US012388973B2

(12) **United States Patent**
Miranda et al.

(10) **Patent No.: US 12,388,973 B2**
(45) **Date of Patent: *Aug. 12, 2025**

(54) **SYSTEMS AND METHOD FOR CAPTURING, PROCESSING, AND DISPLAYING A 360° VIDEO**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 182 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **17/698,946**

(22) Filed: **Mar. 18, 2022**

(65) **Prior Publication Data**

US 2022/0210396 A1 Jun. 30, 2022

Related U.S. Application Data

(63) Continuation-in-part of application No. 16/554,827, filed on Aug. 29, 2019, now Pat. No. 11,284,054.

(60) Provisional application No. 62/725,201, filed on Aug. 30, 2018.

(51) **Int. Cl.**

H04N 13/351 (2018.01)
H04N 13/156 (2018.01)
H04N 23/698 (2023.01)

(52) **U.S. Cl.**

CPC ***H04N 13/351*** (2018.05); ***H04N 13/156*** (2018.05); ***H04N 23/698*** (2023.01)

(58) **Field of Classification Search**

CPC H04N 13/156; H04N 13/351; H04N 21/21805; H04N 21/234345; H04N 21/816; H04N 21/85406; H04N 23/698

See application file for complete search history.

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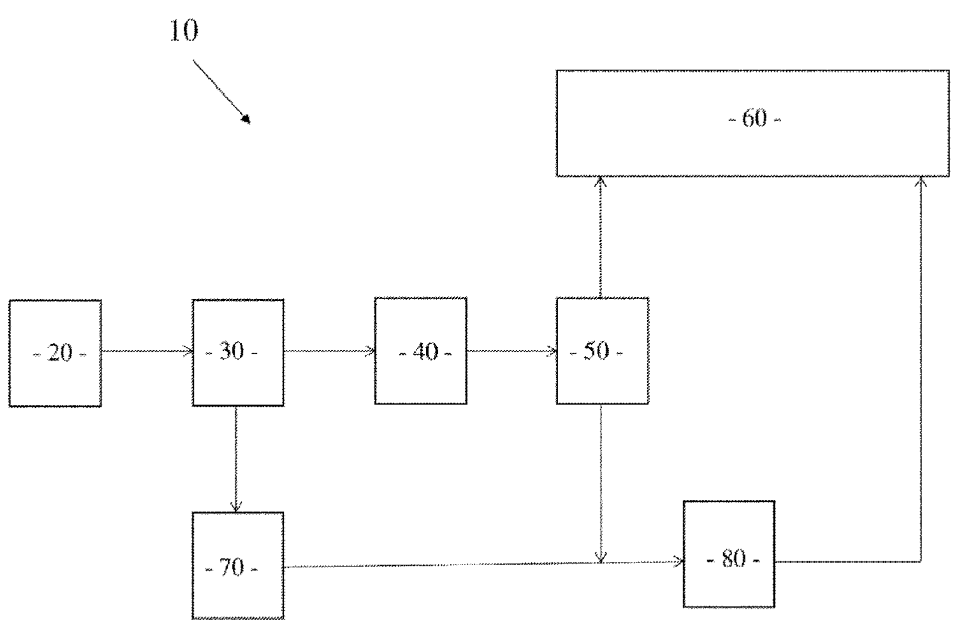
Primary Examiner — Jessica M Prince

(57) **ABSTRACT**

A 360° video capture, processing and display system includes a 360° video camera to capture a 360° raw video file, and a 360° video processing assembly to generate a 360° equirectangular geographic projection from each frame of the 360° raw video file. A 360° video processing algorithm captures a plurality of viewport images from each of a plurality of equirectangular geographic projections. A composite video displays includes a plurality of viewport images from a corresponding one of each of the 360° equirectangular geographic projections, wherein at least one of a top or bottom composite video display comprises a seamless integration of corresponding ones of the plurality of viewport images. The 360° video capture, processing and display system generates a multi-platform compatible processed 360° video file comprising the plurality of composite video displays, wherein the multi-platform compatible processed 360° video file is viewable on a video display assembly.

18 Claims, 22 Drawing Sheets



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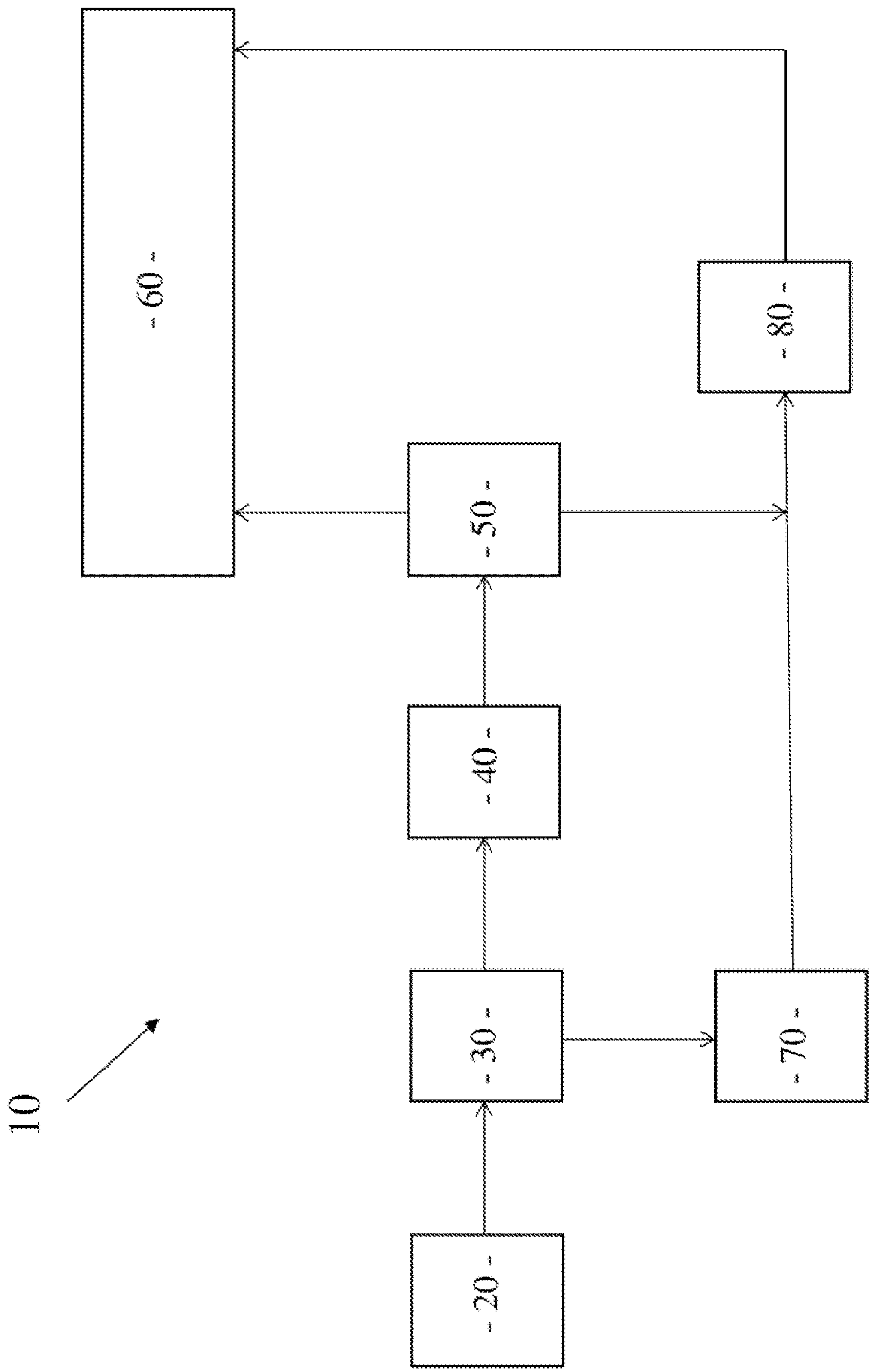

FIG. 1

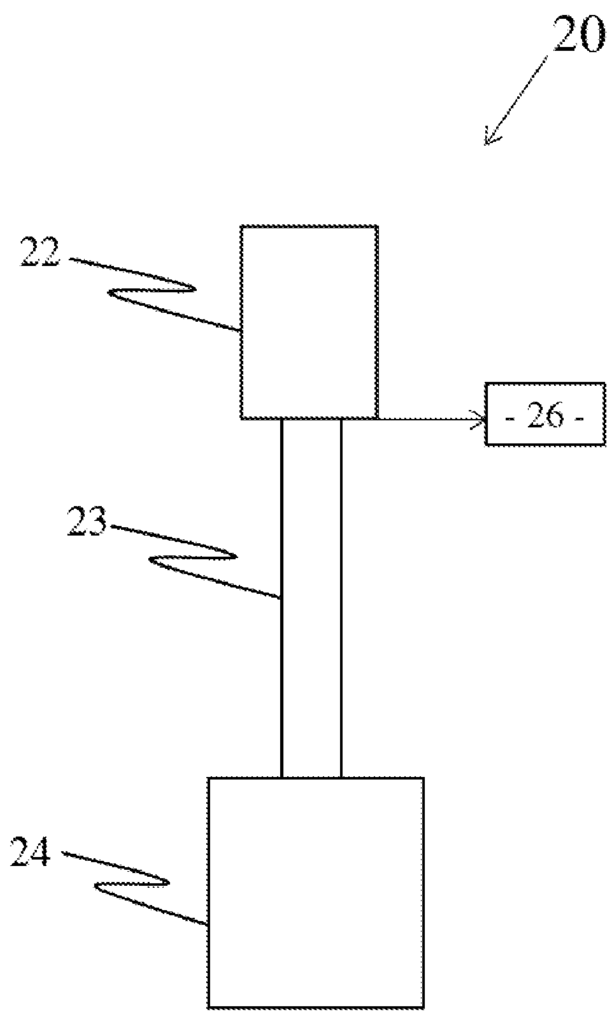

FIG. 2

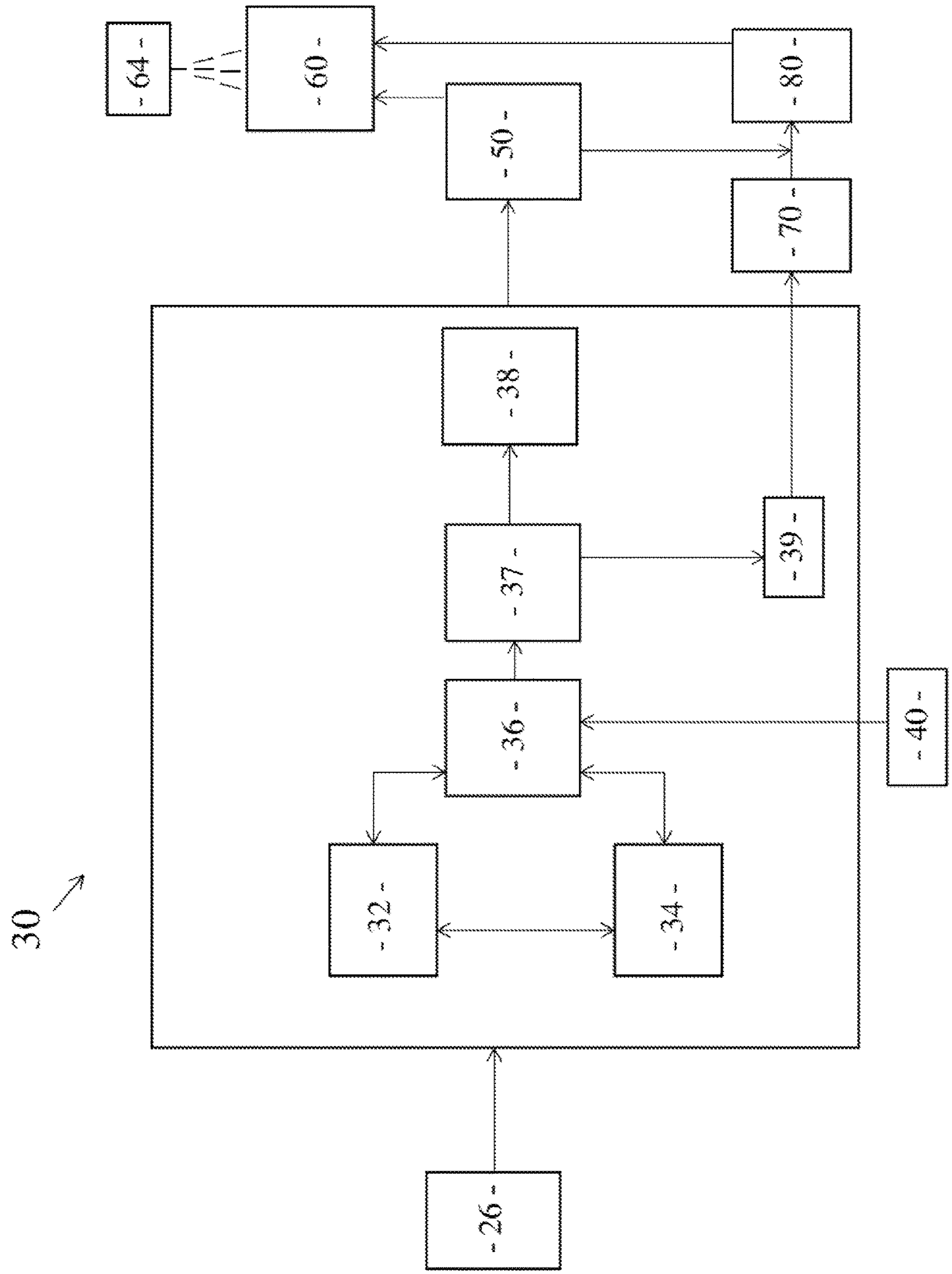

FIG. 3

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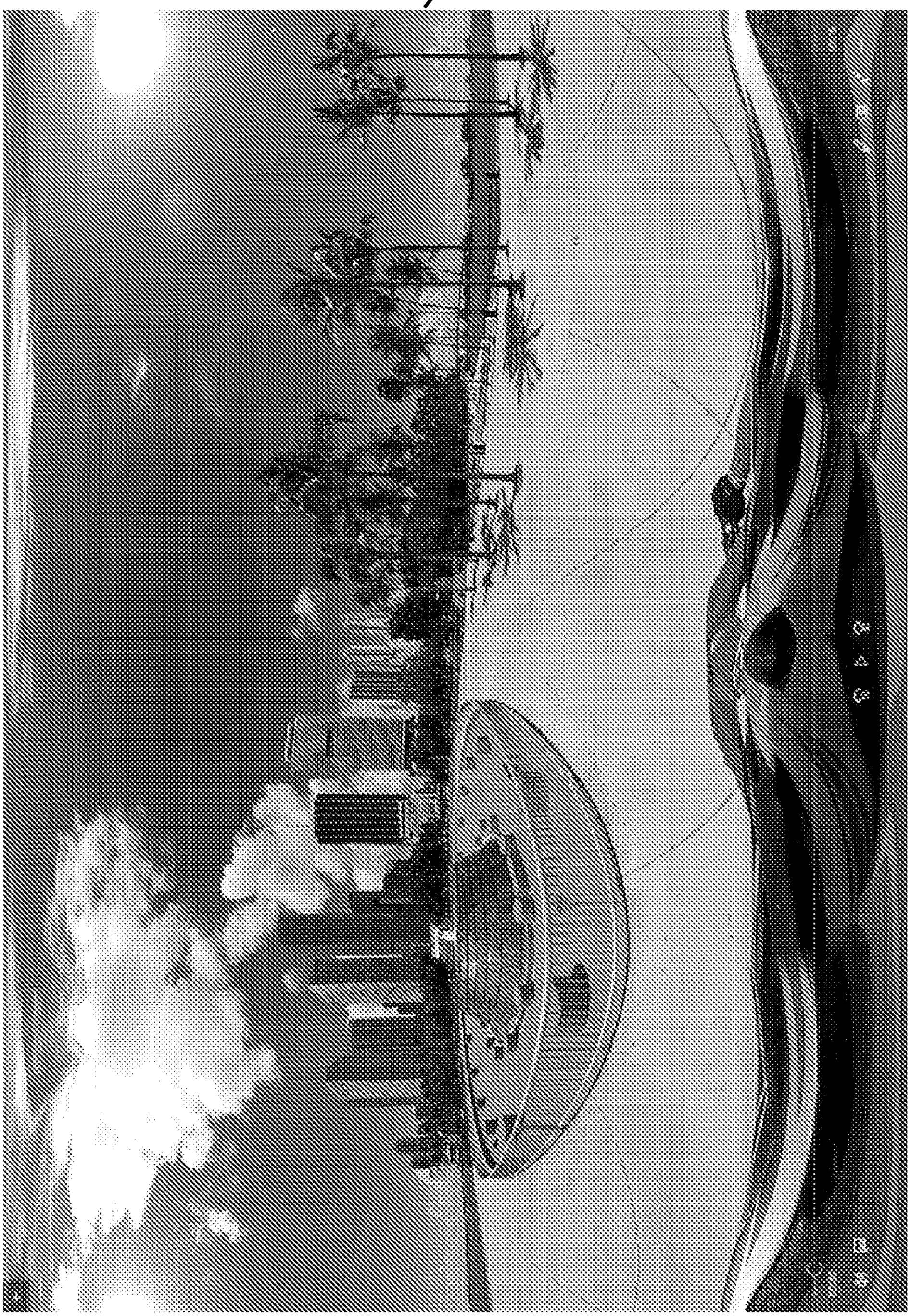


FIG. 4

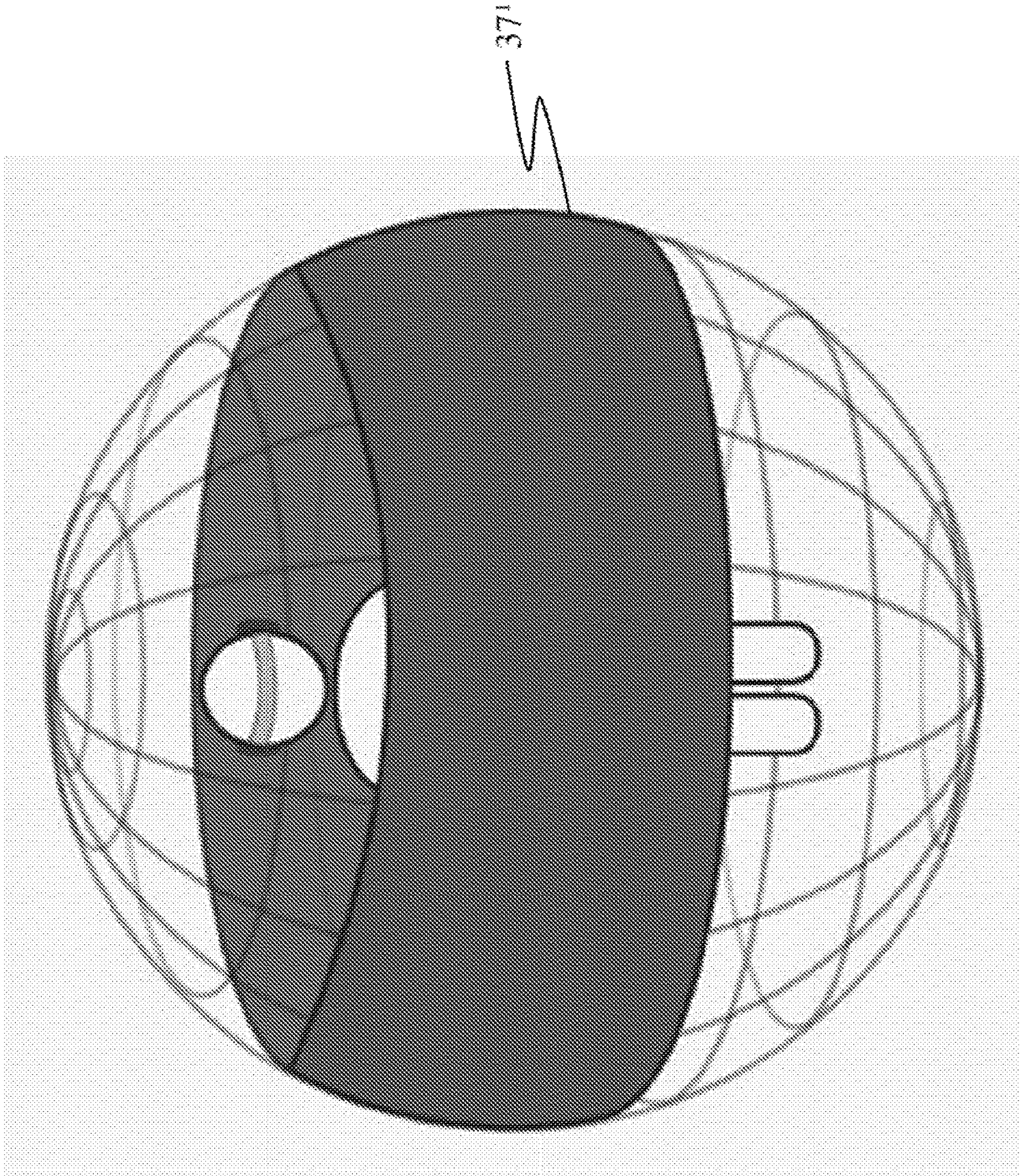


FIG. 5

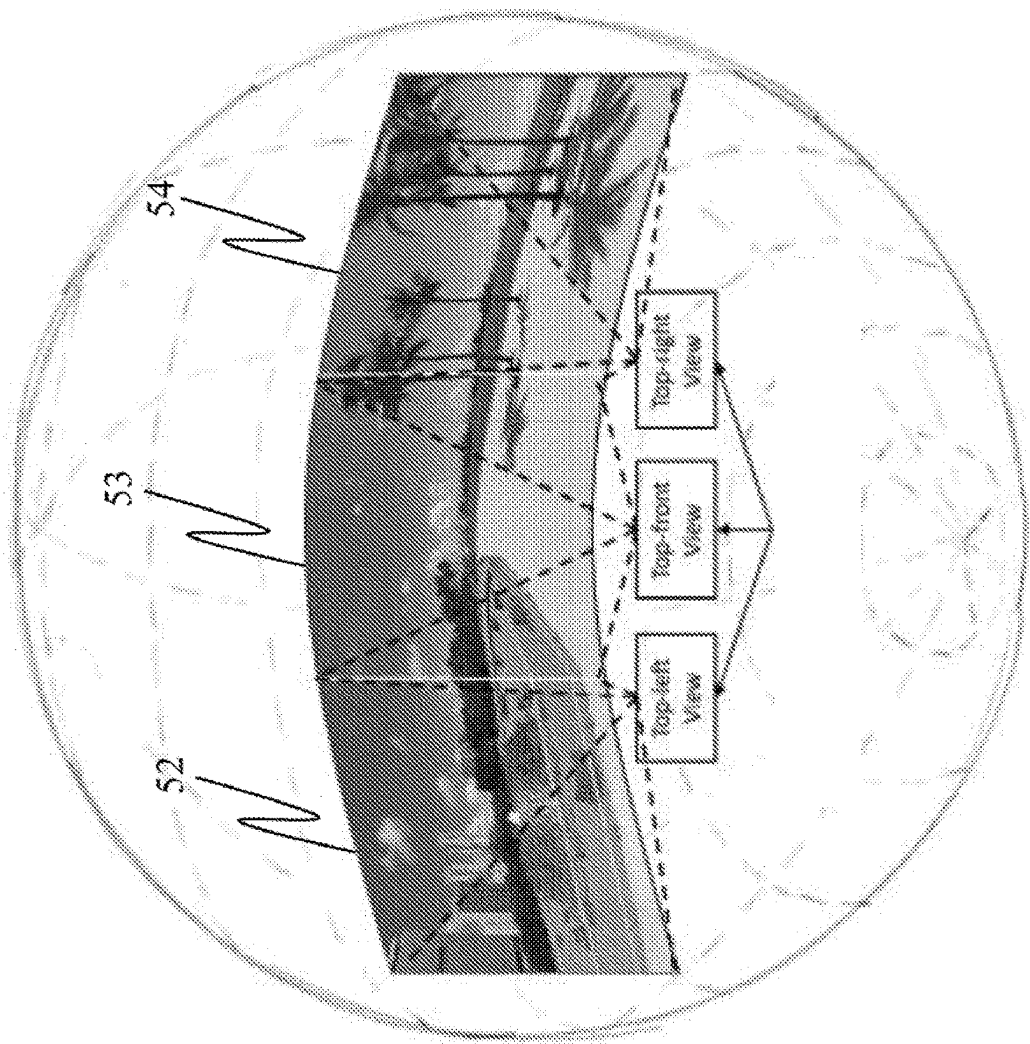


FIG. 6

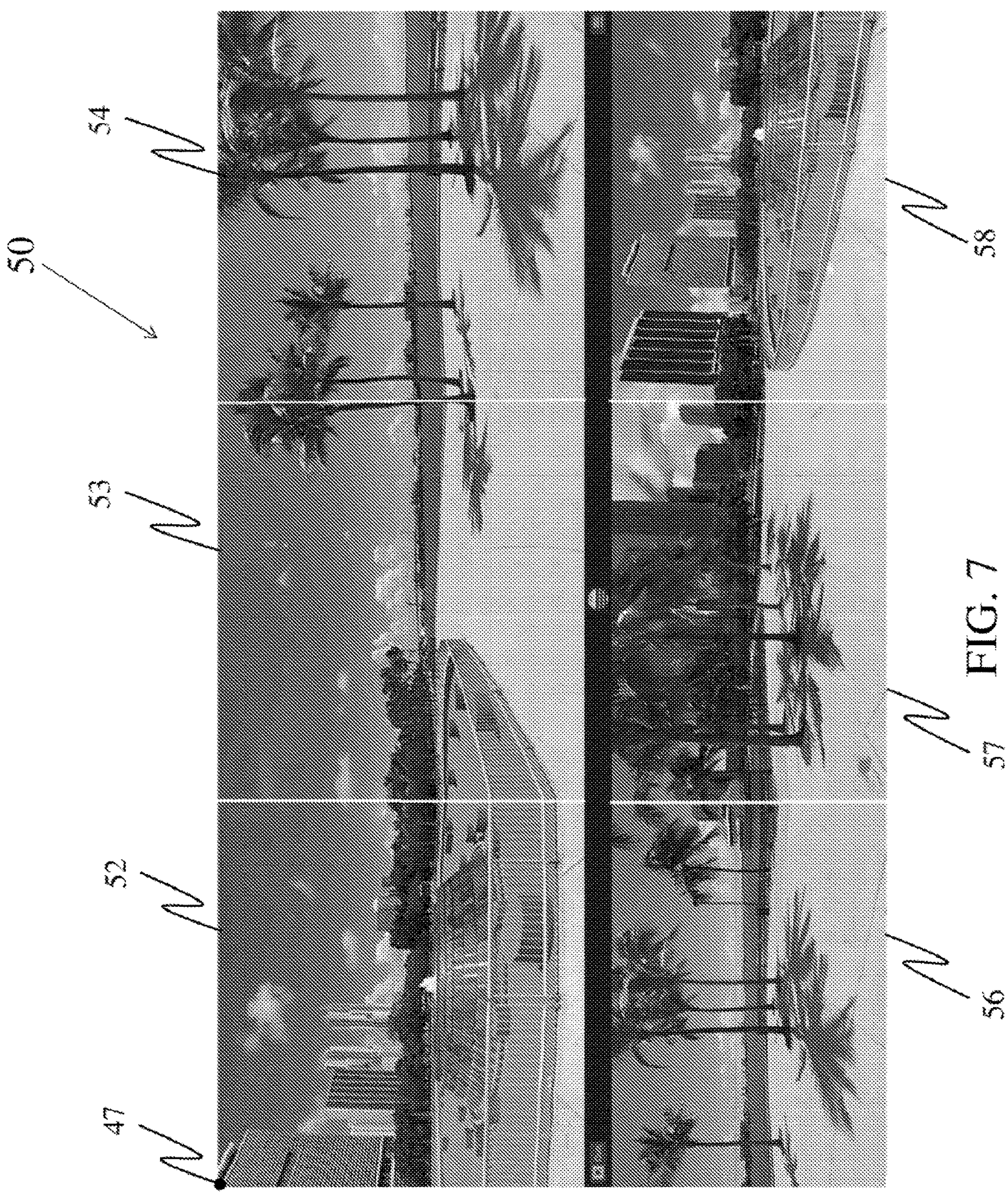


FIG. 7

TABLE 3

Predetermined Video Display Layout (43) - BVT Layout Type 1

Top Viewpoint Height (45):	755	Top Display Height Ratio (44):	58.98%
Navigation Menu (59) Height:	40	Navigation Menu (59) Height Ratio:	3.13%
Bottom Viewpoint Height (45):	485	Bottom Display Height Ratio (44):	37.89%

Top Composite Video Display (51)						
Viewport Image	Viewport Positioning Cordinates (47')		Viewport Width (46) (pixels)	Viewport Height (45) (pixels)	Viewport FOV Angle (48) (degrees)	Viewpoint Heading Angle (49) (degrees)
	x (pixels)	y (pixels)				
Top Left (52)	Top_Left_x	Top_Left_y	Top_Left_Width	Top_Left_Height	Top_Left_FOV	Top_Left_Heading_Ang
	0	0	640	755	70	19.7
Top Center (53)	Top_Center_x	Top_Center_y	Top_Center_Width	Top_Center_Height	Top_Center_FOV	Top_Center_Heading_Ang
	640	0	640	755	70	90.0
Top Right (54)	Top_Right_x	Top_Right_y	Top_Right_Width	Top_Right_Height	Top_Right_FOV	Top_Right_Heading_Ang
	1280	0	640	755	70	160.4

Bottom Composite Video Display (55)						
Viewport Image	Viewport Positioning Cordinates (47')		Viewport Width (46) (pixels)	Viewport Height (45) (pixels)	Viewport FOV Angle (48) (degrees)	Viewpoint Heading Angle (49) (degrees)
	x (pixels)	y (pixels)				
Bottom Left (56)	Bottom_Left_x	Bottom_Left_y	Bottom_Left_Width	Bottom_Left_Height	Bottom_Left_FOV	Bottom_Left_Heading_Ang
	0	795	640	485	70	179.3
Bottom Center (57)	Bottom_Center_x	Bottom_Center_y	Bottom_Center_Width	Bottom_Center_Height	Bottom_Center_FOV	Bottom_Center_Heading_Ang
	640	795	640	485	70	270.0
Bottom Right (58)	Bottom_Right_x	Bottom_Right_y	Bottom_Right_Width	Bottom_Right_Height	Bottom_Right_FOV	Bottom_Right_Heading_Ang
	1280	795	640	485	70	360.8

FIG. 8

TABLE 4

Predetermined Video Display Layout (43) - BVT Layout Type 2

Top Viewpoint Height (45):	853	Top Display Height Ratio (44):	66.64%
Navigation Menu (59) Height:	40	Navigation Menu (59) Height Ratio:	3.13%
Bottom Viewpoint Height (45):	387	Bottom Display Height Ratio (44):	30.23%

Top Composite Video Display (51)

Viewport Image	Viewport Positioning Cordinates (47')		Viewport Width (46) (pixels)	Viewport Height (45) (pixels)	Viewport FOV Angle (48) (degrees)	Viewpoint Heading Angle (49) (degrees)
	x (pixels)	y (pixels)				
Top Left (52)	Top_Left_x	Top_Left_y	Top_Left_Width	Top_Left_Height	Top_Left_FOV	Top_Left_Heading_Ang
	0	0	640	853	70	26.4
Top Center (53)	Top_Center_x	Top_Center_y	Top_Center_Width	Top_Center_Height	Top_Center_FOV	Top_Center_Heading_Ang
	640	0	640	853	70	90.0
Top Right (54)	Top_Right_x	Top_Right_y	Top_Right_Width	Top_Right_Height	Top_Right_FOV	Top_Right_Heading_Ang
	1280	0	640	853	70	153.7

Bottom Composite Video Display (55)

Viewport Image	Viewport Positioning Cordinates (47')		Viewport Width (46) (pixels)	Viewport Height (45) (pixels)	Viewport FOV Angle (48) (degrees)	Viewpoint Heading Angle (49) (degrees)
	x (pixels)	y (pixels)				
Bottom Left (56)	Bottom_Left_x	Bottom_Left_y	Bottom_Left_Width	Bottom_Left_Height	Bottom_Left_FOV	Bottom_Left_Heading_Ang
	0	893	640	387	70	167.7
Bottom Center (57)	Bottom_Center_x	Bottom_Center_y	Bottom_Center_Width	Bottom_Center_Height	Bottom_Center_FOV	Bottom_Center_Heading_Ang
	640	893	640	387	70	270.0
Bottom Right (58)	Bottom_Right_x	Bottom_Right_y	Bottom_Right_Width	Bottom_Right_Height	Bottom_Right_FOV	Bottom_Right_Heading_Ang
	1280	893	640	387	70	372.4

FIG. 9

TABLE 5

Predetermined Video Display Layout (43) - BVT Layout Type 3

Top Viewpoint Height (45):	960	Top Display Height Ratio (44):	75.00%
Navigation Menu (59) Height:	40	Navigation Menu (59) Height Ratio:	3.13%
Bottom Viewpoint Height (45):	280	Bottom Display Height Ratio (44):	21.88%

Top Composite Video Display (51)

Viewport Image	Viewport Positioning Cordinates (47')		Viewport Width (46) (pixels)	Viewport Height (45) (pixels)	Viewport FOV Angle (48) (degrees)	Viewpoint Heading Angle (49) (degrees)
	x (pixels)	y (pixels)				
Top Left (52)	Top_Left_x	Top_Left_y	Top_Left_Width	Top_Left_Height	Top_Left_FOV	Top_Left_Heading_Ang
	0	0	640	960	70	32.0
Top Center (53)	Top_Center_x	Top_Center_y	Top_Center_Width	Top_Center_Height	Top_Center_FOV	Top_Center_Heading_Ang
	640	0	640	960	70	90.0
Top Right (54)	Top_Right_x	Top_Right_y	Top_Right_Width	Top_Right_Height	Top_Right_FOV	Top_Right_Heading_Ang
	1280	0	640	960	70	148.1

Bottom Composite Video Display (55)

Viewport Image	Viewport Positioning Cordinates (47')		Viewport Width (46) (pixels)	Viewport Height (45) (pixels)	Viewport FOV Angle (48) (degrees)	Viewpoint Heading Angle (49) (degrees)
	x (pixels)	y (pixels)				
Bottom Left (56)	Bottom_Left_x	Bottom_Left_y	Bottom_Left_Width	Bottom_Left_Height	Bottom_Left_FOV	Bottom_Left_Heading_Ang
	0	1000	640	280	70	152.3
Bottom Center (57)	Bottom_Center_x	Bottom_Center_y	Bottom_Center_Width	Bottom_Center_Height	Bottom_Center_FOV	Bottom_Center_Heading_Ang
	640	1000	640	280	70	270.0
Bottom Right (58)	Bottom_Right_x	Bottom_Right_y	Bottom_Right_Width	Bottom_Right_Height	Bottom_Right_FOV	Bottom_Right_Heading_Ang
	1280	1000	640	280	70	387.8

FIG. 10

TABLE 6

Predetermined Video Display Layout (43) - BVT Layout Type 4

Top Viewpoint Height (45):	1024	Top Display Height Ratio (44):	80.00%
Navigation Menu (59) Height:	40	Navigation Menu (59) Height Ratio:	3.13%
Bottom Viewpoint Height (45):	216	Bottom Display Height Ratio (44):	16.88%

Top Composite Video Display (51)

Viewport Image	Viewport Positioning Cordinates (47')		Viewport Width (46) (pixels)	Viewport Height (45) (pixels)	Viewport FOV Angle (48) (degrees)	Viewpoint Heading Angle (49) (degrees)
	x (pixels)	y (pixels)				
Top Left (52)	Top_Left_x	Top_Left_y	Top_Left_Width	Top_Left_Height	Top_Left_FOV	Top_Left_Heading_Ang
	0	0	640	1024	70	35.2
Top Center (53)	Top_Center_x	Top_Center_y	Top_Center_Width	Top_Center_Height	Top_Center_FOV	Top_Center_Heading_Ang
	640	0	640	1024	70	90.0
Top Right (54)	Top_Right_x	Top_Right_y	Top_Right_Width	Top_Right_Height	Top_Right_FOV	Top_Right_Heading_Ang
	1280	0	640	1024	70	144.9

Bottom Composite Video Display (55)

Viewport Image	Viewport Positioning Cordinates (47')		Viewport Width (46) (pixels)	Viewport Height (45) (pixels)	Viewport FOV Angle (48) (degrees)	Viewpoint Heading Angle (49) (degrees)
	x (pixels)	y (pixels)				
Bottom Left (56)	Bottom_Left_x	Bottom_Left_y	Bottom_Left_Width	Bottom_Left_Height	Bottom_Left_FOV	Bottom_Left_Heading_Ang
	0	1064	640	216	90	127.3
Bottom Center (57)	Bottom_Center_x	Bottom_Center_y	Bottom_Center_Width	Bottom_Center_Height	Bottom_Center_FOV	Bottom_Center_Heading_Ang
	640	1064	640	216	90	270.0
Bottom Right (58)	Bottom_Right_x	Bottom_Right_y	Bottom_Right_Width	Bottom_Right_Height	Bottom_Right_FOV	Bottom_Right_Heading_Ang
	1280	1064	640	216	90	412.8

FIG. 11

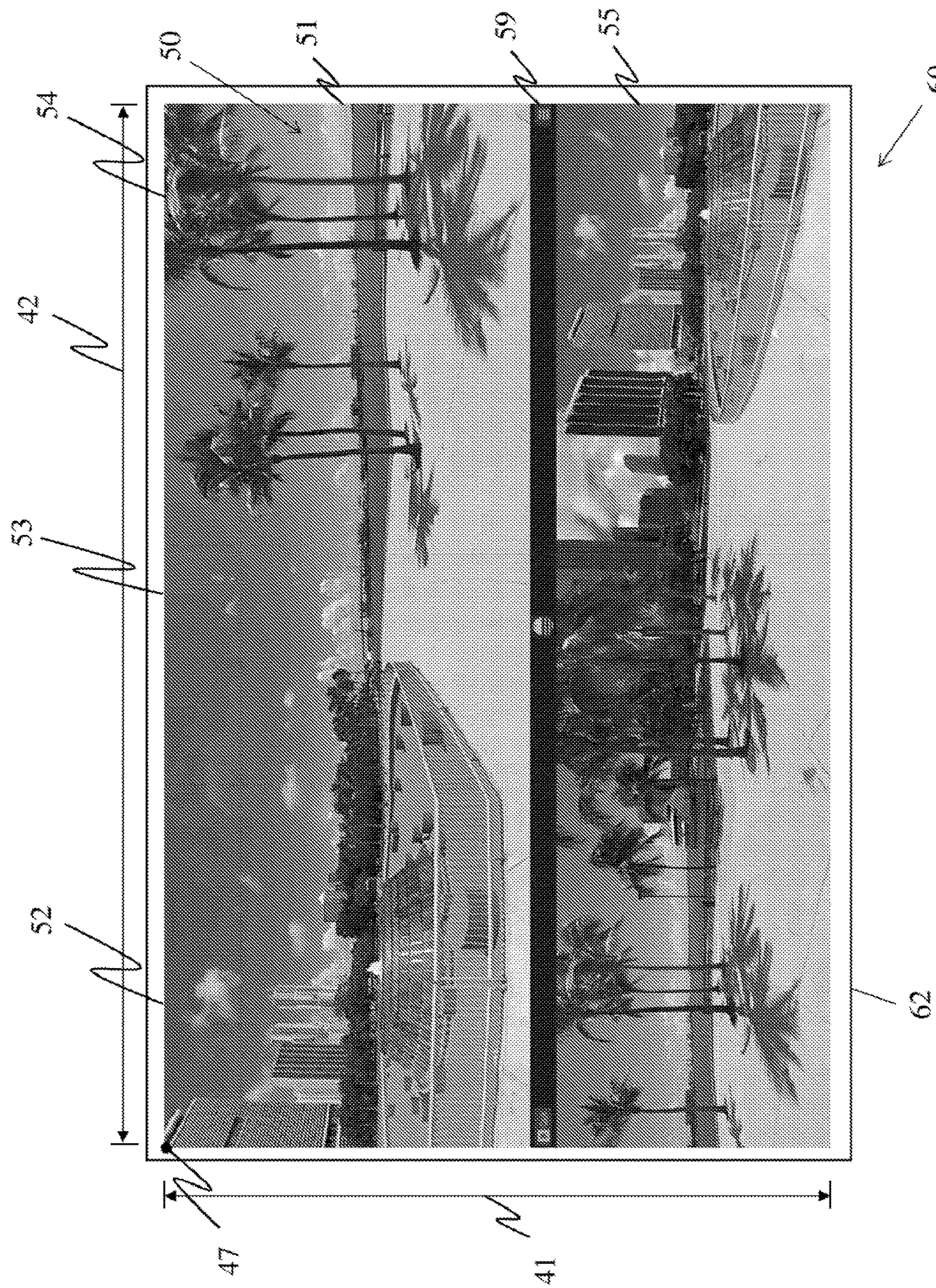


FIG. 12

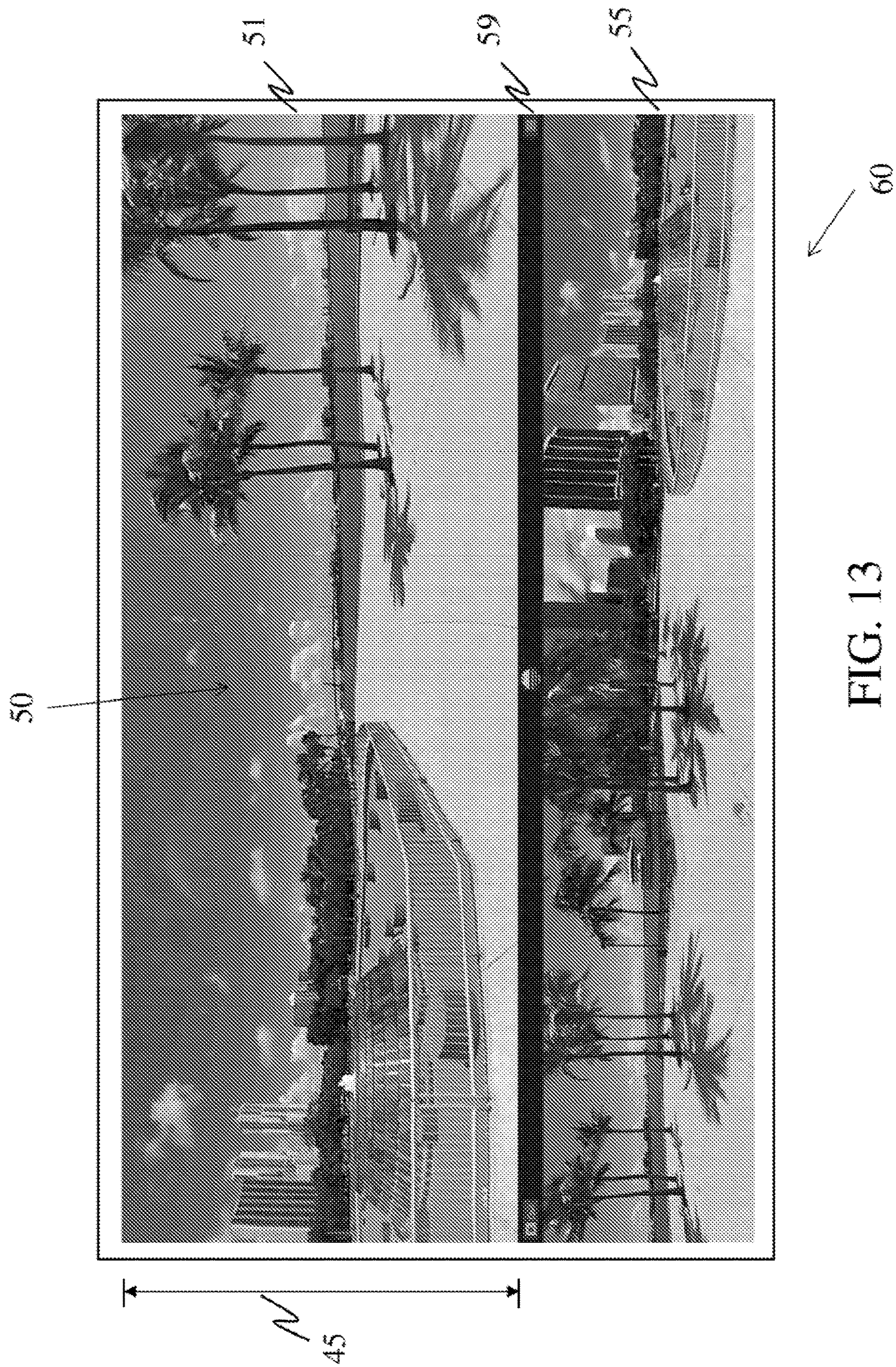


FIG. 13

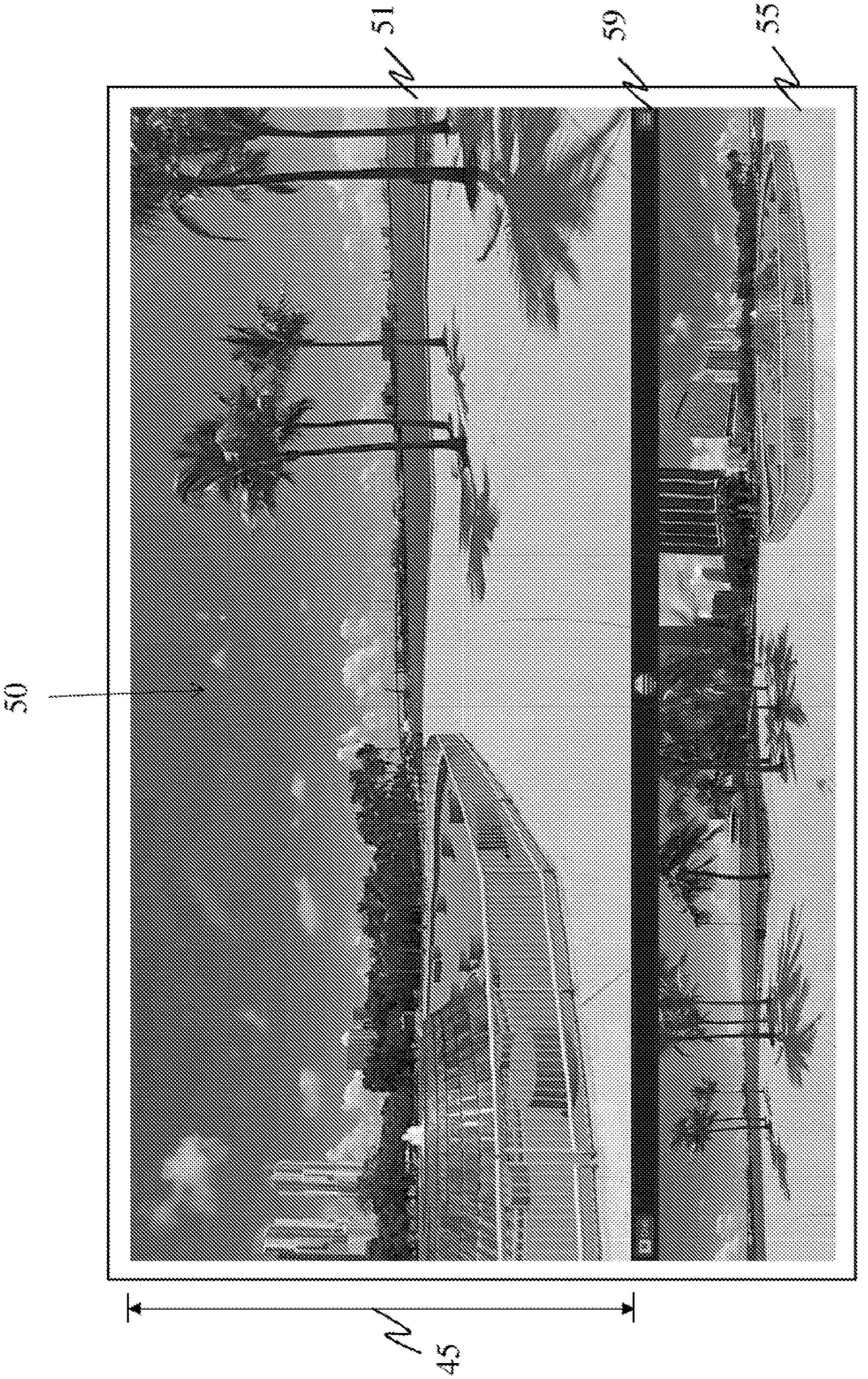


FIG. 14

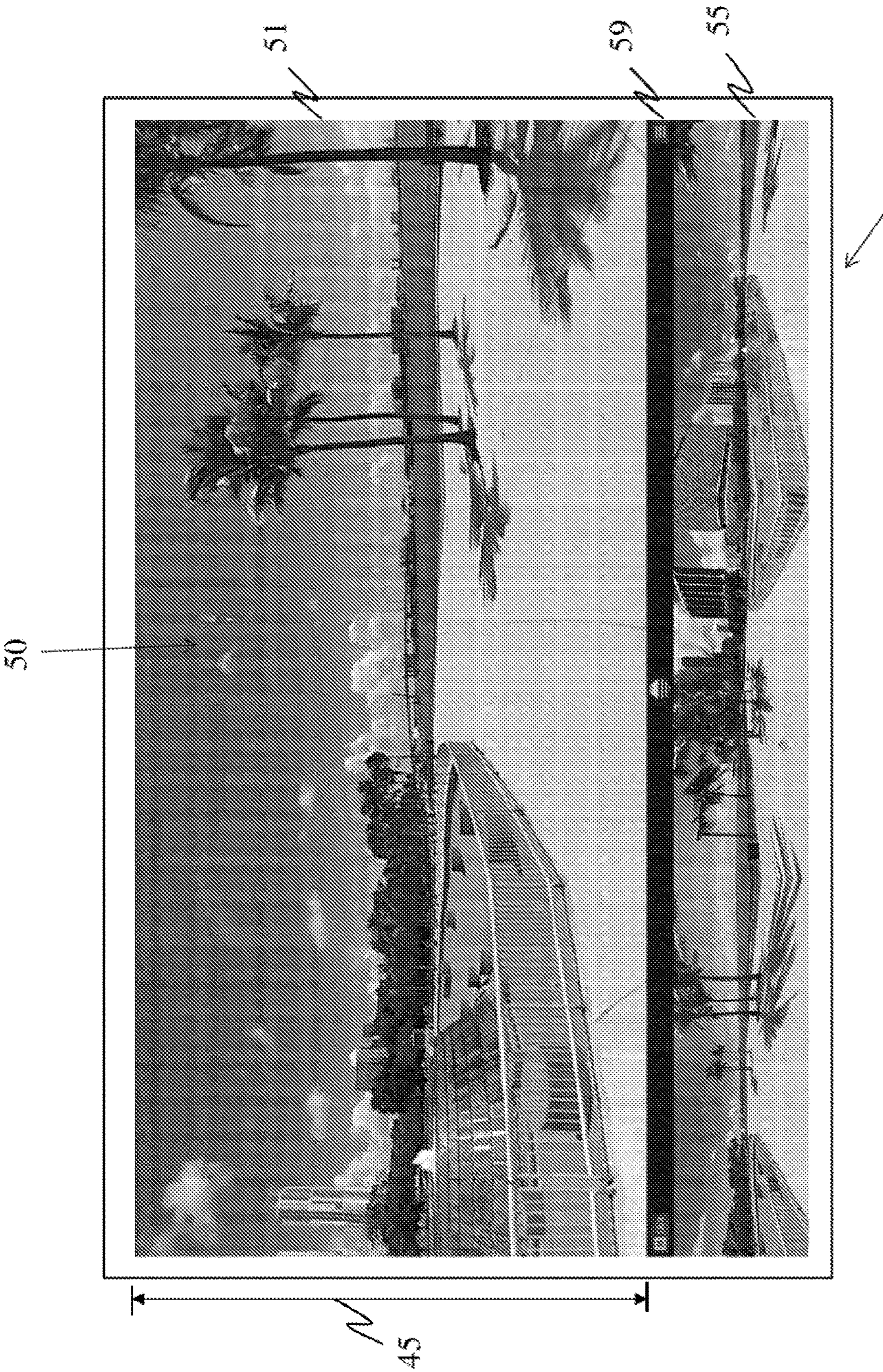
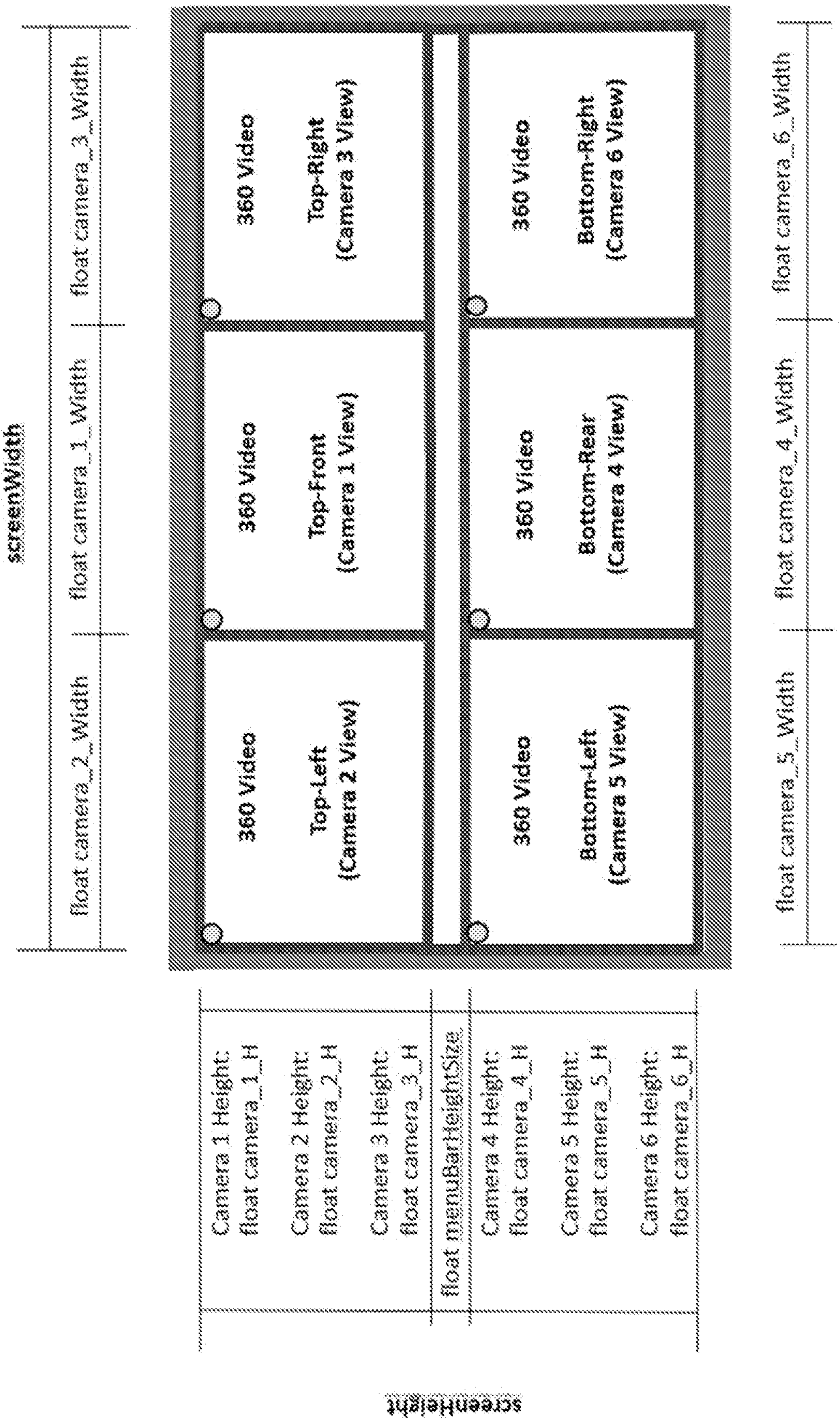


FIG. 15



screenWidth
float camera_2_ Width
float camera_1_ Width
float camera_3_ Width
360 Video
Top-Left
(Camera 2 View)
360 Video
Top-Front
(Camera 1 View)
360 Video
Top-Right
(Camera 3 View)
360 Video
Bottom-Left
(Camera 5 View)
360 Video
Bottom-Rear
(Camera 4 View)
360 Video
Bottom-Right
(Camera 6 View)
float camera_5_ Width
float camera_4_ Width
float camera_6_ Width
Camera 1 Height:
float camera_1_H
Camera 2 Height:
float camera_2_H
Camera 3 Height:
float camera_3_H
float menuBarHeightSize
Camera 4 Height:
float camera_4_H
Camera 5 Height:
float camera_5_H
Camera 6 Height:
float camera_6_H
screenHeight

FIG. 16

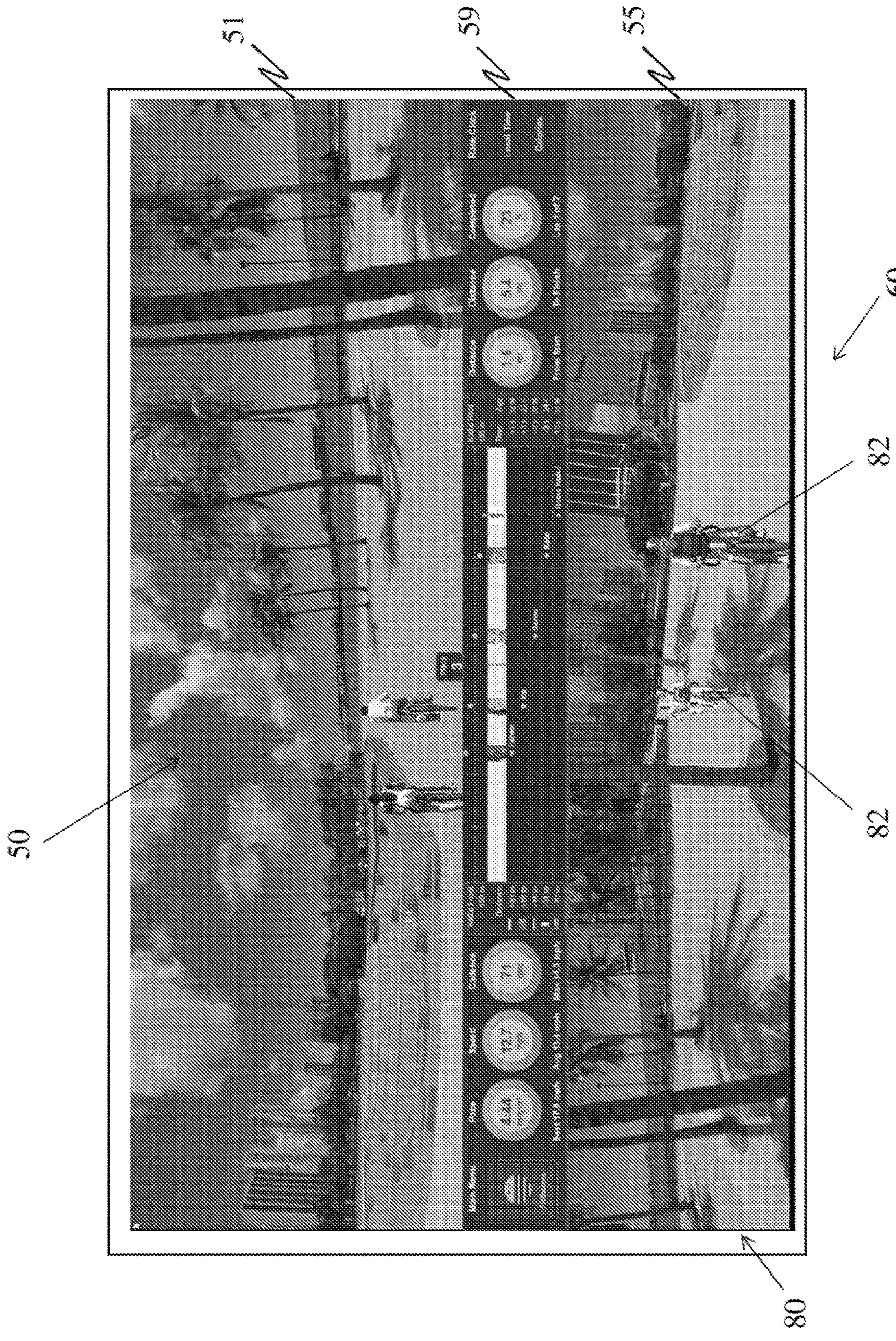


FIG. 17

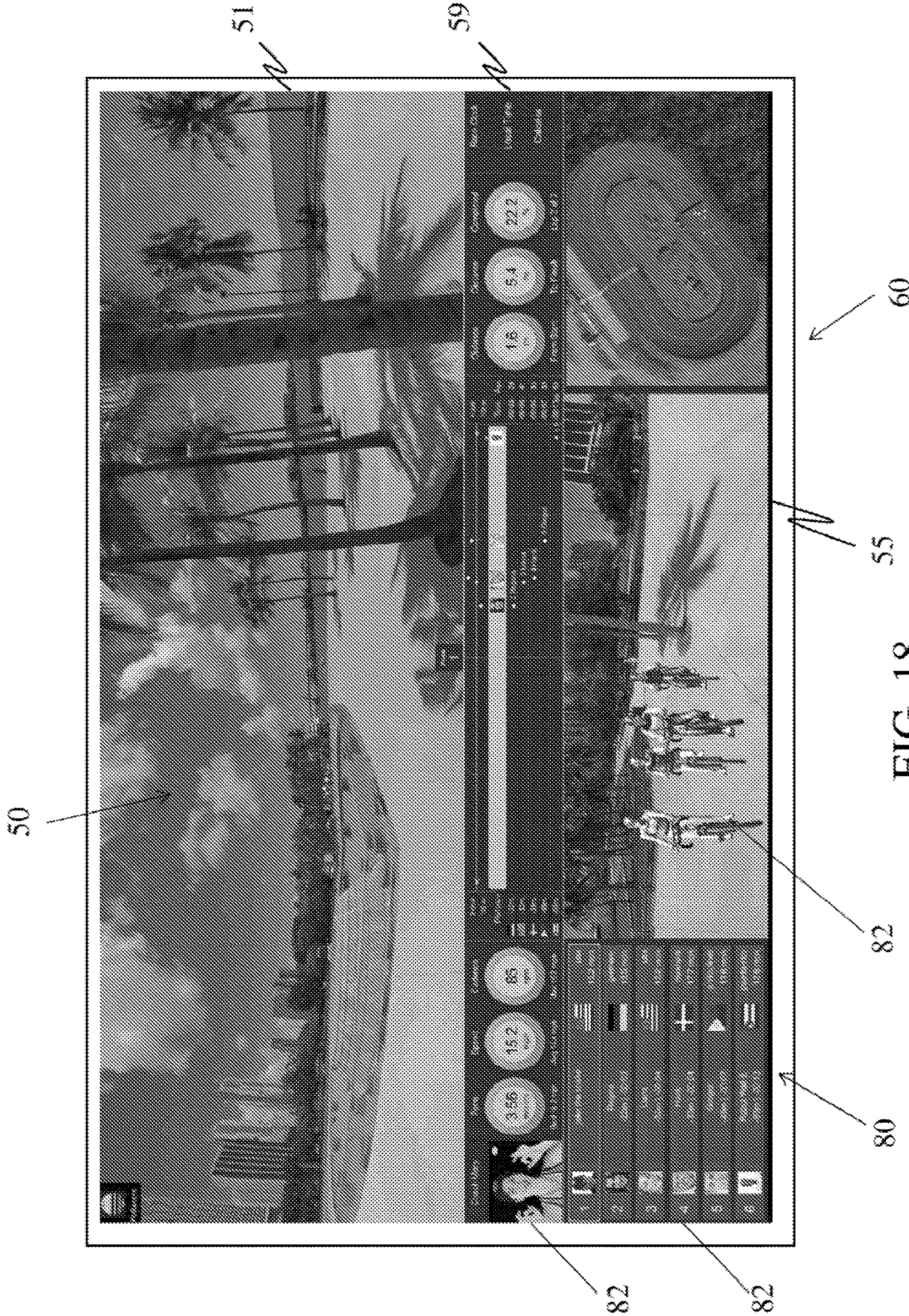


FIG. 18

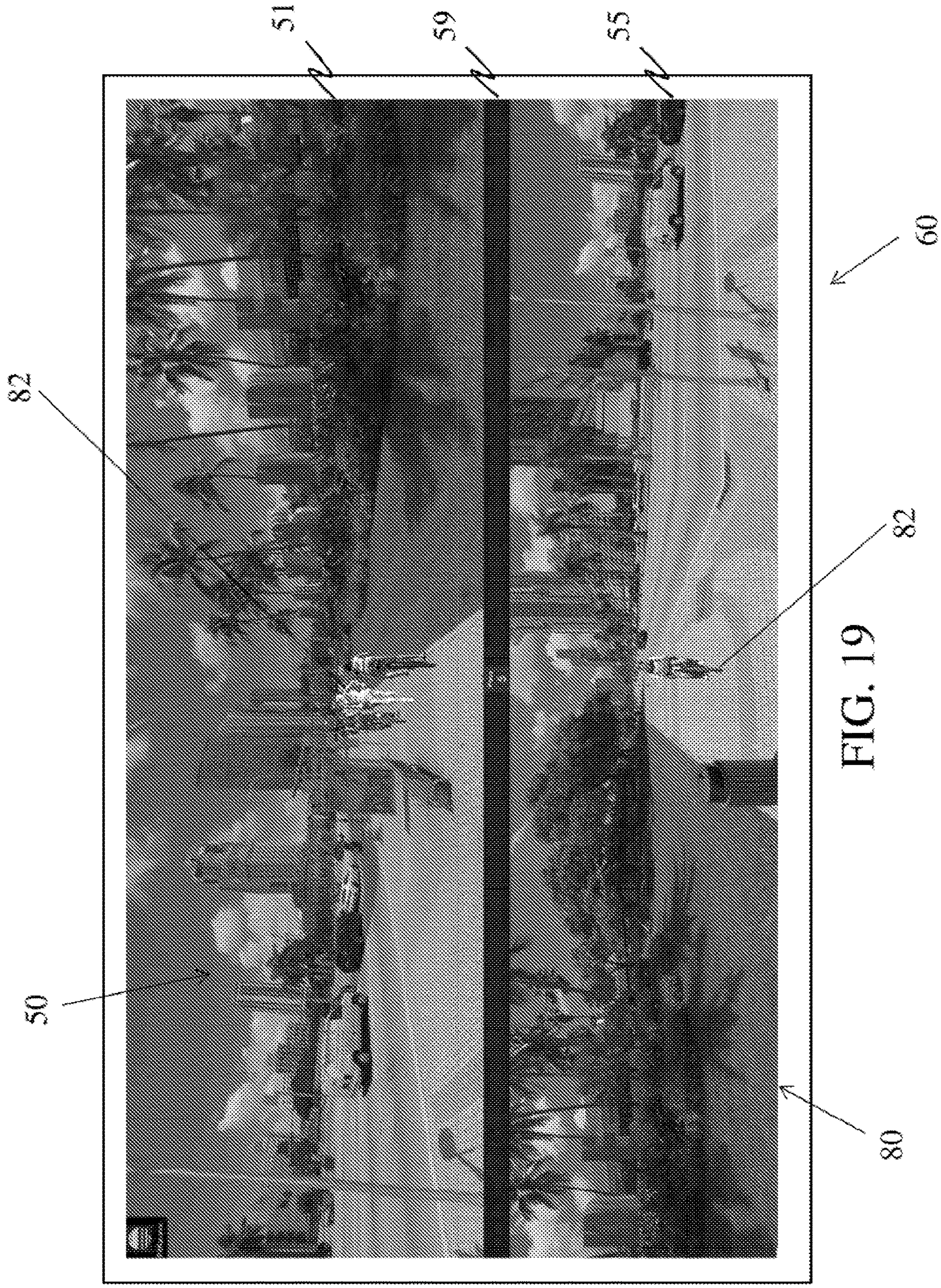


FIG. 19

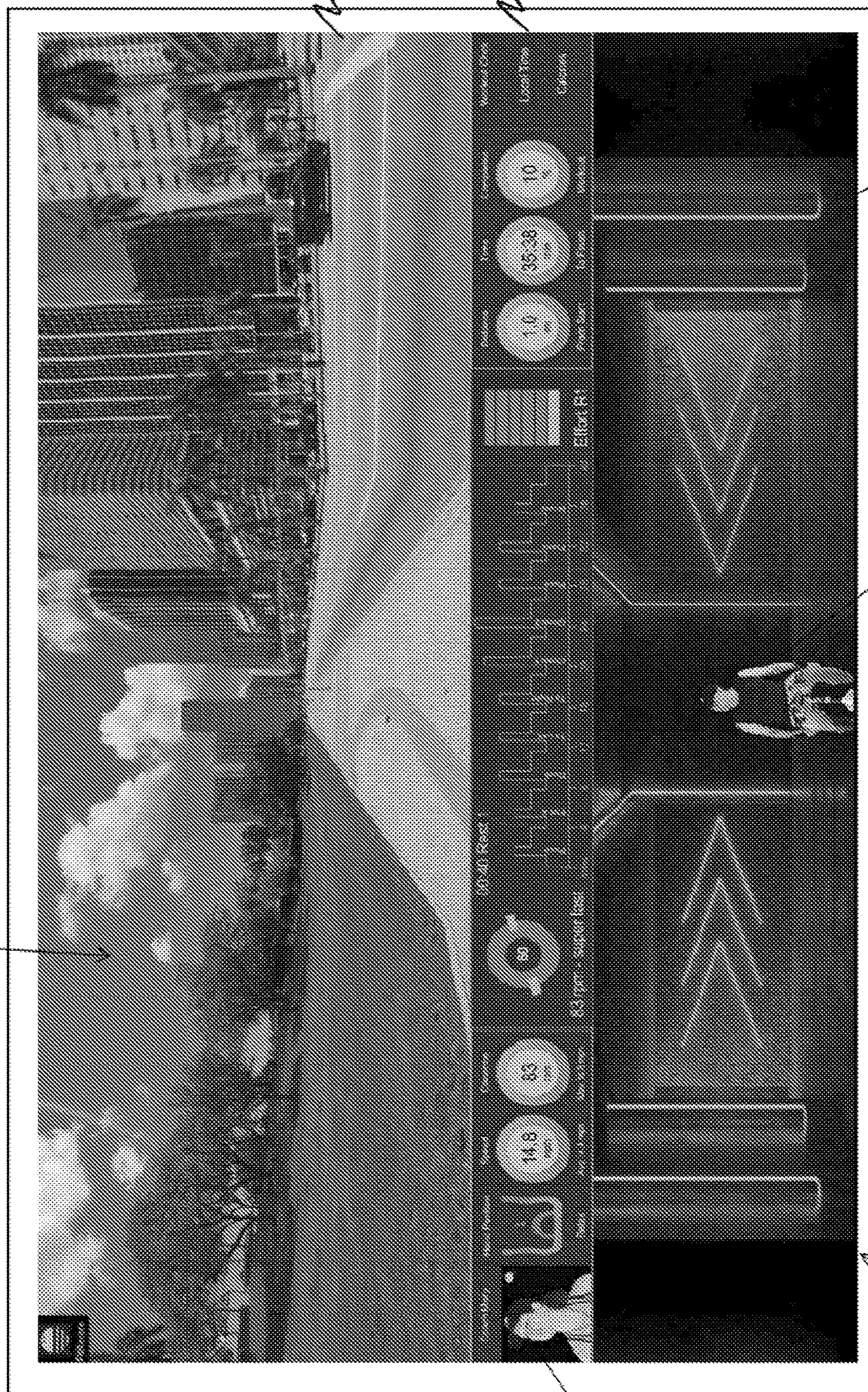


FIG. 20

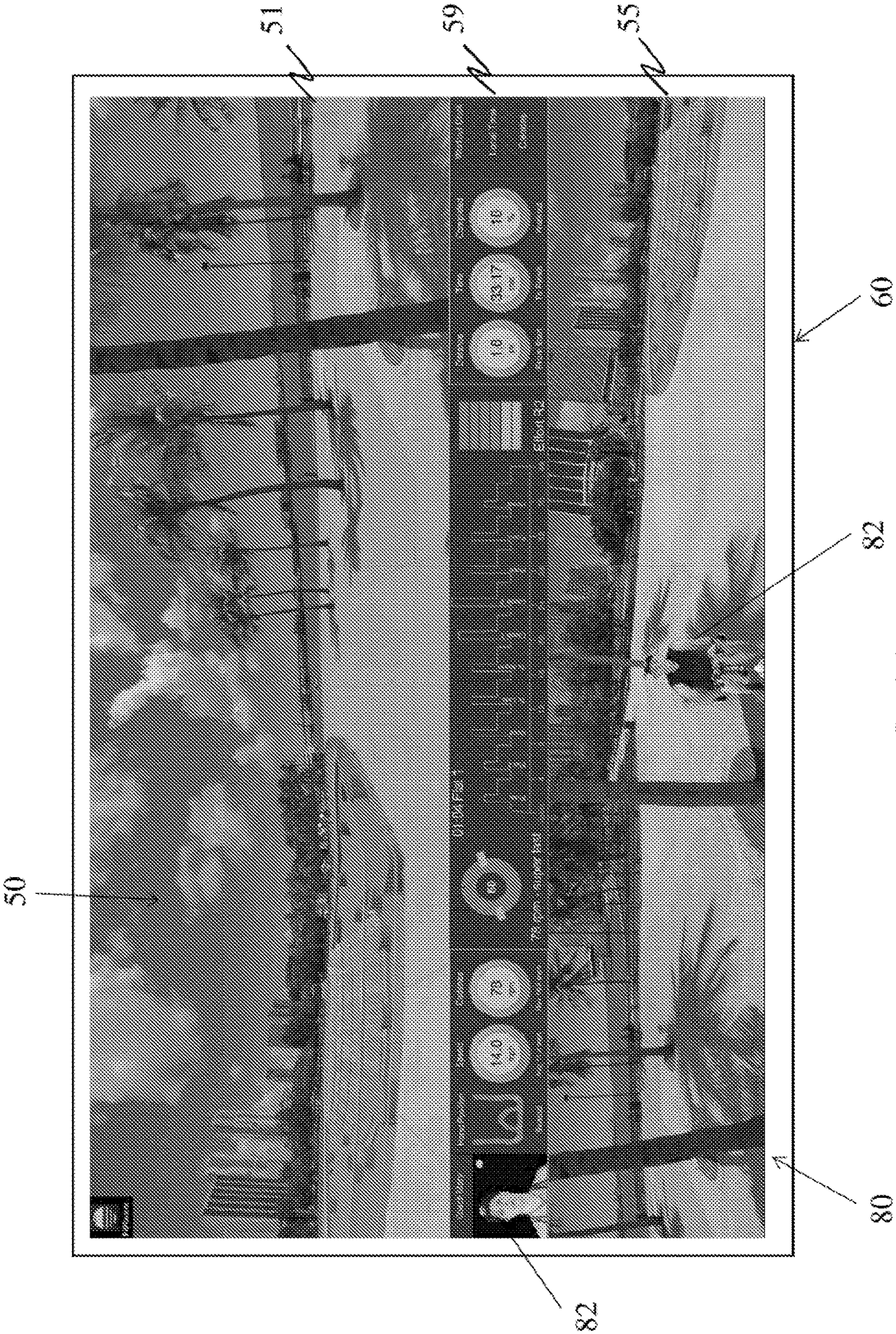


FIG. 21

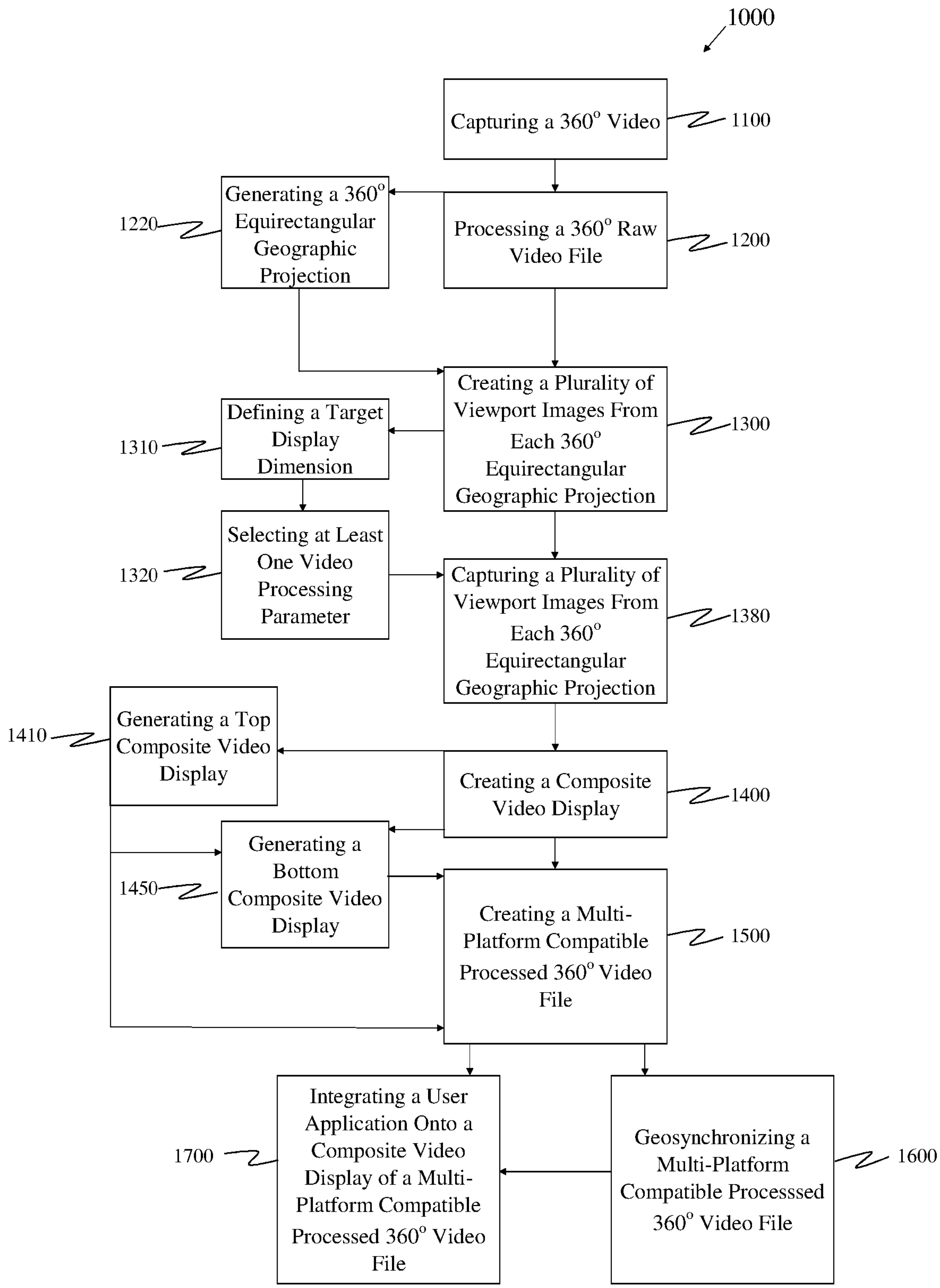

1000
Capturing a 360° Video
1100
Generating a 360° Equirectangular Geographic Projection
1220
Processing a 360° Raw Video File
1200
Creating a Plurality of Viewport Images From Each 360° Equirectangular Geographic Projection
1300
Defining a Target Display Dimension
1310
Selecting at Least One Video Processing Parameter
1320
Capturing a Plurality of Viewport Images From Each 360° Equirectangular Geographic Projection
1380
Generating a Top Composite Video Display
1410
Creating a Composite Video Display
1400
Generating a Bottom Composite Video Display
1450
Creating a Multi-Platform Compatible Processed 360° Video File
1500
Integrating a User Application Onto a Composite Video Display of a Multi-Platform Compatible Processed 360° Video File
1700
Geosynchronizing a Multi-Platform Compatible Processsed 360° Video File
1600

FIG. 22

SYSTEMS AND METHOD FOR CAPTURING, PROCESSING, AND DISPLAYING A 360° VIDEO

The current application is a continuation application of the U.S. non-provisional application Ser. No. 16/554,827 filed on Aug. 29, 2019.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is directed to a system and method for capturing, processing and displaying a 360° video, and in particular, a system and method to process a raw 360° video file such that a full 360° field of view may be viewed by a user in its entirety on a single video display screen.

Description of the Related Art

There are a number of affordable 360° video cameras on the market today, making a 360° video somewhat ubiquitous relative to just a few years ago today. While the technology required to capture 360° videos has progressed rapidly to allow this phenomenon to occur, the technology for playback and viewing such the plethora of 360° videos has not yet kept pace. Many 360° video viewers still require a user to use arrow keys or buttons, or to click and drag his or her way around a 360° video to view the various limited field of view perspectives. As is known to anyone who has attempted such maneuvering, it is easy to loose ones bearings and sense of the original direction of motion. Further, whether click and drag or using arrow keys on a computer keyboard or buttons on a mouse, this process is slow and tedious.

Further, because currently known viewers utilize a Mercator type projection, essentially stretching a 360° video around a virtual sphere, resolution is severely degraded, especially in the polar regions of the virtual sphere.

Virtual reality ("VR") headsets alleviate some of the aforementioned issues related to viewing a 360° video, such as navigation, however, VR technology brings with it its own set of drawbacks. As an initial matter, because the video screen in a VR headset is positioned mere inches away from the user's eyes causes strain, and if combined with motion of the user, for example, while riding a stationary bicycle, many users quickly become disoriented and/or nauseous. Further, the weight of the VR headset itself makes it uncomfortable for users for more than a few minutes, especially if the user is moving. It is also common for users to sweat while wearing a VR headset from more than a few minutes, in some cases, not even that, and this can result in fogging of the lenses requiring a disruption in whatever activity the user was engaged.

As such, it would be highly beneficial to provide a 360° video capture, processing and display system which allows a user to view an entire 360° panoramic view on a video display at one time. It would be further advantageous to generate a processed 360° video file which a user may view on any of a multiplicity of display platforms, such as, but not limited to a television screen, a computer monitor, a tablet computer, a smartphone, etc. Another advantage may be realized by generating a processed 360° video file which a user may view without requiring any specialized video graphics hardware or software, such as a high capacity computer processor, a high capacity video graphics card, or a VR headset. Yet one further benefit may be obtained by integrating a user application onto such a multi-platform compatible processed 360° video file.

SUMMARY OF THE INVENTION

The present invention is directed to a 360° video capture, processing and display system. In at least one embodiment, the system includes a 360° video camera to capture a 360° raw video file, and in one further embodiment, the system comprises a 360° video processing assembly to generate a plurality of 360° equirectangular geographic projections from each frame of the 360° raw video file.

In accordance with at least one embodiment of the present invention, a 360° video processing assembly includes a 360° video processing algorithm utilizing a plurality of video processing parameters to capture a plurality of viewport images from each of the plurality of 360° equirectangular geographic projections. The present system also includes a plurality of composite video displays, each composite video display having a field of view of at least 360°. In accordance with one embodiment of the present invention, each composite video display comprises a plurality of viewport images from a corresponding one of each of the plurality of 360° equirectangular geographic projection. Further, each composite video display in accordance with at least one embodiment of the present invention includes at least a top composite video display and a bottom composite video display, wherein at least one of the top composite video display or the bottom composite video display comprises a seamless integration of corresponding ones of the plurality of viewport images. A multi-platform compatible processed 360° video file comprising the plurality of composite video displays in generated, and the multi-platform compatible processed 360° video file is viewable in its entirety on a video display assembly.

The present invention is further directed to a 360° video processing system to create a multi-platform compatible processed 360° video file from a 360° raw video file which is viewable on a video display screen, wherein the system includes a 360° video processing assembly which generates a 360° equirectangular geographic projection from each frame of the 360° raw video file. In at least one embodiment, the 360° video processing assembly implements a 360° video processing algorithm utilizing a plurality of video processing parameters to capture a plurality of viewport images from each of a plurality of 360° equirectangular geographic projections.

In at least one embodiment, the present system generates a plurality of composite video displays, wherein each of the composite video displays have a field of view of at least 360°. In one further embodiment, each composite video display comprises a plurality of viewport images from a corresponding one of each of said plurality of 360° equirectangular geographic projections.

More in particular, in at least one embodiment, each composite video display includes at least one of a top composite video display comprising a top left viewport image, a top center viewport image and a top right viewport image or a bottom composite video display comprising a bottom left viewport image, a bottom center viewport image and a bottom right viewport image. Further, at least one of the top composite video display or the bottom composite video display comprises a seamless integration of corresponding ones of the plurality of viewport images.

As before, in at least one embodiment, the present 360° video processing system generates a plurality of composite video displays, wherein each of the composite video dis-

plays have a field of view of at least 360°. In one further embodiment, each composite video display comprises a plurality of viewport images from a corresponding one of each of said plurality of 360° equirectangular geographic projections.

At least one embodiment of the present invention is directed to a method for capturing, processing and displaying a 360° video on a video display screen, wherein the method includes: capturing a 360° video; generating a plurality of 360° equirectangular geographic projections; selecting one or more of a plurality of video processing parameters, wherein the video processing parameters include a predetermined video display layout, a display height ratio, a viewport field of view angle, and a viewport heading angle; capturing a plurality of viewport images from each of the plurality of 360° equirectangular geographic projections utilizing the one or more video processing parameters; generating a top composite video display from corresponding ones of the plurality of viewport images from each of the plurality of 360° equirectangular geographic projection: generating a bottom composite video display from corresponding ones of the plurality of viewport images from each of the plurality of 360° equirectangular geographic projection; combining the top composite video display and the bottom composite video display from each of the plurality of 360° equirectangular geographic projection to form a composite video display having a field of view of at least 360°; and creating a multi-platform compatible processed 360° video file comprising a plurality of composite video displays, wherein the multi-platform compatible processed 360° video file is viewable on the video display screen.

These and other objects, features and advantages of the present invention will become clearer when the drawings as well as the detailed description are taken into consideration.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature of the present invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. **1** is a schematic representation of one illustrative embodiment of a 360° video capture, processing and display system in accordance with the present invention.

FIG. **2** is a schematic representation of one illustrative embodiment of a 360° video capture assembly in accordance with the present invention.

FIG. **3** is a schematic representation of one illustrative embodiment of a 360° video processing assembly in accordance with the present invention.

FIG. **4** is a screen shot of one frame of a raw 360° video file in equirectangular video format in accordance with the present invention.

FIG. **5** is a schematic representation of one embodiment of an equirectangular geographic projection in accordance with the present invention.

FIG. **6** is a schematic representation of one embodiment of capturing a plurality of viewport images from an equirectangular geographic projection in accordance with the present invention.

FIG. **7** is a schematic representation of one illustrative embodiment of a plurality of viewport images comprising a composite video display in accordance with the present invention.

FIG. **8** is a table comprising an illustrative embodiment of a plurality of video processing parameters corresponding to a predetermined video display layout designated as BVT Layout Type 1 in accordance with the present invention.

FIG. **9** is a table comprising an illustrative embodiment of a plurality of video processing parameters corresponding to a predetermined video display layout designated as BVT Layout Type 2 in accordance with the present invention.

FIG. **10** is a table comprising an illustrative embodiment of a plurality of video processing parameters corresponding to a predetermined video display layout designated as BVT Layout Type 3 in accordance with the present invention.

FIG. **11** is a table comprising an illustrative embodiment of a plurality of video processing parameters corresponding to a predetermined video display layout designated as BVT Layout Type 4 in accordance with the present invention.

FIG. **12** is a screen shot of one illustrative embodiment of a composite video display corresponding to a predetermined video display layout designated as BVT Layout Type 1 in accordance with the present invention.

FIG. **13** is a screen shot of one illustrative embodiment of a composite video display corresponding to a predetermined video display layout designated as BVT Layout Type 2 in accordance with the present invention.

FIG. **14** is a screen shot of one illustrative embodiment of a composite video display corresponding to a predetermined video display layout designated as BVT Layout Type 3 in accordance with the present invention.

FIG. **15** is a screen shot of one illustrative embodiment of a composite video display corresponding to a predetermined video display layout designated as BVT Layout Type 4 in accordance with the present invention.

FIG. **16** is a schematic representation of a composite video display identifying at least some of the variables utilized in the illustrative embodiment of the portion of a 360° video processing algorithm in accordance with the present invention.

FIG. **17** is a screen shot illustrative of one embodiment of an application module incorporating a multi-platform compatible processed 360° video file in accordance with the present invention.

FIG. **18** is a screen shot illustrative of one other embodiment of an application module incorporating a multi-platform compatible processed 360° video file in accordance with the present invention.

FIG. **19** is a screen shot illustrative of one further embodiment of an application module incorporating a multi-platform compatible processed 360° video file in accordance with the present invention.

FIG. **20** is a screen shot illustrative of yet another embodiment of an application module incorporating a multi-platform compatible processed 360° video file in accordance with the present invention.

FIG. **21** is a screen shot illustrative of still one further embodiment of an application module incorporating a multi-platform compatible processed 360° video file in accordance with the present invention.

FIG. **22** is a diagrammatic representation of one illustrative embodiment of a method of capturing, processing and displaying a 360° video in accordance with the present invention.

Like reference numerals refer to like parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with one embodiment, the present invention is directed to a 360° video capture, processing and display system, generally as shown as **10** throughout the figures. With reference to the illustrative embodiment of FIG. **1**, the present system **10** includes a 360° video capture assembly **20**. With additional reference to FIG. **2**, a 360° video capture assembly **20** in accordance with the present invention comprises a 360° video camera **22**. A wide variety of 360° video cameras **22** are available today ranging from inexpensive hobbyist 360° video cameras **22** to high end professional 360° video cameras **22**. It is within the scope and intent of the present invention to utilize any type of 360° video camera **22** capable of generating a raw 360° video file **26** of a target scene.

A 360° video capture assembly **20** in accordance with at least one embodiment of the present system **10** further comprises a 360° video camera transport **24**. As shown in the illustrative embodiment of FIG. **2**, a 360° video capture assembly **20** in accordance with the present invention may further comprise a video camera support **23** in order to secure a 360° video camera **22** to a 360° video camera transport **24**.

As will be appreciated by those of skill in the art, a 360° video camera transport **24** in accordance with one embodiment of the present system **10** may comprise any of a plurality of transport devices including but in no manner limited to a manned vehicle such as a bicycle, tricycle, scooter, skateboard, motorcycle, automobile, airplane, helicopter, boat, kayak, submarine, surfboard, paddleboard, rocket, etc., in order to transport a 360° video camera **22** while generating a raw 360° video file of a target scene. In accordance with at least one other embodiment of the present system **10**, a 360° video camera transport **24** may comprise, but is in no manner limited to, an unmanned vehicle such as a remote controlled bike, car, plane, drone, boat, submarine, rocket, etc., once again, in order to transport a 360° video camera **22** during generation of a raw 360° video file of a target scene.

Alternatively, a 360° video camera **22** of a 360° video transport capture assembly **20** in accordance with at least one embodiment of the present invention may be simply handheld by a user as he or she walks or is otherwise transported through a target scene. In one further embodiment, a body camera type mount may be used to attach a 360° video camera **22** to a person as he or she is transported through a target scene. In one further embodiment, a body camera type mount may be used to attach a 360° video camera **22** to an animal, such that the 360° video camera **22** generates a raw 360° video file along and through the course of the animal's travels. As will be appreciated, animals ranging from cats, dogs, elephants, lions, birds, dolphins, manatees, whales, sharks, etc., just to name a few, may be utilized to "transport" a 360° video camera **22** while generating a raw 360° video file along and through the course of its travels.

As will be further appreciated by those of skill in the art, currently available 360° video cameras **22** are generally capable of capturing a raw 360° video file **26** in 4K resolution, and more specifically, a resolution of either 4096×2160 pixels or 3840×2160 pixels. It is anticipated that 360° video cameras **22** in the immediate future will be capable of capturing raw 360° video files **26** in 8K resolution, 16K resolution, 32K resolution, etc., and it remains within the scope and intent of the present invention to utilize raw 360° video files **26** having such higher resolutions and beyond.

In accordance with at least one embodiment, a 360° video camera **22** will generate a raw 360° video file **26** in an equirectangular 360° video format **37**, such as is shown in the illustrative embodiment of FIG. **4**. Alternatively, a 360° video processing algorithm **36** is employed, at least partially, to convert a raw 360° video file **26**, such as, a fisheye 360° video format or dual fisheye 360° video format, into an equirectangular 360° video format **37**.

Looking once again to the illustrative embodiment of a 360° video capture, processing and display system **10** is shown in FIG. **1**, the system **10** further comprises a 360° video processing assembly **30**. FIG. **3** is a schematic representation of one illustrative embodiment of a 360° video processing assembly **30** in accordance with the present invention. As may be seen from the illustrative embodiment of FIG. **3**, the primary input to the 360° video processing assembly **30** is a raw 360° video file **26**. A plurality of video processing parameters **40**, discussed in greater detail hereinafter, are also input to a 360° video processing algorithm **36** of a 360° video processing assembly **30** in accordance with at least one embodiment of the present invention.

The illustrative embodiment of a 360° video processing assembly **30** as shown in FIG. **3** includes a high-capacity computer processor **32** which is disposed in a communicative relation with a high-capacity video graphics card **34**.

As will be appreciated by those of skill in the art, the specifications presented in Table **1** below are exemplary of a high-capacity computer processor **32** which may be utilized in a 360° video processing assembly **30** in accordance with the present invention.

TABLE 1

Description	Specification
GPU:	GeForce R TX 2080 OC 8 GB
CPU:	Core i7-9700K (4.6GHz Overclocked)
Motherboard:	MicroATX Z370
RAM:	HyperX 32 GB DDR4 2933MHz (2 X 16 GB)
Storage:	512 GB PCie NVMe M.2 SSD, 2 TB 7200 RPM SATA HDD
PSU:	Alienware 850 Watt Multi-GPU PSU
CPU Cooling:	Alienware High Performance Liquid Cooling System
Core i9-9900K	Core i7-9700K
Architecture:	Coffee Lake
Socket:	1151
Cores I Threads:	8/16
Base Frequency (GHz):	3.6
Boost Frequency (ActiveCores - GHz):	1-2 Cores - 5.0
L3 Cache:	4 Cores - 4.8
	8 Cores - 4.7
	16MB
Process:	14 nm++

TABLE 1-continued

Description	Specification
TDP:	95W
Memory Speed:	DDR4-2666
Memory Controller:	Dual-Channel
PCie Lanes:	x16
Integrated UHD Graphics GT2 (Base/ Boost MHz):	350/1200

As will also be appreciated by those of skill in the art, the specifications presented in Table **2** below are exemplary of a high-capacity video graphics card **34** which may be utilized in a 360° video processing assembly **30** in accordance with the present invention.

TABLE 2

GEFORCE RTX 2080 FOUNDERS EDITION - Reference Product Specs:
GPU Engine Specs:
29442944 NVIDIA CUD A ® Cores
57T60 TRTX-OPS
88 Giga Rays/s
17101800 (QC) Boost Clock (MHz)
15151515 Base Clock (MHz)
Memory Specs:
14 Gbps Memory Speed
8 GB GDDR68 GB GDDR6 Standard Memory Configuration
256-bit Memory Interface Width
448 GB/s Memory Bandwidth (GB/sec)

With continued reference to the 360° video processing assembly **30** as shown in FIG. **3**, the high-capacity computer processor **32** and the high-capacity video graphics card **34** are disposed in an operative communication with a 360° video processing algorithm **36**. Following this Detailed Description in the present specification is an exemplary portion of a 360° video processing algorithm **36** in accordance with at least one embodiment of the present invention.

In at least one embodiment, the 360° video processing algorithm **36** operates to convert a raw 360° video file **26** into an equirectangular 360° video format **37**, once again, as shown in the illustrative embodiment of FIG. **4**. In at least one further embodiment, the 360° video processing algorithm **36** operates to generate an equirectangular 360° geographic projection **37'**, such as is shown by way of example in the illustrative embodiment of FIG. **5**, from each frame of the raw 360° video file **26** in an equirectangular 360° video format **37**.

As stated above, the present 360° video capture, processing and display system **10** further comprises a plurality of video processing parameters **40**. More in particular, in at least one embodiment, the plurality of video processing parameters **40** are utilized by the 360° video processing algorithm **36** to precisely define each of a plurality of viewport images **52**, **53**, **54** and **56**, **57**, **58** to be captured from an equirectangular 360° geographic projection **37'** for each frame of a raw 360° video file **26**. FIGS. **6** and **7** are illustrative of a plurality of viewport images **52**, **53**, **54** and **56**, **57**, **58** captured from a single equirectangular 360° geographic projection **37'** of a raw 360° video file **26** in an equirectangular 360° video format **37**.

In at least one embodiment, the video processing assembly **30** captures each of a plurality of viewport images **52**, **53**, **54** and **56**, **57**, **58** from each 360° equirectangular geographic projection **37'** at a rate of about thirty frames per second. In at least one further embodiment, the video processing assembly **30** captures each of a plurality of viewport images **52**, **53**, **54** and **56**, **57**, **58** from each 360° equirectangular geographic projection **37'** at a rate of about sixty frames per second. As will be appreciated by those of skill in the art, the capture rate, whether thirty frames per second or sixty frames a second, is a function of the current state of the art in video processing, however, it is understood to be within the scope and intent of the present invention to employ capture rates that are less than thirty frames per second or that are greater than sixty frame per second, and which may be substantially greater than sixty frame per second.

The plurality of video processing parameters **40** in accordance with at least one embodiment of a 360° video processing assembly **30** in accordance with the present invention includes a target display width **42** and a target display height **41**. In at least one embodiment, a target display width **42** and a target display height **41** are expressed in terms of a number of pixels.

In accordance with at least one further embodiment of a 360° video processing assembly **30** in accordance with the present invention, the plurality of video processing parameters **40** include a plurality of predetermined video display layouts **43**. Each predetermined video display layout **43** is at least partially defined by a display height ratio **44**. More in particular, a display height ratio **44** is at least partially defined as a height **45** of a viewport image **52**, **53**, **54** and **56**, **57**, **58** divided by the target display height **41**, with the quotient multiplied by 100. As one example, for a predetermined video display layout **43** designated as BVT Layout Type 1, a display height ratio **44** is calculated to be 58.98%. This display height ratio **44** is obtained by dividing a top viewport height **45** of 755 pixels by a target display height of 1280 pixels, and multiplying the quotient by 100.

In addition to a display height ratio **44** and a viewport height **45**, the plurality of video processing parameters **40** in accordance with at least one embodiment of a 360° video processing assembly **30** include a viewport width **46**, viewport origin coordinates **47**, viewport positioning coordinates **47'**, a viewport field-of-view angle **48**, and/or a viewport center heading angle **49**.

Tables **3** through **6** presented in FIGS. **8** through **11**, respectively, assign specific video processing parameters **40** for each of a plurality of predetermined video display layouts **43** designated as BVT Layout Types 1 through 4, respectively, in accordance with at least one embodiment of the present 360° video capture, processing and display system **10** of the present invention. Each of the examples in Tables **3** through **6** are based on a target display width **42** of 1920 pixels and a target display height **41** of 1280 pixels.

Turning next to the illustrative embodiment of FIG. **8**, Table **3** assigns the specific video processing parameters **40** for a predetermined video display layout **43** designated as BVT Layout Type 1. Once again, the plurality of video processing parameters **40** presented in Tables **3** through **6** are based on a target display width of 1920 pixels and a target display height **41** of 1280 pixels. As such, Table **3** assigns a top viewport height **45** of 755 pixels, which corresponds to a top display height ratio **44** of 58.98%, calculated as shown above. Table **3** further assigns a bottom viewport height **45** of 485 pixels, which corresponds to a bottom display height ratio **44** of 37.89%. The remaining 40 pixels of the target display height **41** are utilized to display a navigation menu **59**.

Table **3** further assigns a viewport width **46** of 640 pixels for each of viewport images **52**, **53**, **54** and **56**, **57**, **58**. Likewise, Table **3** assigns a viewport field-of-view angle **48** of 70° for each of viewport images **52**, **53**, **54** and **56**, **57**, **58**. Looking again to the plurality of video processing parameters **40** in Table **3**, viewport positioning coordinates **47** are assigned for each of viewport images **52**, **53**, **54** and **56**, **57**, **58**. In at least one embodiment of the present invention, viewport positioning coordinates **47'** are expressed as x, y coordinates at the uppermost left-hand corner of the corresponding viewport image **52**, **53**, **54** and **56**, **57**, **58**, and are measured in pixels from viewport origin coordinates **47**. More in particular, viewport origin coordinates **47** are expressed as x=0 pixels and y=0 pixels, with the viewport origin coordinates **47** located at the uppermost left-hand corner of a composite video display **50**, such as is shown by way of example in the illustrative embodiments of FIGS. **7** and **12**.

Looking further to the plurality of video processing parameters **40** in Table **3** in FIG. **8**, for a predetermined video display layout **43** designated as BVT Layout Type 1, top left viewport image **52** is assigned viewport positioning coordinates **47'** wherein x=0 pixels and y=0 pixels; top center viewport image **53** is assigned viewport positioning coordinates **47'** wherein x=640 pixels and y=0 pixels; and, top right viewport image **54** is assigned viewport positioning coordinates **47'** wherein x=1280 pixels and y=0 pixels.

Lastly, Table **3** assigns a viewport center heading angle **49** for each of viewport images **52**, **53**, **54** and **56**, **57**, **58**. It is noteworthy from a review of Tables **3** through **6** presented in FIGS. **8** through **11**, respectively, that the viewport center heading angle **49** for each of the top left viewport image **52**, top right viewport image **54**, bottom left viewport image **56**, and a bottom right viewport image **58** are completely unique for each of the plurality of predetermined video display layouts **43**. As may also be seen from Tables **3** through **6**, the viewport center heading angle **49** for each of the top center viewport image **53** and the bottom center viewport image **57**, are 90° and 270°, respectively.

Application of the plurality of video processing parameters **40** in Table **3** of FIG. **8** by a 360° video processing assembly **30** in accordance with the present invention results in the capture of a plurality of top viewport images **52**, **53** and **54** and bottom viewport images **56**, **57** and **58**, such as is shown by way of example in the illustrative embodiment of FIG. **7**. More importantly, application of the specific plurality of video processing parameters **40** of Table **3** to an equirectangular 360° geographic projection **37'** of the equirectangular 360° video format **37** frame as shown in the illustrative embodiment of FIG. **4** results in the creation of the composite video display **50**, as shown by way of example in the illustrative embodiment of FIG. **12**.

It is noteworthy, as may be seen from the illustrative embodiment of FIG. **12** that the present 360° video processing assembly **30** creates a top composite video display **51** comprising a seamless integration of corresponding ones of the top left viewport image **52**, top center viewport image **53** and top right viewport image **54**. Similarly, as may also be seen from the illustrative embodiment of FIG. **12**, the present 360° video processing assembly **30** creates a bottom composite video display **55** comprising a seamless integration of corresponding ones of the bottom left viewport image **56**, bottom center viewport image **57** and bottom right viewport image **58**.

It is further noteworthy that in accordance with at least one embodiment of the present 360° video capture, processing and display system **10**, a composite video display **50** comprising an entire 360° field of view is completely displayed at one time on a video display assembly **60**.

In fact, and with further reference to the illustrative embodiment of FIG. **12**, the composite video display **50** comprising a composite field of view which is greater than 360° is completely displayed at one time on a flat video display screen **62** of a video display assembly **60** in accordance with the present invention. More in particular, in accordance with the plurality of video processing parameters **40** as shown in Table **3** of FIG. **8**, each of the top viewport images **52**, **53** and **54** and the bottom viewport images **56**, **57**, and **58** comprise a viewport field of view angle **48** of 70°. As such, each of top composite video display **51** and bottom composite video display **55** a top or bottom composite field of view of view of 210°, respectively. It of course follows that composite video display **50** comprises a composite field of view of 420°. It is believed that the composite video display **50** having a composite field of view of 360° or greater displayed on a flat video display screen **62** of a video display assembly **60** in accordance with the present invention is heretofore unknown. As will be appreciated, a video display assembly **60** in accordance with at least one embodiment of the present invention may comprise a curved video display screen **62**.

As will be appreciated by those of skill in the art, by capturing and compiling a plurality of viewport images **52**, **53**, **54** and **56**, **57**, **58** for each of a plurality of successive frames of a raw 360° video file to create a plurality of composite video displays **50**, a processed 360° video file may be created. More in particular, and in accordance with at least one embodiment of the present invention, the video processing assembly **30** is utilized to create a multi-platform compatible processed video file **38**, as shown in the illustrative embodiment of FIG. **3**.

Specifically, a multi-platform compatible processed video file **38** may be in any of a number of common video file formats including, but in no manner limited to, "mp4", "mov", "avi", etc. As such, a multi-platform compatible processed video file **38** created in accordance with the present invention comprises a plurality of composite video displays **50** which are viewable on any of a number of video display assembly **60** platforms including, but in no manner limited to, high definition televisions, standard resolution televisions, computers monitors, laptops, tablets, smartphones screens, etc., just to name a few, without the need for any specialized video graphics hardware or software.

In at least one embodiment, the resultant multi-platform compatible processed video file **38** is output in HD resolution, i.e., about half of the resolution of a raw 360° video file, at a rate of about thirty frames per second to about sixty frames per second. Of course, it will be appreciated by those of skill in the art, as higher resolution raw 360° video files become more readily available, higher resolution multi-platform compatible processed video files **38** may be created utilizing the present video capture, processing and display system **10**. More in particular, as a result of the data compression that occurs utilizing a 360° video processing assembly **30** in accordance with the present system **10**, the resulting multi-platform compatible processed video files **38** may be displayed with greater resolution than that which may be obtained utilizing currently known 360° video viewing platforms such as, by way of example, Google Streetview, YouTube 360° video, VIRE 360° Video Player, or GoPro Video Player, just to name a few.

It is further noteworthy, that as a result of capturing a plurality of viewport images **52**, **53**, **54**, and/or **56**, **57**, **58**, which in total comprise only a portion of the data of a frame of a raw 360° video file **26** image file utilized to generate an equirectangular 360° geographic projection **37'**. More in particular, the north and south polar regions of the equirectangular 360° geographic projection **37'** are not utilized while capturing a plurality of viewport images **52**, **53**, **54**, and/or **56**, **57**, **58**, as may be seen from the illustrative embodiment of FIG. **6**, and therefore, a multi-platform compatible processed video files **38** created in accordance with the present invention comprises a file size that is considerably smaller than that of the raw 360° video file **26** from which it was generated. In accordance with at least one embodiment of the present 360° video capture, processing and display system **10**, a multi-platform compatible processed video files **38** comprises a file size which is approximately four times less than that of the raw 360° video file **26** from which it was generated.

Turning next to the illustrative embodiment of FIG. **13**, application of the specific plurality of video processing parameters **40** of Table **4** as shown in FIG. **9** to an equirectangular 360° geographic projection **37'** of the single equirectangular 360° video format **37** frame as shown in the illustrative embodiment of FIG. **4** results in the composite video display **50** as shown in the illustrative embodiment of FIG. **13**. Similarly, application of the specific plurality of video processing parameters **40** of Table **5** as shown in FIG. **10** to an equirectangular 360° geographic projection **37'** of the single equirectangular 360° video format **37** frame as shown in the illustrative embodiment of FIG. **4** results in the composite video display **50** as shown in the illustrative embodiment of FIG. **14**.

Additionally, application of the specific plurality of video processing parameters **40** of Table **6** as shown in FIG. **11** to an equirectangular 360° geographic projection **37'** of the single equirectangular 360° video format **37** frame as shown in the illustrative embodiment of FIG. **4** results in the composite video display **50** as shown in the illustrative embodiment of FIG. **15**. As may be seen from Table **6** in FIG. **11**, the viewport field of view angle **48** assigned to each of the bottom left viewport image **56**, bottom center viewport image **57** and bottom right viewport image **58** is 90°. As such, bottom composite video display **55** in the illustrative embodiment of FIG. **14** comprises a bottom composite field of view of 270°, and further, composite video display **50** in the illustrative embodiment of FIG. **14** comprises a composite field of view of 480°. As will be appreciated by those of skill in the art, in at least one embodiment, the present system **10** may be utilized to generate a composite video display **50** having a field of view of less than 360°.

Turning once again to the 360° video processing assembly **30** as shown in the illustrative embodiment of FIG. **3**, a geographical positioning coordinate file **39** may be generated in conjunction with the creation of a multi-platform compatible **360'** video file **38**. The geographical positioning coordinate file includes geographical positioning coordinates which correspond to each of a plurality of captured viewport images, and may include at least a latitude, longitude, and a heading angle in which the lens of the 360° video camera was directed at the time each frame of a raw 360° video was recorded.

In at least one embodiment, a geosynchronization module **70** disposed in communication with a video processing assembly **30** correlates the data in a geographical positioning coordinate file **39** to each of the plurality of captured viewport images corresponding to each frame of a raw 360° video file.

As further shown in the illustrated embodiment of FIG. **3**, the present 360° video capture, processing and display system **10** may include a user application module **80**. More in particular, an application module **80** is operable to integrate a user application onto a multi-platform compatible **360'** video file **38**. As discussed hereinafter, there are any number of user applications which may benefit from integration with a with a multi-platform processed 360° video file **38** in accordance with the present invention including but not limited to racing, touring, exploring, travelogues, movies, real estate, inspections, engineering, surveying, drone videography, security, surveillance, law enforcement, and military applications.

FIGS. **17** through **21** are illustrative of one example of a user application module **80** integrated onto a composite video display **50** of a multi-platform processed 360° video file **38** in accordance with the present invention. More in particular, the illustrative embodiment of a FIGS. **17** through **21** are representative of a user application module **80** comprising a user fitness application. More in particular, user application module **80** comprises a plurality of user application elements **82** which are overlain onto the composite video display **50**. As one example, in FIG. **17**, a plurality of user application elements **82** in the form of avatars representing participants in a virtual bicycle race relative to a user viewing the video display assembly. As further shown in FIG. **17**, the navigation menu **59** comprises the user's personal metrics as well as those comprising the course, and a leaderboard showing the current position for each of the virtual participants relative to the user. An appropriate sensor assembly may be utilized by a user application module **80** so as to measure the actual performance of a user on a stationary cycle, or other such exercise device which may then be translated and displayed on a navigation menu **59**, as shown in the illustrative embodiments of FIGS. **17** through **21**. An interactive device **64**, such as, by way of example only, a remote controller or mouse, may be utilized to facilitate a user's interaction with a user application module **80** via a navigation menu **59**.

FIG. **18** is illustrative of a user application module **80** in an alternative composite video display **50**, wherein the user application elements **82** further comprise a virtual coach to advise a user on his or her status in the virtual race, as well as strategies to improve his or her performance therein. FIG. **19** is illustrative of a user application module **80** in yet another alternative composite video display **50**, wherein the navigation menu **59** has been minimized in the composite video display **50**.

The illustrative embodiments of FIGS. **20** and **21** are representative examples of a user application module **80** comprising a solo fitness routine for a user, specifically, a spinning exercise regimen. More in particular, in the illustrative embodiment of FIG. **20**, one user application element **82** includes an animated image of the user displayed in the lower portion of the video display screen **62**, while a scenic view is presented for the user to view as he or she rides their stationary cycle or similar exercise device. As will be appreciated by those of skill in the art, it is within the scope and intent of the present invention to incorporate a live video image of the user as a user application element **82** projected onto a composite video display **50**. As before, the navigation menu **59** includes statistics about the user's performance, and a virtual coach to prompt the user to perform. In the illustrative embodiment of FIG. **21**, the plain background behind the animated image of the user **82** has been replaced with a bottom composite video display **55** to provide the user with the sensation of cycling outdoors.

Turning now to FIG. **22**, one illustrative embodiment of a method for capturing, processing and displaying a 360° video **1000** is presented. As may be seen from FIG. **22**, the present method **1000** begins with capturing a 360° video **1100**. In at least one embodiment, this further entails generating a raw 360° video file.

The present method for capturing, processing and displaying a 360° video **1000** further comprises processing a raw 360° video file **1200**. As noted above, in at least one embodiment, the present method **1000** includes converting a raw 360° video file into a 360° equirectangular video format. Looking again to the illustrative embodiment of FIG. **22**, the present method **1000** also includes generating a 360° equirectangular geographic projection from each frame of a raw 360° video file **1220**.

With continued reference to the illustrative embodiment of FIG. **22**, the present method for capturing, processing and displaying a 360° video **1000** includes creating a plurality of viewport images from each 360° equirectangular geographic projection **1300**. As before, a plurality of video processing parameters are input to a 360° video processing assembly in order to create a plurality of viewport images **1300**. In at least one embodiment, the plurality of video processing parameters include a target display dimension, and in at least one further embodiment, the plurality of video processing parameters include a target display width and a target display height.

At least one further embodiment of the present method for capturing, processing and displaying a 360° video **1000** comprises selecting at least one video processing parameter **1320**. Also as before, the plurality of video processing parameters may include one or more of a predetermined video display layout, a display height ratio, a viewport width, a viewport height, viewport origin coordinates, viewport positioning coordinates, a viewport field of view angle and/or a viewport center heading angle. Of course, it will be appreciated that in at least one embodiment of the present method **1000**, all of the foregoing plurality of video processing parameters are utilized by a 360° video processing assembly to create a plurality of viewport images from each 360° equirectangular geographic projection **1300**, in accordance with the present invention.

Looking once again to the illustrative embodiment of FIG. **22**, the present method for capturing, processing and displaying a 360° video **1000** also includes capturing each of a plurality of viewport images from each 360° equirectangular geographic projection **1380**. As before, in at least one embodiment, the present method **1000** includes capturing each of a plurality of viewport images from each 360° equirectangular geographic projection **1380** at a rate of about thirty frames per second. In at least one further embodiment, the present method **1000** includes capturing each of a plurality of viewport images from each 360° equirectangular geographic projection **1380** at a rate of about sixty frames per second. As will be appreciated by those of skill in the art, the capture rate, whether thirty frames a second or sixty frames a second, is a function of the current state of the art in video processing, however, it understood to be within the scope and intent of the present invention to employ capture rates that are less than thirty frames per second or greater than sixty frame per second, including substantially greater than sixty frames per second.

In at least one further embodiment, the present method **1000** also includes capturing a plurality of geographical positioning coordinates corresponding to each frame of a raw 360° video, which may be correlated to each of the plurality of captured viewport images. In at least one embodiment, the geographical positioning coordinates corresponding to each of the plurality of captured viewport images include at least a latitude, longitude, and a heading angle in which the lens of the 360° video camera was directed at the time each frame of a raw 360° video was recorded.

After capturing a plurality of viewport images from each 360° equirectangular geographic projection **1380**, the present method comprises creating a composite video display **1400** in accordance with at least one embodiment, the present method **1000** includes generating a top composite video display **1410**. In at least one further embodiment, generating a top composite video display **1410** includes positioning a top left viewport image, a top center viewport image, and a top right viewport image in such a manner so as to create a seamless integration of the plurality of top viewport images to generate a top composite video display **1410**. Similarly, in at least one embodiment, the present method **1000** includes generating a bottom composite video display **1450**. As with the top composite video display, generating a bottom composite video display **1450** includes positioning a bottom left viewport image, a bottom center viewport image, and the top right viewport image in such a manner so as to create a seamless integration of the plurality of bottom viewport images to generate a bottom composite video display **1450**. As may be seen from the illustrative embodiment of FIG. **22**, creating a composite video display **1400** may include generating a top composite video display **1410**, or generating a bottom composite video display **1450**, or both.

At least one further embodiment of the present method for capturing, processing and displaying a 360° video **1000** further comprises combining a top composite video display and a bottom composite video display to generate a composite video display, such as those shown by way of example only in the illustrative embodiments of FIGS. **12** through **15**.

With reference once again to the illustrative embodiment of FIG. **22**, the present method **1000** further includes creating a multi-platform compatible processed 360° video file **1500**. As before, a multi-platform compatible processed 360° video file may be an "mp4" file, a "movfile, an "avi" file, etc. As such, and as disclosed and described above, creating a multi-platform compatible processed 360° video file **1500** in accordance with the present method **1000** results in a video file which may be played on any of a plurality of video display assemblies from the screen of a smart phone to an ultrahigh definition video monitor.

With continued reference to the illustrative embodiment of FIG. **22**, the present method for capturing, processing and displaying a 360° video **1000** in at least one embodiment includes geosynchronizing the processed 360° video file **1600**. More in particular, geosynchronizing the processed 360° video file **1600** comprises correlating the plurality of geographical positioning coordinates for each frame of a raw 360° video with a corresponding one of each of the plurality of captured viewport images of the multi-platform compatible processed 360° video file.

In at least one further embodiment, the present method for capturing, processing and displaying a 360° video **1000** also includes integrating a user application onto a multi-platform processed 360° video file **1700**. As will be appreciated by those of skill in the art, the number of useful applications which may benefit from integration with a multi-platform processed 360° video are essentially limitless. Examples of user applications which may benefit from integration with a multi-platform processed 360° video in accordance with the present invention include racing, touring, exploring, travelogues, movies, real estate, inspections, engineering, surveying, dronevideography, security, surveillance, law enforcement and military applications. The present invention lends itself to integration into numerous user application including, by way of example, those wherein navigation with a mouse or other such device is not practical or convenient; applications which are not amenable to integration into virtual reality projections; as well as applications that do not require specialized equipment or training, thus making them more acceptable to a wider segment of society.

In still one further embodiment, the present method for capturing, processing and displaying a 360° video **1000** also includes integrating a user application onto a multi-platform processed 360° video file **1700**, wherein the multi-platform processed 360° video file has been geosynchronized, as disclosed hereinabove.

Since many modifications, variations and changes in detail can be made to the described embodiments of the invention, it is intended that all matters in the foregoing description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents.

What is claimed is:

1. A 360° video capture, processing and display system comprising:

a 360° video camera to capture a 360° raw video file;

a 360° video processing assembly to generate a plurality of 360° equirectangular geographic projections from said 360° raw video file;

said 360° video processing assembly comprising a 360° video processing algorithm utilizing a plurality of video processing parameters to capture a plurality of viewport images from each of said plurality of 360° equirectangular geographic projections;

a plurality of composite video displays;

each said composite video display comprising said plurality of viewport images from a corresponding one of each of said plurality of 360° equirectangular geographic projection;

each said composite video display including a top composite video display, said top composite video display comprising a seamless integration of corresponding ones of said plurality of viewport images;

said top composite video display comprising a plurality of viewport images corresponding to a portion of the 360° equirectangular geographic projections;

said top composite video display comprising a field of view of 210°;

a multi-platform compatible processed 360° video file comprising said plurality of composite video displays; and

said multi-platform compatible processed 360° video file viewable on a video display assembly.

2. The system as recited in claim **1** wherein said top composite video display comprises a top left viewport image, a top center viewport image and a top right viewport image.

3. The system as recited in claim **1** wherein said plurality of video processing parameters comprises a predetermined video display layout.

4. The system as recited in claim **1** wherein said plurality of video processing parameters comprises a display height ratio.

5. The system as recited in claim **1** wherein said plurality of video processing parameters comprises a viewport field of view angle.

6. The system as recited in claim **1** wherein said plurality of video processing parameters comprises a viewport center heading angle.

7. The system as recited in claim **1** wherein said 360° video processing assembly captures a plurality of viewport images from each of said plurality of 360° equirectangular geographic projections at a rate of about thirty frames per second to about sixty frames per second.

8. The system as recited in claim **1** wherein said 360° video processing assembly captures a plurality of geographical positioning coordinates corresponding to each of said plurality of viewport images captured from each of said plurality of 360° equirectangular geographic projections.

9. The system as recited in claim **8** wherein said plurality of geographical positioning coordinates comprises a latitude, a longitude and a camera heading angle for each of said plurality of viewport images.

10. The system as recited in claim **9** further comprising a geographical positioning coordinate file comprising said plurality of geographical positioning coordinates corresponding to each of said plurality of captured viewport images.

11. A 360° video processing system to create a multi-platform compatible processed 360° video file from a 360° raw video file which is viewable on a video display screen, said system comprising:

a 360° video processing assembly which generates a 360° equirectangular geographic projection from the 360° raw video file;

said 360° video processing assembly comprising a 360° video processing algorithm utilizing a plurality of video processing parameters to capture a plurality of viewport images from each of a plurality of 360° equirectangular geographic projections;

a plurality of composite video displays;

each said composite video display comprising said plurality of viewport images from a corresponding one of each of said plurality of 360° equirectangular geographic projections;

each said composite video display including a top composite video display comprising a top left viewport image, a top center viewport image and a top right viewport image, said top composite video display comprising a seamless integration of corresponding ones of said plurality of viewport images;

the top left viewport image, the top center viewport image and the top right viewport image corresponding to a portion of the 360° equirectangular geographic projections;

said top composite video display comprising a field of view of 210°;

a multi-platform compatible processed 360° video file comprising said plurality of composite video displays; and said multi-platform compatible processed 360° video file viewable on the video display screen.

12. The system as recited in claim **11** wherein said plurality of video processing parameters comprises a predetermined video display layout.

13. The system as recited in claim **11** wherein said plurality of video processing parameters comprises a display height ratio.

14. The system as recited in claim **13** wherein said plurality of video processing parameters comprises a viewport field of view angle.

15. The system as recited in claim **14** wherein said plurality of video processing parameters comprises a viewport center heading angle.

16. A method for capturing, processing and displaying a 360° video on a video display screen, the method comprising:

capturing a 360° video;

generating a plurality of 360° equirectangular geographic projections;

selecting one or more of a plurality of video processing parameters, wherein the video processing parameters include a predetermined video display layout, a display height ratio, a viewport field of view angle, and a viewport heading angle;

capturing a plurality of viewport images from each of the plurality of 360° equirectangular geographic projections utilizing the one or more video processing parameters;

generating a top composite video display comprising a plurality of viewport images corresponding to a portion of the 360° equirectangular geographic projections, said top composite video display comprising a field of view of 210°;

combining the top composite video display from each of the plurality of 360° equirectangular geographic projection to form a composite video display; and

creating a multi-platform compatible processed 360° video file comprising a plurality of composite video displays, wherein the multi-platform compatible processed 360° video file is viewable on the video display screen.

17. The method as recited in claim **16** wherein the 360° video processing assembly captures a plurality of viewport images from each of the plurality of 360° equirectangular geographic projections at a rate of about thirty frames per second to about sixty frames per second.

18. The method as recited in claim **16** further comprising capturing a plurality of geographical positioning coordinates corresponding to each of the plurality of captured viewport images, creating a geographical positioning coordinate file from the plurality of geographical positioning coordinates corresponding to each of the plurality of captured viewport images, and synchronizing each of the plurality of captured viewport images with the corresponding geographical positioning coordinates from the geographical positioning coordinate file.

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