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A METHOD OF GENERATING A GRAPHIC IMAGE

(57) Abstract:
A method of generating a graphic image, including providing a controller having a configuration generically related to a plurality of graphic images, where each graphic image has a set of fixed coordinates assigned to layers that have a feature of a desired graphic image with a plurality of versions; selecting a desired graphic image; choosing a predetermined function, which has a series of parts and a set of coordinates that correspond with the chosen function, wherein at least one of the coordinates varies with each part of the function; displaying first layers assigned to a first set of coordinates to form a first generation of the desired graphic image that performs a first part of the chosen function; substituting at least one of the first layers with a second layer having an alternate version of the feature; and redisplaying any first layers and the at least one second layer assigned to a second set of coordinates to form a second generation of the desired image to perform a second part of a chosen function. A graphic image database for use with an interactive interface program, including a plurality of layers forming a graphic image that has a torso, a head with an upper portion and a lower portion, which is proximate the torso, a mouth within the head proximate the lower portion, a pair of eyes within the head proximate the upper portion, and a plurality of special features interchangeable with at least one of the features; and a set of coordinates defined by the interactive interface program and assigned to each layer.
A METHOD OF GENERATING A GRAPHIC IMAGE

Field of Invention

The present invention relates to graphic files in computer systems and more specifically, relates to generating a graphic image.

Background of Invention

Many computer application programs employ graphic images or files to interact with a user. For example, animated characters are used in the word processing program sold under the trademark, WORD 97, by Microsoft Corporation. In this program, a "help" feature known as "Office Assistance" displays a graphic file, or animated character, when the "help" feature is requested. Other animated characters can be found in screen savers and computer games, as well as in many other computer applications.

There are several different types of graphic formats that may be used to make these graphic images. For example, a bit mapped graphics display system may be used to store output data in a display memory. The bit mapped approach visualizes the output data as a two-dimensional array of pixels, where each pixel corresponds to an individual picture element in the display device. In a two-dimensional, black and white graphics display, each pixel contains one bit of information, i.e. either 0 or 1, to represent either black or white, respectively. Accordingly, all of the pixels for a two-dimensional, black and white display may be in the form of a two-dimensional map where the bits of information in the map comprise the output data representing the display device. The graphic display of a three-dimensional object in color requires, with respect to color alone, up to eight bits of information per pixel to store information on the red, green and blue components of the color and the intensity of the color for display.

Another type of graphic format is vector imaging. Vector images consist of vectors of data stored in mathematical formats, rather than bits of colored dots. The vector files store data as lines, shapes, text, and objects, instead of using pixels. These images may be scaled and perfectly cropped on an arc. Metafiles are image files that may
contain both vector and bitmap data. Depending on the computer graphics technique used, the graphic format of the graphic image varies.

There are also many different computer graphics techniques, where graphic images are generated in a graphics processor and rendered on a computer display. For example, the motion data of a recorded video of a live actor may be transferred to a threedimensional model to produce animation that imitates the live actor. Motion sensors may record movements of an actor wearing a motion-capture suit and the coordinates from the motion sensors are provided to a computer program, which generates a series of images of a character with a body position or posture corresponding to that of the live actor. If only reference points on the actor are recorded, the computer may generate in-between frames by interpolation of lines appearing in successive key frames. It is believed that the known techniques use entire images on a series of frames, where the image on each subsequent frame is changed slightly to represent movement. The frames are shown in sequence at a rate of about 15-100 images per second to create a moving image.

**Summary of the Invention**

The present invention provides a method of generating a graphic image, including providing a controller having a configuration generically related to a plurality of graphic images, where each graphic image has a set of fixed coordinates assigned to layers that have a feature of a desired graphic image with a plurality of versions; selecting a desired graphic image; choosing a predetermined function, which has a series of parts and a set of coordinates that correspond with the chosen function, wherein at least one of the coordinates varies with each part of the function; displaying first layers assigned to a first set of coordinates to form a first generation of the desired graphic image that performs a first part of the chosen function; substituting at least one of the first layers with a second layer having an alternate version of the feature; and redisplaying any first layers and the at least one second layer assigned to a second set of coordinates to form a second generation of the desired graphic image to perform a second part of a chosen function.
The present invention also provides a graphic image database for use with an interactive interface program, including a plurality of layers forming a graphic image that has a torso, a head with an upper portion and a lower portion, which is proximate the torso, a mouth within the head proximate the lower portion, a pair of eyes within the head proximate the upper portion, and a plurality of special features interchangeable with at least one of the features; and a set of coordinates assigned to each layer. The coordinates are defined by the interactive interface program.

**Brief Description of the Drawings**

The accompanying drawings, which are incorporated herein and constitute part of this specification, illustrate the presently preferred embodiments of the invention, and, together with the general description given above and the detailed description given below, serve to explain the features of the invention.

Fig. 1 is a block diagram of the method of the present invention.

Fig. 2 is an exploded view of the graphic image of the present invention.

Fig. 3 is a block diagram of a preferred embodiment of the method of Fig. 1.

Fig. 4 is an illustration of the graphic image of Fig. 3 with stacked first layers.

Fig. 5 is an illustration of the graphic image of Fig. 4 with stacked first and second layers.

**Detailed Description of the Preferred Embodiment(s)**

As shown in Fig. 1, the method of generating a graphic image includes selecting by the user 1 a desired graphic image 10. In the preferred embodiment, the graphic image 10 is a two-dimensional (2-D) or three-dimensional (3-D) animated character, such as a young professional named Molly 11, a surfer dude named Zack 12, or an English butler named Charles 13. However, the graphic image 10 may be any object in any format, including a photograph. The graphic image 10 may be selected by clicking on an icon, choosing a character in a menu, using a voice command, or any other method available to the user 1. In the preferred embodiment, the graphic image 10 has a height of 460 to 500 pixels, or 6.3 to 6.9 inches, and a width of 340 to 410 pixels, or 4.7 to 5.7 inches. Each
graphic image 11, 12, and 13 has a graphic image file, or plurality of layers 15, 16, or 17, respectively, where the layers 15, 16, and 17 are assigned coordinates 18 that indicate the placement of the layers 15, 16, and 17. The graphic image files 15, 16, and 17 contain features of the graphic image 10, such as a torso, or body, 41, a head 42, lips 43, and eyes 44, as shown in Fig. 2. Preferably, there are also layers with a foreground and a background. In the preferred embodiment, the background is 640 x 480 pixels, or 8.8 x 6.6 inches, and has a resolution of 72 dpi. The features 41, 42, 43, and 44 have a plurality of versions. Preferably, the versions of the head include center, center left, and center right, and the versions of the mouth include resting, smiling, open, closed, center, center left, center right, a plurality of positions corresponding with speech, and combinations thereof. Preferably, the version of the eyes include center, center attentive, looking left, looking right, looking up, looking down, shut, center, center left, and center right, and combinations thereof. The coordinates 18 are fixed, while the layers and features assigned to the coordinates may vary with each graphic file 10. For example, Molly layers 15 has special features that include blowing bangs up that is interchangeable with the head and mouth, sticking tongue out interchangeable with the mouth and eyes, winking interchangeable with the eyes, and looking at watch interchangeable with the torso, or body, which are assigned special feature coordinates. “Interchangeable” means that the special feature layer takes that place of the feature layer when the graphic image 10 is displayed. The interchange takes place within fractions of a second, so the features flow easily from one to the next, similar to standard animation. Some of the same or other special feature coordinates may represent raising eyebrows interchangeable with the eyes, brushing shoulder interchangeable with the torso, and straightening tie interchangeable with the torso in the Charles layers 17. These special features may consist of a plurality of layers displayed in sequence with different coordinates 18 assigned to the layers. Similarly, the coordinates 18 assigned to an eyes center layer in the Zack layers 16 will be the same coordinate 18 assigned to an eyes center layer in the Charles layers 17. As such, the
graphic image 10 is easily interchangeable because the coordinates 18 will be the same, although some may not be used, for each selected graphic image 10.

Once the graphic image 10 is selected, the user 1 or a controller 20 chooses a function 30. For example, the user 1 may choose the function of providing a time of day, where the graphic image 10 will respond by speaking, or the controller 20 may choose the function of sleeping because the user 1 has not interacted with the graphic image 10 within a period of time. The user 1 may choose the function by verbal command, clicking on an icon, or any other available method. The function 30 has a series of parts 31 and 32 and a set of coordinates 18 that correspond to the chosen function 30. For a given function, any number of parts 31 and 32 may be required. For example, a function of speaking a word may require a series of mouth movements, including opening the mouth at different intervals and closing the mouth at different intervals. More specifically the part 31 may represent opening the mouth and part 32 may represent closing the mouth to perform the function of saying, “Hi.” For example, a special feature of Charles 13 includes the function of straightening a tie, which is a six-step animation made from four Charles layers 17 that are interchanged with the torso layer 41. The first Charles layer 17 shows the hands of Charles 13 raised to grasp the ends of a bowtie for a time of 15 ticks, where one tick is equivalent to 1/60 of a second. The next Charles layer 17 shows Charles 13 stretching his bowtie outward for 30 ticks, and the following Charles layer 17 shows the hands of Charles 13 releasing the tie, which rebounds for 8 ticks. The subsequent Charles layer 17 displays the tie returning to its normal appearance with the hands still raised for 12 ticks, and the final Charles layer 17 shows the tie returned to its normal position again for 20 ticks. At the end of the sequence, the torso layer 41 is replaced.

The controller, or computer program, 20 has a configuration generically related to a plurality of graphic images 10. The controller 20 is preferably an interactive interface program. The controller 20 displays the layers 45 assigned to the coordinates 18 that correspond with the chosen function 30, according to software code written for the
function 30. At least one of the coordinates 18 varies with each part 31 and 32 of the function 30. When the character graphic image file 15, 16, or 17, is being developed, each feature 41, 42, 43, and 44 is placed in an exact location within a layer of the graphic image file 15, 16, or 17 according to the assigned coordinates 18 so that the controller 20 displays the features 41, 42, 43, and 44 for each graphic image 11, 12, or 13 in the same location. In other words, the controller 20 operates the same with any graphic image file 15, 16, and 17 because the coordinates 18 assigned to the features 41, 42, 43, and 44 are fixed. In the preferred embodiment, the controller 20 uses a Macromedia® Director® run-time program to display, or play, the different overlay layers from the graphic image file, or layers 15, 16, or 17 at the same time. Each layer has a different and unique driver. When the software code, which is compatible with Macromedia® Director®, is written, independent drivers are designed and set for each layer in the graphic image file 15, 16, or 17. The code is stored in the controller 20. The code may be updated or monitored by the controller 20, or it may be overridden at any time to force the display of different layers. Since each graphic image file 15, 16, and 17 has the same coordinates 18 that correspond to each feature 41, 42, 43, and 44, the same software code stored in the controller 20 is utilized for each graphic image file 15, 16, and 17. This simplified coding process allows for easy transfer from one graphic image to another.

As shown in Fig. 3, the controller 20 displays the first layers 51, 52, 53, 54, and preferably 55 and 56 assigned to a first set of coordinates 18 to form a first generation 50 of the desired graphic image 10. Preferably, the layers 51, 52, 53, 54, 55, and 56 are placed, or overlaid, from bottom to top in the order of a background layer 51, a body layer 52, a head layer 53, a mouth layer 54, an eyes layer 55, and a foreground layer 56. The display of different layers overlaying one another is known as “overlay mode.” The layers 51, 52, 53, 54, 55, and 56 are designed and positioned such that the features on the layer do not cover each other. The graphic image 10 may be displayed on a monitor or any other display device. The first generation 50 of the desired graphic image 10 performs the first part 31 of the chosen function 30, such as opening a mouth or closing
eyes. For example, in Fig. 4, a first generation 150 of graphic image Charles 13 is shown with a body, or torso, 152, a head 153 with an upper portion 157 and a lower portion 158, which is proximate the torso 152, a resting mouth 154 within the head 153 proximate the lower portion 158, a pair of eyes 155 within the head 153 proximate the upper portion 157, a background 151, and a foreground 156. These features 152, 153, 154, 155, 156, and 157 are displayed on different layers 51, 52, 53, 54, 55, 56, and 57, respectively, and stacked to form the first generation 150.

The controller 20 may substitute any layer 51, 52, 53, 54, 55, 56, and 57 with a layer having the same feature 152, 153, 154, 155, 156, and 157, respectively, or a plurality of special features interchangeable with at least one of the features 152, 153, 154, and 155. This substitution takes place within a fraction of a second. The second layers 61 and 62 have an alternate version of the features of the desired graphic image 10. Any remaining first layers 51, 52, 53, and 56 and the at least one second layer 61 and 62 assigned to a second set of coordinates 18 are then displayed. The first layers 51, 52, 53, and 56 and second layers 61 and 62 form a second generation 60 of the graphic image 10 that performs a second part 32 of a chosen function 30. A second generation 160 of graphic image Charles 13 is shown in Fig. 5, where an open mouth 161 that may correspond to speech and eyes looking up 162 were substituted. The unsubstituted layers 151, 152, 153 and 156 display the same features of the graphic image Charles 13 as in the first generation 160.

In the preferred embodiment, the graphic image file 15, 16, or 17 is created by developing vector images of the plurality of features for the graphic image 11, 12, or 13. The features may be drawn on the computer or sketched manually, scanned to produce bitmap images of the features, which are then optimized. The bitmap images may be optimized by either scaling the bitmap image, adjusting the contrast of the bitmap image, and deleting any stray and extraneous pixels, or placing the scanned images into separate layers, tracing the scanned images, deleting the scanned images, converting the traced lines into outline shapes, and merging the outline shapes to form area shapes. Any
bitmap images drawn on the computer or sketched manually must be converted into vector images. In the preferred embodiment, the conversion is performed with the program Adobe® Streamline®. For example, the optimized bitmap images may first be saved as an Adobe® Photoshop® file, imported into Adobe® Streamline®, and converted by selecting the “Convert” command from the “File” menu and then the “Save Art” from the “File” menu. The file may then be saved as an Adobe® Illustrator® file.

The developed vector images are then perfected, preferably, by cleaning vector lines, duplicating each layer chosen to be tilted, and applying an angle of rotation to the chosen layers. Each vector image is pasted onto one of the layers, the layers are stacked to form the graphic image 11, 12, or 13, and a name that corresponds to a feature name template is assigned to each layer. In the preferred embodiment, the vector images are developed by using a vector-based illustration program, such as Adobe® Illustrator®, where the layers are registered, or lined up in relation to one another. Preferably, the name consists of coordinates 18 or code. The vector images are then converted into bitmap images and the layers are merged into a single file. In the preferred embodiment, this conversion is performed by a bit-map editing program, such as Adobe® Photoshop®. The bitmap images may be tinted, and the bitmap, vector, and graphic images may be altered to provide human-like characteristics. A multimedia authoring program, such as Macromedia Director by Media Lab, may then separate the layers into different pieces to form a character file 15, 16, or 17 for the graphic image 11, 12, or 13. In the preferred embodiment, PhotoCaster software by Media Lab is used to import Adobe® Photoshop® layers into the character file 15, 16, or 17, or Cast file of Macromedia Director. The character file 15, 16, or 17 has alpha channel information for each layer. In using the Macromedia Director software, preferably, the “CharacterImport.dir” file is opened, and the “Insert: Media Lab Media: PhotoCaster” command from the menu is chosen. Preferably, all of the sprites in the Score are selected and the “Chart Registry” behavior form the Behavior pull down list is chosen. The movie is rewound and played so that the
“Chart” should fill up with x and y coordinates 18 for each sprite. The chart is opened and coordinates are deleted from any labels with brackets around them.

While the invention has been disclosed with reference to certain preferred embodiments, numerous modifications, alterations, and changes to the described embodiments are possible without departing from the sphere and scope of the invention, as defined in the appended claims and their equivalents thereof. Accordingly, it is intended that the invention not be limited to the described embodiments, but that it have the full scope defined by the language of the following claims.
What we claim is:

1. A method of generating a graphic image comprising:
   providing a controller having a configuration generically related to a plurality of graphic images, each graphic image having a set of fixed coordinates assigned to layers, the layers having a feature of a desired graphic image, the feature having a plurality of versions;
   selecting a desired graphic image;
   choosing a predetermined function, having a series of parts and a set of coordinates that correspond with the chosen function, wherein at least one of the coordinates varies with each part of the function;
   displaying first layers assigned to a first set of coordinates to form a first generation of the desired graphic image that performs a first part of the chosen function;
   substituting at least one of the first layers with a second layer having an alternate version of the feature; and
   redisplaying any first layers and the at least one second layer assigned to a second set of coordinates to form a second generation of the desired graphic image to perform a second part of a chosen function.

2. The method of claim 1 further comprising:
   substituting a chosen graphic image with the desired graphic image.

3. The method of claim 1 further comprising:
   developing vector images of a plurality of features for the graphic image;
   perfecting the vector images;
   pasting each vector image onto one of the layers;
   stacking the layers to form the graphic image;
   assigning a name that corresponds to a feature name template to each layer;
   converting the vector images into bitmap images; and
   merging the layers into a graphic image file.
4. The method of claim 3 wherein the developing comprises:
   drawing the features on a computer; and
   converting any bitmap images into vector images.

5. The method of claim 3 wherein the developing comprises:
   drawing the features including at least a portion of a body, a torso, a head, a
   plurality of mouths, and a plurality of eyes.

6. The method of claim 3 wherein the developing comprises:
   sketching the features manually;
   scanning the sketches to produce bitmap images of the features;
   optimizing the bitmap images; and
   converting the bitmap images into vector images.

7. The method of claim 6 wherein the optimizing comprises:
   scaling the bitmap image;
   adjusting contrast of the bitmap image; and
   deleting any stray and extraneous pixels.

8. The method of claim 6 wherein the optimizing comprises:
   placing the bitmap images into separate layers;
   tracing the bitmap images;
   deleting the bitmap images;
   converting the traced lines into outline shapes; and
   merging the outline shapes to form area shapes.

9. The method of claim 3 wherein the perfecting comprises:
   cleaning vector lines;
   duplicating each layer chosen to be tilted; and
   applying an angle of rotation to the chosen layers.

10. The method of claim 3 wherein the assigning comprises:
    providing coordinates for each layer.

11. The method of claim 3 further comprising:
tinting the bitmap images.

12. The method of claim 3 further comprising altering any bitmap, vector, or graphic images to provide human-like characteristics.

13. The method of claim 1 wherein the displaying comprises:

5 placing the layers from bottom to top in order of a selected background, a selected portion of a body, a selected head, a selected mouth, a selected set of eyes, and a selected foreground.

14. A graphic image database for use with an interactive interface program comprising:

10 a plurality of layers forming a graphic image, including:

a torso;

a head, having an upper portion and a lower portion, proximate the torso;

a mouth within the head proximate the lower portion;

a pair of eyes within the head proximate the upper portion; and

15 a plurality of special features interchangeable with at least one of the features; and a set of coordinates assigned to each layer, the coordinates defined by the interactive interface program.

15. The graphic image database of claim 14 further comprising a foreground and a background.

16. The graphic image database of claim 14 wherein the head is selected from a plurality of interchangeable heads comprising at least one position of center, center left, and center right.

17. The graphic image database of claim 14 wherein the mouth is selected from a plurality of interchangeable mouths comprising at least one position of resting, smiling, open, closed, center, center left, center right and a plurality of positions corresponding with speech.

18. The graphic image database of claim 14 wherein the set of eyes is selected from a plurality of interchangeable eyes comprising at least one position of center, center
attentive, looking left, looking right, looking up, looking down, shut, center, center left, and center right.

19. The graphic image database of claim 14 wherein the special features comprise raising an eyebrow, brushing a shoulder, and straightening a tie.

20. The graphic image database of claim 14 wherein the special features comprise a plurality of layers displayed in sequence.

21. The graphic image database of claim 14 wherein the graphic image comprises at least one of a two-dimensional character, a three-dimensional character, and a photograph.

22. The graphic image database of claim 14 wherein the graphic image comprises:

   the torso having a center position;

   the head having interchangeable positions of center, center left, and center right;

   the mouth having interchangeable positions of center resting, center left resting, center right resting, a plurality of center positions, a plurality of center left positions, and a plurality of center right positions;

   the pair of eyes having interchangeable positions of center shut, center down, center up, center right, center left, center center attentive, center center, center left shut, center left down, center left up, center left center attentive, center left center, center right shut, center right down, center right up, center right right, center right left, center right center attentive, and center right center; and

20   the special features including:

   raise eyebrows interchangeable with the pair of eyes;

   brush shoulders interchangeable with the torso; and

   straighten tie interchangeable with the torso.

23. The graphic image database of claim 14 wherein graphic image comprises:

25   the torso having a center position;

   the head having interchangeable positions of center, center left, and center right;
the mouth having interchangeable positions of center resting, center left resting, center right resting, a plurality of center positions, a plurality of center left positions, and a plurality of center right positions;

the pair of eyes having interchangeable positions of center shut, center down, center up, center right, center left, center center attentive, center center, center left shut, center left down, center left up, center left center attentive, center left center, center right shut, center right down, center right up, center right right, center right left, center right center attentive, and center right center; and the special features including:
b lows bangs up interchangeable with the head and the mouth;

sticks tongue out interchangeable with the mouth and the pair of eyes;
winks interchangeable with the set of eyes; and looks at watch interchangeable with the torso.
FIG. 3

FIRST BACKGROUND LAYER

FIRST BODY LAYER

FIRST HEAD LAYER

FIRST MOUTH LAYER

FIRST EYES LAYER

FIRST FOREGROUND LAYER

SECOND MOUTH LAYER

SECOND EYES LAYER
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06T 11/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06T

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 practical, search terms used)
EPO-Internal, WPI Data, PAJ, IBM-TDB, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>EP 0 571 934 A (CASIO COMPUTER CO LTD) 1 December 1993 (1993-12-01) column 12, line 34 – line 51; figures 8,34</td>
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[** Further documents are listed in the continuation of box C. **]

[** Patent family members are listed in annex. **]

* Special categories of cited documents:
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Date of the actual completion of the international search
23 April 2001

Date of mailing of the international search report
02/05/2001

Name and mailing address of the ISA
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Authorized officer
Perez Molina, E
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