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(54) Title: WEB PAGE RENDERING ON WIRELESS DEVICES

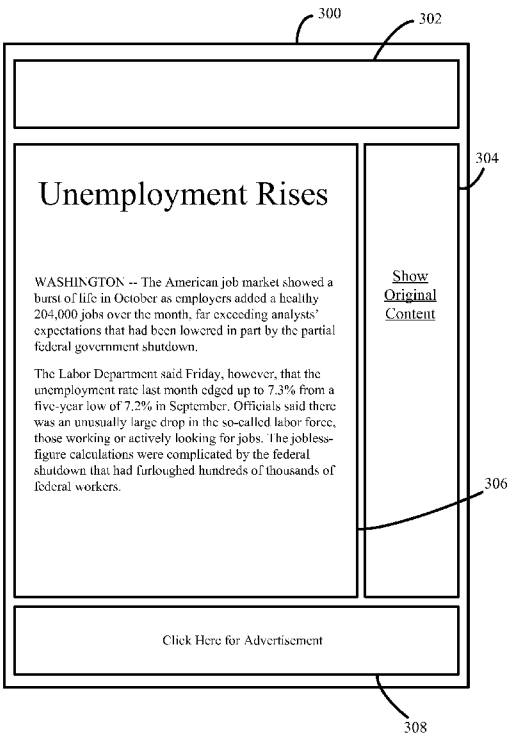

FIG. 3

(57) Abstract: A method and apparatus is described for rendering web pages by a wireless device in order to reduce an amount of data transmitted over-the-air to the wireless device. In one embodiment, a method is performed by a server, comprising receiving a markup language document from a web server via a network interface, the markup language document corresponding to a web page. Next, the markup language document is parsed into a number of blocks by a processor, each of the blocks comprising code representing original content of the web page. Then, the processor creates one or more replacement blocks, each of the replacement blocks corresponding to a respective one of the blocks, each of the replacement blocks comprising code representing substituted content of the web page. Some of the blocks and at least one of the replacement blocks are then sent to a wireless device for rendering.

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WEB PAGE RENDERING ON WIRELESS DEVICES

BACKGROUND

[001] The use of wireless devices, such as smartphones and tablets, has caused a revolution in the way people receive information. For example, surfing the World Wide Web via smartphone has become commonplace. In the past, the limited screen size, processing power, and bandwidth of wireless devices caused many web sites to offer simplified versions of their web pages, modifying the layout and minimizing the amount of data needed for over-the-air transmission. However, with recent technological advancements in wireless device technology, there is a trend today towards delivering original, complex web page content to wireless devices.

[002] While many wireless devices are now technologically capable of presenting original, complex web pages to users, there are a number of problems in doing so. For example, transmitting large amounts of data over-the-air may result in large data usage fees for consumers. Battery life of wireless devices may be reduced as a result of having to process complex web pages. Wireless data providers may experience a reduction in bandwidth. Finally, a significant portion of older wireless devices still in use are not capable of presenting these original, complex web pages in their web browsers.

SUMMARY

[003] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

[004] The embodiments described herein relate to web page rendering by wireless devices in order to reduce an amount of data transmitted over-the-air to the wireless devices. In one embodiment, a method is performed by a server, comprising receiving a markup language document from a web server via a network interface, the markup language document corresponding to a web page. Next, the markup language document is parsed into a number of blocks by a processor, each of the blocks comprising code representing original content of the web page. Then, the processor creates one or more replacement blocks, each of the one or more replacement blocks corresponding to a respective one of the blocks, each of the replacement blocks comprising code representing substituted content of the web page. Some of the blocks and at least one of the

replacement blocks are then sent to a wireless device via the network interface for rendering by the wireless device.

[005] In another embodiment, a wireless device for rendering web pages is described, comprising a memory for storing processor-executable instructions, a wireless transceiver, and a processor coupled to the memory and the wireless transceiver. The processor-executable instructions are executed by the processor, which causes the wireless device to transmit an HTTP request to a server and, in response, receive one or more blocks from the server, each of the blocks comprising markup language corresponding to original content of the requested web page. One or more replacement blocks are also received, each of the replacement blocks comprising markup language corresponding to substituted content of the requested web page. A modified web page is rendered on the wireless device based on the one or more blocks and the one or more replacement blocks on a user interface of the wireless device.

[006] In yet another embodiment, a system is described for rendering web pages on a mobile device, comprising a server that comprises a network interface for sending a modified version of a first web page to the wireless device, the modified version of the first web page comprising blocks and replacement blocks. The server further comprises a first processor coupled to the network interface and configured to parse a markup language document representative of the first web page into a number of the blocks, each of the blocks comprising code representing original content of the first web page, and to create one or more replacement blocks, each of the one or more replacement blocks corresponding to a respective one of the blocks, each of the replacement blocks comprising code representing substituted content of the first web page. The system further comprises the wireless device, comprising a wireless transceiver for transmitting HTTP requests to the server and for receiving the blocks and replacement blocks. The wireless device further comprises a second processor, coupled to the wireless transceiver, for generating the HTTP requests and for rendering the blocks and replacement blocks to form the modified web page, and a user interface for displaying the modified web page.

BRIEF DESCRIPTION OF THE DRAWINGS

[007] The features, advantages, and objects of the present invention will become more apparent from the detailed description as set forth below, when taken in conjunction with the drawings in which like referenced characters identify correspondingly throughout, and wherein:

[008] FIG. **1** illustrates one embodiment of a wireless communication system for use in rendering web pages by a wireless device in a manner that minimizes an amount of data transmitted over-the-air;

[009] FIG. **2** illustrates a typical web page displayed by a desktop computer, highlighting different sections of the web page;

[0010] FIG. **3** illustrates a modified web page of the web page shown in FIG. **2** that is displayed by the wireless device shown in FIG. **1**, the modified web page comprising some substituted content;

[0011] FIG. **4** illustrates another modified web page of the web page shown in FIG. **2** that is displayed by the wireless device shown in FIG. **1**, where the web page format has been modified;

[0012] FIG. **5** illustrates a functional block diagram of one embodiment of the proxy server shown in FIG. **1**;

[0013] FIG. **6** illustrates a functional block diagram of one embodiment of the wireless device shown in FIG. **1**;

[0014] FIG. **7** is a flow diagram illustrating one embodiment of a method for rendering web pages, performed by the proxy server shown in FIG. **1**;

[0015] FIG. **8** is a flow diagram illustrating one embodiment of a method for rendering web pages, performed by the wireless device shown in FIG. **1**;

[0016] FIG. **9** is a flow diagram illustrating one embodiment of an automatic data reduction method for rendering web pages by the wireless device shown in FIG. **1**.

DETAILED DESCRIPTION

[0017] The descriptions of embodiments disclosed herein relate to techniques for web page rendering by wireless devices that reduce the amount of data normally transmitted over-the-air to such wireless devices. The current trend in wireless technology today is to provide full, complex web pages to wireless devices, resulting in large amounts of data being transmitted over-the-air. The increase of data transmitted over-the-air typically results in increased wireless data costs for consumers, decreased battery life of wireless devices, decreased bandwidth available to service providers, and difficulties in processing the standard web pages on older wireless devices. The embodiments discussed herein, thus, minimize the amount of data transmitted over-the-air to wireless devices.

[0018] FIG. **1** illustrates one embodiment of a communication system for use in rendering web pages by wireless devices in a manner that minimizes an amount of data transmitted over-the-air. Shown is wireless device (WD) **100**, proxy server **102**, web

server **104**, and wide-area network **106**, such as the Internet. WD **100** may comprise a smartphone, a tablet computer, a laptop computer, a fixed, wireless data terminal, or virtually any other electronic device capable of wirelessly receiving and displaying information provided by a server, such as proxy server **102** or web server **104**.

[0019] Proxy server **102** comprises one or more electronic computing devices or other processing units configured to act as an intermediary for requests from wireless devices, such as WD **100**, seeking resources from other servers, such as web server **104**. For example, WD **100** may request a service provided by proxy server **102**, such as providing an HTML document to WD **100** for rendering and display to a user of WD **100**. Proxy server **102** comprises any device that executes instructions (e.g., as application programs, operating systems, and/or other processor-executable code) to implement the operations and functionality associated with proxy server **102**.

[0020] Web server **104** comprises one or more electronic computing devices or other processing units configured to offer information to clients via wide area network **106** in the form of web pages, downloadable files, text, images, and/or videos. Web server **104** is typically used to host web sites, although it could also be used for other purposes, such as gaming or running enterprise applications. The web server **104** may receive HTTP requests from the proxy server **102**, i.e., requests to provide web pages, typically in the form of a markup language document such as an HTML document, XML document, etc. Web server **104** comprises any electronic computing device executing instructions (e.g., as application programs, operating systems, and/or other, processor-executable code) to implement the operations and functionality associated with web server **104**.

[0021] Wide area network **106** comprises one or more information transmission networks, such as the Internet, cellular communication networks, satellite communication networks, cellular data networks, traditional telephone networks, radio networks, local area networks, or fiber optic networks, used to transport information from a source entity to a destination entity. For example, WD **100**, proxy server **102**, and web server **104** may all be considered source and destination entities. Typically, information is transmitted over at least some of wide area network **106** in the form of data packets using well-known communication protocols such as TCP/IP, FTP, SMTP, etc.

[0022] A user of WD **100** may send an HTTP request to view a web page offered by web server **104** using a web browser running on WD **100**. The HTTP request, typically in the form of a target IP address and resource request, is transmitted from WD **100** to proxy server **102** via wide area network **106**. Proxy server **102** receives the request and, in turn,

sends an HTTP request message to web server **104** for web server **104** to provide a markup language document representing an original version of the requested web page to proxy server **102**. The term "original" meaning that the markup language document is a "standard" or "full" version of a web page offered by web server **104** to client devices that are not bandwidth constrained, such as desktop or laptop computers connected to wide area network **106** via a high-speed data connection such as DSL, cable, or some other high-bandwidth connection technique. In other words, the markup language document from web server **104** represents a complex form of the requested web page, complete with HTML code, Javascrips, and Cascading Style Sheet (CSS). An example of an original web page showing original content is shown in FIG. **2** as original web page **200**, shown as it would be displayed on a desktop computer screen. FIG. **2** illustrates how a web page may comprise a number of sections. In this example, web page **200** comprises header section **202**, side section **204**, main section **206**, and footer section **208**. It should be understood that web page **200** is merely one example of a web page, and that other web pages might have a greater or fewer number of sections, and/or that multiple section types might be present, such as a web page having two or more side sections (e.g., right side section and left side section), main sections, headers, footers, etc. It should be further understood that in most cases, the lines defining the boundaries of each section are not present in typical web pages.

[0023] Each of the sections shown in FIG. **2** comprises original web page content, e.g., text, images, videos, hyperlinks, and other viewable information in a web page designed for a rendering on a non-limited display, such as on a desktop computer display. Original web page content may be differentiated between mobile web page content, which may comprise a simplified version of a web page, having a different format, look, or feel than a web page designed for non-mobile applications.

[0024] Header section **202** typically comprises text and/or images denoting an identification of the web site, in this case, www.msn.com, and other information. In this case, a search bar **210** is also present, allowing access to a convenient web search, along with tools such as Web, MSN, Images, Video, or News used for presenting the search results. Footer section **208** may comprise text, images, hyperlinks, videos, or other information distinct from other sections of web page **200**. In this case, footer section **208** comprises an advertisement in the form of a hyperlink for a web site called "bestcardeals.com". Side section **204** comprises another area of web page **200** distinct from other sections, and may comprise text, images, videos, hyperlinks or other

information. In the embodiment shown in FIG. **2**, side section **204** comprises a text advertisement for "Joe's". Main section **206** comprises text, images, videos, hyperlinks or other information generally related to the nature of the website. For example, main section **206** might comprise a recipe if the web page relates to food or recipes. In another example, main section **206** might comprise financial information if web page **200** is related to finance. In the present example shown in FIG. **2**, main section **206** comprises a text article about unemployment, where web page **200** is a general web "portal" having a variety of information and news articles.

[0025] The proxy server **102** receives the markup language document from web server **104** and, in response, parses the markup language document into two or more blocks of code representing original content of the web page. Such parsing may be performed by a proxy server **102** or web server **104**, in one embodiment, by executing a computer program that identifies blocks of code between certain markers contained in the markup language document. For example, a web page provided to proxy server **102** in the form of an HTML document may be parsed into multiple blocks, each block representing a section of original content of the web page. Each block may be defined as the HTML code contained between tags contained in the HTML document. Other embodiments of parsing are described later herein.

[0026] In one embodiment, the proxy server **102** ranks, rates, or otherwise prioritizes the blocks parsed from the web page by assigning a value to each block based on one or more characteristics of the blocks or the content that the blocks represent. The value may be based, for example, on a user desirability metric, i.e., whether the information represented by the block is determined to be highly desired by, or relevant to, the user, or to a majority of users, in which case a high value might be assigned, or whether the information represented by the block is of a secondary importance to most users, or to a particular user, and thus a low value might be assigned. The value may additionally, or alternatively, be based on a type of information contained in the block (i.e., advertisement, non-advertisement, video information, text information, image information), an amount of each of the types of information in any block (for example, a block having 5 or more videos might be assigned a low value), a size of the block (e.g., a large amount of data may be assigned a low value while a small amount of data may be assigned a high value, based on a predetermined threshold, such as 1 megabyte). The content represented by the block may be evaluated using text-recognition techniques to determine if the content may be less

desirable to users, such as an advertisement, or whether the content is more desirable to users, such as a news article, recipe, or other information-bearing content.

[0027] The possible number of values that may be assigned to blocks may vary in one embodiment verses another. For example, in one embodiment, blocks may be assigned one value out of two possible values while, in another embodiment, blocks are assigned one value out of five possible values, the values determined by comparing block/block content characteristics to one or more thresholds.

[0028] In one embodiment, blocks that are assigned a value less than a predetermined threshold are stored within the proxy server **102**, or at some other location, in conjunction with their respective values. In another embodiment, all blocks are stored in conjunction with their respective, assigned values. In yet another embodiment, none of the blocks are stored and some or all of the blocks are used to either create a modified markup language document representing a modified web page, or the blocks are sent to WD **100** as a response to the HTTP request, as will be discussed below.

[0029] In one embodiment, after values have been assigned to the blocks, the proxy server **102** may build a modified markup language document by using only blocks having a value greater than a predetermined threshold and replacing blocks that do not meet the threshold with replacement blocks, each of the replacement blocks comprising code representing substituted content of the web page. For example, a block representing a large file such as a video, assigned a low value, might be replaced by a replacement block comprising code that, when rendered by WD **100**, produces a simple visual graphic such as a blank space in a web browser or a blank space plus simple text or hypertext, and/or an icon, indicating that some of the original content of the web page has been replaced by the simple visual graphic. For example, a replacement block might comprise code or script that, when rendered by WD **100**, produces a text message/hyperlink on blank space or other simple background such as, “Press here to receive the original content”. The text or hypertext may provide an indication as to the nature of the original content, such as “Advertisement”, “Auto Advertisement”, “More News”, “Contact Information”, “Header”, “Footer”, “Video”, a vender name or website, etc. The modified markup language document is then provided to WD **100** via wide area network **106**.

[0030] Often, replacement blocks comprise less data than respective blocks that they replace, advantageously reducing the amount of data that is transmitted over-the-air to the WD **100** that requested the web page.

[0031] In another embodiment, rather than building a modified markup language document using blocks and replacement blocks, proxy server **102** sends the blocks and one or more replacement blocks to WD **100** for web page construction and rendering by WD **100** to create a modified version of the web page with at least some original content replaced by substitute content.

[0032] In one embodiment, WD **100** receives the modified markup language document constructed by proxy server **102** and renders a modified web page for display to the user via a web browser running on WD **100**. In another embodiment, WD **100** receives one or more high value blocks and one or more replacement blocks and renders these blocks to construct a modified web page. The modified web page is presented with one or more visual portions of the original web page replaced with substituted content, the substituted content comprising a simple visual graphic such as whitespace, text, hyper-text, or an icon, generated from one or more of the replacement blocks. In one embodiment, the modified web page presented to the user retains the formatting of the original web page. For example, each section retains its relative placement within the viewable area of the display. Such a rendering is shown in FIG. **3**.

[0033] FIG. **3** shows a modified web page **300** as it is rendered on WD **100**. The modified web page **300** comprises one visual section of original content **306**, corresponding to original content section **206** in FIG. **2** contained in the original web page, and three sections of substituted content **302**, **304**, and **308**. Again, it should be understood that in most cases, the lines defining the boundaries of each section are not displayed on typical web pages.

[0034] Sections **302**, **304**, and **308** illustrate sections of substituted content, each corresponding to a particular replacement block, shown in FIG. **3** as either a blank space (section **302**) or blank spaces with text and/or a hyperlink (sections **304** and **308**) instructing a user to "Show Original Content," or "Click Here" to retrieve original content such as an advertisement, a video, a full-sized image, etc. In one embodiment, the text/hypertext in sections of substituted content may provide an indication as to the type of original content that has been replaced. For example, in FIG. **3**, section **308** indicates that the original content comprises an advertisement, as opposed to a news article, or some other form of content. In another embodiment, further details may be provided regarding the type of original content, for example, the text/hypertext in section **308** might recite, "Click here for Auto Advertisement," "Click here for Buick Car Advertisement," "Click here for Amazon.com Deals", etc.

[0035] In another embodiment, the modified web page is reformatted to deliver a uniform presentation of the content represented by high value blocks to the user, as shown in FIG. **4**. In the example of FIG. **4**, a modified web page **400** comprises a header section **402** and a main section **404**, each of the header section **402** and main section **404** comprising original content from the original web page **200**. For example, the header section **402** might comprise a title of a web site associated with the original web page, while main section **404** might comprise one or more textual news articles from the original web page. However, formatting of the main section **402** may be modified such that it fills most of the modified web page **400**. As shown in FIG. **4**, the font of the news article has been increased to fill most of the viewable area of a visual display device of WD **100**.

[0036] If a user desires to view original content that is not visible to the user in the modified web page as a result of using one or more replaced blocks, the user may provide an indication to WD **100**, typically by touching an area of a touchscreen display corresponding to the substituted content, for example, an area on the modified web page displaying a simple background and/or a hyperlink that has been rendered from one or more replacement blocks.

[0037] In response, WD **100** sends a request to proxy server **102** to provide the original content associated with the substituted content identified by the user. In another embodiment, selection of any section of replaced content by a user results in a request to proxy server 102 to provide all of the original content associated with either the entire web page, or just the presently-viewable area of the modified web page. In one embodiment, in response to the user's request, proxy server **102** provides an original version of the markup language document previously received by proxy server **102** from web server **104**. In another embodiment, proxy server **102** retrieves one or more low value blocks stored in memory corresponding to the substituted content requested by the user, builds a second, modified markup language document using high value blocks and the low value blocks corresponding to the original content requested by the user, and sends this second, modified markup language document to WD **100**. In yet another embodiment, proxy server **102** retrieves and sends low value blocks corresponding to the original content requested by the user to WD **100** for rendering by WD **100**. Details of these embodiments are explained below.

[0038] FIG. **5** illustrates a functional block diagram of one embodiment of proxy server **102**. Proxy server **102** typically comprises a processor **500**, a memory **502**, a network interface **504**, and an optional user interface **506**. Proxy server **102** may comprise a

computer, server, or other processing device that executes processor-readable instructions stored in memory **502** that enables proxy server **102** to perform the functionality described herein. It should be understood that the functional blocks shown in FIG. **5** may be connected to one another in a variety of ways, and that some basic functionalities have been omitted (such a power supply function) for purposes of simplicity and clarity.

[0039] Processor **500** comprises a microprocessor, microcontroller, and/or other circuitry that is able to execute processor-executable instructions, and suitable for use in a server application setting. Alternatively, processor **500** may comprise a custom or semi-custom ASIC able to carry out the functionality required to reduce data transmitted over-the-air for rendering by WD **100**. Processor **500** performs the functionalities described herein by executing processor-executable instructions stored in memory **502**.

[0040] Memory **502** comprises one or more information storage devices accessible by processor **500** and may include one or both of volatile and nonvolatile media, and/or removable and/or non-removable media, but excludes propagated signals. By way of example, and not limitation, such as volatile and/or nonvolatile, removable and/or non-removable media may be implemented in any method or technology for storage of information such as processor-executable instructions, data structures, program modules, blocks of code representing sections of original content of web pages, replacement blocks of code representing substituted web page content, and/or other data. Memory **502** includes, but is not limited to, RAM, ROM, EEPROM, flash memory, optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other media suitable for use in a server application setting.

[0041] Network interface **504** comprises circuitry configured to transmit and receive information over wide area network **106**. Typically, network interface **504** comprises a wired or wireless Ethernet port, a T1 port, a T3 port, or other port typically used in the networking industry.

[0042] User interface **506** comprises circuitry for allowing a user of proxy server **102**, such as an authorized technician or service provider, to perform various duties related to the provisioning, maintenance, and/or upkeep of proxy server **102**. User interface **506** may comprise one or more commonly used input and/or output devices, such as a keyboard, mouse, touchscreen, video display, and/or virtually any other device that allows a user to interact with proxy server **102**.

[0043] FIG. **6** illustrates a functional block diagram of one embodiment of WD **100**. Specifically, FIG. **6** shows processor **600**, memory **602**, user interface **604**, and transceiver

606. It should be understood that the functional blocks shown in FIG. **6** may be connected to one another in a variety of ways, and that certain, basic functionalities have been omitted (such as power supply functionality) for purposes of simplicity and clarity.

[0044] Processor **600** comprises one or more processors, such as microprocessors, microcontrollers, custom or semi-custom ASICs that are configured to provide general operation of WD **100** by executing processor-executable instructions stored in memory **602**. Processor **600** is typically a processor designed for mobile telephony applications, such as a processor designed for low power consumption, small size, high processing power, and/or other features desirable in mobile processing applications. A wide variety of such processors are available in the marketplace today.

[0045] Memory **602** comprises one or more information storage devices that can be accessed by processor **600** and may include one or both of volatile and nonvolatile media, and/or removable and/or non-removable media, but excludes propagated signals. By way of example, and not limitation, such media may be implemented in any method or technology for storage of information, such as processor-executable instructions, data structures, program modules, or other data. Memory **602** includes, but is not limited to, RAM, ROM, EEPROM, flash memory, or other type of memory technology used in modern smartphone designs, optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store information necessary for operation of WD **100** and which can accessed by processor **600**. In typical applications, memory **602** comprises more than one memory type, for example, it is common to find both RAM memory as well as flash memory in modern smartphones.

[0046] Transceiver **606** comprises circuitry and/or firmware necessary for wirelessly transmitting and receiving information using one or more wireless protocols, such as any variety of CDMA, GSM, 802.11 (Wi-Fi), Wi-Fi Direct, LTE, WIMAX, etc. Transceiver **606** may comprise a single or multiple integrated circuits, discreet components, or custom or semi-custom ASICS, and are readily available in the marketplace.

[0047] User interface **604** is coupled to processor **600** and allows a user of WD **100** to operate and interact with WD **100**. For example, user interface **604** may comprise one or more pushbuttons, switches, sensors, touchscreens, keypads, keyboards, ports, and/or microphones that generate electronic signals for use by processor **600** upon initiation by a user. User interface **604** may additionally comprise one or more visual displays, such as a liquid crystal display (LCD), organic light-emitting diode (OLED), or any other type of

device for visual display of information to users. User interface **604** may alternatively, or in addition, comprise one or more audio generation devices, such as a speaker, as well as a tactile alert mechanism, such as a vibration-generation device that may be used to provide non-auditory signals to users. Of course, the aforementioned items could be used alone or in combination with each other and other devices may be alternatively, or additionally, used. In some implementations user interface **604** may support natural user interface (NUI) methods. Examples of NUI methods include those relying on speech recognition, touch and stylus recognition, gesture recognition both on screen and adjacent to the screen, air gestures, head and eye tracking, voice and speech, vision, touch, gestures, and machine intelligence. Specific categories of NUI technologies include touch sensitive displays, voice and speech recognition, intention and goal understanding, motion gesture detection using depth cameras (such as stereoscopic camera systems, infrared camera systems, rgb camera systems and combinations of these), motion gesture detection using accelerometers/gyroscopes, facial recognition, 3D displays, head, eye, and gaze tracking, immersive augmented reality and virtual reality systems, all of which provide a more natural interface, as well as technologies for sensing brain activity using electric field sensing electrodes (EEG and related methods).

[0048] FIG. **7** is a flow diagram illustrating one embodiment of a method for rendering web pages, as performed by proxy server **102**, in order to reduce the amount of data transmitted over-the-air to WD **100**. The method is implemented by processor **500** executing processor-executable instructions stored in memory **502**. It should be understood that in some embodiments, not all of the steps shown in FIG. **7** are performed and/or that the order in which the steps are carried out may vary. Finally, some minor method steps have been omitted for purposes of clarity and simplicity.

[0049] At block **700**, proxy server **102** may receive an HTTP request from WD **100** to provide one or more web pages to WD **100** using a data reduction mode. The data reduction mode reduces the amount of data transmitted over the air to WD **100**. The request may instruct proxy server **102** to enter into a particular data reduction mode, such as a mode that utilizes an image compression technique and/or a block replacement technique, or it may simply instruct proxy server **102** to enter into a data reduction mode determined by proxy server **102**. For example, upon receiving a first request to enter into a data reduction mode, proxy server **102** may be programmed to begin providing web pages to WD **100** using image compression techniques and, upon receipt of a second request, begin providing web pages to WD **100** using the block replacement technique. In any case,

proxy server **102** provides subsequent web page information to WD **100** using at least one data reduction technique.

[0050] At block **702**, proxy server **102** requests a markup language document from a web server via network interface **504**, the markup language document typically corresponding to a web page. Proxy server **102** may request the markup language document as a result of receiving an HTTP request from WD **100**, or it may request the markup language document as part of an autonomous process to archive a large number of web pages.

[0051] At block **704**, proxy server **102** receives the requested markup language document from web server **104** via network interface **504** and provides it to processor **500**.

[0052] At block **706**, proxy server **102** parses the received markup language document into two or more blocks, each block comprising code representing a portion of the original web page. In one embodiment, at least some of the blocks are created using a section of code from the markup language document received from web server **104**. In one embodiment, at least some of the blocks are created by copying markup language between a "start" tag and an "end" tag found in the markup language document provided by web server **104**. In general, any other HTML element could be used to parse the markup language document, including elements such as "Body", "Table", "Row", "Section", "Footer", "Header", etc. In another embodiment, text files may be parsed using the "textfieldparser" object in Visual Basic. In yet another embodiment, an HTML DOM object tree is compared against a library of known section-delimiting information. In yet still another embodiment, markup language documents are parsed based on a visual presentation of the content on a device. For example, a long web page may be viewable only by scrolling down or sideways on WD **100**. In this case, the content normally shown at the top portion of the long web page is parsed as one block, and the content normally shown only after scrolling is parsed as a second block. Other embodiments include the use of open source tools such as Nreadability or HtmlAgilityPack. In any of these embodiments, Xpath strings are typically generated which are used to form blocks and/or replacement blocks.

[0053] At block **708**, proxy server **102** may assign a value to at least some of the blocks based on a characteristic of the block itself, or the content of the block when rendered by WD **100**. For example, the value assigned to any block could be based on a user desirability metric, i.e., whether the information represented by the block is determined to be highly desired by, or relevant to, the user, or to a majority of users, in which case a high

value might be assigned, or whether the information represented by the block is of a secondary importance or relevance to most users, or to a particular user, and thus a low value might be assigned. The value may additionally, or alternatively, be based on a type of information contained in the block (i.e., advertisement, non-advertisement, video information, text information, image information), an amount of each of the types of information in any block (for example, a block having 5 or more videos might be assigned a low value), a size of the block (e.g., a large amount of data may be assigned a low value while a small amount of data may be assigned a high value, based on a predetermined threshold, such as 1 megabyte). For example, if a web page is related to food recipes, a recipe for apple pie may be determined to be particularly relevant and desirable for users to view, and blocks relating to the recipe or a digital image of a pie are assigned a "high" value. A "low" value may be assigned to content not as desirable or relevant to a user or group of users as "high" value content. The characteristics of a block may include the size of a block or an amount of data contained within a block. For example, blocks containing a large amount of data may indicate, for example, a video, and may be assigned a "low" value, while small blocks, possibly representing text, may be assigned a "high" value. One or more block size thresholds could be established by an administrator of proxy server **102** or by a user of WD **100** and used to assign values by block size as compared to the thresholds. For example, blocks having a size less than a first threshold could be assigned a first value, blocks exceeding the first threshold and less than a second threshold could be assigned a second value, while blocks exceeding the third threshold could be assigned a third value. Values may comprise two or more values, for example, two values (i.e., high relevancy or low relevancy), three values (i.e., "small", "medium", or "large" block sizes, etc.), ten values (i.e., a value between one and ten, ten being the highest value and one being the lowest value), etc.

[0054] At block **710**, in one embodiment, at least some of the blocks are stored in memory **502** for use in subsequent HTTP requests or to provide original web page content to WD **100**, as explained below.

[0055] In one embodiment, at block **712**, processor **500** builds a modified markup language document by replacing at least one block assigned with a low value with a replacement block having substituted content. The substituted content typically contains less information than the block that it replaces which results in a reduction in the amount of data transmitted over-the-air to WD **100**. In other words, the modified markup language document is constructed from one or more blocks designated as high value and one or

more replacement blocks designated as lower value. When rendered by a web browser on WD **100**, the modified markup language document will appear to be missing sections of visual content relating to the low value blocks that were replaced during construction of the modified markup language document by processor **500**, as shown in FIG. **3**. In one embodiment, a replacement block comprises markup language that, when rendered by a web browser, inserts a simple visual graphic, such as a blank space, into a section of the web page, replacing original content assigned a low value by processor **500**. In another embodiment, the replacement block comprises markup language that, when rendered by a web browser, provides a blank space along with a text message indicating that some original content has been purposely replaced, and/or a hypertext message for the user to press in order to view the original content.

[0056] In another embodiment, rather than construct a modified markup language document at block **712**, processor **500** selects one or more high value blocks and one or more replacement blocks created from the markup language document provided by web server **104** for transmission to WD **100** for rendering by WD **100**. Selection of blocks by processor **500** may be based on keeping the total amount of data transmitted over-the-air less than a predetermined amount, either as a percentage of the size of the markup language document or a predetermined fixed or variable size. In one embodiment, the blocks are analyzed by processor **500** to determine if the content of any blocks are related to advertisement content, for example visual and/or textual content promoting the purchase of goods or services. If so, these blocks may be replaced with replacement blocks that are transmitted to WD **100** instead of the blocks determined to be advertisement related.

[0057] At block **714**, the modified markup language document, or simply the high value blocks and selected replacement blocks, is/are sent to WD **100** via network interface **504** and wide area network **106**.

[0058] At block **716**, proxy server **102** receives a request from WD **100** to provide at least some of the original content that was replaced by the one or more replacement blocks sent at block **714**. The request may identify a particular section of the modified web page to be updated with original content, may comprise a request to download the next-higher value block(s) of content, or may comprise a request to provide all of the low value blocks that were not sent to WD **100** at block **700** **714**. The request may comprise an identification of particular blocks to send to WD **100**, an instruction to send any block assigned a certain value identified by WD **100**, an indication to send low value blocks in

order to render an entire first page of a web page, an indication to send all blocks related to the web page, or some other variation or combination of instructions.

[0059] In one embodiment, at block **718**, processor **500** builds a second markup language document using the high value blocks stored in memory **502**, as well as any low value blocks associated with original content requested by WD **100** at block **716**. In another embodiment, processor **500** does not build a second markup language document but, rather, identifies and retrieves from memory **502** low value blocks associated with original content requested by WD **100**. In another embodiment where blocks are not stored in memory **500**, processor **500** requests the original markup language document from web server **104**, parses the markup language document as in block **706**, and provides the requested original content block(s) to WD **100**.

[0060] At block **720**, the second markup language document is sent to WD **100** via network interface **504** and wide area network **106**. In another embodiment, the low value block(s) associated with original content requested by WD **100** is sent to WD **100** via network interface **504** and wide area network **106**. In yet another embodiment, both high value block(s) and the low value block(s) associated with original content requested by WD **100** is sent to WD **100**.

[0061] At block **722**, in one embodiment, some blocks stored in memory **502** at proxy server **102** may have their values changed by processor **500** if the content represented by a particular block has been requested more than a predetermined number of times, indicating content that is highly desired by users. Processor **500** may re-assign a higher value to any block having content that was requested a number of times greater than the predetermined threshold. For example, proxy server **102** may initially assign a low value to an advertisement. Subsequently, proxy server **102** receives more than **100** requests to provide the advertisement in original content requests, described above with respect to blocks **716 - 720**. In response, processor **500** re-assigns a higher value to the low value block corresponding to the advertisement.

[0062] In another related embodiment, in a single web browsing session with WD **100**, processor **500** re-assigns block values based on a number of times that a particular section of web sites are requested by a particular user or particular WD **100**. For example, processor **500** may initially assign a low value to blocks representing the "comments" section commonly found on many web pages, and replace this content with replacement blocks for rendering by WD **100** into a modified web page lacking the comments. Subsequently, processor **500** can determine that WD **100** has requested the comments

section of one or more web pages more than 20 times. Processor **500** can then re-assign a higher value to blocks related to "comments".

[0063] FIG. **8** is a flow diagram illustrating one embodiment of a method for rendering web pages, as performed by WD **100**, in order to reduce the amount of data transmitted over-the-air to WD **100**. The method is implemented by processor **600** executing processor-executable instructions stored in memory **602**. It should be understood that in some embodiments, not all of the steps shown in FIG. **8** are performed and/or that the order in which the steps are carried out may vary. Finally, some minor method steps have been omitted for purposes of clarity and simplicity.

[0064] At block **800**, in one embodiment, a data reduction mode is chosen by a user of WD **100** via a browser operating on WD **100**. In this embodiment, one of several data reduction modes are available when viewing web pages in the browser. In one embodiment, four data reduction modes are available: a Data Reduction Off mode, a Low Data Reduction mode, a High Data Reduction mode, and an Automatic Data Reduction mode. In other embodiments, a greater, or fewer, modes are available. For example, in one embodiment, only a Data Reduction Off mode and High Data Reduction mode is available. The mode may be pre-set in the operating system of WD **100** or as a user-changeable setting in a browser application running on WD **100**. Additionally, or alternatively, a user may be prompted to select a data reduction mode by the operating system running on WD **100** or by the web browser. For example, the operating system or web browser may prompt a user to select a data reduction mode each time the user launches the web browser by providing a pop-up window that is displayed to the user with a menu of data reduction mode selections. The user may select one of the data reduction modes from the pop-up window. In another embodiment, the user is prompted to select a data reduction mode when WD **100** has consumed a predetermined amount of wireless data, for example, when WD **100** is nearing a predetermined periodic data consumption limit of the user's wireless data service contract.

[0065] In the Data Reduction Off mode, the web browser behaves in a typical manner, requesting web pages from web server **104**, with no reduction in the amount of data transmitted over-the-air to WD **100**. Original, complex web pages are, thus, rendered by the browser for display to a user.

[0066] In the Low Data Reduction mode, one or more techniques may be used to reduce some amount of data transmitted over-the-air to WD **100**, but less than in the High Data Reduction mode. In one embodiment, as a result of being placed in the Low Data

Reduction mode, subsequent HTTP requests are sent to proxy server **102**, rather than to web server **104**. In this embodiment, the Low Data Reduction technique is performed by proxy server **102**, rather than web server **104**. However, in other embodiments, the low data reduction technique could be performed by web server **104** and, therefore, HTTP requests continue to be sent to web server **104** while the browser is in the Low Data Reduction mode.

[0067] The High Data Reduction mode is described with respect to blocks **802** and on, below.

[0068] The Automatic Data Reduction mode is described with respect to the flow diagram of FIG. **9** later herein.

[0069] At block **802**, an indication of the selected data reduction mode is transmitted to either proxy server **102** or web server **104**, depending on which server is configured to use data reduction techniques. In response to receiving the indication, proxy server **102** or web server **104** enters a data reduction mode, as described above with respect to the method of FIG. **7**.

[0070] At block **804**, a user of WD **100** provides an indication, via user interface **604**, to a web browser running on WD **100** of the user's desire to view a web page offered by web server **104**. For example, a user may type in a domain name into the browser and press "Enter".

[0071] At block **806**, processor **600** receives the indication from user interface **604**, and transmits an HTTP request to proxy server **102**, via transceiver **606** and wide area network **106**, for proxy server **102** to provide the requested web page. In this embodiment, HTTP requests are transmitted to proxy server **102**, rather than to web server **104**, as a result of the browser being placed in the High Data Reduction mode, as proxy server **102** is configured to provide a reduction in the amount of data transmitted over-the-air to WD **100**, while web server **104** is typically not configured to do so. In other embodiments, this data reduction technique could be performed by web server **104** rather than proxy server **102** and, therefore, HTTP requests are sent to web server **104**, rather than to proxy server **102**.

[0072] At block **808**, a modified version of the web page is received by WD **100** from either proxy server **102** or web server **104** via wide area network **106** and transceiver **606** in the form of a modified markup language document, wherein at least some of the original content of the web page has been replaced by proxy server **102** or web server **104** with substituted content. The substituted content typically contains less information than

the block that it replaces which results in a reduction in the amount of data transmitted over-the-air to WD **100**. When rendered by a web browser on WD **100**, the modified markup language document will appear to be missing sections of visual content relating to the low value blocks that were replaced during construction of the modified markup language document by proxy server **102** or web server **104**. In one embodiment, a replacement block comprises markup language that, when rendered by a web browser, inserts a simple visual graphic, such as a blank space, into a section of the web page, replacing original content that was assigned a low value by proxy server **102** or web server **104**. In another embodiment, the replacement block comprises markup language that, when rendered by a web browser, provides a blank space along with a text message indicating that some original content has been purposely replaced, and/or a hypertext message for the user to press in order to view the original content.

[0073] In another embodiment, rather than receive a modified markup language document at block **808**, WD **100** receives one or more high value blocks and one or more replacement blocks from proxy server **102** or web server **104**. The creation of replacement blocks and the selection of high value blocks and replacement blocks are explained above with respect to the method of FIG. **7**.

[0074] At block **810**, the modified markup language document is provided by processor **600** to the web browser running on WC **100**, and the web browser renders the modified markup language document for presentation to the user via user interface **604**. In another embodiment, processor **600** provides the high value blocks and the replacement blocks to the browser for rendering, forming the modified web page.

[0075] At block **812**, a request is received by processor **600** from the user interface **604** indicating that the user wishes to view at least some of the original content that was replaced by substituted content in the modified web page. The request may identify a particular section of the modified web page to be updated with original content. The request may, alternatively, comprise a request to download the next-higher value block(s) of content, an indication to provide all of the low value blocks to WD **100**, a request to provide all content shown in the display of WD **100**, or some other request to provide additional content to WD **100**.

[0076] At block **814**, the request for original content is transmitted to proxy server **102** or web server **104** via transceiver **606** and wide area network **606**.

[0077] At block **816**, a second markup language document is received by WD **100** via transceiver **606** and provided to processor **600**. In another embodiment, the low value

block(s) associated with original content requested by WD **100** is received by WD **100** via transceiver **606** and provided to processor **600**. In yet another embodiment, both high value block(s) and the low value block(s) associated with original content requested by WD **100** is received by WD **100**.

[0078] At block **818**, in one embodiment, processor **600**, provides the second markup language document to the web browser for rendering into a second modified web page for display via interface **606**. In another embodiment, processor **600** provides the high value block(s) and the low value block(s) received at block **816** to the web browser for rendering into the second modified web page. In another embodiment, the low value block(s) received at block **816** is/are rendered into the second modified web page without having to re-render the original content of the modified web page. The second modified web page now contains additional original content that had been replaced by substitute content in the modified web page. In one embodiment, a selected portion of the second modified web page now displays the original content. In another embodiment, other sections of original content are displayed, in addition to the section selected by the user at block **812**. For example, an entire web page, or an entire first page of a web page, could be displayed.

[0079] FIG. **9** is a flow diagram illustrating one embodiment of execution of the Automatic Data Reduction mode, mentioned above with respect to the description of the method shown in FIG. **8**. The method is implemented by processor **600** residing with WD **100**, executing processor-executable instructions stored in memory **602**. It should be understood that in some embodiments, not all of the steps shown in FIG. **9** are performed and/or that the order in which the steps are carried out may vary. Finally, some minor method steps have been omitted for purposes of clarity and simplicity.

[0080] At block **900**, a user of WD **100** may select an Automatic Data Reduction mode for use in web browsing. In this mode of operation, processor **600** automatically determines whether to invoke any over-the-air data reducing techniques available to WD **100** based on one or more factors, as explained below. The user may select the Automatic Data Reduction mode as a result of being provided a menu of operating mode choices, for example each time a web browser is launched, upon processor **600** determining that a monthly data usage limit is being approached or exceeded, or available as a general setting for access at any time by the user of WD **100**. In another embodiment, the Automatic Data Reduction mode could be a default setting for the web browser.

[0081] At block **902**, processor **600** determines how much data WD **100** has received over a particular time period and how close the user is to exceeding a predetermined

periodic data limit for the particular time period. For example, processor **600** may store a value in memory **602** indicative of the cumulative amount of data received since the start of a predetermined time period, for example, the start of a billing cycle. Processor **600** determines whether WD **100** has exceeded the periodic data consumption limit by comparing the value of the cumulative data received to either the periodic data consumption limit, or one or more predetermined data usage thresholds set to invoke data reduction techniques well before the periodic data consumption limit is reached. The predetermined data usage thresholds each may represent a predetermined percentage of the periodic data consumption limit, or comprise a fixed or variable number.

[0082] Processor **600** may determine whether any usage threshold has been reached upon the user launching the web browser on WD **100**, on a continuous basis, or at periodic time intervals. In one embodiment, the one or more data consumption thresholds and the periodic data consumption limit may be set by the user via user interface **604**, or it may be set by the wireless data service provider, or a combination of both. For example, the first data consumption threshold may be initially set by the service provider and then modifiable by a user. In any case, the one or more data consumption thresholds and periodic data consumption limit are stored in memory **602**.

[0083] At block **904**, processor **600** determines that WD **100** has exceeded a first data consumption threshold, or is approaching or has exceeded a periodic data consumption limit. For example, if the periodic data consumption limit is 1G byte per month and the first data consumption threshold is **600**M bytes, processor **600** may determine that WD **100** has exceeded the first data consumption threshold.

[0084] In one embodiment, at block **906**, upon exceeding the first data consumption threshold, processor **600** invokes one or more data reduction techniques by sending future HTTP requests to proxy server **102**, rather than to web server **104**. In another embodiment, processor **600** invokes one or more data reduction techniques by requesting a particular type of data reduction technique from either proxy server **102** or web server **104**. For example, processor **600** could request that proxy server **102**, or web server **104**, begin using the image compression technique and/or the block replacement technique, both described above. In yet another embodiment, processor **600** alerts proxy server **102** or web server **104** to begin sending reduced-sized web pages in a manner determined by proxy server **102** or web server **104**. For example, proxy server **102** or web server **104** could be configured to first reduce the size of web pages provided to WD **100** using the image

compression technique, followed by the block replacement technique if a subsequent request to reduce over-the-air transmission is received from WD **100**, as discussed below.

[0085] In one embodiment, more than one data consumption threshold is used to reduce the amount of data transmitted over-the-air to WD **100**. Thus, at block **908**, at some time after the determination at block **904**, processor **600** determines that WD **100** has exceeded a second data consumption threshold. The second data consumption threshold may be set closer to the periodic data consumption limit than the first data consumption threshold. For example, if the periodic data consumption limit is 1G byte, and the first data consumption threshold is 600M bytes, then the second data consumption threshold set could be set something closer to 1G byte, such as 800M bytes.

[0086] As a result of determining that WD **100** has exceeded the second data consumption threshold, at block **910**, processor **600** invokes one or more of the data-reducing techniques discussed above, either in addition or alternative, to a data-reduction technique already invoked as a result of exceeding the first data consumption threshold at block **904**. For example, if proxy server **102** had already been using an image compression technique to transmit web pages to WD **100**, processor **600** could send a message to instruct proxy server **102** instructing proxy server **102** to stop using the image compression technique and begin using the block replacement technique. In another embodiment, processor **600** sends a message to proxy server **102** to use the block replacement technique in addition to the image compression technique. Proxy server **102** responds to future HTTP requests from WD **100** in accordance with one or more data reduction techniques, until WD **100** provides an indication to proxy server **102** to either stop all data reduction techniques, or to use only one or more selected data conservation techniques.

[0087] The methods or algorithms described in connection with the embodiments disclosed herein may be embodied directly in hardware, in processor-executable instructions executed by a processor, or in a combination of the two. The processor-executable instructions may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal or communication device. In the alternative, the processor and the storage medium may reside as discrete components.

[0088] Accordingly, various embodiments of the ideas presented herein may include a computer readable media embodying a code or processor-readable instructions to implement the methods of operation of the system in accordance with the methods, processes, algorithms, blocks and/or functions disclosed herein.

[0089] The subject matter described herein can be implemented as software, or processor-executable instructions, that is/are stored in one or more storage media. Such instructions, when executed by a computer, processor or other machine, may cause the computer, processor or other machine to perform one or more acts of a method. The instructions to perform the acts could be stored on one medium, or could be spread out across plural media, so that the instructions might appear collectively on the one or more computer-readable media, regardless of whether all of the instructions happen to be on the same medium. The term "computer-readable media" does not include signals per se; nor does it include information that exists solely as a propagating signal. It will be understood that, if the claims herein refer to media that carry information solely in the form of a propagating signal, and not in any type of durable storage, such claims will use the terms "transitory" or "ephemeral" (e.g., "transitory computer-readable media", or "ephemeral computer-readable media"). Unless a claim explicitly describes the media as "transitory" or "ephemeral," such claim shall not be understood to describe information that exists solely as a propagating signal or solely as a signal per se. Additionally, it is noted that "hardware media" or "tangible media" include devices such as RAMs, ROMs, flash memories, and disks that exist in physical, tangible form; such "hardware media" or "tangible media" are not signals per se. Moreover, "storage media" comprises media that store information. The term "storage" is used to denote the durable retention of data. For the purpose of the subject matter herein, information that exists only in the form of propagating signals is not considered to be "durably" retained. Therefore, "storage media" include disks, RAMs, ROMs, etc., but does not include information that exists only in the form of a propagating signal because such information is not "stored".

[0090] While the foregoing disclosure shows illustrative embodiments, it should be noted that various changes and modifications could be made herein without departing from the scope of the invention as defined by the appended claims. The functions, blocks and/or actions of the method claims in accordance with the embodiments of the invention described herein need not be performed in any particular order. Furthermore, although elements of the invention may be described or claimed in the singular, the plural is contemplated unless limitation to the singular is explicitly stated.

CLAIMS

1. A method performed by a server, comprising:

receiving a markup language document from a web server via a network interface, the markup language document corresponding to a web page;

parsing the markup language document into a number of blocks by a processor, each of the blocks comprising code representing original content of the web page;

creating one or more replacement blocks by the processor, each of the one or more replacement blocks corresponding to a respective one of the blocks, each of the replacement blocks comprising code representing substituted content of the web page; and

sending some of the blocks and at least one of the replacement blocks to a wireless device via the network interface for rendering by the wireless device.

2. The method of claim 1, further comprising:

assigning a first value to one or more of the blocks, the first value indicative of a characteristic of the original content represented by a particular block;

wherein sending some of the blocks and at least one of the replacement blocks comprises replacing at least one of the blocks assigned with the first value with a replacement block.

3. The method of claim 1, further comprising:

receiving a request from the wireless device to provide original content corresponding to at least one of the replacement blocks; and

sending at least one block comprising the requested original content to the wireless device.

4. The method of claim 1, further comprising:

receiving an indication from the wireless device that the wireless device has exceeded a predetermined data usage threshold; and

increasing the number of replacement blocks provided to the wireless device in response to future web page requests by the wireless device, verses a number of replacement blocks provided to other wireless devices for the same future web page requests.

5. A wireless device for rendering web pages, comprising:

a memory for storing processor-executable instructions;

a wireless transceiver;

a processor, coupled to the memory and the wireless transceiver, for executing the processor-executable instructions that cause the wireless device to:

transmit an HTTP request to a server;

receive one or more blocks from the server, each of the blocks comprising markup language corresponding to original content of the requested web page, and one or more replacement blocks, each of the replacement blocks comprising markup language corresponding to substituted content of the requested web page;

render a modified web page based on the one or more blocks and the one or more replacement blocks;

and

a user interface for displaying the modified web page.

6. The wireless device of claim 5, wherein the processor-executable instructions further comprise instructions that causes the wireless device to:

receive an indication from the user to provide a first portion of original content corresponding to a first portion of substituted content displayed in the modified web page;

transmit a second request to provide the first portion of original content;

receive one or more one or more blocks corresponding to the requested first portion of original content; and

render a second web page based on the one or more blocks and the one or more blocks corresponding to the requested first portion of original content requested by the user;

wherein the user interface is further configured to display the second web page to the user.

7. The wireless device of claim 6, wherein the user interface comprises a touchscreen and the second request comprises an identification of a first visual portion of the modified web page having the substituted content.

8. The wireless device of claim 6, wherein the second web page comprises the original content of the requested web page.

9. The wireless device of claim 6, wherein the requested web page comprises a first web page and a second web page, wherein the modified web page comprises the first page, and the second web page comprises the first page and the second web page.

10. A system for reducing an amount of data transmitted over-the-air from a server to a wireless device, comprising:

the server, comprising:

a network interface for sending a modified version of a first web page to the wireless device, the modified version of the first web page comprising blocks and replacement blocks; and

a first processor coupled to the network interface and configured to parse a markup language document representative of the first web page into a number of the blocks, each of the blocks comprising code representing original content of the first web page, and to create one or more replacement blocks, each of the one or more replacement blocks corresponding to a respective one of the blocks, each of the replacement blocks comprising code representing substituted content of the first web page;

and

the wireless device, comprising:

a wireless transceiver for transmitting HTTP requests to the server and for receiving the blocks and replacement blocks;

a second processor, coupled to the wireless transceiver, for generating the HTTP requests and for rendering the blocks and replacement blocks to form the modified web page;

and

a user interface for displaying the modified web page.

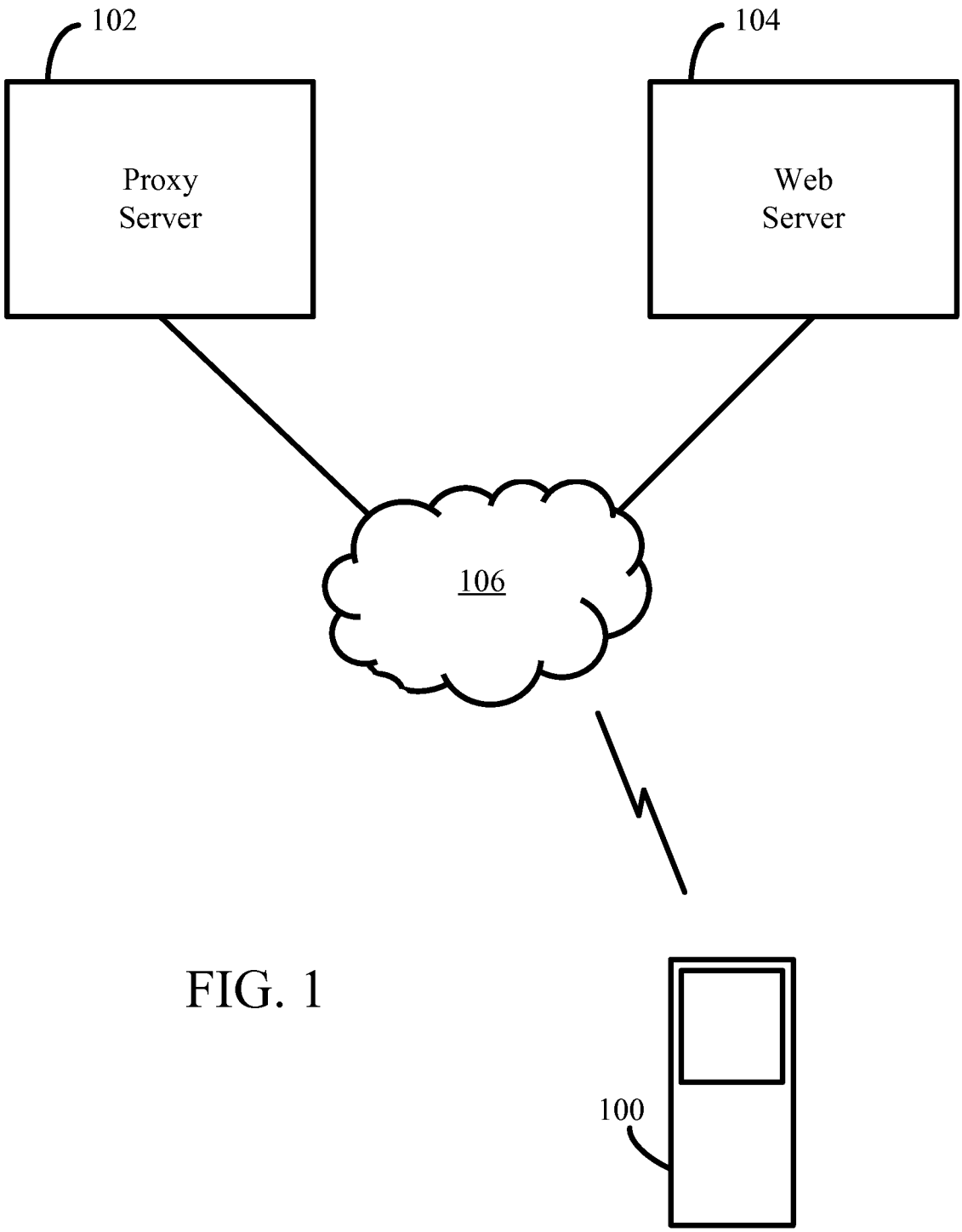


FIG. 1

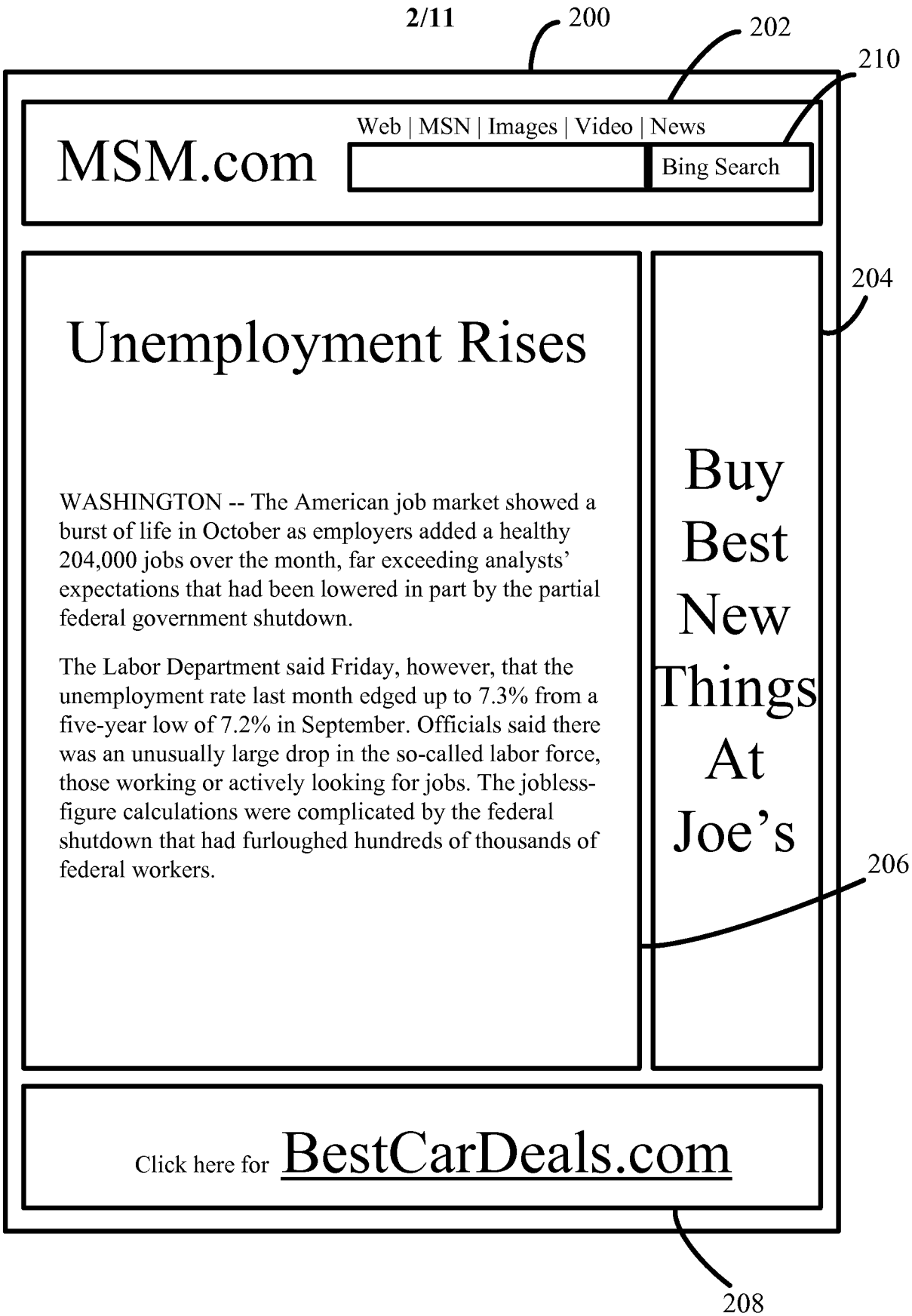

200
202
210
Web | MSN | Images | Video | News
MSM.com
Bing Search
204
Unemployment Rises
WASHINGTON -- The American job market showed a burst of life in October as employers added a healthy 204,000 jobs over the month, far exceeding analysts' expectations that had been lowered in part by the partial federal government shutdown.
The Labor Department said Friday, however, that the unemployment rate last month edged up to 7.3% from a five-year low of 7.2% in September. Officials said there was an unusually large drop in the so-called labor force, those working or actively looking for jobs. The jobless-figure calculations were complicated by the federal shutdown that had furloughed hundreds of thousands of federal workers.
Buy Best New Things At Joe's
206
Click here for BestCarDeals.com
208

FIG. 2

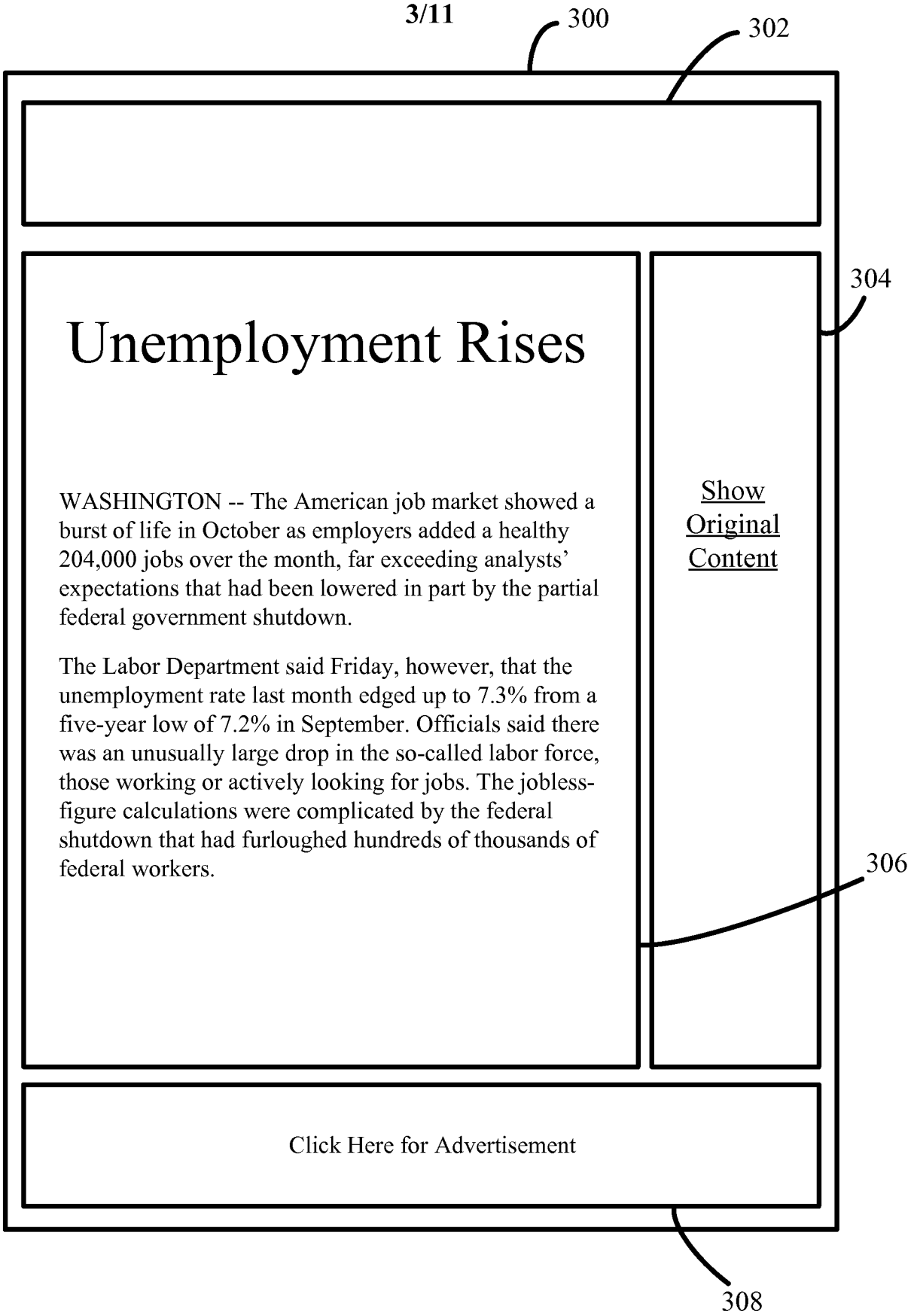

300
302
304
Unemployment Rises
WASHINGTON -- The American job market showed a burst of life in October as employers added a healthy 204,000 jobs over the month, far exceeding analysts' expectations that had been lowered in part by the partial federal government shutdown.
The Labor Department said Friday, however, that the unemployment rate last month edged up to 7.3% from a five-year low of 7.2% in September. Officials said there was an unusually large drop in the so-called labor force, those working or actively looking for jobs. The jobless-figure calculations were complicated by the federal shutdown that had furloughed hundreds of thousands of federal workers.
Show Original Content
306
Click Here for Advertisement
308

FIG. 3

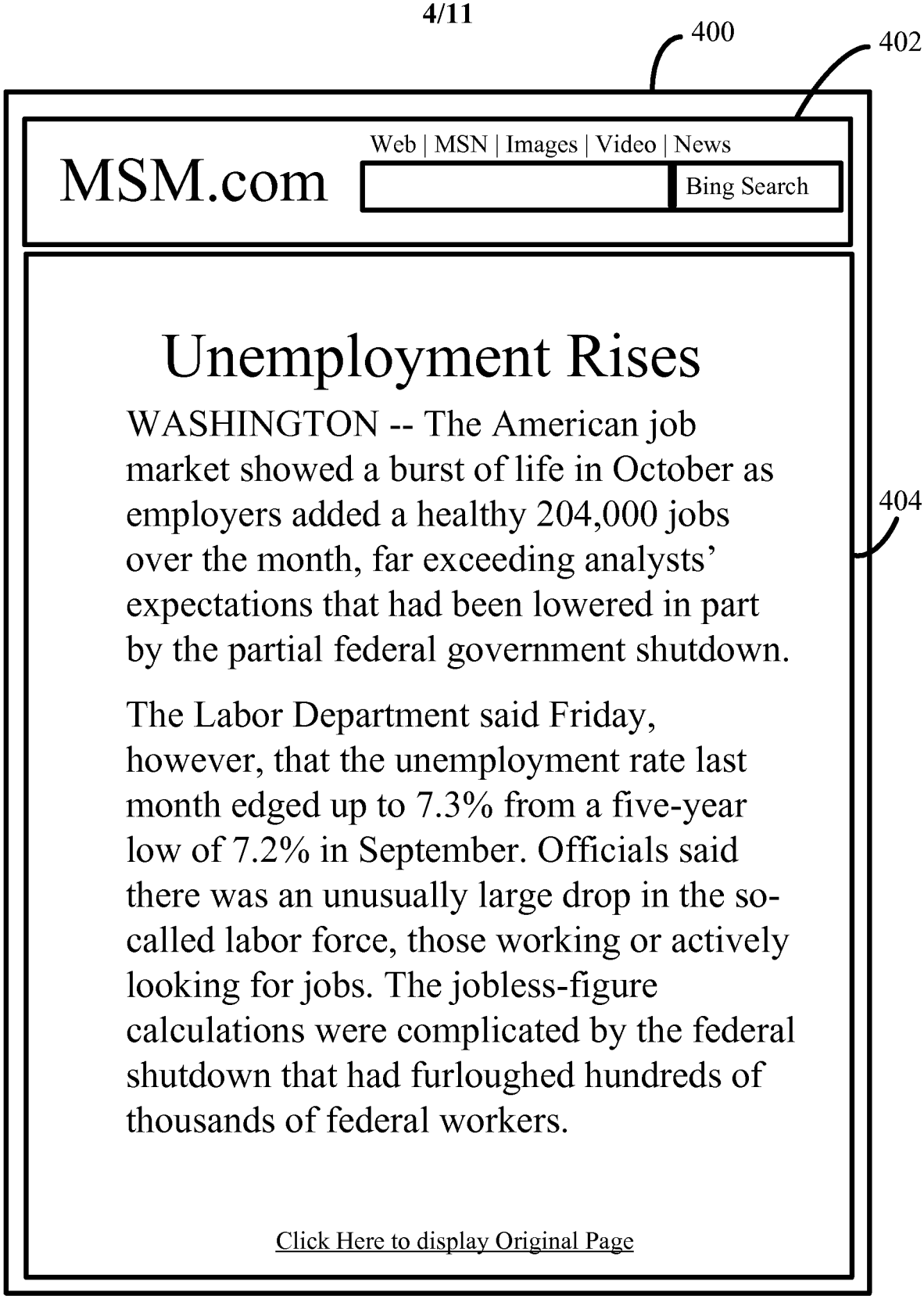

400
402
MSM.com
Web | MSN | Images | Video | News
Bing Search
Unemployment Rises
WASHINGTON -- The American job market showed a burst of life in October as employers added a healthy 204,000 jobs over the month, far exceeding analysts' expectations that had been lowered in part by the partial federal government shutdown.
The Labor Department said Friday, however, that the unemployment rate last month edged up to 7.3% from a five-year low of 7.2% in September. Officials said there was an unusually large drop in the so-called labor force, those working or actively looking for jobs. The jobless-figure calculations were complicated by the federal shutdown that had furloughed hundreds of thousands of federal workers.
Click Here to display Original Page
404

FIG. 4

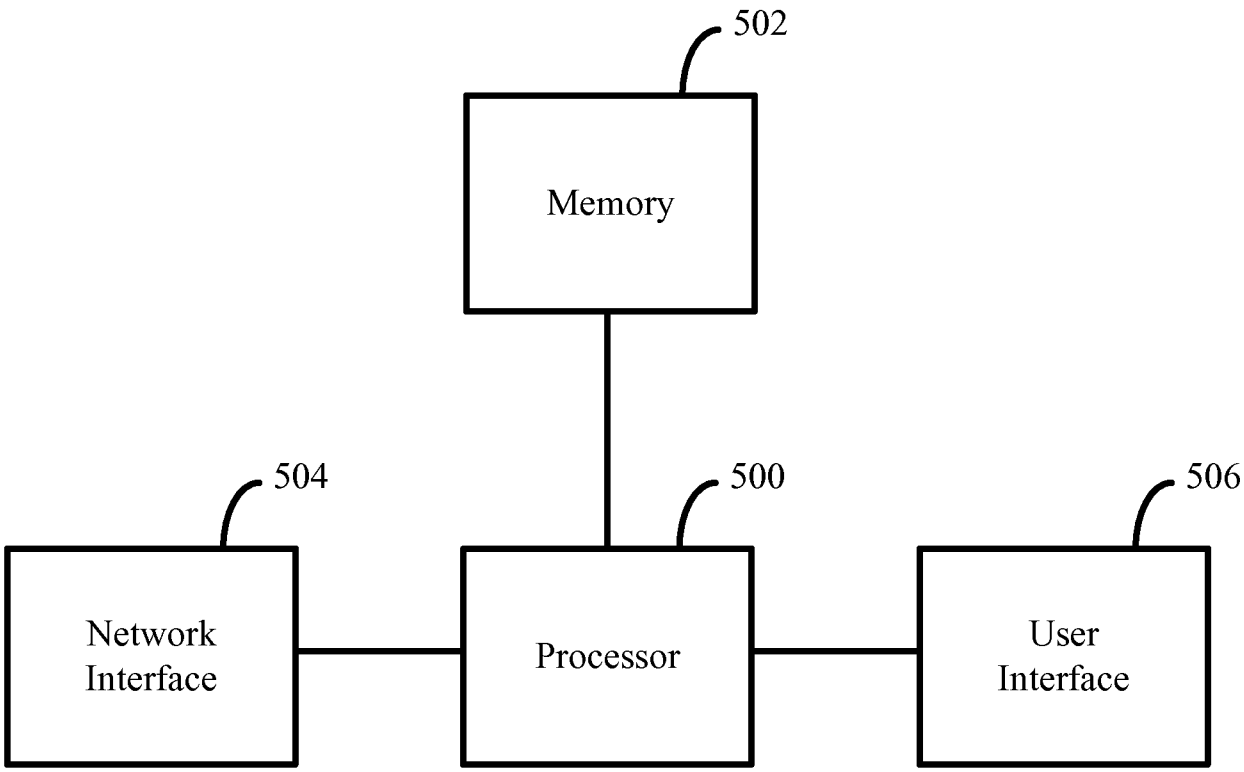

502
Memory
504
500
506
Network Interface
Processor
User Interface

FIG. 5

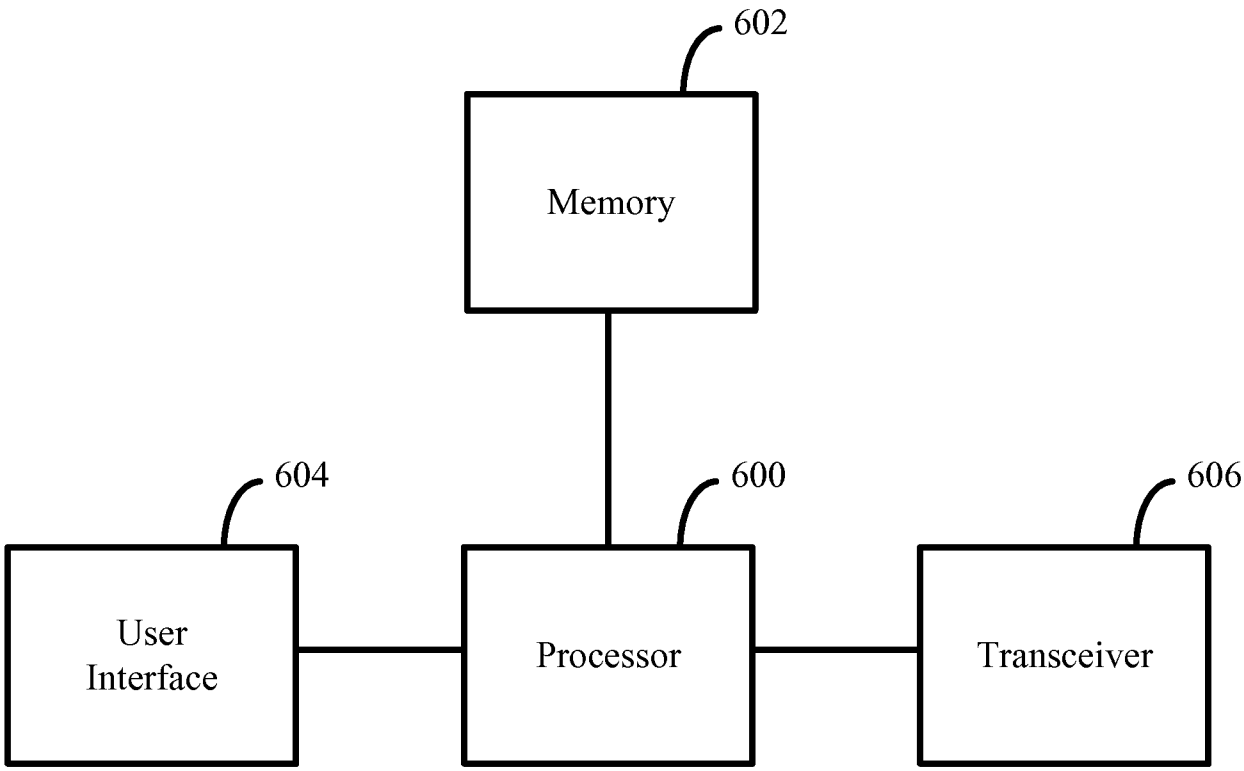

602
Memory
604
600
606
User Interface
Processor
Transceiver

FIG. 6

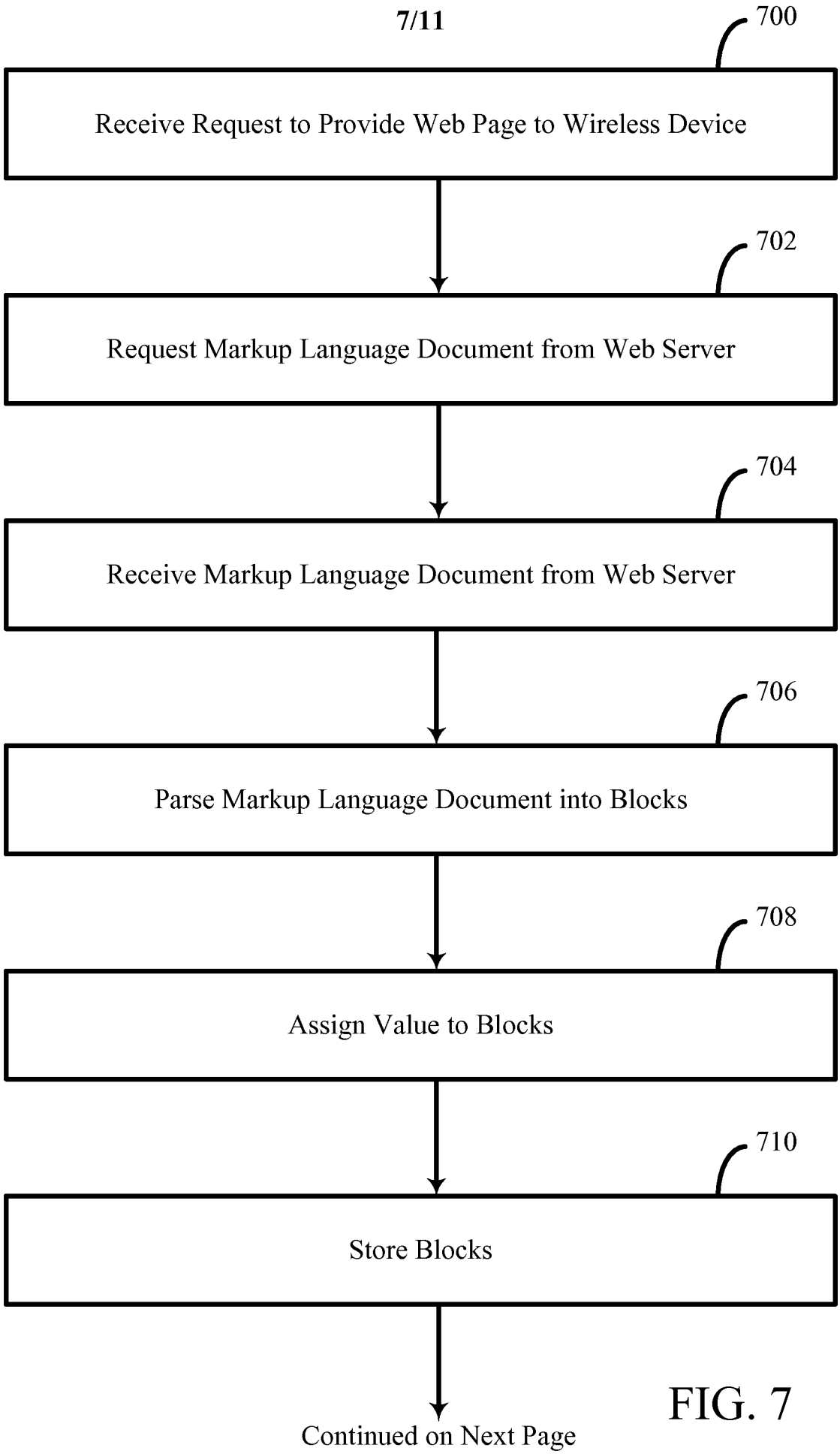
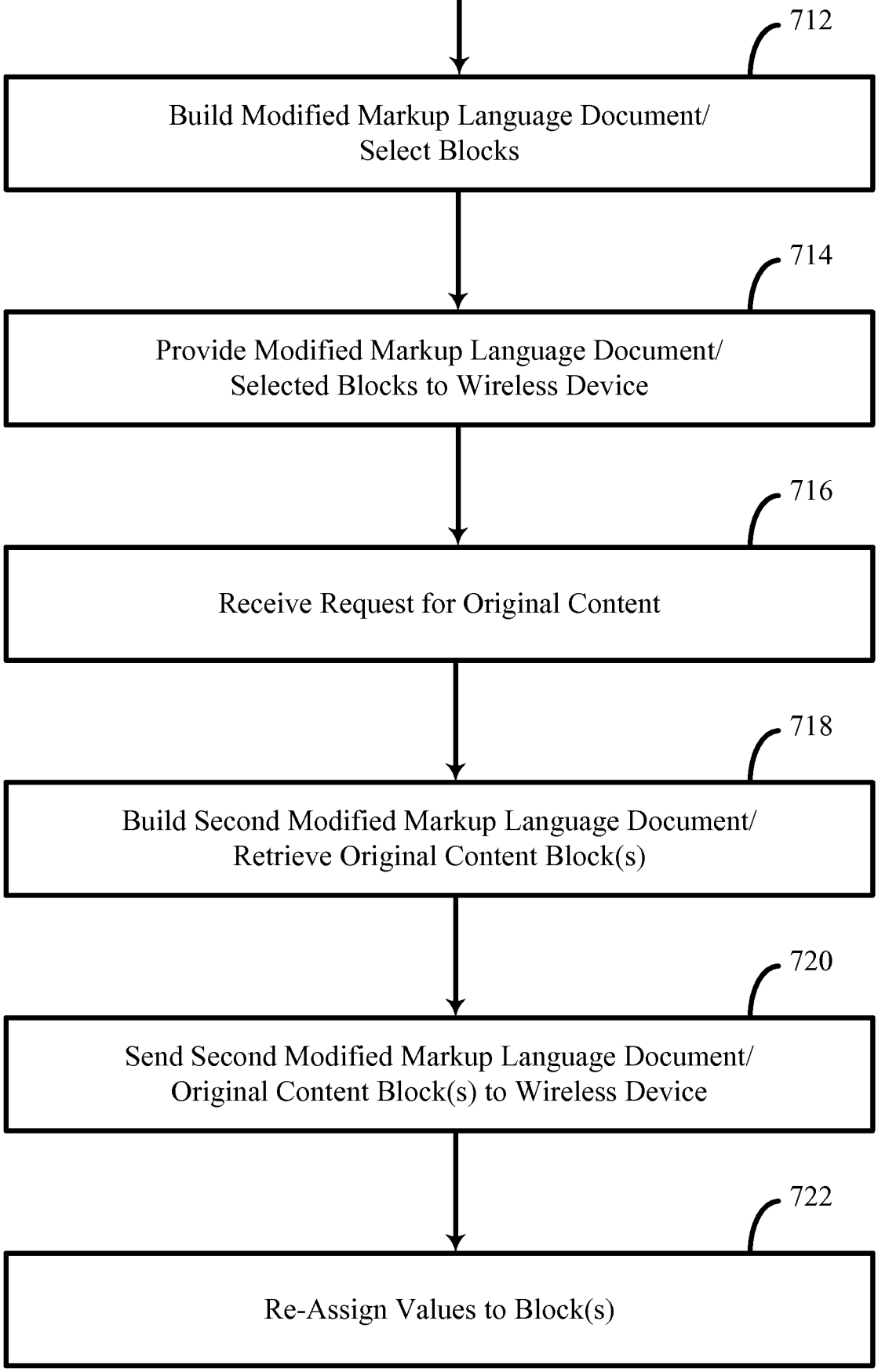

700
Receive Request to Provide Web Page to Wireless Device
702
Request Markup Language Document from Web Server
704
Receive Markup Language Document from Web Server
706
Parse Markup Language Document into Blocks
708
Assign Value to Blocks
710
Store Blocks
Continued on Next Page

FIG. 7

From Previous Page

FIG. 7
(Continued)



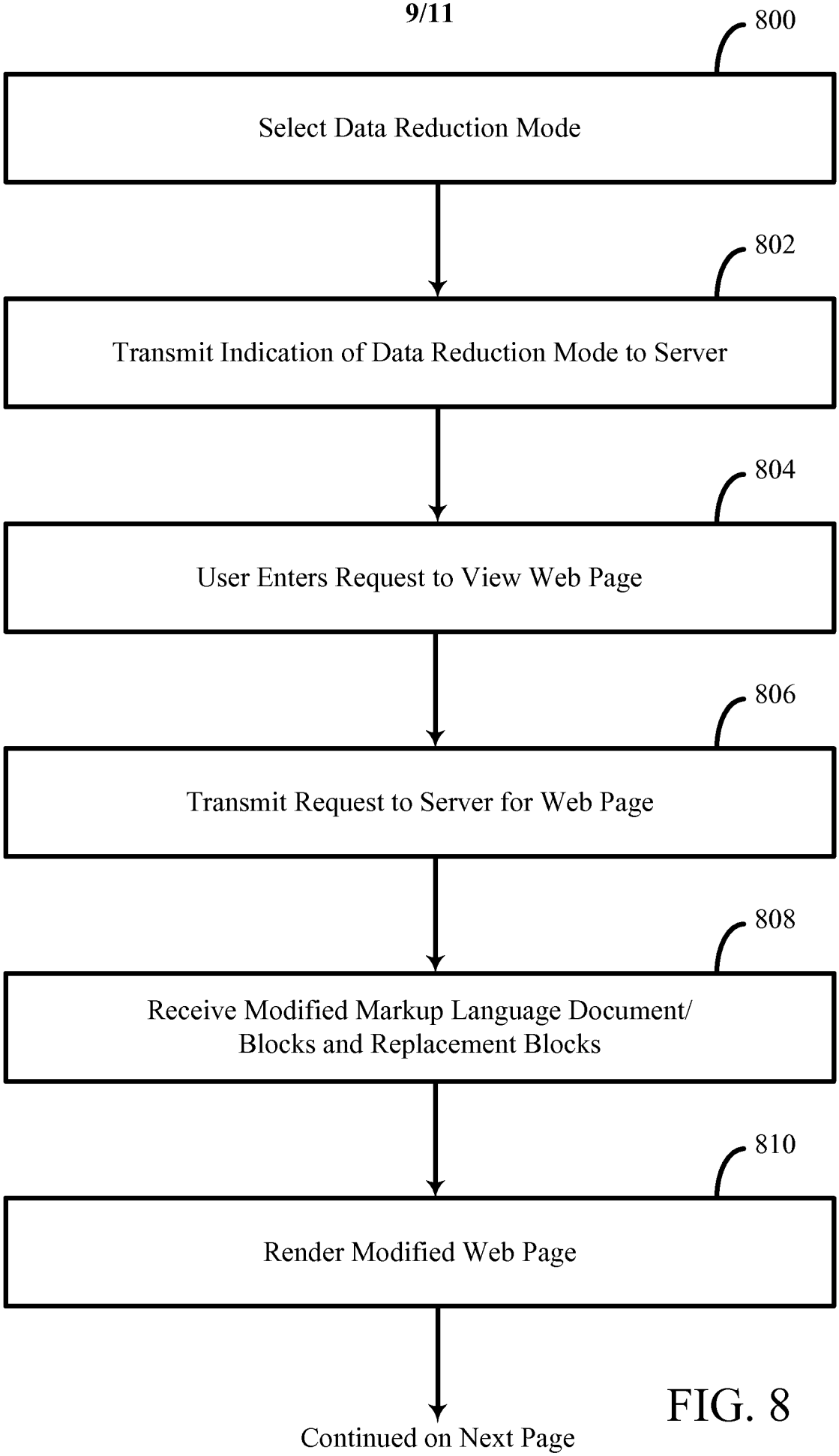
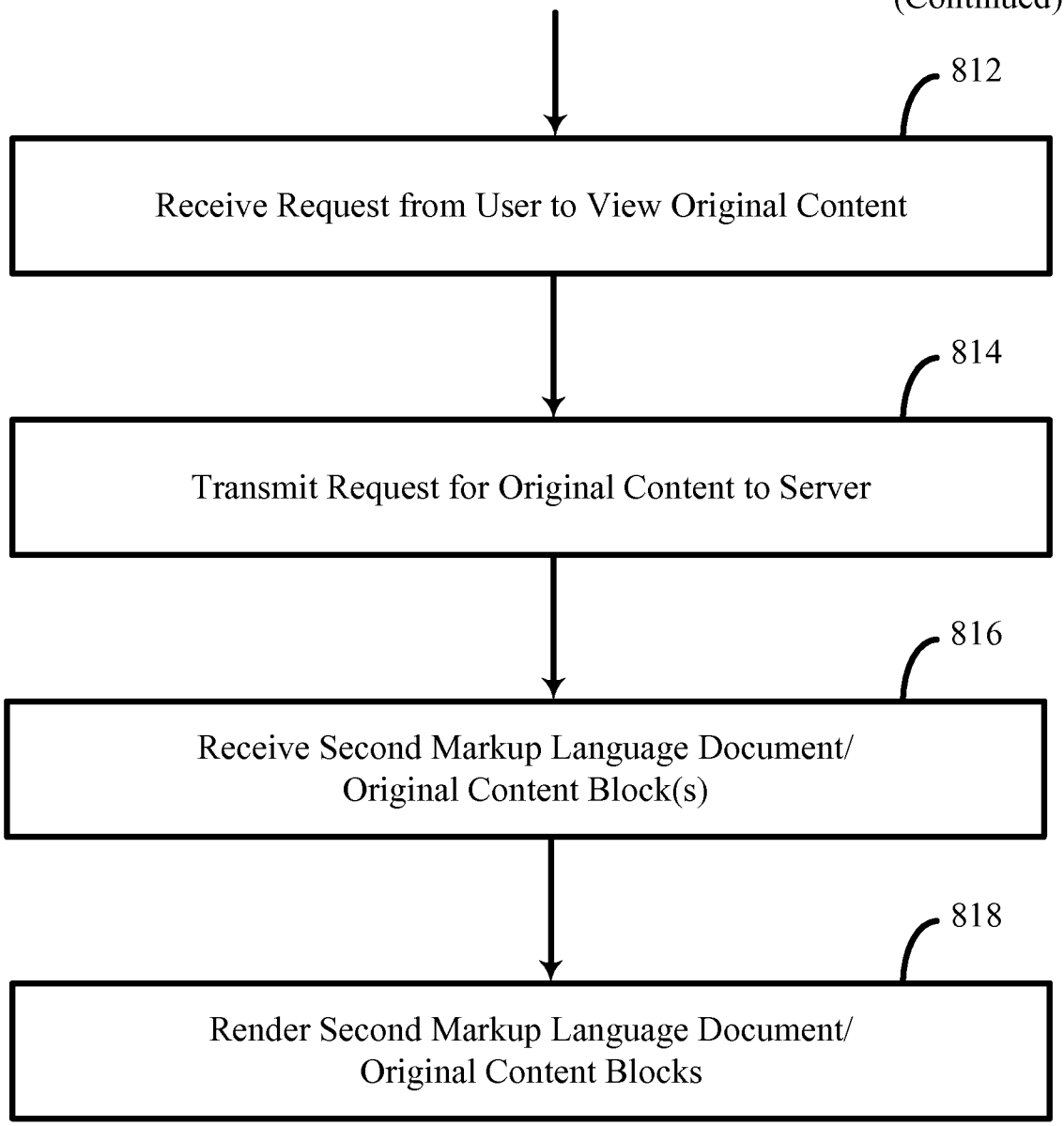

800
Select Data Reduction Mode
802
Transmit Indication of Data Reduction Mode to Server
804
User Enters Request to View Web Page
806
Transmit Request to Server for Web Page
808
Receive Modified Markup Language Document/
Blocks and Replacement Blocks
810
Render Modified Web Page
Continued on Next Page

FIG. 8

FIG. 8
(Continued)



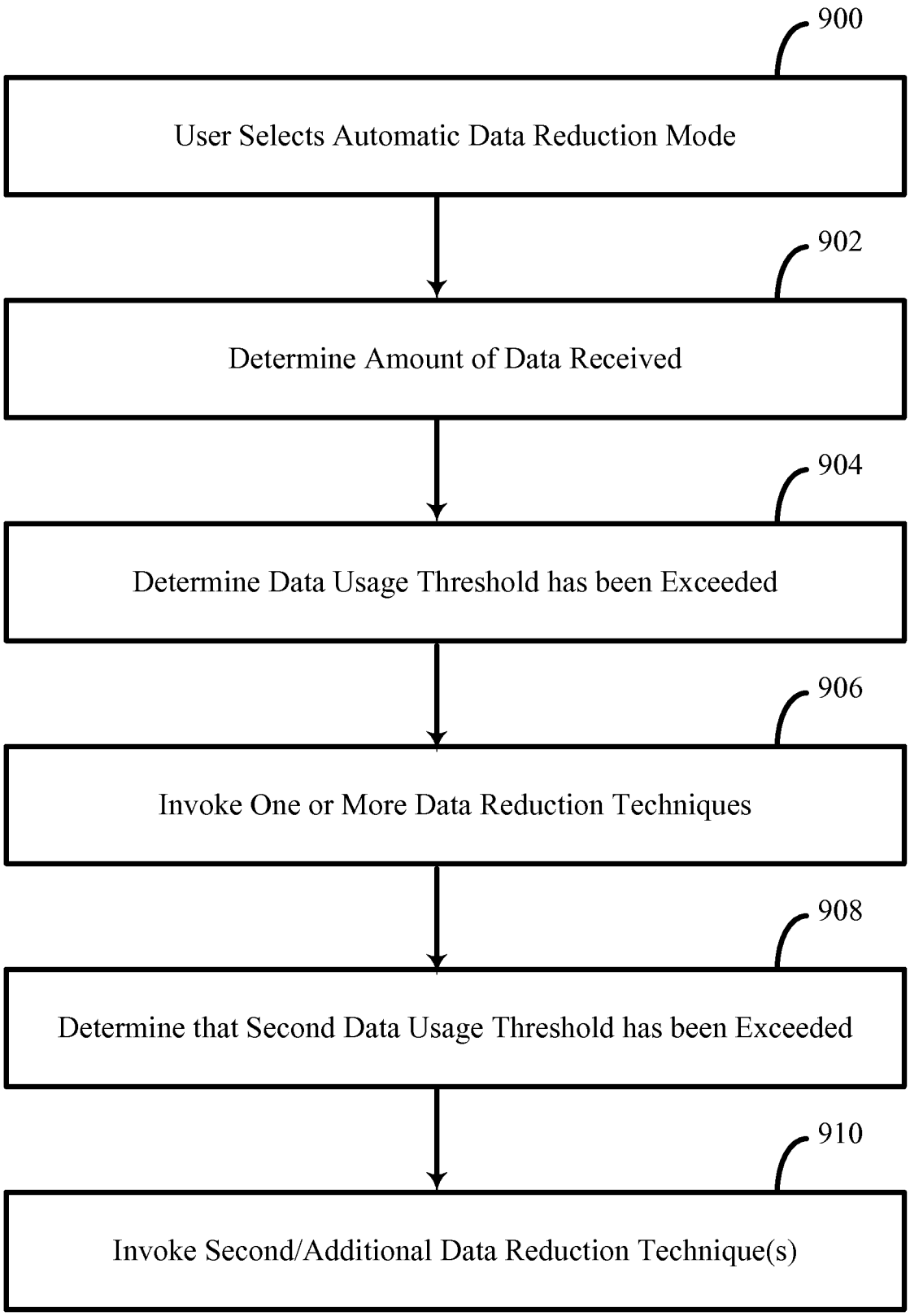

900
User Selects Automatic Data Reduction Mode
902
Determine Amount of Data Received
904
Determine Data Usage Threshold has been Exceeded
906
Invoke One or More Data Reduction Techniques
908
Determine that Second Data Usage Threshold has been Exceeded
910
Invoke Second/Additional Data Reduction Technique(s)

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/069175

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F17/30
ADD.

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)
G06F

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BICKMORE T W ET AL: "Digestor: device-independent access to the World Wide Web", COMPUTER NETWORKS AND ISDN SYSTEMS, NORTH HOLLAND PUBLISHING. AMSTERDAM, NL, vol. 29, no. 8-13, 30 September 1997 (1997-09-30), pages 1075-1082, XP004095305, ISSN: 0169-7552, DOI: 10.1016/S0169-7552(97)00026-3 page 1076, right-hand column, line 34 - line 36 page 1078, right-hand column, line 14 - line 21 page 1080, left-hand column, line 21 - line 25 page 1078, left-hand column, line 5 - line 7 page 1078, left-hand column, line 25 - -/--	1-10

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 February 2015	09/03/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	de Castro Palomares

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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	line 26	
X	US 2008/071857 A1 (LIE HAKON W [NO] LIE HAAKON WIUM [NO]) 20 March 2008 (2008-03-20) abstract paragraph [0001] - paragraph [0002] paragraph [0016] paragraph [0036] - paragraph [0048] paragraph [0053] - paragraph [0056]	1-10
X	US 2005/229111 A1 (MAKELA MIKKO [FI] MÄKELÄ MIKKO [FI]) 13 October 2005 (2005-10-13) paragraph [0013] - paragraph [0016] paragraph [0018] - paragraph [0019] paragraph [0027] paragraph [0059]	1-10
X	US 6 275 829 B1 (ANGIULO MICHAEL [US] ET AL) 14 August 2001 (2001-08-14) abstract column 5, line 61 - column 6, line 32 column 11, line 36 - line 49	1-10

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2014/069175

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008071857 A1	20-03-2008	NO 325628 B1	30-06-2008
		US 2008071857 A1	20-03-2008
US 2005229111 A1	13-10-2005	NONE	
US 6275829 B1	14-08-2001	NONE	