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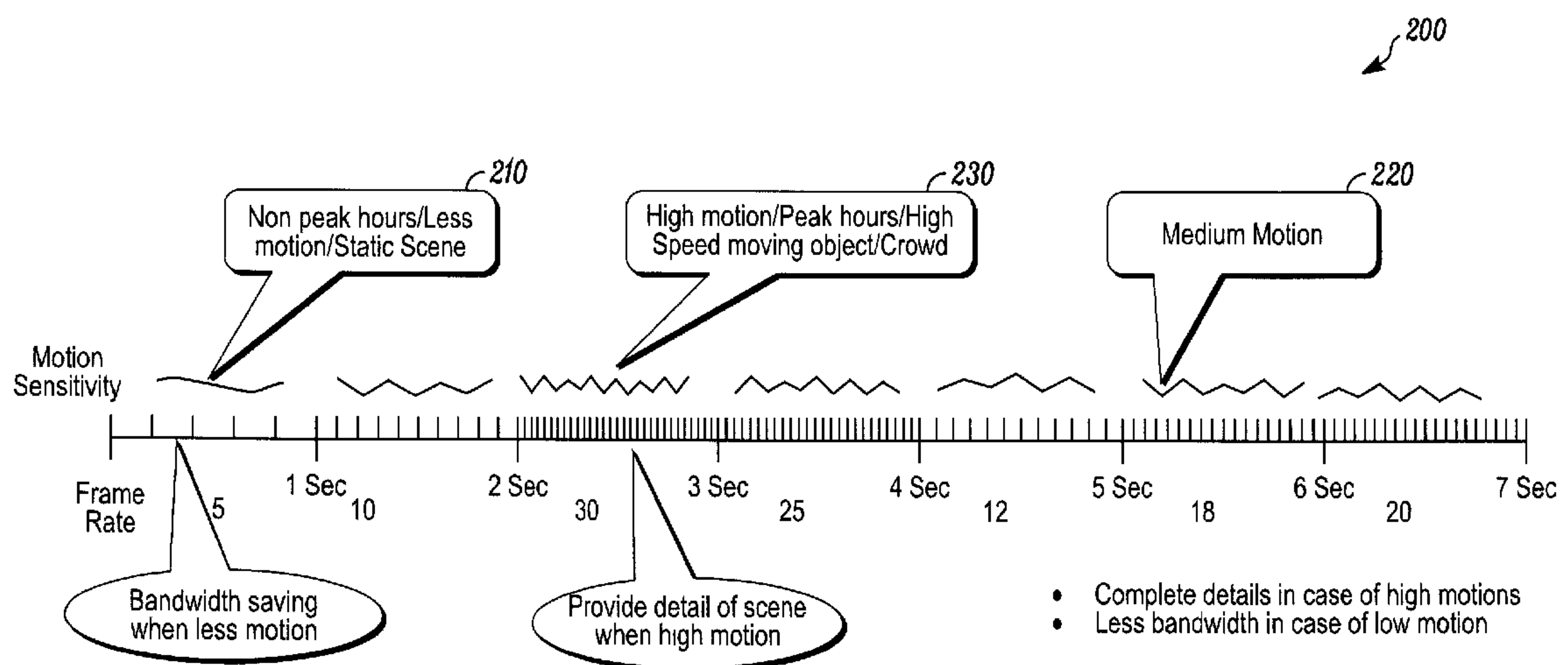
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(54) Titre : SYSTEMES ET METHODES D'AJUSTEMENT DE LA FREQUENCE D'IMAGES DE VIDEO TRANSMISES
S'APPUYANT SUR LE NIVEAU DE MOUVEMENT DANS LA VIDEO

(54) Title: SYSTEMS AND METHODS FOR ADJUSTING THE FRAME RATE OF TRANSMITTED VIDEO BASED ON
THE LEVEL OF MOTION IN THE VIDEO



(57) Abrégé/Abstract:

Systems and methods for adjusting the frame rate of transmitted video based on the level of motion in the video are provided. Some methods can include receiving a video data stream from a video capture device at a first frame rate, identifying a level of motion in one or more frames of the video data stream at a regular interval, identifying a plurality of second frame rates for the video data stream, and transmitting the video data stream to a storage device or a display device at respective ones of the plurality of second frame rates, wherein each of the plurality of second frame rates can correspond to the level of motion in a respective frame of the video data stream.

ABSTRACT

Systems and methods for adjusting the frame rate of transmitted video based on the level of motion in the video are provided. Some methods can include receiving a video data stream from a video capture device at a first frame rate, identifying a level of motion in one or more frames of the video data stream at a regular interval, identifying a plurality of second frame rates for the video data stream, and transmitting the video data stream to a storage device or a display device at respective ones of the plurality of second frame rates, wherein each of the plurality of second frame rates can correspond to the level of motion in a respective frame of the video data stream.

SYSTEMS AND METHODS FOR ADJUSTING THE FRAME RATE OF TRANSMITTED VIDEO BASED ON THE LEVEL OF MOTION IN THE VIDEO

FIELD

[0001] The present invention relates generally to video systems. More particularly, the present invention relates to systems and methods for adjusting the frame rate of transmitted video based on the level of motion in the video.

BACKGROUND

[0002] Known video systems in the surveillance industry include a plurality of video sources, encoders, recorders, streamers, cloud server devices, and client devices, such as web applications, mobile applications, desktop applications, and the like. Known video flow includes capturing a scene, then encoding video of the captured scene, and then streaming or recording the encoded video. The video can be transmitted over a plurality of different channels, such as a LAN, a WAN, or the Internet. However, the size of the video data is critical when accessing the video from the Internet, where bandwidth is both limited and valuable.

[0003] For example, when streaming or recording video, the challenge always exists to provide adequate and enough details about the captured scene, without providing more or less than is necessary. Indeed, when streaming or recording video of a static scene, providing more or extra frames will not provide any advantages to a user viewing the video. Conversely, when streaming or recording video of a dynamic or high motion scene, providing fewer frames will cause the video to be jerky. Indeed, a user may

want to utilize all available bandwidth when a captured scene includes motion so that the user can view each and every movement.

[0004] Notwithstanding the above, some known video systems in the surveillance industry are configured with a low and constant frame rate, resulting in jerky video when streaming and recording video of a dynamic or high motion scene, and resulting in missing video details when movements in a dynamic or high motion scene are quick. Conversely, some known video systems in the surveillance industry are configured with a high and constant frame rate, resulting in video that includes more information about a captured scene than is necessary, and resulting in wasted bandwidth and other limited and valuable resources. Indeed, known video systems that are configured with a constant frame rate, such that the same number of frames is streamed in every situation, inefficiently use bandwidth. Furthermore, known video systems that are configured with a constant frame rate, such that the same number of frames is stored in every situation, inefficiently use storage space, for example, by storing a high number of frames or a high amount of video information, which can include useless information when captured motion is static or low.

[0005] FIG. 1 is a view of a timeline 100 of the frame rate of video vs. the level of motion in the video in accordance with known systems and methods. As seen in FIG. 1, in known systems and methods, the frame rate of the streamed and recorded video is constant over time. However, the level of motion in the video changes over time. Accordingly, during non-peak hours, as indicated at 110, when the level of motion in video may be low or a captured scene may be static, bandwidth is often wasted because the video

streams and records more details than is necessary. While the constant bandwidth may be appropriate during hours when the level of motion in video is at a medium level, as indicated at 120, during peak hours, as indicated at 130, when the level of motion in video may be high or a captured scene may include crowds or high speed moving objects, the available bandwidth is often not sufficient to stream and record all of the details in the captured scene. Accordingly, many details may be lost by the video captured during peak hours.

[0006] In view of the above, there is a continuing, ongoing need for improved systems and methods.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a view of a timeline of the frame rate of video vs. the level of motion in the video in accordance with known systems and methods;

[0008] FIG. 2 is a view of a timeline of the frame rate of video vs. the level of motion in the video in accordance with disclosed embodiments; and

[0009] FIG. 3 is a block diagram of a system for adjusting the frame rate of transmitted video based on the level of motion in the video in accordance with disclosed embodiments.

DETAILED DESCRIPTION

[0010] While this invention is susceptible of an embodiment in many different forms, there are shown in the drawings and will be described herein in detail specific embodiments thereof with the understanding that the present disclosure is to be considered as an exemplification of the principles of the

invention. It is not intended to limit the invention to the specific illustrated embodiments.

[0011] Embodiments disclosed herein can include systems and methods for adjusting the frame rate of transmitted video based on the level of motion in the video. For example, in some embodiments, systems and methods disclosed herein can identify or determine the motion sensitivity level in video of a captured scene and, based thereon, derive a frame rate for processing the video of the captured scene, for example, transmitting, streaming, rendering, or recording the video. Because the motion sensitivity level in the video can change over time, the frame rate for transmitting, streaming, rendering, and recording the video can be dynamic.

[0012] In accordance with disclosed embodiments, systems and methods disclosed herein can receive video from a video source such that the received video can have a frame rate that includes a maximum number of frames per second (fps) that the video source is capable of capturing. Systems and methods can process one or more frames of the received video at a periodic or regular interval, for example, one frame per second, to identify or determine the motion sensitivity level of the scene in the video frame and, based thereon, identify a frame rate for a respective frame. For example, in some embodiments, systems and methods disclosed herein can map the identified motion sensitivity level, or a range thereof, to an fps value, and, in some embodiments, such mapping can be proportional or based on a predetermined configuration. However, even though the frame rate is adaptive, in some embodiments, systems and methods disclosed herein do

not require user input to identify or configure the frame rate for a frame of the received video as the respective frame is processed.

[0013] Once a frame rate is identified in accordance with disclosed embodiments, systems and methods disclosed herein can consume or process the video at the identified frame rate for transmitting, streaming, rendering, or recording the video. Because the frame rate can be dynamic and change from frame to frame in the video, systems and methods disclosed herein can utilize bandwidth efficiently so as to not waste bandwidth on unnecessary frames and so as to consume enough bandwidth to transmit, stream, render, or record the appropriate level of detail in the video.

[0014] In some embodiments, systems and methods disclosed herein can be used in connection with streaming video via the Internet, when bandwidth efficiency is necessary. Indeed, streaming video over the Internet presents a challenge due to limited and expensive bandwidth, and systems and methods disclosed herein can utilize the appropriate and necessary amount of bandwidth (no more and no less) for the level of motion in the video, rather than consuming a constant bandwidth and wasting or underutilizing available bandwidth. For example, when scenes that include a high level of motion are captured, systems and methods disclosed herein can be used to track every movement, but can avoid losing movement because of a constant bandwidth that is too low for the level of motion. Similarly, when scenes that are static or include no or a low level of motion, systems and methods disclosed herein can be used to transmit the necessary information, but can avoid transmitting useless video data or frames that do not include additional information.

[0015] In some embodiments, systems and methods disclosed herein can be used in connection with saving and recording video and can optimize system resources, such as processing power and memory space, by processing, encoding, decoding, compressing, and saving the appropriate and necessary number of frames (no more and no less) for the level of motion in the video. Similarly, when video clips are created, archived, and exported, systems and methods disclosed herein can optimize system resources by creating, archiving, and exporting video clips with the appropriate and necessary number of frames (no more and no less) for the level of motion in the video.

[0016] In some embodiments, systems and methods disclosed herein can be used in connection with a variable group of pictures (GOP). For example, systems and methods disclosed herein can identify a GOP value based on the level of motion in associated video. When the level of motion is zero or low, the GOP value can be high, and when the level of motion is high, the GOP value can be low.

[0017] In some embodiments, systems and methods disclosed herein can be used in connection with PTZ cameras. For example, systems and methods disclosed herein can dynamically identify a frame rate to be used in connection with PTZ operations such that the frame rate is based on the level of motion in video captured by a PTZ camera. Furthermore, systems and methods disclosed herein can dynamically identify a frame rate to be used in connection with PTZ operations such that the frame rate is based on the speed of a PTZ camera, for example, the PTZ camera speed identified in a PTZ command.

[0018] In some embodiments, systems and methods disclosed herein can be used in connection with uncompressed or unencoded video to identify an adaptive frame rate of the video. Accordingly, systems and methods disclosed herein can be used in connection with video systems independently of a codec used therein.

[0019] FIG. 2 is a view of a timeline 200 of the frame rate of video vs. the level of motion in the video in accordance with disclosed embodiments. As seen in FIG. 2, and in accordance with disclosed embodiments, the frame rate of the captured, streamed, transmitted, and recorded video can change over time and be adaptive to the level of motion in the video over time. For example, during non-peak hours, as indicated at 210, when the level of motion in video may be low or a captured scene may be static, bandwidth can be saved or conserved and less bandwidth can be used to stream, transmit, render, and record the video. For example, video can be streamed, transmitted, rendered, and recorded at a frame rate of 5 fps during non-peak hours. More bandwidth can be used during hours when the level of motion in video is at a medium level, as indicated at 220. For example, during hours when the level of motion in video is at a medium level, video can be streamed, transmitted, rendered, and recorded at a rate of 18 fps. However, during peak hours, as indicated at 230, when the level of motion in video may be high or a captured scene may include crowds or high speed moving objects, more bandwidth can be consumed and used to stream, transmit, render, and record the video so that all of the details in the captured scene are shown in the video. For example, video can be stream, transmitted, rendered, and recorded at a rate of 30 fps during peak hours.

[0020] FIG. 3 is a block diagram of a system 300 for adjusting the frame rate of transmitted video based on the level of motion in the video in accordance with disclosed embodiments. As seen in FIG. 3, the system 300 can include a video source 310, a video processing device 320, a storage device 330, and a client device 340. The video source 310 can capture a video data stream of a scene in a monitored region at a frame rate that includes a maximum number of frames per second (fps) that the video source 310 is capable of capturing. The video source 310 can transmit the captured video data stream to the video processing device 320, which can process the video in accordance with methods described above and herein and transmit the processed video to one or both of the storage device 330 and the client device 340, via a network 350, which can include, for example, the Internet, a LAN, or a WAN.

[0021] As seen in FIG. 3, the video processing device 320 can include first and second transceiver devices 322, 324 and a memory device 326, each of which can be in communication with control circuitry 328, one or more programmable processors 328a, and executable control software 328b as would be understood by one of ordinary skill in the art. The executable control software 328b can be stored on a transitory or non-transitory computer readable medium, including, but not limited to, local computer memory, RAM, optical storage media, magnetic storage media, flash memory, and the like. In some embodiments, the control circuitry 328, programmable processor 328a, and control software 328b can execute and control at least some of the methods described above and herein.

[0022] For example, in some embodiments, the transceiver device 322 can receive the video data stream captured by the video source 310, and the control circuitry 328, programmable processor 328a, and control software 328b can analyze the received video data stream to identify and determine the motion sensitivity level in one or more frames of the video data stream at a periodic or regular interval, for example, one frame per second, and, based thereon, identify a frame rate for a respective frame. In some embodiments, the memory device 326 can store a map of motion sensitivity levels, or ranges thereof, to fps values, and the control circuitry 328, programmable processor 328a, and control software 328b can access the map in the memory device 326 to identify a frame rate for a frame based on the identified motion sensitivity level of the respective frame. Furthermore, in some embodiments, the control circuitry 328, programmable processor 328a, and control software 328b can compress the video data stream in accordance with the identified frame rate for a respective video frame, and the transceiver device 324 can transmit, to the storage device 330 or the client device 340, the video data stream at the identified frame rates for the respective frames of the video data stream.

[0023] Although a few embodiments have been described in detail above, other modifications are possible. For example, the logic flows described above do not require the particular order described, or sequential order, to achieve desirable results. Other steps may be provided, or steps may be eliminated, from the described flows, and other components may be added to, or removed from, the described systems. Other embodiments may be within the scope of the invention.

[0024] From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific system or method described herein is intended or should be inferred. It is, of course, intended to cover all such modifications as fall within the spirit and scope of the invention.

What is claimed is:

1. A method comprising:
receiving a video data stream from a video capture device at a first frame rate;
identifying a level of motion in one or more frames of the video data stream at a regular interval;
identifying a plurality of second frame rates for the video data stream, wherein each of the plurality of second frame rates corresponds to the level of motion in a respective frame of the video data stream; and
transmitting the video data stream to a storage device or a display device at respective ones of the plurality of second frame rates.
2. The method of claim 1 wherein the first frame rate includes a maximum number of frames per second that the video capture device is capable of capturing.
3. The method of claim 1 wherein identifying the plurality of second frame rates for the video data stream includes mapping the level of motion in the one or more frames of the video data stream to a respective one of the plurality of second frame rates.
4. The method of claim 1 further comprising receiving each frame of the video data stream from the video capture device at the first frame rate.
5. The method of claim 1 wherein a first of the plurality of frame rates is higher than the first frame rate when the level of motion in the respective frame of the video data stream is higher than a predetermined threshold value.
6. The method of claim 5 wherein transmitting the respective frame of the video data stream at the first of the plurality of frame rates causes all motion in the respective frame to be stored in the storage device or to be displayed on the display device.

7. The method of claim 1 wherein a first of the plurality of frame rates is lower than the first frame rate when the level of motion in the respective frame of the video data stream is lower than a predetermined threshold value.

8. The method of claim 7 wherein transmitting the respective frame of the video data stream at the first of the plurality of frame rates avoids transmission of frames of the video data stream that do not include motion.

9. The method of claim 1 wherein a first of the plurality of frame rates is lower than the first frame rate when the level of motion in the respective frame of the video data stream is zero.

10. The method of claim 1 further comprising optimizing bandwidth consumed when transmitting the video data stream, wherein optimization is based on the level of motion in the respective frame of the video data stream.

11. A system comprising:
a first transceiver device;
a programmable processor;
executable control software stored on a non-transitory computer readable medium; and
a second transceiver device,
wherein the first transceiver device receives a video data stream from a video capture device at a first frame rate,
wherein the programmable processor and the executable control software identify a level of motion in one or more frames of the video data stream at a regular interval,
wherein the programmable processor and the executable control software identify a plurality of second frame rates for the video data stream, wherein each of the plurality of second frame rates corresponds to the level of motion in a respective frame of the video data stream, and

wherein the second transceiver device transmits the video data stream to a storage device or a display device at respective ones of the plurality of second frame rates.

12. The system of claim 11 wherein the first frame rate includes a maximum number of frames per second that the video capture device is capable of capturing.

13. The system of claim 11 further comprising a memory device, wherein the programmable processor and the executable control software retrieve a motion level-to-fps value map from the memory device to identify the plurality of second frame rates for the video data stream based on the level of motion the one or more frames of the video data stream.

14. The system of claim 11 wherein the first transceiver device receives each frame of the video data stream from the video capture device at the first frame rate.

15. The system of claim 11 wherein a first of the plurality of frame rates is higher than the first frame rate when the level of motion in the respective frame of the video data stream is higher than a predetermined threshold value.

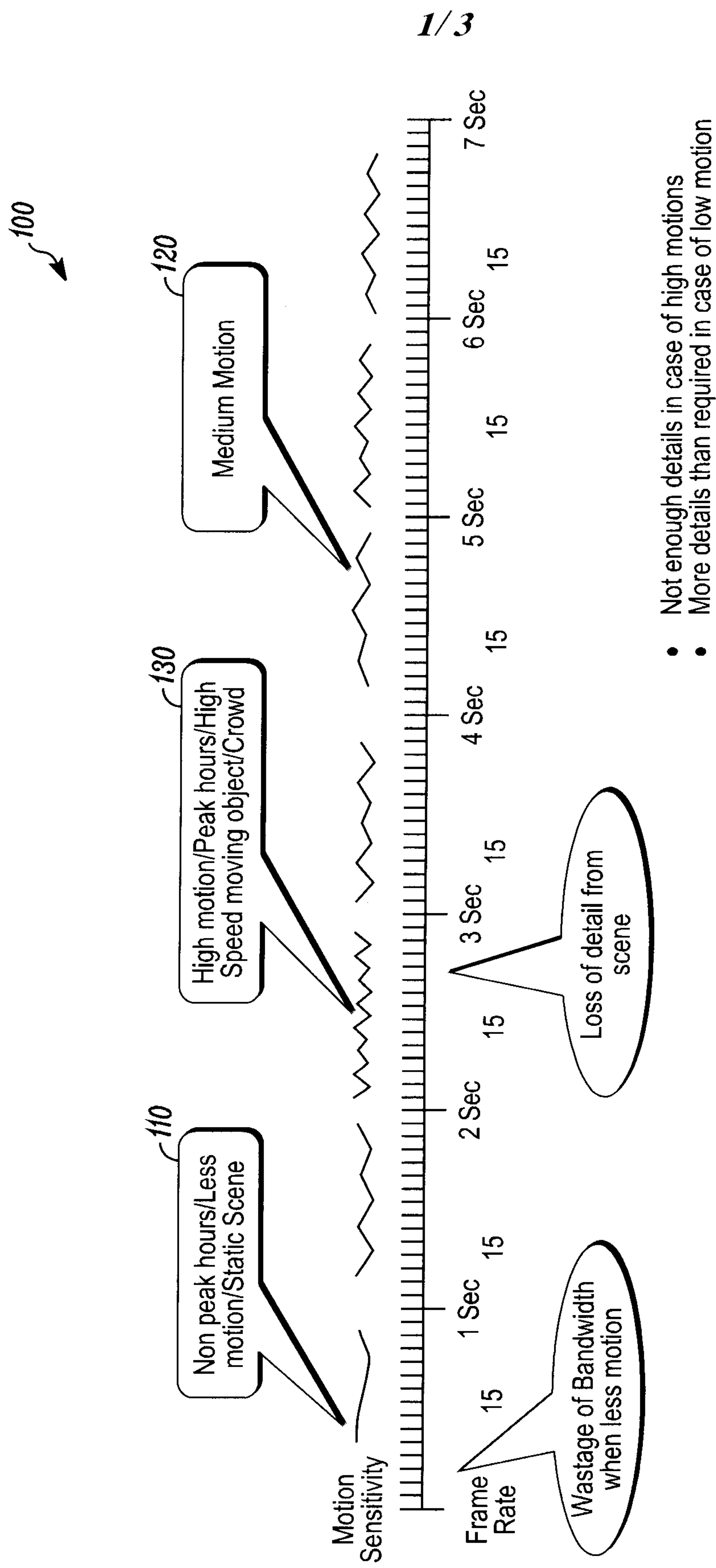
16. The system of claim 15 wherein the second transceiver transmitting the respective frame of the video data stream at the first of the plurality of frame rates causes all motion in the respective frame to be stored in the storage device or to be displayed on the display device.

17. The system of claim 11 wherein a first of the plurality of frame rates is lower than the first frame rate when the level of motion in the respective frame of the video data stream is lower than a predetermined threshold value.

18. The system of claim 17 wherein the second transceiver transmitting the respective frame of the video data stream at the first of the plurality of frame rates avoids transmission of frames of the video data stream that do not include motion.

19. The system of claim 11 wherein a first of the plurality of frame rates is lower than the first frame rate when the level of motion in the respective frame of the video data stream is zero.

20. The system of claim 11 wherein the programmable processor and the executable control software optimize bandwidth consumed when the second transceiver device transmits the video data stream by basing each of the plurality of second frame rates on the level of motion in the respective frame of the video data stream.



(Prior Art)

FIG. 1

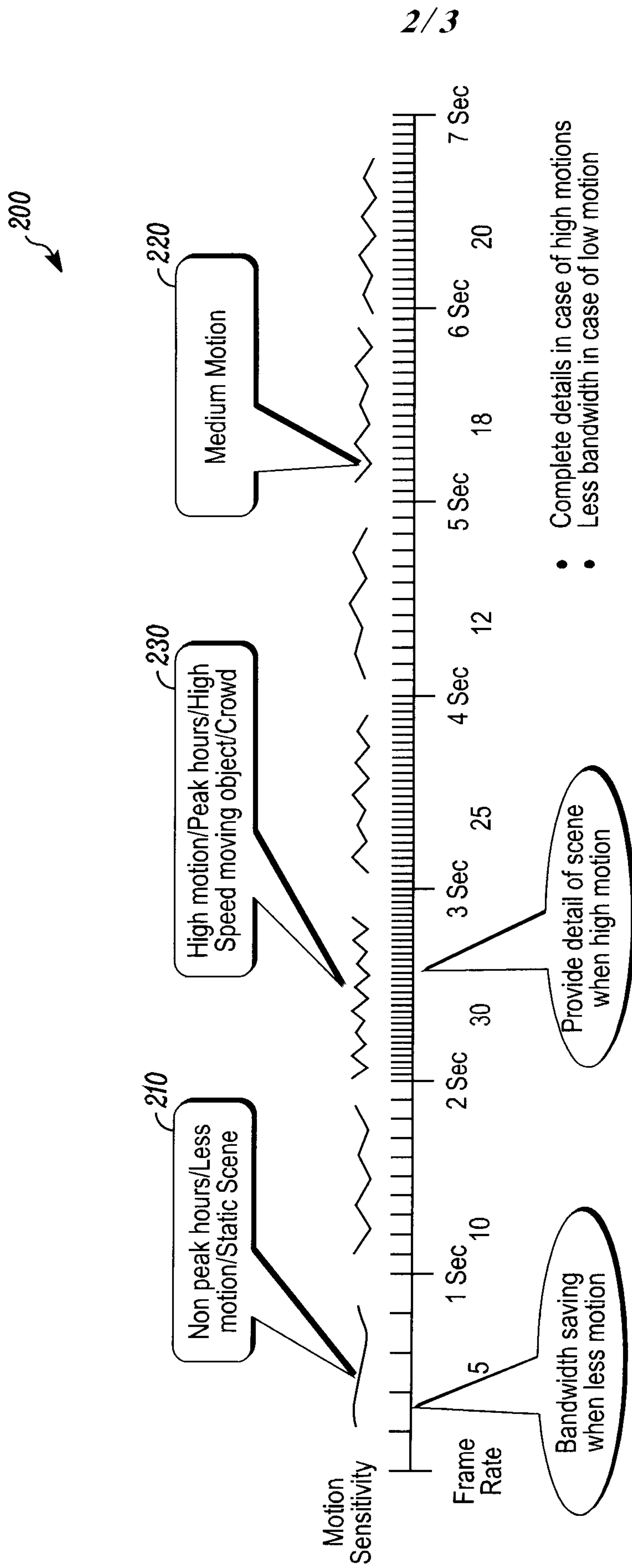


FIG. 2

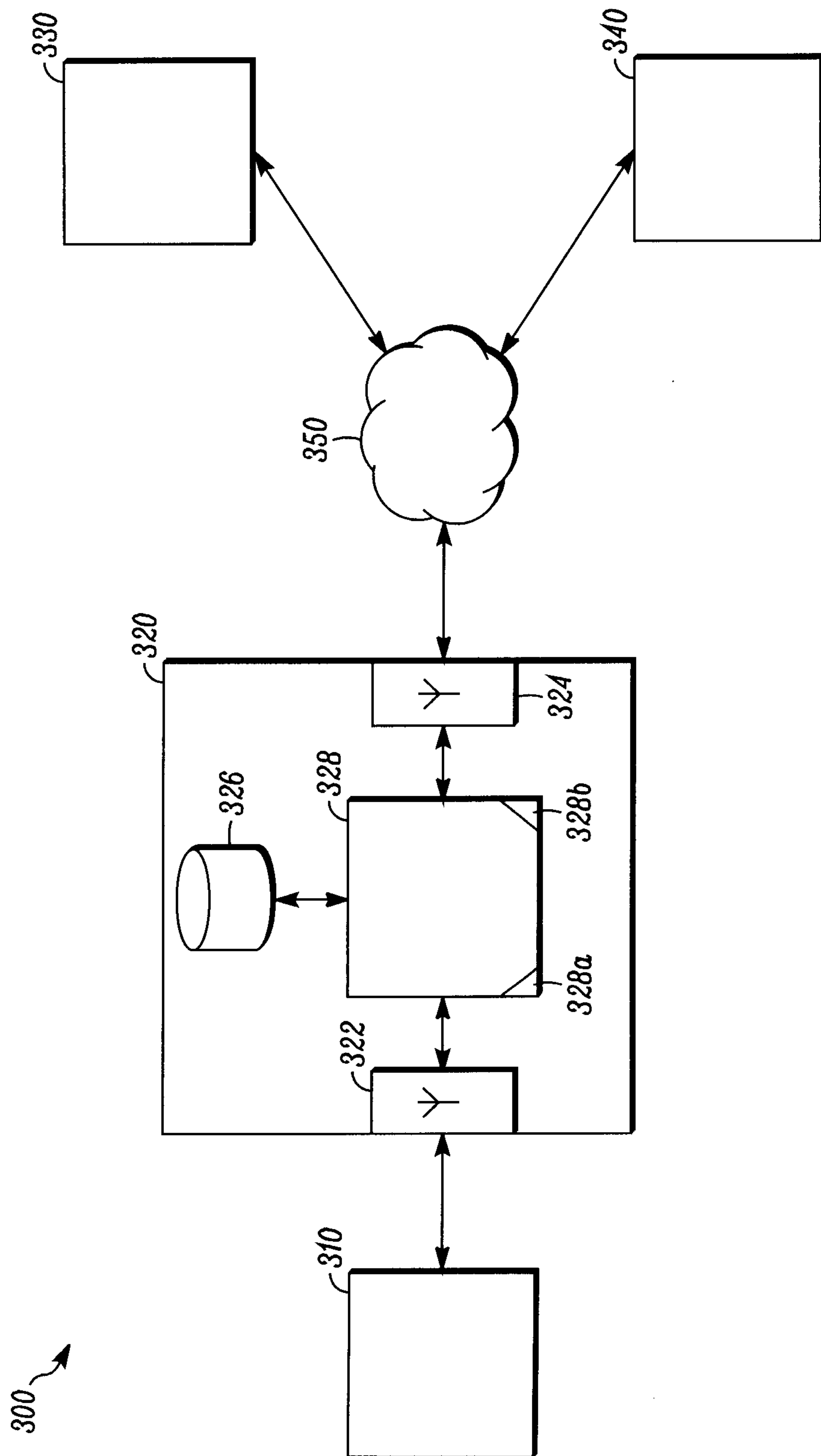


FIG. 3

