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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	101488.0003US4
		Application Number	
Title of Invention	Loop Recording With Book Marking		
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Application Information:

Title of the Invention	Loop Recording With Book Marking		
Attorney Docket Number	101488.0003US4	Small Entity Status Claimed ☒	
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	4	Suggested Figure for Publication (if any)	

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Title of Invention	Loop Recording With Book Marking		

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Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	12/268286	2009-11-10
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
12/268286	Continuation in part of	11/770920	2007-06-29
Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
11/770920	non provisional of	60/824097	2006-08-31
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	Continuation in part of	11/843217	2007-08-28
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11/843217	non provisional of	60/824095	2006-08-31
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Title of Invention	Loop Recording With Book Marking		

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First Name	Nicholas J.	Last Name	Witchey	Registration Number	63481

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LOOP RECORDING WITH BOOK MARKING

[0001] This application is a continuation of U.S. patent application serial no 12/268286, filed November 10, 2008 which is a continuation-in-part of U.S. patent application serial no. 11/770920, filed June 29, 2007, which claims the benefit of U.S. provisional patent 60/824097, filed August 31, 2006, and this application is a continuation-in-part of U.S. patent application serial no. 11/846217, filed August 28, 2007, which claims the benefit of U.S. provisional patent 60/824095, filed August 31, 2006. These and all other referenced extrinsic materials are incorporated herein by reference in their entirety. Where a definition or use of a term in an incorporated reference is inconsistent or contrary to the definition of that term provided herein, the definition of that term provided herein applies and the definition of that term in the reference does not apply.

I. Field of the Invention

[0002] The field of the invention is video camera recording technology.

II. Background

[0003] Conventional camcorders use a variety of storage formats including digital video cassettes, mini-DV cassettes, or DVD-R discs that offer a limited amount of memory to store data. One of the major shortcomings of the existing camcorder technology is that the memory runs out too soon. Once a portion of the memory has been recorded, there is less memory available for further recording. Then when the memory is full, users have to return to their home/work computer or media station to transfer the recorded data from the camera to free up the memory. This creates inconvenience and inflexibility for recording on the go.

[0004] WO 2006/044476 to Vanman describes an electronic camera mounted to a police vehicle with a circular buffer that is constantly recording. When the camera reaches the end of the memory it records from the beginning of memory, erasing the earliest recorded data. Such technology is often employed with surveillance cameras for long and continuous recording with little or no supervision. However, Vanman does not distinguish or differentiate any data that is of importance. To save data in the buffer, the user of the Vanman device needs to transfer

important portions of the buffer wirelessly to a central office or physically to a DVD disc, or else risk having the interesting data be recorded over during loop recording. Such transfers are processor intensive and may not be possible when the central office is out of range or an empty DVD disc is unavailable.

[0005] Vanman and all other extrinsic materials identified herein are incorporated by reference in their entirety. Where a definition or use of a term in an incorporated reference is inconsistent or contrary to the definition of that term provided herein, the definition of that term provided herein applies and the definition of that term in the reference does not apply.

[0006] EP 1064783 to Mann describes a camera mountable to a pair of eyeglasses that continuously saves recorded images to a circular buffer in a computer on the user's waist. When a user wants to save a piece of recorded video, the user must stop recording and offload the data at another location before the user can record again. Mann also discusses streaming the images directly to a wireless memory that may have a larger capacity; however, this means that the camera does not work in the absence of a wireless connection. U.S. Patent 5,523,799 to Hattori et al. also describes storing data in a memory having an archival portion. However, Hattori fails to address sending data to a remote memory.

[0007] Thus, there is still a need for a recording camera that provides better recording and editing functions.

III. Summary of the Invention

[0008] The present invention provides apparatus, systems, and methods in which a surveillance apparatus processes images by (1) continuously recording a stream of imaged data, (2) write protecting segments of the recorded stream, and (3) sending write protected segments from a local memory to a remote memory using a wireless transmitter.

[0009] The surveillance apparatus generally has a camera functionally coupled to a local memory with a circular buffer. As used herein, the term "a local memory functionally coupled to the camera" means that the memory that is distanced less than 20 cm from the camera, and is coupled to the camera using entirely physical connectors (*e.g.*, wires, pins, conductive paths, etc.). This contrasts with a "remote memory functionally coupled to the camera", which would

be a memory that is distanced from the camera by at least 20 cm, or is coupled to the camera using a wireless connection. The circular buffer is preferably organized into a series of memory segments that loops back on itself and is organized into both available segments and write-protected segments. This allows a recording facility to record the data stream available in portions of the circular buffer while skipping over write-protected matter. Preferably, the local memory is large enough to store at least 5 or 10 minutes of imaged data.

[0010] Preferably, the recording facility continuously records the data stream into the circular buffer any time the surveillance apparatus is powered on. As used herein, the term "continuous" with respect to recording a video data stream means that data is recorded at least every half second over a given ten second period. When a signal to record is sent to the surveillance apparatus, a protecting facility designates a segment of the circular buffer to be write-protected to prevent that segment from being overwritten during the next recording loop. Part of the write-protected portion could be a pre-recorded subset that is recorded before the signal is received, while part of the write-protected portion could be a post-recorded subset that is recorded after the signal is received. The pre-recorded subset could be as long as 5 seconds, 10 seconds, 30 seconds, or more. Preferably, various aspects of both the pre-recorded subset and the post-recorded subset can be configured with a user interface. While the write-protected portions could be electronically indexed using a memory heap or a clustered index, the write-protected portions are preferably stored as separate files in the memory. Such files could be stored in physically dis-contiguous parts of the circular buffer. Additionally, the indexing is preferably performed while the recording facility is still recording data into the memory.

[0011] The signal to record is preferably automatically triggered by a sensor that detects an image in the camera or a sound by the camera's microphone. For example, the signal to record could be triggered by a human face, an open book, a computer screen, a whistle, a verbal command, a recognized object, or a pattern of knocks. Alternatively, a user interface could allow a human user to manually send the signal to record and could even allow the human user to designate a length of time of the pre-recorded subset or the post-recorded subset. A user could send two signals, one to start recording and another to stop recording, but preferably the user merely sends a signal to start recording for a specified period of time. In an exemplary embodiment, when the specified period of time has almost expired, say, for example, 5 seconds,

10 seconds, or longer, the user could extend the length of specified time by sending another trigger to the surveillance apparatus. For example, the surveillance apparatus could send a warning 10 seconds before it is scheduled to stop recording by vibrating against the user; in response the user could say "don't stop" or merely cough to extend the length of the write-protected portion of memory.

[0012] While the surveillance apparatus could be a mounted on a hand-held video camera, the surveillance apparatus is preferably a small device that can be mounted inconspicuously on a person. For example, contemplated surveillance apparatus mounts are a pair of wearable sunglasses or eyeglasses, a lapel pin, a collar button, a hat or visor, a hair pin, or a front of a purse.

[0013] Since the surveillance apparatus is typically too small to house a large amount of memory, the surveillance apparatus also preferably has a wireless transmitter that is also functionally connected to the local memory. A sending facility uses the wireless transmitter to transmit write-protected portions of the circular buffer to a remote memory that is not physically connected to the local memory in some way. For example, the wireless transmitter could send write-protected portions of the circular buffer to a mobile phone, or the surveillance apparatus could be plugged into a mobile phone which is then used as a wireless transmitter to forward a write-protected portion to another remote memory. In a preferred embodiment, after a write-protected portion of the circular buffer is transferred to a remote memory, the protecting facility could remove the corresponding portion from protection so that the recording facility could use that portion to record data.

[0014] Various objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the invention, along with the accompanying drawings in which like numerals represent like components.

IV. Brief Description of The Drawing

[0015] Fig. 1 is a camera mounted on a pair of glasses connected to a circular buffer in a local memory that is controlled by a ring.

[0016] Fig. 2A and 2B show user interface buttons for the ring of Figure 1.

[0017] Fig. 3 shows a diagram representation of the circular buffer of Figure 1.

[0018] Fig. 4A-4H show representations of the circular buffer of Figure 1 while the surveillance apparatus is in use.

V. Detailed Description

[0019] In **Figure 1**, an example surveillance apparatus 100 generally comprising eyeglasses 110 having a camera 120 mounted at the nose bridge, and an optional viewfinder 130 applied onto one of the lenses. A data and power cord 140 couples the camera 120 to a belt-worn recorder 160, which cooperates with a ring-shaped signaling device 150 and a remote memory 170. Those skilled in the art will appreciate that the term "surveillance" is used herein in its broadest possible sense, to include not only professional or commercial types of surveillance, but also any other type of observation, including for example an ordinary person watching a baseball game or birthday party.

[0020] The eyeglasses 110 are used here euphemistically to represent any type of camera mount. In a preferred embodiment, the camera mount is disguised to be a common object worn by a person or lying around a house, but could also be shaped and sized to look like a camera. Contemplated mounts include lapel pins, hair clips, shirt buttons, purses, staplers, desk clocks, tripods, head gear, hand grips, or security camera mounts. As used herein the term "camera" means any device or collection of devices that includes an image capturing component that captures image data, and a converting component that converts the image data into digital data, possibly at least one data stream. An image capturing component could include one or more charge-couple devices (CCD) complimentary metal-oxide-semiconductors (CMOS), CMOS focal plane arrays (CFP), radiometers, or other manners of image obtaining devices. Camera 120 should be interpreted euphemistically to include all such variants. Likewise, a suitable converting component could include one or more analog-to-digital converters, software codecs, or integrated circuits.

[0021] Camera 120 contains an imager lens 122 used to focus images for camera 120. Conventional lenses allow one or more of the following adjustments: aperture (to control the

amount of light), zoom (to control the field-of-view), or shutter speed (to capture continuous motion.). In preferred embodiments, these adjustments are automatically controlled by the camcorder electronics, generally to maintain constant exposure onto the imager without the manual adjustment from a user. It is contemplated that the preferred embodiments offer direct user control of all major optical functions. As with most modern digital recorders and camcorders, an analog-to-digital (ADC) converter is used to digitize the analog imager waveform output into a discrete digital-video signal. Thus, the recorder can be used to record analog or digital formats.

[0022] Viewfinder image lens 130 is calibrated to have the same field of view as camera 120. Preferably, viewfinder image lens 130 is embedded in between the two glass lenses of eyeglasses 110. Preferably viewfinder image lens 130 is a zoom lens with preferred standard zoom ration of 3x in or out of the focal length of the camera. A more sophisticated viewfinder image lens 130 is contemplated to have a greater zoom range and also has nighttime vision or is able to render images under different light conditions. Within the lenses, viewfinder image lens 130 is outlined by tinted area or graticle and the outline graticle is embedded with glowing fiber optic filament. Eye-glasses are made preferably from opaque, translucent, or possibly photo gray-type tint of glasses. Alternatively, glasses change color slightly when energized.

[0023] Where the camera is a hand-held camera and is not embedded in a pair of eyeglasses, viewfinder image lens 130 can be permanently fixed to camera 120, or it can be interchangeable with lenses of different focal lengths and other properties depending on the need and circumstances of use.

[0024] Recorder 160 is any recording device that records video and/or audio/video data, including conventional recorders. Recorder 160 preferably includes a processor 162 with software or hardware that accomplishes the functions described herein, or one or more physical memories that are collectively referred to herein as memory 166. Typically, the recorder or the camera converts analog images into a digital format to be stored in the memory, or also preferably records both audio and video input analog signals from the camera to the memory. Those skilled in the art will also appreciate that the concepts described herein with respect to video and/or audio/video data can be applied to recordation of purely audio, or in fact any other

type of data stream; this specification should be interpreted as expressly including such application. A wearer could clip recorder 160 as a belt clip or another compact device. Contemplated recorders include MP3 players, purses, or buttons. It is also contemplated that recorder 160 could also comprise a cell or mobile phone having a suitable recorder application installed that is configured to communicate with the other components of apparatus 100.

[0025] Although not expressly shown, recorder 160 also includes an appropriate power supply or connection, supporting electronics, or a display or other interface. The power source can vary considerably. For example, in embodiments where the recorder is relatively large, a suitable power source can include a rechargeable battery. On the other hand, when the recorder is relatively small, an appropriate power source can include an external power source (e.g., transformer for wall outlet or cigarette lighter adapter). Whether embodied in control buttons or in some other manner, it is also contemplated that recorder can include some sort of security control requiring a password and some sort of automatic turnoff feature that activates after a certain amount of inactivity. Authentication or authorization of user access provides for ensuring a proper user of apparatus 100 retains desired control. For example, once a user is authenticated, the user can control indexing, editing, transmitting, or adjusting content data in memory.

[0026] Recorder 160 would typically record images in digital format, but analog or combination formats are also contemplated. Preferably, the recorder's electronics are preferably all on a unitary printed circuit board with different functions, or facilities, encoded on a programmable chip or disk. For example, a recording facility 163 could record the data stream from camera 120 to local memory 166, a protecting facility 164 could protect segments (not shown) of recorded data on memory 166, or a sending facility 165 could transmit protected segments (not shown) of recorded data to remote memory 170. While the different facilities are preferably part of a single hardware or software program, the facilities could be split into different components as necessary. Other facilities could be installed, for example a facility that allows editing of the received image data or protected data. It is contemplated that such facilities could be purchased through or installed on a cell phone, possibly through an on-line application store.

[0027] The contemplated memory could vary depending on the particular configuration of the recorder. Particularly suitable memories include commercially available micro hard drives with

a 1-inch disc (which can preferably have a capacity of more than 1 GB), flash memory cards with a capacity of up to 128 MB and more, or other transient and/or permanent memory units. Likewise, suitable memory can also include SDRAM, MRAM, racetrack memory, SIMM, DIMM, etc. with a capacity of at least 32 MB, more preferably at least 64 MB, or most preferably above 128 MB. In preferred embodiments, memory 164 is a SDRAM capable of storing at least 1000 frames of data. Once received by memory 164, frames are preferably compressed by employing conventional compression rates and methods to achieve at least a 50:1 ratio.

[0028] In preferred embodiments, image data received by recorder 160 is stored in a circular buffer 167 on memory 166. Preferably, all of the free space in memory 166 is used to create circular buffer 167, however, multiple circular buffers could be created in the memory where there exist multiple cameras connected to a single recorder. Once the recorder is turned on, image data is continuously stored in circular buffer 167 for access. If no record or protect button is pushed, the recorder will loop back and store the image data for a said length of time. Recording, book-marking and protecting are used synonymously herein. Recording, book-marking and protecting means that a portion of the imaged data is write-protected upon an activation of a signal by a user and can not then be overwritten unless the write-protection is later removed. Consequently, protected data cannot be overwritten by newly stored imaged data in the circular buffer.

[0029] The circular buffer is preferably large enough to store at least 3 minutes of data, more preferably 5 minutes and most preferred 10 minutes of data. However, it is contemplated that depending on the size and capacity of the device, any length longer or shorter is possible. It is preferred when the recorder is turned on the entire circular buffer is treated and stored as a single file. Thus, if no recording is protected or bookmarked, then the entire file will be erased and the recording will start at the beginning of the circular buffer.

[0030] Signaling device 150 is shown in the figure as a ring that communicates wirelessly (*e.g.*, BlueTooth, Skinplex, wireless USB, 802.11, 802.15, UWB, Z-Wave, IrDa, Zigbee, etc.) with the recorder, possibly as part of a personal area network (PAN). The ring can have any suitable interface, shown in **Figures 2A and 2B**, including for example buttons on its outer periphery, or

a sensor along its inner edge. In Figure 2A, ring 150 has user interface 200, with a start signal button 210, a stop signal button 220, a transmit button 230, a zoom in button 240, or a zoom out button 250. Alternatively, the buttons could have decorative symbols in lieu of words of function as shown in Figure 2B, or could even have arbitrary symbols surrounding the entirety of signaling device 150. These buttons allow a user to manipulate and control image data and to generate protected data.

[0031] In an alternative embodiment, turning the ring in one direction might produce a start signal, and continuing to turn the ring in that direction might extend backwards the time period that is protected. Where a default time period for storing pre-start signal data is used, extending the time can be considered overriding the default. Similarly, turning the ring in the opposite direction might produce a stop signal, and where a default time period for storing post-start signal data is used, extending the time can be considered overriding that default. Electronics for such a ring or other control device are readily available, and for example are similar to those used in key fobs. Indeed, signaling device 150 should be interpreted euphemistically to include key fob type device.

[0032] It is contemplated that the signaling device could be integrated into other items as an accessory and that is wearable on an individual, for example a lapel pin or a pen within a pocket protector. It is also contemplated that the switch could be portable or can be hidden or attached to other devices such as a vehicle, furniture, etc. The signal could also be generated in non-tactile ways, for example by an audio command or whistle, or by an automatic sensor. Preferably, the user could configure the audio signal to match only his/her voice.

[0033] At any moment, the user can signal recorder 160 to place a “bookmark” in the recording. This signal can be sent by pressing a button that will then transmit a signal through wires 140 that attach to the glasses then to the recorder. The wires 140 could be fiber optic wires that are small and thin to avoid detection. In an exemplary embodiment, the user could control the entire system using signaling device 150, for example by turning the camera on and off, recording a portion of image data, stop the recording, zooming in and out of image data; or transmitting protected data into the remote memory 170.

[0034] While remote memory 170 is shown in the figure as a mobile or cell phone, remote memory 170 should be interpreted euphemistically to include any memory that is not connected to surveillance apparatus 100, for example, a DVD writer, a wireless network attached storage (NAS) device, a wireless storage area network (SAN) device, a home computer, or even a second surveillance apparatus. Preferably, sending facility 165 sends protected segments of circular buffer 169 wirelessly to remote memory 170 whenever remote memory 170 is within range of wireless transceiver 169, possibly as part of a PAN using one or more wireless communication technologies (*e.g.*, Bluetooth, Skinplex, wireless USB, 802.11, 802.15, UWB, Z-Wave, IrDa, Zigbee, etc.). However, sending facility 165 could also respond to manual commands, for example through a button on signaling device 150, recorder 160, or the mobile phone itself. In an alternative embodiment, the mobile phone does not act as a remote memory depository, and instead forwards the protected segment to a remote memory via a mobile internet or wi-fi connection. Preferably, once protected data is transferred to a remote memory, the protected memory areas then will go back to become free memory areas that are available for further loop recording.

[0035] Write-protected data could be sent to the remote memory by an image sensor that outputs data directly in "block" format typically converted with a raster-to-block converter. Further compression could be used before transmitting the data if wireless bandwidth is an issue. Either DCT or wavelet transformed data on native sensor formats could be used. The data is preferably transmitted via the Internet, but could also be transmitted using radio waves, a pager, a two-way pager, a physical cable, email, text message, picture message, or any other suitable communication mechanism.

[0036] **Figure 3** shows a diagram representation of circular buffer 167 in memory 166, with unprotected segment 320 and write-protected segment 330. Write-protected segment 330 is characterized as a predefined portion of the recording data. The recording facility 163 continuously records the data stream 310 into circular buffer 167. The recording facility 163 records over unprotected segment 320 of circular buffer 167, while skipping over protected segments 330 of circular buffer 167. It is contemplated that the portion of the circular buffer that is marked as write-protected data cannot be overwritten once the recorder loops back to the beginning of the media.

[0037] **Figures 4A-4H** show an alternative diagram representation of a circular buffer 300 as it is being used.

[0038] In **Figure 4A** the recording facility (not shown) records data stream "A" into circular buffer 400. The "_" character is used to designate blank memory, or unprotected memory that can be overwritten. The ellipsis "..." is used to show that the memory can be very large relative to the number of positions shown in the figure. It is contemplated, for example, that memory 400 can be up to several hundred megabytes, 1 GB, 2GB, 4GB, 8GB, or even more. Such memory is preferably of a flash type, non-volatile RAM, preferably in the form of a standard flash memory card. In a preferred embodiment, circular buffer 400 comprises a logical representation of a physical memory area. Buffer 400 can be configured to store data in the physical memory by taking into account wear-leveling across the physical memory.

[0039] In **Figure 4B** the protecting facility (not shown) has protected a recent period of data stream "A" as a function of a start signal, shown by the character "[". The start signal can be triggered in any suitable manner, including for example manual operation of a trigger or a switch by a user. For example, the ring of Figure 1 could be used as a switch, or any other wearable accessory could have a switch integrated into it. In other examples, start signals can be triggered by detection of a particular circumstance by a motion, sound or other sensor. In an exemplary system, software can operate upon content in the data stream, such as by monitoring an entrance to a building using a data stream received from one or more cameras, and could then send a start signal when the image shows a person loitering in a certain area of the screen.

[0040] The "[" character is used to designate the start of protected memory. Concomitantly, the portion of the data stream prior to the protected portion has once again been marked "_" to show that it is unprotected. In protecting recent data, the system can protect a default historical time period before the start signal is sent and protect a default period after the start signal is sent (such as 30 seconds, 2 minutes, etc). All suitable defaults are contemplated. Alternatively, the historical time period being protected could be altered in some manner, such as by software or by a user operating a history button. For example, if a user hits a start button, the system might default to protecting the last 30 seconds and the next 60 seconds; or it might protect the last 15 seconds and the next 2 minutes.

[0041] Preferably, before the protecting facility stops protecting data, the system sends a signal to the user that the system is about to stop write-protecting data. For example, the system could send an audio chirp signal, or in the case of a pair of eyeglasses, a portion of the glasses could slightly vibrate to signal that the system will stop recording in 10 seconds. If the user wishes to protect an additional 60 second time period, the user could hit a "more time" button. In this manner a user could protect a 5 or 10 minute period, or an even much longer portion of a data stream prior to a start signal. Indeed, if memory 400 is interpreted as a multi gigabyte flash memory, it is entirely possible that one could back up sufficiently to protect an hour or more of such a data stream.

[0042] In **Figure 4C** the protecting facility has received a "stop" signal some time after receiving the start signal, thereby lengthening the protected portion of the "A" data stream. The stop signal is shown as character "]" and could be automatically generated from software or hardware as a function of a default time after the start signal, or could be manually sent by the user of the system. All suitable defaults are contemplated, including for example a 30 second or 1 minute time period. Stop signals could also be generated in a variable fashion, again as a function of software or hardware, through action of a user, or in any other suitable manner. Thus, a user can well operate a start button or other switch, a more time switch, and a stop switch, which could have the same or different interfaces. It is also contemplated that the system could recognize a user's verbal commands for these functions.

[0043] Just as the system can utilize a default pre-start signal period of time for which a portion of the data stream is stored unless overridden in some manner, contemplated systems can utilize a default post-start signal period of time for which a portion of the data stream is stored unless overridden in some manner. Using defaults for both pre-start and post-start signal periods allows a system to operate with an extremely high level of user convenience. For example, in one contemplated class of systems using such defaults, a user could operate a single button, ring or other interface to initiate a start signal, and the system could respond by automatically storing a default 60 second portion of a data stream prior to the signal, as well as a default 30 time period of the data stream after the signal. And all of that could be accomplished with a single operation of the button. An interface could also be provided to allow the user to alter the length of time for

the pre-recorded portion and the length of time for the post-recorded portion. As should be apparent from the description above, all reasonable the default time periods are contemplated.

[0044] In **Figure 4D**, the system has finished protecting the desired portion of the "A" data stream, and the recording facility continues to store a "B" data stream into circular buffer 400. Of course, the "B" data stream can be contiguous with the "A" data stream, so that differentiation of "A" and "B" streams is merely an artifact of how the data is being stored. For example, if a system included an eyeglasses camera being used at baseball game, the wearer might watch the game for an hour or more without anything of interest happening. During all that time the system would record image frames from the camera, looping in memory if the memory had remaining capacity for less than an hour of images. When finally the wearer sees an interesting play that he wants to protect, he operates a start button, or perhaps a more time button to protect the previous minute of play. Once the interesting action has completed, he operates a stop button, which thereby causes the system to complete protecting the entire "A" period of interest. But the wearer continues watching the game, and the subsequent images, continuous with the "A" images, would be considered "B" images. In some embodiments, the wearer can select to have more of previously recorded data to be protected. For example, once the wearer operates the start button, the wearer could also indicates that additional previously recorded data should be protected (*e.g.*, past 10 seconds, 30 seconds, one minute, five minutes, etc.) while new image data is being stored and protected.

[0045] In **Figure 4E** the system has again received a start signal, and has again protected a fixed or variable historical time period. In **Figure 4F** the system has received a stop signal, and has protected the entire desired portion of the "B" data stream.

[0046] In **Figure 4G** the system has continued to record data, which is now depicted as data stream "C" because it follows data stream "B". This figure is particularly significant in that recordation of the "C" data stream skips over the protected portion of the "A" data stream. In **Figure 4H** the system received another start signal, and has protected a desired portion of the "C" data stream that straddles the protected "A" stream. As shown, the C data stream is saved as a physically dis-contiguous file.

[0047] In a preferred embodiment, segments of recorded data are "write-protected" by being indexed in an electronic index. This scheme allows the system to protect previously recorded areas of memory without interrupting any concurrent recording, and further allows the system to easily locate such protected segments for play-back or offloading to a remote memory. Additionally, this allows the system to keep track of multiple fragments dis-contiguous fragments of a single write-protected segment. The electronic index is preferably a hash table or a clustered index, but other methods of addressing memory are also suitable.

[0048] Protected data can be copied to a memory separate from the circular buffer, for example in a separate file within a local memory. Multiple segments of protected data could thus be stored as a series of protected files in a directory structure. In an exemplary embodiment, as soon as the data is designated in the index as being protected, the recorder searches for a remote memory in range, and immediately copies the protected data from the circular buffer to the remote memory. Once confirmation of copying is received, the index can be updated to identify the previously protected portion of the circular buffer as being non-protected.

[0049] As previously discussed, a sending facility uses a wireless transmitter to transmit write-protected data to a remote memory. One should note that there are many additional aspects of the inventive subject matter surrounding transmitting the data to the remote memory. In some embodiments a surveillance apparatus participates in a PAN with other components including the remote memory. In such embodiments the apparatus can discover other components of the system, including the remote memory or signaling devices, by sending message over one or more suitable protocols (*e.g.*, Bluetooth, Skinplex, wireless USB, 802.11, 802.15, 802.16, UWB, Z-Wave, IrDA, Zigbee, etc.). Component discovery can be via a push where the apparatus sends a discovery message over a protocol to remote components or via a pull where the remote components send a discovery message to the apparatus. The components of the system can respond with a discovery response message. Preferred discovery or discovery response messages comprise characteristics of the various responding components including buffer size, read/write rates, authentication, authorized command sets, or other parameters. For example, the surveillance apparatus could send a discovery message out to discover any suitable remote memories in the PAN where the message is encapsulated in a Bluetooth protocol packet. A cell phone could respond by allocating a memory area to operate as a remote memory and by sending

a discovery response message back to the apparatus describing the amount of memory available. Such an approach provides for creating surveillance apparatus products that are able to operate across multiple cell phone platforms by allowing a cell phone user to download or install an application, or possibly a driver for their specific cell phone model, capable of being discovered and operating with the apparatus.

[0050] Another aspect of transmitting data to the remote memory includes authenticating the various components with respect to access or to control remote memory. In some embodiments, the surveillance apparatus, or even the signaling facility, can be authenticated with the remote memory via a suitable token exchange (*e.g.*, passwords, public-private key, handshakes, etc.). For example, a remote memory could be bound to a specific apparatus via a secret key, possibly having a UUID or GUID. Furthermore, the components of the system can be authorized to access various levels of functionality based on their authentication. Some apparatus could have read only access, while other could have write access, or while still others have editing capabilities.

[0051] Yet another aspect of transmitting data to the remote memory includes the remote memory providing access to multiple surveillance apparatus. For example, a single remote memory, possibly a cell phone, could be in close proximity (*e.g.*, physically local within 100 meters or logically local within the same network) to two or more apparatus. The remote memory can provide image storage as necessary to each apparatus, assuming appropriate authentication or permissions. In addition, it is contemplated that a single apparatus could have more than one camera where each camera has its data transmitted to the remote memory collectively via the apparatus or even individually, possibly where each camera has access to different remote memories, or different areas (*e.g.*, files) in the same remote memory.

[0052] One should also note that a surveillance apparatus can employ multiple wireless protocols to interact with the various components. For example, the apparatus's signaling device could connect to a recorder via Zigbee or Skiplex protocols while the apparatus could connect to the remote memory via IEEE 802.16.

[0053] One purpose of the invention is to allow secret recording by a user. The user can integrate the recorder as part of his/her wardrobe or even as clothing accessories, such as a pin or

a hat. Preferably, recorder will record video and audio as seen from the wearer's point of view without requiring the wearer to exert any special effort to operate the recorder. The recorder operates for extended periods of time while remaining unobtrusive both to the wearer/operator and to the subject(s) being recorded.

[0054] In order for the device to be practical, physical size and weight are of primary importance. The recorder portion must be small and lightweight enough to be unobtrusive. Preferably, the size of the recorder is two inches by three inches by one-half inch and six ounces in weight including battery. The camera or imaging component must be small and lightweight enough to be mounted on a pair of eyeglasses without conspicuous bulk or uncomfortable weight on the order of one-quarter inch by one-quarter inch by one inch or smaller and weighing one ounce or less. Further, the imaging component must be capable of sufficient resolution that the image quality of the resulting recording is comparable with existing consumer camcorder products. Preferred resolutions are at least 640 x 480 pixels. However, more preferred resolutions include high definition quality resolutions (*e.g.*, 720p, 1080i, 1080p, 2160p, etc.).

[0055] Since the recorder will be worn on the body and the wearer can move actively about when the device is in operation, it is important that the entire device be mechanically rugged and that all components, particularly the storage media, be impervious to the shocks resulting from such body movement. The device is also likely to be exposed to environmental stresses such as dust and moisture so the components and packaging must accommodate this exposure. Solid state media such as compact flash memory is particularly suitable as the recorder's storage media since it meets these requirements.

[0056] Alternatively, the recorder device can be mounted on vehicles, planes or any other objects for ease of use. It is contemplated that the present invention can be used in military or field intelligence operations.

[0057] The advantages of the disclosed techniques are clear. A user of the inventive subject matter can capture image data while also participating with others in an event without being trapped behind a recording device. Furthermore, the user's hands can remain substantially free while recording.

[0058] Thus, specific embodiments and applications of recording images to a circular buffer in a local memory and transmitting it wirelessly to a remote memory have been disclosed. It should be apparent, however, to those skilled in the art that many more modifications besides those already described are possible without departing from the inventive concepts herein. The inventive subject matter, therefore, is not to be restricted except in the spirit of the appended claims. Moreover, in interpreting both the specification and the claims, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms “comprises” and “comprising” should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps can be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced. Where the specification claims refers to at least one of something selected from the group consisting of A, B, C and N, the text should be interpreted as requiring only one element from the group, not A plus N, or B plus N, etc.

CLAIMS

What is claimed is:

1. A surveillance apparatus, comprising:
 - a camera having an image capturing component that captures image data;
 - a local memory functionally coupled to the camera;
 - a recording facility that records the image data into available portions of a circular buffer in the local memory as a first file using a digital video file format;
 - a protecting facility that responds to a signal to record the image data by designating a segment of the circular buffer as a write-protected portion and by indexing the write-protected portion as a second file in the circular buffer, wherein the segment includes a pre-recorded subset recorded before the signal is received and a post-recorded subset to be recorded after the signal is received; and
 - wherein the local memory is configured to allow access to at least one of the files.
2. The apparatus of claim 1, further comprising a sending facility configured to transmit the second file from the local memory to a remote memory;
3. The apparatus of claim 2, wherein the sending facility comprises a wireless transmitter
4. The apparatus of claim 1, further comprising a sensor that automatically triggers the signal to record upon detecting identified content in at least one of the captured images.
5. The apparatus of claim 1, further comprising an interface through which a human can initiate the signal.
6. The apparatus of claim 1, further comprising an interface through which a human can designate a length of time of at least one of the pre-recorded subset, the post-recorded subset, and the segment.
7. The apparatus of claim 1, wherein the local memory is configured to provide access to the at least one of the files to a mobile phone.

8. The apparatus of claim 1, wherein a mobile phone automatically receives the second file and automatically forwards the second file to a remote memory.
9. The system of claim 1, further comprising a mount for the camera.
10. The system of claim 9, wherein the mount is a pair of wearable glasses.
11. The system of claim 1, further comprising an electronic index that provides a directory to the first and the second files within the circular buffer.
12. A method of processing imaged data from a camera, comprising the following steps:
 - receiving video data;
 - recording the video data into available portions of a circular buffer as a first file;
 - responding to a signal by write-protecting a segment that includes a newly recorded portion of the buffer, wherein the newly recorded portion is recorded before the signal is received, and includes a post-recorded portion to be recorded after the signal is received;
 - indexing write protected portions of the buffer as separate, distinct files during the step of recording; and
 - allowing access to at least one of the distinct files from the write-protected portions of the circular buffer.
13. The method of claim 12, further comprising storing the distinct files from the write-protected portions as the distinct, separate files in a remote memory.
14. The method of claim 12, further comprising recording the video data as the first file into physically dis-contiguous parts of the circular buffer.
15. The method of claim 12, wherein the signal to save a recording comprises a signal to start recording and a signal to stop recording.
16. The method of claim 12, further comprising receiving the signal to save a recording through at least one of a manually operated switch and an audio signal.
17. The method of claim 12, further comprising configuring the size of the pre-recorded subset.

18. The method of claim 12, further comprising removing write-protection from a transmitted write-protected portion after transmission of its corresponding distinct file.

19. The method of claim 12, further comprising sending a warning to a user before the write protected segment of the circular buffer is fully recorded.

20. The method of claim 19, further comprising extending a length of the write protected segment of the circular buffer in response to at least one of a manually operated switch and an audio signal.

21. The method of claim 12, wherein the step of providing access to the at least one of the distinct files includes transmitting the at least one of the distinct files for storage in a remote memory.

22. The method of claim 21, wherein the step of transmitting includes wirelessly transmitting the at least one of the distinct files.

ABSTRACT

A surveillance apparatus continuously records imaged data from a camera into a circular buffer in a local memory. When a record signal is received, the system records the video stream that was recorded before the record signal was received, and the video stream that is recorded after the record signal was received. The recorded segment is then write-protected, so that the surveillance apparatus does not overwrite the recorded segment. The recorded segment could then be sent to a remote memory via a wireless connection to free up local memory for future recording sessions.

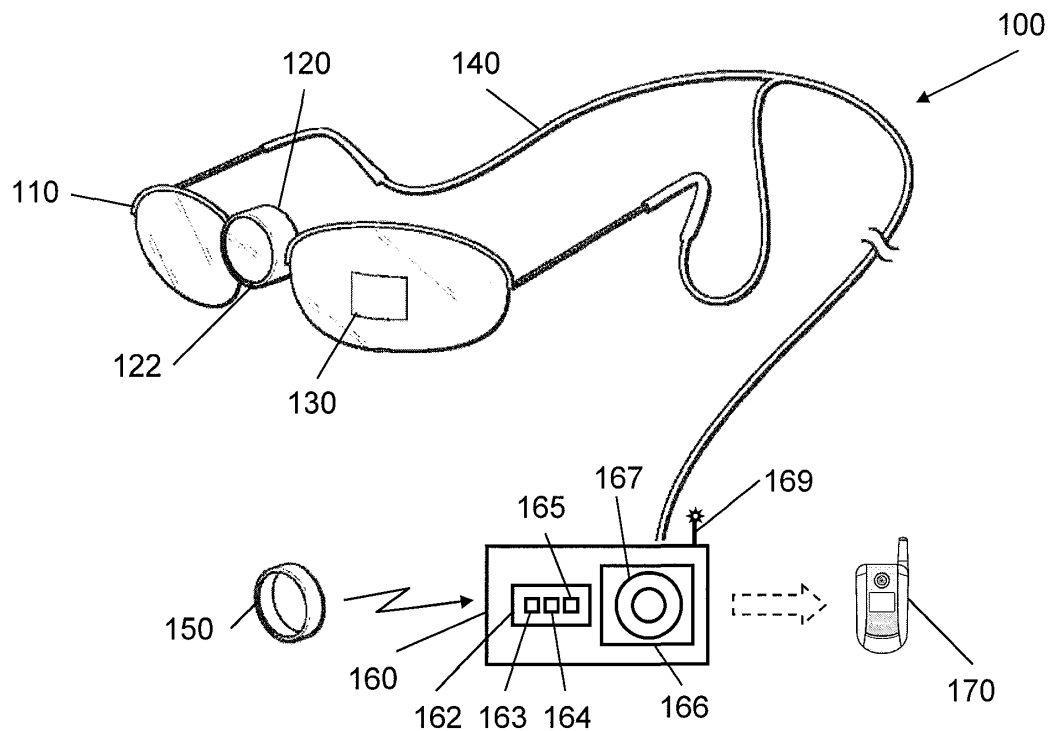


FIG. 1

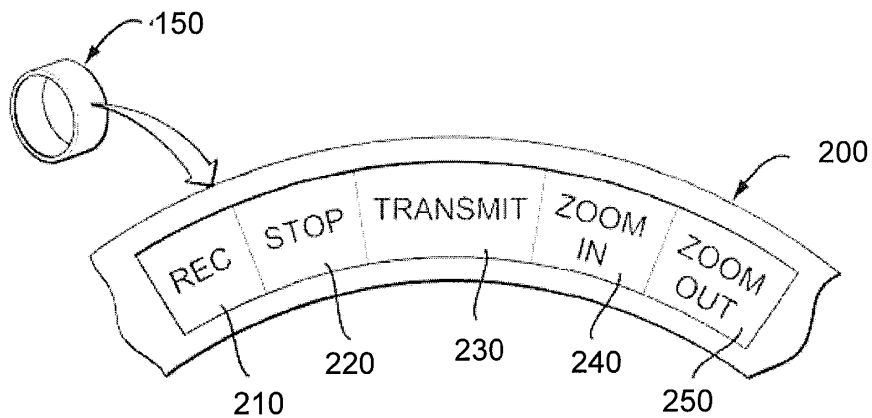


FIG. 2A

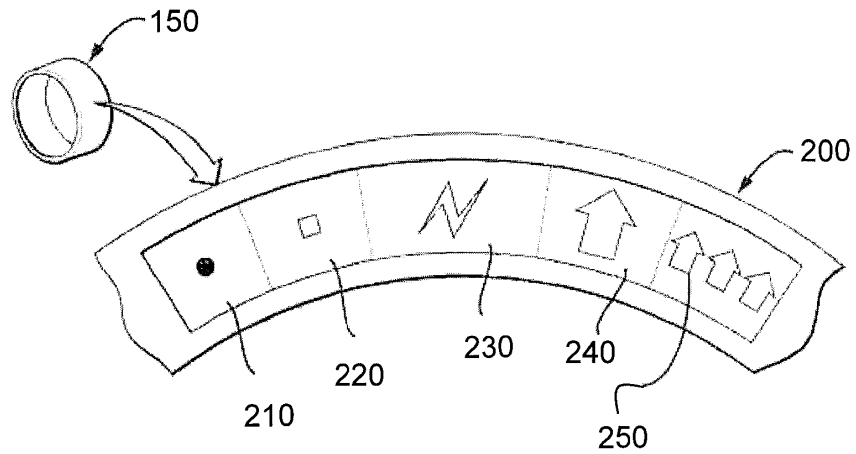


FIG. 2B

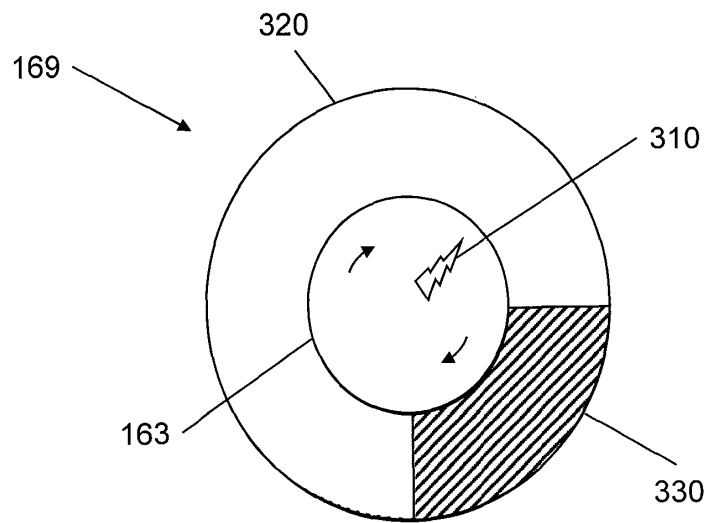


FIG. 3

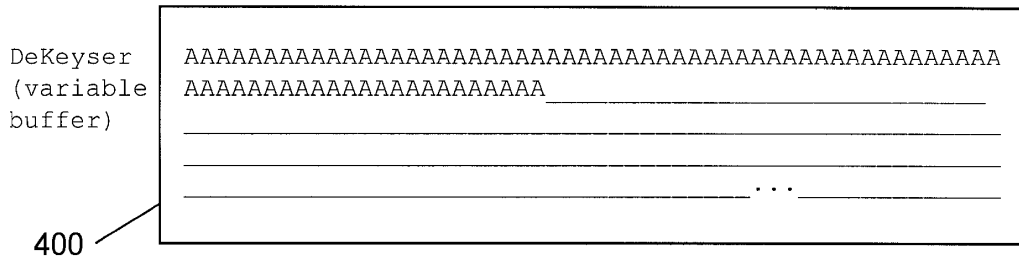


FIG. 4A

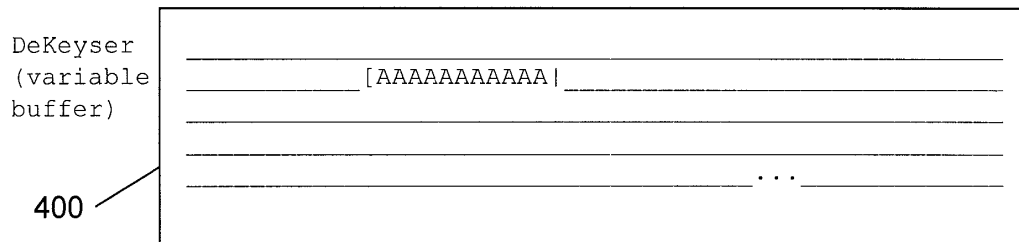


FIG. 4B

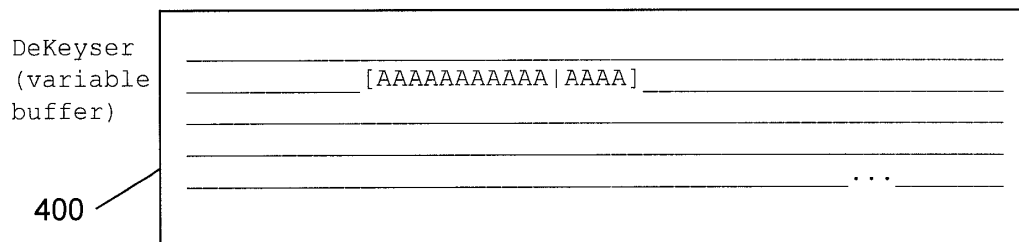


FIG. 4C

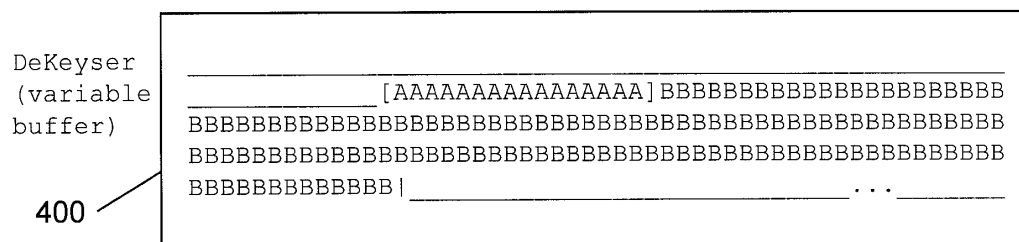


FIG. 4D

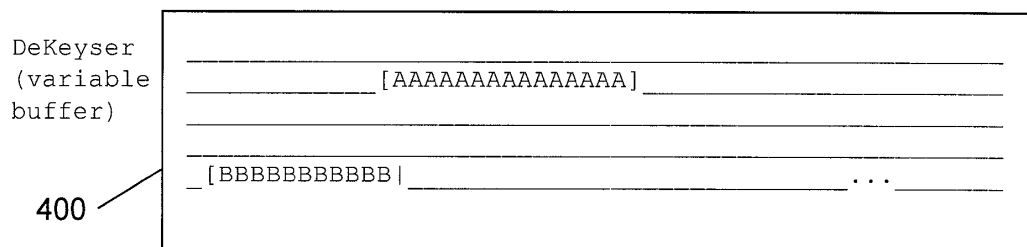


FIG. 4E

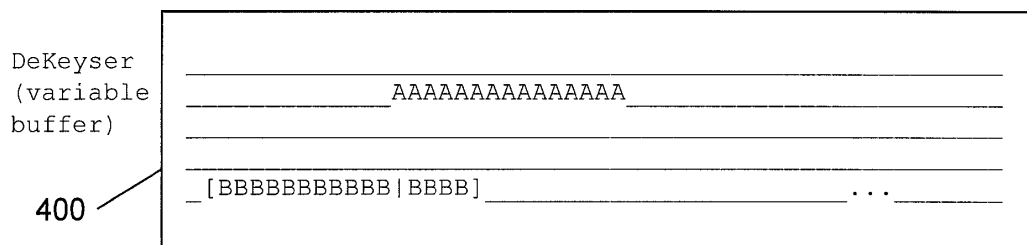


FIG. 4F

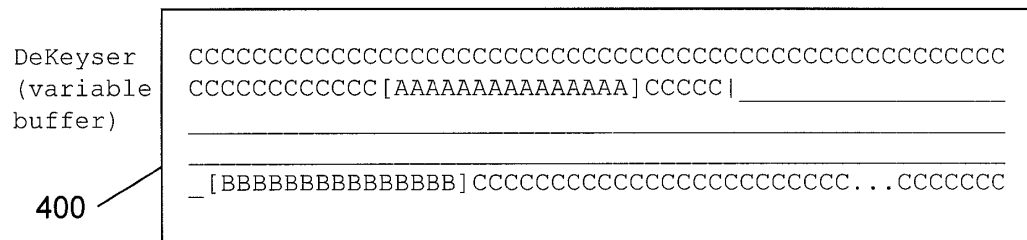


FIG. 4G

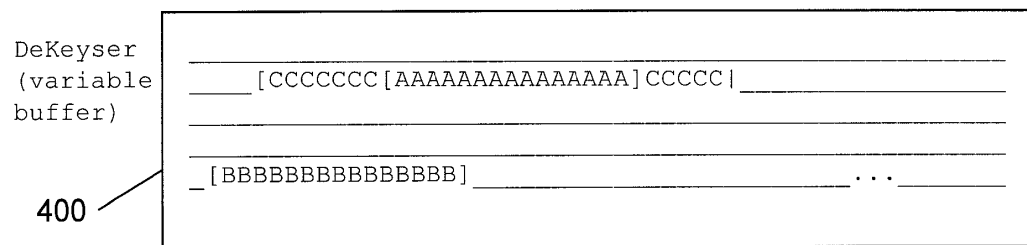


FIG. 4H

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Loop Recording With Book Marking		
First Named Inventor/Applicant Name:		Paul DeKeyser		
Filer:		Martin Fessenmaier/Sara Geer		
Attorney Docket Number:		101488.0003US4		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	82	82
Utility Search Fee	2111	1	270	270
Utility Examination Fee	2311	1	110	110
Pages:				
Claims:				
Claims in excess of 20	2202	2	26	52
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				514

Electronic Acknowledgement Receipt	
EFS ID:	6082343
Application Number:	12560584
International Application Number:	
Confirmation Number:	1641
Title of Invention:	Loop Recording With Book Marking
First Named Inventor/Applicant Name:	Paul DeKeyser
Customer Number:	24392
Filer:	Martin Fessenmaier/Sara Geer
Filer Authorized By:	Martin Fessenmaier
Attorney Docket Number:	101488.0003US4
Receipt Date:	16-SEP-2009
Filing Date:	
Time Stamp:	13:02:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 514
RAM confirmation Number	8519
Deposit Account	500341
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)					
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	US_ADS_Form_SB_14.pdf	1099697	no	5
			886b56a98adbe2653e4dae3a0ce34e2356db8020		
Warnings:					
Information:					
2		Application.pdf	162093	yes	21
			d21df8fe8604b6182d191bf62aa6d0a557a05c32		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	17	
	Claims		18	20	
	Abstract		21	21	
Warnings:					
Information:					
3	Drawings-only black and white line drawings	Drawings.pdf	88455	no	4
			ac8910f8141ec9b834a19d9011fca70a1703a8ba		
Warnings:					
Information:					
4	Fee Worksheet (PTO-875)	fee-info.pdf	36354	no	2
			47f532047c38455c3874c7149d8f1d88b6bde9e0		
Warnings:					
Information:					
Total Files Size (in bytes):			1386599		

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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Filing Date: 09/16/09

PTO/SB/06 (12-04)

Approved for use through 7/31/2006. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 12/560,584			
APPLICATION AS FILED – PART I									
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	82	N/A				
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	270	N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	110	N/A				
TOTAL CLAIMS (37 CFR 1.16(i))	22	minus 20 = 2	x\$26	52	x\$52				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2	minus 3 = *	x\$110		x\$220				
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR								
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			195		390				
			TOTAL	514	TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.									
APPLICATION AS AMENDED – PART II									
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus **	=	X =	X =	X =		
	Independent (37 CFR 1.16(h))	*	Minus ***	=	X =	X =	X =		
	Application Size Fee (37 CFR 1.16(s))			N/A		N/A			
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))			TOTAL ADD'T FEE		TOTAL ADD'T FEE			
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus **	=	X =	X =	X =		
	Independent (37 CFR 1.16(h))	*	Minus ***	=	X =	X =	X =		
	Application Size Fee (37 CFR 1.16(s))			N/A		N/A			
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))			TOTAL ADD'T FEE		TOTAL ADD'T FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". If the "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.									

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
12/560,584	09/16/2009	2621	514	101488.0003US4	22	2

CONFIRMATION NO. 1641

FILING RECEIPT



OC000000038004891*

24392
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

Date Mailed: 10/05/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Paul DeKeyser, Irvine, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/268,286 11/10/2008 PAT 7,593,034
which is a CIP of 11/770,920 06/29/2007
which claims benefit of 60/824,097 08/31/2006
and said 12/268,286 11/10/2008
is a CIP of 11/846,217 08/28/2007
which claims benefit of 60/824,095 08/31/2006

Foreign Applications

If Required, Foreign Filing License Granted: 09/28/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/560,584**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Loop Recording With Book Marking

Preliminary Class

386

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

page 2 of 3

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/560,584	09/16/2009	Paul DeKeyser	101488.0003US4

CONFIRMATION NO. 1641

FORMALITIES LETTER



24392
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

Date Mailed: 10/05/2009

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is missing.

A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of **\$65** for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this notice.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **\$65** for a small entity

- **\$65** Surcharge.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/mkoroma/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Doc Code: Oath

Document Description: Oath or declaration filed

PTO/SB/01 (04-09)

Approved for use through 06/30/2010. OMB 0651-0032

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)		Attorney Docket Number	101488.0003US4
		First Named Inventor	Paul DeKeyser
☐ Declaration Submitted With Initial Filing OR ☒ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)		COMPLETE IF KNOWN	
		Application Number	12/560,584
		Filing Date	September 16, 2009
		Art Unit	2621
		Examiner Name	

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention titled:

Loop Recording With Book Marking

(Title of the Invention)

the application of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 09/16/2009 as United States Application Number or PCT International

Application Number 12/560,584 and was amended on (MM/DD/YYYY) (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Authorization To Permit Access To Application by Participating Offices

☒ If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified patent application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

[Page 1 of 3]

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

DECLARATION — Utility or Design Patent Application

Claim of Foreign Priority Benefits

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application number(s) are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 2 of 3]

Electronic Patent Application Fee Transmittal				
Application Number:		12560584		
Filing Date:		16-Sep-2009		
Title of Invention:		Loop Recording With Book Marking		
First Named Inventor/Applicant Name:		Paul DeKeyser		
Filer:		Martin Fessenmaier/Sara Geer		
Attorney Docket Number:		101488.0003US4		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Late filing fee for oath or declaration	2051	1	65	65
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				65

Electronic Acknowledgement Receipt	
EFS ID:	6392988
Application Number:	12560584
International Application Number:	
Confirmation Number:	1641
Title of Invention:	Loop Recording With Book Marking
First Named Inventor/Applicant Name:	Paul DeKeyser
Customer Number:	24392
Filer:	Martin Fessenmaier/Sara Geer
Filer Authorized By:	Martin Fessenmaier
Attorney Docket Number:	101488.0003US4
Receipt Date:	04-NOV-2009
Filing Date:	16-SEP-2009
Time Stamp:	16:51:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$65
RAM confirmation Number	12084
Deposit Account	500341
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)					
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	Declaration.pdf	99825	no	2
			9314f17e4204142d96c84565db4a16d9cbbdcd8e		
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	30062	no	2
			572fea88487cdd9a6130dc7b13801d490f17f4		
Warnings:					
Information:					
Total Files Size (in bytes):			129887		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/560,584	09/16/2009	Paul DeKeyser	101488.0003US4

CONFIRMATION NO. 1641

FORMALITIES LETTER



24392
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

Date Mailed: 11/16/2009

NOTICE OF INCOMPLETE REPLY (NONPROVISIONAL)

Filing Date Granted

The U.S. Patent and Trademark Office has received your reply on 11/04/2009 to the Notice to File Missing Parts (Notice) mailed 10/05/2009 and it has been entered into the nonprovisional application. The reply, however, does not include the following items required in the Notice.

The period of reply remains as set forth in the Notice. You may, however, obtain EXTENSIONS OF TIME under the provisions of 37 CFR 1.136(a) accompanied by the appropriate fee (37 CFR 1.17(a)).

A complete reply must be timely filed to prevent ABANDONMENT of the above-identified application. Replies should be mailed to: Mail Stop Missing Parts, Commissioner for Patents, P.O. Box 1450, Alexandria VA 22313-1450.

- The oath or declaration is unsigned.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
<https://portal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/eggolla/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

page 1 of 1

Doc Code: Oath

Document Description: Oath or declaration filed

PTO/SB/01 (04-09)

Approved for use through 06/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)		Attorney Docket Number	101488.0003US4
		First Named Inventor	Paul DeKeyser
☐ Declaration Submitted With Initial Filing OR ☒ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)		<i>COMPLETE IF KNOWN</i>	
		Application Number	12/560,584
		Filing Date	September 16, 2009
		Art Unit	2621
		Examiner Name	

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention titled:

Loop Recording With Book Marking

(Title of the Invention)

the application of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 09/16/2009 as United States Application Number or PCT International
Application Number 12/560,584 and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Authorization To Permit Access To Application by Participating Offices

☒ If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified patent application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

[Page 1 of 3]

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

DECLARATION — Utility or Design Patent Application

Claim of Foreign Priority Benefits

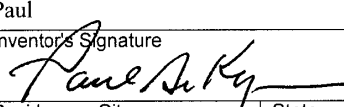
I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application number(s) are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 2 of 3]

DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☒ The address associated with Customer Number: 24392		OR ☐ Correspondence address below	
Name			
Address			
City		State	Zip
Country	Telephone	Email	
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NAME OF SOLE OR FIRST INVENTOR:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle [if any])		Family Name or Surname	
Paul		DeKeyser	
Inventor's Signature 		Date 11/3/09	
Residence: City	State	Country	Citizenship
Irvine	CA	US	US
Mailing Address 55 Hidden Trail			
City	State	Zip	Country
Irvine	CA	92603	US
☐ Additional inventors or a legal representative are being named on the _____ supplemental sheet(s) PTO/SB/02A or 02LR attached hereto			

[Page 3 of 3]

Electronic Acknowledgement Receipt	
EFS ID:	6542427
Application Number:	12560584
International Application Number:	
Confirmation Number:	1641
Title of Invention:	Loop Recording With Book Marking
First Named Inventor/Applicant Name:	Paul DeKeyser
Customer Number:	24392
Filer:	Martin Fessenmaier/Sara Geer
Filer Authorized By:	Martin Fessenmaier
Attorney Docket Number:	101488.0003US4
Receipt Date:	30-NOV-2009
Filing Date:	16-SEP-2009
Time Stamp:	18:20:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	Declaration.pdf	160015 eff997cebd97641b8e08cd51c1f2d1303d75d45	no	3

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
12/560,584	09/16/2009	2621	579	101488.0003US4	22	2

CONFIRMATION NO. 1641

UPDATED FILING RECEIPT



OC000000039097357*

24392
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

Date Mailed: 12/08/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Paul DeKeyser, Irvine, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/268,286 11/10/2008 PAT 7,593,034
which is a CIP of 11/770,920 06/29/2007
which claims benefit of 60/824,097 08/31/2006
and said 12/268,286 11/10/2008
is a CIP of 11/846,217 08/28/2007
which claims benefit of 60/824,095 08/31/2006

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If Required, Foreign Filing License Granted: 09/28/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/560,584**

Projected Publication Date: 03/18/2010

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

page 1 of 3

Title

Loop Recording With Book Marking

Preliminary Class

386

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12560584
	Filing Date		2009-09-16
	First Named Inventor	Paul H. DeKeyser	
	Art Unit	2621	
	Examiner Name		
	Attorney Docket Number	101488.0003US4	

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	1	99/49656	WO		1999-09-30	MANN, W., Stephen		☐

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	Filing Date		2009-09-16	
	First Named Inventor	Paul H. DeKeyser		
	Art Unit	2621		
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	2	2006/044476	WO	A2	2006-04-27	VANMAN, Robert Vernon		☐
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12560584
	Filing Date		2009-09-16
	First Named Inventor	Paul H. DeKeyser	
	Art Unit	2621	
	Examiner Name		
	Attorney Docket Number	101488.0003US4	

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☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

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Signature	/Nicholas J. Witchey/	Date (YYYY-MM-DD)	2009-12-10
Name/Print	Nicholas J. Witchey	Registration Number	

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶: H04N 5/232, G06F 1/16	A1	(11) International Publication Number: WO 99/49656 (43) International Publication Date: 30 September 1999 (30.09.99)
(21) International Application Number: PCT/CA99/00249 (22) International Filing Date: 25 March 1999 (25.03.99) (30) Priority Data: 2,233,047 25 March 1998 (25.03.98) CA 2,249,976 15 October 1998 (15.10.98) CA (71)(72) Applicant and Inventor: MANN, W., Stephen, G. [CA/CA]; N1NLF, University of Toronto, Dept. of E.C.E., Room 2001, 10 Kings College Road, Toronto, Ontario M5S 3G4 (CA). (74) Agent: FAGGETTER, Ronald, D.; Smart & Biggar, Suite 1500, 438 University Avenue, Box 111, Toronto, Ontario M5G 2K8 (CA).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: WEARABLE CAMERA SYSTEM WITH VIEWFINDER MEANS (57) Abstract A novel means and apparatus for a new kind of photography and videography is described. In particular, a wearable camera with a viewfinder suitable for long-term use is introduced. The system, in effect, absorbs and quantifies rays of light and processes this quantigraphic information on a small wearable computer system, then the processed information is re-constituted into light rays emerging to reconstruct the virtual image of objects at nearly the same position in space, or at a coordinate transformed position, as viewed by the wearer of the apparatus. The wearer of the apparatus becomes, after adaptation, an entity that seeks, without conscious thought or effort, an optimal point of vantage and cameral orientation. Because of the wearer's ability to constantly see the world through the apparatus, which may also function as an image enhancement device, the apparatus behaves as a true extension of the wearer's mind and body, giving rise to a new genre of documentary video.		

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WEARABLE CAMERA SYSTEM WITH VIEWFINDER MEANS

FIELD OF THE INVENTION

The present invention pertains generally to a new photographic or video means and apparatus comprising a body-worn portable electronic camera system with wearable viewfinder means.

BACKGROUND OF THE INVENTION

In photography (and in movie and video production), it is desirable to capture events in a natural manner with minimal intervention and disturbance. Current state-of-the-art photographic or video apparatus, even in its most simple "point and click" form, creates a visual disturbance to others and attracts considerable attention on account of the gesture of bringing the camera up to the eye. Even if the size of the camera could be reduced to the point of being negligible (e.g. no bigger than the eyecup of a typical camera viewfinder, for example), the very gesture of bringing a device up to the eye is unnatural and attracts considerable attention, especially in establishments such as gambling casinos or department stores where photography is often prohibited. Although there exist a variety of covert cameras such as a camera concealed beneath the jewel of a necktie clip, cameras concealed in baseball caps, and cameras concealed in eyeglasses, these cameras tend to produce inferior images, not just because of the technical limitations imposed by their small size, but, more importantly because they lack a means of viewing the image. Because of the lack of a viewfinder, investigative video and photojournalism made with such cameras suffers from poor composition.

It appears that apart from large view cameras upon which the image is observed on a ground glass, most viewfinders present an erect image. See, for example, U.S. Pat. No. 5095326 entitled "Keppler-type erect image viewfinder and erecting prism". In

contrast to this fact, it is well-known that one can become accustomed, through long-term psychophysical adaptation (as reported by George M. Stratton, in *Psychology Review*, in 1896 and 1897) to eyeglasses that present an upside-down image. After wearing upside-down glasses constantly, for eight days (keeping himself blindfolded when removing the glasses for bathing or sleeping) Stratton found that he could see normally through the glasses. More recent experiments, as conducted by and reported by Mann, in an MIT technical report *Mediated Reality*, medialab vismod TR-260, (1994), (the report is available in <http://wearcam.org/mediated-reality/index.html>) suggest that slight transformations such as rotation by a few degrees or small image displacements give rise to a reversed aftereffect that is more rapidly assimilated by the wearer, and that such effects can often have a more detrimental effect on performing other tasks through the camera as well as more detrimental flashbacks upon removal of the camera. These findings suggest that merely mounting a conventional camera such as a small 35mm rangefinder camera or a small video camcorder to a helmet, so that one can look through the viewfinder and use it it hands-free while performing other tasks, will result in poor performance at doing those tasks while looking through the camera viewfinder. Moreover, these findings suggest that doing tasks while looking through the viewfinder of a conventional camera, over a long period of time, may give rise to detrimental flashback effects that may persist even after the camera is removed. This is especially true when the tasks involve a great deal of hand-eye coordination, such as when one might, for example, wish to photograph, film, or make video recordings of the experience of eating or playing volleyball or the like, by doing the task while concentrating primarily on the eye that is looking through the camera viewfinder. Indeed, since known cameras were never intended to be used this way (to record events from a first-person-perspective while looking through the viewfinder) it is not surprising that performance is poor in this usage.

Part of the reason for poor performance associated with simply attaching a conventional camera to a helmet is the induced parallax and the failure to provide an

orthoscopic view. Even viewfinders which correct for parallax, as described in U.S. Pat. No. 5692227 in which a rangefinder is coupled to a parallax error compensating mechanism, only correct for parallax between the viewfinder and the camera lens that is taking the picture, but do not correct for parallax between the viewfinder and the image that would be observed with the naked eye while not looking through the camera.

Traditional camera viewfinders often include the ability to overlay virtual objects, such as camera shutter speed, or the like, on top of reality, as described in U.S. Pat. No. 5664244 which describes a viewfinder with additional information display capability.

Open-air viewfinders are often used on extremely low cost cameras, as well as on some professional cameras for use at night when the light levels would be too low to tolerate any optical loss in the viewfinder. Examples of open-air viewfinders used on professional cameras, in addition to regular viewfinders, include those used on the Grafflex press cameras of the 1940s (which had three different kinds of viewfinders), as well as those used on some twin-lens reflex cameras. While such viewfinders, if used with a wearable camera system, would have the advantage of not inducing the problems such as flashback effects described above, they would fail to provide an electronically mediated reality. Moreover, although such open air viewfinders would eliminate the parallax between what is seen in the real world and what is seen in the real world looking through the viewfinder, they fail to eliminate the parallax error between the viewfinder and the camera.

A manner of using a plurality of pictures of the same scene or object, in which the pictures were taken using a camera with automatic exposure control, automatic gain control, or the like has been proposed in *'PENCIGRAPHY' WITH AGC: JOINT PARAMETER ESTIMATION IN BOTH DOMAIN AND RANGE OF FUNCTIONS IN SAME ORBIT OF THE PROJECTIVE-WYCKOFF GROUP*, published by S. Mann, in M.I.T. (medialab vismod) tech report TR-384, December, 1994, and later

published also in Proceedings of the IEEE International Conference on Image Processing (ICIP-96), Lausanne, Switzerland, September 16-19, 1996, pages 193-196. (The report is also available on a world wide web site: <http://wearcam.org/icip96/index.html> as a hypertext document, along with related documents on <http://wearcam.org>.) This report relates to a manner of camera self-calibration in which the unknown nonlinear response function of the camera is determined up to a single unknown scalar constant. Therefore, once the camera is so understood, it may be used, within the context of the method, as a quantigraphic light measuring instrument. As each pixel of the camera then becomes a light measuring instrument, successive pictures in a video sequence become multiple estimates of the same quantity once the multiple images are registered and appropriately interpolated. The measurement from a plurality of such estimates gives rise to knowledge about the scene sufficient to render pictures of increased dynamic range and tonal fidelity, as well as increased spatial resolution and extent. In this way a miniature video camera as may be concealed inside a pair of eyeglasses may be used to generate images of very high quality, sufficient for fine-arts work or other uses where good image quality is needed.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a method of positioning a camera in which both hands may be left free.

It is a further object of this invention to provide a means of exposing a film or acquiring a picture electronically where the spatial extent (field of view) of the image may be ascertained without having to hold any device up to the eye.

What is described is a wearable camera and viewfinder for capturing video of exceptionally high compositional and artistic calibre. In addition to the fact that covert versions of the apparatus can be used to create investigative documentary videos having very good composition, for everyday usage the device need not necessarily be covert. In fact, it may be manufactured as a fashionable device that serves

as both a visible crime deterrent, as well as a self-explanatory (through its overt obviousness) tool for documentary videomakers and photojournalists.

Another feature of the invention is that the wearable camera has a viewfinder such that the image may be presented in a natural manner suitable for long-term usage patterns.

There are several reasons why it might be desired to wear the camera over a sustained period of time:

1. There is the notion of a personal visual diary of sorts.
2. There is the idea of being always ready. By constantly recording into a circular buffer, a retroactive record function, such as a button that instructs the device to "begin recording from five minutes ago" may be useful in personal safety (crime reduction) as well as in ordinary everyday usage, such as capturing a baby's first steps on video. With the prior art in photography and video, we spend so much time preparing the camera and searching for film, batteries, etc., or at the very least, just getting the camera out of its carrying case, that we often miss important moments like a baby's first steps, or a spontaneous facial expression during the opening of a gift.
3. There is the fact that the wearable camera system, after being worn for a long period of time, begins to behave as a true extension of the wearer's mind and body. As a result, the composition of video shot with the device is often impeccable without even the need for conscious thought or effort on the part of the user. Also, one can engage in other activities, and one is able to record the experience without the need to be encumbered by a camera, or even the need to remain aware, at a conscious level, of the camera's existence. This lack of the need for conscious thought or effort suggests a new genre of documentary video characterized by long-term psychophysical adaptation to the device. The result is a very natural first-person perspective documentary, whose artistic style is

very much as if a recording could be made from a video tap of the optic nerve of the eye itself. Events that may be so recorded include involvement in activities such as horseback riding, climbing up a rope, or the like, that cannot normally be well recorded from a first-person perspective using cameras of the prior art. Moreover, a very natural first-person perspective genre of video results. For example, while wearing an embodiment of the invention, it is possible to look through the eyepiece of a telescope or microscope and record this experience, including the approach toward the eyepiece. The experience is recorded, from the perspective of the participant.

4. A computational system, either built into the wearable camera, or worn on the body elsewhere and connected to the camera system, may be used to enhance images. This may be of value to the visually impaired. The computer may also perform other tasks such as object recognition. Because the device is worn constantly, it may also function as a photographic/videographic memory aid, e.g. to help in way-finding through the recall and display of previously captured imagery.

It is desired that the proposed viewfinder arrangement be suitable for long-term usage, such as when one may be wearing the camera for sixteen hours per day, looking through it all the while. Traditional viewfinders are only looked through on a shorter term basis. Thus there will be some important differences between the wearable camera system and traditional cameras. For example, when the wearable camera system comprises a zoom lens for the camera, it is desired that the viewfinder also comprise a zoom lens, so that when zooming into a scene, the image in the viewfinder can be made to subtend a lesser visual angle (appear to get smaller). It is also desired that the exact extent of this reduction in apparent visual angle be controlled to exactly cancel out the usual effect in which zooming in produces increased magnification. In this manner the wearable camera system provides the wearer with absolutely no apparent magnification, or change in apparent magnification, while looking through

the viewfinder and exploring the full range of zoom adjustment.

Some viewfinders are equipped with a zoom capability, as, for example, is described in U.S. Pat. No. 5323264, so that their field of coverage (magnification) varies with the varying of a zoom lens. The reader will need to be careful not to confuse these zoom viewfinders of the prior art with the zoom viewfinder of the wearable camera invention in which viewing takes place through an electronic viewfinder where the decrease in visual angle subtended by the image of the viewfinder screen is coupled to the increase in focal length of the camera within the proposed invention. This coupling negates (cancels out) any increase in magnification that would otherwise result from zooming in on the scene. At first this lack of increase in apparent magnification with increase in lens focal-length may seem counter-intuitive, in the sense that we normally expect zooming in to produce an increase in apparent magnification as observed while looking through a camera viewfinder. This expectation is owing to known cameras. However, after using the wearable camera system for an extended period of time, one quickly grows accustomed to the unique characteristics of its viewfinder, and the much more seamless integration of its viewfinder with everyday life. This seamlessness is such that after time, the wearer will begin to operate the wearable camera invention without appreciable conscious thought or effort. With magnification, or changes in magnification, it is much more difficult to fully adapt to the presence of the camera.

An important aspect of the proposed invention is the capability of the apparatus to mediate (augment, diminish, or otherwise alter) the visual perception of reality.

The proposed camera viewfinder is related to the displays that are used in the field of Virtual Reality (VR) in the sense that both are wearable. However, an important difference is that the proposed invention allows the wearer to continue to see the real world, while VR displays block out the ability to see the real world.

It is possible with the invention to allow visual reality to be mediated in order to make certain that exposure is correct as well as to keep the wearer of the apparatus

in the feedback loop of the photo compositional process by constantly providing the wearer with a video stream. Moreover, it is desired that the apparatus will allow the wearer to experience a computationally mediated visual reality, and for that experience to be shared through wireless communications networks so that the wearer may receive additional visual information, as well as be aware of modifications to visual reality that might arise, for example, as part of a communications process in a shared virtual environment. For such compositional and interactional capabilities, a simple air-based viewfinder is inadequate.

It is possible with this invention to provide such a method of exposing a film or acquiring a picture electronically where the tonal characteristics of the picture may be ascertained without having to hold any device up to the eye.

It is possible with this invention to provide such a method of exposing a film or acquiring a picture electronically where no apparent difference in body movement or gesture between when a picture is being taken and when no picture is being taken is detectable by others.

It is possible with this invention to provide the user with a means of determining the composition of the picture from a display device that is located such that only the user can see the display device, and so that the user can ascertain the composition of a picture or take a picture or video and transmit image(s) to one or more remote locations without the knowledge of others in the immediate environment.

It is possible with this invention to provide the user with a means of determining the composition of the picture from a display device that is located such that only the user can see the display device, as well as an optional additional display device that the user can show to others if and when the user desires to do so.

It is possible with this invention to provide the user with a means of determining the composition of the picture from a display device that is located such that both the user as well as others can see it, if the user should so desire.

It is possible with this invention to provide a wearable camera viewfinder means in

which video is displayed on a viewfinder in such a way that all rays of light from the viewfinder that enter the eye appear to emanate from essentially the same direction as they would have had the apparatus not been worn.

It is possible with this invention to provide a means for a user to experience additional information overlaid on top of his or her visual field of view such that the information is relevant to the imagery being viewed.

It is possible with this invention to provide a means and apparatus for a user to capture a plurality of images of the same scene or objects, in a natural process of simply looking around, and then have these images combined together into a single image of increased spatial extent, spatial resolution, dynamic range, or tonal fidelity.

It is possible with this invention to provide a viewfinder means in which the viewfinder has a focusing mechanism that is coupled to a focusing mechanism of a camera system, so that when the camera is focused on a particular object the viewfinder also presents that object in a manner such that when the apparatus moves relative to the user's eye, the object appears to neither move with or against the movement of the eye, so that the rays of light entering the eye are approximately the same in direction as if the apparatus were not present.

It is possible with this invention to provide a viewfinder means in which the viewfinder has a focusing mechanism that is coupled to a focusing mechanism of a camera system, so that when the camera is focused on a particular object the viewfinder also presents that object in the same focal depth plane as the object would appear to the user with the apparatus removed.

It is possible with this invention to provide a viewfinder means in which the viewfinder has a focusing mechanism that is controlled by an automatic focusing mechanism of a camera system.

It is possible with this invention to provide a stereo viewfinder means in which the viewfinder system has camera focusing, camera vergence, display focusing, and display vergence control where all four are linked together so that there is only need

for a single control.

It is possible with this invention to provide a stereo viewfinder means in which the viewfinder has focusing and vergence control mechanisms that are controlled by an automatic focusing mechanism of a camera system.

It is possible with this invention to provide a viewfinder means in which the viewfinder has a focusing mechanism that is controlled by an automatic focusing mechanism of a camera system, and in which the apparatus comprises an eye-tracking mechanism that causes the focus of the camera to be based on where the user is looking, and therefore the focus of the viewfinder mechanism to be also focused in such a manner that the convergence of light rays from whatever object happens to be within the foveal region of the eye's view also produces rays of light that have the same focal distance as they would have had with the apparatus removed from the user.

The proposed invention facilitates a new form of visual art, in which the artist may capture, with relatively little effort, a visual experience as viewed from his or her own perspective. With some practice, it is possible to develop a very steady body posture and mode of movement that best produces video of the genre pertaining to this invention. Because the apparatus may be lightweight and close to the head, there is not the protrusion associated with carrying a hand-held camera. Also because components of the proposed invention are mounted very close to the head, in a manner that balances the weight distribution. Mounting close to the head minimizes the moment of inertia about the rotational axis of the neck, so that the head can be turned quickly while wearing the apparatus. This arrangement allows one to record the experiences of ordinary day-to-day activities from a first-person perspective. Moreover, because both hands are free, much better balance and posture is possible while using the apparatus. Anyone skilled in the arts of body movement control as is learned in the martial arts such as karate, as well as in dance, most notably ballet, will have little difficulty capturing exceptionally high quality video using the apparatus

of this invention.

With known video or movie cameras, the best operators tend to be very large people who have trained for many years in the art of smooth control of the cumbersome video or motion picture film cameras used. In addition to requiring a very large person to optimally operate such cameras, various stabilization devices are often used, which make the apparatus even more cumbersome. The apparatus of the invention may be optimally operated by people of any size. Even young children can become quite proficient in the use of the wearable camera system.

A typical embodiment of the invention comprises one or two spatial light modulators or other display means built into a pair of eyeglasses together with one or more sensor arrays. Typically one or more CCD (charge coupled device) image sensor arrays and appropriate optical elements comprise the camera portion of the invention. Typically a beamsplitter or a mirror silvered on both sides is used to combine the image of the viewfinder with the apparent position of the camera. The viewfinder is simply a means of determining the extent of coverage of the camera in a natural manner, and may comprise either of:

- A reticle, graticule, rectangle, or other marking that appears to float within a portion of the field of view.
- A display device that shows a video image, or some other dynamic information perhaps related to the video image coming from the camera.

One aspect of the invention allows a photographer or videographer to wear the apparatus continuously and therefore always end up with the ability to produce a picture from something that was seen a couple of minutes ago. This may be useful to everyone in the sense that we may not want to miss a great photo opportunity, and often great photo opportunities only become known to us after we have had time to think about something we previously saw.

Such an apparatus might also be of use in personal safety. Although there are a

growing number of video surveillance cameras installed in the environment allegedly for "public safety", there have been recent questions as to the true benefit of such centralized surveillance infrastructures. Most notably there have been several examples in which such centralized infrastructure has been abused by the owners of it (as in roundups and detainment of peaceful demonstrators). Moreover, "public safety" systems may fail to protect individuals against crimes committed by the organizations that installed the systems. The apparatus of this invention allows the storage and retrieval of images by transmitting and recording images at one or more remote locations. Images may be transmitted and recorded in different countries, so that they would be difficult to destroy, in the event that the perpetrator of a crime might wish to do so.

The apparatus of the invention allows images to be captured in a natural manner, without giving an unusual appearance to others (such as a potential assailant).

Moreover, as an artistic tool of personal expression, the apparatus allows the user to record, from a first-person-perspective, experiences that have been difficult to so record in the past. For example, a user might be able to record the experience of looking through binoculars while riding horseback, or the experience of waterskiing, rope climbing, or the like. Such experiences captured from a first-person perspective provide a new genre of video by way of a wearable camera system with viewfinder means that goes beyond current state-of-the-art point of view sports videos (such as created by cameras mounted in sports helmets which have no viewfinder means).

A typical embodiment of the invention comprises a wearable viewfinder system which is fitted with a motorized focusing mechanism. A camera also fitted with a motorized focusing mechanism is positioned upon one side of a mirror that is silvered on both sides, so that the viewfinder can be positioned on the other side and provide a view that is focused to whatever the camera is focused on. Such an apparatus allows the user to record a portion of his or her eye's visual field of view. With the correct design, the device will tend to cause the wearer to want to place the recording zone

over top of whatever is most interesting in the scene. This tendency arises from the enhancement of the imagery in this zone. In much the same way that people tend to look at a TV set in a darkened room, regardless of what is playing (even if the TV is tuned to a blank station and just playing "snow"), there is a tendency when wearing the invention to look at the recording/display/viewfinder zone. Therefore, there is a tendency to try to put the recording zone on top that which is of most interest. Therefore using the apparatus, after time, does not require conscious thought or effort. It was once said that television is more real than real life, and in much the same way, the wearer of the apparatus becomes a cybernetic organism (cyborg) in a true synergy of human and camera. This is particularly true with a low vision system in which one can actually see better through the viewfinder than in real life (e.g. at night when an image intensifier provides enhanced vision). In this case, the tendency of the wearer to want to become an organism that seeks best picture is very pronounced.

Accordingly, the present invention in one aspect comprises camera bearing head-gear with electronic display responsive to an electronic output from the camera so that the electronic display may function as a viewfinder for the camera. Preferably, the optical arrangement of the camera and viewfinder display are such that each ray of light is absorbed and quantified by the camera and that the viewfinder results in a synthesis of the rays of light that are collinear to the rays of light entering the camera. In this way, rays of light pass through the apparatus to provide the wearer with an electronically mediated experience but without otherwise distorting the spatial arrangement, focus, or appearance of the scene viewed through the apparatus.

According to another aspect of the invention, there is provided an eyeglass based wearable camera system with eyeglass based viewfinder. Preferably, the optical arrangement of the camera and viewfinder display are such that each ray of light is absorbed and quantified by the camera and that the viewfinder results in a synthesis of the rays of light that are collinear to the rays of light entering the camera. In this

way, rays of light pass through the apparatus to provide the wearer with an electronically mediated experience but without otherwise distorting the spatial arrangement, focus, or appearance of the scene viewed through the apparatus.

According to another aspect of the invention, there is provided camera bearing headgear with viewfinder based on a display device of a body-worn computer system. Preferably, the optical arrangement of the camera and viewfinder display are such that each ray of light is absorbed and quantified by the camera and that the viewfinder results in a synthesis of the rays of light that are collinear to the rays of light entering the camera. In this way, rays of light pass through the apparatus to provide the wearer with an computer mediated experience but without otherwise distorting the spatial arrangement, focus, or appearance of the scene viewed through the apparatus.

According to another aspect of the invention, there is provided a wearable camera system with virtual-light viewfinder, so that a portion of the light that provides a field of view to the wearer is diverted by converting the incoming light into a numerical representation, processing that numerical representation, and then taking that processed numerical representation and forming it back into rays of light approximately collinear with those rays of light that entered the apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of examples which in no way are meant to limit the scope of the invention, but, rather, these examples will serve to illustrate the invention with reference to the accompanying drawings, in which:

FIG. 1 is a diagram of a simple embodiment of the invention in which there are two cameras, a wide-angle camera concealed in the nose bridge of a pair of sunglasses, a tele-camera concealed in the top part of the frame of the sunglasses, and combined by way of a beamsplitter with the wide-camera, as well as a viewfinder means concealed in the left temple side-piece of the glasses with optics concealed in or behind the glass

of the left lens. FIG 1A is an exploded view of a portion of FIG 1. FIG 1B is a detail view of a portion of FIG 1. FIG 1C and FIG 1D illustrate aspects of the operation of the embodiment of FIG 1.

FIG. 2 is a diagram of the wearable camera system with an improvement in which the viewfinder is constructed so that when other people look at the wearer of the apparatus they can see both of the wearer's eyes in such a way that they do not notice any unusual magnification of the wearer's left eye which might otherwise look unusual or become a problem in making normal eye contact with the wearer.

FIG. 3 illustrates the principle of a camera viewfinder which replaces a portion of the visual field of view with the view from a camera, yet allows the wearer to see through the apparatus without experiencing any psychophysical adaptation or coordinate transformation.

FIG. 4 illustrates a version of the apparatus similar to that in FIG. 1, except where a portion of the visual field of view is only partially replaced, owing to the use of polarizers to prevent video feedback, as well as a beamsplitter rather than a double-sided mirror.

FIG. 5 shows an embodiment of the invention in which there are two televisions of different sizes which are each superimposed upon exactly the field of view that corresponds to each of two cameras, one being wide-angle and the other being tele.

FIG. 6 shows an embodiment of the wearable camera invention in which the viewfinder contains considerable magnification, yet allows other people to see both of the wearer's eyes except for a slight amount of blocked vision which may be concealed by making the glasses look like bifocal glasses.

FIG. 7 shows an embodiment of the invention where there is coupling between camera focus and viewfinder focus.

FIG. 8 shows an embodiment of the invention where there is a zoom capability, and where the virtual light principle is preserved regardless of zoom setting.

FIG. 9 shows a stereo embodiment of the invention where both cameras are fo-

cused by the left camera, and where the left camera also controls the focus of both viewfinders and the vergence of the entire system.

FIG. 10 shows an embodiment of the invention where an eye tracker is used to set the stereo camera focus, the stereo viewfinder focus, and the vergence, to all correspond with the object the wearer is looking at.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the invention shall now be described with reference to the preferred embodiments shown in the drawings, it should be understood that the intention is not to limit the invention only to the particular embodiments shown but rather to cover all alterations, modifications and equivalent arrangements possible within the scope of appended claims.

In all aspects of the present invention, references to "camera" mean any device or collection of devices capable of simultaneously determining a quantity of light arriving from a plurality of directions and or at a plurality of locations, or determining some other attribute of light arriving from a plurality of directions and or at a plurality of locations. Similarly references to "display", "television", or the like, shall not be limited to just television monitors or traditional televisions used for the display of video from a camera near or distant, but shall also include computer data display means, computer data monitors, other video display devices, still picture display devices, ASCII text display devices, terminals, systems that directly scan light onto the retina of the eye to form the perception of an image, direct electrical stimulation through a device implanted into the back of the brain (as might create the sensation of vision in a blind person), and the like.

With respect to both the cameras and displays, as broadly defined above, the term "zoom" shall be used in a broad sense to mean any lens of variable focal length, any apparatus of adjustable magnification, or any digital, computational, or electronic means of achieving a change in apparent magnification. Thus, for example, a zoom

viewfinder, zoom television, zoom display, or the like, shall be taken to include the ability to display a picture upon a computer monitor in various sizes through a process of image interpolation as may be implemented on a body-worn computer system.

References to "processor", or "computer" shall include sequential instruction, parallel instruction, and special purpose architectures such as digital signal processing hardware, Field Programmable Gate Arrays (FPGAs), programmable logic devices, as well as analog signal processing devices.

References to "transceiver" shall include various combinations of radio transmitters and receivers, connected to a computer by way of a Terminal Node Controller (TNC), comprising, for example, a modem and a High Level Datalink Controller (HDLCs), to establish a connection to the Internet, but shall not be limited to this form of communication. Accordingly, "transceiver" may also include analog transmission and reception of video signals on different frequencies, or hybrid systems that are partly analog and partly digital. The term "transceiver" shall not be limited to electromagnetic radiation in the frequency bands normally associated with radio, and may therefore include infrared or other optical frequencies. Moreover, the signal need not be electromagnetic, and "transceiver" may include gravity waves, or other means of establishing a communications channel.

While the architecture illustrated shows a connection from the headgear, through a computer, to the transceiver, it will be understood that the connection may be direct, bypassing the computer, if desired, and that a remote computer may be used by way of a video communications channel (for example a full-duplex analog video communications link) so that there may be no need for the computer to be worn on the body of the user.

The term "headgear" shall include helmets, baseball caps, eyeglasses, and any other means of affixing an object to the head, and shall also include implants, whether these implants be apparatus imbedded inside the skull, inserted into the back of the brain, or simply attached to the outside of the head by way of registration pins

implanted into the skull. Thus "headgear" refers to any object on, around, upon, or in the head, in whole or in part.

When it is said that object "A" is "borne" by object "B", this shall include the possibilities that A is attached to B, that A is part of B, that A is built into B, or that A is B.

Fig 1 shows an embodiment of the invention built into eyeglass frames 100, typically containing two eyeglass lenses 105. An electronic wide-angle camera 110 is typically concealed within the nose bridge of the eyeglass frames 100. In what follows, the wide-angle camera 110 may be simply referred to as the "wide-camera", or as "wide-angle camera". In this embodiment of the wearable camera, a second camera, 120, is also concealed in the eyeglass frames 100. This second camera is one which has been fitted with a lens of longer focal length, and will be referred to as a "narrow-angle camera", or simply a "narrow-camera" in what follows. The wide-camera 110 faces forward looking through a beamsplitter 130. The narrow-camera 120 faces sideways looking through the beamsplitter. For clarity, the beamsplitter 130 and camera 110 are shown separated in Fig 1a, while in actual construction, the beamsplitter is cemented between the two cameras as shown in Fig 1. The beamsplitter 130 is typically mounted at a 45 degree angle, and the optical axes of the two cameras are typically at 90 degree angles to each other. The optical axes of the two cameras should intersect and thus share a common viewpoint. Thus the narrow camera 120 may have exactly the same field of view as the wide-camera 110. Typically eyeglasses with black frames are selected, and a CCD sensor array for wide-camera 110 is concealed in a cavity which is also used as a nose bridge support, so that the eyeglasses have a normal appearance. Typically, the body of the wide-camera is formed from epoxy, which sets it permanently in good register with the beamsplitter and the narrow-camera 120. During setting of the epoxy, the cameras are manipulated into an exact position, to ensure exact collinearity of the two effective optical axes. The wide-camera 110 is typically fitted with a lens having a diameter of approximately

1/32 inch (less than one millimeter) — small enough that it cannot be easily seen by someone at close conversational distance to the person wearing the eyeglasses. The narrow-camera 120 is typically concealed in the upper portion of the eyeglass frames. The narrow-camera 120 is preferably custom-made, like the wide-camera, by encapsulating a CCD sensor array, or the like, in an epoxy housing together with the appropriate lens, so that cameras 110 and 120 are both bonded to beamsplitter 130, and all three are in turn bonded to the eyeglass frame. A satisfactory narrow-camera, for use in small-production runs of the invention (where it is difficult to construct the housing from epoxy) is an Elmo (TM) model QN42H camera, owing to its long and very slender (7mm diameter) construction. In mass-production, a custom-made narrow-camera could be built directly into the eyeglass frames. Since the narrow-camera 120 is typically built into the top of the eyeglass frames, the wide-camera 110 should also be mounted near the top of the frames, so the two optical axes can be made to intersect at right angles, making the effective optical axes (e.g. that of camera 120 as reflected in beamsplitter 130) collinear.

Preferably, a complete camera system providing NTSC video is not installed directly in the eyeglasses. Instead, wires 125 from the camera sensor arrays are concealed inside the eyeglass frames and run inside a hollow eyeglass safety strap 126. A satisfactory eyeglass safety strap is the safety strap that is sold under the trademark "Croakies". Eyeglass safety strap 126 typically extends to a cloth-wrapped cable harness 127 typically made of the same kind of hollow cloth material from which safety strap 126 is made. There is typically a connection between cable harness 127 and a wiring harness 180, where wiring harness 180 is typically not wrapped in cloth. Wiring harness 180 and cable harness 127 are connected together by connection 175. Connection 175 typically includes a strain relief clip or the like that clips to the inside of the wearer's shirt, at the back of the neck, so that wiring harness 180 will not pull on cable harness 127. In this way, cable harness 127 is slack, and allows safety strap 126 to fall slack and thus have an appearance that it just happened to fall down

partially inside the wearer's shirt.

Wires 125 are run down to a belt pack or to a body-worn pack 128, often comprising a computer as part of processor 182, powered by battery pack 181 which also powers the portions of the camera and display system located in the headgear. The processor 182, if it includes a computer, preferably contains also a nonvolatile storage device or network connection. Alternatively, or in addition to the connection to processor 182, there is often another kind of recording device, or connection to a transmitting device 186. The transmitter 186, if present, is typically powered by the same battery pack 181 that powers the processor. In some embodiments, a minimal amount of circuitry may be concealed in the eyeglass frames so that the wires 125 may be driven with a buffered signal in order to reduce signal loss. In or behind one or both of the eyeglass lenses 105, there is typically an optical system 150. This optical system provides a magnified view of an electronic display in the nature of a miniature television screen 160 in which the viewing area is typically less than one inch (or less than 25 millimeters) on the diagonal. The electronic display acts as a viewfinder screen. The viewfinder screen may comprise a 1/4 inch (approx. 6mm) television screen comprising an LCD spatial light modulator with a field-sequenced LED backlight. Preferably custom-built circuitry is used. However, a satisfactory embodiment of the invention may be constructed by having the television screen be driven by a coaxial cable carrying a video signal similar to an NTSC RS-170 signal. In this case the coaxial cable and additional wires to power it are concealed inside the eyeglass safety-strap and run down to a belt pack or other body-worn equipment by wiring harness 180.

In some embodiments, television 160 contains a television tuner so that a single coaxial cable may provide both signal and power. In other embodiments the majority of the electronic components needed to construct the video signal are worn on the body, and the eyeglasses contain only a minimal amount of circuitry, perhaps only a spatial light modulator, LCD flat panel, or the like, with termination resistors and

backlight. In this case, there are a greater number of wires 170. In some embodiments of the invention the television screen 160 is a VGA computer display, or another form of computer monitor display, connected to a computer system worn on the body of the wearer of the eyeglasses.

Wearable display devices have been described, such as in U.S. Pat. No. 5546099, Head mounted display system with light blocking structure, by Jessica L. Quint and Joel W. Robinson, Aug. 13, 1996, as well as in U.S. Pat. No. 5708449, Binocular Head Mounted Display System by Gregory Lee Heacock and Gordon B. Kuenster, Jan. 13, 1998. (Both of these two patents are assigned to Virtual Vision (TM), a well-known manufacturer of head-mounted displays). A "personal liquid crystal image display" has been described U.S. Pat. No. 4636866, by Noboru Hattori, Jan. 13, 1987. Any of these head-mounted displays of the prior art may be modified into a form such that they will function in place of television display 160.

In typical operation of the system of Fig 1, light enters the eyeglasses and is absorbed and quantified by one or more cameras. By virtue of a connection through wiring harness 180, information about the light entering the eyeglasses is available to the body-worn computer system previously described. The computer system may calculate the actual quantity of light, up to a single unknown scalar constant, arriving at the glasses from each of a plurality of directions corresponding to the location of each pixel of the camera with respect to the camera's center of projection. This calculation may be done using photoquantigraphic image processing. In some embodiments of the invention the narrow-camera 120, is used to provide a more dense array of such photoquanta estimates. This increase in density toward the center of the visual field of view matches the characteristics of the human visual system in which there is a central foveal region of increased visual acuity. Video from one or both cameras is possibly processed by the body-worn computer 182 and recorded or transmitted to one or more remote locations by a body-worn video transmitter 186 or body-worn Internet connection, such as a standard WA4DSY 56 kbps RF link with

a KISS 56 eeprom running TCP/IP over an AX25 connection to the serial port of the body-worn computer. The possibly processed video signal is sent back up into the eyeglasses through wiring harness 180 and appears on viewfinder screen 160, viewed through optical elements 150.

Typically, rather than displaying raw video on display 160, processed video is displayed thereupon, with reference also to FIG 1b (a close-up detail view of processor 182), as follows: The video outputs from cameras 110 and 120 pass through wiring harness 180 into vision analysis processor 183. Vision analysis processor 183 typically uses the output of the wide-camera for head-tracking. This head-tracking determines the relative orientation (yaw, pitch, and roll) of the head based on the visual location of objects in the field of view of camera 110. Vision analysis processor 183 may also perform some 3-D object recognition or parameter estimation, or construct a 3-D scene representation. Information processor 184 takes this visual information, and decides which virtual objects, if any, to insert into the viewfinder. Graphics synthesis processor 185 creates a computer-graphics rendering of a portion of the 3-D scene specified by the information processor 184, and presents this computer-graphics rendering by way of wires in wiring harness 180 to television screen 160. Typically the objects displayed are synthetic (virtual) objects overlaid in the same position as some of the real objects from the scene. Typically the virtual objects displayed on television 160 correspond to real objects within the field of view of narrow-camera 120. In this way, narrow camera 120 provides vision analysis processor 183 with extra details about the scene so that the analysis is more accurate in this foveal region, while wide-camera 110 provides both an anticipatory role and a head-tracking role. In the anticipatory role, vision analysis processor 183 is already making crude estimates of identity or parameters of objects outside the field of view of the viewfinder screen 160, with the possible expectation that the wearer may at any time turn his or her head to include some of these objects, or that some of these objects may move into the field of view of viewfinder 160 and narrow camera 120. With this operation, synthetic

objects overlaid on real objects in the viewfinder provide the wearer with enhanced information of the real objects as compared with the view the wearer has of these objects outside of the viewfinder.

Thus even though television viewfinder screen 160 may only have 240 lines of resolution, a virtual television screen, of extremely high resolution, wrapping around the wearer, may be implemented by virtue of the head-tracker, so that the wearer may view very high resolution pictures through what appears to be a small window that pans back and forth across the picture by the head-movements of the wearer. Optionally, in addition to overlaying synthetic objects on real objects to enhance real objects, graphics synthesis processor 182 (FIG 1b) may cause the display of other synthetic objects on the virtual television screen. For example, FIG 1c illustrates a virtual television screen with some virtual (synthetic) objects such as an Emacs Buffer upon an xterm (text window in the commonly-used X-windows graphical user-interface). The graphics synthesis processor 182 causes the viewfinder screen 160 (FIG 1) to display a reticle seen in the viewfinder window at 192. Typically viewfinder screen 160 has 640 pixels across and 480 down, which is only enough resolution to display one xterm window since an xterm window is typically also 640 pixels across and 480 down (sufficient size for 24 rows of 80 characters of text). Thus the wearer can, by turning the head to look back and forth, position viewfinder reticle 192 on top of any of a number of xterms 194 that appear to hover in space above various real objects 198. The real objects themselves, when positioned inside the mediation zone established by the viewfinder, may also be visually enhanced as seen through the viewfinder. Suppose the wearer is in a department store and, after picking up a \$7 item for purchase, the wearer approaches the cashier, hands the cashier a \$20 dollar bill, but only receives change for a \$10 bill (e.g. only receives \$3 change from \$20). Upon realizing this fact a minute or so later, the wearer locates a fresh available, (e.g. one that has no programs running in it so that it can accept commands) xterm 196. The wearer makes this window active by head movement up and to the right,

as shown in Fig 1d. Thus the camera functions also as a head tracker, and it is by orienting the head (and hence the camera) that the cursor may be positioned. Making a window active in the X-windows system is normally done by placing the mouse cursor on the window and possibly clicking on it. However, having a mouse on a wearable camera/computer system is difficult owing to the fact that it requires a great deal of dexterity to position a cursor while walking around. With the invention described here, the viewfinder is the mouse/cursor: the wearer's head is the mouse, and the center of the viewfinder is the cursor. In Fig 1c and Fig 1d, windows outside the viewfinder are depicted in dashed lines, because they are not actually visible to the wearer. The wearer can see real objects outside the field of view of the viewfinder (either through the remaining eye, or because the viewfinder permits one to see around it). However, only xterms in the viewfinder are visible. Portions of the xterms within the viewfinder are shown with solid lines, as this is all that the wearer will see.

Once the wearer selects window 196 by looking at it, then the wearer presses the letter "d" to begin "recorDing", as indicated on window 196. Note that the letter "d" is pressed for "recorD", because the letter "r" means "Recall" (in some ways equivalent to "Rewind" on a traditional video cassette recorder). Letters are typically selected by way of a small number of belt-mounted switches that can be operated with one hand, in a manner similar to the manner that courtroom stenographers use to form letters of the alphabet by pressing various combinations of pushbutton switches. Such devices are commonly known as "chording keyboards" and are well known in the prior art. Also note that the wearer did not need to look right into all of window 196: the window accepts commands as long as it is active, and doesn't need to be wholly visible to accept commands.

Recording is typically retroactive, in the sense that the wearable camera system, by default, always records into a 5-minute circular buffer, so that pressing "d" begins recording starting from 5 minutes ago, e.g. starting from 5 minutes before "d" is pressed. This means that if the wearer presses "d" within a couple of minutes of

realizing that the cashier short-changed the wearer, then the transaction will have been successfully recorded. The customer can then see back into the past 5 minutes, and can assert with confidence (through perfect photographic/videographic memory Recall, e.g. by pressing "r") to the cashier that a \$20 bill was given. The extra degree of personal confidence afforded by the invention typically makes it unnecessary to actually present the video record (e.g. to a supervisor) in order to correct the situation. Of course, if there was a belief that the cashier was dishonest, the customer could file a report or notify authorities while at the same time submitting the recording as evidence. Typically the recording is also transmitted by way of transmitter 186 so that the cashier or other representatives of the department store (such as a department store security guard who might be a close personal friend of the cashier) cannot seize and destroy the storage medium upon which the recording was made.

Note that here the drawings depict objects moved translationally (e.g. the group of translations specified by two scalar parameters) while in actual practice, virtual objects undergo a projective coordinate transformation in two dimensions, governed by eight scalar parameters, or objects undergo three dimensional coordinate transformations. When the virtual objects are flat, such as text windows, such a user-interface is called a "Reality Window Manager" (RWM).

In using the invention, typically various windows appear to hover above various real objects, and regardless of the orientation of the wearer's head (position of the viewfinder), the system sustains the illusion that the virtual objects 194 (in this example, xterms) are attached to real objects 198. The act of panning the head back-and forth in order to navigate around the space of virtual objects also may cause an extremely high-resolution picture to be acquired through appropriate processing of a plurality of pictures captured on narrow-camera 120. This action mimicks the function of the human eye, where saccades are replaced with head movements to sweep out the scene using the camera's light-measurement ability as is typical of photoquantigraphic image processing. Thus head movements are used to direct the

camera to scan out a scene in the same way that eyeball movements normally orient the eye to scan out a scene.

Processor 182 is typically responsible for ensuring that the view rendered in graphics processor 185 matches the viewing position of the eye in front of optics 150, and not the original position from which the video was presented from cameras 110 and 120 to vision processor 183. Thus there is a change of viewing angle, in the rendering, so as to compensate for the difference in position (parallax) between the cameras and the view afforded by the display.

Some homographic and quantigraphic image analysis embodiments do not require a 3-D scene analysis, and instead use 2-D projective coordinate transformations of a flat object or flat surface of an object, in order to effect the parallax correction between virtual objects and the view of the scene as it would appear with the glasses removed from the wearer.

A drawback of the apparatus depicted in Fig 1 is that the optical elements 150 block the eye(s) of the wearer. The wearer may be able to adapt to this condition, or at least compensate for it through the display of video from the wearable camera to create an illusion of transparency, in the same way that a hand-held camcorder creates an illusion of transparency when it is on and running even though it would function as a vision-blocking eye patch when turned off. However, because of the parallax between cameras 110 and 120 and the actual eye position given by viewfinder optics 150, creating the illusion of transparency requires passing all objects through the analysis processor 183, followed by the synthesis processor 185, and this may present processor 182 with a formidable task. Moreover, the fact that the eye of the wearer is blocked means that others cannot make eye-contact with the wearer. In social situations this creates an unnatural form of interaction. Although the lenses of the glasses may be made sufficiently dark that the viewfinder optics are concealed, it is preferable that the viewfinder optics may be concealed in eyeglasses that allow others to see both of the wearer's eyes. A beamsplitter may be used for this purpose, but it

is preferable that there be a strong lens directly in front of the eye of the wearer to provide for a wide field of view. While a special contact lens might be worn for this purpose, there are limitations on how short the focal length of a contact lens can be, and such a solution is inconvenient for other reasons.

Accordingly, a viewfinder system is depicted in Fig 2 in which an optical path 200 brings light from a viewfinder screen 210, through a first relay mirror 220, along a cavity inside the left temple-side piece of the glasses formed by an opaque side shield 230, or simply by hollowing out a temple side-shield. Light travels to a second relay mirror 240 and is combined with light from the outside environment as seen through diverging lens 250. The light from the outside and from the viewfinder is combined by way of beamsplitter 260. The rest of the eyeglass lenses 261 are typically tinted slightly to match the beamsplitter 260 so that other people looking at the wearer's eyes do not see a dark patch where the beamsplitter is. Converging lens 270 magnifies the image from the viewfinder screen 210, while canceling the effect of the diverging lens 250. The result is that others can look into the wearer's eyes and see both eyes at normal magnification, while at the same time, the wearer can see the camera viewfinder at increased magnification. The rest of the system of Fig 2 is similar to that of Fig 1 (and like parts have been given like reference numerals in their last two digits), except that the video transmitter 186 shown in Fig 1 has been replaced with a data communications transceiver 286. Transceiver 286 along with appropriate instructions loaded into computer 282 provides a camera system allowing collaboration between the user of the apparatus and one or more other persons at remote locations. This collaboration may be facilitated through the manipulation of shared virtual objects such as cursors, or computer graphics renderings displayed upon the camera viewfinder(s) of one or more users.

Similarly, transceiver 286, with appropriate instructions executed in computer 282, allows multiple users of the invention, whether at remote locations or side-by-side, or in the same room within each other's field of view, to interact with one another

through the collaborative capabilities of the apparatus. This also allows multiple users, at remote locations, to collaborate in such a way that a virtual environment is shared in which camera-based head-tracking of each user results in acquisition of video and subsequent generation of virtual information being made available to the other(s).

Multiple users, at the same location, may also collaborate in such a way that multiple camera viewpoints may be shared among the users so that they can advise each other on matters such as composition, or so that one or more viewers at remote locations can advise one or more of the users on matters such as composition or camera angle.

Multiple users, at different locations, may also collaborate on an effort that may not pertain to photography or videography directly, but an effort nevertheless that is enhanced by the ability for each person to experience the viewpoint of another.

It is also possible for one or more remote participants at conventional desktop computers or the like to interact with one or more users of the camera system, at one or more other locations, to collaborate on an effort that may not pertain to photography or videography directly, but an effort nevertheless that is enhanced by the ability for one or more users of the camera system to either provide or obtain advice from or to another individual at a remote location.

The embodiments of the wearable camera system depicted in Fig 1 and Fig 2 give rise to a small displacement between the actual location of the camera, and the location of the virtual image of the viewfinder. Therefore, either the parallax must be corrected by a vision system 183, followed by 3-D coordinate transformation (e.g. in processor 184), followed by re-rendering (e.g. in processor 185), or if the video is fed through directly, the wearer must learn to make this compensation mentally. When this mental task is imposed upon the wearer, when performing tasks at close range, such as looking into a microscope while wearing the glasses, there is a discrepancy that is difficult to learn, and may also give rise to unpleasant psychophysical effects

such as nausea or “flashbacks”. Initially when wearing the glasses, the tendency is to put the microscope eyepiece up to one eye, rather than the camera 110 which is right between the eyes. As a result, the apparatus fails to record exactly the wearer’s experience, until the wearer can learn that the effective eye position is right in the middle. Locating the cameras elsewhere does not help appreciably, as there will always be some error. It is preferred that the apparatus will record exactly the wearer’s experience. Thus if the wearer looks into a microscope, the glasses should record that experience for others to observe vicariously through the wearer’s eye. Although the wearer can learn the difference between the camera position and the eye position, it is preferable that this not be required, for otherwise, as previously described, long-term usage may lead to undesirable flashback effects.

Accordingly, Fig 3 illustrates a system whereby rays of light spanning a visual angle from ray 310 to ray 320 enter the apparatus and are intercepted by a two-sided mirror 315, typically mounted at a 45 degree angle with respect to the optical axis of a camera 330. These rays of light enter camera 330. Camera 330 may be a camera that is completely (only) electronic, or it may be a hybrid camera comprising photographic emulsion (film) together with a video tap, electronic previewer, or other manner of electronic output, so that a film may be exposed and the composition may also be determined by monitoring an electronic output signal. Such a camera that provides an electronic output signal from which photographic, videographic, or the like, composition can be judged, will be called an “electronic camera” regardless of whether it may also contain other storage media such as photographic film. The video output of the camera 330 is displayed upon television screen 340 possibly after having been processed on a body-worn computer system or the like. A reflection of television screen 340 is seen in the other side of mirror 315, so that the television image of ray 310 appears as virtual ray 360 and the television image of ray 320 appears as ray 370. Since the camera 330 records an image that is backwards, a backwards image is displayed on the television screen 340. Since the television 340 is observed

in a mirror, the image is reversed again so that the view seen at pencil of light rays 390 is not backwards. In this way a portion of the wearer's visual field of view is replaced by the exact same subject matter, in perfect spatial register with the real world as it would appear if the apparatus were absent. Thus the portion of the field of view spanned by rays 310 to 320 which emerges as virtual light, will align with the surrounding view that is not mediated by the apparatus, such as rays 311 and 321 which pass through the apparatus and enter directly into the eye without being deflected by two-sided mirror 315. The image could, in principle also be registered in tonal range, using the photoquantigraphic image processing framework for estimating the unknown nonlinear response of the camera, and also estimating the response of the display, and compensating for both. So far focus has been ignored, and infinite depth-of-field has been assumed. In practice, a viewfinder with a focus adjustment is used, and the focus adjustment is driven by a servo mechanism controlled by an autofocus camera. Thus camera 330 automatically focuses on the subject matter of interest, and controls the focus of viewfinder 330 so that the apparent distance to the object is the same while looking through the apparatus as with the apparatus removed.

It is desirable that embodiments of the wearable camera system comprising manual focus cameras have the focus of the camera linked to the focus of the viewfinder so that both may be adjusted together with a single knob. Moreover, a camera with zoom lens may be used together with a viewfinder having zoom lens. The zoom mechanisms are linked in such a way that the viewfinder image magnification is reduced as the camera magnification is increased. Through this appropriate linkage, any increase in magnification by the camera is negated exactly by decreasing the apparent size of the viewfinder image.

The calibration of the autofocus zoom camera and the zoom viewfinder may be done by temporarily removing the mirror 315 and adjusting the focus and zoom of the viewfinder to maximize video feedback. This must be done for each zoom setting,

so that the zoom of the viewfinder will properly track the zoom of the camera. By using video feedback as a calibration tool, a computer system may monitor the video output of the camera while adjusting the viewfinder and generating a lookup table for the viewfinder settings corresponding to each camera setting. In this way, calibration may be automated during manufacture of the wearable camera system.

The apparatus of Fig 3 does not permit others to make full eye-contact with the wearer. Accordingly, Fig 4 depicts a similar apparatus in which only a portion of the rays of the leftmost ray of light 310 is deflected by beamsplitter 415 which is installed in place of mirror 315. The visual angle subtended by incoming light ray 310 to light ray 320 is deflected by way of beamsplitter 415 into camera 330. Output from this camera is displayed on television 340, possibly after processing on a body-worn computer or processing at one or more remote sites, or a combination of local and remote image processing or the like. A partial reflection of television 340 is visible to the eye of the wearer by way of beamsplitter 415. The leftmost ray of light 460 of the partial view of television 340 is aligned with the direct view of the leftmost ray of light 310 from the original scene. Thus the wearer sees a superposition of whatever real object is located in front of ray 310 and the television picture of the same real object at the same location. The rightmost ray of light 320 is similarly visible through the beamsplitter 415 in register with the rightmost virtual ray reflected off the beamsplitter 415.

Note that the partial transparency of beamsplitter 415 allows one to see beyond the screen, so it is not necessary to carefully cut beamsplitter 415 to fit exactly the field of view defined by television 340, or to have the degree of silvering feather out to zero at the edges beyond the field of view defined by television 340.

Rays 460 and 470 differ from rays 360 and 370 in that 460 and 470 present the viewer with a combination of virtual light and real light. In order to prevent video feedback, in which light from the television screen would shine into the camera, a polarizer 480 is positioned in front of the camera. The polarization axis of the polarizer

is aligned at right angles to the polarization axis of the polarizer inside the television, assuming the television already has a built-in polarizer as is typical of small battery powered LCD televisions, LCD camcorder viewfinders, and LCD computer monitors. If the television does not have a built in polarizer, a polarizer is added in front of the television. Thus video feedback is prevented by virtue of the two crossed polarizers in the path between the television 340 and the camera 330. Alternatively, instead of using explicit polarizers, a beamsplitter with polarization properties may be used for beamsplitter 415. Although many beamsplitters will exhibit some polarization properties, on account of being somewhat near the Brewster angle (functioning somewhat like a Brewster plate), certain kinds of beamsplitters, such as dichroic beamsplitters, exhibit very strong polarization characteristics. For example, beamsplitter 415 may comprise a dichroic beamsplitter cube.

The pencil of rays of light 490 will provide a mixture of direct light from the scene, and virtual light from the television display 340. The pencil of rays 490 thus differs from the pencil of rays 390 (FIG 3) in that 490 is a superposition of the virtual light as in 390 with real light from the scene.

In describing this invention, the term "pencil" of rays shall be taken to mean rays that intersect at a point in arbitrary dimensions (e.g. 3D as well as 2D) even though the term "pencil" usually only so-applies to 2D in common usage. This will simplify matters (rather than having to use the word "bundle" in 3D and "pencil" in 2D).

It is desired that both the real light and virtual light be in perfect or near perfect registration. However, in order that the viewfinder provide a distinct view of the world, it may be desirable that the virtual light from the television be made different in color or the like from the real light from the scene. For example, simply using a black and white television, or a black and red television, or the like, or placing a colored filter over the television, will give rise to a unique appearance of the region of the wearer's visual field of view by virtue of a difference in color between the television image and the real world upon which it is exactly superimposed. Even with

such chromatic mediation of the television view of the world, it may still be difficult for the wearer to discern whether or not video is correctly exposed. Accordingly, a pseudocolor image may be displayed, or unique patterns may be used to indicate areas of over exposure or under exposure. Once the wearer becomes aware of areas of improper exposure (such as when an automatic exposure algorithm is failing), the parameters of the automatic exposure algorithm (such as setting of program mode to "backlight", "high contrast", "sports mode" or the like) may be changed, or the automatic exposure may be overridden.

Television 340 may also be fitted with a focusing lens so that it may be focused to the same apparent depth as the real objects in front of the apparatus. A single manual focus adjustment may be used for both camera 330 and television 340 to adjust them both together. Alternatively, an autofocus camera 330 may control the focus of television 340. Similarly, if a varifocal or zoom camera is used, a varifocal lens in front of television 340 should be used, and should be linked to the camera lens, so that a single knob may be used to adjust the zoom setting for both.

The apparatus of Fig 4 may be calibrated by temporarily removing the polarizer, and then adjusting the focal length of the lens in front of television 340 to maximize video feedback for each zoom setting of camera 330. This process may be automated if desired, for example, using video feedback to generate a lookup table used in the calibration of a servo mechanism controlling the zoom and focus of television 340.

The entire apparatus is typically concealed in eyeglass frames in which the beam-splitter is either embedded in one or both glass lenses of the eyeglasses, or behind one or both lenses. In the case in which a monocular version of the apparatus is being used, the apparatus is built into one lens, and a dummy version of the beamsplitter portion of apparatus may be positioned in the other lens for visual symmetry. These beamsplitters may be integrated into the lenses in such a manner to have the appearance of ordinary lenses in ordinary bifocal eyeglasses. Moreover, magnification may be unobtrusively introduced by virtue of the bifocal characteristics of such eyeglasses.

Typically the entire eyeglass lens is tinted to match the density of the beamsplitter portion of the lens, so there is no visual discontinuity introduced by the beamsplitter.

Fig 5 depicts a foveated embodiment of the invention in which incoming light 500 and 501 is intercepted from the direct visual path through the eyeglasses and directed instead, by double-sided mirror 510 to beamsplitter 520. A portion of this light passes through beamsplitter 520 and is absorbed and quantified by wide-camera 530. A portion of this incoming light is also reflected by beamsplitter 520 and directed to narrow-camera 540. The image from the wide-camera 530 is displayed on a large screen television 550, typically of size 0.7 inches (approx. 18mm) on the diagonal, forming a wide-field-of-view image of virtual light 551 from the wide-camera. The image from the narrow-camera 540 is displayed on a small screen television 560, typically of screen size 1/4 inch (approx. 6mm) on the diagonal, forming a virtual image of the narrow-camera as virtual light 561.

Real rays of light in the periphery of the mediation zone formed by the apparatus emerge as virtual rays from television 550 only. For example, real ray 500 emerges as virtual ray 551.

Real rays near the central (foveal) region of the mediation zone emerge as virtual rays from both televisions (e.g. they also emerge as virtual rays from television 560). Television 560 subtends a smaller visual angle, and typically has the same total number of scanlines or same total number of pixels as television 550, so the image is sharper in the central (foveal) region. Thus television 560 is visually more dominant in that region, and the viewer can ignore television 550 in this region (e.g. the blurry image and the sharp image superimposed appear as a sharp image in the central region).

Thus, for example, unlike the real light ray 500 which emerges as virtual light from only one of the two televisions (from only television 550), the real light ray 501 emerges as virtual light from both televisions. Only one of the virtual rays collinear with real ray 501 is shown, in order to emphasize the fact that this virtual ray is

primarily associated with television 560 (hence the break between where the solid line 501 is diverted by mirror 510 and where the collinear portion continues after mirror 570). This portion of the dotted line between mirror 510 and mirror 570 that is collinear with real light ray 510 has been omitted to emphasize the visual dominance of television 560 over television 550 within the central (foveal) field of view,

In this foveal region, it is the virtual light from television 560 that is of interest, as this virtual light will be perceived as more pronounced, since the image of television 560 will be sharper (owing to its more closely packed pixel array or scanlines). Thus even though real light ray 501 emerges as two virtual rays, only one of these, 561, is shown: the one corresponding to television 560.

A smaller television screen is typically used to display the image from the narrow-camera in order to negate the increased magnification that the narrow-camera would otherwise provide, when equal magnification lenses are used for both. In this manner, there is no magnification, and both images appear as if the rays of light were passing through the apparatus, so that the virtual light rays align with the real light rays were they not intercepted by the double-sided mirror 510. Television 550 is viewed as a reflection in mirror 510, while television 560 is viewed as a reflection in beamsplitter 570. Note also that the distance between the two televisions 550 and 560 should equal the distance between double-sided mirror 510 and beamsplitter 570 as measured in a direction perpendicular to the optical axes of the cameras. In this way, the apparent distance to both televisions will be the same, so that the wearer experiences a view of the two televisions superimposed upon one-another in the same depth plane. Alternatively, the televisions may be equipped with lenses to adjust their magnifications so that the television displaying the image from the tele camera 540 subtends a smaller visual angle than the television displaying the image from wide camera 530, and so that these visual angles match the visual angles of the incoming rays of light 500. In this way, two television screens of equal size may be used, which simplifies manufacture of the apparatus. Typically, the entire apparatus is

built within the frames 590 of a pair of eyeglasses, where cameras 530 and 540, as well as televisions 550 and 560 are concealed within the frames 590 of the glasses, while double-sided mirror 510 and beamsplitter 570 are mounted in, behind, or in front of the lens of the eyeglasses. In some embodiments, mirror 510 is mounted to the front of the eyeglass lens, while beamsplitter 570 is mounted behind the lens. In other embodiments, one or both of mirror 510 and beamsplitter 570 are actually embedded in the glass of the eyeglass lens.

Two-sided mirror 510 may instead be a beamsplitter, or may be fully silvered in places (to make a partial beamsplitter and partial fully silvered two-sided mirror). For example, it may be silvered more densely in the center, where the visual acuity is higher, owing to the second television screen. It may also be feathered out, so that it slowly fades to totally transparent around the edges, so there is not an abrupt discontinuity between the real world view and the portion that has been replaced by virtual light. In this case, it is often desirable to insert the appropriate polarizer(s) to prevent video feedback around the edges, or to use appropriate polarizing beamsplitters, such as dichroic beamsplitter materials.

Fig 6 depicts an alternate embodiment of the wearable camera invention depicted in Fig 4 in which both the camera and television are concealed within the left temple side-piece of the eyeglass frames. A first beamsplitter 610 intercepts a portion of the incoming light and directs it to a second beamsplitter 620 where some of the incoming light is directed to camera 630 and some is wasted illuminating the television screen 640. However, the screen 640, when presented with a video signal from camera 630 (possibly after being processed by a body-worn computer, or remotely by way of wireless communications, or the like) directs light back through beamsplitter 620, where some is wasted but is absorbed by the eyeglass frame to ensure concealment of the apparatus, and some is directed to beamsplitter 610. Some of this light is directed away from the glasses and would be visible by others, and some is directed to the curved mirror 650 where it is magnified and directed back toward

beamsplitter 610. The portion that is reflected off of beamsplitter 610 is viewed by the wearer, while the portion that continues back toward beamsplitter 620 must be blocked by a polarizer 660 to prevent video feedback. Implicit in the use of polarizer 660 is the notion that the television produces a polarized output. This is true of LCD televisions which comprise a liquid crystal display between crossed polaroids. If the television is of a type that does not already produce a polarized output, an additional polarizer should be inserted in front of television 640. Finally, if it is desired that the apparatus be unobtrusive, an additional polarizer or polarizing beamsplitter should be used so that the television 640 is not visible to others by way of its reflection in beamsplitter 610. Beamsplitter 610 may, for example, be a dichroic cube beamsplitter that has polarization properties. Alternatively, in certain situations it may actually be desirable to make the display visible to others. For example when the system is used for conducting interviews, it might be desirable that the person being interviewed see himself or herself upon the screen. This may be facilitated by exposing beamsplitter 620 to view, or allowing the reflection of the television to be seen in beamsplitter 610. Alternatively, another television may be mounted to the glasses, facing outwards. Therefore, just as the wearer of an embodiment of the invention may see the image captured by the camera, along with additional information such as text of a teleprompter, the interviewee(s) may also be presented with an image of themselves so that they appear to be looking into an electronic mirror, or may be teleprompted by this outward-facing display, or both. In some embodiments of the invention, the use of two separate screens was useful for facilitation of an interview, in which the same image was presented to both the inward-facing television and the outward-facing television, but the images were mixed with different text. In this way the wearer was teleprompted with one stream of text, while the interviewee was prompted with a different stream of text.

While the optical elements of the camera system of the described embodiments are embedded in eyeglasses, equally these elements may be embedded in other headgear

such as a helmet.

The beamsplitter 415 of figure 4 and 610 of figure 6 could conveniently be implemented as a metallisation within a lens of the eyeglasses. These beamsplitters and diverging lens 250 of figure 2 may be embedded within the eyeglass lens below the main optical axis of the eye in its normal position so that the embedded elements may appear to be a feature of bifocal eyeglasses.

Fig 7 depicts a wearable camera system with automatic focus. While the system depicted in Fig 3 may operate with a fixed focus camera 330, so long as it has sufficient depth of field, there is still the question of at what focus depth television 340 will appear. Ideally the apparent depth of the display would match that of objects seen around the display, as represented by rays of light 311, 321, which are beyond two-sided mirror 315. This may be achieved if display medium 340 is such that it has nearly infinite depth of field, for example, by using a scanning laser ophthalmoscope (SLO), or other device which displays an image directly onto the retina of the eye, for display 340, or if display 340 were a holographic video display.

A lower-cost alternative is to use a variable focus display. The primary object(s) of interest, 700 are imaged by lens assembly 710 which is electronically focusable by way of a servo mechanism 720 linked to camera 730 to provide automatic focus. Automatic focus cameras are well known in the prior art, so the details of automatic focus mechanisms will not be explained here. A signal, 750, from the automatic focus camera is derived by way of reading out the position of the servo 720, and this signal 750 is conveyed to a display focus controller (viewfinder focus controller) 760. Viewfinder focus controller 760 drives, by way of focus control signal 770, a servo mechanism 780 which adjusts the focus of viewfinder optics 790. The arrangement of signals and control systems is such that the apparent depth of television screen 340 is the same as the apparent depth at which the primary object(s) of interest in the real scene would appear without the wearable camera apparatus.

Other objects, 701, located in different depth planes, will not be in focus in camera

730, and will thus appear blurry on screen 340. They may appear slightly misaligned with where they would have appeared in the absence of the wearable camera system. The degree of misalignment will depend on eye position — the misalignment may or may not be present, or may be quite small. However, because the objects are out of focus, and are not the primary details of the scene, a small possible misalignment will not be particularly objectionable to the wearer of the apparatus.

In this example, rays 310 and 311 are both in the depth plane of the central object of interest, so that there is no discontinuity between emergent virtual light 360 and real light 311. Thus there is no discontinuity in perceived depth at the leftmost edge of two-sided mirror 315. There is, however, a difference in depth between virtual ray 370 of real ray 320 and almost adjacent real ray 321, because virtual ray 370 is in the same depth plane as 310, 311, and 360, while real ray 321 is in a more distant depth plane owing to the more distant facing surface of objects 701. However, because the eye will be focused on the depth plane of 310, 311, and 360, ray 311 from the real world will be out of focus by virtue of the limited depth of focus of the human eye itself. Thus the real objects will appear blurry, and a discontinuity between these real objects and their blurry image on screen 340 will not be appreciably perceptible.

Fig 8 depicts an embodiment of the wearable camera system having a zoom lens. Rays of light, for example, rays 500 and 501, enter the wearable camera system and emerge from display 840 as virtual light rays 800 and 801 respectively. In this process of going from light input to virtual light output, two-sided mirror 510 serves to deflect light to autofocus camera 730. Autofocus camera 730 comprises lens 810 and servo mechanism 820 configured in such a manner as to function as a conventional automatic focus camera functions, except that there is, provided to the rest of the system, a signal 750 that indicates the focus setting of the camera 730 and its lens 810 as selected by the camera's control system and servo mechanism 820, and that the camera is also a zoom camera in which the zoom setting can be controlled remotely by zoom signal input 850. Zoom signal input 850 controls, by way of servo 820, the

relative position of various optical elements 810, so that, in addition to automatic focus, the camera can be given a desired focal length (field of view). The focus signal 750 goes into a focus and zoom controller 860 which accepts a zoom control signal input, 852, from the user, and directs this zoom control signal to the camera by way of signal 850, and also directs an appropriately processed version of this zoom control signal 851 to display controller 861. In this embodiment, display zoom is achieved as an electronic zoom. While camera zoom is achieved optically, display zoom is achieved electronically, by way of display controller 861 and display signal 870. The camera zooms in by adjustment of lens 810 for longer focal length, increasing the focal distance from the lens to the sensor array in camera 730, resulting in increased magnification. This increase in magnification is accompanied by a decrease, by operation of display controller 861, of the image size displayed on television 840. Television 840 may differ from television 340 (of FIG 7) in the sense that television 840 is optimized for display of resampled (electronically resized) images. This reduction in image size cancels out what would otherwise be an increase in magnification when zooming in with camera 730. It is this precisely controlled cancellation of any magnification that ensures that rays of light entering the apparatus are collinear with rays of virtual light emerging from the other side of the apparatus.

Fig. 9 depicts a stereo embodiment of the wearable camera system. An eyeglass frame comprising left temple side-piece 910 and right temple side-piece 911 contains two complete assemblies, 920 and 921, each one similar to the entire assembly depicted in Fig 7 or Fig 8.

Rays of light, for example, ray 320, enter the left eye assembly 920, and emerge as rays of virtual light, for example, 370. As a result, a focus of autofocus camera 730 results, by virtue of the main object of interest before assembly 920. The autofocus camera 730 includes a servo mechanism 720, and the control voltage that the camera feeds to this servo mechanism to keep the camera in focus is also sent outside assembly 920 to focus controller 930. Focus controller 930 drives camera 731 inside the right

eye assembly 921. Camera 731 is not an autofocus camera, but, instead is a remotely focusable camera. By remotely focusable, what is meant is that rather than having its servo mechanism 721 driven by the camera itself, as it hunts for best focus, the servo mechanism is instead driven by an external signal. This external signal comes from the camera 730 in the left eye assembly 920. The reason for not having two independently automatically focusing cameras is that it is desired that both cameras will focus in the same depth plane irrespective of slight errors that might be present in the focus of either one.

Focus controller 930 also sets the focus of both left and right viewfinders by controlling left viewfinder lens servo 780 and right viewfinder lens servo 781. Moreover, focus controller 930 sends a signal to vergence controller 940 which drives servo mechanism 950 to adjust the vergence of left eye assembly 920 and servo mechanism 951 to adjust the vergence of right eye assembly 921.

In this embodiment, the focus of both cameras, the focus of both displays, and the vergence of both assemblies are all controlled by the focus of the left camera, so that whatever object the left camera focuses itself onto, will define the depth plane perceived by both eyes looking at their respective displays. This depth plane will also correspond to the vergence of the displays, so that depth and disparity will match at all times.

Fig. 10 depicts the left eye portion of an embodiment of the wearable camera system where the camera focus and vergence are driven by the output of an eyetracker. Eyetracker assembly 1010 (comprising camera and infrared light sources) illuminates and observes the eyeball by way of rays of light 1011 that partially reflect off beamsplitter 1020. Beamsplitter 1020 also allows the wearer to see straight through to mirror 315 and thus see virtual light from viewfinder 340. The eyetracker 1010 reports the direction of eye gaze and conveys this information as a signal 1012 to eye tracker processor 1030 which converts this direction into "X" and "Y" coordinates that correspond to the screen coordinates of viewfinder screen 340. These "X" and

“Y” coordinates, which are expressed as signal 1031, indicate where on the viewfinder screen 340 the wearer is looking. Signal 1031 and the video output 1032 of camera 730 are both passed to focus analyzer 1040. Focus analyzer 1040 selects a portion of the video signal 1032 in the neighbourhood around the coordinates specified by signal 1031. In this way, focus analyzer 1040 ignores video except in the vicinity of where the wearer of the apparatus is looking. Because the coordinates of the camera match the coordinates of the display (by way of the virtual light principle), the portion of video analyzed by focus analyzer 1040 corresponds to where the wearer is looking. The focus analyzer 1040 examines the high-frequency content of the video in the neighbourhood of where the wearer is looking, to derive an estimate of how well focused that portion of the picture is. This degree of focus is conveyed by way of focus sharpness signal 1041 to focus controller 1050 which drives, by way of focus signal 1051, the servo mechanism 720 of camera 730. Focus controller 1050 is such that it causes the servo mechanism 720 to hunt around until it sharpness signal 1041 reaches a global or local maximum.

The focus analyzer 1040 and focus controller 1050 thus create a feedback control system around camera 730 so that it tends to focus on whatever object(s) is (are) in the vicinity of camera and screen coordinates 1031. Thus camera 730 acts as an automatic focus camera, but instead of always focusing on whatever is in the center of its viewfinder, it focuses on whatever is being looked at by the left eye of the wearer.

In addition to driving the focus of the left camera 730, focus controller 1050 also provides a control voltage 1052 identical to the control voltage of 1051. Control signal 1052 drives servo mechanism 780 of lens 790, so that the apparent depth of the entire screen 340 appears focused at the same depth as whatever object the wearer is looking at. In this way, all objects in the viewfinder appear in the depth plane of the one the wearer is looking at.

Focus controller 1050 provides further control voltages, 1053 and 1054 for the right eye camera and right eye viewfinder, where these signals 1053 and 1054 are identical

to that of 1051. Moreover, focus controller 1050 provides the same control voltage to the vergence controller 940 so that it can provide the control signal to angle the left and right assemblies inward by the correct amount, so that all focus and vergence controls are based on the depth of the object the left eye is looking at. It is assumed left and right eyes are looking at the same object, as is normal for any properly functioning human visual system.

In other embodiments of the invention, it may be desired to know which object is of interest when there are multiple objects in the same direction of gaze, as might happen when the wearer is looking through a dirty glass window. In this case there are three possible objects of interest: the object beyond the window, the object reflected in the glass, and the dirt on the window. All three may be at different depth planes but in the same gaze direction.

An embodiment of the wearable camera system with a human-driven autofocus camera (e.g. driven by eye focus), could be made from an eye tracker that would measure the focus of the wearer's left eye. Preferably, however, two eyetrackers may be used, one on the left eye, and one on the right eye, in order to attempt to independently track each eye, and attempt to obtain a better estimate of the desired focus by way of the vergence of the wearer's eyes.

A reality window manager (RWM), similar to that depicted in Fig 1c and Fig 1d, may also be driven by the eyetracker, so that there can be an independent head position (framing) and cursor position (where looking), rather than always having the cursor in the center of the viewfinder. This arrangement would also facilitate movement of the cursor without moving the head, which may reduce head movements that appear unnatural to others watching the user of the wearable camera system.

The apparatus of this invention allows the wearer to experience the camera over a long period of time. For example, after wearing the apparatus sixteen hours per day for several weeks, it begins to function as a true extension of the mind and body. In this way, photographic composition is much more optimal, because the act

of taking pictures or shooting video no longer requires conscious thought or effort. Moreover, the intentionality of the picture-taking process is not evident to others, because picture-taking is not preceeded by a gesture such as holding a viewfinder object up to the eye. The wearable viewfinder is an important element of the wearable camera invention allowing the wearer to experience everyday life through a screen, and therefore be always ready to capture anything that might happen, or even anything that might have happened previously by virtue of the retroactive record capability of the invention. Moreover, additional information beyond just exposure and shutter speed may be displayed in the camera viewfinder. For example, the camera allows the wearer to augment, diminish, or otherwise alter his or her perception of visual reality. This mediated-reality experience may be shared. The wearer may allow others to alter his or her perception of reality. In this way the invention is useful as a new communications medium, in the context of collaborative photography, collaborative videography, and telepresence. Moreover, the invention may perform other useful tasks such as functioning as a personal safety device and crime deterrent by virtue of its ability to maintain a video diary transmitted and recorded at multiple remote locations. As a tool for photojournalists and reporters, the invention has clear advantages over other competing technologies.

From the foregoing description, it will thus be evident that the present invention provides a design for a wearable camera with a viewfinder. As various changes can be made in the above embodiments and operating methods without departing from the spirit or scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings should be interpreted as illustrative and not in a limiting sense.

Variations or modifications to the design and construction of this invention, within the scope of the invention, may occur to those skilled in the art upon reviewing the disclosure herein. Such variations or modifications, if within the spirit of this invention, are intended to be encompassed within the scope of any claims to patent

protection issuing upon this invention.

WHAT IS CLAIMED IS:

1. Camera bearing headgear, comprising:
 - an electronic camera borne by said headgear;
 - an electronic display responsive to an electronic output from said electronic camera, said electronic display borne by said headgear for providing a viewfinder for said electronic camera.
2. The headgear of claim 1 including optics for directing light emitted from said electronic display to an eye of a wearer of said headgear.
3. The headgear of claim 2 wherein said electronic camera comprises a first camera and wherein said headgear further includes an electronic second camera borne by said headgear, one of said first camera and said second camera comprising a wide angle camera and another of said first camera and said second camera comprising a narrow angle camera.
4. The headgear of claim 2 wherein said electronic camera comprises a narrow angle camera and wherein said headgear further includes an electronic wide angle camera borne by said headgear, and wherein said electronic display is responsive to an output from said narrow angle camera for providing a viewfinder for said narrow angle camera and said wide angle camera.

5. The headgear of claim 2 wherein said electronic camera comprises a wide angle camera and wherein said headgear further includes an electronic narrow angle camera borne by said headgear, and wherein said electronic display is a first electronic display and including a second electronic display responsive to an output of said narrow angle camera and including optics for directing light emitted from said second electronic display to said eye of said wearer in order to provide a viewfinder for said narrow angle camera.
6. The headgear of claim 3 wherein said optics is first optics and including second optics directing incoming light so that a center of a field of view of said first camera is collinear with a center of a field of view of said second camera.
7. The headgear of claim 6 wherein said second optics comprises a beamsplitter.
8. The headgear of claim 7 wherein said second optics further comprises a mirror directing incoming light to said beamsplitter.
9. The headgear of claim 2 wherein said optics comprises at least one mirror.
10. The headgear of claim 4 wherein said optics comprises at least one mirror for directing light from said electronic display to a beamsplitter in front of an eye of a wearer.
11. The headgear of claim 1 including optics arranged for diverting light which would otherwise enter an eye of a wearer to said camera and for diverting light emitted from said

display to said eye of a wearer such that diverted light from said display is collinear with said light which would otherwise enter said eye of said wearer.

12. The headgear of claim 11 wherein said camera and said display are opposite one another so as to have aligned optical axes and said optics comprises an optical element positioned so as to be in front of an eye of a wearer and between said camera and said electronic display.

13. The headgear of claim 12 wherein said optical element comprises a two-sided mirror making a 45° angle with said optical axes.

14. The headgear of claim 12 wherein said optical element comprises a beamsplitter making a 45° angle with said optical axes and wherein said electronic display incorporates a polarizer and wherein said headgear includes a further polarizer in front of said camera oriented to block polarized light emitted by said display.

15. The headgear of claim 11 wherein said optics comprises a mirror and including a beamsplitter, said beamsplitter positioned between said mirror and an eye of a wearer.

16. The headgear of claim 15 wherein said beamsplitter comprises a first beamsplitter, an optical axis of said camera is perpendicular to an optical axis of said display, and said electronic display incorporates a polarizer and including

a second beamsplitter interposed along said optical axes and making a 45° angle with

said optical axes;

a polarizer in front of said camera oriented to block polarised light emitted by said display.

17. The headgear of claim 4 further including head tracking means input with an electronic output signal of said wide angle camera.

18. The headgear of claim 17 including a processor for providing a reality window manager, said processor outputting to said electronic display such that said display provides a virtual window as well as providing a viewfinder for said narrow-angle electronic camera.

19. The headgear of claim 1 further comprising means for (i) directing incoming rays of light that would enter an eye of a user in an absence of said means into said camera and (ii) directing rays of light emitted from said display into said eye of a user, each directed emitted ray of light being approximately collinear with an incoming ray of light from which said each directed emitted ray of light was derived, prior to direction of said incoming ray of light into said camera.

20. The headgear of claim 9 where said at least one mirror is a two sided mirror.

21. The headgear of claim 20 where said mirror comprises a flat transparent surface with a metallic coating on one side, and where said one side faces toward said camera.

22. The headgear of claim 11 where said optics includes a beamsplitter and where said optics further includes a concave reflective material discontinuity.

23. The headgear of claim 11 where said optics includes a beamsplitter and where light emitted from said display passes through said beamsplitter at least once before travelling away from said beamsplitter and then back toward said beamsplitter and being reflected off of said beamsplitter toward an eye of said wearer.

24. The headgear of claim 23 where said display includes a polarizer.

25. The headgear of claim 23 where said display beamsplitter comprises a dichroic beamsplitter which has polarization properties.

26. Camera bearing eyeglasses comprising:

an electronic camera borne by said eyeglasses;

an electronic display responsive to an electronic output from said electronic camera, said electronic display borne by said eyeglasses for providing a viewfinder for said electronic camera.

27. The eyeglasses of claim 26 including optics for directing light emitted from said electronic display to an eye of a wearer of said eyeglasses.

28. The eyeglasses of claim 26 including optics arranged for diverting light which would

otherwise enter an eye of a wearer to said camera and for diverting light emitted from said display to said eye of a wearer such that said diverted light from said display is collinear with said light which would otherwise enter said eye of said user.

29. The eyeglasses of claim 28 wherein said optics comprises a beamsplitter implemented as a metallisation of a lens of said eyeglasses.

30. The headgear of claim 1 including a transmitter for transmitting camera signals.

31. The headgear of claim 1 wherein said headgear comprises eyeglasses having a safety strap said strap receiving an output wire from said camera and including a body pack receiving a recorder fed with said camera output wire from said strap.

32. Camera bearing headgear, comprising:

an electronic camera borne by said headgear;

an electronic display borne by said headgear;

a processor connected to an output of said camera and to an input of said electronic display.

33. The headgear of claim 32 including optics arranged for diverting light which would otherwise enter an eye of a wearer to said camera and for diverting light emitted from said display to said eye of a wearer such that said diverted light from said display is collinear with said light which would otherwise enter said eye of said wearer.

34. The headgear of claim 32 wherein said processor comprises a computer wirelessly connected to a computer network.

35. The headgear of claim 32 wherein said headgear comprises eyeglasses having a safety strap said strap receiving an output wire from said camera and including a body pack receiving a recorder fed with said camera output wire from said strap.

36. The headgear of claim 32 where said processor comprises a vision analysis processor and a graphics synthesis processor.

37. The headgear of claim 36 where said processor includes means for compensating for parallax between said camera and said display.

38. The headgear of claim 36 where said processor means for compensating for parallax between said camera and said display includes a machine vision process, and a computer graphics rendering process.

39. The headgear of claim 32 further including head tracking means input with an electronic output signal of said wide angle camera.

40. The headgear of claim 39 including a processor for providing a reality window manager, said processor outputting to said electronic display such that said display provides a virtual window as well as providing a viewfinder for said electronic camera.

41. Camera bearing headgear comprising:

an electronic camera borne by said headgear;

an electronic display borne by said headgear;

optics arranged for diverting light which would otherwise enter an eye of a wearer to said camera and for diverting light emitted from said display to said eye of a wearer such that said diverted light from said display is collinear with said light which would otherwise enter said eye of said wearer.

42. The headgear of claim 40 further including a focusable camera and focusable display means where said focusable camera and focusable display means are such that they may be operated by a single control that focuses real light going to said camera and virtual light coming from said display onto the same depth plane.

43. The headgear of claim 41 further including a camera with zoom and display means with zoom where a zoom setting of both said camera and said display means may be operated by a single control so that a virtual light principle is maintained for all zoom settings.

44. The headgear of claim 41 further including an autofocus camera and remotely focusable display means where said autofocus camera drives a focus of said focusable display means.

45. The headgear of claim 41 where said camera is a left camera, said display is a left display, and said optics are left optics, and further including a right camera, right display, and right optics, similarly arranged, except that one of said cameras is an automatic focus

camera and the other is a remotely focusable camera, where said automatic focus camera provides a focus output to said remotely focusable camera.

46. The headgear of claim 45 where said left display and said right display are remotely focusable displays and where said automatic camera also provides outputs to focus both of said remotely focusable displays onto the same depth plane as an object onto which said automatic focus camera is focussed.

47. The headgear of claim 46 where said automatic focus camera also provides a signal to automatically adjust vergence of at least said cameras so that their optical axes intersect in the vicinity of an object to which they are focussed.

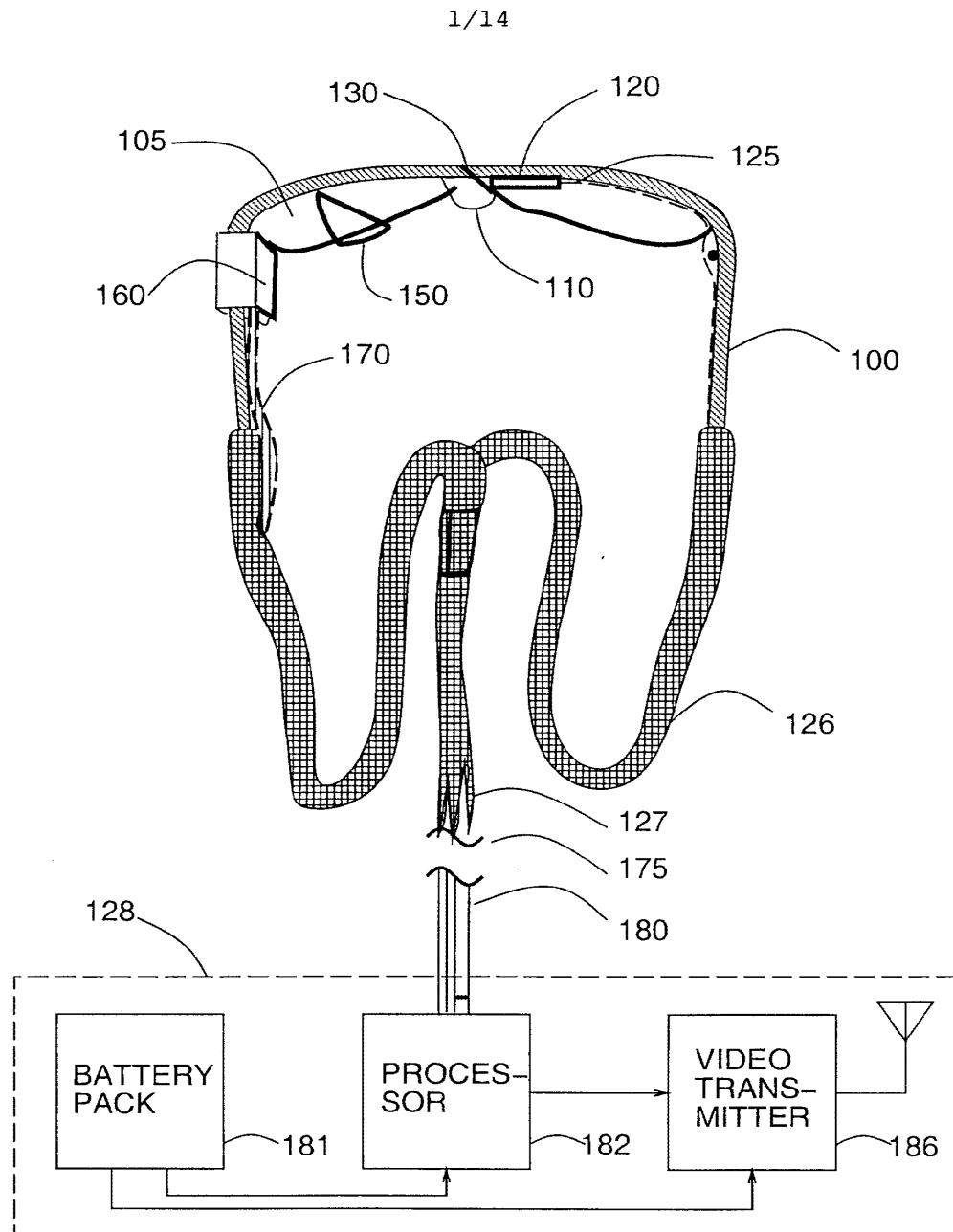


FIG. 1 – FOVEATED EMBODIMENT OF WEARABLE CAMERA SYSTEM

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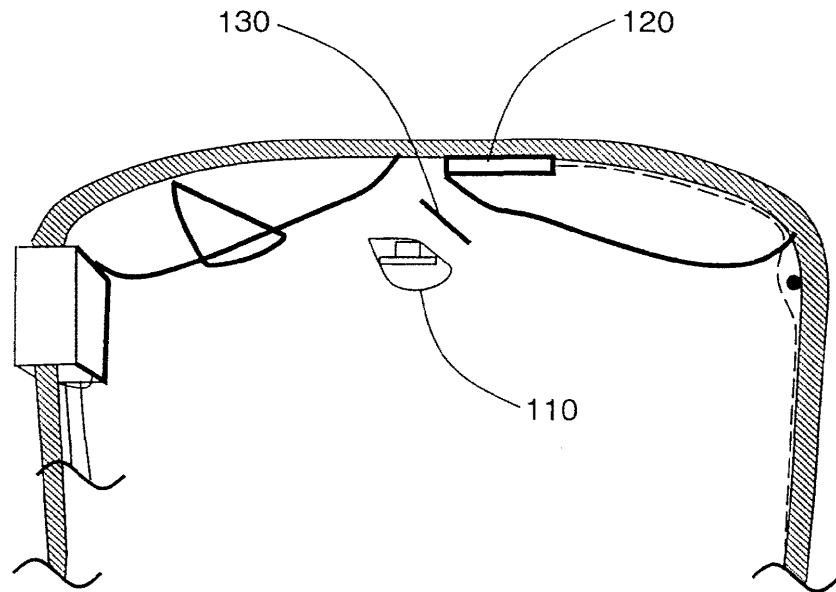


FIG. 1a – FOVEATED EMBODIMENT OF WEARABLE
CAMERA SYSTEM – DETAIL OF BEAMSPLITTER

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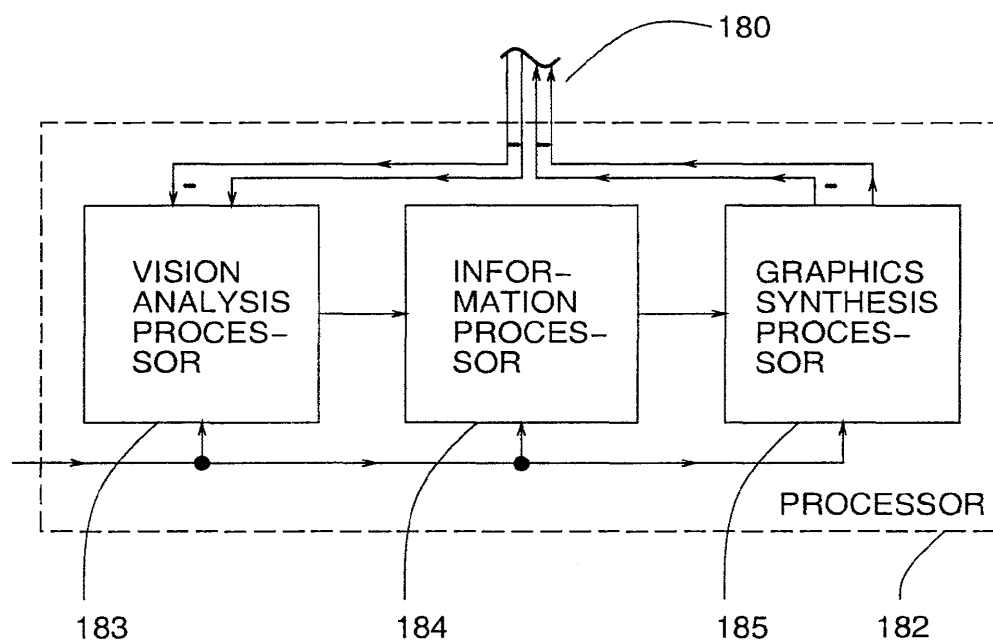


FIG. 1b - FOVEATED EMBODIMENT OF WEARABLE CAMERA SYSTEM - DETAIL OF PROCESSOR

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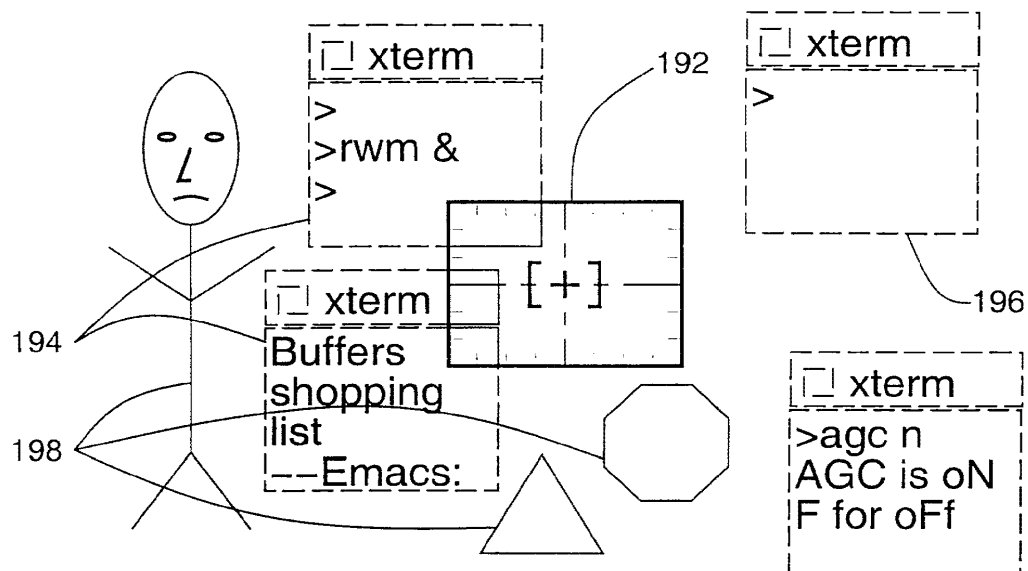


FIG. 1c - FOVEATED EMBODIMENT OF WEARABLE CAMERA SYSTEM - AS SEEN WHILE LOOKING THROUGH VIEWFINDER

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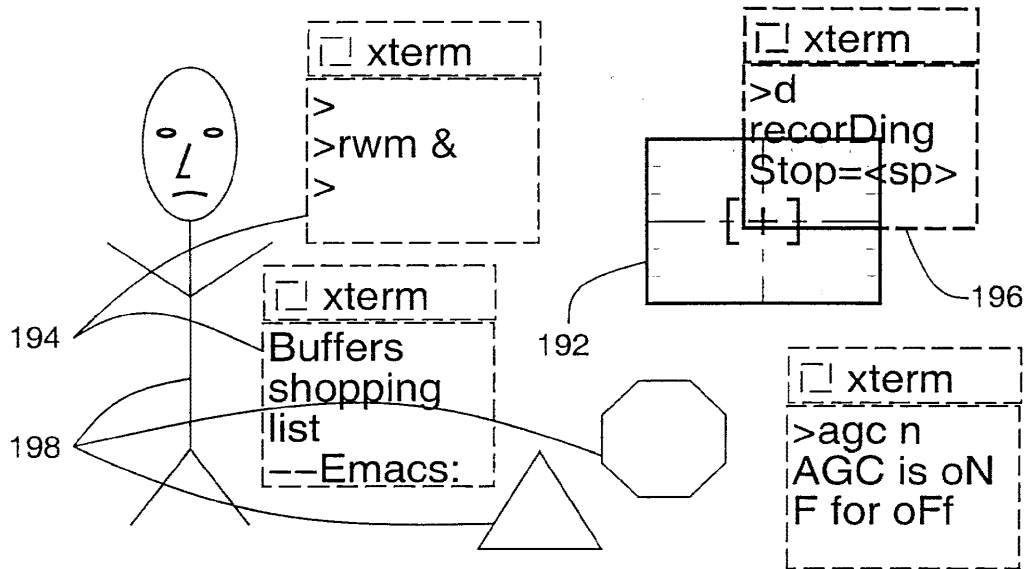


FIG. 1d - FOVEATED EMBODIMENT OF WEARABLE CAMERA SYSTEM - AS SEEN WHILE LOOKING THROUGH VIEWFINDER

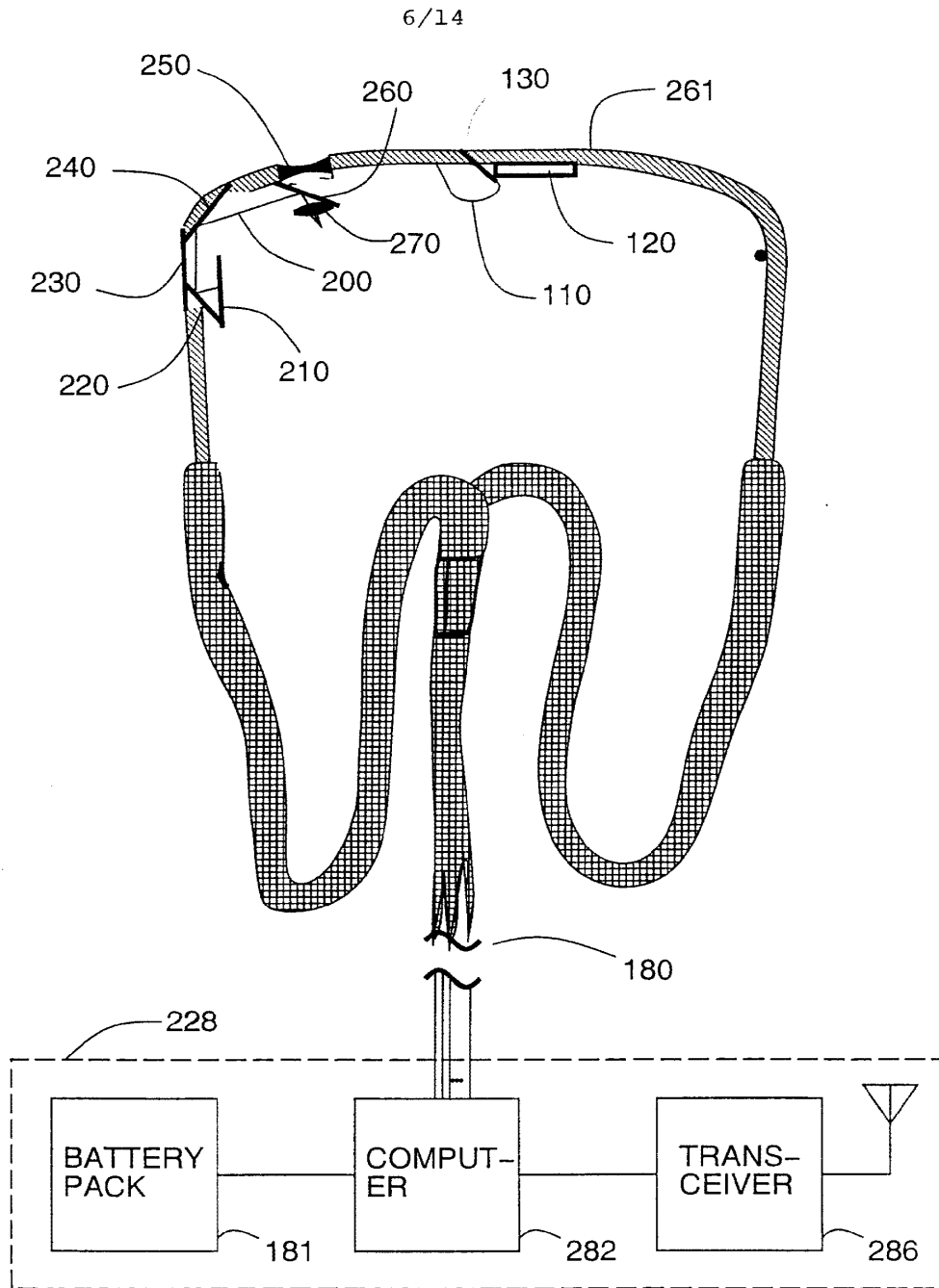


FIG. 2 - EMBODIMENT OF WEARABLE CAMERA SYSTEM
WITH BOTH EYES VISIBLE TO OTHERS

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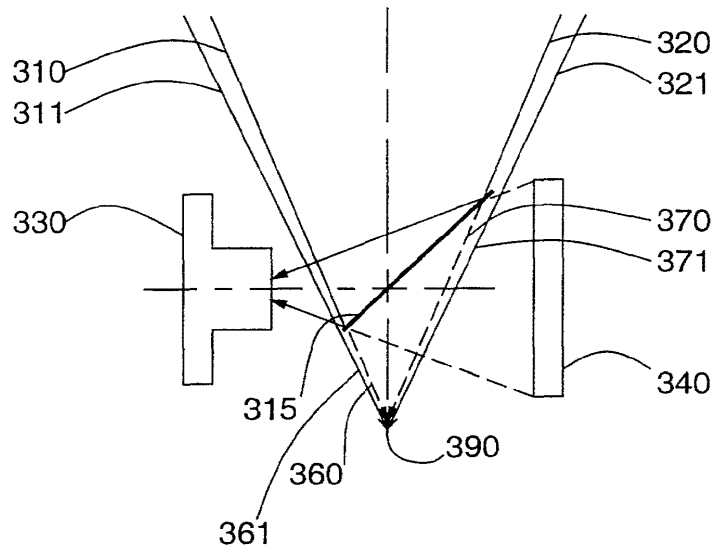


FIG. 3 - VIRTUAL LIGHT

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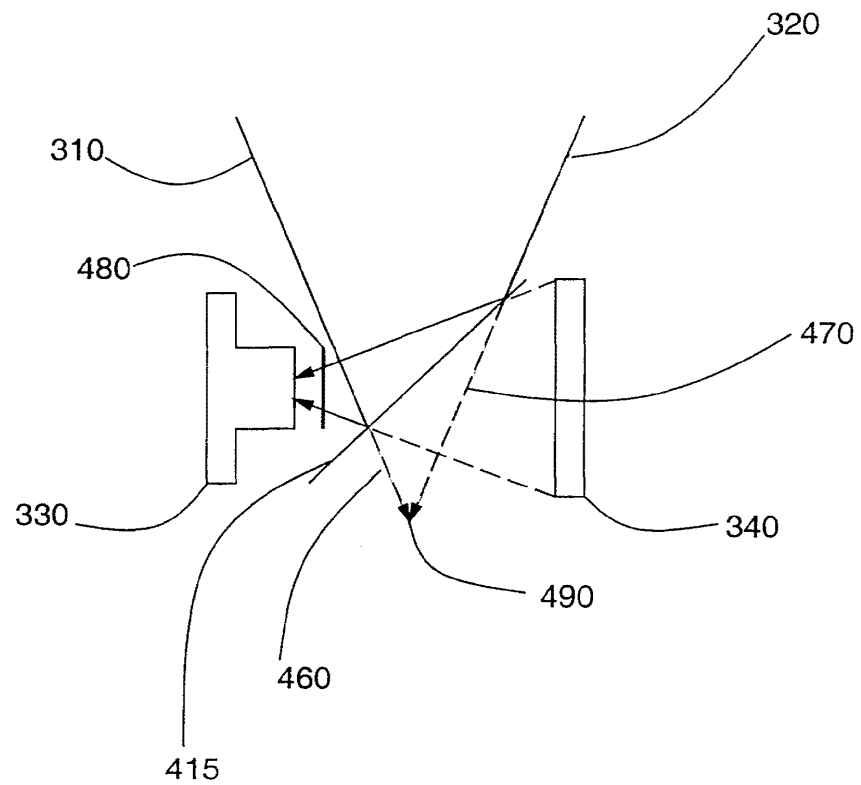


FIG. 4 - PARTIAL VIRTUAL LIGHT WITH VIDEO FEEDBACK PREVENTION MEANS

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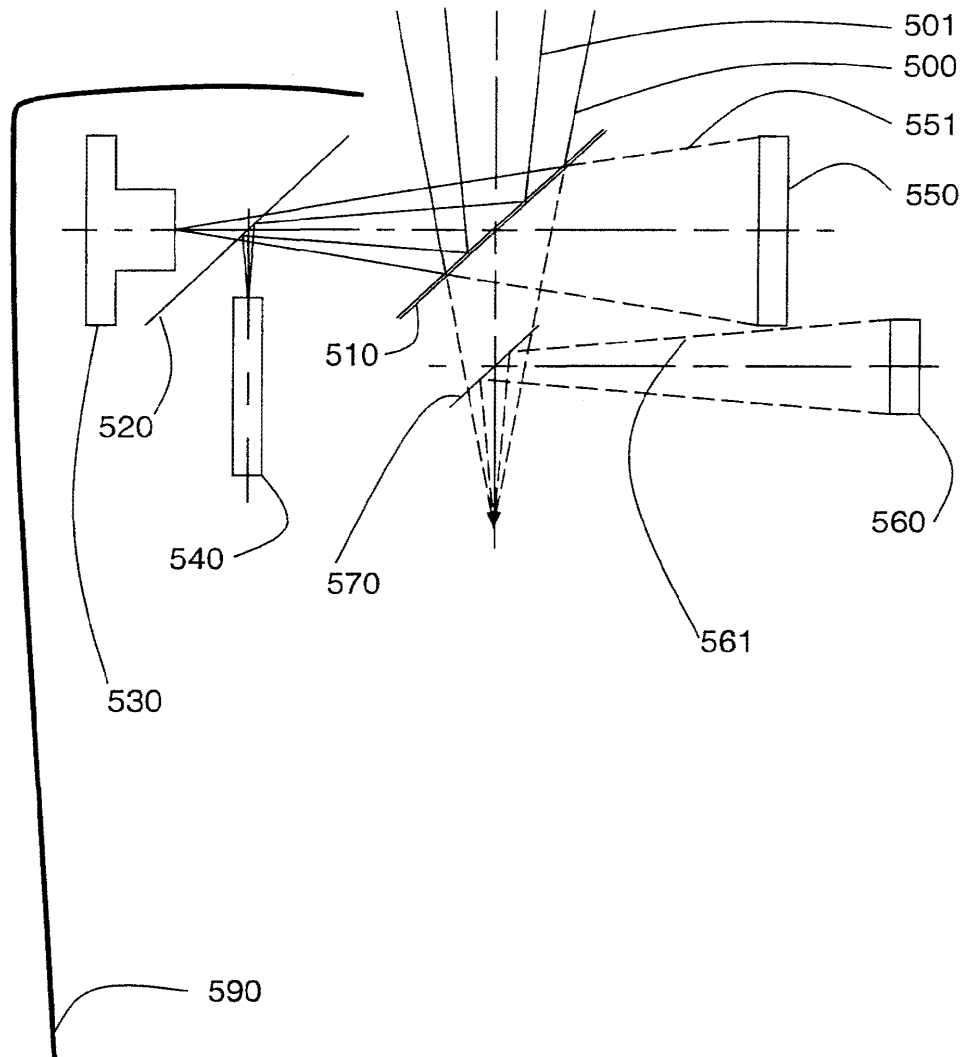


FIG. 5 - FOVEATED WEARABLE CAMERA WITH FOVEATED VIEWFINDER MEANS

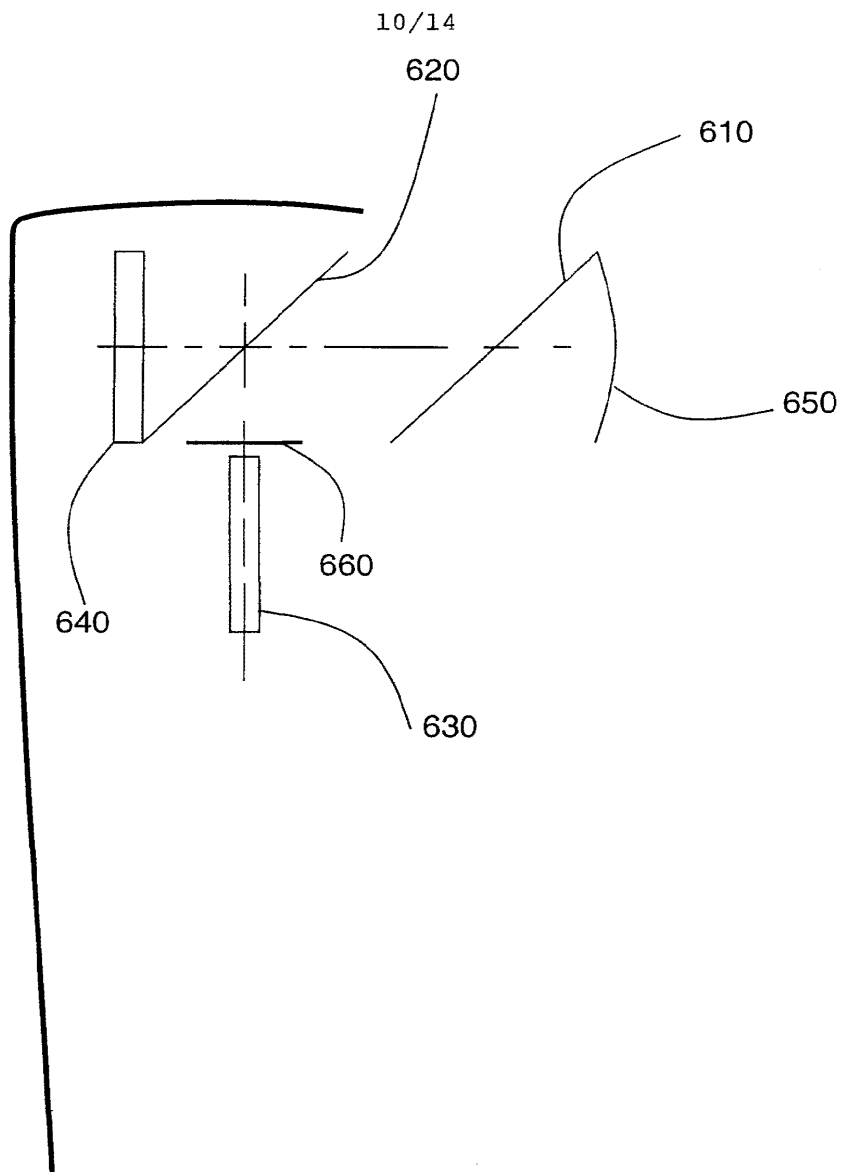


FIG. 6 – WEARABLE CAMERA SYSTEM WITH VIEWFINDER ALLOWING OTHERS TO SEE BOTH OF WEARER'S EYES

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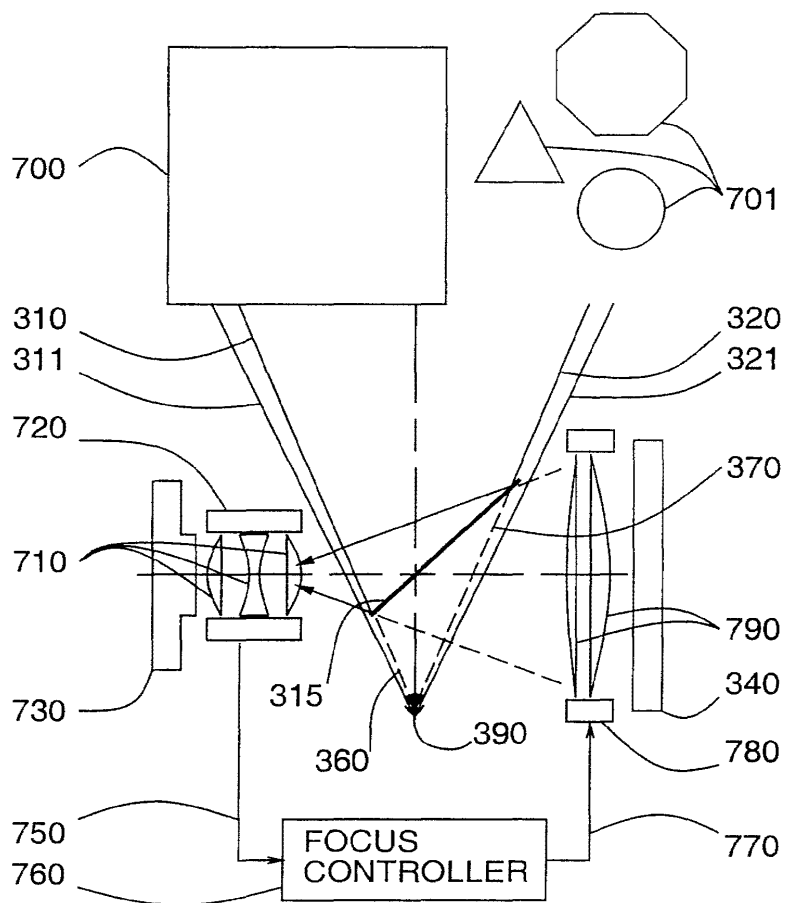


FIG. 7 – VIRTUAL LIGHT WITH FOCUS COUPLING

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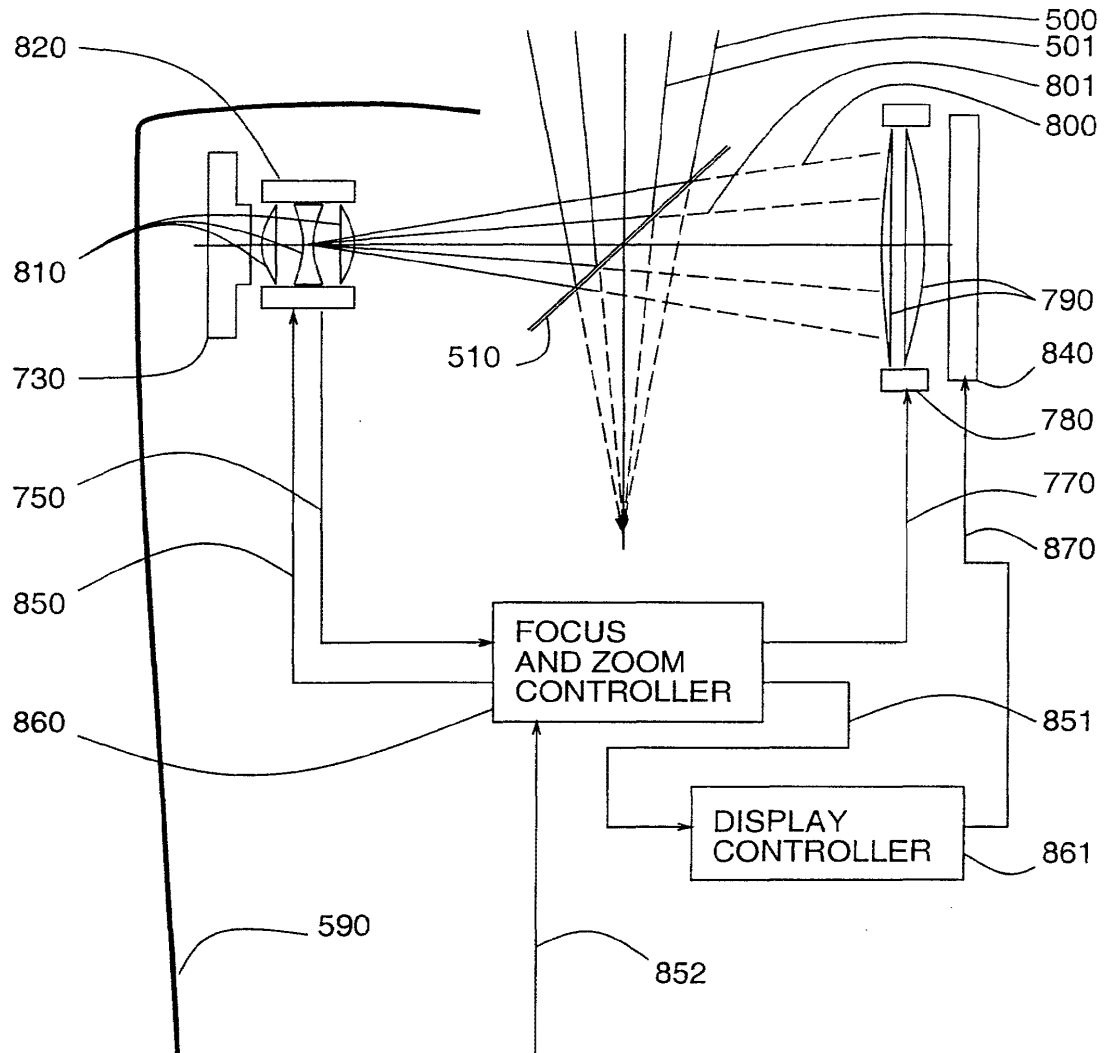


FIG. 8 - WEARABLE CAMERA SYSTEM WITH ZOOM LENS

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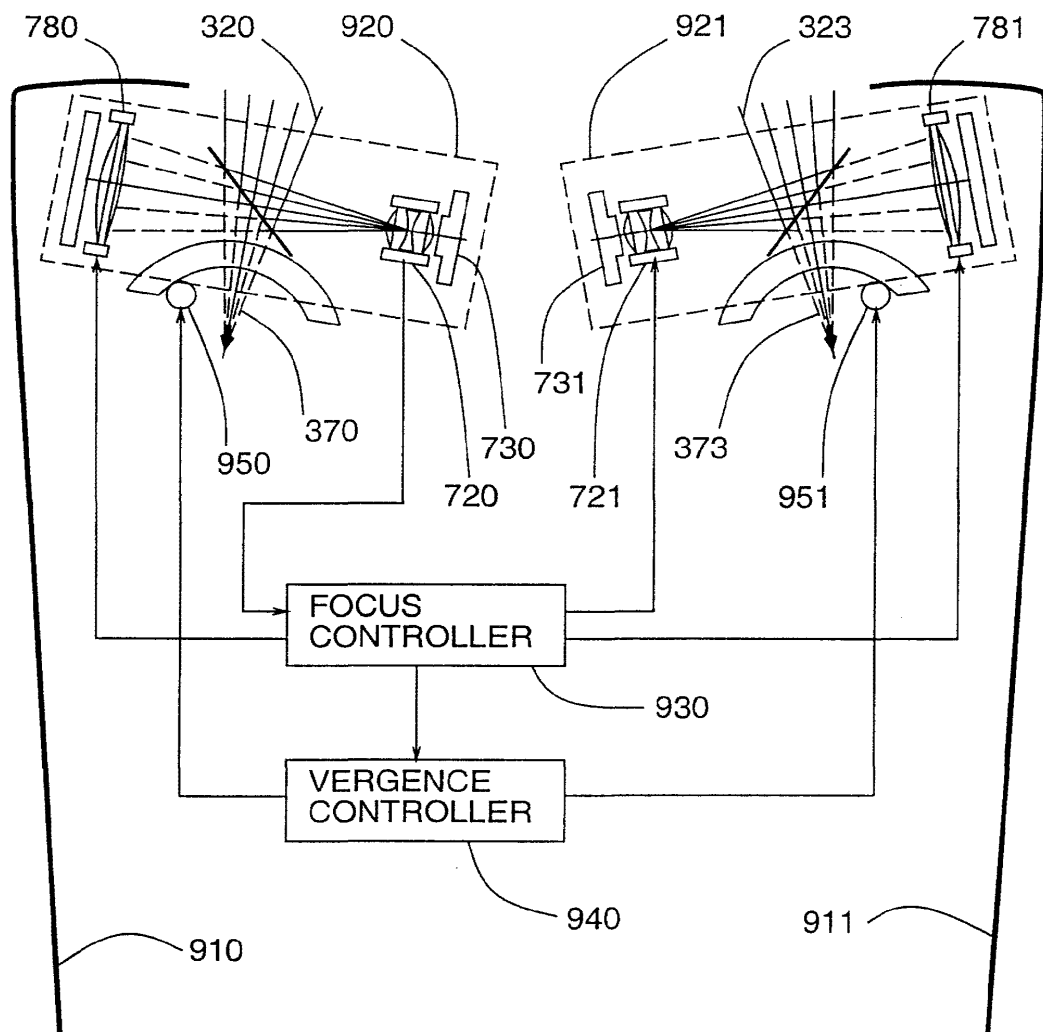


FIG. 9 – STEREO WEARABLE CAMERA SYSTEM

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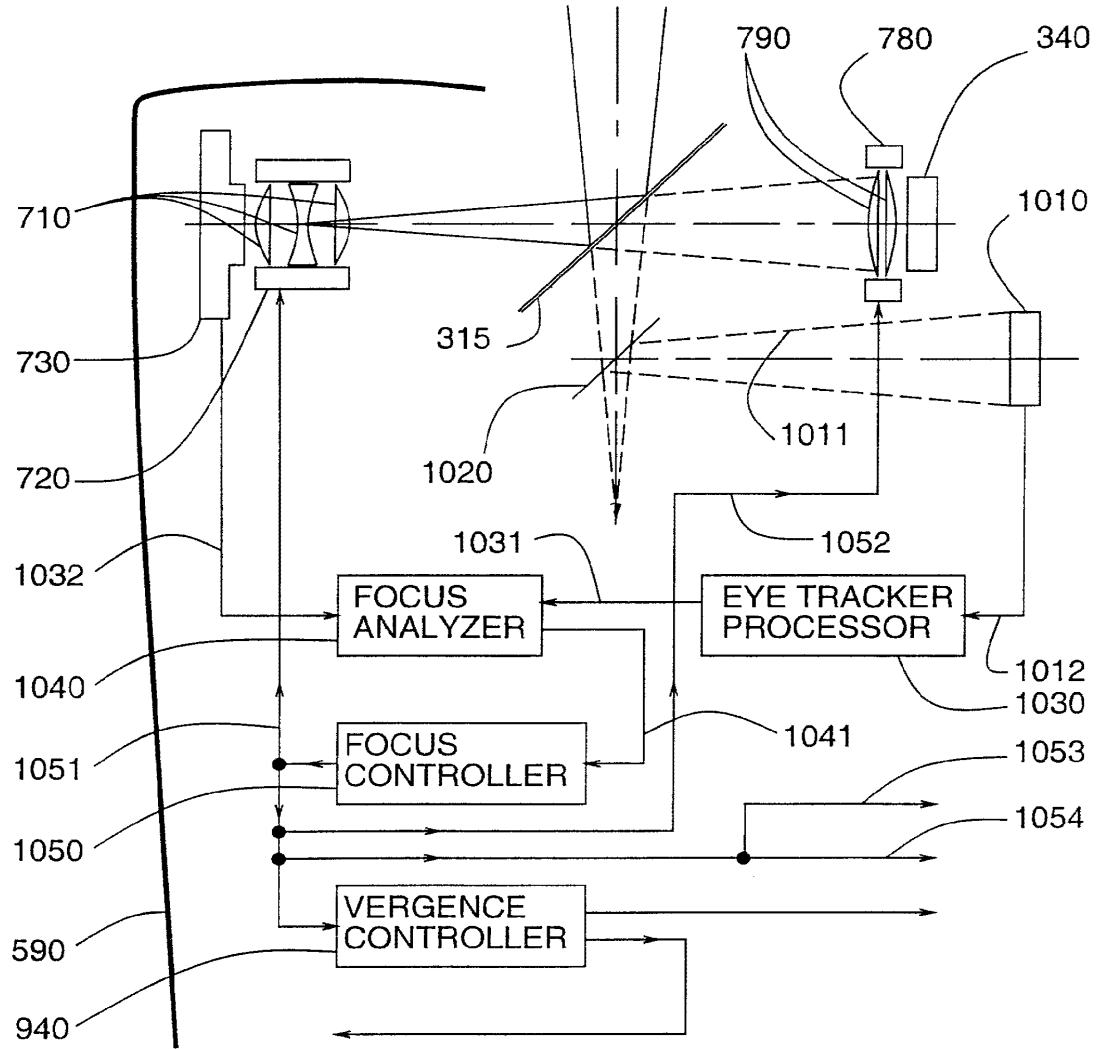


FIG. 10 - WEARABLE CAMERA SYSTEM WITH AUTOFOCUS AND VERGENCE DRIVEN BY EYETRACKER

INTERNATIONAL SEARCH REPORT

Inter national Application No
PCT/CA 99/00249

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N5/232 G06F1/16

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)
IPC 6 H04N G06F

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 786 966 A (FALLSTROM ROBERT D ET AL) 22 November 1988	1,2,9, 26,27,30
Y	see column 3, line 44 - column 8, line 31	4,5,19, 31
Y	DE 44 36 528 A (LIXFELD WOLF DIETER) 25 April 1996	4,10,17
Y	WO 96 36271 A (LEICA AG ;STUETTTLER HERBERT M (AT)) 21 November 1996	5
Y	WO 97 34411 A (FRASER VOLPE CORP ;VOLPE JOSEPH B (US)) 18 September 1997	11-13, 28,33,34
	see page 17, line 13 - page 19	
	see page 6, line 21 - page 8, line 5	
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"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

2 July 1999

Date of mailing of the international search report

09/07/1999

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Authorized officer

Materne, A

INTERNATIONAL SEARCH REPORT

Intel onal Application No
PCT/CA 99/00249

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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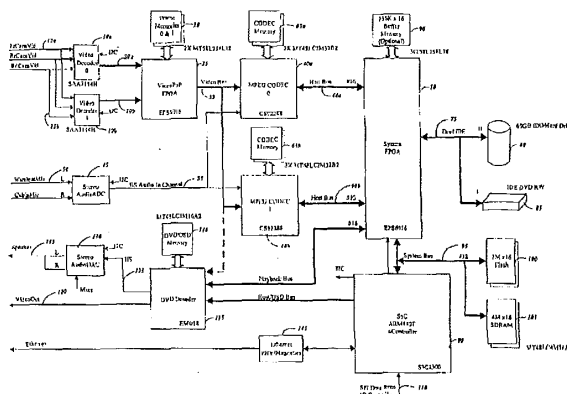
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- (57) Abstract: A data-encoding system includes a source of unencoded data, and a first encoder interoperably coupled to the source, wherein the first encoder is adapted to receive the unencoded data, encode the unencoded data, and output encoded data at a first data rate. The data encoding system further includes a second encoder interoperably coupled to the source, wherein the second encoder is adapted to receive the unencoded data, encode the unencoded data, and output encoded data at a second data rate in which the second data rate exceeds the first data rate. This Abstract is provided to comply with rules requiring an Abstract that allows a searcher or other reader to quickly ascertain subject matter of the technical disclosure. This Abstract is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims.

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**METHOD OF AND SYSTEM FOR MOBILE SURVEILLANCE
AND EVENT RECORDING**

CROSS-REFERENCE TO RELATED APPLICATIONS

[001] This patent application claims priority from, and incorporates by reference the entire disclosure of, U.S. Provisional Patent Application No. 60/617,988, filed on October 12, 2004.

BACKGROUND OF THE INVENTION

[002] This invention is directed to a video surveillance system, and in particular, by way of example and not limitation, to a video surveillance system adapted to be mounted in a law enforcement vehicle for producing a permanent digital evidentiary record, on a multi-media disc, of a traffic stop or other event and incidents occurring after a suspect's vehicle has been stopped.

[003] In law enforcement, a reliable witness that is incapable of perjury is needed to substantiate actions taken by a law enforcement officer and to protect the officer against false allegations by persons involved in an incident. An excellent witness of this type is a video recording of the incident, now widely used in traffic stops and criminal investigations, which can be reviewed after the incident and archived. By recording the incident first-hand as it actually happens, video recordings serve to eliminate conflicting individual interpretations of the incident and facilitate effective and efficient law enforcement.

[004] Vehicle-mounted video cameras to make video records of an incident or scene external to the law enforcement vehicle are well known in the art. For example, U.S. Pat. No. 4,949,186 to Peterson discloses a vehicle-mounted system in which a video-cassette recorder is housed in a vault located in the trunk of a patrol car. U.S. Pat. No. 5,677,979 to Squicciarini et al discloses a video surveillance system which integrates the outputs of a video camera, a radar unit, a remote control, and a wireless microphone to produce a comprehensive video recording of an incident from its beginning to the end. This system also uses a video cassette recorder to capture the incident on videotape. However, VHS and digital video tapes are bulky, requiring considerable space for storage, are susceptible to damage, and degrade over time. Additionally, the data on tapes may only be accessed sequentially.

SUMMARY OF THE INVENTION

[005] A video-data chapter segmentation method includes monitoring for at least one external start trigger, and responsive to detection of at least one of the at least one external start trigger, creating a chapter start point at a point in the video data corresponding to a specified time preceding the at least one detected external start trigger. The method further includes initiating recording of the video data beginning at the point in the video data and monitoring for at least one stop trigger. The method still further includes responsive to detection of at least one of the at least one stop trigger, creating a chapter stop point at a point in the data corresponding to a specified time preceding the at least one detected stop trigger.

[006] A video-data chapter segmentation computer system includes a processor and a memory. The memory includes software instructions adapted to enable the computer system to perform the steps of monitoring for at least one external start trigger, and responsive to detection of at least one of the at least one external start trigger, creating a chapter start point at a point in the video data corresponding to a specified time preceding the at least one detected external start trigger. The software instructions are further adapted to enable the computer system to perform the steps of initiating recording of the video data beginning at the point in the video data, monitoring for at least one stop trigger, and responsive to detection of at least one of the at least one stop trigger, creating a chapter stop point at a point in the data corresponding to a specified time preceding the at least one detected stop trigger.

[007] A data-encoding system includes a source of unencoded data, and a first encoder interoperably coupled to the source, wherein the first encoder is adapted to receive the unencoded data, encode the unencoded data, and output encoded data at a first data rate. The data encoding system further includes a second encoder interoperably coupled to the source, wherein the second encoder is adapted to receive the unencoded data, encode the unencoded data, and output encoded data at a second data rate in which the second data rate exceeds the first data rate.

[008] A data-encoding method includes a first encoder interoperably coupled to a source of unencoded data receiving the unencoded data, encoding the unencoded data, and outputting encoded data at a first data rate. The method further includes a second encoder interoperably coupled to the source receiving the unencoded data, encoding the unencoded data, and outputting encoded data at a second data rate, wherein the second data rate exceeds the first data rate.

[009] A data-overflow-handling method includes storing at least one of captured audio data, video data, and metadata to a first directory of a non-removable data storage medium, and determining whether an event is being recorded. The method further includes responsive to a determination that an event is being recorded, storing an image of the stored at least one of captured audio data, video data, and metadata to a second directory of the non-removable data storage medium. The method still further includes determining whether a predefined capacity threshold relative to a removable data storage medium has been exceeded, and responsive to a determination that the predefined capacity threshold has been exceeded, creating a third directory of the non-removable data storage medium. The method still further includes determining whether data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium, and responsive to a determination that data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium, storing any unstored data in the second directory to the removable data storage medium. The method further includes determining whether the second directory contains finalization files, and responsive to a determination that the second directory contains finalization files, finalizing the removable storage medium and providing a prompt to insert another removable storage medium. The method still further includes responsive to a determination that the second directory contains no finalization files, returning to the step of determining whether data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium.

[0010] A data-overflow-handling computer system includes a processor and a memory. The memory includes software instructions adapted to enable the computer system to perform the steps of storing at least one of captured audio data, video data, and metadata to a first directory of a non-removable data storage medium, determining whether an event is being recorded, and responsive to a determination that an event is being recorded, storing an image of the stored at least one of captured audio data, video data, and metadata to a second directory of the non-removable data storage medium. The memory further includes software instructions adapted to enable the computer system to perform the steps of determining whether a predefined capacity threshold relative to a removable data storage medium has been exceeded, and responsive to a determination that the predefined capacity threshold has been exceeded, creating a third directory of the non-removable data storage medium. The memory further includes software instructions adapted to enable the computer system to perform the steps of determining

whether data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium, and responsive to a determination that data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium, storing any unstored data in the second directory to the removable data storage medium. The memory further includes software instructions adapted to enable the computer system to perform the steps of determining whether the second directory contains finalization files, and responsive to a determination that the second directory contains finalization files, finalizing the removable storage medium and providing a prompt to insert another removable storage medium. The memory still further includes software instructions adapted to enable the computer system to perform the step of responsive to a determination that the second directory contains no finalization files, returning to the step of determining whether data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium.

[0011] A method for archiving data includes receiving data, storing the data on a first data storage medium, and selecting a portion of the data. The method further includes determining if at least one environmental factor indicates that environmental conditions are acceptable for storing the selected portion of the data on a second data storage medium. The method still further includes responsive to a determination that the at least one environmental factor indicates that environmental conditions are acceptable, storing the selected portion of the data on the second data storage medium.

[0012] A computer system for archiving data includes a processor and a memory. The memory includes software instructions adapted to enable the computer system to perform the steps of receiving data, storing the data on a first data storage medium, and selecting a portion of the data. The memory further software instructions adapted to enable the computer system to perform the steps of determining if at least one environmental factor indicates that environmental conditions are acceptable for storing the selected portion of the data on a second data storage medium, and responsive to a determination that the at least one environmental factor indicates that environmental conditions are acceptable, storing the selected portion of the data on the second data storage medium.

[0013] A data security method includes performing a checksum on data contained on a removable data storage medium, and storing the checksum on the removable data storage medium in at least one of an encrypted and a hidden form. The method further includes storing

a unique serial number pertaining to the removable storage medium to the removable storage medium, and storing a checksum and a corresponding unique serial number of a plurality of previous removable storage media to the removable storage medium.

[0014] A data security computer system includes a processor and a memory. The memory includes software instructions adapted to enable the computer system to perform the steps of performing a checksum on data contained on a removable data storage medium, and storing the checksum on the removable data storage medium in at least one of an encrypted and a hidden form. The memory further includes software instructions adapted to enable the computer system to perform the steps of storing a unique serial number pertaining to the removable storage medium to the removable storage medium, and storing a checksum and a corresponding unique serial number of a plurality of previous removable storage media to the removable storage medium.

[0015] The above summary of the invention is not intended to represent each embodiment or every aspect of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] A more complete understanding of the method and apparatus of the present invention may be obtained by reference to the following Detailed Description when taken in conjunction with the accompanying Drawings wherein:

[0017] FIGURE 1 is a block diagram of an in-vehicle system for recording video, audio, and data in accordance with principles of the present invention;

[0018] FIGURE 2 is a procedure for opportunistic archiving without error checking in accordance with principles of the present invention;

[0019] FIGURE 3 is a procedure for opportunistic archiving with optional error checking in accordance with principles of the present invention;

[0020] FIGURE 4 is a procedure for automatic DVD-video chapter segmentation by external triggers in accordance with principles of the present invention;

[0021] FIGURE 5 is a procedure for parallel high and low bit-rate encoding with post even bit rate selection in accordance with principles of the present invention;

[0022] FIGURE 6 is a perspective and side view of an embodiment of a drive suspension system in accordance with principles of the present invention; and

[0023] FIGURE 7 is a procedure for automatic DVD-video disc record overflow handling in accordance with principles of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Referring now to FIGURE 1, a block diagram of an in-vehicle system for recording video, audio, and data in accordance with an embodiment of the present invention is illustrated. In the system of FIGURE 1, a first video decoder 10a and a second video decoder 10b each include a plurality of respective video inputs 15a, 15b for receiving analog video signals from one or more video sources, such as, for example, a video camera. In the embodiment of the present invention illustrated in FIGURE 1, each of the video decoder 10a and 10b receives analog video signals from a front video camera, a rear video camera, and an in-vehicle camera, although it should be understood that, in some embodiments, more or fewer cameras may be used. Each of the video decoders 10a, 10b processes the received video signals and produces respective digital video signals 20a and 20b. The digital video signals 20a and 20b are then provided to a video processor 25. The video processor 25 processes the digital video signals 20a and 20b and outputs the processed video signals to a video bus 35 as a video stream.

[0025] In an exemplary embodiment of the present invention, the video processor 25 includes a video picture-over-picture (POP) field programmable gate array (FPGA) chip that processes video from one or more sources to combine the video from the multiple sources to be combined into a single video stream. For example, two video camera feeds can be processed by the video processor 25 for simultaneous display on the same screen as a split screen image. The system of FIGURE 1 can be further provided with a frame memory 30 associated with the video processor 25 to store video frames during processing by the video processor 25. The video stream from the video bus 35 is provided to first and second audio/video encoder integrated circuits (ICs) 40a, 40b. In accordance with principles of the present invention, the first and second video encoder ICs 40a, 40b include circuitry adapted to encode video and audio in compliance with a Motion Picture Expert Group (MPEG) standard, such as the MPEG-2 standard. For example the first and second video encoders 40a, 40b can be MPEG codec ICs. However, other video-encoding standards may be used without departing from principles of the invention.

[0026] The system of FIGURE 1 also includes an audio analog-to-digital converter 45 adapted to receive analog audio signals 50 from one or more audio sources, such as

microphones, and process the analog audio signals 50 to produce a digital audio signal 55. In accordance with the embodiment of the present invention illustrated in FIGURE 1, an analog audio signal from a wireless microphone is provided to a left channel input of the audio analog-to-digital converter 45, an analog audio signal from a cabin microphone is provided to a right channel of the audio analog-to-digital converter 45, and the audio analog-to-digital converter 45 outputs a combined digital audio signal 55 therefrom.

[0027] The digital audio signal 55 is then provided to each of the first and second audio/video encoder ICs 40a, 40b. Each of the first and second audio/video encoder ICs 40a, 40b encodes the video stream received from the video bus 35 and the digital audio signal 55 from the audio analog-to-digital converter 45 as respective encoded audio/video streams 60a and 60b, such as, for example, MPEG-2 streams. In various embodiments of the present invention, the first audio/video encoder IC 40a and the second audio/video encoder IC 40b output representations of the same video and audio streams that have been encoded at different data rates in parallel. For example, in accordance with principles of the present invention, the first audio/video encoder IC 40a outputs a high-bit-rate encoded stream 60a (e.g., 6.0 Mbps), while the second audio/video encoder IC 40b outputs a low-bit-rate encoded stream 60b (e.g., 1.0 Mbps) representation of the same audio and video signals. The low-bit-rate stream can be obtained, for example, by reducing at least one of the video resolution and the frame rate. The system of FIGURE 1 can be further provided with first and second coded memory 65a, 65b associated with each of the first and second audio/video encoder ICs 40a, 40b, respectively, for use by the first and second audio/video encoder ICs 40a, 40b as memory storage during encoding operations.

[0028] The resolution, bit-rate, and frame rate of both the low-bit-rate stream and the high-bit-rate stream can be set based on a record length selection made in a setup menu. Some example combinations are shown in Table 1:

<u>Resolution</u>	<u>Var. Bit rate</u>	<u>Frame Rate</u>	<u>Record Length</u>
720x480	5-6 Mbps	30 fps	2 hrs
480x480	2.0 Mbps	30 fps	4 hrs
352x480	1.5 Mbps	30 fps	6 hrs
352x480	1.1 Mbps	30 fps	8 hrs

TABLE 1

[0029] Each of the first encoded stream 60a and the second encoded stream 60b are then provided to a system FPGA 70. The system FPGA 70 provides the first encoded stream 60a and the second encoded stream 60b over an IDE bus 75 to a hard drive 80. The system of FIGURE 1 can further include a buffer memory 90 associated with the system FPGA 70 to buffer data before it is written to the hard drive 80. The first encoded stream 60a and the second encoded stream 60b are each buffered and written to the hard drive 80. As a result, two versions of the same video and audio source, for example, a high-bit-rate encoded and a low-bit-rate encoded version, are buffered and written to the hard drive 80 for subsequent processing. After a predetermined time period has elapsed and/or after a particular event has occurred, the encoded video and audio data may be sent over the IDE bus 75 from the hard drive 80 to a DVD read/write (RW) drive 85 for archiving to a DVD disc. In accordance with an embodiment of the present invention, the encoded video and audio data is written to the DVD disc so that the DVD disc is formatted as a standard DVD video disc playable in a standalone (i.e., non-PC based) DVD player. The hard drive 80 is described as an example of a non-removable data storage medium such as typically found in personal computers. A DVD disc is described as an example of a removable data storage medium. Other examples of removable data storage media include floppy discs, and flash memory drives.

[0030] The system of FIGURE 1 further includes a microcontroller 90 that functions to control the various components as well as the overall operation of the system of FIGURE 1. Flash memory 100 and dynamic RAM 105 may further be connected to the microcontroller 90 via a system bus 95. The flash memory 100 may function to store firmware for use by the microcontroller 90, and the dynamic RAM 105 may be used by the microcontroller 90 as temporary storage. In accordance with principles of the present invention, the firmware within

the flash memory 100 can be upgraded, for example, by inserting a disc including updated firmware into the DVD RW drive 85.

[0031] The microcontroller 90 is further provided with a data input 110 for receiving metadata including externally-measured data. Examples of metadata that can be provided to the data input 110 include Global Positioning System (GPS) coordinates, GPS calculated patrol speed, vehicle speed sensor (VSS) calculated patrol speed, radar measured patrol speed, radar target speed, accelerometer X, Y, and Z values, braking status, emergency lights status, siren status, system board temperature, drive door opening and closing logging, power up and power down logging, and DVD disc ejection and insertion logging. The metadata is provided by the microcontroller 90 to the system FPGA 70, which further transmits the metadata to the hard drive 80, where it is written to a metadata log file in association with the encoded audio and video data. Accordingly, a particular item of metadata can be directly linked to the audio and video segment obtained at the time that the metadata item was measured.

[0032] In addition, a subset of the metadata is included in the encoded audio and video data so that it is available for viewing in parallel with the audio and video during playback. In accordance with an embodiment of the present invention, the subset of the metadata is included in one or more closed-captioning fields of an MPEG-2 encoded DVD disc. An advantage provided by including the subset of the metadata in a closed-captioning field is that the visibility of the metadata information can be selectively toggled by a viewer of the audio and video. Another advantage provided by including the subset of the metadata in a closed-captioning field is that the information in the closed-captioning field is a text overlay that does not effect the encoding of the underlying video; thus, the underlying video is not degraded by the inclusion of the metadata. Examples of metadata that may be included in the closed-captioning field include time, date, frame counter, vehicle ID, GPS longitude and latitude, vehicle speed (from VSS signal), radar target speed, radar patrol car speed, remote microphone active indicator, emergency lights active indicator, siren active indicator, braking in progress indicator, and camera ID and zoom level. In still another embodiment of the present invention, the subset of metadata may be provided in a subtitle field.

[0033] The system of FIGURE 1 further allows for playback of encoded audio and video stored on the hard drive 80 and a disc in the DVD RW drive 85. To accomplish playback, the system of FIGURE 1 further includes a DVD decoder 115 that receives encoded audio and video from either the hard drive 80 or the DVD RW drive 85 via a playback bus. The DVD

decoder 115 decodes the video into a video output signal 120 and decodes the audio into a digital audio signal 125. The digital audio signal 125 is provided to a digital-to-audio converter 130 that converts the digital audio signal to an analog audio signal 135. A DVD/on-screen display (OSD) memory 140 may further be provided for use by the DVD decoder 115 as temporary storage during decoding.

[0034] The system of FIGURE 1 may also be provided with an Ethernet interface 145 that allows for communication between either a wired or wireless Ethernet-connected device and the microcontroller 90. The Ethernet interface 145 may be used, for example, for transmitting encoded audio and video, as well as associated metadata, to a central office. The Ethernet port can also be used for uploading new firmware files, and for populating user settings as configured on a laptop computer attached to the invention. Specific identifiers shown in FIGURE 1 for various components illustrated therein are for illustrative purposes. These identifiers will be understood by those having skill in the art to be merely examples of components that could be employed in the system shown therein. Other commercially available components could be employed without departing from the principles of the invention.

EVENT BASED RECORDING

[0035] In various embodiments of the present invention, recording of video, audio, and metadata is event-based. In these embodiments, the system only records when a triggering event has occurred, for example, when the user turns on the emergency lights, siren, the onboard accelerometers sense a vehicle crash, or when the user manually hits a record button. Upon occurrence of the event, the beginning of a recorded event is marked. Other examples of an event that initiates recording can be, for example, a traffic stop, a chase, a domestic call, or pulling into a driveway. The recording of the event continues until a stop point is determined. In at least one embodiment of the present invention, the stop point is determined when the user hits a stop button. The system may also include an automatic stop event that allows the system to automatically stop recording at a predetermined time after all start record triggers have been turned off (e.g., the lights and siren are off and the wireless microphone is off), but the user has forgotten to hit the stop button. If the system detects that that condition has occurred based on user settings, it can decide to enter a stop flag and stop recording the event.

[0036] In at least one embodiment of the present invention, when the system is turned on, two data streams (i.e., a high bit-rate stream and a low bit-rate stream) as well as metadata are recorded to the hard drive 80. The metadata may include, for example, the status of

the brake lights, status of the emergency lights and siren, GPS coordinates, the vehicle's speed, data from an interface from the police radar system, etc. The metadata and the high and low bit-rate streams are time-stamped and synchronized. During recording to a DVD disc, the video and/or audio of events, as well as the metadata are recorded to the DVD disc.

[0037] The system may also use vehicle speed as a recording trigger where the system can initiate the recording of an event if the patrol car exceeds a preset speed. For example, a department supervisor can decide that if an officer ever goes in excess of 110 miles an hour, the system should begin recording an event to the hard drive 80 or the DVD drive 85. A new event begins automatically and the officer has no control over the recording of the event. Likewise, organizations outside of law enforcement may utilize threshold criteria for initiating self-activating monitoring of persons or conditions.

OPPORTUNISTIC ARCHIVING

[0038] The automobile environment is subject to demanding environmental conditions for the operation of electronic equipment. Recording onto a rewriteable DVD in an automobile environment is particularly subject to these conditions. A system in accordance with principles the present invention has a drive suspension system in place. The system monitors shock and vibration in x, y, and z axes using accelerometers. The system may also monitor the vehicle speed by one or more of three methods. The system can monitor vehicle speed through the VSS signal. If an optional GPS subsystem is included in the system, the system can get speed coordinates from the GPS data. If the system is interfaced to a radar system and the radar is operating in moving mode, the system can get vehicle speed from the radar. In various embodiments of the present invention, an opportunistic archiving algorithm is used that provides parameters and steering as to when the system should burn to the DVD drive 85. Using shock and vibration measurements, the opportunistic archiving algorithm is adapted to ensure that data is not written to the DVD disc until environmental conditions are acceptable for doing so.

[0039] Referring now to FIGURE 2, a procedure for opportunistic archiving without error checking in accordance with principles of the present invention is illustrated. In step 205, background recording of data including, for example, audio data, video data, and metadata, is initiated. In background recording, an encoded stream, and optionally associated metadata, is continuously written to the hard drive 80. Thus, referring again to FIGURES 1 and 2, during background recording, the first encoded stream 60a and the second encoded stream 60b, and optionally associated metadata, are continuously written to the hard drive 80. Background

recording of audio, video, and metadata is typically performed in one minute segments, although it should be understood that other segment lengths may be used. After initiation of background recording (step 205), the data is buffered in RAM (step 210) and then written to the hard drive 80 (step 215). A determination is then made regarding whether any record triggers are active (step 217). If a determination is made that no active record triggers exist (step 220), background recording is continued (step 225) and the procedure returns to step 205.

[0040] If a determination is made that a record trigger is active (step 230), the data to be archived on the DVD is selected (step 235). The range of data to be archived includes selected time periods before and after event start and stop points. For example, the system can be configured to archive a range of data that extends from ten minutes prior to the start point and ten minutes after the stop point. At step 240, a verification of environmental factors is performed to insure that environmental conditions are acceptable for recording data to the DVD disc. The environmental factors can include, for example, temperature, shock, and vibration measurements. If the environmental factors are determined to exceed DVD drive limits (step 245), better environmental conditions are waited for via use of, for example, a timer (step 250), and the procedure returns to step 240. Steps 240-255 can be characterized collectively as opportunistic-archiving steps.

[0041] If the environmental factors are determined to be within predetermined limits (step 255), burning of a sector of data to the DVD disc is initiated (step 260). During the burn cycle, accelerometers are monitored to determine whether any G-spikes exceed tolerable limits (step 265). An example of a tolerable limit for burning of data to a DVD is less than 0.3 G. If it is determined that a G-spike occurred during the burn cycle that is above tolerable limits (step 270), a decision is made to rewrite the sector in question (step 275) and the procedure returns to step 260. If it is determined that no G-spikes occurred during the burn cycle that are above the tolerable limits (step 280), the procedure continues to the next sector to be burned (step 285) and then returns to step 205. Steps 260-285 can be characterized collectively as reactive correction steps.

[0042] Referring now to FIGURE 3, a procedure for opportunistic archiving with optional error checking in accordance with principles of the present invention is illustrated. In step 305, background recording of data including, for example, audio data, video data, and metadata, is initiated. In background recording, an encoded stream, and optionally associated metadata, is continuously written to the hard drive 80. Thus, referring again to FIGURES 1 and

3, during background recording, the first encoded stream 60a and the second encoded stream 60b, and optionally associated metadata, are continuously written to the hard drive 80. Background recording of audio data, video data, and metadata is typically performed in one minute segments, although it should be understood that other segment lengths may be used. After initiation of background recording (step 305), the data is buffered in RAM (step 310) and then written to the hard drive 80 (step 315). A determination is then made regarding whether any record triggers are active (step 317). If a determination is made that no active record triggers exist (step 320), background recording is continued (step 325) and the procedure returns to step 305.

[0043] If a determination is made that a record trigger is active (step 330), the data to be archived on the DVD is selected (step 335). The range of data to be archived includes selected time periods before and after event start and stop points. For example, the system can be configured to archive a range of data that extends from ten minutes prior to the start point and ten minutes after the stop point. At step 340, a verification of environmental factors is performed in order to insure that environmental conditions are acceptable for recording data to the DVD disc. The environmental factors can include, for example, temperature, shock, and vibration measurements. If the environmental factors are determined to exceed DVD drive limits (step 345), better environmental conditions are waited for via use of, for example, a timer (step 350), and the procedure returns to step 340. Steps 340-355 can be characterized collectively as opportunistic archiving steps.

[0044] If the environmental factors are determined to be within predetermined limits (step 355), burning a sector of data to the DVD disc is initiated (step 360). At step 365, a checksum is calculated for the sector from hard drive data. The burned sector is then read from the DVD disc (step 370), and a checksum is calculated from the sector read from the DVD (step 375). The checksum obtained from hard drive data and the checksum obtained from the burned DVD sector are compared and, if the checksums do not match, the sector is rewritten (step 380) and the procedure returns to step 360. If the checksums match, the archiving procedure returns to step 305. Steps 360-385 can be characterized collectively as DVD burn error correction steps.

[0045] In various embodiments, an opportunistic archiving algorithm may be used that also considers, in addition to environmental factors, how much data the system needs to archive to the DVD disc. For example, if the system starts off in the morning and there have been no events and no start flags, the system is operating with zero unburned events. However,

if, for example, the user gets into a high-speed chase that lasts for three hours and the system has not detected a stop trigger, the system has recorded three hours of unburned data to the hard drive 80. In this situation, the system could lower the environmental limits, at step 255 or 355 for example, in order to archive the large amount of accumulated data to the DVD disc. Environmental conditions, including a speed factor, may also be considered. The system may consider whether the vehicle is driving along at a high rate of speed (e.g., hundred miles an hour) or if it is stopped. The algorithm may also consider accumulated shock and vibration.

[0046] The algorithm processing starts with the calculation of how much data is present and comes up with a numerical value. And then the processor using the algorithm comes up with a numerical value for how conducive the environment is to DVD burning. The processor using the algorithm subtracts the environment number from the unburned data number and comes up with a value. If the value is positive, the need to burn data is greater than how bad the environmental conditions are. If the algorithm defines a negative number, the unburned data does not outweigh how bad the environmental conditions are.

[0047] If the environmental conditions are very poor, the system does not record anything. Instead, the system just waits and monitors for a while and checks the environmental conditions again. If the speed factor is zero (i.e., the car is stopped), that is preferably an automatic burn decision. Condition one is no speed, which is preferably an automatic decision to burn anything on the hard drive 80 that needs to be burned. Condition number two is unacceptable environmental conditions under which the system does not burn anything. Condition number three is somewhere in between, in which the system has some unburned event data, the car is moving, and determinations are made regarding how bad the conditions are, how much does the need to burn data outweigh the environmental conditions that the system detects.

[0048] The hard drive 80 of the system preferably has an accelerometer to detect physical shocks. When the hard drive 80 detects an unacceptable shock, the system goes back and recopies the last section. An error is assumed, so the last DVD section is overwritten. The hard drive 80 may be mounted on a vibration shock mount as well. In various embodiments, the DVD drive 85 can also include an accelerometer to detect physical shocks. Hard drives typically have a 200 g shock tolerance whereas DVD drives typically have a 0.5 g shock tolerance.

[0049] An illustrative opportunistic archiving algorithm could utilize the following equation:

$(\text{Buffer Amount}) - [(\text{Speed Factor}) + (\text{Shock Factor}) + (\text{Vibration Factor})] = \text{Archive Threshold}$

where

Buffer Amount = Size of Data Buffer

Speed Factor = Accumulated Vehicle Speed From Recent History

Shock Factor = Peak Shock in Recent History

Vibration Factor = Accumulated Vibration From Recent History

[0050] If the Archive Threshold is exceeded, the need to burn data overrides the environmental conditions. If the Archive Threshold is not exceeded, the amount of unburned data does not override the environmental conditions.

AUTOMATIC CHAPTER SEGMENTATION BY EVENT MARKERS

[0051] In various embodiments of the present invention, the system may be adapted to automatically divide the video into separate navigable chapters to make location of a specific point or event easier during playback, such that each chapter of the DVD disc contains the data from one event. This process eliminates the need to fast forward or rewind the media to search for a specific traffic stop or event. The start of an event period is determined by monitoring metadata from various devices, such as external emergency lights, emergency siren, wireless microphone activation, extreme shock data from accelerometers indicating, for example, a collision or panic braking, an elapsed time period, etc. The start of an event period can also be determined by an operator pressing a RECORD key on a control panel.

[0052] The end of an event is determined by the operator pressing a STOP key on the control panel or by the passage of a predetermined period of time after any triggering device is turned off or is inactive. In various embodiments, when the system is turned on, all video data, audio data, and metadata is continuously written to the hard drive 80, and only event data is written to the DVD disc. The system is able to automatically include video and audio data that occurred prior to the start of the event period or after the end of an event period by moving event start and end flags based on rules determined by user settings. For example, a setting in a user-interface menu can be used to determine how much data to include in the DVD chapter before and after the event markers.

[0053] Referring now to FIGURE 4, a procedure for automatic DVD-video chapter segmentation by external triggers is illustrated. In step 405, background recording of data including audio, video, and metadata is initiated. In various embodiments of the present

invention, background recording of audio, video, and metadata is performed in one-minute segments, although it should be understood that other segment lengths may be used. At step 410, external record triggers are monitored for the occurrence of one or more triggering events. If a record trigger is not detected (step 415), the procedure returns to step 405.

[0054] If a record trigger is detected (step 420), a new chapter start point is initiated (step 425) that includes a specified number of minutes of data from before the event start point to the beginning of the chapter. At step 430, burning of the data from the event period to the DVD is started. At step 435, monitoring of stop triggers is performed. The stop triggers may be either generated by a timer or user-initiated. If a stop trigger is not detected (step 440), event recording is continued (step 445), and the procedure returns to step 430. If a stop trigger is detected (step 450), a chapter stop point is determined, which step includes a specified number of minutes of data from after the event stop point being added to the end of the chapter (step 455). Next, the DVD chapter menu is built (step 460), a video frame from the event is selected for use as a selectable chapter icon (step 465), and a time/date stamp from the chapter stop point is used as part of the chapter name/number (step 470). Next, the DVD chapter is closed out (step 475), and the procedure returns to step 405.

PARALLEL HIGH AND LOW BIT-RATE ENCODING

[0055] In order to provide users with the ability to archive as many hours of video and audio data on to a single DVD disc, while still providing maximum video quality for important events, various embodiments of the present invention provide for encoding multiple versions of the same video and audio source in parallel. The system encodes both a high bit-rate stream and a lower bit-rate stream. Both streams are buffered and written to the hard drive 80.

[0056] The rules for archiving event data to the DVD disc can be determined by user settings. During typical operation, the system will automatically transfer the lower bit-rate video stream to the DVD disc based on event markers. Should the system capture some video or audio footage that the user deems to be important, the user can transfer the high bit-rate version to the DVD disc from data on the hard drive 80. This process allows users to make extended-length recordings without having to sacrifice audio and video quality of important events.

[0057] A user may choose high or low quality video after an event has occurred. The system by default archives events to the DVD that are low quality. After the recording has been made, if something that was important has occurred, the user can easily go back and set new start and stop flags. A section of video may be chosen, whether it was included in the original

event or not, a new chapter added to the DVD, and a high resolution version of the video can be chosen to be burned to DVD. After the fact, a user can choose to grab any video from the hard drive 80 and make new chapters on the DVD. The new chapters can be based on the same event or on multiple events or non-events, and then a user could choose high or low resolution.

[0058] Referring now to FIGURE 5, a procedure for high and low bit-rate encoding with post-event bit-rate selection in accordance with principles of the present invention is illustrated. In various embodiments of the present invention, the high and low bit-rate encoding occurs in parallel. At step 505, a raw video stream, such as a BT656 stream, is split into first and second streams that are identical to each other. The first stream is provided to a first video encoder 40a, which encodes the stream at a low bit-rate to be used for normal recording (step 510). The low bit-rate stream can be optionally written to a temporary storage area, such as a hard drive 80, Flash RAM, RAM, or other storage media (step 515). The second stream is provided to a second video encoder 40b, which encodes the stream at a high bit rate to be used as a backup for important events (step 520). The data of the high bit-rate stream is then written to a circular buffer (step 525), which is a continuously-overwritten data buffer on a hard drive 80, Flash RAM, RAM, or other storage media. If no important events occur while the high bit-rate data is in the circular buffer (step 530), new high bit-rate data overwrites old data in the circular buffer (step 535).

[0059] If an operator deems a time period from the data buffer to be important (step 540), the system takes the high-bit-rate data from the important time period (step 545) selected by the operator. At step 550, the low-bit-rate data and the selected portion of the high-bit-rate data are written to storage media, such as a DVD disc, hard drive, flash memory, etc. (step 550). In various embodiments, the step 550 of writing the low-bit-rate data to the storage media can include opportunistic archiving such as that described with respect to FIGURE 2 and FIGURE 3. In various embodiment of the present invention, step 515 of writing the low-bit-rate stream to a temporary storage can be omitted, and the low-bit-rate stream can be written directly to the storage media in step 550. In other embodiments of the present invention, the temporary storage for the low-bit-rate data and the circular buffer for the high-bit-rate data are the same hard drive, and the storage media for the low-bit-rate data and the selected portion of the high-bit-rate data are a DVD disc.

RECORD AFTER-THE-FACT

[0060] Recording after-the-fact permits manual chapter event creation to be performed. If a user wants to go in after the fact and copy some video that wasn't marked as an event, the user can go back and manually put in a new start and stop point. The system will automatically grab that section of video and feed it to the DVD drive 85 and make a new chapter. The common use of that feature will be by, for example, internal affairs in order to investigate some alleged misconduct. Of course, embodiments of the system may be applied to areas outside of the area of law enforcement, and then the conduct referred to may be an officer or another party in an organization utilizing the methods and systems of the present invention.

DRIVE SUSPENSION SYSTEM

[0061] A drive suspension system in accordance with principles of the present invention permits isolation of the DVD drive from environmental conditions that could impair DVD burning. Different suspension systems may be used in different versions of the system. One version of the system as currently envisioned is entirely overhead-console mounted. Another version of the system is a multi-piece unit (e.g., two) that may be used when there is not room to mount the overhead console-mounted version. In the second version, the user can, for example, put the recording unit underneath the seat and the display and control panel on a stalk near the radio console area. Although packaging for the drive suspension system is different on the two versions discussed, the underlying principles are analogous and other versions are possible without departing from principles of the present invention.

[0062] Referring now to FIGURE 6, a perspective and side elevational view of an embodiment of a drive suspension system in accordance with an embodiment of the present invention are illustrated. In FIGURE 6, a DVD recorder drive 605 slides into a drive chassis 610. The drive suspension system includes a momentum mass in the form of a heavy steel chassis weight 615. The assembly including the DVD recorder drive 605, the drive chassis 610, and the chassis weight 615 is suspended inside an assembly shield area 620 by expansion elements, such as, for example, assembly springs 625. On the chassis 610, four pins 635 insert into four vibrational-energy-absorption elements, such as, for example, silicon-oil-filled sack dampers 630. A hole inside the particular damper shown in FIGURE 6 is provided for the pins 635 from the chassis 610 to meet into. The four silicon-oil-filled sack dampers 630 serve to stabilize the floating mechanism, provide heavy damping characteristics, and reduce the resonance frequency. The chassis weight 615 provides momentum and also serves to help

reduce the resonance frequency. In a typical embodiment, there is about one-half inch of suspension travel in every direction.

[0063] In the under-seat version of the system, a spring orientation pivot 640 is used to permit horizontal mounting or vertical mounting (e.g., on the side of a cage) or mounting on a stalk or on a center console. If the system is mounted flat, the springs are mounted in an upward orientation.. However, if the user turns the orientation such that the drive is pointing upward and gravity is trying to pull the drive in a different direction, the spring may be pivoted so that the spring is able to handle the gravity load in that direction.

AUTOMATIC DVD-VIDEO DISC RECORD OVERFLOW HANDLING

[0064] Various embodiments of the invention provide a method to seamlessly allow a user to record data onto the DVD disc to the disc's capacity, yet continue to capture and prepare additional data intended to be burned onto another DVD disc. With previous in-vehicle recording systems, there was a risk of running out of media (e.g., DVD) space during the middle of a patrol officer's shift. Since the media is considered evidentiary in nature, many law enforcement agencies limit access to the media, and do not provide the officer with a second piece of media. Thus, when the media became full, it would necessitate a trip back to the police station to replace the media with blank media. Automatic DVD-Video disc record overflow handling in accordance with principles of the invention serves to eliminate the need for an officer to return to the police station to replace media during a shift. The officer may continue recording even after the DVD media is at capacity. In a typical case, the system finalizes a first DVD and automatically prepares unburned data for an additional DVD. When new media (e.g., DVD) is inserted into the drive, the unburned data is automatically transferred onto the new media.

[0065] Referring now to FIGURE 7, a procedure for automatic DVD-video disc record overflow handling is illustrated. At step 705, video, audio, and data from vehicle mounted cameras, microphones, and sensors is captured. At step 710, video, audio, and data is continuously written onto a hard drive 80. Next, a determination is made regarding whether the system is in event-record mode (step 715). If the system is not in event-record mode, the procedure (step 720) returns to step 705. Steps 705-720 can be characterized collectively as a data-capture process.

[0066] If it is determined that the system is in event-record mode (step 725), the procedure continues to step 730, at which step data is written into a DVD image working

directory on the hard drive 80. At step 735, a determination is made regarding whether the working directory is close to reaching the size limit of the DVD disc. If it is determined that the working directory is not close to reaching the size limit of the DVD disc (step 740), the procedure returns to step 715. If it is determined that the working directory is close to reaching the size limit of the DVD disc, a DVD chapter-stop point is initiated and a DVD chapter menu is built (step 745). Next, all remaining files for the DVD-video image are closed out (step 750), the current working directory is saved (step 755), and a new working directory is created (step 760). The procedure then returns to step 715. Steps 730-760 can be characterized collectively as DVD image preparation steps.

[0067] From step 730, an execution proceeds also to step 765. At step 765, un-burned data in the working directory is looked for. Next, a determination is made regarding whether there is un-burned data in the working directory (step 770). If there is no un-burned data in the working directory (step 775), the process returns to step 765. If there is unburned data in the working directory, DVD-video data from the working directory is transferred on to the DVD-video disc (step 780). At step 785, a determination is made regarding whether the working directory contains finalized files. If the working directory does not contain finalized files (step 787), the procedure returns to step 765. If the working directory contains finalized files, the DVD is finalized (step 790). At step 795, the user is prompted to replace the current DVD with a blank DVD. At step 796, a determination is made regarding if the user has loaded a blank DVD. If the user has not loaded a blank DVD (step 797), the procedure returns to step 795. If the user has loaded a blank DVD, a check is made for a new DVD working directory (step 798). The procedure then returns to step 765. Steps 765-798 can be characterized collectively as DVD burning process steps.

AUTOMATIC DVD DISC-IMAGE BACK-UP

[0068] In various embodiments, the system's hard drive 80 is formatted with a separate partition that is reserved for making mirror images of DVD discs. A typical DVD RW disc is 4.7 GB. As the system is creating a DVD disc, the system makes an exact duplicate of the entire disc on the hard drive 80 in a separate partition. An administrator or user can select how many back-up copies of DVDs the system retains.

[0069] As the user continues to create new DVDs, the oldest hard-drive backup will be overwritten; thus, if the user selected three back-up images, by the time the user creates the fourth DVD, the oldest one is being overwritten with a mirror image of the number four disc.

Using this feature, if an original DVD is lost, unreadable, or intentionally destroyed, a supervisor can go back and create an exact copy of the same DVD disc.

VIDEO DATA SECURITY

[0070] Since the system's video files are typically in MPEG-2 format, the files could conceivably be manipulated using video-editing tools. In litigation, attorneys could attempt bring into question the authenticity of the MPEG files, suggesting that they could be exported, manipulated, and then re-inserted onto the disc. The system thus uses checksums in some embodiments to ensure that the files have not been manipulated or edited.

First Level of Security – The Self-Verifying Checksum Result

[0071] When the system is ready to close a DVD disc (e.g., just prior to disc ejection), the system performs a checksum calculation on the disc contents and writes that result into a hidden and/or encrypted file saved on the DVD disc. By using a video utility, the DVD disc can be analyzed to see if a checksum result from the disc's contents matches the result of the hidden (and/or encrypted) checksum result on that DVD disc. This process verifies that the disc's content matches the checksum file.

Second Level of Security – System Verification of the Hidden (or Encrypted) Checksum Files

[0072] The system also provides a method to verify that the checksum file that is hidden on a DVD disc has not been recreated to match a manipulated disc. This is done by comparing subsequently-recorded DVD discs (e.g., discs recorded using the same system) to the DVD disc in question. The system automatically generates a unique disc serial number for each DVD disc it records. This serial number is written onto the DVD disc and is also saved into a log file in the system's non-volatile memory. When a DVD disc is closed, the checksum result of that DVD disc is also written to the log file in the system's non-volatile memory.

[0073] The log file preferably contains the serial number and checksum result of every DVD disc that that specific system has authored. The entire contents of the log files that are stored on the system's non-volatile memory may then be copied onto every DVD disc the system creates. Every DVD disc created by a specific system can be used to verify the validity of a checksum result contained on any other DVD disc previously recorded by the same system.

COVERT RECORDING MODE

[0074] In various embodiments of the present invention, the system has the ability to be placed into a covert-recording mode. In this mode, the system has the appearance of being

powered off. However, it is actually recording data, such as video and audio, on the hard drive 80. The covert-recording mode permits events inside a patrol car to be recorded without a suspect being aware that he is being recorded. A record trigger is generated when the system is placed into covert-recording mode. However, the system will only archive to the DVD after the system has been taken out of covert recording mode to prevent the DVD drive noise from giving an indication that the system is not actually powered off.

[0075] In an illustrative example of placing the system into covert recording mode, a user presses and holds a power OFF key for more than 2 seconds. A sound indicates that the unit has been placed into covert recording mode and all lights, backlights, indicators, and displays are turned off. This gives the appearance to a back-seat occupant that the unit is turned off. The system automatically selects an interior camera input to be recorded. The covert mode is ended by pressing POWER ON or a STOP key. At that time, the system lights, backlights, indicators, and displays are turned on, and the video that has been marked for recording will be archived to the DVD disc.

[0076] Various embodiments of the invention may reside in a computer system. Here, the term "computer system" is to be understood to include at least a memory and a processor. In general, the memory will store, at one time or another, at least portions of an executable program code, and the processor will execute one or more of the instructions included in that executable program code. It will be appreciated that the term "executable program code" and the term "software" mean substantially the same thing for the purposes of this description. It is not necessary to the practice of this invention that the memory and the processor be physically located in the same place. That is to say, it is foreseen that the processor and the memory might be in different physical pieces of equipment or even in geographically distinct locations.

[0077] Various embodiments of the invention may also be embodied in a computer program product, as will now be explained. On a practical level, the software that enables the computer system to perform the operations described further below in detail, may be supplied on any one of a variety of media. Furthermore, the actual implementation of the approach and operations of the invention are actually statements written in a programming language. Such programming language statements, when executed by a computer, cause the computer to act in accordance with the particular content of the statements. Furthermore, the software that enables a computer system to act in accordance with the invention may be provided in any number of

forms including, but not limited to, original source code, assembly code, object code, machine language, compressed or encrypted versions of the foregoing, and any and all equivalents.

[0078] One of skill in the art will appreciate that "media", or "computer-readable media", as used here, may include a diskette, a tape, a compact disc, an integrated circuit, a ROM, a CD, a cartridge, a remote transmission via a communications circuit, or any other similar medium useable by computers. For example, to supply software for enabling a computer system to operate in accordance with the invention, the supplier might provide a diskette or might transmit the software in some form via satellite transmission, via a direct telephone link, or via the Internet. Thus, the term, "computer readable medium" is intended to include all of the foregoing and any other medium by which software may be provided to a computer.

[0079] Although the enabling software might be "written on" a diskette, "stored in" an integrated circuit, or "carried over" a communications circuit, it will be appreciated that, for the purposes of this application, the computer usable medium will be referred to as "bearing" the software. Thus, the term "bearing" is intended to encompass the above and all equivalent ways in which software may be associated with a computer usable medium.

[0080] For the sake of simplicity, therefore, the term "program product" is thus used to refer to a computer useable medium, as defined above, which bears in any form of software to enable a computer system to operate according to the above-identified invention. Thus, the invention may also be embodied in a program product bearing software that enables a computer to perform management of information according to the invention.

[0081] In the foregoing Detailed Description, it can be seen that various features may be grouped together into a single embodiment for the purpose of streamlining the disclosure. This method of disclosure is not to be interpreted as reflecting an intention that the claimed embodiment(s) of the invention require more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive subject matter lies in less than all the features of a single disclosed embodiment. Thus, the following claims are hereby incorporated into the Detailed Description, with each claim standing on its own as a separate embodiment of the invention.

WHAT IS CLAIMED IS:

1. A video-data chapter segmentation method comprising:
monitoring for at least one external start trigger;
responsive to detection of at least one of the at least one external start trigger,
creating a chapter start point at a point in the video data corresponding to a specified time
preceding the at least one detected external start trigger;
initiating recording of the video data beginning at the point in the video data;
monitoring for at least one stop trigger; and
responsive to detection of at least one of the at least one stop trigger, creating a
chapter stop point at a point in the data corresponding to a specified time preceding the at least
one detected stop trigger.
2. The method of claim 1, wherein the step of monitoring for at least one external
start trigger comprises at least one of:
monitoring for emergency light activation;
monitoring for siren activation;
monitoring for a vehicle crash;
monitoring for a predefined vehicle speed being exceeded;
monitoring for wireless microphone activation;
monitoring for record button activation; and
monitoring for acceleration outside a predefined range.
3. The method of claim 1, wherein the specified time preceding the at least one
detected external start trigger is zero seconds.
4. The method of claim 1, wherein the specified time preceding the at least one
detected stop trigger is zero seconds.
5. The method of claim 1, wherein the step of monitoring for at least one stop
trigger comprises at least one of:
monitoring for stop button activation;
monitoring for timer expiration following deactivation of a triggering device.

6. The method of claim 1, further comprising:
building a chapter menu;
using a frame from the video data between the chapter start point and the chapter stop inclusive as a selectable chapter icon.
7. The method of claim 6, further comprising using a time and date stamp from the chapter start point in a chapter identifier.
8. The method of claim 7, further comprising background recording the video data.
9. The method of claim 1, further comprising, prior to detection of the at least one stop trigger, continuing recording of the video data.
10. A video-data chapter segmentation computer system comprising:
a processor; and
a memory including software instructions adapted to enable the computer system to perform the steps of:
monitoring for at least one external start trigger;
responsive to detection of at least one of the at least one external start trigger, creating a chapter start point at a point in the video data corresponding to a specified time preceding the at least one detected external start trigger;
initiating recording of the video data beginning at the point in the video data;
monitoring for at least one stop trigger; and
responsive to detection of at least one of the at least one stop trigger, creating a chapter stop point at a point in the data corresponding to a specified time preceding the at least one detected stop trigger.
11. The computer system of claim 10, wherein the step of monitoring for at least one external start trigger comprises at least one of:
monitoring for emergency light activation;
monitoring for siren activation;
monitoring for a vehicle crash;
monitoring for a predefined vehicle speed being exceeded;

monitoring for wireless microphone activation;
monitoring for record button activation; and
monitoring for acceleration outside a predefined range.

12. The computer system of claim 10, wherein the specified time preceding the at least one detected external start trigger is zero seconds.

13. The computer system of claim 10, wherein the specified time preceding the at least one detected stop trigger is zero seconds.

14. The computer system of claim 10, wherein the step of monitoring for at least one stop trigger comprises at least one of:

monitoring for stop button activation;
monitoring for timer expiration following deactivation of a triggering device.

15. The computer system of claim 10, further comprising software instructions adapted to enable the computer system to perform the steps of:

building a chapter menu;
using a frame from the video data between the chapter start point and the chapter stop inclusive as a selectable chapter icon.

16. The computer system of claim 15, further comprising software instructions adapted to enable the computer system to perform the step of using a time and date stamp from the chapter start point in a chapter identifier.

17. The computer system of claim 16, the software instructions further comprising software instructions adapted to enable the computer system to perform the steps of background recording the video data.

18. The computer system of claim 10, further comprising software instructions adapted to enable the computer system to perform the step of, prior to detection of the at least one stop trigger, continuing recording of the video data.

19. A data-encoding system comprising:
 - a source of unencoded data;
 - a first encoder interoperably coupled to the source;
 - wherein the first encoder is adapted to receive the unencoded data, encode the unencoded data, and output encoded data at a first data rate;
 - a second encoder interoperably coupled to the source;
 - wherein the second encoder is adapted to receive the unencoded data, encode the unencoded data, and output encoded data at a second data rate;
 - wherein the second data rate exceeds the first data rate.
20. The data-encoding system of claim 19, further comprising:
 - a first data storage device adapted to store the data encoded at the first rate; and
 - a second data storage device adapted to store a user-selected portion of the data encoded at the second rate.
21. The data-encoding system of claim 20, wherein the first data storage device and the second data storage device are identical.
22. The data-encoding system of claim 20, wherein:
 - the first data storage comprises non-removable data storage media; and
 - the second data storage comprises removable data storage media.
23. The data-encoding system of claim 22, wherein:
 - the first data storage is a hard drive; and
 - the removable data storage media is selected from the group consisting of a digital video disc and a compact disc.
24. The data-encoding system of claim 22, wherein the first data storage is adapted to store at least a portion of the data encoded at the second rate and output the user-selected portion of the data encoded at the second rate.
25. The data-encoding system of claim 24, wherein the second data storage is adapted to receive the user-selected portion of the data encoded at the second rate from the first data storage and store the received user-selected portion of the data encoded at the second rate.

26. The data-encoding system of claim 21, further comprising a third data storage adapted to receive the user-selected portion of the data encoded at the second rate from the second data storage and store the received user-selected portion of the data encoded at the second rate.

27. The data-encoding system of claim 24, wherein the first data storage cyclically overwrites previously-stored data encoded at the second rate responsive to receipt of new data encoded at the second rate.

28. The data-encoding system of claim 19, wherein the unencoded data is video data.

29. A data-encoding method comprising:
a first encoder interoperably coupled to a source of unencoded data receiving the unencoded data, encoding the unencoded data, and outputting encoded data at a first data rate;
a second encoder interoperably coupled to the source receiving the unencoded data, encoding the unencoded data, and outputting encoded data at a second data rate; and
wherein the second data rate exceeds the first data rate.

30. The data-encoding method of claim 29, further comprising:
a first data storage device storing the data encoded at the first rate; and
a second data storage device storing a user-selected portion of the data encoded at the second rate.

31. The method of claim 30, wherein the first data storage device and the second data storage device are identical.

32. The method of claim 30, wherein:
the first data storage comprises non-removable data storage media; and
the second data storage comprises removable data storage media.

33. The method of claim 32, wherein:
the first data storage is a hard drive; and
the removable data storage media is selected from the group consisting of a digital video disc and a compact disc.

34. The data-encoding method of claim 32, further comprising the first data storage storing at least a portion of the data encoded at the second rate and outputting the user-selected portion of the data encoded at the second rate.

35. The data-encoding method of claim 34, further comprising the second data storage receiving the user-selected portion of the data encoded at the second rate from the first data storage and storing the received user-selected portion of the data encoded at the second rate.

36. The data-encoding method of claim 31, further comprising a third data storage adapted receiving the user-selected portion of the data encoded at the second rate from the second data storage and storing the received user-selected portion of the data encoded at the second rate.

37. The data-encoding method of claim 34, further comprising the first data storage cyclically overwriting previously-stored data encoded at the second rate responsive to receipt of new data encoded at the second rate.

38. The data-encoding method of claim 29, wherein the unencoded data is video data.

39. A data-overflow-handling method comprising:
storing at least one of captured audio data, video data, and metadata to a first directory of a non-removable data storage medium;
determining whether an event is being recorded;
responsive to a determination that an event is being recorded, storing an image of the stored at least one of captured audio data, video data, and metadata to a second directory of the non-removable data storage medium;
determining whether a predefined capacity threshold relative to a removable data storage medium has been exceeded;
responsive to a determination that the predefined capacity threshold has been exceeded, creating a third directory of the non-removable data storage medium;
determining whether data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium;

responsive to a determination that data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium, storing any unstored data in the second directory to the removable data storage medium;

determining whether the second directory contains finalization files;

responsive to a determination that the second directory contains finalization files, finalizing the removable storage medium and providing a prompt to insert another removable storage medium; and

responsive to a determination that the second directory contains no finalization files, returning to the step of determining whether data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium.

40. The data-overflow-handling method of claim 39, further comprising, responsive to insertion of another removable data storage medium, checking for the third directory.

41. The data-overflow-handling method of claim 40, further comprising:

determining whether data in the third directory of the non-removable storage medium has not been stored to the removable data storage medium;

responsive to a determination that data in the third directory of the non-removable storage medium has not been stored to the removable data storage medium, storing any unstored data in the third directory to the new removable data storage medium;

determining whether the third directory contains finalization files; and

responsive to a determination that the third directory contains finalization files, finalizing the removable storage medium and providing a prompt to insert another removable storage medium.

42. The data-overflow-handling method of claim 39, wherein:

a hard drive comprises the non-removable data storage medium; and

the removable data storage medium is a digital video disc.

43. A data-overflow-handling computer system comprising:
a processor; and
a memory including software instructions adapted to enable the computer system to perform the steps of:
- storing at least one of captured audio data, video data, and metadata to a first directory of a non-removable data storage medium;
 - determining whether an event is being recorded;
 - responsive to a determination that an event is being recorded, storing an image of the stored at least one of captured audio data, video data, and metadata to a second directory of the non-removable data storage medium;
 - determining whether a predefined capacity threshold relative to a removable data storage medium has been exceeded;
 - responsive to a determination that the predefined capacity threshold has been exceeded, creating a third directory of the non-removable data storage medium;
 - determining whether data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium;
 - responsive to a determination that data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium, storing any unstored data in the second directory to the removable data storage medium;
 - determining whether the second directory contains finalization files;
 - responsive to a determination that the second directory contains finalization files, finalizing the removable storage medium and providing a prompt to insert another removable storage medium; and
 - responsive to a determination that the second directory contains no finalization files, returning to the step of determining whether data in the second directory of the non-removable storage medium has not been stored to the removable data storage medium.
44. The computer system of claim 43, further comprising software instructions adapted to enable the computer system to perform the step of, responsive to insertion of another removable data storage medium, checking for the third directory.

45. The system of claim 44, further comprising software instructions adapted to enable the computer system to perform the steps of:

determining whether data in the third directory of the non-removable storage medium has not been stored to the removable data storage medium;

responsive to a determination that data in the third directory of the non-removable storage medium has not been stored to the removable data storage medium, storing any unstored data in the third directory to the new removable data storage medium;

determining whether the third directory contains finalization files; and

responsive to a determination that the third directory contains finalization files, finalizing the removable storage medium and providing a prompt to insert another removable storage medium.

46. The system of claim 43, wherein:

a hard drive comprises the non-removable data storage medium; and
the removable data storage medium is a digital video disc.

47. A method of archiving data, the method comprising:

receiving data;

storing the data on a first data storage medium;

selecting a portion of the data;

determining if at least one environmental factor indicates that environmental conditions are acceptable for storing the selected portion of the data on a second data storage medium; and

responsive to a determination that the at least one environmental factor indicates that environmental conditions are acceptable, storing the selected portion of the data on the second data storage medium.

48. The method of claim 47, further comprising:

responsive to a determination that the at least one environmental factor indicates that environmental conditions are not acceptable, returning to the determining step.

49. The method of claim 47, wherein the at least one environmental factor comprises at least one of temperature, physical shock, and vibration.

50. The method of claim 47, wherein the step of determining further comprises:
measuring the at least one environmental factor; and
determining if the at least one environmental factor is less than a predetermined threshold.

51. The method of claim 47, wherein the step of storing the selected portion of the data on the second data storage medium further comprises:
writing the selected portion of the data on the second data storage medium;
monitoring at least one accelerometer during the storing of the selected portion of the data;
determining if an output value of the at least one accelerometer exceeds a predetermined accelerometer threshold; and
responsive to a determination that the output value of the at least one accelerometer exceeds the predetermined accelerometer threshold, rewriting the selected portion of the data on the second data storage medium.

52. The method of claim 51, further comprising:
responsive to a determination that the output value of the at least one accelerometer does not exceed the predetermined accelerometer threshold, returning to the selecting step.

53. The method of claim 47, wherein the step of storing the selected portion of the data on the second data storage medium further comprises:
writing the selected portion of the data on the second data storage medium;
calculating a first checksum corresponding to the selected portion of the data;
reading the selected written portion of the data from the second data storage medium;
calculating a second checksum corresponding the selected written portion of the data read from the second data storage medium;
determining if the first checksum matches the second checksum; and
responsive to a determination that the first checksum does no match the second checksum, rewriting the selected portion of the data on the second data storage medium.

54. The method of claim 53, further comprising:

responsive to a determination that the first checksum matches the second checksum, returning to the selecting step.

55. The method of claim 47, wherein the encoded data comprises at least one of video data, audio data, and metadata.

56. The method of claim 47, wherein the data comprises encoded data.

57. The method of claim 47, wherein the first data storage medium comprises a non-removable storage medium.

58. The method of claim 47, wherein the second data storage medium comprises a removable storage medium.

59. A computer system for archiving data, the computer system comprising:
a processor; and
a memory including software instructions adapted to enable the computer system to perform the steps of:

receiving data;
storing the data on a first data storage medium;
selecting a portion of the data;
determining if at least one environmental factor indicates that environmental conditions are acceptable for storing the selected portion of the data on a second data storage medium; and
responsive to a determination that the at least one environmental factor indicates that environmental conditions are acceptable, storing the selected portion of the data on the second data storage medium.

60. The computer system of claim 59, further comprising software instructions adapted to enable the computer system to perform the step of, responsive to a determination that the at least one environmental factor indicates that environmental conditions are not acceptable, returning to the determining step.

61. The computer system of claim 59, wherein the at least one environmental factor comprises at least one of temperature, physical shock, and vibration.

62. The computer system of claim 59, wherein the step of determining further comprises:
measuring the at least one environmental factor; and
determining if the at least one environmental factor is less than a predetermined threshold.

63. The computer system of claim 59, wherein the step of storing the selected portion of the data on the second data storage medium further comprises:
writing the selected portion of the data on the second data storage medium;
monitoring at least one accelerometer during the storing of the selected portion of the data;

determining if an output value of the at least one accelerometer exceeds a predetermined accelerometer threshold; and

responsive to a determination that the output value of the at least one accelerometer exceeds the predetermined accelerometer threshold, rewriting the selected portion of the data on the second data storage medium.

64. The computer system of claim 63, further comprising software instructions adapted to enable the computer system to perform the step of, responsive to a determination that the output value of the at least one accelerometer does not exceed the predetermined accelerometer threshold, returning to the selecting step.

65. The computer system of claim 59, wherein the step of storing the selected portion of the data on the second data storage medium further comprises:

writing the selected portion of the data on the second data storage medium;

calculating a first checksum corresponding to the selected portion of the data;

reading the selected written portion of the data from the second data storage medium;

calculating a second checksum corresponding the selected written portion of the data read from the second data storage medium;

determining if the first checksum matches the second checksum; and

responsive to a determination that the first checksum does not match the second checksum, rewriting the selected portion of the data on the second data storage medium.

66. The computer system of claim 65, further comprising software instructions adapted to enable the computer system to perform the step of, responsive to a determination that the first checksum matches the second checksum, returning to the selecting step.

67. The computer system of claim 59, wherein the encoded data comprises at least one of video data, audio data, and metadata.

68. The computer system of claim 59, wherein the data comprises encoded data.

69. The computer system of claim 59, wherein the first data storage medium comprises a non-removable storage medium.

70. The computer system of claim 59, wherein the second data storage medium comprises a removable storage medium.

71. A data security method comprising:
performing a checksum on data contained on a removable data storage medium;
storing the checksum on the removable data storage medium in at least one of an encrypted and a hidden form;
storing a unique serial number pertaining to the removable storage medium to the removable storage medium; and
storing a checksum and a corresponding unique serial number of a plurality of previous removable storage media to the removable storage medium.

72. The data security method of claim 71, further comprising storing the unique serial number pertaining to the removable storage medium to a non-removable storage medium of a system used to store data to the removable storage medium.

73. A data security computer system comprising:
a processor; and
a memory including software instructions adapted to enable the computer system to perform the steps of:
performing a checksum on data contained on a removable data storage medium;
storing the checksum on the removable data storage medium in at least one of an encrypted and a hidden form;
storing a unique serial number pertaining to the removable storage medium to the removable storage medium; and
storing a checksum and a corresponding unique serial number of a plurality of previous removable storage media to the removable storage medium.

74. The data security system of claim 73, further comprising software instructions adapted to enable the computer system to perform the step of storing the unique serial number pertaining to the removable storage medium to a non-removable storage medium of a system used to store data to the removable storage medium.

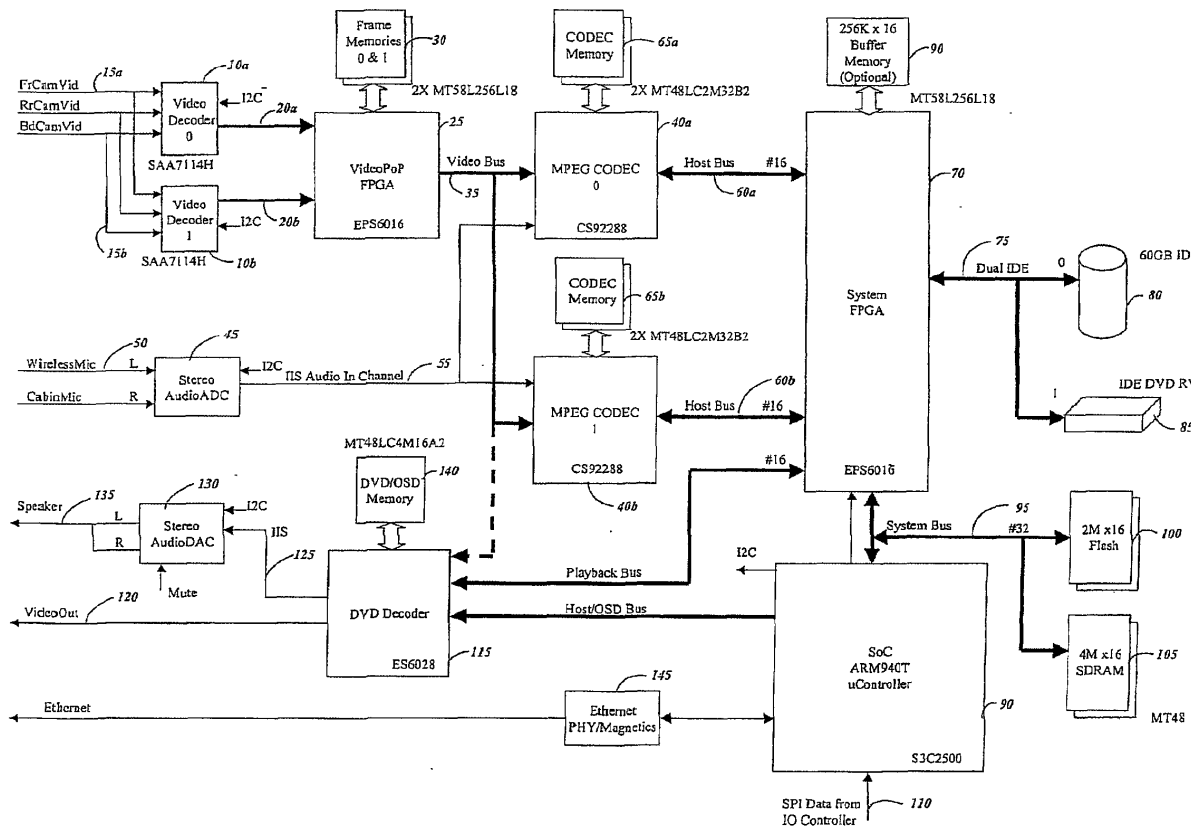
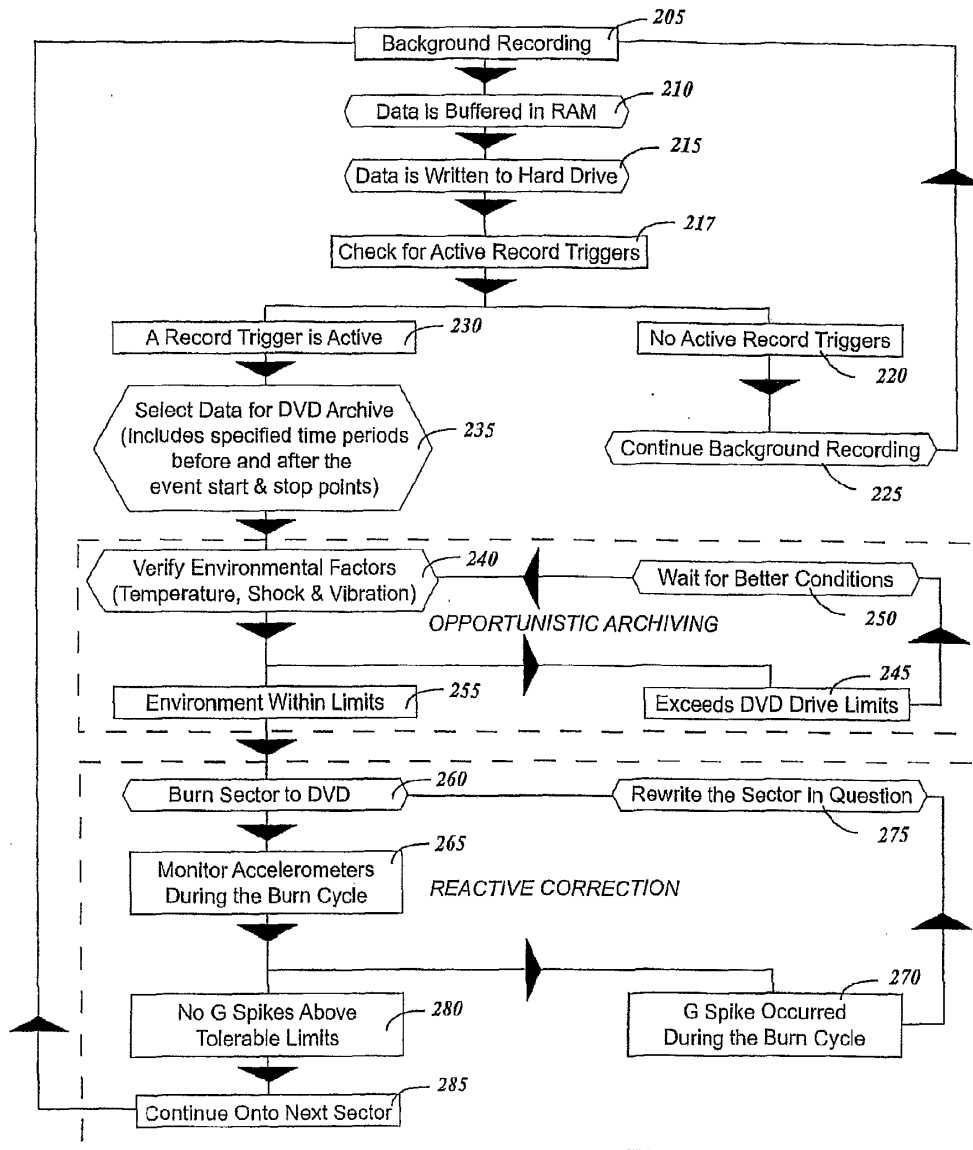


FIGURE 1



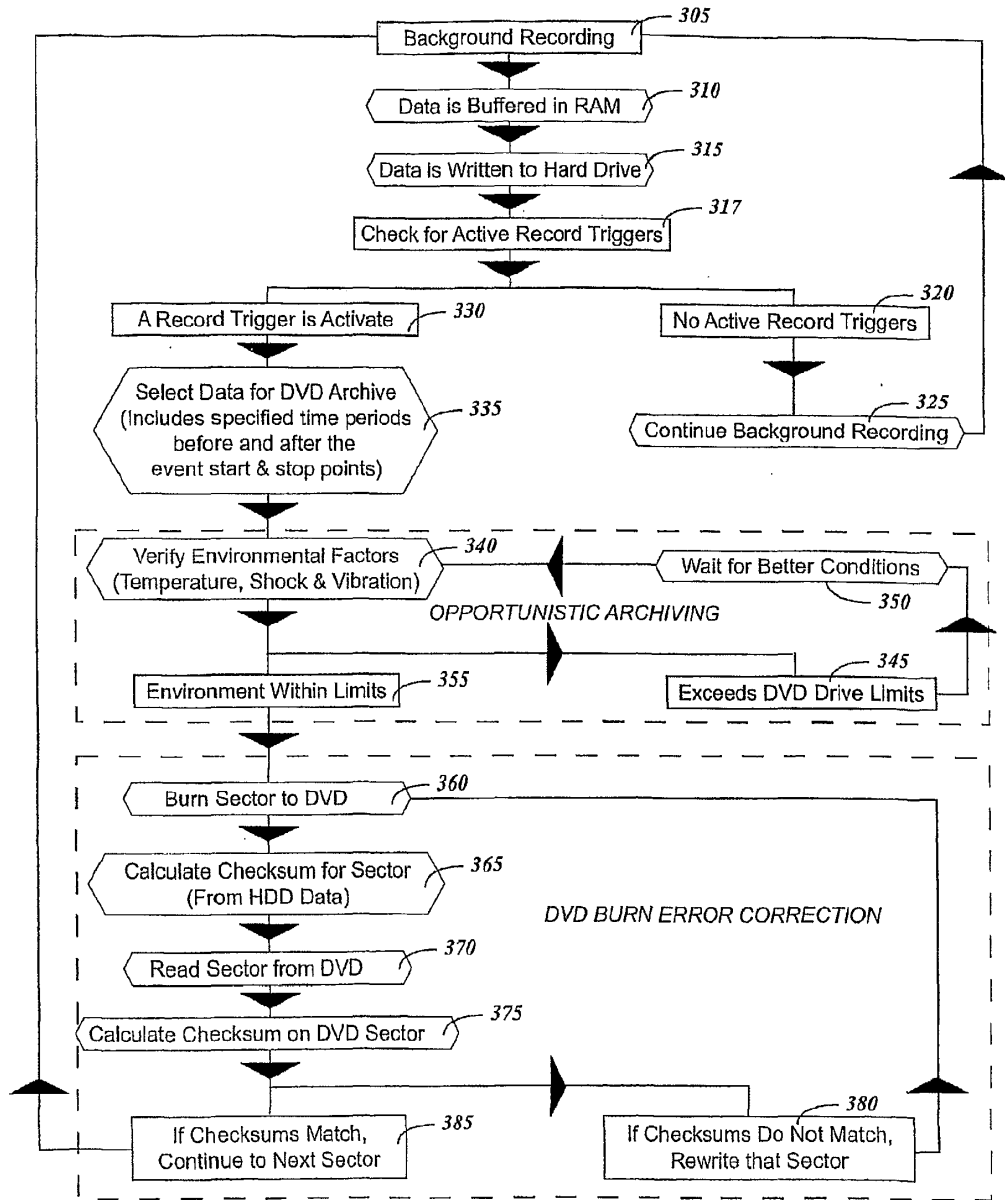


FIGURE 3

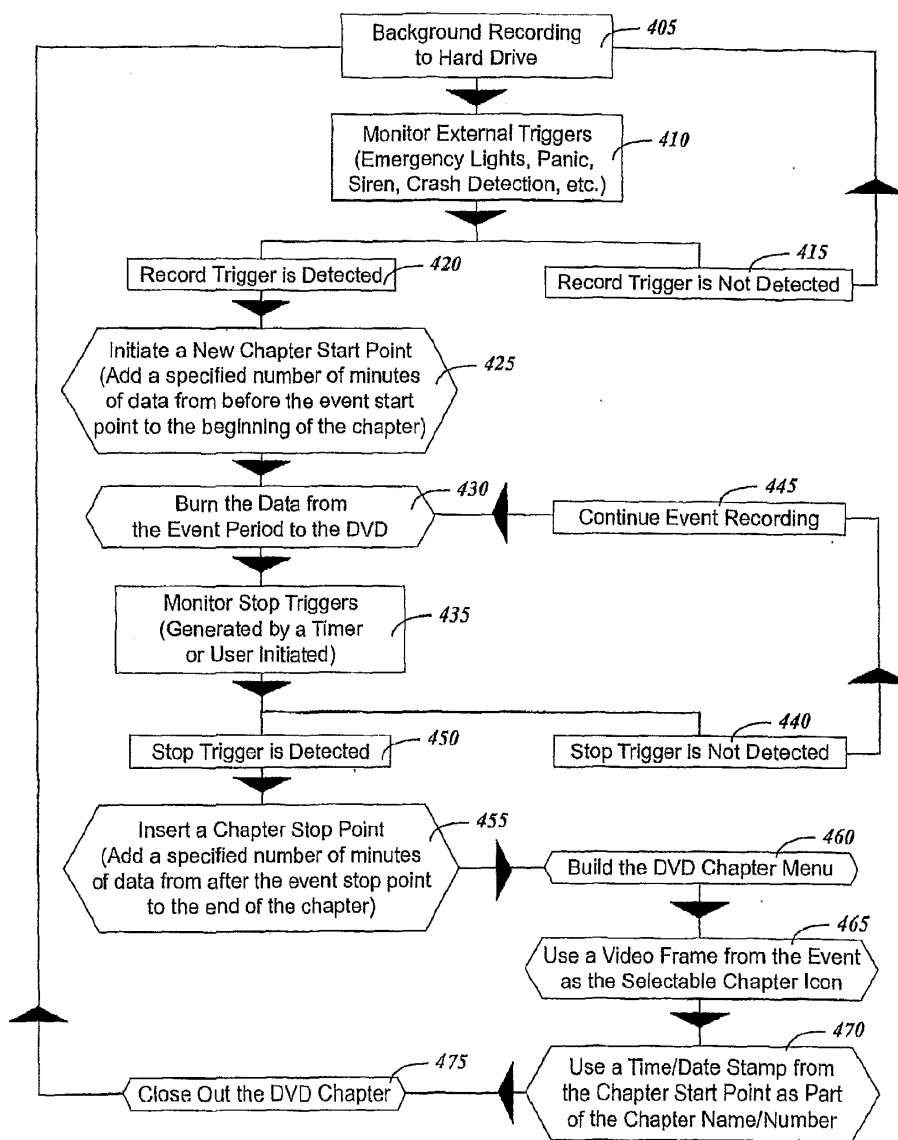


FIGURE 4

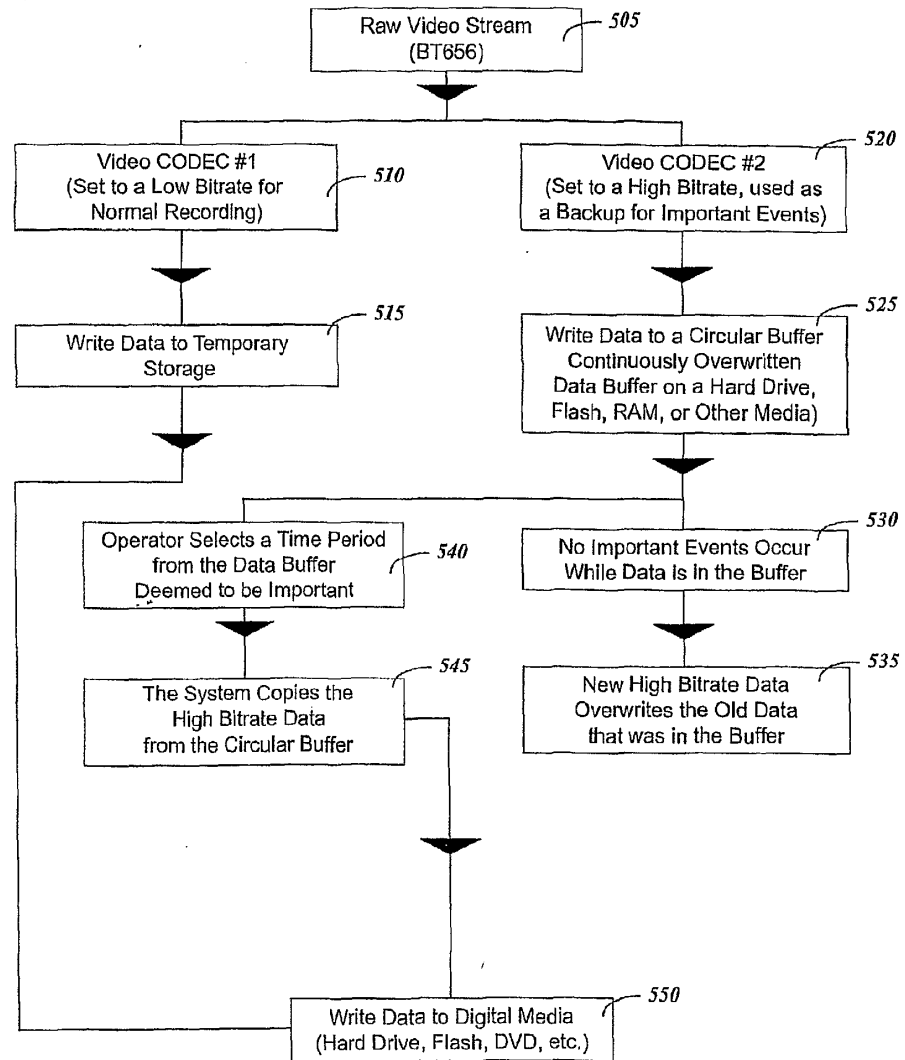


FIGURE 5

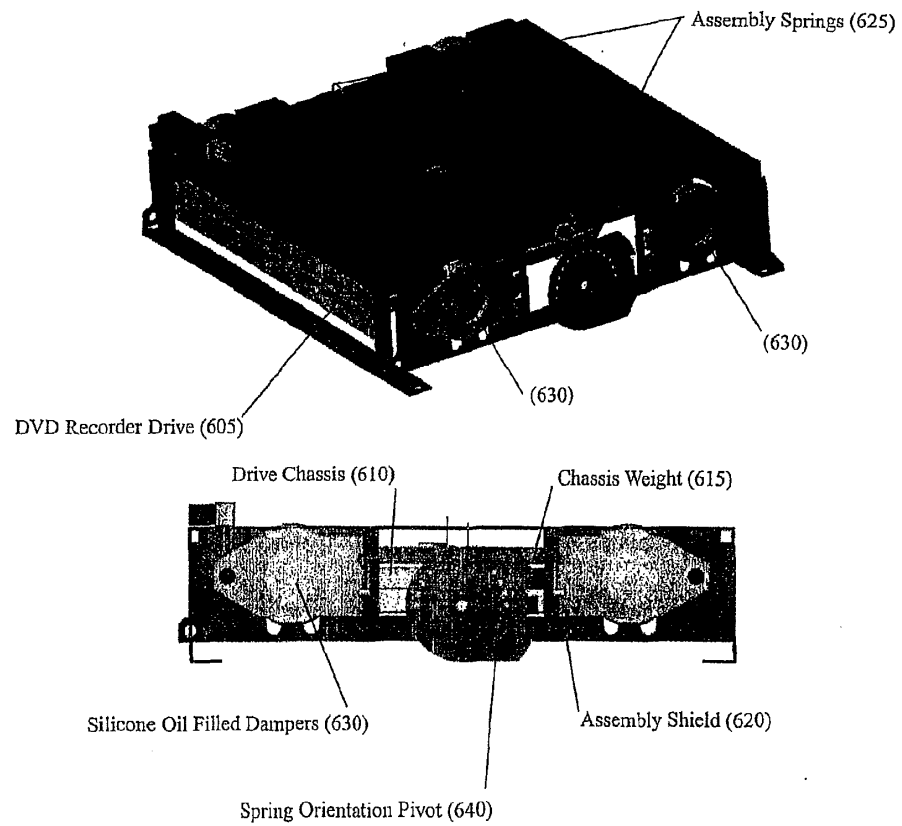


FIGURE 6

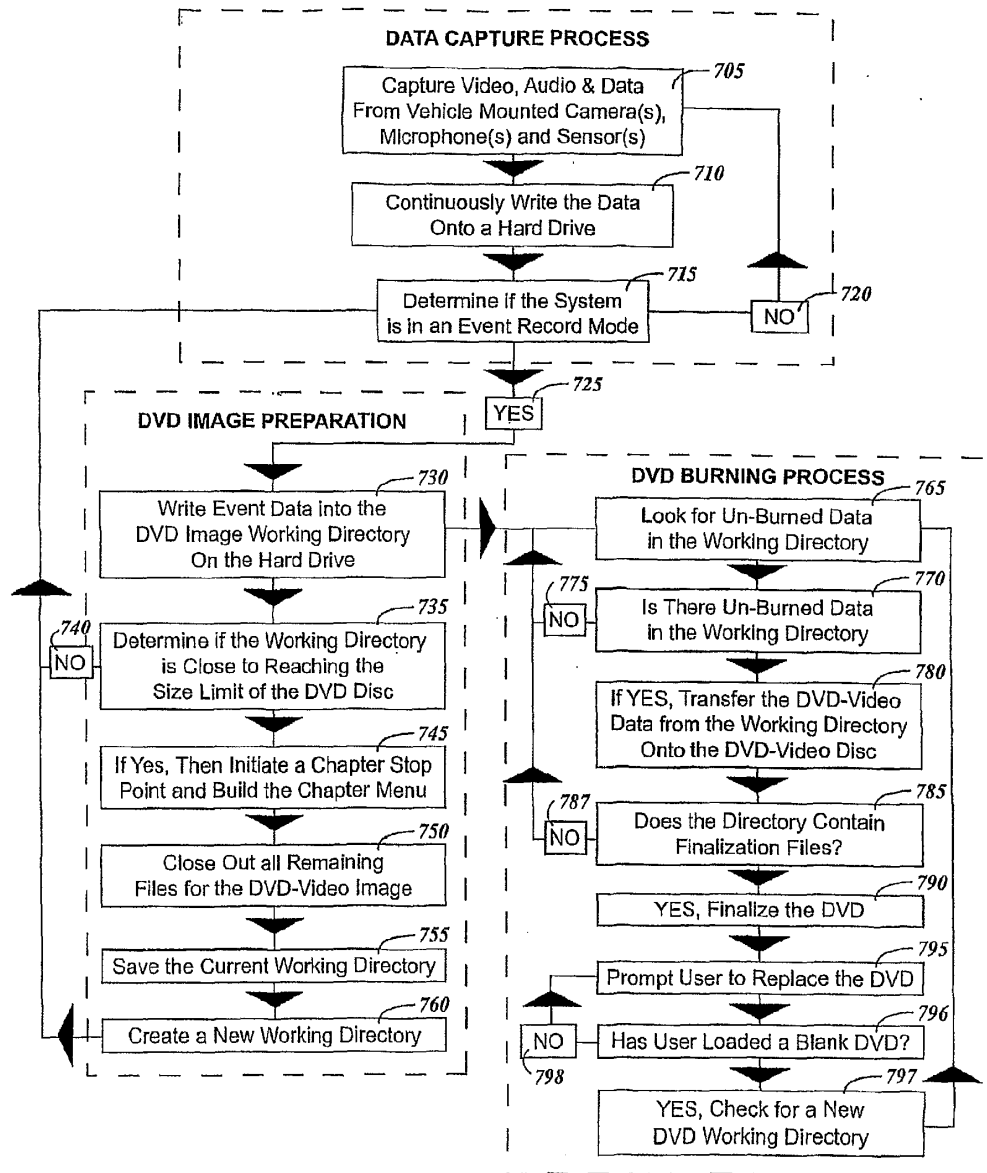


FIGURE 7

Electronic Acknowledgement Receipt	
EFS ID:	6613847
Application Number:	12560584
International Application Number:	
Confirmation Number:	1641
Title of Invention:	Loop Recording With Book Marking
First Named Inventor/Applicant Name:	Paul DeKeyser
Customer Number:	24392
Filer:	Martin Fessenmaier/Sara Geer
Filer Authorized By:	Martin Fessenmaier
Attorney Docket Number:	101488.0003US4
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Time Stamp:	17:11:39
Application Type:	Utility under 35 USC 111(a)

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Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Filed (SB/08)	US_IDS_Form__SB_08a.pdf	817773 5dca8c5e627b798ece6c77ec1cf30e6441dc84d0	no	4

Warnings:

Information:

2	Foreign Reference	EP1064783_Mann.pdf	1342962 f1450cd530ce21571baf57901b214795a3c9c8b	no	73
Warnings:					
Information:					
3	Foreign Reference	WO2006_044476_Vanman.pdf	1988216 d826e9e565564a53d839e64680f39706dbb7946e	no	45
Warnings:					
Information:					
Total Files Size (in bytes):			4148951		
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/560,584	09/16/2009	Paul DeKeyser	101488.0003US4

CONFIRMATION NO. 1641

PUBLICATION NOTICE



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24392
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
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Title: Loop Recording With Book Marking

Publication No. US-2010-0066830-A1

Publication Date: 03/18/2010

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/560,584	09/16/2009	Paul DeKeyser	101488.0003US4	1641
24392 7590 08/16/2013 FISH & ASSOCIATES, PC ROBERT D. FISH 2603 Main Street Suite 1000 Irvine, CA 92614-6232			EXAMINER DIEP, NHON THANH	
			ART UNIT	PAPER NUMBER
			2487	
			NOTIFICATION DATE	DELIVERY MODE
			08/16/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

rfish@fishiplaw.com
patents@fishiplaw.com

Office Action Summary	Application No. 12/560,584	Applicant(s) DEKEYSER, PAUL	
	Examiner NHON DIEP	Art Unit 2487	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 19 March 2010.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5) ☒ Claim(s) 1-22 is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☒ Claim(s) 1-22 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☒ The drawing(s) filed on 16 September 2009 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some * c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

4) ☐ Other: _____.

DETAILED ACTION

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will

determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to

<http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

2. Claims 1 and 6-20 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1 and 6-10 of U.S. Patent No. 7,593,034 B2.

Although the claims at issue are not identical, they are not patentably distinct from each other because claims 1 and 6-20 of the present application are anticipated by claims 1 and 6-10 of U.S. Patent.

3. Claim 1 is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 8,310,540 B2. Although the claims at issue are not identical, they are not patentably distinct from each other because claim 1 of the present application is an obvious variance over claim 1 of the U.S. Patent.

4. Claim 1 is provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of copending Application No. 11/846,217. Although the claims at issue are not identical, they are not patentably distinct from each other because claim 1 of the present application is an obvious variance over claim 1 of the copending Application.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

5. Claims 1-12 are is provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-5, 6-12 and 14 of copending Application No. 13/790,553. Although the claims at issue are not identical, they are not patentably distinct from each other because claims 1-12 of the present application are an obvious variance over claims 1-5, 6-12 and 14 of copending Application.

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

Allowable Subject Matter

6. Claims 1-22 are to be allowed when the double Patenting rejections are overcome, and that update search would not uncover any applicable prior art.

7. The following is a statement of reasons for the indication of allowable subject matter: The present application relates to a video recording technology. The various prior art of record do not anticipate nor render obviousness a surveillance apparatus, comprising a recording facility that records the image data into available portions of a circular buffer in the local memory as a first file using a digital video file format; a protecting facility that responds to a signal to record the image data by designating a segment of the circular buffer as a write-protected portion and by indexing the write-protected portion as a second file in the circular buffer as in combination with other limitations as specified in claims 1 and 12.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to NHON DIEP whose telephone number is (571)272-7328. The examiner can normally be reached on m-f.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Czekaj can be reached on 571-272-7327. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nhon T Diep/
Primary Examiner, Art Unit 2487

Notice of References Cited	Application/Control No. 12/560,584	Applicant(s)/Patent Under Reexamination DEKEYSER, PAUL	
	Examiner NHON DIEP	Art Unit 2487	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,813,822	10-2010	Hoffberg, Steven M.	700/94
*	B	US-2008/0177994	07-2008	Mayer, Yaron	713/2
*	C	US-2005/0240943	10-2005	Smith et al.	719/328
*	D	US-7,546,602	06-2009	Hejlsberg et al.	719/313
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Index of Claims</i> 	Application/Control No. 12560584	Applicant(s)/Patent Under Reexamination DEKEYSER, PAUL
	Examiner NHON DIEP	Art Unit 2487

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant											☐ CPA											☐ T.D.											☐ R.1.47										
CLAIM			DATE																																								
Final	Original	08/12/2013																																									
	1	✓																																									
	2	✓																																									
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	22	✓																																									

EAST Search History**EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	5	Dekeyser-paul\$.in. and circular and (buffer or memory) and write same protected	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/12 14:40
L4	0	((first and second) same file circular and (buffer or memory) and write same protected)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/12 14:43
L5	13	((first and second) same file same circular and (buffer or memory) and write same protected)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/12 14:43
L7	5	((first and second) same file same circular and (buffer or memory) and write same protected) and (pre and post) same record\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/12 14:46
L8	12	((first and second) same file same circular and (buffer or memory) and write same protected) and trigger\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/12 14:51

EAST Search History (Interference)

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L3	0	((first and second) same file circular and (buffer or memory) and write same protected).clm.	USPAT; UPAD	OR	ON	2013/08/12 14:42
L6	1	((first and second) same file and circular and (buffer or memory) and write same protected).clm.	USPAT; UPAD	OR	ON	2013/08/12 14:44

8/ 12/ 2013 2:53:32 PM**C:\Users\ndiep\Documents\EAST\Workspaces\default.wsp**



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BIB DATA SHEET

CONFIRMATION NO. 1641

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
12/560,584	09/16/2009	348	2487	101488.0003US4		
RULE						
APPLICANTS Paul DeKeyser, Irvine, CA; ** CONTINUING DATA ***** This application is a CON of 12/268,286 11/10/2008 PAT 7593034 which is a CIP of 11/770,920 06/29/2007 PAT 8310540 which claims benefit of 60/824,097 08/31/2006 and said 12/268,286 11/10/2008 is a CIP of 11/846,217 08/28/2007 which claims benefit of 60/824,095 08/31/2006 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 09/28/2009						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and /NHON THANH DIEP/ Acknowledged Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 4	TOTAL CLAIMS 22	INDEPENDENT CLAIMS 2
ADDRESS FISH & ASSOCIATES, PC ROBERT D. FISH 2603 Main Street Suite 1000 Irvine, CA 92614-6232 UNITED STATES						
TITLE Loop Recording With Book Marking						
FILING FEE RECEIVED 579	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

Search Notes 	Application/Control No. 12560584	Applicant(s)/Patent Under Reexamination DEKEYSER, PAUL
	Examiner NHON DIEP	Art Unit 2487

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor's names search, reviewed copending and related applications, east search	8/12/2013	N.D.

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12560584
	Filing Date		2009-09-16
	First Named Inventor	Paul H. DeKeyser	
	Art Unit	2621	
	Examiner Name		
	Attorney Docket Number	101488.0003US4	

U.S.PATENTS							Remove	
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1	5523799		1996-06-04	Hattori et al.			
	2	6351798	B1	2002-02-26	Aono			
	3	7195164	B2	2007-03-27	Patel			
If you wish to add additional U.S. Patent citation information please click the Add button.							Add	
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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear		
	1							
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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² i	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	99/49656	WO		1999-09-30	MANN, W., Stephen		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		12560584	
	Filing Date		2009-09-16	
	First Named Inventor	Paul H. DeKeyser		
	Art Unit	2621		
	Examiner Name			
	Attorney Docket Number	101488.0003US4		

	2	2006/044476	WO	A2	2006-04-27	VANMAN, Robert Vernon		☐
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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		☐

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EXAMINER SIGNATURE

Examiner Signature	/Nhon Diep/	Date Considered	08/12/2013
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450**

Appl No.: 12/560584
Inventor: Paul DeKeyser
Filing Date: September 16, 2009
Art Unit: 2487
Examiner: Nhon Thanh Diep
Attorney Docket No.: 102246.0003US4

Title Loop Recording With Book Marking

Mail Stop Amendments
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO OFFICE ACTION

Sir:

This paper responds to the Office Action dated August 16, 2013 and is accompanied by four Terminal Disclaimers. Please enter the terminal disclaimers into the record and consider the remarks herein.

- Claims begin on page 2.
- Remarks begin on page 5.

AMENDMENTS TO THE CLAIMS

This listing of claims represents the current version of claims before the Office:

1. (original) A surveillance apparatus, comprising:
 - a camera having an image capturing component that captures image data;
 - a local memory functionally coupled to the camera;
 - a recording facility that records the image data into available portions of a circular buffer in the local memory as a first file using a digital video file format;
 - a protecting facility that responds to a signal to record the image data by designating a segment of the circular buffer as a write-protected portion and by indexing the write-protected portion as a second file in the circular buffer, wherein the segment includes a pre-recorded subset recorded before the signal is received and a post-recorded subset to be recorded after the signal is received; andwherein the local memory is configured to allow access to at least one of the files.
2. (original) The apparatus of claim 1, further comprising a sending facility configured to transmit the second file from the local memory to a remote memory;
3. (original) The apparatus of claim 2, wherein the sending facility comprises a wireless transmitter
4. (original) The apparatus of claim 1, further comprising a sensor that automatically triggers the signal to record upon detecting identified content in at least one of the captured images.
5. (original) The apparatus of claim 1, further comprising an interface through which a human can initiate the signal.
6. (original) The apparatus of claim 1, further comprising an interface through which a human can designate a length of time of at least one of the pre-recorded subset, the post-recorded subset, and the segment.
7. (original) The apparatus of claim 1, wherein the local memory is configured to provide access to the at least one of the files to a mobile phone.

8. (original) The apparatus of claim 1, wherein a mobile phone automatically receives the second file and automatically forwards the second file to a remote memory.
9. (original) The system of claim 1, further comprising a mount for the camera.
10. (original) The system of claim 9, wherein the mount is a pair of wearable glasses.
11. (original) The system of claim 1, further comprising an electronic index that provides a directory to the first and the second files within the circular buffer.
12. (original) A method of processing imaged data from a camera, comprising the following steps:
 - receiving video data;
 - recording the video data into available portions of a circular buffer as a first file;
 - responding to a signal by write-protecting a segment that includes a newly recorded portion of the buffer, wherein the newly recorded portion is recorded before the signal is received, and includes a post-recorded portion to be recorded after the signal is received;
 - indexing write protected portions of the buffer as separate, distinct files during the step of recording; and
 - allowing access to at least one of the distinct files from the write-protected portions of the circular buffer.
13. (original) The method of claim 12, further comprising storing the distinct files from the write-protected portions as the distinct, separate files in a remote memory.
14. (original) The method of claim 12, further comprising recording the video data as the first file into physically dis-contiguous parts of the circular buffer.
15. (original) The method of claim 12, wherein the signal to save a recording comprises a signal to start recording and a signal to stop recording.
16. (original) The method of claim 12, further comprising receiving the signal to save a recording through at least one of a manually operated switch and an audio signal.

17. (original) The method of claim 12, further comprising configuring the size of the pre-recorded subset.
18. (original) The method of claim 12, further comprising removing write-protection from a transmitted write-protected portion after transmission of its corresponding distinct file.
19. (original) The method of claim 12, further comprising sending a warning to a user before the write protected segment of the circular buffer is fully recorded.
20. (original) The method of claim 19, further comprising extending a length of the write protected segment of the circular buffer in response to at least one of a manually operated switch and an audio signal.
21. (original) The method of claim 12, wherein the step of providing access to the at least one of the distinct files includes transmitting the at least one of the distinct files for storage in a remote memory.
22. (original) The method of claim 21, wherein the step of transmitting includes wirelessly transmitting the at least one of the distinct files.

REMARKS/ARGUMENTS

The Office Action dated August 16, 2013 has been received and carefully considered. By this amendment, no claims are being amended. In view of the accompanying Terminal Disclaimers, Applicant respectfully requests reconsideration.

Double Patenting

The Office rejected claims 1 and 6-20 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 6-10 of U.S. Patent No. 7,593,034 and claim 1 as being unpatentable over claim 1 of U.S. Patent No. 8,310,540. These rejections are rendered moot by the attached terminal disclaimers for each of these cited patents herewith along with the appropriate Power of Attorney.

The Office provisionally rejected claims 1 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of co-pending Application No. 11/846,217 and claims 1-12 as being unpatentable over claims 1-5, 6-12 and 14 of co-pending Application No. 13/790,553. These provisional rejections are rendered moot by the attached terminal disclaimers for each of these applications herewith along with the appropriate Power of Attorney.

///

Request for Allowance

Claims 1-22 are pending in this application. Applicant requests allowance of all pending claims.

Respectfully submitted,
Fish & Associates, PC

Date: October 28, 2013

By: /Nicholas J. Witchey/
Nicholas J. Witchey
Reg. No. 63481

Fish & Associates, PC
2603 Main Street, Suite 1000
Irvine, CA 92614-4271
Telephone (949) 943-8300
Fax (949) 943-8358

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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☒ Practitioners associated with the Customer Number:

24392

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

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The address associated with Customer Number:

24392

OR

☐ Firm or Individual Name			
Address			
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Assignee Name and Address:

Stellar LLC
55 Hidden Trail
Irvine, CA 92603

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/86 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	<i>Paul DeKeyser</i>	Date	10/24/13
Name	Paul DeKeyser	Telephone	(949) 463-7120
Title	President MEMBER		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Paul DeKeyser

Application No./Patent No.: 12/560854 Filed/Issue Date: September 16, 2009

Entitled: Loop Recording With Book Marking

Stellar LLC, a

Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title and interest
(The extent (by percentage) of its ownership interest is _____ %)

in the patent application/patent identified above by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 028980, Frame 0430, or for which a copy thereof is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

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☐ Additional documents in the chain of title are listed on a supplemental sheet.

☐ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Nicholas J. Withey
Signature

Nicholas J. Withey
Printed or Typed Name

Agent for Applicant
Title

October 28, 2013
Date

949-943-8300
Telephone Number

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Electronic Patent Application Fee Transmittal				
Application Number:		12560584		
Filing Date:		16-Sep-2009		
Title of Invention:		Loop Recording With Book Marking		
First Named Inventor/Applicant Name:		Paul DeKeyser		
Filer:		Martin Fessenmaier/Laryssa Weiland		
Attorney Docket Number:		102246.0003US4		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Statutory or Terminal Disclaimer	1814	4	160	640
Total in USD (\$)				640

Electronic Acknowledgement Receipt	
EFS ID:	17238830
Application Number:	12560584
International Application Number:	
Confirmation Number:	1641
Title of Invention:	Loop Recording With Book Marking
First Named Inventor/Applicant Name:	Paul DeKeyser
Customer Number:	24392
Filer:	Martin Fessenmaier/Laryssa Weiland
Filer Authorized By:	Martin Fessenmaier
Attorney Docket Number:	102246.0003US4
Receipt Date:	28-OCT-2013
Filing Date:	16-SEP-2009
Time Stamp:	11:29:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$640
RAM confirmation Number	9410
Deposit Account	500341
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response_01b.pdf	479449	yes	6
			612e36029f10e21db8a6acfab3aecf3984505ad		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	4	
	Applicant Arguments/Remarks Made in an Amendment		5	6	
Warnings:					
Information:					
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Warnings:					
Information:					
3	Terminal Disclaimer Filed	TD_3US1.pdf	419018	no	1
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4	Terminal Disclaimer Filed	TD_3US2.pdf	419060	no	1
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5	Terminal Disclaimer Filed	TD_3US5.pdf	420212	no	1
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Warnings:					
Information:					
6	Power of Attorney	POA.pdf	490215	no	2
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Warnings:					
Information:					

7	Fee Worksheet (SB06)	fee-info.pdf	30065 eb736a622a28d90019fdb05dd10dca7e263aae	no	2
Warnings:					
Information:					
Total Files Size (in bytes):				2678333	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

TERMINAL DISCLAIMER TO OBTAIN A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number (Optional) 102246.0003US4
In re Application of: Paul DeKeyser Application No.: 12/560584 Filed: September 16, 2009 For: Loop Recording With Book Marking The owner*, <u>Stellar, LLC</u>, of <u>100</u> percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending reference Application Number <u>11/846217</u>, filed on <u>August 28, 2007</u>, as such term is defined in 35 U.S.C. 154 and 173, and as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the reference application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns. In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of any patent granted on said reference application, "as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application," in the event that: any such patent: granted on the pending reference application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant. Check either box 1 or 2 below, if appropriate. 1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. 2. ☒ The undersigned is an attorney or agent of record. Reg. No. <u>63481</u> <u>/Nicholas J. Witchey/</u> Signature <u>October 28, 2013</u> Date <u>Nicholas J. Witchey</u> Typed or printed name <u>(949) 943-8300</u> Telephone Number ☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. *Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this statement. See MPEP § 324.	

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

TERMINAL DISCLAIMER TO OBTAIN A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number (Optional) 102246.0003US4
In re Application of: Paul DeKeyser Application No.: 12/560584 Filed: September 16, 2009 For: Loop Recording With Book Marking The owner*, <u>Stellar, LLC</u>, of <u>100</u> percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending reference Application Number <u>13/790553</u>, filed on <u>March 8, 2013</u>, as such term is defined in 35 U.S.C. 154 and 173, and as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the reference application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns. In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of any patent granted on said reference application, "as the term of any patent granted on said reference application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending reference application," in the event that: any such patent: granted on the pending reference application: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant. Check either box 1 or 2 below, if appropriate. 1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. 2. ☒ The undersigned is an attorney or agent of record. Reg. No. <u>63481</u> <u>/Nicholas J. Witchey/</u> Signature <u>October 28, 2013</u> Date <u>Nicholas J. Witchey</u> Typed or printed name <u>(949) 943-8300</u> Telephone Number ☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. *Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this statement. See MPEP § 324.	

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) 102246.0003US4
In re Application of: Paul DeKeyser Application No.: 12/560584 Filed: September 16, 2009 For: Loop Recording With Book Marking The owner*, <u>Stellar, LLC</u>, of <u>100</u> percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term prior patent No. <u>7593034</u> as the term of said prior patent is defined in 35 U.S.C. 154 and 173, and as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns. In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later: - expires for failure to pay a maintenance fee; - is held unenforceable; - is found invalid by a court of competent jurisdiction; - is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; - has all claims canceled by a reexamination certificate; - is reissued; or - is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. Check either box 1 or 2 below, if appropriate. 1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. 2. ☒ The undersigned is an attorney or agent of record. Reg. No. <u>63481</u> <u>/Nicholas J. Witchey/</u> Signature <u>October 28, 2013</u> Date <u>Nicholas J. Witchey</u> Typed or printed name <u>(949) 943-8300</u> Telephone Number ☒ Terminal disclaimer fee under 37 CFR 1.20(d) included. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. *Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner). Form PTO/SB/96 may be used for making this certification. See MPEP § 324.	

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING
REJECTION OVER A "PRIOR" PATENT**

Docket Number (Optional)
102246.0003US4

In re Application of: Paul DeKeyser

Application No.: 12/560584

Filed: September 16, 2009

For: Loop Recording With Book Marking

The owner*, Stellar, LLC, of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term **prior patent** No. 8310540 as the term of said prior patent is defined in 35 U.S.C. 154 and 173, and as the term of said **prior patent** is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ For submissions on behalf of a business/organization (e.g., corporation, partnership, university, government agency, etc.), the undersigned is empowered to act on behalf of the business/organization.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

2. ☒ The undersigned is an attorney or agent of record. Reg. No. 63481

/Nicholas J. Witchey/

Signature

October 28, 2013

Date

Nicholas J. Witchey

Typed or printed name

(949) 943-8300

Telephone Number

- ☒ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 12/560,584		Filing Date 09/16/2009		☐ To be Mailed	
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO									
APPLICATION AS FILED – PART I									
(Column 1)		(Column 2)							
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)	
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A			
☐ SEARCH FEE (37 CFR 1.16(k), (j), or (m))		N/A		N/A		N/A			
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A			
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =		*		X \$		=	
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =		*		X \$		=	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))									
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL			
APPLICATION AS AMENDED – PART II									
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT	10/28/2013	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 22	Minus	** 22	= 0	x \$40 =		0	
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	x \$210 =		0	
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE		0	
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$			
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$			
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.									

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/560,584	09/16/2009	Paul DeKeyser	102246.0003US4

24392
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

CONFIRMATION NO. 1641
POA ACCEPTANCE LETTER



Date Mailed: 11/01/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/28/2013.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/sleutchit/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Application Number 	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/560,584	DEKEYSER, PAUL	
Document Code - DISQ		Internal Document – DO NOT MAIL	

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 10/28/13	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by: Felicia D. Roberts 4 TDs approved with this filing date

U.S. Patent and Trademark Office



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

24392 7590 11/26/2013
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

EXAMINER

DIEP, NHON THANH

ART UNIT

PAPER NUMBER

2487

DATE MAILED: 11/26/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/560,584	09/16/2009	Paul DeKeyser	102246.0003US4	1641

TITLE OF INVENTION: LOOP RECORDING WITH BOOK MARKING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	02/26/2014

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

24392 7590 11/26/2013
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/560,584	09/16/2009	Paul DeKeyser	102246.0003US4	1641

TITLE OF INVENTION: LOOP RECORDING WITH BOOK MARKING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	02/26/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
DIEP, NHON THANH	2487	348-143000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.563).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/560,584	09/16/2009	Paul DeKeyser	102246.0003US4	1641
24392 7590 11/26/2013 FISH & ASSOCIATES, PC ROBERT D. FISH 2603 Main Street Suite 1000 Irvine, CA 92614-6232			EXAMINER DIEP, NHON THANH	
			ART UNIT 2487	PAPER NUMBER

DATE MAILED: 11/26/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 1004 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 1004 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**Notices of Allowance and Fee(s) Due mailed between October 1, 2013 and
December 31, 2013**

(Addendum to PTOL-85)

If the "Notice of Allowance and Fee(s) Due" has a mailing date on or after October 1, 2013 and before January 1, 2014, the following information is applicable to this application.

If the issue fee is being timely paid on or after January 1, 2014, the amount due is the issue fee and publication fee in effect January 1, 2014. On January 1, 2014, the issue fees set forth in 37 CFR 1.18 decrease significantly and the publication fee set forth in 37 CFR 1.18(d)(1) decreases to \$0.

If an issue fee or publication fee has been previously paid in this application, applicant is not entitled to a refund of the difference between the amount paid and the amount in effect on January 1, 2014.

Notice of Allowability	Application No. 12/560,584	Applicant(s) DEKEYSER, PAUL	
	Examiner NHON DIEP	Art Unit 2487	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 11/7/2013.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-22. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/oph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
* Certified copies not received: ____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date ____ 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date ____	5. ☐ Examiner's Amendment/Comment 6. ☐ Examiner's Statement of Reasons for Allowance 7. ☐ Other ____
--	---

/Nhon T Diep/ Primary Examiner, Art Unit 2487	
--	--

EAST Search History**EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	"7593034".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/18 14:37
L2	430659	circular and (buffer or memory) sme writ\$3 same protect\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/18 14:39
L3	2351	circular and (buffer or memory) same writ\$3 same protect\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/18 14:39
L4	2	((first or 1st) and (second or 2nd)) same file same circular same (buffer and memory) same writ\$3 and protect\$3 and (pre and post) same record\$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/11/18 14:41

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L5	1	((((first or 1st) and (second or 2nd)) same file same circular same (buffer and memory) same writ\$3 and protect\$3 and (pre and post) same record\$3).clm.	USPAT; UPAD	OR	ON	2013/11/18 14:41
L6	1	((((first or 1st) and (second or 2nd)) and file and circular same (buffer and memory) and writ\$3 and protect\$3 and (pre and post) and record\$3).clm.	USPAT; UPAD	OR	ON	2013/11/18 14:42

11/ 18/ 2013 2:42:42 PM**C:\Users\ndiep\Documents\EAST\Workspaces\default.wsp**

Issue Classification 	Application/Control No. 12560584	Applicant(s)/Patent Under Reexamination DEKEYSER, PAUL
	Examiner NHON DIEP	Art Unit 2487

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	17	17												
2	2	18	18												
3	3	19	19												
4	4	20	20												
5	5	21	21												
6	6	22	22												
7	7														
8	8														
9	9														
10	10														
11	11														
12	12														
13	13														
14	14														
15	15														
16	16														

NONE		Total Claims Allowed:	
		22	
(Assistant Examiner)	(Date)	O.G. Print Claim(s)	O.G. Print Figure
/NHON DIEP/ Primary Examiner.Art Unit 2487	11/18/2013	1	1 7 3
(Primary Examiner)	(Date)		

Search Notes 	Application/Control No. 12560584	Applicant(s)/Patent Under Reexamination DEKEYSER, PAUL
	Examiner NHON DIEP	Art Unit 2487

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor's names search, reviewed copending and related applications, east search	8/12/2013	N.D.
Update search	11/18/2013	N.D.

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
See attached		8/12/2013	n.D.N

--	--

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

24392 7590 11/26/2013
FISH & ASSOCIATES, PC
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Laryssa Weiland	(Depositor's name)
/Laryssa Weiland/	(Signature)
January 24, 2014	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/560,584	09/16/2009	Paul DeKeyser	102246.0003US4	1641

TITLE OF INVENTION: LOOP RECORDING WITH BOOK MARKING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	02/26/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
DIEP, NHON THANH	2487	348-143000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.563).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Fish & Associates, PC
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Stellar, LLC

Irvine, CA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 500341 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Nicholas J. Witchey/

Date January 24, 2014

Typed or printed name Nicholas J. Witchey

Registration No. 63481

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal				
Application Number:		12560584		
Filing Date:		16-Sep-2009		
Title of Invention:		LOOP RECORDING WITH BOOK MARKING		
First Named Inventor/Applicant Name:		Paul DeKeyser		
Filer:		Martin Fessenmaier/Laryssa Weiland		
Attorney Docket Number:		102246.0003US4		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	2501	1	480	480
Publ. Fee- Early, Voluntary, or Normal	1504	1	0	0

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				480

Electronic Acknowledgement Receipt	
EFS ID:	18016683
Application Number:	12560584
International Application Number:	
Confirmation Number:	1641
Title of Invention:	LOOP RECORDING WITH BOOK MARKING
First Named Inventor/Applicant Name:	Paul DeKeyser
Customer Number:	24392
Filer:	Martin Fessenmaier/Laryssa Weiland
Filer Authorized By:	Martin Fessenmaier
Attorney Docket Number:	102246.0003US4
Receipt Date:	24-JAN-2014
Filing Date:	16-SEP-2009
Time Stamp:	14:05:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 480
RAM confirmation Number	349
Deposit Account	500341
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)					
Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)					
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Issue_Fee.pdf	122436	no	2
			a58d3d2111475410768263477a57815a4a2d994		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31886	no	2
			25bfb486044b323bb07f84bb95347a6ecbb0f6e7		
Warnings:					
Information:					
Total Files Size (in bytes):			154322		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/560,584	04/08/2014	8692882	102246.0003US4	1641

24392 7590 03/19/2014
FISH & TSANG LLP
ROBERT D. FISH
2603 Main Street
Suite 1000
Irvine, CA 92614-6232

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 1239 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Paul DeKeyser, Irvine, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

IR103 (Rev. 10/09)

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court for the Eastern District of Texas on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 4:22-cv-877	DATE FILED 10/14/2022	U.S. DISTRICT COURT for the Eastern District of Texas
PLAINTIFF STELLAR, LLC		DEFENDANT PITTASOFT CO., LTD. D/B/A BLACKVUE
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 7,593,034	9/22/2009	STELLAR, LLC
2 US 8,692,882	4/8/2014	STELLAR, LLC
3 US 9,485,471	11/1/2016	STELLAR, LLC
4 US 9,912,914	3/6/2018	STELLAR, LLC
5 US 10,965,910	3/30/2021	STELLAR, LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK	
1			
2			
3			
4			
5			

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT		
CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy