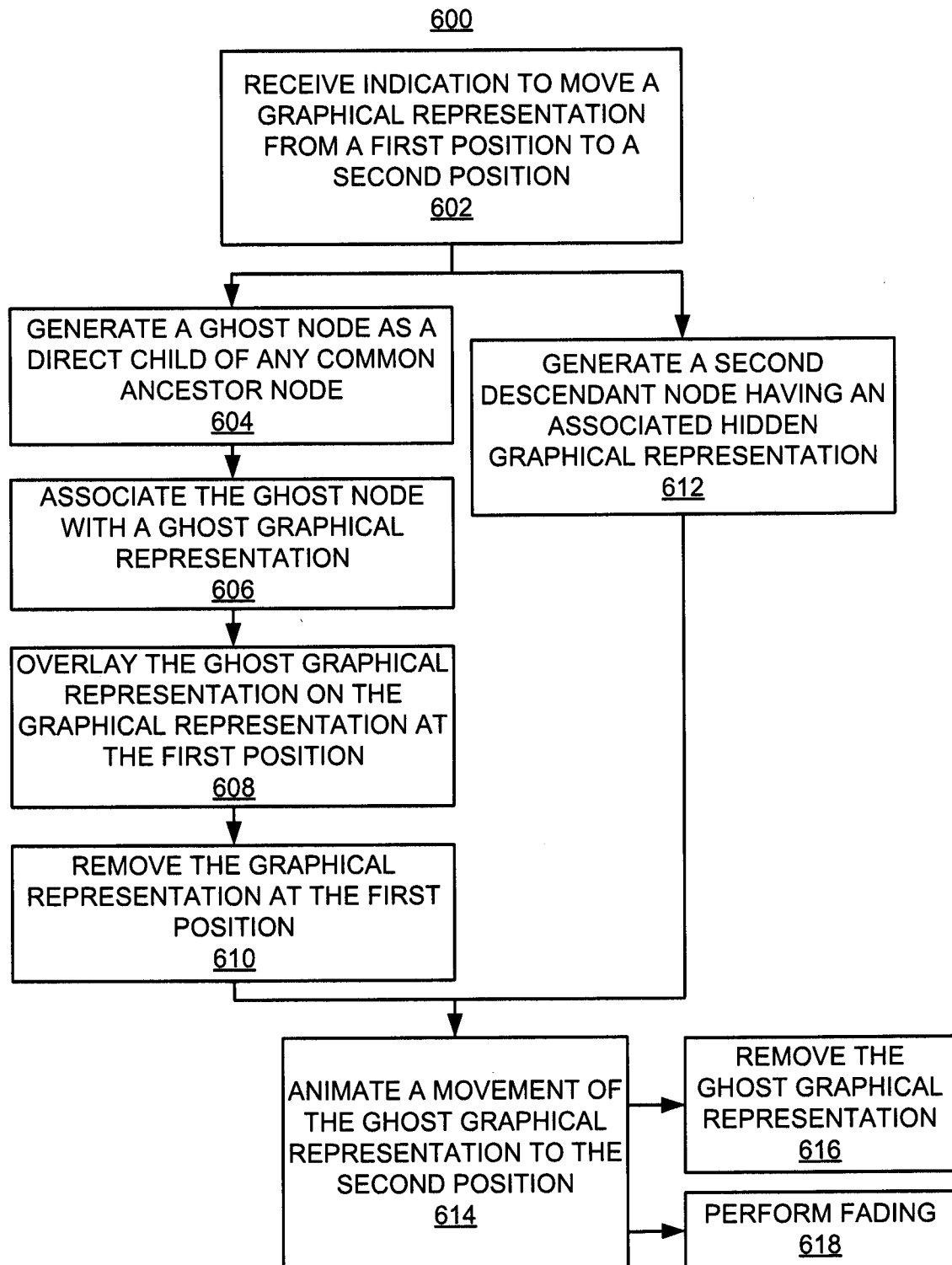


FIG. 4





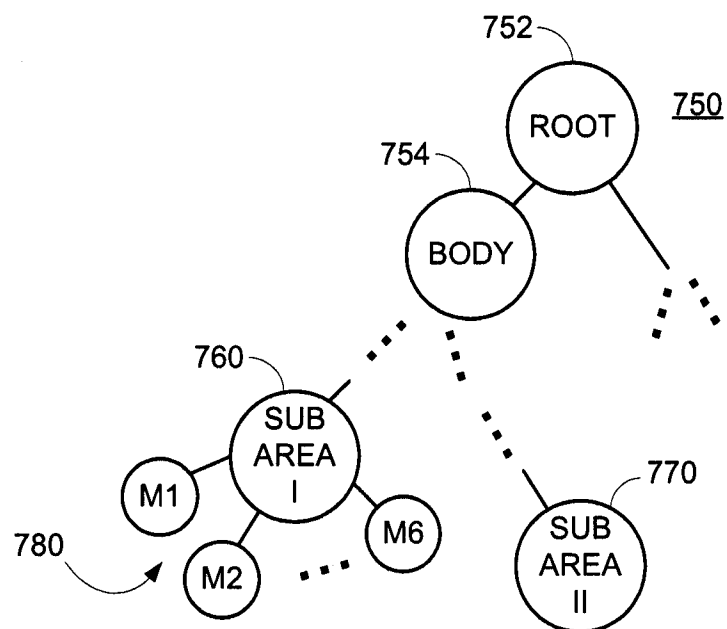
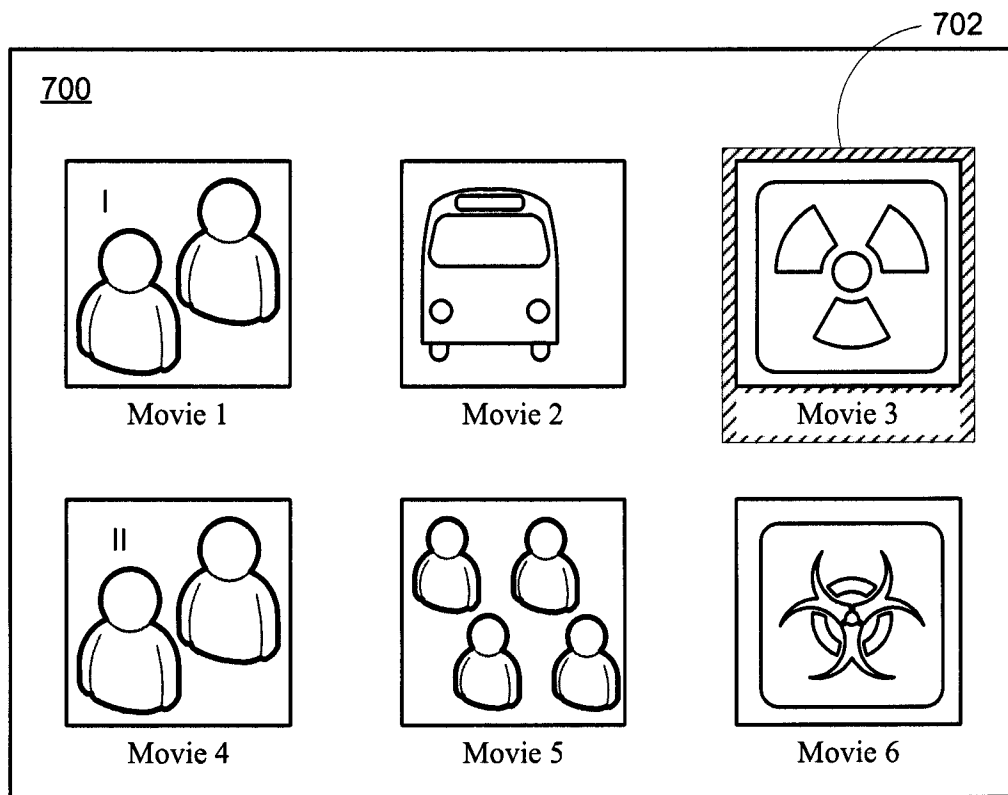


FIG. 7

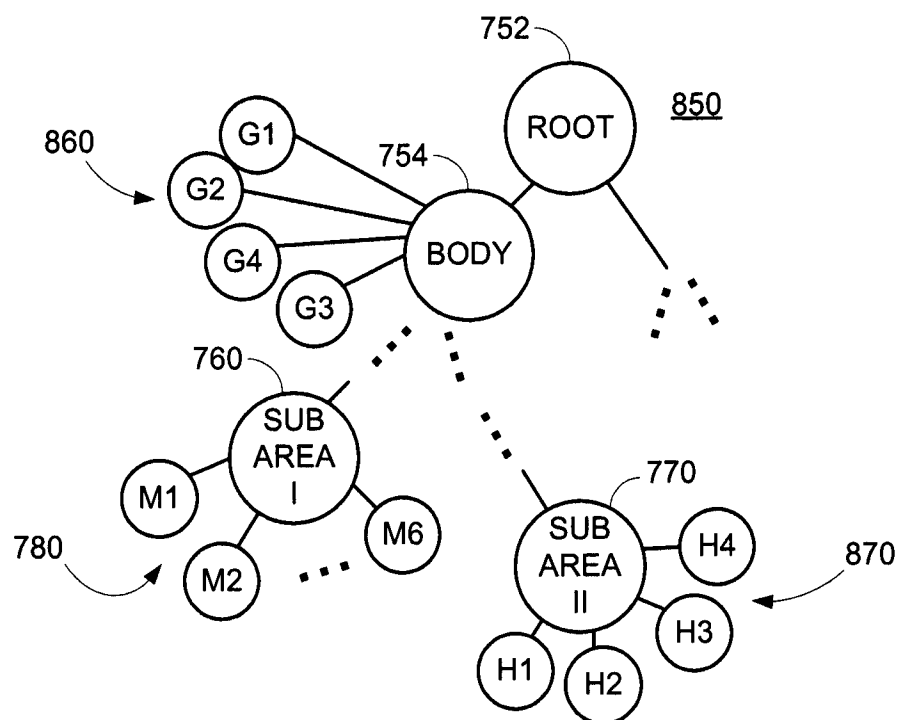
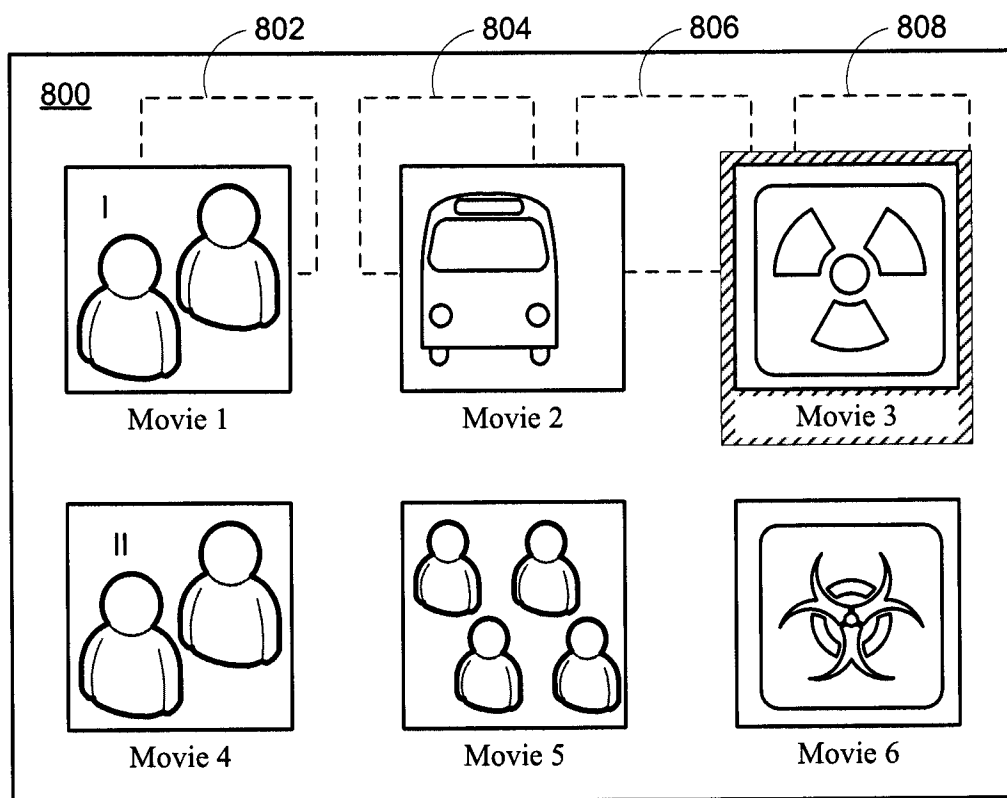


FIG. 8

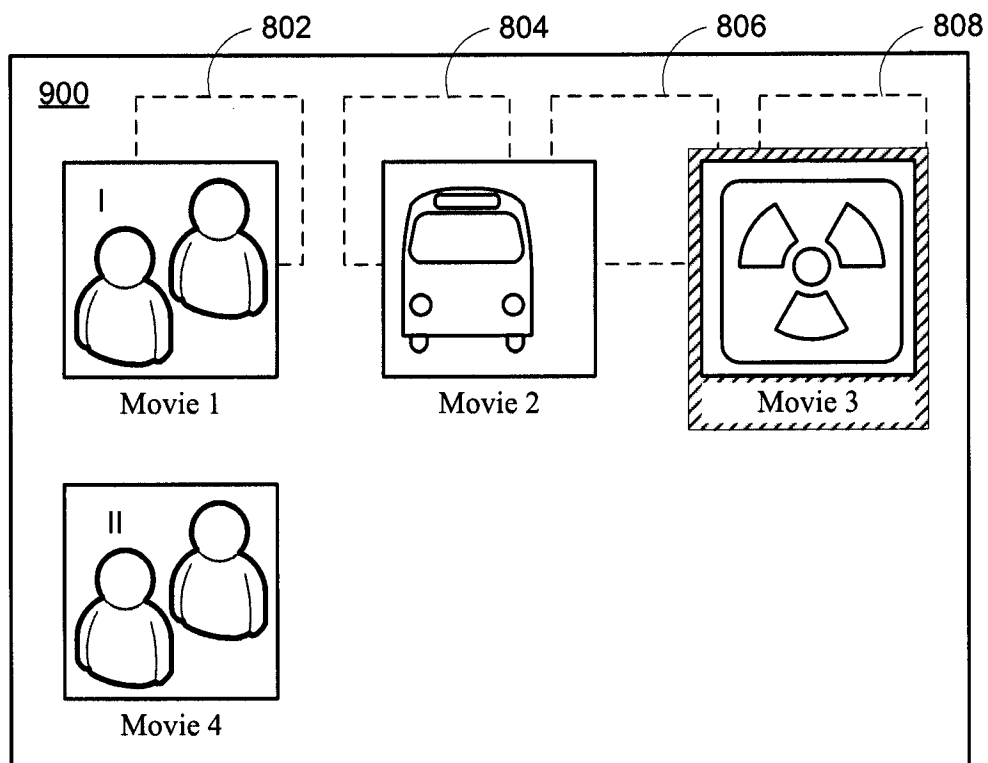


FIG. 9

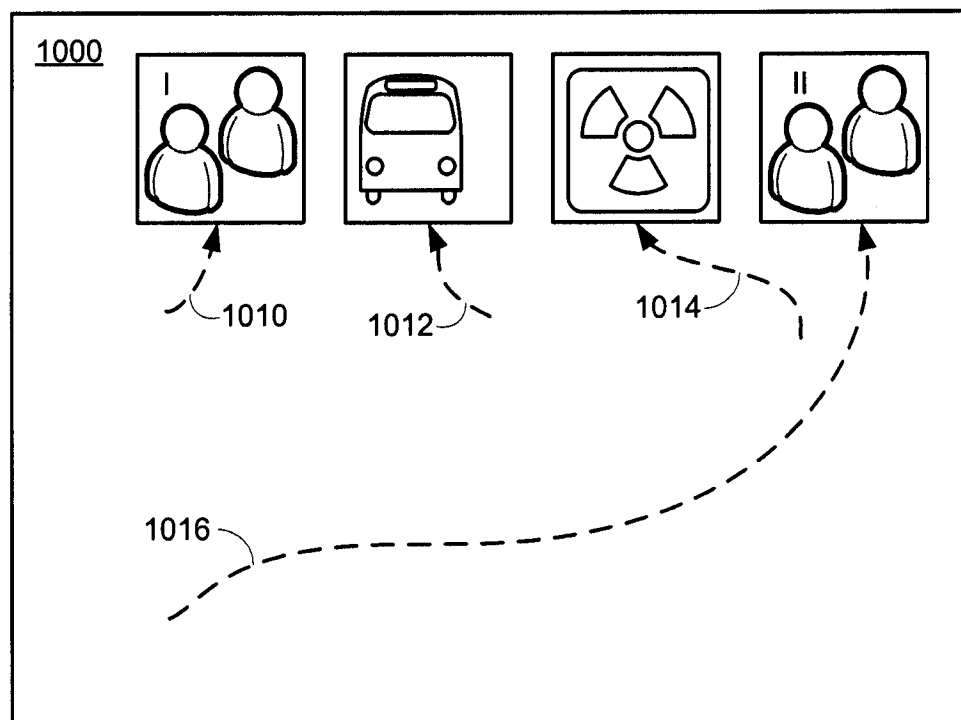


FIG. 10

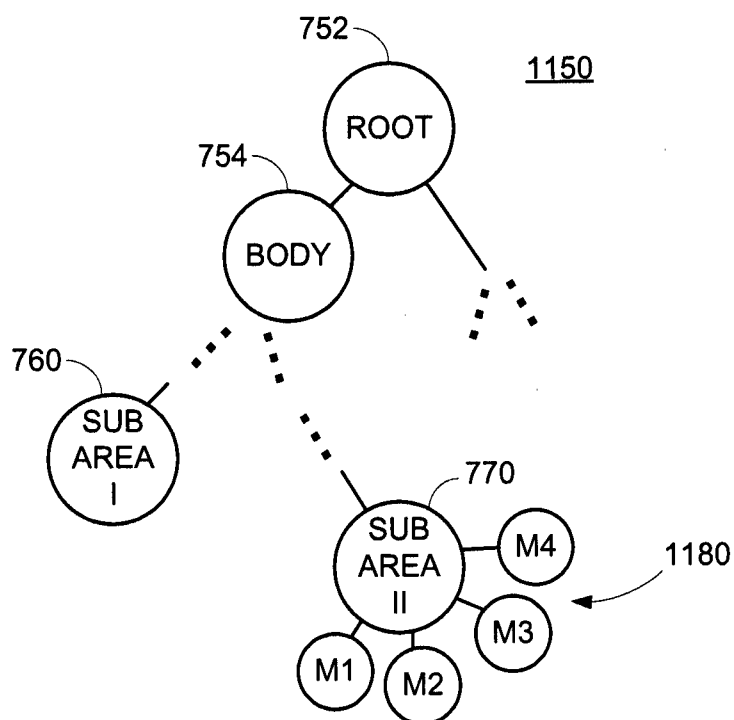
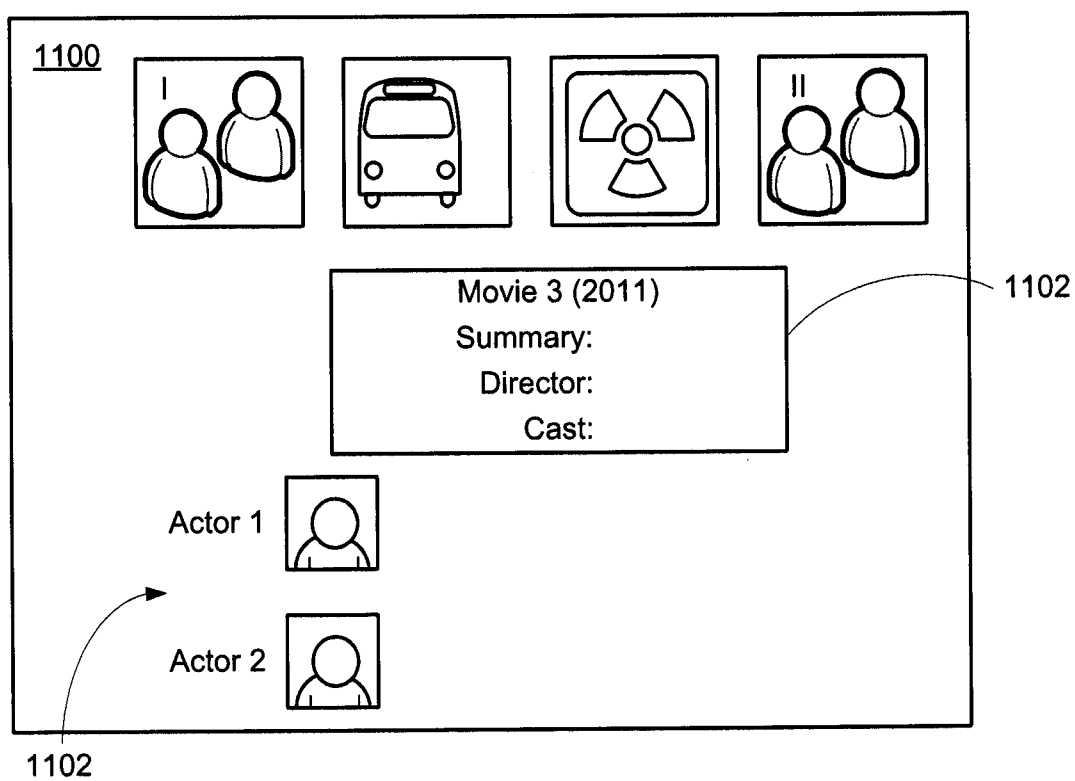


FIG. 11

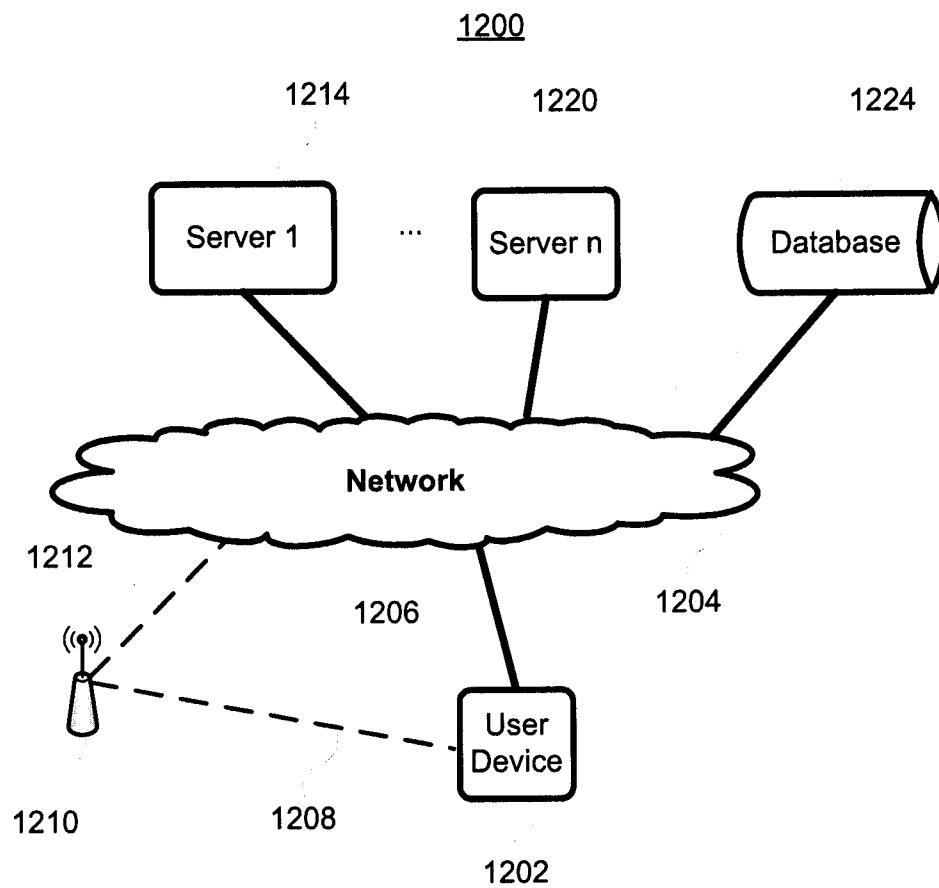


FIG. 12

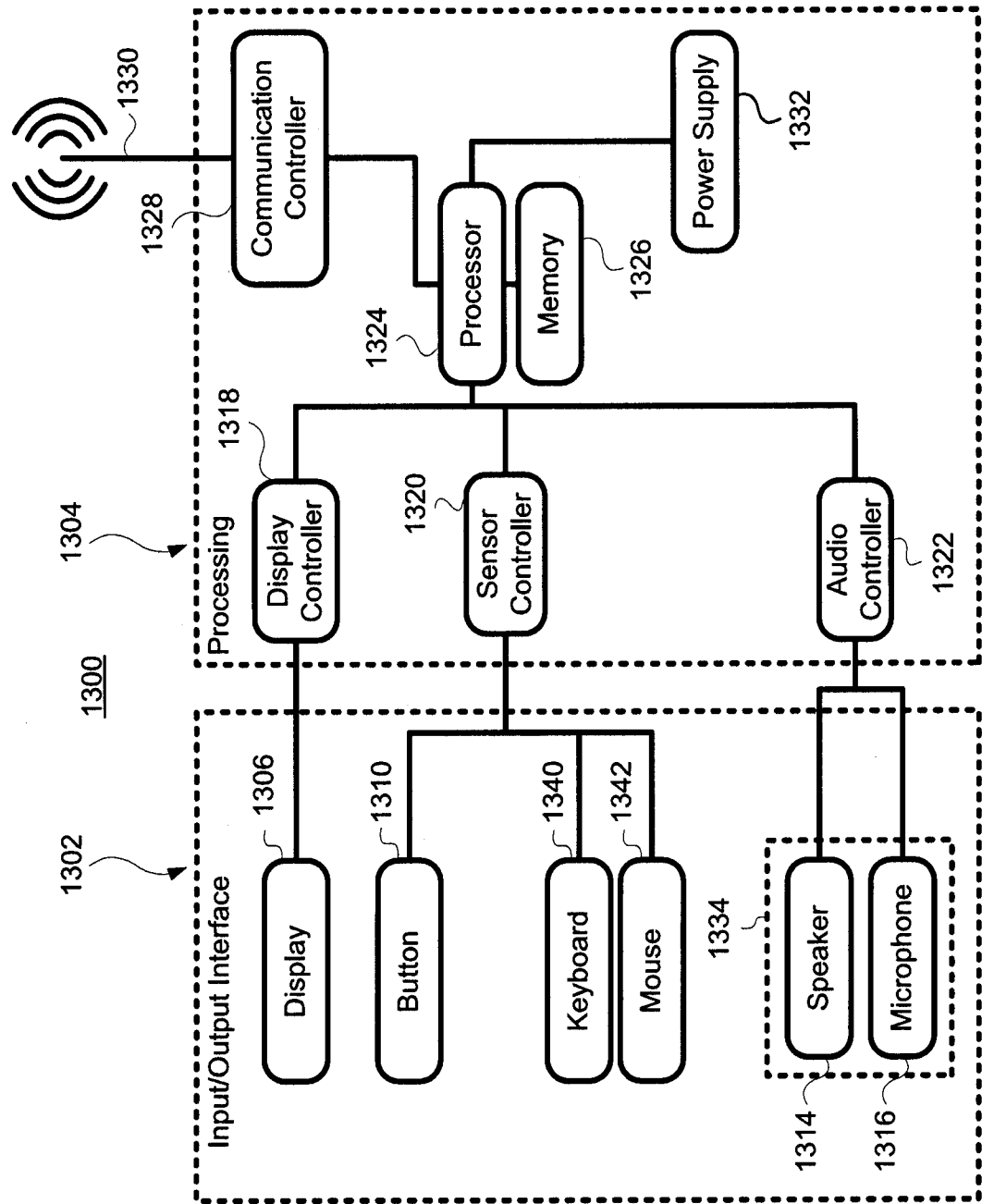


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/079803

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

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)

IPC: G06F3; G06F17

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)
CNKI, CNPAT, WPI, EPODOC, USTXT, CNTXT; graphical, representation, icon, dom, tree, animate, movement, ancestor, descendant, ghost, node, icon, layout, transition

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2009/0058821A1 (APPLE INC.) 05 Mar. 2009 (05.03.2009) description, paragraphs 0026-0028, figures 1,2A-2E, 6	1-20
A	US2007/0055947A1 (MICROSOFT CORPORATION) 08 Mar. 2007 (08.03.2007) the whole document	1-20
A	US2012/0159340A1 (BAE, Jisoo et al.) 21 Jun.2012 (21.06.2012) the whole document	1-20
A	US2012/0066627A1 (NINTENDO CO., LTD.) 15 Mar. 2012 (15.03.2012) the whole document	1-20

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“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
“A” document defining the general state of the art which is not considered to be of particular relevance	“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
“E” earlier application or patent but published on or after the international filing date	“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
“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)	“&” document member of the same patent family
“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	

Date of the actual completion of the international search 27 Apr. 2013 (27.04.2013)	Date of mailing of the international search report 16 May 2013 (16.05.2013)
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer DONGGang Telephone No. (86-10)62413649

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/079803

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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US2012/0066627A1	15.03.2012	JP2012063860A	29.03.2012

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/079803

CLASSIFICATION OF SUBJECT MATTER

G06F 3/041 (2006.01) i

G06F 17/30 (2006.01) i