

METHOD AND APPARATUS FOR ANIMATING IMAGES ON MOBILE DEVICES

TECHNICAL FIELD

[0001] The present application relates to the field of network communications technologies, and in particular, to a method and an apparatus for animating images on mobile devices.

BACKGROUND

[0002] With performance development of mobile devices, complexity and friendliness of user interfaces running on the mobile devices are also respectively reduced and improved. To implement better user experience, more and more network service providers display various materials on browser pages or client interfaces by using an animation method.

[0003] In the existing technology, animation implementation on mobile devices usually uses a solution on a personal computer (PC). To be specific, data used for display such as the size and a location of each frame of image is calculated, and both the data used for display and data of the image are buffered in a memory. In an animation execution process, current content on canvases is cleared at a certain interval, and a next frame of display content is redrawn on the canvases by using a buffered next frame of data.

[0004] In such the solution, information about a hierarchy and an attribute of each frame of image needs to be recorded. Consequently, a programming code amount is quite large, much memory is occupied to buffer data of each frame of image, and more processing capabilities are consumed to redraw each frame of image. Because hardware resources and operation speeds of the mobile devices are still quite poorer than those of the PCs, such the solution has problems of an excessively large code amount, high memory overheads, and low execution efficiency.

SUMMARY

[0005] In view of this, the present application provides a method for animating images on mobile devices, including: drawing a final image to be displayed on a hidden canvas, and storing the drawn image as an endpoint image; and displaying at least a part of the endpoint image frame by frame in an animation area at a certain interval by using a changing display parameter, until the endpoint image is finally displayed, where the changing display parameter is determined based on an animation effect.

[0006] The present application further provides an apparatus for animating images on mobile devices, including: an endpoint image generation unit, configured to draw a final image to be displayed on a hidden canvas, and store the drawn image as an endpoint image; and an animation display unit, configured to display at least a part of the endpoint image frame by frame in an animation area at a certain interval by using a changing display parameter, until the endpoint image is finally displayed, where the changing display parameter is determined based on an animation effect.

[0007] It can be learned from the previously described technical solutions that in the implementations of the present application, the final image to be displayed is drawn on the hidden canvas and stored as the endpoint image, and the endpoint image is displayed in an animation execution process by using a changing display parameter. Therefore, there is no need to calculate, buffer, and draw each frame of image in an animation process frame by frame, so as to reduce a code amount needed for animation, reduce memory occupation, and improve animation execution efficiency.

BRIEF DESCRIPTION OF DRAWINGS

[0008] FIG. 1 is a flowchart illustrating a method for animating images on mobile devices, according to an implementation of the present application;

[0009] FIG. 2 is an example diagram of an endpoint image in a trending graph, according to an application example of the present application;

[0010] FIG. 3 is a schematic diagram of displaying each frame of image sequence of an animation in a trending graph, according to an application example of the present application;

[0011] FIG. 4 is an example diagram of an endpoint image in a bar graph, according to an application example of the present application;

[0012] FIG. 5 is a schematic diagram of displaying each frame of image sequence of an animation in a bar graph, according to an application example of the present application;

[0013] FIG. 6 is a hardware structure diagram of a mobile device; and

5 **[0014]** FIG. 7 is a logical structure diagram of an apparatus for animating images on mobile devices, according to an implementation of the present application.

DESCRIPTION OF IMPLEMENTATIONS

[0015] The implementations of the present application provide a new method for animating images on mobile devices. An image to be displayed as an animation endpoint is drawn on a hidden canvas, and is stored as an endpoint image. In an animation execution process, each frame of display parameter is determined based on an animation effect to be displayed, and a part of or all of the endpoint image is displayed by using each frame of display parameter, until the endpoint image is finally displayed. In the implementations of the present application, an animation effect is achieved by displaying all or a part of the endpoint image through changing display, so as to avoid calculating and recording information about a hierarchy and an attribute of each frame of image in an animation process, and reduce a programming code amount. In the animation process, a drawn image is used, and therefore there is no need to draw each frame of image or buffer data of each frame of image, so as to reduce memory occupation and processing capability consumption, and alleviate problems in the existing technology.

[0016] The implementations of the present application can be applied to any mobile device having computing, storage, and display capabilities, for example, a device such as a mobile phone, a tablet computer, and a notebook. In terms of software, the implementations of the present application can be applied to a client in a client/server (C/S) structure, or can be applied to a browser page in a browser/server (B/S) structure, or can be applied to other software running on a mobile device.

[0017] In the implementations of the present application, a procedure of the method for animating images on mobile devices is shown in FIG. 1.

30 **[0018]** Step 110: Draw a final image to be displayed on a hidden canvas, and store the drawn image as an endpoint image.

[0019] A mobile device creates the hidden canvas, draws the final image to be

displayed, namely, the image to be displayed to a user at the end of an animation on the hidden canvas, and stores the image drawn on the hidden canvas as the endpoint image.

[0020] Data needed by the mobile device to draw the final image to be displayed

5 can be determined based on content to be displayed on the image in actual application scenarios. The data needed for drawing the image can be locally read or calculated by the mobile device, or can be obtained from a server or calculated based on other data obtained from the server. For a specific drawing method used when the image is drawn, reference can be made to the existing technology. A data source for drawing
10 the image, display content of the image, and an image drawing method are not limited in this implementation of the present application.

[0021] The mobile device can create the hidden canvas based on an animation area. For example, referring to peak data of the finally displayed image, a hidden canvas that is scaled up or scaled down in a same proportion can be created based on
15 the shape of the animation area. For another example, a hidden canvas that has a same shape and size as the animation area can be created. As such, the endpoint image can be directly displayed in the animation area at the end of the animation without a need for scale-up or scale-down, so as to simplify calculation. Certainly, the mobile device can randomly create the hidden canvas, and in a subsequent animation process, all or
20 a part of the endpoint image is displayed in the animation area by setting a display parameter.

[0022] The endpoint image drawn on the hidden canvas can be locally stored in the mobile device in a form of a file, or can be stored in a buffer in a form of image data. The hidden canvas can be deleted after the endpoint image is stored.

25 **[0023]** Step 120: Display at least a part of the endpoint image frame by frame in an animation area at a certain interval by using a changing display parameter, until the endpoint image is finally displayed.

[0024] After the endpoint image is generated, various frames of display parameters in the animation execution process are determined based on an animation
30 effect to be displayed, and the various frames of display parameters are successively used at a certain interval to display a part of or all of the endpoint image in the animation area, until the endpoint image is displayed at the end of the animation. Display parameters of adjacent frames are different, and a changing mode is related to an animation effect to be displayed.

[0025] The display parameter can include an endpoint image processing parameter used to process the endpoint image to obtain each frame of image, and a display location parameter used to determine a location in the animation area that the processed endpoint image is displayed at. Adjacent frames are different in at least one of an endpoint image processing parameter or a display location parameter. In the animation execution process, the mobile device processes the endpoint image based on each frame of endpoint image processing parameter, to obtain an image of the frame, and displays the image of the frame in the animation area at a time point corresponding to each frame of image (images of two adjacent frames are spaced by the previously described interval) by using a display location parameter of the frame. Different animation effects can be achieved when endpoint image processing parameters of adjacent frames change, or display location parameters change, or both endpoint image processing parameters and display location parameters change. The following provides description by using examples.

[0026] In a first example, a fixed display location parameter and each frame of screenshot parameter determined based on an animation effect are used as changing display parameters, so as to achieve an effect of gradually displaying the endpoint image in the animation area. A part of the endpoint image captured based on each frame of screenshot parameter is displayed frame by frame in the animation area at a certain interval by using the fixed display location parameter, until the entire endpoint image is finally displayed. To be specific, at a time point corresponding to each frame, the mobile device captures a part of the endpoint image based on the screenshot parameter of the frame, to obtain an image of the frame, and displays the image of the frame in the animation area based on the fixed display location parameter. The image captured based on the screenshot parameter is gradually enlarging, until the complete endpoint image is formed.

[0027] In an application of the first example, a display location parameter in an upper left corner of each frame of image can be fixed as an upper left corner of the animation area, a part of the endpoint image on the left is captured as each frame of image, and a captured area is gradually enlarging, so as to achieve an animation effect of gradually displaying the endpoint image from left to right. In another application of the first example, a display location parameter of a central point of each frame of image can be fixed as a central point of the animation area, a central point of the endpoint image is used as a central point of each frame of image that is captured, and

a captured area is gradually enlarging, so as to achieve an animation effect of gradually displaying the endpoint image from the center to the periphery. Other application scenarios are omitted here for simplicity.

[0028] In a second example, each frame of display location parameter determined based on an animation effect and each frame of screenshot parameter are used as changing display parameters, so as to achieve an effect of gradually moving the endpoint image from the outside of the animation area to the animation area for display. A part of the endpoint image captured based on the screenshot parameter of the frame is displayed frame by frame in the animation area at a certain interval by using the display location parameter of the frame, until the entire endpoint image is finally displayed. To be specific, at a time point corresponding to each frame, the mobile device captures a part of the endpoint image based on the screenshot parameter of the frame, to obtain an image of the frame, and displays the image of the frame in the animation area based on the display location parameter of the frame. The image captured based on the screenshot parameter is gradually enlarging, and a display location of the image also correspondingly moves, so that the image of the frame can be completely displayed in the animation area until the last frame of image becomes a complete endpoint image and occupies the entire animation area.

[0029] In an application of the second example, a display location parameter in an upper right corner of each frame of image can be gradually shifted rightward along an upper edge of the animation area, a part of the endpoint image on the left is captured as each frame of image (the size of the image corresponds to the display location parameter), and a captured area is gradually enlarging, so as to achieve an effect of moving the endpoint image to the animation area from left to right. Other application scenarios are omitted here for simplicity.

[0030] In a third example, a fixed display location parameter and each frame of compression parameter determined based on an animation effect are used as changing display parameters, so as to achieve an effect that the entire endpoint image gradually occupies the entire animation area. An endpoint image obtained by performing compression based on the compression parameter of the frame is displayed frame by frame in the animation area at a certain interval by using the display location parameter, until an endpoint image matching the animation area is finally displayed. To be specific, at a time point corresponding to each frame, the mobile device obtains the image of the frame after compressing the endpoint image based on the

compression parameter of the frame, and displays the image of the frame in the animation area based on the fixed display location parameter. Each frame of image obtained by performing compression based on the compression parameter is gradually enlarging until the entire animation area is occupied.

- 5 **[0031]** In an application of the third example, a display location parameter of an upper left corner of each frame of image can be fixed as an upper left corner of the animation area, proportional compression is performed in each frame based on a length-width ratio of the endpoint image, and a compression ratio is gradually decreasing, so as to achieve an effect of gradually animating the endpoint image from the upper left corner of the animation area from far to near. In another application of the third example, a display location parameter of a lower edge of each frame of image can be fixed as a lower edge of the animation area, a width of the endpoint image is compressed in each frame, and a compression ratio is gradually decreasing, so as to achieve an effect that the endpoint image gradually occupies the entire animation area starting from the bottom. Other application scenarios are omitted here for simplicity.

- 15 **[0032]** When animation effects to be achieved are different, other endpoint image processing parameters different from the screenshot parameter and the compression parameter can be used, for example, a rotation parameter for rotating the endpoint image and a filter parameter for performing color processing on the endpoint image. In addition, multiprocessing can be performed on the endpoint image with reference to various different endpoint image processing parameters. For example, by combining the compression parameter with the rotation parameter, an animation effect of gradually rotating the entire endpoint image by using a certain point as a central point can be achieved. A type and a quantity of the endpoint image processing parameter to be used, and combined usage of the endpoint image processing parameter and the fixed or changing display location parameter are not limited in this implementation of the present application.

- 25 **[0033]** It can be learned that in this implementation of the present application, the final image to be displayed is drawn on the hidden canvas and stored as the endpoint image. In an animation execution process, each frame of display parameter is determined based on an animation effect to be displayed, a part of or all of the endpoint image is displayed by using each frame of display parameter, and an animation effect is achieved by using a changing display parameter, so as to avoid

calculating and recording information about a hierarchy and an attribute of each frame of image in an animation process, and reduce a programming code amount. In the animation process, the endpoint image is used, and therefore there is no need to draw each frame of image and butter data of each frame of image, so as to reduce memory occupation, and improve animation execution efficiency.

[0034] In an application example of the present application, in a browser environment of a smartphone, an animation effect is used when a graph (including a trending graph and a bar graph) is displayed to the user.

[0035] When the trending graph needs to be displayed on a browser page, a hidden canvas with the same size as a display area of the trending graph is created, and a final trending graph to be displayed to the user is drawn on the hidden canvas based on graphic data of the trending graph received from the server, as shown in FIG. 2. The drawn trending graph is buffered in the memory as an endpoint image of the trending graph.

[0036] The trending graph is a change trending graph that shows a certain variable changes in chronological order. When the trending graph is displayed, an animation effect of gradually forming a variable trend in chronological order is used. Therefore, a fixed display location parameter and a changed screenshot parameter can be used as display parameters. A display location parameter in an upper left corner of each frame of image is fixed as an upper left corner of the display area of the trending graph. Some endpoint images with different lengths of the trending graph are captured in each frame starting from the left of the endpoint image of the trending graph to serve as an image of the frame, and a captured length is gradually increasing. A possible frames sequence is shown in FIG. 3. As such, when various frames of images are successively displayed in the display area of the trending graph at a certain interval, an animation effect that a variable trend occurs in chronological order is formed.

[0037] When the bar graph needs to be displayed on a browser page, a hidden canvas with the same size as a display area of the bar graph is created, and a final bar graph to be displayed to the user is drawn on the hidden canvas based on graphic data of the bar graph received from the server, as shown in FIG. 4. The drawn bar graph is buffered in the memory as an endpoint image of the bar graph.

[0038] The bar diagram is used to reflect a value of a certain variable at a certain time point. When the bar graph is displayed, an animation effect of gradually changing the bar to a final value in ascending order is used. Therefore, a fixed display

location parameter and a changed compression parameter can be used as display parameters. A display location parameter of a lower left corner of each frame of image is fixed as a lower left corner of the display area of the bar graph. An image of the frame is generated after a width of an endpoint image of the bar graph is compressed in different compression proportions in each frame, and a compression ratio is gradually decreasing until a compression proportion of the last frame of image is 1. A possible each frame of image sequence is shown in FIG. 5. As such, when various frames of images are successively displayed in the display area of the bar graph at a certain interval, an animation effect that a variable value is gradually increasing until a final value is reached is formed.

[0039] Corresponding to the previously described procedure implementations, an implementation of the present application further provides an apparatus for animating images on mobile devices. The apparatus can be implemented by using software, or can be implemented by using hardware, or can be implemented by using a combination of hardware and software. By using software implementation as an example, a logical apparatus is obtained by reading a corresponding computer program instruction to a memory by using a central processing unit (CPU) of a mobile device. In terms of hardware, in addition to the CPU, the memory, and the non-volatile memory shown in FIG. 6, the mobile device that the apparatus for animating images on mobile devices is located in usually further includes other hardware such as a chip for receiving and sending a wireless signal, and/or other hardware such as a board card for implementing a network communication function.

[0040] FIG. 7 shows an apparatus for animating images on mobile devices according to an implementation of the present application, including an endpoint image generation unit and an animation display unit. The endpoint image generation unit is configured to draw a final image to be displayed on a hidden canvas, and store the drawn image as an endpoint image. The animation display unit is configured to display at least a part of the endpoint image frame by frame in an animation area at a certain interval by using a changing display parameter, until the endpoint image is finally displayed. The changing display parameter is determined based on an animation effect.

[0041] Optionally, the display parameter includes an endpoint image processing parameter used to process the endpoint image to obtain each frame of image, and a display location parameter used to determine a display location of each frame of

image in the animation area, and adjacent frames are different in at least one of an endpoint image processing parameter and a display location parameter.

[0042] In an example, the display parameter includes a display location parameter and each frame of screenshot parameter determined based on an animation effect. The animation display unit is specifically configured to display, frame by frame in the animation area at the certain interval by using the display location parameter, a part of the endpoint image captured based on the screenshot parameter of the frame, until the entire endpoint image is finally displayed.

[0043] In another example, the display parameter includes each frame of display location parameter determined based on an animation effect and a screenshot parameter. The animation display unit is specifically configured to display, frame by frame in the animation area at the certain interval by using the display location parameter of the frame, a part of the endpoint image captured based on the screenshot parameter of the frame, until the entire endpoint image is finally displayed.

[0044] In still another example, the display parameter includes a display location parameter and each frame of compression parameter determined based on an animation effect. The animation display unit is specifically configured to display, frame by frame in the animation area at the certain interval by using the display location parameter, an endpoint image obtained by performing compression based on the compression parameter of the frame, until an endpoint image matching the animation area is finally displayed.

[0045] Optionally, the shape and the size of the hidden canvas are the same as those of the animation area.

[0046] Optionally, the apparatus further includes a hidden canvas deletion unit, configured to delete the hidden canvas after the endpoint image is stored.

[0047] The previous descriptions are merely preferred implementations of the present application, but are not intended to limit the present application. Any modification, equivalent replacement, or improvement made without departing from the spirit and principle of the present application should fall within the protection scope of the present application.

[0048] In a typical configuration, a computing device includes one or more processors (CPU), one or more input/output interfaces, one or more network interfaces, and one or more memories.

[0049] The memory can include a non-permanent memory in a computer readable

medium, a random access memory (RAM), and/or a non-volatile memory such as a read-only memory (ROM) or a flash memory (flash RAM). The memory is an example of the computer readable medium.

[0050] The computer readable medium includes persistent, non-persistent, movable, and unmovable media that can implement information storage by using any method or technology. Information can be a computer readable instruction, a data structure, a program module, or other data. An example of a computer storage medium includes but is not limited to a phase-change random memory (PRAM), a static random access memory (SRAM), a dynamic random access memory (DRAM), another type of random access memory (RAM), a read-only memory (ROM), an electrically erasable programmable read-only memory (EEPROM), a flash memory or another memory technology, a compact disc read-only memory (CD-ROM), a digital versatile disc (DVD) or another optical storage, a magnetic tape, a magnetic disk storage or another magnetic storage device, or any other non-transmission medium, and can be used to store information that can be accessed by the computing device. As described in the present specification, the computer readable medium does not include a transitory computer readable media (transitory media) such as a modulated data signal and carrier.

[0051] It should be noted that the terms "include", "comprise", or their any other variant is intended to cover a non-exclusive inclusion, so that a process, a method, an article, or an apparatus that includes a list of elements not only includes those elements but also includes other elements that are not expressly listed, or further includes elements inherent to such process, method, article, or apparatus. An element preceded by "includes a ..." does not, without more constraints, preclude the presence of additional identical elements in the process, method, article, or device that includes the element.

[0052] A person skilled in the art should understand that the implementations of the present application can be provided as a method, a system, or a computer program product. Therefore, the present application can use a form of hardware only implementations, software only implementations, or implementations with a combination of software and hardware. Moreover, the present application can use a form of a computer program product that is implemented on one or more computer usable storage media (including but not limited to a disk memory, a CD-ROM, an optical memory, etc.) that include computer usable program code.

CLAIMS

What is claimed is:

1. A method for animating images on mobile devices, comprising:
drawing a final image to be displayed on a hidden canvas, and storing the drawn
5 image as an endpoint image; and
displaying at least a part of the endpoint image frame by frame in an animation
area at a certain interval by using a changing display parameter, until the endpoint
image is finally displayed, wherein the changing display parameter is determined
based on an animation effect.
- 10 2. The method according to claim 1, wherein the display parameter comprises an
endpoint image processing parameter used to process the endpoint image to obtain
each frame of image, and a display location parameter used to determine a display
location of each frame of image in the animation area, and adjacent frames are
different in at least one of an endpoint image processing parameter and a display
15 location parameter.
3. The method according to claim 2, wherein the display parameter comprises a
display location parameter and each frame of screenshot parameter determined based
on an animation effect; and
the displaying at least a part of the endpoint image frame by frame in an
20 animation area at a certain interval by using a changing display parameter, until the
endpoint image is finally displayed comprises: displaying, frame by frame in the
animation area at the certain interval by using the display location parameter, a part of
the endpoint image captured based on the screenshot parameter of the frame, until the
entire endpoint image is finally displayed.
- 25 4. The method according to claim 2, wherein the display parameter comprises
each frame of display location parameter determined based on an animation effect and
a screenshot parameter; and
the displaying at least a part of the endpoint image frame by frame in an
animation area at a certain interval by using a changing display parameter, until the
30 endpoint image is finally displayed comprises: displaying, frame by frame in the
animation area at the certain interval by using the display location parameter of the
frame, a part of the endpoint image captured based on the screenshot parameter of the

frame, until the entire endpoint image is finally displayed.

5. The method according to claim 2, wherein the display parameter comprises a display location parameter and each frame of compression parameter determined based on an animation effect; and

5 the displaying at least a part of the endpoint image frame by frame in an animation area at a certain interval by using a changing display parameter, until the endpoint image is finally displayed comprises: displaying, frame by frame in the animation area at the certain interval by using the display location parameter, an endpoint image obtained by performing compression based on the compression
10 parameter of the frame, until an endpoint image matching the animation area is finally displayed.

6. The method according to claim 1, wherein the shape and the size of the hidden canvas are the same as those of the animation area.

7. The method according to claim 1, wherein the method further comprises:
15 deleting the hidden canvas after the endpoint image is stored.

8. An apparatus for animating images on mobile devices, comprising:

an endpoint image generation unit, configured to draw a final image to be displayed on a hidden canvas, and store the drawn image as an endpoint image; and

20 an animation display unit, configured to display at least a part of the endpoint image frame by frame in an animation area at a certain interval by using a changing display parameter, until the endpoint image is finally displayed, wherein the changing display parameter is determined based on an animation effect.

9. The apparatus according to claim 8, wherein the display parameter comprises an endpoint image processing parameter used to process the endpoint image to obtain
25 each frame of image, and a display location parameter used to determine a display location of each frame of image in the animation area, and adjacent frames are different in at least one of an endpoint image processing parameter and a display location parameter.

10. The apparatus according to claim 9, wherein the display parameter comprises
30 a display location parameter and each frame of screenshot parameter determined based on an animation effect; and

the animation display unit is specifically configured to display, frame by frame in the animation area at the certain interval by using the display location parameter, a part of the endpoint image captured based on the screenshot parameter of the frame,

until the entire endpoint image is finally displayed.

11. The apparatus according to claim 9, wherein the display parameter comprises each frame of display location parameter determined based on an animation effect and a screenshot parameter; and

5 the animation display unit is specifically configured to display, frame by frame in the animation area at the certain interval by using the display location parameter of the frame, a part of the endpoint image captured based on the screenshot parameter of the frame, until the entire endpoint image is finally displayed.

12. The apparatus according to claim 9, wherein the display parameter comprises
10 a display location parameter and each frame of compression parameter determined based on an animation effect; and

 the animation display unit is specifically configured to display, frame by frame in the animation area at the certain interval by using the display location parameter, an endpoint image obtained by performing compression based on the compression
15 parameter of the frame, until an endpoint image matching the animation area is finally displayed.

13. The apparatus according to claim 8, wherein the shape and the size of the hidden canvas are the same as those of the animation area.

14. The apparatus according to claim 8, wherein the apparatus further comprises
20 a hidden canvas deletion unit, configured to delete the hidden canvas after the endpoint image is stored.