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(54) **Title:** A SYSTEM AND METHOD FOR ADAPTIVE MEDIA CONTENT DELIVERY

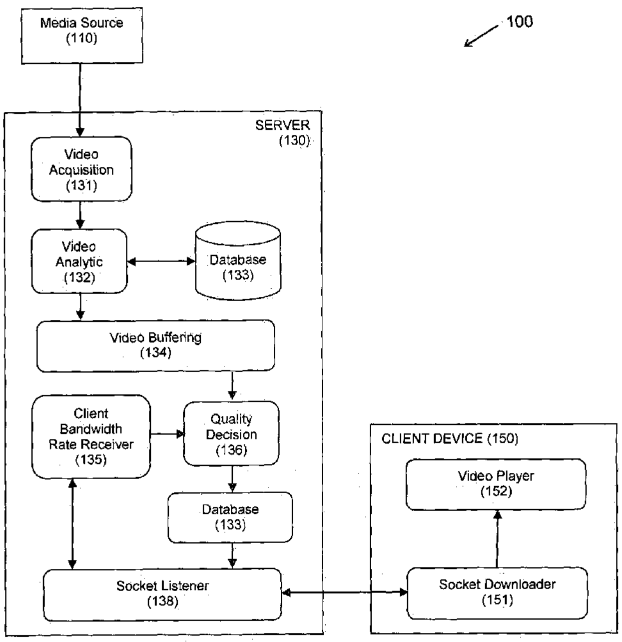

FIG. 1

(57) **Abstract:** The present invention relates to a system for adaptive media content delivery (100). The system (100) adapts the quality of media content to be delivered based on bandwidth of a client device (150) connection and event detected in the media content. This allows the system (100) to adaptively send a media content while preserving the quality of frames capturing an event. The system (100) comprises of a media source (110), a server (130), and a client device (150). The server (130) includes a video acquisition component (13 1), a video analytic component (132), a database (133), a video buffering component (134), bandwidth rate receiver component (135), a quality decision component (136), a video encoder (137), and a socket listener component (138). The client device (130) includes a socket downloader component (15 1) and a video player (152).

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A SYSTEM AND METHOD FOR ADAPTIVE MEDIA CONTENT DELIVERY

FIELD OF INVENTION

The present invention relates to a system and method for adaptive delivering of media content over a network having varying bandwidth capacities.

BACKGROUND OF THE INVENTION

Delivery of media content such as video and audio over a network requires coping with bandwidth which varies with time and location. This variation in bandwidth causes data losses and latency in the media content being delivered. Thus, a client with low-bandwidth connection experiences interruption and jittering playback of the delivered media content. In regard to this, adaptive media content delivery is developed. Such adaptive media content delivery adapts the quality of the media content to be delivered based on the client's bandwidth connection. Thus, the quality of the media content can be scaled down for delivering to the client having a low-bandwidth connection.

In European Patent No. 1777969, an adaptive video transmission with variable frame rate is provided. The method includes: (a) measuring the transmission capacity to the receiver; (b) determining the rate of change of transmission capacity; and (c) adjusting the transmitted video frame rate as a function of the said rate of change.

In US Patent No. 6014694, a system for adaptively transporting video over networks is disclosed. The system comprises a video/audio codec that functions to compress, code, decode and decompress video streams that are transmitted over networks having available bandwidths that vary with time and location. Depending on the channel bandwidth, the system adjusts the compression ratio to accommodate a plurality of bandwidths ranging from 20 Kbps for POTS to several Mbps for switched LAN and ATM environments. Bandwidth adjustability is provided by offering a trade off between video resolution, frame rate and individual frame quality. The system generates a video data stream comprised of Key, P and B frames from a raw source of video. Each frame type is further comprised of multiple levels of data representing varying degrees of quality. In addition, several video server platforms can be utilized in tandem to transmit video/audio information with each video server platform transmitting information for a single compression/resolution level.

However, such adaptive media content delivery may not be suitable for a surveillance system. The clarity of the media content and the event carried by the media content are essential elements for forensic processing of the media content. Thus, by reducing the quality of the delivered media content, suspicious event that is captured in the media content cannot be seen clearly through a playback at the client.

Therefore, there is a need to provide a system for adaptive delivering of media content while considering events captured in the media content.

SUMMARY OF INVENTION

According to a first aspect of the present invention, a system for adaptive media content delivery **(100)** is provided. The system **(100)** comprises of at least one media source **(110),** a server **(130),** and a client device **(150).** The server **(130)** includes at least one video analytic component **(132),** wherein the at least one video analytic component **(132)** is used to analyse event in images captured by the at least one media source **(110);** a bandwidth rate receiver component **(135),** wherein the client bandwidth rate receiver component **(135)** is used to estimate the bandwidth of the client device **(150)** connection; a quality decision component **(136),** wherein the quality decision component (13S) is used to perform image compression for each frame and selective temporal buffer frames based on bandwidth of the client device **(150)** connection and event captured in the images; and a video encoder **(137),** wherein the video encoder **(137)** is used to encode the compressed and selected temporal buffer frames from the quality decision component **(136)** into a video.

According to a second aspect of the present invention, a method for delivering of a media content by using the system for adaptive media content delivery **(100)** is provided. The method comprises the steps of receiving a plurality of captured images or video frames from at least one media source **(110)** by a video acquisition component **(131);** analysing each frame by at least one video analytic component **(132)** to determine whether an event is detected in each frame; buffering the frames in a video buffering component (134); estimating bandwidth of a client device **(150)** connection by the client bandwidth rate receiver component (135); performing image compression on each frame and selective temporal buffer frames by a quality decision component (136), wherein the image compression and selective temporal buffer frames are performed based on the bandwidth of the client device (150) connection and the event detected in each frame; encoding the compressed and selected temporal buffer frames into video by a video encoder (137); and transmitting the video to the client device (150).

Preferably, the bandwidth estimation includes the steps of sending a test frame from the client device (150) to the server (130); recording arrival time of the first bit and the last bit of the test frame; and calculating the bandwidth of the client device (150) connection based on data size of the test frame, arrival time of the last bit of the test frame, and the arrival time of the first bit of the test frame.

Preferably, the step of performing image compression on each frame and selective temporal buffer frames by a quality decision component (136) includes the steps of: (a) selecting and extracting a frame from the video buffering component (134); (b) determining whether an event is detected in the frame, wherein if an event is detected in the frame, selecting a lower image compression ratio and more frequent frame sequence for the following frame by the quality decision component (136), and wherein if there is no event detected in the frame, selecting a higher image compression ratio and less frequent frame sequence for the following by frame the quality decision component (136); (c) compressing the frame based on the selected compression ratio; (d) packetizing the compressed frame with previous selected frames; (e) comparing total size of the packetized frames with the bandwidth of the client device (150) connection, wherein if the total size of the packetized frames is lower than the bandwidth estimated by the client bandwidth rate receiver component (135), repeating steps (a) to (d) for the following frame selected from the video buffering component (134), and wherein if the total size of the packetized frames is higher than the bandwidth estimated by the client bandwidth rate receiver component (135), compressing the packetized frames if the packetized frames can be reduced to a size lower than or equal to the estimated bandwidth or discarding the frame from the packetized frames if the packetized frames cannot be reduced to a size lower than or equal to the estimated bandwidth; and (f) sending the packetized frames to the video encoder (137).

According to a third aspect of the present invention, a server **(130)** for delivering media content to a client device **(150)** is provided. The server **(130)** comprises of a video acquisition component **(131),** a database **(133),** a video buffering component **(134),** and a socket listener component **(138).** Moreover, the server **(130)** further includes at least one video analytic component **(132),** wherein the at least one video analytic component **(132)** is used to analyse event in images captured by the at least one media source **(110);** a bandwidth rate receiver component **(135),** wherein the client bandwidth rate receiver component **(135)** is used to estimate the bandwidth of the client device **(150)** connection; a quality decision component **(136),** wherein the quality decision component **(136)** is used to perform image compression for each frame and selective temporal buffer frames based on bandwidth of the client device **(150)** connection and event captured in the images; and a video encoder **(137),** wherein the video encoder **(137)** is used to encode the compressed and selected temporal buffer frames from the quality decision component **(136)** into a video.

According to a fourth aspect of the present invention, a method for delivering of a media content by using the server **(130)** is provided. The method comprises the steps of receiving a plurality of captured images or video frames by a video acquisition component **(131);** analysing each frame by at least one video analytic component **(132)** to determine whether an event is detected in each frame; buffering the frames in a video buffering component **(134);** estimating bandwidth of a client device **(150)** connection by the client bandwidth rate receiver component **(135);** performing image compression on each frame and selective temporal buffer frames by a quality decision component **(136),** wherein the image compression and selective temporal buffer frames are performed based on the bandwidth of the client device **(150)** connection and the event detected in each frame; encoding the compressed and selected temporal buffer frames into video by a video encoder **(137);** and transmitting the video to the client device **(150).**

Preferably, the bandwidth estimation includes the steps of sending a test frame from the client device **(150)** to the server **(130);** recording arrival time of the first bit and the last bit of the test frame; and calculating the bandwidth of the client device (150) connection based on data size of the test frame, arrival time of the last bit of the test frame, and the arrival time of the first bit of the test frame.

Preferably, the step of performing image compression on each frame and selective temporal buffer frames by a quality decision component (136) includes the steps of: (a) selecting and extracting a frame from the video buffering component (134); (b) determining whether an event is detected in the frame, wherein if an event is detected in the frame, selecting a lower image compression ratio and more frequent frame sequence for the following frame by the quality decision component (136), and wherein if there is no event detected in the frame, selecting a higher image compression ratio and less frequent frame sequence for the following by frame the quality decision component (136); (c) compressing the frame based on the selected compression ratio; (d) packetizing the compressed frame with previous selected frames; (e) comparing total size of the packetized frames with the bandwidth of the client device (150) connection, wherein if the total size of the packetized frames is lower than the bandwidth estimated by the client bandwidth rate receiver component (135), repeating steps (a) to (d) for the following frame selected from the video buffering component (134), and wherein if the total size of the packetized frames is higher than the bandwidth estimated by the client bandwidth rate receiver component (135), compressing the packetized frames if the packetized frames can be reduced to a size lower than or equal to the estimated bandwidth or discarding the frame from the packetized frames if the packetized frames cannot be reduced to a size lower than or equal to the estimated bandwidth; and (f) sending the packetized frames to the video encoder (137).

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIG. 1 shows a block diagram of a system for adaptive media content delivery (100) according to an embodiment of the present invention.

FIG. 2 shows a flowchart of a method for adaptive delivering of media content using the system (100) of FIG. 1 according to an embodiment of the present invention.

FIG. 3 shows a flowchart of a method for performing image compression and selective temporal buffer frames by the quality decision component **(136)** by using a quality decision component **(136)** of the system **(100)** of **FIG. 1** according to an embodiment of the present invention.

FIGS. 4(a-c) show a set of video frames undergoing the method of **FIG. 3.**

DESCRIPTION OF THE PREFFERED EMBODIMENT

A preferred embodiment of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well known functions or constructions are not described in detail since they would obscure the description with unnecessary detail.

Referring now to **FIG. 1,** there is shown a block diagram of a system for adaptive media content delivery **(100)** according to an embodiment of the present invention. The system **(100)** adapts the quality of media content to be delivered based on bandwidth of a client device **(150)** connection and event detected in the media content. This allows the system **(100)** to adaptively send a media content while preserving the quality of frames capturing an event. The term "event" used in the description and in the appended claims refers to a behaviour of an object captured in a media content that is detected and deemed as being suspicious by a surveillance system such as, but not limited to intrusion, loitering, slip and fall, unattended object and etc. The system **(100)** generally comprises of a media source **(110),** a server **(130),** and a client device **(150).**

The media source **(110)** is used for capturing a sequence of images of a location area under surveillance. Preferably, the media source **(110)** is a video camera or any other image sensor device. The images captured by the media source **(110)** are pulled by the server **(130)** as video through either a wired or wireless connection.

The server **(130)** is connected to the client device **(150)** through a network such as an Internet Protocol network. The server **(130)** comprises of a video acquisition component **(131),** a video analytic component **(132),** a database **(133),** a video buffering component **(134),** bandwidth rate receiver component **(135),** a quality decision component **(136),** a video encoder **(137),** and a socket listener component **(138).**

The video acquisition component **(131)** is used to acquire the video from the media source **(110).** Moreover, the video acquisition component **(131)** decodes the video into a plurality of frames and thereon, it sends each frame to video analytic component **(132)** for event analysis.

The video analytic component **(132)** performs event analysis on each frame of the video to detect an event captured in the video. The event analysis is performed by analysing each pixel in each frame to identify motion blobs, filtering noise from the frames, and applying event rules such as object tracking, intrusion detection and loitering detection. Based on the event analysis performed by the video analytic component **(132),** each frame is tagged with event information. The frames tagged with event information are stored in a database **(133)** and temporarily stored in the video buffering component **(134).**

The video buffering component **(134)** is used to temporarily store each frame tagged with event information based on the event analysis performed by the video analytic component **(132)** before transmitting those images to the quality decision component **(136).** The video buffering component **(134)** is connected to the quality decision component **(136).**

The quality decision component **(136)** is used to select image compression ratio for each frame, and to select temporal buffer frames. The selection of image compression and temporal buffer frames is based on the bandwidth of the client device **(150)** connection and event information tagged with each frame. The selected image compression ratio is used by the quality decision component **(136)** to compress each frame, wherein frame tagged with an event is compressed with a higher image compression ratio than the frame without an event. The image compression used to reduce the images bit rate includes any intra-codec, lossy or lossless compression. The quality decision component **(136)** is further connected to the video encoder **(137)** and the client bandwidth rate receiver component **(135).**

The client bandwidth rate receiver component **(135)** is used to estimate the bandwidth of the client device **(150)** connection. More specifically, the client bandwidth rate receiver component **(135)** receives bit rate value based on transmission rate and packets size yield from the client device **(150).**

The video encoder **(137)** is used to encode the compressed and selected temporal buffer frames from the quality decision component **(136)** into a video. The video encoder **(137)** is further connected to the socket listener component **(138).**

The socket listener component **(138)** is an interface component to receive a request message from the client device **(150)** and to deliver the video encoded by the video encoder **(137)** to the client device **(150)** over a wired or wireless network. Moreover, the socket listener component **(138)** communicates with the client device **(150)** either through TCP protocol, UDP protocol, HTTP protocol or any other communication protocol.

The client device **(150)** is used for downloading and playing the media content from the server **(130).** The client device **(130)** includes a socket downloader component **(151)** and a video player **(152).**

The socket downloader component **(151)** is an interface component which is used to send a request message to the server **(130)** and to receive the video from the server **(130).** The socket downloader component **(151)** is connected to the video player **(152).** Moreover, the socket downloader component **(151)** communicates with the server **(130)** either through TCP protocol, UDP protocol, HTTP protocol or any other communication protocol.

The video player **(152)** is used to decode the received video and thereon, playing and displaying the decoded video on a monitor connected to the client device **(150).**

Referring now to **FIG.** 2, there is shown a flowchart of a method for adaptive delivering of media content by using the system **(100)** of **FIG. 1.** Initially, as in step **201,** the video acquisition component **(131)** receives a video from the media source **(110)** and thereon, decodes the video into a plurality of frames **(1 - 10)** as illustrated in **FIG. 4a.** Thereon, each frame of the video is analysed by the video analytic component **(132)** to detect any event captured in the frames as in step **202.** Each frame is tagged with event information based on the event analysis performed by the video analytic component **(132).** As an example, **FIG. 4b** illustrates each frame of the video of **FIG. 4a** is tagged with event information, wherein a first frame **(1),** a second frame **(2),** a fifth frame **(5),** a sixth frame **(6),** an eighth frame **(8),** and a ninth frame **(9)** are tagged with no event while, a third frame **(3),** a fourth frame **(4),** and a tenth frame **(10)** are tagged with having an event. In step **203,** the frames tagged with event information are buffered in the video buffering component **(134).** Next, in step **204,** the bandwidth of the client device **(150)** connection is estimated by the client bandwidth rate receiver component **(135).** The bandwidth estimation includes the steps of sending a test frame from the client device **(150)** to the server **(130),** recording arrival time of the first bit and the last bit of the test frame, and calculating the bandwidth based on the equation below:

$$R_{si} = \sum Size / (T_{sn} - T_{b0})$$

where R_{si} is the bandwidth of the client device **(150)** connection, *'Size'* is the data size of the test frame, T_{sn} is the arrival time of the last bit of the test frame, and T_{bO} is the arrival time of the first bit of the test frame.

Once the bandwidth of the client device **(150)** connection has been estimated, the quality decision component **(136)** performs image compression for each frame and selective temporal buffer frames based on the bandwidth of the client device **(150)** connection and event information tagged with each frame (step **205).** The image compression used to reduce the images bit rate includes any intra-codec, lossy or lossless compression. The compressed and selected temporal buffer frames are then transmitted to the video encoder **(137).**

Thereon, the video encoder **(137)** encodes the compressed and selected temporal buffer frames into video. **FIG. 4c** illustrates the frames of **FIG. 4b** encoded by the video encoder **(137)** based on a selected temporal buffer frames, wherein the encoded video comprises of only the first frame **(1),** the third frame **(3),** the fourth frame **(4),** the fifth frame **(5),** and the seventh frame **(7).** The encoded video is then transmitted to the client device **(150)** via the socket listener component **(138)** as in step **206.** The video received by the socket downloader component **(151)** are then decoded and played by video player **(152)** as in step **207.**

Referring now to **F!G. 3**, there is shown a flowchart of a method for performing image compression and selective temporal buffer frames by the quality decision component **(136).** In step **301,** the quality decision component **(136)** selects and extracts a frame from the video buffering component **(134)** and thereon, checks whether the frame is tagged with an event.

If the frame is tagged with an event, then the quality decision component **(136)** selects a lower image compression ratio and more frequent frame sequence for the following frame (decision **302,** and steps **303** to **304).**

However, if the frame is not tagged with an event, the quality decision component **(136)** selects a higher image compression ratio and less frequent frame sequence for the following frame (decision **302** and steps **305** to **307).** Thus, the selected image compression ratio reduces the image quality of the frame.

Based on the compression ratio selected, the frame is compressed according to the selected image compression and packetized with other selected frames (step **308).**

Thereon, as in decision **309,** the total size of the packetized frames is compared with the bandwidth of the client device **(150)** connection.

If the total size of the packetized frames is lower than the bandwidth estimated by the client bandwidth rate receiver component **(135),** the quality decision component **(136)** repeats step **301** to decision **309,** wherein the quality decision component **(136)** extracts the following frame from the video buffering component **(134)** to check whether the frame is tagged with an event. The following frame is selected and extracted based on the previous frame packetized.

If the total size of the packetized frames is higher than the bandwidth estimated by the client bandwidth rate receiver component **(135),** the quality decision component **(136)** determines whether the packetized frames can be compressed to reduce it to a size lower than or equal to the estimated bandwidth as in decision **310.** If the packetized frames can be reduced, the quality decision component **(136)** compresses the packetized frames and thereon, sends the packetized frames to the video encoder **(137)** as in step **311** and **313.** Otherwise, the quality decision component **(136)** discards the frame from the packetized frames and sends the packetized frames to the video encoder **(137)** as in step **312** and **313.** The frame which is discarded from the packetized frames is included for the following packetized frames to be sent to the video encoder **(137).**

If the total size of the packetized frames is similar to the bandwidth estimated by the client bandwidth rate receiver component **(135),** the quality decision component **(136)** sends the packetized frames to the video encoder **(137)** as in step **313.**

To provide a better understanding of the abovementioned steps performed by the quality decision component **(136), FIG. 4b** and **FIG. 4c** are referred to illustrate an example of the frames stored in the video buffering component **(134)** and the packetized frames. The size for each frame is 180kbit and the estimated bandwidth is 750kbit/s.

Initially, the quality decision component **(136)** selects and extracts the first frame **(1)** stored in the video buffering component **(134).** Since the first frame **(1)** is tagged with no event, the quality decision component **(136)** selects a higher image compression ratio. Moreover, the quality decision component **(136)** selects a less frequent frame sequence for the following frame, wherein the quality decision component **(136)** skips a frame to select the third frame **(3)** as the following frame. Thereon, the first frame **(1)** is compressed to a size of 120kbit and the compressed first frame **(1)** is packetized. The total size of the packetized frames is compared with the bandwidth of the client device **(150)** connection. Since the total size of the packetized frames of 120kbit is lower than the estimated bandwidth of 750kbit/s, the quality decision component **(136)** selects and extracts the following frame which is the third frame **(3)** stored in the video buffering component **(134).**

The third frame **(3)** is tagged with an event and thus, the quality decision component **(136)** selects a lower image compression ratio. Moreover, the quality decision component **(136)** selects more frequent frame sequence for the following frame, wherein the quality decision component **(136)** selects the fourth frame **(4)** as the following frame. Thereon, the third frame **(3)** is compressed to a size of 180kbit and then, packetized with the first frame **(1).** The total size of the packetized frames is compared with the bandwidth of the client device **(150)** connection. Since the total size of the packetized frames of 300kbit is lower than the estimated bandwidth of 750kbit/s, the quality decision component **(136)** selects and extracts the following frame which is the fourth frame (4) stored in the video buffering component **(134).**

The fourth frame (4) is tagged with an event and thus, the quality decision component **(136)** selects a higher image compression ratio. Moreover, the quality decision component **(136)** selects more frequent frame sequence for the following frame, wherein the quality decision component **(136)** selects the fourth frame **(5)** as the following frame. Thereon, the fourth frame **(4)** is compressed to a size of 180kbit and then, packetized with the first frame **(1)** and the third frame **(3).** The total size of the packetized frames is compared with the bandwidth of the client device **(150)** connection. Since the total size of the packetized frames of 480kbit is still lower than the estimated bandwidth of 750kbit/s, the quality decision component **(136)** selects and extracts the following frame which is the fifth frame **(5)** stored in the video buffering component **(134).**

The fifth frame **(5)** is tagged with no event and thus, the quality decision component **(136)** selects a higher image compression ratio. Moreover, the quality decision component **(136)** selects a less frequent frame sequence for the following frame, wherein the quality decision component **(136)** skips a frame to select the seventh frame **(7)** as the following frame. Thereon, the fifth frame **(5)** is compressed to a size of 120kbit and then, packetized with the first frame **(1),** the third frame **(3)** and the fourth frame **(4).** The total size of the packetized frames is compared with the bandwidth of the client device **(150)** connection. Since the total size of the packetized frames of 600kbit is lower than the estimated bandwidth of 750kbit/s, the quality decision component **(136)** selects and extracts the following frame which is the seventh frame **(7)** stored in the video buffering component **(134).**

The seventh frame (7) is tagged with no event and thus, the quality decision component **(136)** selects a higher image compression ratio. Moreover, the quality decision component **(136)** selects a less frequent frame sequence for the following frame, wherein the quality decision component **(136)** skips two frames to select the tenth frame **(10)** as the following frame. Thereon, the seventh frame **(7)** is compressed to a size of 100kbit and then, packetized with the first frame **(1),** the third frame **(3),** the fourth frame (4) and the fifth frame **(5).** The total size of the packetized frames is compared with the bandwidth of the client device **(150)** connection. Since the total size of the packetized frames of 700kbit is still lower than the estimated bandwidth of 750kbit/s, the quality decision component **(136)** selects and extracts the following frame which is the tenth frame (10) stored in the video buffering component **(134).**

The tenth frame **(10)** is tagged with an event and thus, the quality decision component **(136)** selects a lower image compression ratio. Moreover, the quality decision component **(136)** selects more frequent frame sequence for the following frame. Thereon, the tenth frame **(10)** is compressed to a size of 180kbit and then, packetized with the first frame (1), the third frame **(3),** the fourth frame **(4),** the fifth frame **(5)** and the seventh frame **(7).** The total size of the packetized frames is compared with the bandwidth of the client device **(150)** connection. Since the total size of the packetized frames of 880kbit is higher than the estimated bandwidth of 750kbit/s and it cannot be compressed to a size lower than or equal to the estimated bandwidth, the quality decision component **(136)** discards the tenth frame **(10)** from the packetized frames. The packetized frames comprising the first frame **(1),** the third frame **(3),** the fourth frame **(4),** the fifth frame **(5)** and the seventh frame **(7)** as shown in **FIG. 4c** are then sent to the video encoder **(137).** The tenth frame **(10)** will be included for the following packetized frames to be sent to the video encoder **(137).**

Although described in the abovementioned description that only one media source **(110)** is connected to the server **(130),** it is appreciated by a person skilled in the art that more than one media source **(110)** can be connected to the server **(130).**

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrated and describe all possible forms of the invention. Rather, the words used in the specifications are words of description rather than limitation and various changes may be made without departing from the scope of the invention.

CLAIMS

1. A system for adaptive media content delivery (100) comprising at least one media source (110), a server (130), and a client device (150), wherein the system (100) is characterised in that the server (130) includes:
   a) at least one video analytic component (132), wherein the at least one video analytic component (132) is used to analyse event in images captured by the at least one media source (110);
   b) a bandwidth rate receiver component (135), wherein the client bandwidth rate receiver component (135) is used to estimate the bandwidth of the client device (150) connection;
   c) a quality decision component (136), wherein the quality decision component (136) is used to perform image compression for each frame and selective temporal buffer frames based on bandwidth of the client device (150) connection and event captured in the images; and
   d) a video encoder (137), wherein the video encoder (137) is used to encode the compressed and selected temporal buffer frames from the quality decision component (136) into a video.

2. A method for delivering of a media content by using the system (100) as claimed in claim 1, comprising the steps of:
   a) receiving a plurality of captured images or video frames from at least one media source (110) by a video acquisition component (131);
   b) analysing each frame by at least one video analytic component (132) to determine whether an event is detected in each frame;
   c) buffering the frames in a video buffering component (134);
   d) estimating bandwidth of a client device (150) connection by the client bandwidth rate receiver component (135);
   e) performing image compression on each frame and selective temporal buffer frames by a quality decision component (136), wherein the image compression and selective temporal buffer frames are performed based on the bandwidth of the client device (150) connection and the event detected in each frame;
   f) encoding the compressed and selected temporal buffer frames into video by a video encoder (137); and
   g) transmitting the video to the client device (150).

3. The method as claimed in claim 2, wherein the bandwidth estimation includes the steps of:
   a) sending a test frame from the client device (150) to the server (130);
   b) recording arrival time of the first bit and the last bit of the test frame; and
   c) calculating the bandwidth of the client device (150) connection based on data size of the test frame, arrival time of the last bit of the test frame, and the arrival time of the first bit of the test frame.

4. The method as claimed in claim 2, wherein the step of performing image compression on each frame and selective temporal buffer frames by a quality decision component (136) includes the steps of:
   a) selecting and extracting a frame from the video buffering component (134);
   b) determining whether an event is detected in the frame, wherein if an event is detected in the frame, selecting a lower image compression ratio and more frequent frame sequence for the following frame by the quality decision component (136), and wherein if there is no event detected in the frame, selecting a higher image compression ratio and less frequent frame sequence for the following by frame the quality decision component (136);
   c) compressing the frame based on the selected compression ratio;
   d) packetizing the compressed frame with previous selected frames;
   e) comparing total size of the packetized frames with the bandwidth of the client device (150) connection, wherein if the total size of the packetized frames is lower than the bandwidth estimated by the client bandwidth rate receiver component (135), repeating steps (a) to (d) for the following frame selected from the video buffering component (134), and wherein if the total size of the packetized frames is higher than the bandwidth estimated by the client bandwidth rate receiver component (135), compressing the packetized frames if the packetized frames can be reduced to a size lower than or equal to the estimated bandwidth or discarding the frame from the packetized

frames if the packetized frames cannot be reduced to a size lower than or equal to the estimated bandwidth; and

f) sending the packetized frames to the video encoder (137).

5. A server (130) for delivering media content to a client device (150) comprising a video acquisition component (131), a database (133), a video buffering component (134), and a socket listener component (138), characterised in that the server (130) further includes:

a) at least one video analytic component (132), wherein the at least one video analytic component (132) is used to analyse event in images captured by the at least one media source (110);

b) a bandwidth rate receiver component (135), wherein the client bandwidth rate receiver component (135) is used to estimate the bandwidth of the client device (150) connection;

c) a quality decision component (136), wherein the quality decision component (136) is used to perform image compression for each frame and selective temporal buffer frames based on bandwidth of the client device (150) connection and event captured in the images; and

d) a video encoder (137), wherein the video encoder (137) is used to encode the compressed and selected temporal buffer frames from the quality decision component (136) into a video.

6. A method for delivering of a media content by using the server (130) as claimed in claim 5, comprising the steps of:

a) receiving a plurality of captured images or video frames by a video acquisition component (131);

b) analysing each frame by at least one video analytic component (132) to determine whether an event is detected in each frame;

c) buffering the frames in a video buffering component (134);

d) estimating bandwidth of a client device (150) connection by the client bandwidth rate receiver component (135);

e) performing image compression on each frame and selective temporal buffer frames by a quality decision component (136), wherein the image compression and selective temporal buffer frames are performed based on the bandwidth of the client device (150) connection and the event detected in each frame;

f) encoding the compressed and selected temporal buffer frames into video by a video encoder (137); and

g) transmitting the video to the client device (150).

7. The method as claimed in claim 6, wherein the bandwidth estimation includes the steps of:

a) sending a test frame from the client device (150) to the server (130);

b) recording arrival time of the first bit and the last bit of the test frame; and

c) calculating the bandwidth of the client device (150) connection based on data size of the test frame, arrival time of the last bit of the test frame, and the arrival time of the first bit of the test frame.

8. The method as claimed in claim 6, wherein the step of performing image compression on each frame and selective temporal buffer frames by a quality decision component (136) includes the steps of:

a) selecting and extracting a frame from the video buffering component (134);

b) determining whether an event is detected in the frame, wherein if an event is detected in the frame, selecting a lower image compression ratio and more frequent frame sequence for the following frame by the quality decision component (136), and wherein if there is no event detected in the frame, selecting a higher image compression ratio and less frequent frame sequence for the following by frame the quality decision component (136);

c) compressing the frame based on the selected compression ratio;

d) packetizing the compressed frame with previous selected frames;

e) comparing total size of the packetized frames with the bandwidth of the client device (150) connection, wherein if the total size of the packetized frames is lower than the bandwidth estimated by the client bandwidth rate receiver component (135), repeating steps (a) to (d) for the following frame selected from the video buffering component (134), and wherein if the total size of the packetized frames is higher than the bandwidth estimated by the client bandwidth rate receiver component **(135),** compressing the packetized frames if the packetized frames can be reduced to a size lower than or equal to the estimated bandwidth or discarding the frame from the packetized frames if the packetized frames cannot be reduced to a size lower than or equal to the estimated bandwidth; and

f) sending the packetized frames to the video encoder **(137).**

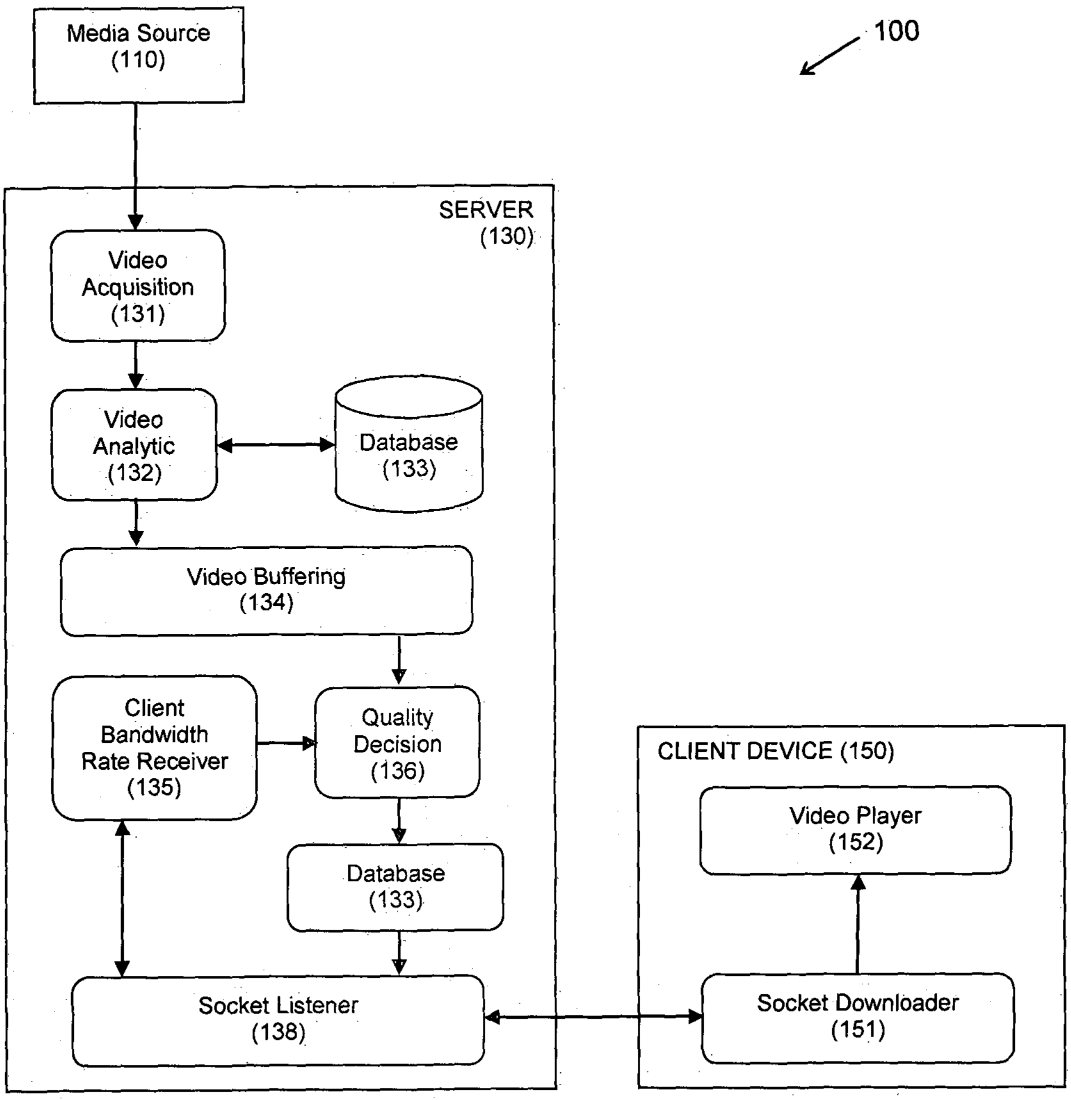
100
Media Source
(110)
SERVER
(130)
Video
Acquisition
(131)
Video
Analytic
(132)
Database
(133)
Video Buffering
(134)
Client
Bandwidth
Rate Receiver
(135)
Quality
Decision
(136)
Database
(133)
Socket Listener
(138)
CLIENT DEVICE (150)
Video Player
(152)
Socket Downloader
(151)

FIG. 1

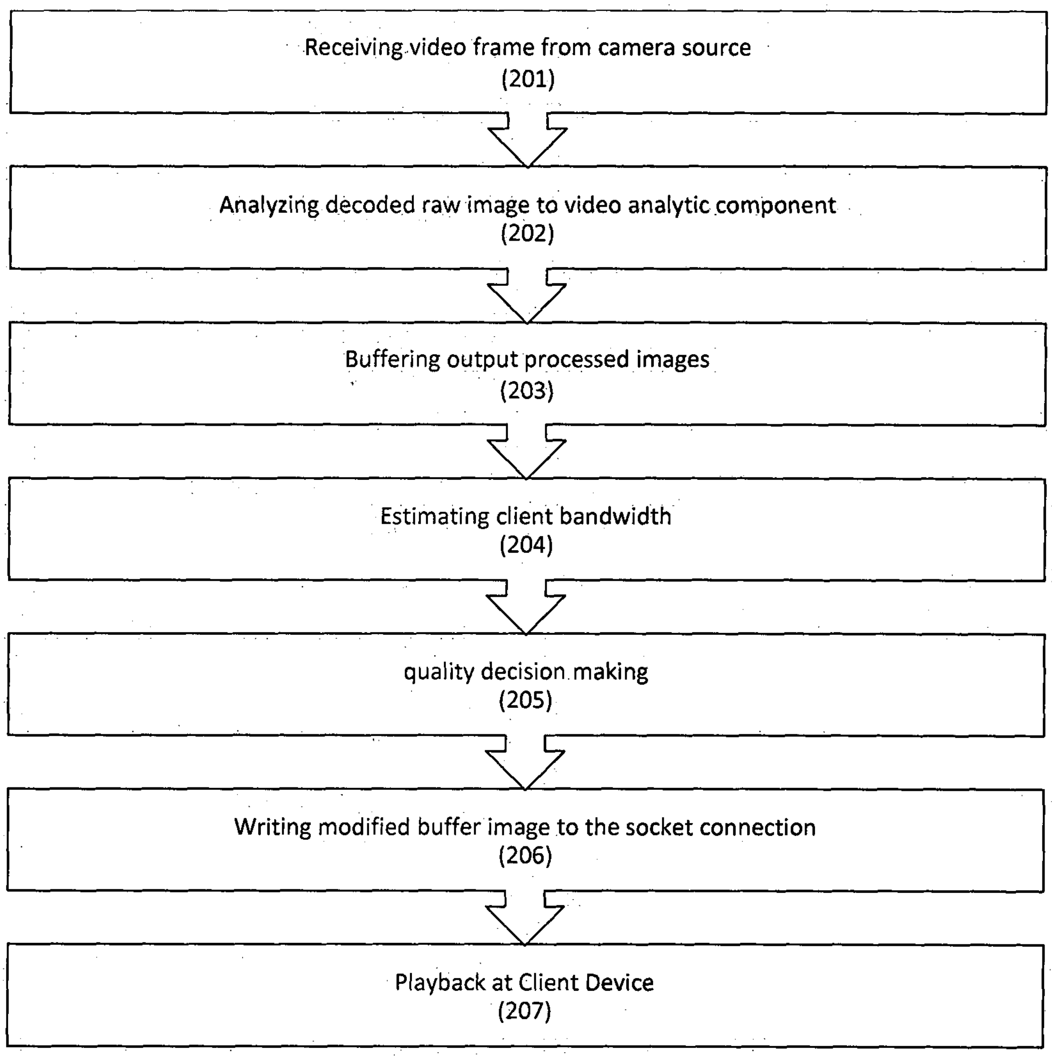
Receiving video frame from camera source
(201)
Analyzing decoded raw image to video analytic component
(202)
Buffering output processed images
(203)
Estimating client bandwidth
(204)
quality decision making
(205)
Writing modified buffer image to the socket connection
(206)
Playback at Client Device
(207)

FIG. 2

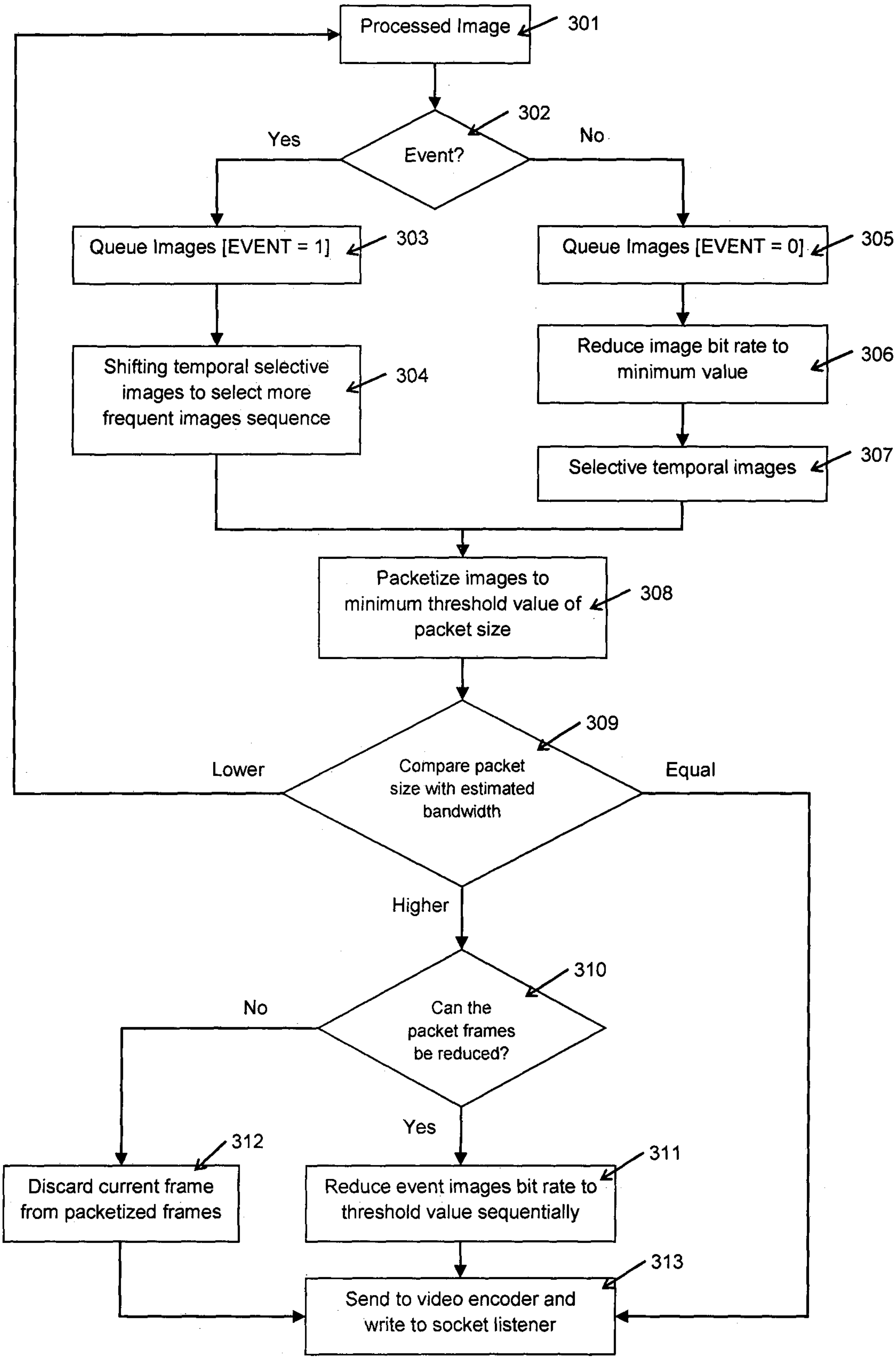
Processed Image
301
Event?
302
Yes
No
Queue Images [EVENT = 1]
303
Queue Images [EVENT = 0]
305
Shifting temporal selective images to select more frequent images sequence
304
Reduce image bit rate to minimum value
306
Selective temporal images
307
Packetize images to minimum threshold value of packet size
308
Compare packet size with estimated bandwidth
309
Lower
Equal
Higher
Can the packet frames be reduced?
310
No
Yes
Discard current frame from packetized frames
312
Reduce event images bit rate to threshold value sequentially
311
Send to video encoder and write to socket listener
313

FIG. 3

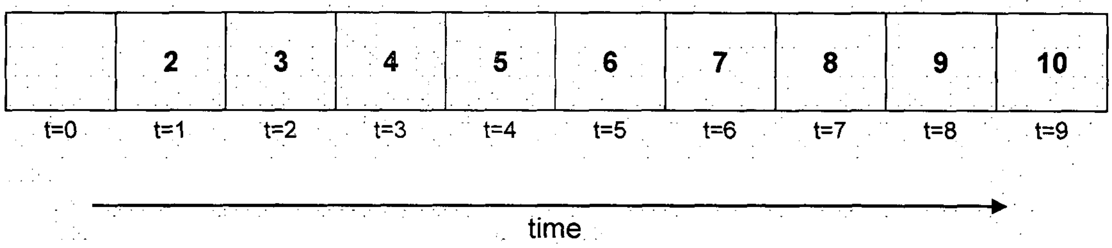

FIG. 4a

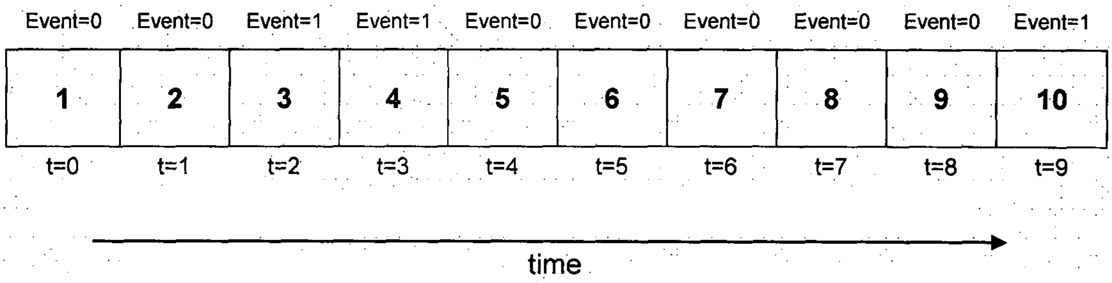

FIG. 4b

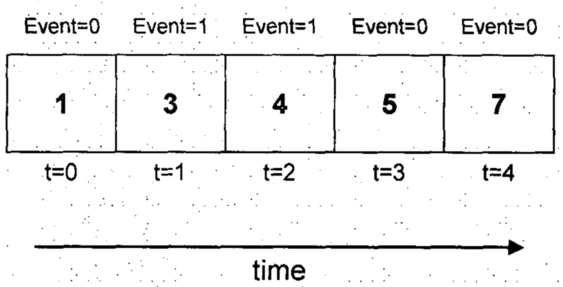

FIG. 4c

INTERNATIONAL SEARCH REPORT

International application No
PCT/MY2012/000171

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N21/2343 H04N21/2662 H04N21/24 H04N7/26 H04N7/18
G06K9/00 H04N21/44
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04N G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/27763 A1 (IVEX CORP [US]) 19 April 2001 (2001-04-19)	1-3,5-7
A	the whole document	4,8

X	WO 2008/119043 A1 (ARMIDA TECHNOLOGIES [US]; FOSTER SLOAN B [US]; LAWRENCE WILLIAM [US];) 2 October 2008 (2008-10-02)	1-3,5-7
A	the whole document	4,8

A	US 2011/119716 A1 (COLEMAN SR MARQUIS R [US]) 19 May 2011 (2011-05-19) the whole document	1-8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 October 2012	27/11/2012

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/MY2012/000171

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0127763 A1	19-04-2001	AU 1330601 A	23-04-2001
		US 6954859 B1	11-10-2005
		US 2006053459 A1	09-03-2006
		WO 0127763 A1	19-04-2001
WO 2008119043 A1	02-10-2008	US 2008288986 A1	20-11-2008
		WO 2008119043 A1	02-10-2008
US 2011119716 A1	19-05-2011	NONE	