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In Re The Application Of: )  
 )  
Shmuel Peleg, et al. )  
 )  
Serial No. 09/396,248 ) Examiner: Behrooz M. Senfi  
 )  
Filed: September 16, 1999 ) Art Unit 2613  
 )  
For: System and Method for Generating and Displaying Panoramic Images and Movies

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Respectfully submitted

*Richard A. Jordan*

Richard A. Jordan  
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Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

Sir:



Response To Office Action

This Response to Office Action is in response to the Office Action mailed June 5, 2002.

# **A. Clean Version Of Amended Portion(s) Of Application**

## In the Claims

The following are all claims that are to be pending in the above-referenced application as a result of this Response to Office Action. Claims 1 through 27 have been cancelled, and claims 28-127 have been added.

1 ~~28~~. A system for generating a stereoscopic panoramic mosaic image pair comprising:

2 A. a strip generator module configured to generate two series of image strips, all of said image  
3 strips in each series comprising strips of a series of images of a scene as would be recorded  
4 by a camera from a respective series of positions relative to the scene, the image strips of the  
5 respective series representing strips of the respective images displaced from one another by  
6 at least one selected displacement; and

7 B. a mosaic image generator module configured to mosaic the respective series of images strips  
8 together thereby to construct two panoramic mosaic images, the panoramic mosaic images  
9 comprising the stereoscopic panoramic mosaic image pair providing a stereoscopic image  
10 of the scene as recorded over the path.

1 ~~29~~. A system as defined in claim ~~28~~ in which the series of positions define a path at least a portion  
2 of which corresponds to a curved arc.

1 ~~30~~. A system as defined in claim ~~28~~ in which the series of positions define a path at least a portion  
2 of which corresponds to a straight line.

1 ~~31~~. A system as defined in claim ~~28~~ in which the series of positions define a translation relative to  
2 the scene.

1 32. A system as defined in claim 28 in which the series of positions define a change in angular  
2 orientation relative to the scene.

1 33. A system as defined in claim 28 in which the image strips are parallel to an axis defined for the  
2 respective image.

1 34. A system as defined in claim 33 in which the axis is horizontal.

1 35. A system as defined in claim 33 in which the axis is vertical.

1 36. A system as defined in claim 28 in which the strip generator module includes a camera  
2 configured to record at least one image strip.

1 37. A system as defined in claim 36 in which the camera is configured to record a plurality of image  
2 strips from both series.

1 38. A system as defined in claim 37 in which the strip generator module includes a plurality of  
2 cameras configured to record at least image strips from both series, the plurality of cameras being  
3 disposed at respective positions along the path.

1 39. A system as defined in claim 36 in which the strip generator module further includes  
2 A. a reflector configured to reflect images of the scene to the camera for recording thereby of  
3 at least the image strips; and  
4 B. a reflector position control module configured to position the reflector at at least one position  
5 to facilitate definition of the path.

1 40. A system as defined in claim 39 in which the reflector has at least one flat portion.

1 41. A system as defined in claim 39 in which the reflector has at least one curved portion.

1 42. A system as defined in claim 39 in which the reflector position control module is configured to  
2 position the reflector at a plurality of positions to facilitate definition of the path.

1 43. A system as defined in claim 28 in which the strip generator module is configured to generate  
2 at least one image strip using a selected computer graphics methodology.

1 44. A system as defined in claim 43 in which the strip generator module is configured to generate  
2 a plurality of image strips, at least one of the plurality of image strips being generated using the  
3 selected computer graphics methodology.

1 45. A system as defined in claim 28 in which the strip generator module is configured to generate  
2 the two series of image strips such that the displacement varies as between at least two images.

1 46. A system as defined in claim 45 in which the strip generator module includes  
2 A. a camera configured to record a plurality of images; and  
3 B. a strip selector module configured to select at least two image strips from respective ones of  
4 the images, one of the selected image strips from each of the images being associated with  
5 one of the respective series, the strip selector module being configured to control the  
6 locations in the respective images from which the image strips are selected thereby to  
7 provide the respective displacements.

1 47. A system as defined in claim 46 in which the strip selector module is configured to control the  
2 locations in the respective images from which the image strips are selected by controlling the  
3 separations of the image strips in the respective images.

1 48. A system as defined in claim 45 in which the strip generator module is configured to generate  
2 at least some of said image strips using a selected computer graphics methodology.

1 49. A system as defined in claim 28 in which:

- 2 A. the strip generator module is further configured to generate a third series of image strips, all  
 3 of said image strips in said third series comprising strips of a series of images of a scene as  
 4 would be recorded by a camera, the image strips of the third series being displaced from the  
 5 image strips of the other two series by another selected displacement; and  
 6 B. the mosaic image generator module is further configured to mosaic the third series of images  
 7 strips together thereby to construct a third panoramic mosaic image, a selected two of the  
 8 panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair.

1 *23* 30. A system as defined in claim 28 in which:

- 2 A. the strip generator module is further configured to generate camera position information  
 3 representing positions of the camera associated with the respective image strips; and  
 4 B. the mosaic image generator module is further configured to use the camera position  
 5 information in constructing the panoramic mosaic images.

1 *24* 31. A system as defined in claim 28 in which the mosaic image generator module is configured to  
 2 generate at least one of the panoramic mosaic images by measuring image motion between  
 3 successive image strips using a selected computer vision technique.

4 *25* 32. A system for generating a stereoscopic panoramic mosaic image pair comprising:

- 5 A. a strip generator module configured to generate two series of image strips, all of said image  
 6 strips in each series comprising strips of a series of images of a scene as would be recorded  
 7 by a camera from a respective series of positions relative to the scene, the image strips of the  
 8 respective series representing strips of the respective images displaced from one another by  
 9 at least two selected displacements;  
 10 B. a mosaic image generator module configured to mosaic the respective series of images strips  
 11 together thereby to construct two panoramic mosaic images, the panoramic mosaic images  
 12 comprising the stereoscopic panoramic mosaic image pair providing a stereoscopic image  
 13 of the scene.

1 *26* 33. A system as defined in claim 32 in which the strip generator module includes

- 2 A. a camera configured to record a plurality of images; and  
 3 B. a strip selector module configured to select at least two image strips from respective ones of  
 4 the images, one of the selected image strips from each of the images being associated with  
 5 one of the respective series, the strip selector module being configured to control the  
 6 locations in the respective images from which the image strips are selected thereby to  
 7 provide the respective displacements.

1 *21* 34. A system as defined in claim *25* 52 in which the strip generator module is configured to generate  
 2 at least some of said image strips using a selected computer graphics methodology.

1 *20* 35. A system as defined in claim *25* 52 in which:

- 2 A. the strip generator module is further configured to generate a third series of image strips, all  
 3 of said image strips in said third series comprising strips of a series of images of a scene as  
 4 would be recorded by a camera, the image strips of the third series being displaced from the  
 5 image strips of the other two series by another selected displacement; and  
 6 B. the mosaic image generator module is further configured to mosaic the third series of images  
 7 strips together thereby to construct a third panoramic mosaic image, a selected two of the  
 8 panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair.

1 *29* 36. A system for displaying a stereo panoramic image to a viewer, said system comprising:

- 2 A. a panoramic screen;  
 3 B. a plurality of projectors each disposed to project a respective portion of one of a plurality  
 4 panoramic images in overlapping fashion on the screen, each panoramic image being for  
 5 viewing by a respective one of a viewer's eyes; and  
 6 C. a viewing arrangement for facilitating transmission of a respective one of said images to each  
 7 of the viewer's eyes thereby to facilitate stereoscopic viewing of the panoramic image  
 8 defined by the panoramic images.

1 *29* 37. A system as defined in claim *29* 36 in which:

- 2 A. the respective panoramic images are polarized with orthogonal polarizations; and

- 3 B. the viewing arrangement comprises a pair of lenses polarized with corresponding orthogonal  
4 polarizations.

1 *31* 58. A system as defined in claim *29* 56 in which:

- 2 A. the respective panoramic images are of different colors; and  
3 B. the viewing arrangement comprises a pair of lenses having the corresponding colors.

1 *32* 59. A system for displaying a stereo panoramic image to a viewer, said system comprising:

- 2 A. a panoramic screen;  
3 B. a plurality of projectors each configured to project a respective portion of a panoramic image  
4 on the screen, the panoramic image comprising alternating portions of panoramic images  
5 each to be alternatingly viewed by respective ones of a viewers eyes; and  
6 C. a viewing arrangement for facilitating alternating transmission of the respective alternating  
7 portions to respective ones of the viewer's eyes thereby to facilitate stereoscopic viewing of  
8 the panoramic image.

1 *33* 60. A system as defined in claim *32* 59 in which the viewing arrangement comprises a pair of lenses,  
2 each lens being associated with a shutter, the shutters being configured to alternatingly open and  
3 close in synchrony with the display of the respective alternating portions.

1 *34* 61. A method of generating a stereoscopic panoramic mosaic image pair comprising the steps of:

- 2 A. a strip generation step of generating two series of image strips, all of said image strips in  
3 each series comprising strips of a series of images of a scene as would be recorded by a  
4 camera from a respective series of positions relative to the scene, the image strips of the  
5 respective series representing strips of the respective images displaced from one another by  
6 at least one selected displacement; and  
7 B. a mosaic image generation step of mosaicing the respective series of images strips together  
8 thereby to construct two panoramic mosaic images, the panoramic mosaic images comprising  
9 the stereoscopic panoramic mosaic image pair providing a stereoscopic image of the scene  
10 as recorded over the path.

1 35 62. A method as defined in claim 61 in which the series of positions define a path at least a portion  
2 of which corresponds to a circular arc.

1 36 63. A method as defined in claim 61 in which the series of positions define a path at least a portion  
2 of which corresponds to a straight line.

1 37 64. A method as defined in claim 61 in which the series of positions define a translation relative to  
2 the scene.

1 38 65. A method as defined in claim 61 in which the series of positions define a change in angular  
2 orientation relative to the scene.

1 39 66. A method as defined in claim 61 in which the image strips are parallel to an axis defined for the  
2 respective image.

1 40 67. A method as defined in claim 66 in which the axis is horizontal.

1 41 68. A system as defined in claim 66 in which the axis is vertical.

1 42 69. A method as defined in claim 61 in which the strip generation step includes the step of using a  
2 camera configured to record at least one image strip.

1 43 70. A method as defined in claim 69 in which the strip generation step includes the step of using a  
2 camera configured to record a plurality of image strips from both series.

1 44 71. A method as defined in claim 70 in which the strip generation step includes the step of using a  
2 plurality of cameras configured to record at least image strips from both series, the plurality of  
3 cameras being disposed at respective positions along the path.

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1 45 72. A method as defined in claim 69 in which the strip generation step further includes the steps of  
 2 A. using a reflector configured to reflect images of the scene to the camera for recording  
 3 thereby; and

4 B. positioning the reflector at at least one position to facilitate definition of the path.

1 46 73. A method as defined in claim 72 in which the reflector has at least one flat portion.

1 47 74. A method as defined in claim 72 in which the reflector has at least one flat portion.

1 48 75. A method as defined in claim 72 in which the reflector positioning step includes the step of  
 2 positioning the reflector at a plurality of positions to facilitate definition of the path.

1 49 76. A method as defined in claim 61 in which the strip generation step includes the step of  
 2 generating at least one image strip using a selected computer graphics methodology.

1 50 77. A method as defined in claim 76 in which the strip generation step includes the step of  
 2 generating a plurality of image strips, at least one of the plurality of image strips being generated  
 3 using the selected computer graphics methodology.

1 51 78. A method as defined in claim 76 in which the strip generation step includes the step of  
 2 generating the two series of image strips such that the displacement varies as between at least two  
 3 images.

1 52 79. A method as defined in claim 78 in which the strip generation step includes the steps of  
 2 A. using a camera to record a plurality of images; and  
 3 B. a strip selection step of selecting at least two image strips from respective ones of the images,  
 4 one of the selected image strips from each of the images being associated with one of the  
 5 respective series, the strip selection step including the step of controlling the locations in the  
 6 respective images from which the image strips are selected thereby to provide the respective  
 7 displacements.

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1 80. A method as defined in claim 79 in which the strip selection step includes the step of controlling  
2 the locations in the respective images from which the image strips are selected by controlling the  
3 separations of the image strips in the respective images.

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1 81. A method as defined in claim 78 in which the strip generation step includes the step of  
2 generating at least some of said image strips using a selected computer graphics methodology.

55  
1 82. A method as defined in claim 61 in which:

- 2 A. the strip generation step includes the step of generating a third series of image strips, all of  
3 said image strips in said third series comprising strips of a series of images of a scene as  
4 would be recorded by a camera, the image strips of the third series being displaced from the  
5 image strips of the other two series by another selected displacement; and  
6 B. the mosaic image generation step includes the step of mosaicing the third series of images  
7 strips together thereby to construct a third panoramic mosaic image, a selected two of the  
8 panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair.

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1 83. A method as defined in claim 61 in which:

- 2 A. the strip generation step includes the step of generating camera position information  
3 representing positions of the camera associated with the respective image strips; and  
4 B. the mosaic image generation step includes the step of using the camera position information  
5 in constructing the panoramic mosaic images.

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1 84. A method as defined in claim 61 in which the mosaic image generation step includes the step of  
2 generate at least one of the panoramic mosaic images by measuring image motion between  
3 successive image strips using a selected computer vision technique.

58  
1 85. A method for generating a stereoscopic panoramic mosaic image pair comprising:

- 2 A. a strip generation step of generating two series of image strips, all of said image strips in  
3 each series comprising strips of a series of images of a scene as would be recorded by a

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camera from a respective series of positions relative to the scene, the image strips of the respective series representing strips of the respective images displaced from one another by at least two selected displacements; and

- B. a mosaic image generation step of mosaicing the respective series of images strips together thereby to construct two panoramic mosaic images, the panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair providing a stereoscopic image of the scene.

86. A method as defined in claim 85 in which the strip generation step includes the steps of

- A. using a camera to record a plurality of images; and

- B. a strip selection step of selecting at least two image strips from respective ones of the images, one of the selected image strips from each of the images being associated with one of the respective series, the strip selection step including the step of controlling the locations in the respective images from which the image strips are selected thereby to provide the respective displacements.

87. A method as defined in claim 86 in which the strip selection step includes the step of controlling the locations in the respective images from which the image strips are selected by controlling the separations of the image strips in the respective images.

88. A method as defined in claim 85 in which the strip generation step includes the step of generating at least some of said image strips using a selected computer graphics methodology.

89. A method as defined in claim 85 in which:

- A. the strip generation step includes the step of generating a third series of image strips, a third series of image strips, all of said image strips in said third series comprising strips of a series of images of a scene as would be recorded by a camera, the image strips of the third series being displaced from the image strips of the other two series by another selected displacement; and

7 B. the mosaic image generation step includes step of mosaicing the third series of images strips  
 8 together thereby to construct a third panoramic mosaic image, a selected two of the  
 9 panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair.

1 *63* 90. A method as defined in claim *58* 85 in which:

2 A. the strip generation step includes the step of generating camera position information  
 3 representing positions of the camera associated with the respective image strips; and

4 B. the mosaic image generation step includes the step of using the camera position information  
 5 in constructing the panoramic mosaic images.

1 *64* 91. A method as defined in claim *58* 85 in which the mosaic image generation step includes the step of  
 2 generate at least one of the panoramic mosaic images by measuring image motion between  
 3 successive image strips using a selected computer vision technique.

1 *65* 92. A method of displaying a stereo panoramic image to a viewer on a panoramic screen, said  
 2 method comprising the steps of:

3 A. using a plurality of projectors each disposed to project a respective portion of one of a  
 4 plurality panoramic images in overlapping fashion on the screen; and

5 C. using a viewing arrangement to facilitate transmission of a respective one of said images to  
 6 each of the viewer's eyes thereby to facilitate stereoscopic viewing of the panoramic image  
 7 defined by the respective panoramic images.

1 *66* 93. A method as defined in claim *65* 92 in which:

2 A. the respective panoramic images are polarized with orthogonal polarizations; and

3 B. the viewing arrangement using step includes the step of using a viewing arrangement that  
 4 comprises a pair of lenses polarized with corresponding orthogonal polarizations.

1 *67* 94. A method as defined in claim *65* 92 in which:

2 A. the respective panoramic images are of different colors; and

B. the viewing arrangement using step includes the step of using a viewing arrangement that comprises a pair of lenses having the corresponding colors.

95. A method displaying a stereo panoramic image to a viewer on a panoramic screen, said method comprising the steps of:

- A. using a plurality of projectors each configured to project a respective portion of a panoramic image on the screen, the panoramic image comprising alternating portions of panoramic images each to be alternatingly viewed by respective ones of a viewers eyes; and
- C. using a viewing arrangement for facilitating alternating transmission of the respective alternating portions to respective ones of the viewer's eyes thereby to facilitate stereoscopic viewing of the panoramic image.

96. A method as defined in claim 95 in which the viewing arrangement comprises a pair of lenses, each lens being associated with a shutter, the method including the step of controlling the shutters to alternatingly open and close in synchrony with the display of the respective alternating portions.

97. A computer program product for use in connection with a computer to provide a system for generating a stereoscopic panoramic mosaic image pair, the computer program product comprising a computer-readable medium having encoded thereon:

- A. a strip generator module configured to enable the computer to generate two series of image strips, all of said image strips in each series comprising strips of a series of images of a scene as would be recorded by a camera from a respective series of positions relative to the scene, the image strips of the respective series representing strips of the respective images displaced from one another by at least one selected displacement; and
- B. a mosaic image generator module configured to enable the computer to mosaic the respective series of images strips together thereby to construct two panoramic mosaic images, the panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair providing a stereoscopic image of the scene as recorded over the path.

1 71 98. A computer program product as defined in claim 97 in which the series of positions define a path  
2 at least a portion of which corresponds to a circular arc.

1 72 99. A computer program product as defined in claim 97 in which the series of positions define a path  
2 at least a portion of which corresponds to a straight line.

1 73 100. A computer program product as defined in claim 97 in which the series of positions define a  
2 translation relative to the scene.

1 74 101. A computer program product as defined in claim 97 in which the series of positions define a  
2 change in angular orientation relative to the scene.

1 75 102. A computer program product as defined in claim 97 in which the image strips are parallel to  
2 an axis defined for the respective image.

1 76 103. A computer program product as defined in claim 102 in which the axis is horizontal.

1 77 104. A computer program product as defined in claim 102 in which the axis is vertical.

1 78 105. A computer program product as defined in claim 97, the system further including a camera  
2 configured to record an image including at least one image strip, the strip generator module being  
3 further configured to enable the computer to generate the at least one image strip from the image.

1 79 106. A computer program product as defined in claim 105 in which the camera is configured to  
2 record a plurality of images each including at least one image strip from both series, the strip  
3 generator module being further configured to enable the computer to generate the respective image  
4 strips from the respective images.

1 107. A computer program product as defined in claim 106 in which system includes a plurality of  
2 cameras configured to record at least image strips from both series, the plurality of cameras being  
3 disposed at respective positions along the path.

1 108. A computer program product as defined in claim 105 in which  
2 A. the system further includes a reflector configured to reflect images of the scene to the camera  
3 for recording thereby; and  
4 B. the strip generator module further includes a reflector position control module configured to  
5 enable the computer to enable the reflector to be positioned at at least one position to  
6 facilitate definition of the path.

1 109. A computer program product as defined in claim 108 in which the reflector has at least one flat  
portion.

1 110. A computer program product as defined in claim 108 in which the reflector has at least one flat  
2 portion.

1 111. A computer program product as defined in claim 108 in which the reflector position control  
2 module is configured to enable the computer to enable the reflector to be positioned at a plurality  
3 of positions to facilitate definition of the path.

1 112. A computer program product as defined in claim 97 in which the strip generator module is  
2 configured to enable the computer to generate at least one image strip using a selected computer  
3 graphics methodology.

1 113. A computer program product as defined in claim 112 in which the strip generator module is  
2 configured to enable the computer to generate a plurality of image strips, at least one of the plurality  
3 of image strips being generated using the selected computer graphics methodology.

1 14. A computer program product as defined in claim 97 in which the strip generator module is  
2 configured to enable the computer to generate generate the two series of image strips such that the  
3 displacement varies as between at least two images.

1 15. A computer program product as defined in claim 14 in which:  
2 A. the system includes a camera configured to record a plurality of images; and  
3 B. the strip generator module includes a strip selector module configured to enable the computer  
4 to select at least two image strips from respective ones of the images, one of the selected  
5 image strips from each of the images being associated with one of the respective series, the  
6 strip selector module being configured to enable the computer to control the locations in the  
7 respective images from which the image strips are selected thereby to provide the respective  
8 displacements.

1 16. A computer program product as defined in claim 15 in which the strip selector module is  
2 configured to enable the computer to control the locations in the respective images from which the  
3 image strips are selected by controlling the separations of the image strips in the respective images.

1 17. A computer program product as defined in claim 14 in which the strip generator module is  
2 configured to enable the computer to generate at least some of said image strips using a selected  
3 computer graphics methodology.

1 18. A computer program product as defined in claim 97 in which:  
2 A. the strip generator module is further configured to enable the computer to generate a third  
3 series of image strips, all of said image strips in said third series comprising strips of a series  
4 of images of a scene as would be recorded by a camera, the image strips of the third series  
5 being displaced from the image strips of the other two series by another selected  
6 displacement; and  
7 B. the mosaic image generator module is further configured to enable the computer to mosaic  
8 the third series of images strips together thereby to construct a third panoramic mosaic



9 image, a selected two of the panoramic mosaic images comprising the stereoscopic  
10 panoramic mosaic image pair.

1 96 119. A computer program product as defined in claim 97 in which: 70

2 A. the strip generator module is further configured to enable the computer to generate camera  
3 position information representing positions of the camera associated with the respective  
4 image strips; and

5 B. the mosaic image generator module is further configured to enable the computer to use the  
6 camera position information in constructing the panoramic mosaic images.

1 93 120. A computer program product as defined in claim 97 in which the mosaic image generator  
2 module is configured to enable the computer to generate at least one of the panoramic mosaic images  
3 by measuring image motion between successive image strips using a selected computer vision  
4 technique. 70

1 94 121. A computer program product for use in connection with a computer to provide a system for  
2 generating a stereoscopic panoramic mosaic image pair, the computer program product comprising  
3 a computer readable medium having encoded thereon:

4 A. a strip generator module configured to enable the computer to generate two series of image  
5 strips, all of said image strips in each series comprising strips of a series of images of a scene  
6 as would be recorded by a camera from a respective series of positions relative to the scene,  
7 the image strips of the respective series representing strips of the respective images displaced  
8 from one another by at least two selected displacements;

9 B. a mosaic image generator module configured to enable the computer to mosaic the respective  
10 series of images strips together thereby to construct two panoramic mosaic images, the  
11 panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair  
12 providing a stereoscopic image of the scene.

1 95 122. A computer program product as defined in claim 121 in which 94

2 A. the system includes a camera configured to record a plurality of images; and

B. the strip generator module includes a strip selector module configured to enable the computer to select at least two image strips from respective ones of the images, one of the selected image strips from each of the images being associated with one of the respective series, the strip selector module being configured to control the locations in the respective images from which the image strips are selected thereby to provide the respective sets of angles.

123. A computer program product as defined in claim 122 in which the strip selector module is configured to enable the computer to control the locations in the respective images from which the image strips are selected by controlling the separations of the image strips in the respective images.

124. A computer program product as defined in claim 121 in which the strip generator module is configured to enable the computer to generate at least some of said image strips using a selected computer graphics methodology.

125. A computer program product as defined in claim 121 in which:

A. the strip generator module is further configured to enable the computer to generate a third series of image strips, all of said image strips in said third series comprising strips of a series of images of a scene as would be recorded by a camera, the image strips of the third series being displaced from the image strips of the other two series by another selected displacement; and

B. the mosaic image generator module is further configured to enable the computer to mosaic the third series of images strips together thereby to construct a third panoramic mosaic image, a selected two of the panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair.

126. A computer program product as defined in claim 121 in which:

A. the strip generator module is further configured to enable the computer to generate camera position information representing positions of the camera associated with the respective image strips; and

5 B. the mosaic image generator module is further configured to enable the computer to use the  
6 camera position information in constructing the panoramic mosaic images.

1 10 127. A computer program product as defined in claim 121 in which the mosaic image generator  
2 module is configured to enable the computer to generate at least one of the panoramic mosaic images  
3 by measuring image motion between successive image strips using a selected computer vision  
4 technique.

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**B. Marked-Up Version Of Amended Portion(s) Of Application To Show Changes Made**

In the Claims

The changes made to the previously-pending claims are: the cancellation of claims 1-27 and the addition of new claims 28-127.

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REMARKS

The Office Action mailed June 5, 2002 has been carefully considered.

In the Office Action, the Examiner rejected claims 1-8 under 35 U. S. C. §103 as being obvious over U. S. Patent No. 5,963,664 to Kumar et al (hereinafter "Kumar") in view of U. S. Patent No. 5,850,352 to Moezzi, et al. (hereinafter "Moezzi"). The Examiner also rejected claims 9-11, 24 and 25 under 35 U. S. C. §102 as being anticipated by U. S. Patent Application Publication No. US 2002/0005921 to Sasakura, et al. (hereinafter "Sasakura"), and claims 12 and 27 under 35 U. S. C. §103 as being obvious over Sasakura in view of U. S. Patent No. 5,130,794 to Ritchey (hereinafter "Ritchey"). The Examiner further rejected claims 13-23 under 35 U. S. C. §103 as being obvious over Kumar in view of Moezzi, and further in view of U. S. Patent No. 5,686,975 to Lipton (hereinafter "Lipton"). No claims have been allowed.

By this Response, Applicants are cancelling claims 1-27 and adding new claims 28-113 including new independent apparatus claims 28, 52, 56 and 59, new independent method claims 60, 85, 92 and 95, and new independent computer program product claims 97 and 125.

Applicants respectfully submit that the claims patentably distinguish over the references. Applicants will initially address independent apparatus claim 28, as also representative of independent method claim 60 and independent computer program product claim 97. Claim 28 is directed to a system for generating a stereoscopic panoramic mosaic image pair comprising a strip generator module and a mosaic image generator module. The strip generator module is configured to generate two series of image strips, with all of the image strips in each series comprising strips of a series of images of a scene as would be recorded by a camera from a respective series of positions relative to the scene, and with the image strips of the respective series representing strips of the respective images displaced from one another by at least one selected displacement. The mosaic image generator module is configured to mosaic the respective series of images strips together thereby to construct two panoramic mosaic images, the panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair providing a stereoscopic image of the scene as recorded over the path.



Preliminarily, regarding claim 28, Applicants note that the strip generator module is recited as generating image strips from images *as would be* recorded by a camera. This language is used for several purposes. For example, the language is used to make clear that the images would not actually need to be recorded by a camera, but instead may be generated by other means, such as, for example, a computer graphics arrangement, as is specifically recited in claim 32. In addition, the language is used to make clear that the strip generator module does not have to generate, for each image strip, an entire image--instead, the strip generator module need only generate the respective image strip.

Applicants respectfully submit that the references neither teach nor suggest the invention recited in claim 28. Applicants will address the Kumar and Moezzi references in connection with claim 28. Kumar describes a system for generating a three-dimensional mosaic of a scene using a plurality of images of the scene. In Kumar's system, information from the images are used to generate two mosaics, including what appears to be a image mosaic representing a panoramic view of the scene and a shape mosaic representing the three-dimensional geometry of the scene. The image mosaic is a conventional two-dimensional mosaic derived from a series of images of the scene that overlap somewhat along their edges to facilitate mosaicing them together. For the three-dimensional shape mosaic, a pair of images are used, one of which is referred to as a reference image and the other as an inspection image. Both images are used to simulate a parametric reference surface in the portion of the scene that appears in both images. In addition, both images are used to generate a parallax displacement field for the portion of the scene that appears in both images. The parallax displacement field comprises a plurality of parallax displacement vectors in the reference image. Each parallax displacement vector is associated with a point on the surface of an object in the scene and the magnitude and direction corresponds to the displacement of the point P (referring to Kumar FIG. 3) in the scene from the point Q on the parametric reference surface that corresponds to the projection of the point P onto the parametric reference surface along the line from the optical center M of the camera that recorded the inspection image. After the parametric reference surface and parallax displacement field have been generated, the three-dimensional shape mosaic is generated.



While Kumar describes a system for generating two mosaics, the mosaics are very different from those generated by the arrangement recited in claim 28. In the arrangement recited in claim 28, the two mosaic images comprise a panoramic mosaic image pair that, when viewed contemporaneously by respective left and right eyes, facilitate panoramic stereoscopic viewing of a scene. The mosaics generated by Kumar's system comprise one conventional two-dimensional image mosaic and a three-dimensional mosaic, and there is no suggestion that they are to be viewed contemporaneously by respective eyes of a viewer or that, if they were, that would facilitate panoramic *stereoscopic* viewing of the scene. The Examiner recognizes this deficiency and cites Moezzi as teaching that "respective left and right eyes facilitate panoramic stereoscopic viewing of a scene." While Moezzi does teach that respective left and right eyes facilitate *stereoscopic* viewing of a scene, Applicants respectfully submit that it does not teach that respective left and right eyes facilitate *panoramic stereoscopic* viewing of a scene. Regardless, Applicants respectfully submit that there is no suggestion in either Moezzi or Kumar of generating two panoramic images, that, when a viewer views them contemporaneously with his or her respective left and right eyes, facilitate panoramic stereoscopic viewing of the scene, with each of the images being generated by mosaicing together respective left and right strips from a series of images, as is required in the claim.

More specifically, Moezzi teaches an arrangement that generates two two-dimensional images (a "stereoscopic image pair") that facilitate stereoscopic viewing of a scene, but the arrangement generates the images from a three dimensional model of the scene. The three-dimensional model is, in turn, generated from two-dimensional images of the scene. Accordingly, Moezzi's arrangement uses two-dimensional images to generate a three-dimensional model, from which a stereoscopic image pair is generated. Thus, Moezzi's arrangement goes from two-dimensional images, to a three-dimensional model, and again to two-dimensional images (the stereoscopic image pair). In the arrangement recited in claim 28, it is unnecessary to generate a three-dimensional model; each of the left and right panoramic mosaic images can be generated directly from the two-dimensional images.

Accordingly, Applicants respectfully submit that claim 28 patentably distinguishes over the references. Applicants further submit that method claim 60 and computer program product claim 97 also patentably distinguish over the references for the same reasons as set forth above in

connection with claim 28. Applicants further submit that the claims that depend directly or indirectly from independent claims 28, 57 and 87 are allowable at least for the reason that they depend from allowable independent claims.

Applicant will address independent apparatus claim 52, as representative also of new independent method claim 85 and new independent computer program product claim 125. Apparatus claim 50 is similar to apparatus claim 28, except that apparatus claim 52 also calls for at least two selected displacements of the image strips. This allows for changing the stereoscopic disparity as between different parts of the stereoscopic panorama when images comprising the stereoscopic panoramic mosaic image pair are viewed together. Applicants submit that claim 50 is allowable at least for the reasons set forth above in connection with claim 28. Applicant further submits that method claim 85 and computer program product claim 125 are allowable at least for the reasons set forth above in connection with claim 52, and that the claims depending directly or indirectly from claims 52, 85 and 125 are allowable at least for the reason that they depend from allowable independent claims.

Applicants further submit that independent apparatus claims 56 and 59 and independent method claims 92 and 95 patentably distinguish over the references. These claims are directed to systems and methods for displaying panoramic stereoscopic images to a viewer, along the lines described in connection with FIGS. 12A and 12B. Applicant will address new claim 56 as also being representative of method claim 92. Claim 56 recites a system for displaying a stereo panoramic image to a viewer, the system comprising a panoramic screen, a plurality of projectors and a viewing arrangement. The various projectors are disposed to project a respective portion of one of a plurality left and right panoramic images in overlapping fashion on the screen. The viewing arrangement facilitates transmission of a respective one of said images to each of the viewer's eyes thereby to facilitate stereoscopic viewing of the panoramic image defined by the left and right panoramic images.

The Examiner cited Sasakura in connection with claim 9, which is directed to a system for displaying a stereo panoramic image to a viewer, and so Applicants will address claim Sasakura in connection with claim 56 here. Sasakura describes an arrangement for displaying images stereoscopically to a viewer. In Sasakura's arrangement, the images for the respective eyes are



projected directly into the respective eyes. There is no suggestion in Sasakura of projecting images onto a panoramic screen in an overlapping manner, and providing an arrangement for the viewer to use to disambiguate the respective images for the respective eyes, as required in the patent claim. Accordingly, Applicants respectfully submit that Sasakura neither teaches nor suggests the invention recited in claim 56.

Applicants further submit that Sasakura neither teaches nor suggests the invention recited in method claim 92 for the reasons set forth above in connection with claim 56.

Applicants will address new independent apparatus claim 59 as also being representative of independent method claim 95. Claim 59 is directed to a system for displaying a stereo panoramic image to a viewer, the system comprising a panoramic screen, a plurality of projectors and a viewing arrangement. Each projector is configured to project a respective portion of a panoramic image on the screen, the panoramic image comprising alternating portions of panoramic images each to be alternately viewed by respective ones of a viewer's eyes. The viewing arrangement facilitates alternating transmission of the respective alternating portions to respective ones of the viewer's eyes thereby to facilitate stereoscopic viewing of the panoramic image. Essentially, claim 59 is directed to the arrangement described on page 19, lines 19-23 of the specification. There is no suggestion in Sasakura of projecting images onto a panoramic screen in an alternating manner, and providing an arrangement for the viewer to use to disambiguate the respective images for the respective eyes, as required in the patent claim. Accordingly, Applicants respectfully submit that Sasakura neither teaches nor suggests the invention recited in claim 59.

Applicants further submit that Sasakura neither teaches nor suggests the invention recited in method claim 95 for the reasons set forth above in connection with claim 59.

The dependent claims are allowable at least for the reason that they depend directly or indirectly from the respective allowable independent claims.



It is believed that this application is allowable, and a notice of allowability is respectfully solicited.

Respectfully submitted,

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