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(54) METHOD AND APPARATUS TO TRANSMIT VIDEO DATA

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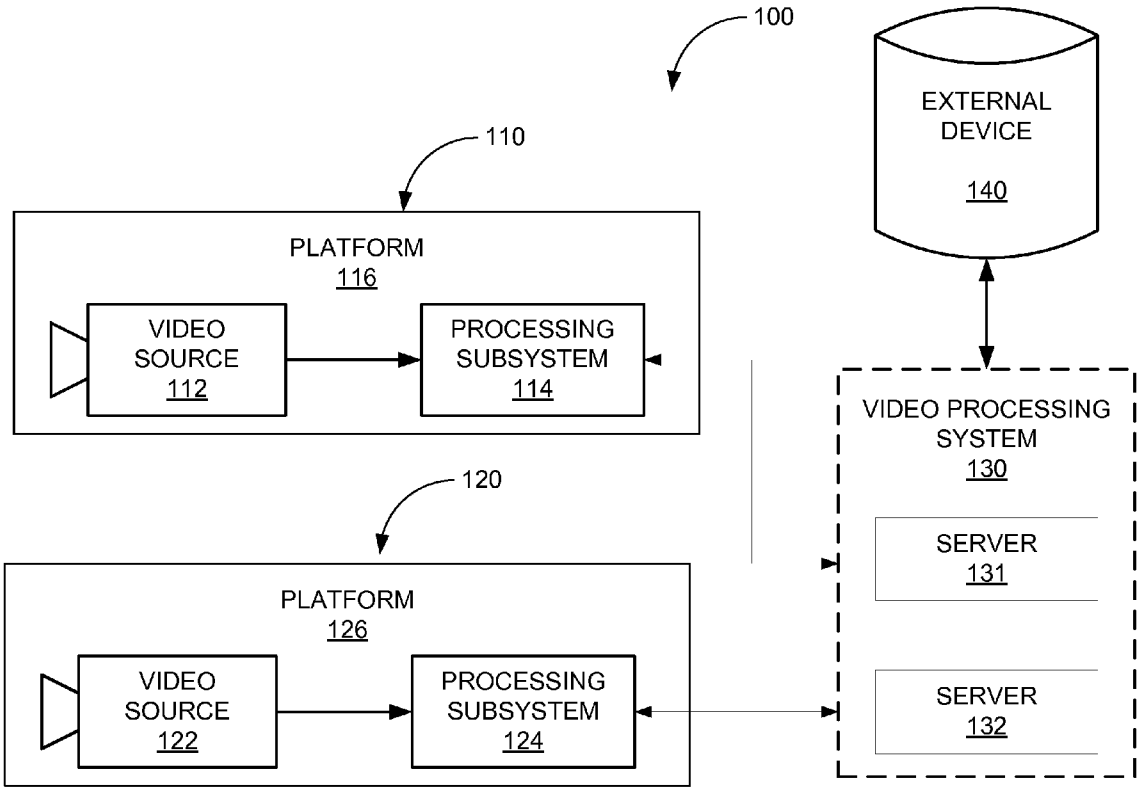
(57) **ABSTRACT**

A video system includes at least one video subsystem including a video source coupled to a mobile platform. The video source is configured to capture and transmit video data. A video processing system is configured to receive transmission of the video data from the video subsystem at a plurality of locations in which the video subsystem is configured to transmit the video data to the video processing system automatically when the video subsystem is in range of the video processing system at each of the plurality of locations.



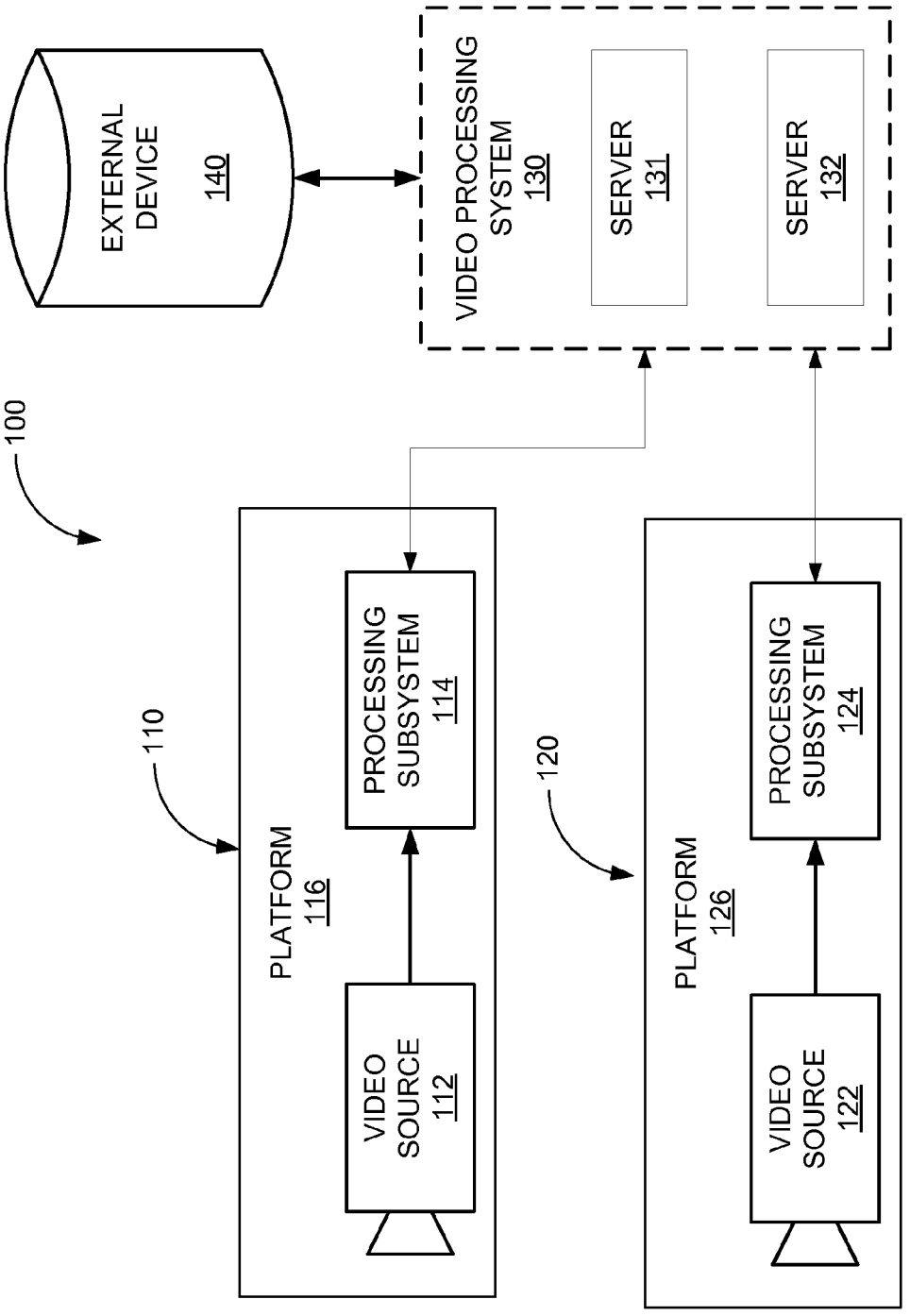

EXTERNAL DEVICE 140
VIDEO PROCESSING SYSTEM 130
SERVER 131
SERVER 132
100
110
PLATFORM 116
PROCESSING SUBSYSTEM 114
VIDEO SOURCE 112
120
PLATFORM 126
PROCESSING SUBSYSTEM 124
VIDEO SOURCE 122

Figure 1

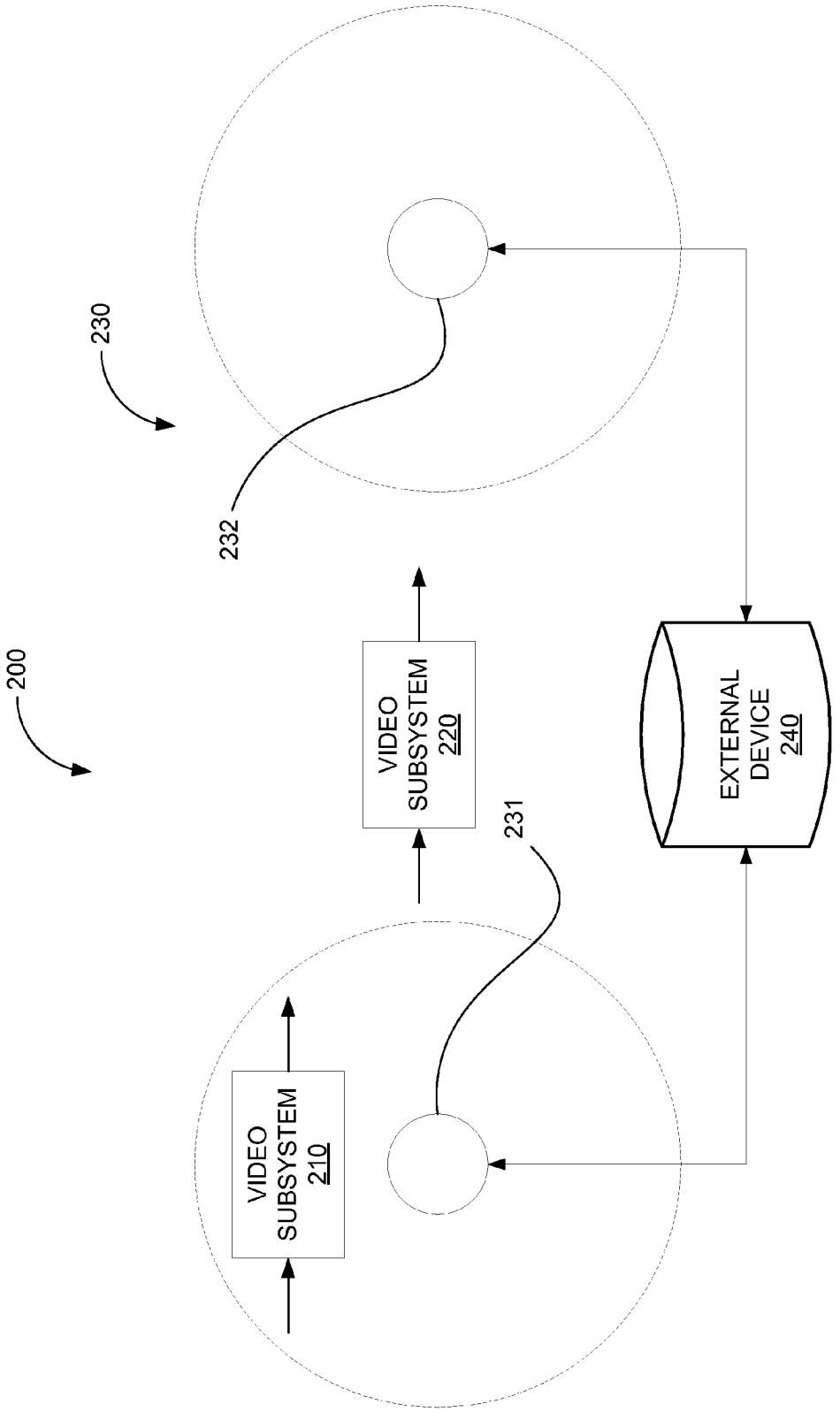

200
230
232
231
VIDEO SUBSYSTEM 220
VIDEO SUBSYSTEM 210
EXTERNAL DEVICE 240

Figure 2

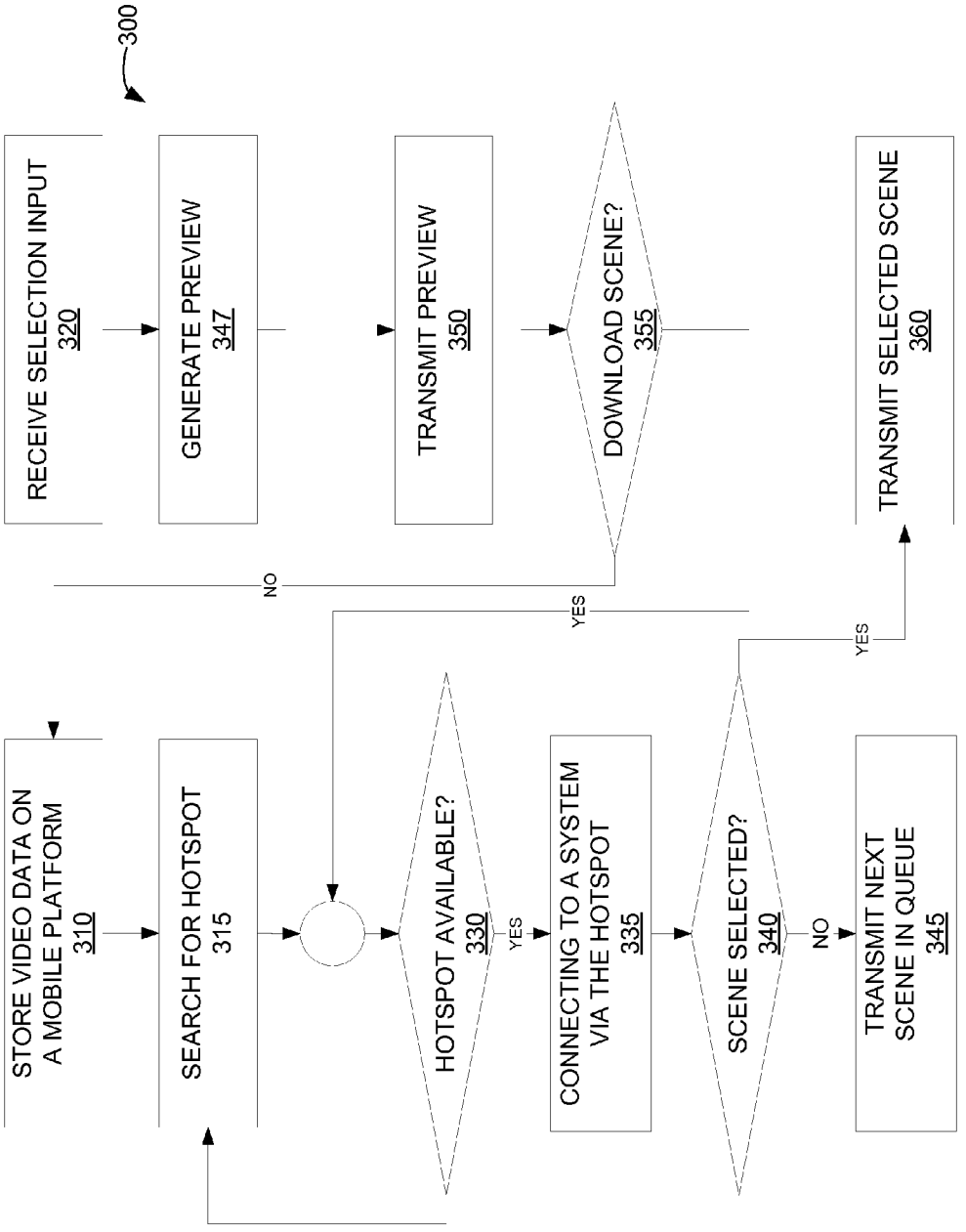

300
RECEIVE SELECTION INPUT 320
GENERATE PREVIEW 347
TRANSMIT PREVIEW 350
DOWNLOAD SCENE? 355
TRANSMIT SELECTED SCENE 360
NO
YES
YES
STORE VIDEO DATA ON A MOBILE PLATFORM 310
SEARCH FOR HOTSPOT 315
HOTSPOT AVAILABLE? 330
YES
CONNECTING TO A SYSTEM VIA THE HOTSPOT 335
SCENE SELECTED? 340
NO
TRANSMIT NEXT SCENE IN QUEUE 345

Figure 3

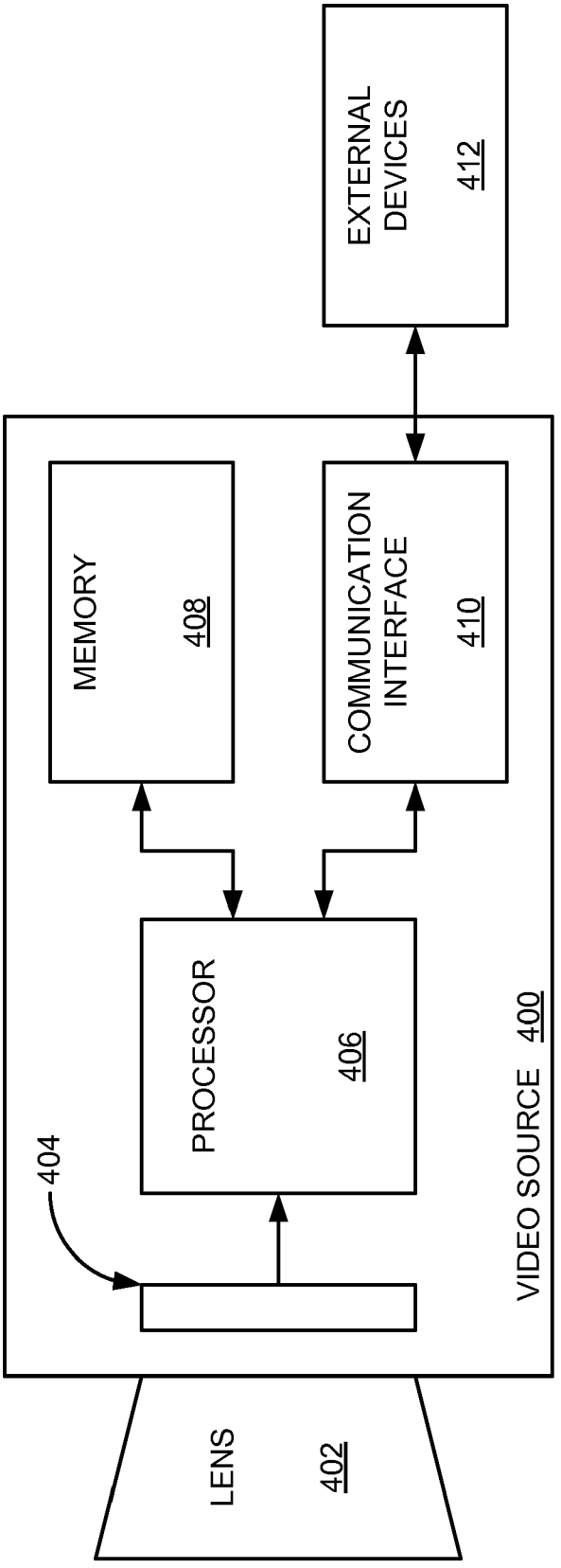

EXTERNAL DEVICES 412
MEMORY 408
COMMUNICATION INTERFACE 410
PROCESSOR 406
404
VIDEO SOURCE 400
LENS 402

Figure 4

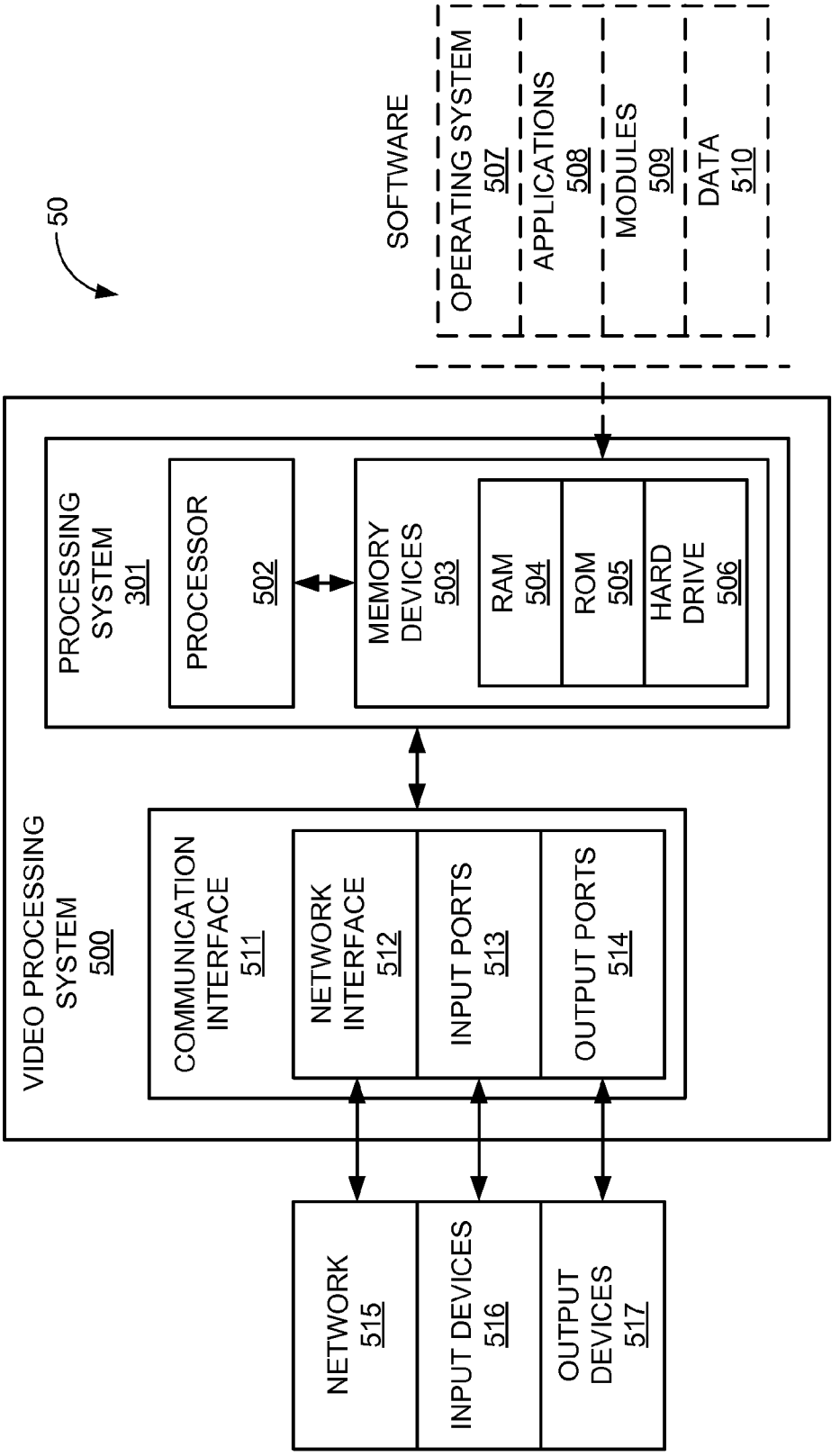

50
SOFTWARE
OPERATING SYSTEM 507
APPLICATIONS 508
MODULES 509
DATA 510
VIDEO PROCESSING SYSTEM 500
PROCESSING SYSTEM 301
PROCESSOR 502
MEMORY DEVICES 503
RAM 504
ROM 505
HARD DRIVE 506
COMMUNICATION INTERFACE 511
NETWORK INTERFACE 512
INPUT PORTS 513
OUTPUT PORTS 514
NETWORK 515
INPUT DEVICES 516
OUTPUT DEVICES 517

Figure 5

METHOD AND APPARATUS TO TRANSMIT VIDEO DATA

RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application Ser. No. 61/259,452 filed Nov. 9, 2009 and entitled "METHOD AND APPARATUS TO TRANSMIT VIDEO DATA" and U.S. Provisional Patent Application Ser. No. 61/259,464 filed Nov. 9, 2009 and entitled "METHOD AND APPARATUS TO PREVIEW VIDEO DATA FROM A VEHICLE," both of which are hereby incorporated by reference in their entireties.

TECHNICAL BACKGROUND

[0002] Presently, transit vehicles store video data over the course of a shift and download the video data to a storage system when they return to a depot at the end of the shift. However, the bandwidth available at the depot may be limited, especially if several vehicles are downloading the video data at the same time. As a result, only a subset of the video data is often downloaded. This subset often includes video data that has been specifically identified by an operator for downloading during the shift. However, if an operator fails to identify a scene that may be interest, that scene may be lost when subsequent video data is recorded over the previously recorded video data.

OVERVIEW

[0003] A video system includes at least one video subsystem including a video source coupled to a mobile platform. The video source is configured to capture and transmit video data. A video processing system is configured to receive transmission of the video data from the video subsystem at a plurality of locations in which the video subsystem is configured to transmit the video data to the video processing system automatically when the video subsystem is in range of the video processing system at each of the plurality of locations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. **1** illustrates a block diagram of an example of a video system.

[0005] FIG. **2** illustrates a block diagram of an example of a video system.

[0006] FIG. **3** illustrates a method of transmitting video data.

[0007] FIG. **4** illustrates a block diagram of an example of a video source.

[0008] FIG. **5** illustrates a block diagram of an example of a video system.

DETAILED DESCRIPTION

[0009] The following description and associated drawings teach the best mode of the invention. For the purpose of teaching inventive principles, some conventional aspects of the best mode may be simplified or omitted. The following claims specify the scope of the invention. Some aspects of the best mode may not fall within the scope of the invention as specified by the claims. Thus, those skilled in the art will appreciate variations from the best mode that fall within the scope of the invention. Those skilled in the art will appreciate that the features described below can be combined in various ways to form multiple variations of the invention. As a result, the invention is not limited to the specific examples described below, but only by claims and their equivalents.

[0010] Presently, transit vehicles store video all day and download once they park in the depot. But, the wireless bandwidth available at the depot is very limited, and thus only a subset of the video data is downloaded. The remaining portion is written over. Disclose herein is a method and apparatus for the transit vehicles to automatically download video data throughout the day whenever a wireless hotspot is encountered. Inexpensive hotspots could be constructed and placed throughout a route.

[0011] FIG. **1** illustrates a schematic view of an exemplary video system **100**. The exemplary video system **100** generally includes at least one video subsystem, such as video subsystems **110**, **120**. The video system **100** also includes at least one video processing system, such as video processing system **130** and at least one external device **140**.

[0012] The video subsystems **110**, **120** are configured to capture video data over the course of a time interval. In at least one example, input from an operator, system intelligence, or other input during the shift may identify video data to be transferred from the video subsystems to the external device **140** via the video processing system **130** during the shift **130**. Once the shift has ended, the video subsystems **110**, **120** may then download additional video data stored thereon to the external device **140** directly. The external device **140** may include a storage system, an input/output interface, and/or other external devices as desired.

[0013] The video processing system **130** is configured to communicate with the video subsystems **110**, **120** during the shift to transmit portions of the video data to the external device **140**, as will be described at appropriate points hereinafter. Such a configuration can allow for a more complete transfer of video data that occurs during a shift.

[0014] Further, the video processing system **130** may allow an administrator to preview the video data during a shift. Previewing the video data during a shift may allow the administrators to identify video data that should be acted on as soon as possible, thereby allowing earlier access to potentially relevant video data. The general configuration of the exemplary video subsystems **110**, **120** and the video processing system **130** will first be discussed, followed by a more detailed description of various components with the video subsystems **110**, **120** and the video processing system **130**.

[0015] As illustrated in FIG. **1**, the video subsystem **110** generally includes a video source **112** and a processing subsystem **114** associated with a platform **116**. In the illustrated example, the video source **112** is in communication with the processing subsystem **114**, which in turn is in communication with the video processing system **130**.

[0016] Similarly, the second video subsystem **120** may include a video source **122** and a processing subsystem **124** associated with a platform **126**. The video source **122** is in communication with video processing subsystem **126**, which in turn is in communication with the video processing system **130**.

[0017] In at least one example, the processing subsystems **114**, **124** may be very basic processing systems configured to transmit raw video data to the video processing system **130**. In other examples, the processing subsystems **114**, **124** may be more full-featured and may do some amount of video processing before transmitting the processed video data to the video processing system **130**.

[0018] The connections and links between the elements of video system **100** may use various communication media, such as air, metal, optical fiber, or some other signal propagation path—including combinations thereof. Such connections may be direct links, or they might include various intermediate components, systems, and networks.

[0019] The video processing system **130** includes at least one device configured to receive transmissions of video subsystems **110**, **120**. In the illustrated example, the video processing system **130** includes at least one server configured to communication with either or both of the video subsystems **110**, **120**, such as servers **131**, **132**. Accordingly, FIG. **1** illustrates the video subsystems **110**, **120** in communication with the entire video processing system **130** to emphasize the video subsystems **110**, **120** may couple to either or both of the servers **131**, **132**, which are part of the video processing system **130**. The video processing system **130** then processes the video data to a desired extent.

[0020] Once the video processing system **130** has processed the video data, the video processing system **130** transmits some or all of the video data to an external device **140** or other external device. By providing a plurality of pathways which the video subsystems **110**, **120** may use to transfer video data from their locations to the central storage systems **140** during their shifts, the video processing system **130** may increase the amount of video data from each shift the video system **100** is able to retain.

[0021] Further, such a configuration may allow the video processing system **130** to provide a preview of video data. Such a situation may be desirable when relevance of selected video data is unclear and thus it is unclear whether it would be desirable to analyze the selected video data immediately or whether it may be suitable to analyze the selected video data at a later time. To this point, the locations of the video subsystems **110**, **120** and the servers **131**, **132** have been introduced generally.

[0022] One exemplary arrangement is illustrated in more detail in FIG. **2**. As illustrated in FIG. **2**, a video system **200** may include a plurality of video subsystems **210**, **220** positioned within a geographical region. The video subsystems **210**, **220** may be configured similarly to the video subsystems as have been described with reference to FIG. **1** or as will be described with reference to FIG. **4**. In any case, the video subsystems **210**, **220** are configured to communicate with a processing/transmission system **230** at various locations within the region.

[0023] In the illustrated example, the processing/transmission system **230** includes a plurality of hotspots **231**, **232**. The hotspots **231**, **232** may be at fixed locations or mobile locations. For ease of reference, the hotspots **231**, **232** will be described as being located at fixed geographic locations.

[0024] The hotspots **231**, **232** may be configured to provide a range of coverage, illustrated by the dashed lines around the hotspots **231**, **232**. In such an example, the video subsystems **210**, **220** may automatically couple with the video processing system **230** when the video subsystems **210**, **220** are within range of the hotspots **231**, **232**. One such example may occur when the platforms associated with the video subsystems **210**, **220** are vehicles that move along various routes within the region. Such routes may include transit routes, such that the vehicles may be transit vehicles.

[0025] In the illustrated example, the video subsystem **210** is shown in range of the hotspot **231**. While the video subsystem **210** is thus in range of the hotspot **231**, the video subsystem **231** automatically transmits video data to the hotspot **231**, which in turn transmits the video data to an external system **240**.

[0026] The selection of which video data the video subsystem **210** transmits may be determined in response to user input, by system intelligence, or by some combination thereof. The transmission of video data to the hotspot **231** may part of a download operation and/or may be a preview of video data that has been identified for potential investigation. Each of these two scenarios will now be discussed in more detail.

[0027] FIG. **3** illustrates a method **300** for transmitting video data from a video subsystem to according to one example. As illustrated in FIG. **3**, the method **300** begins at step **310** when a video system begins by storing video data on a video subsystem that includes a mobile platform. The video data may include any number of scenes.

[0028] As previously discussed, the mobile platform may include one or more video subsystem that travels along various routes within a geographical region. The video subsystems may be configured to communicate with one or more hotspots within the geographical region. Accordingly, the method includes searching for hotspots at step **315** as the video subsystems travel along the various routes. Searching for hotspots **315** may include searching for wireless hotspots.

[0029] In at least one example, the method **300** may also optionally include at step **320** receiving selection input to identify one or more scene for investigation by an administrator. This step is shown in parallel with the steps of storing video data **310** and searching for hotspots **315** since all three of these steps may be performed on an ongoing basis.

[0030] As shown in FIG. **3**, if a hot spot is not available (NO, step **330**), the video subsystem continues to search for a hotspot until an available hotspot is in range. Once a hotspot is available (YES, step **330**), the method includes connecting to a system via the hotspot. Connecting to a system via the hotspot may include connecting to a processing/transmission system that is in further communication with an external device, such as a storage system or an I/O interface.

[0031] How the video subsystem transmits video data may depend on whether a scene has been selected at step **340**. If no scene is selected (NO, step **340**), then the video subsystem transmits the next scene in a transmission queue at step **345** to an external storage device, such as a storage system. Such an example may occur where no previews are available in the optional steps described above or if no input selection has been received to select a scene. A transmission queue may be merely the earliest video data yet to be transmitted or may be any other arrangement of video data, such as video data that have been selected for retention, but which have been identified as being suitable for analysis at the end of the shift.

[0032] However, if a scene has been selected, various steps may be performed to indicate how the video data should be treated. Referring still to FIG. **3**, once selection input is received at step **320**, the method includes generating a preview of the scene identified by the selection input at step **347**. Previews may be generated in any desired format, such as a video clip, video stills, or any other desired format.

[0033] If a scene has been selected the method includes transmitting the preview at step **350**. For example, the preview may be transmitted to an external I/O device. In at least one example, transmitting the preview may include transmitting the scene to an I/O device for an administrator to view. In at least one example, the preview may be transmitted once the

preview is generated. Further, the preview may be generated using any suitable network including the processing systems described herein, wide area networks, cellular networks, other networks, or combinations thereof.

[0034] As a result, the method includes determining whether to download the identified scene at step **355**. As previously introduced, the preview may be generated and sent to an administrator at steps **325** and **350**. For example, an administrator may provide instructions to the video subsystem to download the scene or not at step **355**. These instructions may be provided from the same network used to transmit the preview or may be provided in some other manner. If the instructions indicate the scene is to be downloaded, the video subsystem prioritizes delivery of that scene. As a result, when the video subsystem has coupled to a system via a hotspot as described in steps **310-340**, at step **340** the system then determines that a scene has been selected (Yes, step **340**) and the video subsystem transmits the selected scene to an external device at step **345**, such as a storage system accessible by an administrator.

[0035] If, however, the instructions indicate that the scene should not be downloaded immediately (NO, step **355**), the video subsystem continues to store the video data and handles the video data normally, as indicated by the arrow from the NO decision returning to the first step of the process. In such a process, the video data may be transmitted when in turn as part of the transmission processes described herein.

[0036] Though two video subsystems are shown, it will be appreciated that the video system **200** may include any number of video subsystems. Further, while two hotspots **231**, **232** are shown, it will be appreciated that any number of hotspots may be distributed within a region.

[0037] As introduced, any number of video subsystems may communicate with the external device **240** via the hotspots **231**, **232**. Accordingly, a large number of video subsystems may all communicate with the video processing system **230**. Communication between several video subsystems and the video processing system **230** may result in bandwidth concerns as video processing system **230** may not have an input port capable of receiving full resolution, real time video from all of the video sources.

[0038] In such a case, it may be desirable to incorporate some video processing functionality within each of the video sources and video transmission systems associated with each of the carriers such that the bandwidth requirements between the various video sources and video processing system **130** are reduced. An example of such a video source is illustrated in FIG. **4**.

[0039] FIG. **4** is a block diagram of an exemplary video source **300** similar to video sources **112**, **122** (FIG. **1**). The video source **400** includes a lens **402**, a sensor **404**, a processor **406**, memory **408**, and a communication interface **410**. The lens **402** is configured to focus an image of a scene on the sensor **404**. The lens **402** may be any type of lens, pinhole, zone plate, or the like able to direct light to and/or focus an image on the sensor **404**. The sensor **404** then digitally captures video of the scene and passes the video images to the processor **406**. The processor **406** is configured to store some or all of the video in the memory **408**, process the video, and send the processed video to external devices **412** through the communication interface **410**. In some examples, the external devices **412** may include the video processing system **130** and/or the external device **140** (both seen in FIG. **1**).

[0040] Any of the processing subsystems **110**, **120** (FIG. **1**), the video processing system **130** (FIG. **1**), the processor **406** from FIG. **2** and the video processing system **510** from FIG. **5** may be implemented on a computer system **50** such as that shown in FIG. **5**. The computer system **50** includes a video processing system **300**. The video processing system **300** includes communication interface **311**, and processing system **301**. Processing system **301** is linked to communication interface **311** through a bus. Processing system **301** includes processor **302** and memory devices **303** that store operating software.

[0041] Communication interface **511** includes network interface **512**, input ports **513**, and output ports **514**. Communication interface **511** includes components that communicate over communication links, such as network cards, ports, RF transceivers, processing circuitry and software, or some other communication device. Communication interface **511** may be configured to communicate over metallic, wireless, or optical links. Communication interface **511** may be configured to use TDM, IP, Ethernet, optical networking, wireless protocols, communication signaling, or some other communication format—including combinations thereof.

[0042] Network interface **512** is configured to connect to external devices over network **515**. In some examples these external devices may include video sources and video storage systems as illustrated in FIGS. **1** and **5**. Input ports **513** are configured to connect to input devices **516** such as a keyboard, mouse, or other user input devices. Output ports **514** are configured to connect to output devices **517** such as a display, a printer, or other output devices.

[0043] Processor **502** includes microprocessor and other circuitry that retrieves and executes operating software from memory devices **503**. Memory devices **503** include random access memory (RAM) **504**, read only memory (ROM) **505**, a hard drive **506**, and any other memory apparatus. Operating software includes computer programs, firmware, or some other form of machine-readable processing instructions. In this example, operating software includes operating system **507**, applications **508**, modules **509**, and data **510**. Operating software may include other software or data as required by any specific embodiment. When executed by processor **502**, operating software directs processing system **501** to operate video processing system **500** to process and/or transfer video data as described herein.

[0044] The above description and associated figures teach the best mode of the invention. The following claims specify the scope of the invention. Note that some aspects of the best mode may not fall within the scope of the invention as specified by the claims. Those skilled in the art will appreciate that the features described above can be combined in various ways to form multiple variations of the invention. As a result, the invention is not limited to the specific embodiments described above, but only by the following claims and their equivalents.

What is claimed is:

1. A video system, comprising:

at least one video subsystem including a video source coupled to a mobile platform, the video source being configured to capture and transmit video data; and

a video processing system configured to receive transmission of the video data from the video subsystem at a plurality of locations, wherein the video subsystem is configured to transmit the video data to the video pro-

cessing system automatically when the video subsystem is in range of the video processing system at each of the plurality of locations.

2. The video system of claim **1**, wherein the video processing system includes a plurality of servers.

3. The video system of claim **2**, wherein the servers include a plurality of wireless hotspots.

4. The video system of claim **3**, wherein the wireless hotspots are positioned along a transit route.

5. The video system of claim **4**, wherein the wireless hotspots are at fixed locations along the transit route.

6. The video system of claim **1**, wherein the external device includes a storage system in communication with the video processing system.

7. The video system of claim **1**, wherein the video subsystem further includes a processing subsystem.

8. The video system of claim **1**, wherein the mobile platform includes a vehicle.

9. The video system of claim **8**, wherein the video processing system is configured to directly communicate with a storage system.

10. The video system of claim **9**, wherein the video source is configured to wirelessly communicate with the storage system and the video processing system.

11. The video system of claim **10**, wherein the video source transmits video data directly to the storage system when the video source is in proximity to the storage system and transmits the video data to the storage system via the video processing system when the video source is in proximity with the video processing system.

12. A method of transmitting video data, comprising:

capturing video data using a video source, the video source being coupled to a mobile platform;

determining if the video source is in proximity of a wireless hotspot; and

responsive to a determination that the video source is in proximity to the wireless hotspot, initiating transmission of the video data to the wireless hotspot.

13. The method of claim **12**, wherein the video data is transmitted from the wireless hotspot to at least one of a processing system and a storage system.

14. The method of claim **13**, wherein the video data is transmitted to the processing system when the video source is in proximity with the processing system

15. The method of claim **14**, wherein the processing system is configured to communicate with the video source at a plurality of locations.

16. The method of claim **15**, further comprising transmitting video data received by the processing system to the storage system.

17. The method of claim **14**, further comprising transmitting the video data to the storage system directly when the video source is in proximity with the storage system

18. The method of claim **13**, further comprising detecting a plurality of wireless hotspots at fixed locations.

19. The method of claim **18**, further comprising transmitting video data to wireless hotspots at fixed locations positioned along at least one transit route.

20. A computer readable medium having instructions residing thereon, that when executed, perform a method for transmitting video data, the method including the steps of:

capturing video data using a video source, the video source being configured to transmit data to a storage system when the video source is in proximity with the storage system;

transmitting the video data from the video source to a processing system when the video source is in proximity with the processing system, the processing system being configured to communicate with the video source at a plurality of locations;

transmitting the video data from the video source to the storage system directly when the video source is in range of the storage system; and

transmitting the video data from the video source to the storage system by way of the processing system when the video source is in proximity to the processing system.

* * * * *