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Automotive Accident And Incident Record SystemField of the invention

The present invention relates to a vehicle accident recording system, that is a
5 system which can be installed into a road vehicle for recording any accidents
experienced by the vehicle.

Background of the invention

10 Blackbox devices are conventionally used to record incidents leading up to an
accident involving a vehicle. Known systems use digital recording cameras
which transmit a sequence of images to a memory device. When the memory is
full, the memory device overwrites the earliest images received by the memory
device, so that the memory is in effect storing the last images received by the
15 memory device. The data collected by such devices may be recovered from the
device by a PC and then examined to determine the cause of an accident.

A problem with some such systems is that, unless following an accident the
digital camera is stopped from taking further images, it will eventually overwrite
20 the first images which were taken. To address this, Singapore patent
application 9901330-2 (granted as Singapore patent 87795) proposed that a
sensor should be employed which identifies that a deceleration or impact has
occurred, so that the image recording can be turned off a fixed time after the
accident has occurred.



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Although this solution gives an advantage compared to a system in which the image recording must be switched off manually, it is still liable to problems. In particular, a given acceleration measured by the sensor will have different
5 significance according to the state of the vehicle. If the vehicle is parked, then a modest acceleration usually means that another vehicle has collided with the one carrying the image recording system. Such a level of acceleration, and even higher levels of acceleration/deceleration will occur frequently in normal driving of the vehicle.

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An additional problem is that there are certain sorts of accidents - such as a grazing impact, or an impact with a soft object - which do not trigger the sensor, so that the image recording is not turned off, leading to a risk of the images recording the accident being overwritten.

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An additional problem with known vehicle accident recording systems is that the data collected by such a system may not be sufficiently detailed to indicate full details of the operations stages of the vehicle. For that reason, it has been proposed to gather further data about the operation of the vehicle, and to keep
20 a record of this data by superimposing it onto the images produced by the digital camera. For example, a digital processor may be provided between the digital camera and the memory device for superimposing text onto a portion of the image before it is written to the memory. Unfortunately, the data processor

for generating the superimposed text is a relatively expensive component, and increases the overall cost of the device.

Summary of the invention

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The present invention aims to provide a new and useful road vehicle recording system, and in particular one which may overcome at least one of the above problems. It also aims to provide a new and useful process for recording images illustrative of a vehicle accident.

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Specific expression of the invention can be found in claims 1, 20, 21, 22 and 23.

In a first aspect the invention proposes in general terms that a vehicle accident recording system should include a speed sensor for monitoring the speed of the car, and that when the car is in motion the mechanism for turning on an off the image recording should depend upon the output of the speed sensor.

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Specifically, one expression of a first preferred aspect of the invention is a vehicle accident recording system for installation in or on a vehicle, comprising a system controller, at least one image recorder device, and a speed sensor for measuring the speed of the vehicle and sending a signal to the system

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controller, the system controller controlling the operation of the image recorder device in dependence on the signal.

In another expression, the first preferred aspect of the invention provides a process for recording images illustrative of a vehicular accident, the process comprising the

steps of monitoring the speed of the vehicle, and transmitting a signal indicative of the speed of the vehicle to a system controller which controls at least one image recorder device, the system controller controlling which images are recorded by the image recorder based on the signal.

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For example, if the speed sensor registers that the speed is below a certain threshold for a certain time without the vehicle engine being turned off, this may be indicative of an accident having occurred, so that the image recorder is turned off.

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In a second preferred aspect the invention proposes in general terms that a vehicle accident recording system should include a first acceleration sensor having high sensitivity, and at least one second acceleration sensor of lower sensitivity. When the engine of the vehicle is not on (the vehicle is parked), the recording operation is controlled using the output of the first acceleration sensor (and optionally also the second acceleration sensor), but when the engine of the vehicle is on the recording operation is controlled using the output of the second acceleration sensor.

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Specifically, one expression of the second preferred aspect of the invention is a vehicle accident recording system for installation in or on a vehicle, comprising a system controller, at least one image recorder device, and at least one first acceleration sensor, the system controller being arranged to sense whether the

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engine of the vehicle is on, and control the image recorder device based on the first acceleration sensor in only the case that the engine is off.

In another expression, the second preferred aspect of the invention provides a process

5 for recording images illustrative of a vehicular accident, the process comprising the steps of monitoring whether the engine is on or off, and only in the case that the engine is off controlling the operation of at least one image recorder device based on at least one first acceleration sensor.

10 Thus, the second preferred aspect of the invention makes it possible that when the engine is off, the system controller may control the image recorder device based on the output of first sensor which is sensitive to jolts received by the vehicle when it is stationary. Conversely, when the speed sensor determines that the engine is on, the image recording may be based on the output of less
15 sensitive sensors, which are triggered only by the higher accelerations/decelerations associated with high-speed vehicle accidents.

In a third preferred aspect of the invention, which is freely combinable with the first and/or second aspects, the invention proposes in general terms that a vehicle accident
20 recording system should include one or more lamps for generating light at a wavelength invisible to humans, that the system should control the turning on and off of the lamps in dependence on information to be recorded, and that the camera is sensitive to light of the wavelength of the lamps. When the system is installed in a vehicle, the camera may be positioned so that the lamp(s) are in

its field of view. This means that information to be recorded is encoded in the recorded image without the use of an expensive processor, and without any risk of the attention of a human driver of the car being diverted by seeing the lamp(s) turn on and off.

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Specifically, one expression of the third preferred aspect of the invention is a vehicle accident recording system for installation in or on a vehicle, comprising a system controller, at least one lamp for producing light at a wavelength which is invisible to humans and arranged to be controlled according to data to be recorded, and at least one image recorder device which is sensitive to light at the wavelength generated by the lamp, whereby when the image controller is arranged with the lamp in its field of view the image controller device records the information.

15 Another expression of the third preferred aspect of the invention is a process for recording images illustrative of a vehicular accident, the method including controlling at least one lamp which generates light at a wavelength invisible to a human user according to information to be recorded, the method further including arranging for at least one image recorder device to record images which include the lamp
20 in the field of view, so that the images recorded encode the information.

Brief description of the figures

Preferred features of the invention will now be described, for the sake of illustration only, with reference to the following figures in which:

Figure 1 is a block diagram of an embodiment of the invention; and

Figures 2 to 4 are a series of images captured by the embodiment of Fig.

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Description of the embodiment

Referring to Fig. 1, an embodiment of the invention is illustrated. The
10 embodiment is installed in a road vehicle, in particular, an automobile, to record visual data in the event of an accident and the moments immediately before and/or after an accident. The system may be used whether the vehicle is on the move or when it is parked.

15 The embodiment comprises a system control unit 1. The system control unit has an input 10 through which the system control unit 1 receives a signal indicative of whether the engine of the vehicle is turned on.

The system further includes at least one digital image recorder unit 2 having a
20 camera capable of capturing both visible and infrared light, and a memory device for recording images captured by the camera. The image recorder unit 2 is provided with an internal memory store, and the internal memory can retain the recorded picture for more than 10 years. The image recorder unit 2 may have a controller CPU including means to prevent unauthorised access to

image files (for example, requiring that a password is given) and a fixed program for operation. The image recorder unit 2 may be provided with an internal digital clock capable of running by itself for more than ten years. It may have a programmable mode which allows only programming or setting of the recording interval, internal digital clock and erase function. In this case, the digital image recorder only has two ways to erase the recorded data: one way is to put the digital image recorder unit 2 on record mode to carry on recording; and the other way is to enter an erase instruction, which causes the digital image recorder to erase all recorded information.

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Additionally, the system comprises at least one incident sensor unit 3, which is an acceleration meter sensitive to the relatively low accelerations typically experienced by a vehicle when, while it is parked, another vehicle collides with it. The incident sensor unit 3 may be mounted either internally or externally on the vehicle. If an impact exceeds a pre-programmed threshold value the incident sensor unit 3 sends a signal to an input 16 of the system control unit 1 through an electrical line 25. The system control unit only reacts to the signal from the incident sensor unit 3 if the input 10 indicates that the vehicle ignition is off.

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The system further includes a front impact sensor unit 4 and a rear impact sensor 5, which respectively indicate whether an impact has occurred at the front and rear of the vehicle. The respective outputs of the units 4, 5 are labelled 26 and 27 in Fig. 1. The impact sensors 4, 5 are G-force sensors – measuring

acceleration or deceleration or whether the car has hit or been hit by something.

The front impact sensor unit 4 is preferably mounted on the front bumper of the vehicle and is connected to an input 15 of the system control unit 1 (and via the system control unit 1 to the standby power supply unit 7), and also to the infra

5 red indicator unit 8. The rear impact sensor unit 5 is similarly mounted on the rear bumper of the vehicle. The output 27 of the impact sensor unit 5 is connected to input 14 of the system control unit 1 (and via the system control unit 1 to the standby power supply unit 7) and to the infra red indication unit 8.

10 Like the incident sensor unit 3, the impact sensor units 4, 5 will only send signals to the system control unit 1 if the impact level detected by the impact sensors 4, 5 exceeds a threshold value programmed into the impact sensors. The signals output from impact sensor units 4, 5 are maintained by respective latches until the sensor units 4, 5 are reset manually.

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The system also includes at least one car speed sensor unit 6 having an output terminal 28 connected to an input terminal 13 of the system control unit 1.

Typically, the sensor unit 6 operates by a measurement of the tyre rotation angle per unit of time, and conversion of this to distance of travel. In some

20 newer cars, the system of the invention obtains the car speed from a signal indicative of the speed of the car is available from a car speed sensor unit which is built into the electrical system of the car.

The car speed sensor unit 6 continuously monitors the speed of the vehicle. If the speed exceeds 10 cm/second, a signal will be sent by the car speed sensor unit 6 to the system control unit 1 to indicate that the vehicle is moving.

- 5 The system further includes an infrared indication unit 8, which is powered from the system control unit using its input 38. Typically, the indication unit 8 includes a number of lamps 31, 32, 33, 34, 35, 36. These lamps are LEDs which emit light in the infra red region (or some other invisible wavelength(s)) detectable by the image recorder unit 2. The LED 31 is on/off according to
10 whether the brake light of the vehicle is on/off which it determines using its input 21. The LED 32 is on/off according to whether the left signal light of the vehicle is on/off which it determines using its input 19. The LED 33 is on/off according to the output of the front impact sensor 4. The LED 34 is on/off according to whether the head lamp of the vehicle is on/off which it determines using its input
15 22. The LED 35 is on/off according to the output of the rear impact sensor 5. The LED 36 is on/off according to whether the right signal light of the vehicle is on/off which it determines using its input 20. The LED 37 is connected to the power supply to the image recorder 2 and is on whenever the image recorder 2 is in operation. The infra red indicator unit 8 may comprise an automatic
20 brightness control circuit.

The LEDs 31 to 37 are arranged in a straight line, with the exception of the LED 37 connected to the image recorder 2 via leads 38, 24. It is not arranged in a straight line with the other LEDs and, since it is switched on all the time when

the image recorder is power on, it is useable as a visual reference against the other LEDs. The digital image recorder unit 2 records pictures of the view seen facing forward from the car, along with images of the lit LEDs of the infra red indicator unit 8. The radiation emitted by the LEDs can be captured by the infra red sensitive image digital camera, and is thus recorded as a part of the picture.

In use, the infrared indicator unit 8 is preferably installed on the front windscreen inside the car and faces backwards to the end of the car. The digital image recorder unit 2 is mounted to face the front of the car. The infrared indication unit 8 indication is thus in the field of view of the infra-red sensitive digital image recorder unit 2.

The digital image recorder unit 2 is powered by system control unit 1. The system control unit 1 only outputs an 8 to 14V DC signal to the image recorder. The image recorder unit 2 operates in its recording mode when the power supply is in the range 8 to 14V, external power supply. If the image recorder input 24 later receives an external power supply in the range 15 to 18V (when it is removed from a vehicle after an accident to playback the recorded picture), it switches to playback mode. This prevents over-write of the recorded picture. One reason why the digital image recorder unit 2 obtains its power from the standby power supply unit 7 (at least after an accident) in some countries there is a requirement that the main battery of the car does not supply any power during a period after an accident, in which the airbags of the car are triggered.

The digital image recorder unit 2 is powered by the system control unit 1 which selectively supplies power to the recorder unit 2 from the standby power supply unit 7 through the input which is marked as 24 in Fig. 1. The image recorder unit 2 operates in its recording mode when the power supply is 8 to 14 volts, and if
5 the power supply is 15 to 18 volts, it switches to playback mode. If the power supply is out of this range, the image recorder unit neither records nor replays images. Thus, the system control unit 1 controls whether the image recorder unit 2 retrieves data in play back mode, or captures images, or is inactive.

10 The digital image recorder unit 2 may comprise composite video and RGB output. The digital image recorder unit 2 has two inputs. As mentioned above, input 24 is for the power supply only. The other input (not shown) is to control the playback, programming of date, time and recording intervals only. The digital image recorder unit 2 has no RS232 input, USB input, etc. in order to
15 prevent unauthorised access and modification to the image files. The digital image recorder unit 2 is programmed to record in a way such that once the internal memory of the digital image recorder unit 2 is full, new pictures are recorded by reusing the part of the memory storing the earliest recorded pictures. Therefore only the most recent pictures are stored.

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The operation of the system will now be described.

In a first case, suppose that input 10 to the system control unit 1 indicates that the engine is turned off. In this case, when the incident sensor is triggered, the

system control unit 1 will supply a 8V to 14V power supply for a pre-set period of time to the digital image recorder unit 2, which will then capture pictures for the pre-set period of time, for example 5 to 10 seconds, until the power supply voltage is cut. Optionally, the system control unit can also put the image
5 recorder unit 2 into the recording mode for a fixed time, for example 5 to 10 seconds, if it receives an impact signal from either of the sensors 4, 5.

In a second case, suppose that the input 10 to the system control unit 1 indicates that the engine is turned on. In this case, the output of the incident
10 sensor unit 3 is not regarded. The system control unit controls the image recorder unit 2 based on the car speed sensor unit 6 and the impact sensor unit(s) 4,5.

Specifically, the image recorder unit is controlled to be in the recording mode if
15 the ignition is switched on and the car speed is 10cm/second or more. In this case, the image recorder unit 2 is powered, and controlled to continuously record images at a fixed interval. When the vehicle is moving safely without experiencing any impact, the car speed sensor unit 6 continually sends out a signal to the system control unit 1, preferably every second, indicating that the
20 car speed is equal to or above a certain speed. This speed threshold is preferably set to 10 cm/second. The system control unit 1 responds to this signal from the speed sensor 6, and supplies power to the digital image recorder unit 2.

This continuous recordal of images can be interrupted by any of the following events.

Firstly, in the case that the sensor(s) 4, 5 indicate that an accident has occurred, the system control unit controls the image recorder unit 2 to continue to record images for a fixed time, such as 5 to 10 seconds, and then stops supplying power to cease recording. Thus, the recorded pictures thus cover a period before the impact sensor(s) 4,5 were triggered, and another period of 5 to 10 seconds after the detection of the impact. Since the recording ceases at the end of the fixed period there is no risk of these images being overwritten.

Secondly, if the car speed sensor 6 indicates that the vehicle is slower than the speed threshold (e.g. 10 cm/second) for more than a first preset period of time (for example 5 seconds) with the engine still running, the system control unit 1 cuts power supply to the digital camera recorder unit 2 .

In this second case, if the car speed sensor continues to indicate that the car speed is below the speed threshold (e.g. indicating that the car is stopped completely) for more than a second preset period (e.g. 300 seconds or 600 seconds), the system control unit 1 turns on a buzzer (not shown) to indicate that the vehicle has been idling. To reset the buzzer sound, the driver may press on a reset switch for a few seconds.

If the system control unit 1 still does not receive any signal from the car speed sensor within a third pre-set time (which is preferably 600 to 1200 seconds), the system control unit 1 will assume that the vehicle was involved in an accident.

The system control unit 1 will then trigger the buzzer, turn on the standby power
5 supply to the digital image recorder unit 2 for a pre-set period of time, preferably 5 to 10 seconds, and then fully cuts off the power.

As a result, the recording would include pictures taken just before the vehicle stops, those taken within a period of 5 to 10 seconds after the car has stopped,
10 and those taken during a period of 5 to 10 seconds after the end of the third pre-set time. Without the car speed sensor 6, the system would have been unable to control the recording in this way, and thus would be unable to record reliably an event which causes the driver to stop the car but which does not trigger the impact sensors 4, 5.

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An example of the system in operation is shown in Figure 2, which is composed of Fig. 2, Fig. 3 and Fig. 4, which are the field of view of the image recorder 2.

The sample pattern of illumination lamps within the unit 8 is shown just above a car dashboard. Fig. 2 shows a frame of normal driving. Fig. 3 shows a frame
20 with the head lamp on and the brake applied. Fig. 4 shows a frame with the left signal on, right signal on, impact front triggered and head lamp on. All the indications of Figs. 2 to 4 correspond to the LEDs shown in Fig. 1.

Although only a single embodiment of the invention has been described, the invention is not limited in this respect, and many variations are possible within the scope of the invention, as will be clear to a skilled reader. For example, more than one digital image recorder unit 2 may be used to provide a greater
5 coverage of the exterior surroundings. One digital image recorder unit 2 installed inside the car may point to the front of the vehicle and to the infra red indicator unit 8, while other recorder unit(s) point in other directions. Each digital image recorder unit 2 typically has its own internal memory capable of storing a number of images in a digital format.

Claims

1. A vehicle accident recording system for installation in or on a vehicle, comprising a system controller, at least one image recorder device, and a
5 speed sensor for measuring the speed of the vehicle and sending a signal to the system controller, the system controller controlling the operation of the image recorder device in dependence on the signal, wherein the at least one image recorder device operates in recording mode when the input DC power is in a first voltage range and in a playback or program mode if the supply is in a
10 second voltage range.
2. A vehicle accident recording system according to claim 1 in which the system controller controls the image recorder device to begin to operate when the speed sensor indicates that the velocity of the vehicle is above a predefined
15 threshold.
3. A vehicle accident recording system according to claim 2 in which the system controller is operative to stop the image recorder device from operating when the velocity falls below a predefined threshold.
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4. A vehicle accident recording system according to claim 3 in which the system controller stops the image recorder device from operating when the speed of the vehicle falls below the predefined threshold for a predefined period.

5. A vehicle accident recording system according to any preceding claim, further comprising at least one impact sensor, and in which the system controller is arranged to stop the image recording when the impact sensor
5 indicates that there has been an impact.

6. A vehicle accident recording system according to claim 5 in which the system controller stops the image recording a predetermined time after the impact sensor indicates that there has been an impact.

10 7. A vehicle accident recording system according to claim 5 or claim 6 further including at least one incident acceleration sensor of higher sensitivity than the impact sensor, the system controller being arranged to sense whether the engine of the vehicle is on or off, and control the image recorder device
15 using on the incident sensor in only the case that the engine is off.

8. A vehicle accident recording system according to claim 7 in which the system control unit controls the image recorder device to record images for a predetermined time upon sensing that the engine is off and the incident sensor
20 or impact sensor indicating that an accident has occurred.

9. A vehicle accident system according to any preceding claim further comprising at least one lamp for producing light at a wavelength which is invisible to humans and arranged to be controlled according to data to be

recorded, and the image recorder device is sensitive to light at the wavelength generated by the lamp, whereby when the image recorder device is arranged with the lamp in its field of view the image recorder device records the information.

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10. A recording system according to claim 9 wherein the wavelength is in the infrared frequency range.

11. A recording system according to any preceding claim wherein the at least
10 one image recorder device is provided with an internal memory store, and the internal memory can retain the recorded picture for at least 10 years.

12. A recording system according to any preceding claim wherein the one
15 image recorder device includes a controller designed, manufactured and arranged to prevent unauthorised access to modification image files.

13. A recording system according to any preceding claim wherein the digital image recorder has no RS232 port, USB port or any similar communication port for input.

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14. A recording system according to any preceding claim wherein the image recorder device is provided with an internal digital clock for running by itself for at least ten years.

15. A recording system according to any the preceding claim wherein the image recorder device in program mode allows only programming or setting of the recording interval, internal digital clock and erase function.

5 16. A recording system according to any preceding claim wherein the image recorder device only has two ways to erase the recorded data, one way being to put digital image recorder on record mode to carry on recording and the other way being to enter an erase instruction.

10 17. A recording system according to claim 16 wherein upon entering an erase instruction the image recorder device will erase all recorded information.

18. A recording system according to any preceding claim wherein the image recorder device is pointed in the direction of forward travel of the vehicle and
15 includes the indicator unit in the range of view.

19. A recording system according to any preceding claim having means of providing a warning buzzer after the said impact sensor is triggered or the system control unit indicates that there has been an accident.

20 20. A process for recording images illustrative of a vehicular accident, the process comprising the steps of monitoring the speed of the vehicle, transmitting a signal indicative of the speed of the vehicle to a system controller which controls at least one image recorder device, the system controller

controlling which images are recorded by the image recorder based on the signal, and

selectively operating the at least one image recorder device in recording mode when the input DC power is in a first voltage range or in a playback or program

5 mode if the supply is in a second voltage range.

21. A vehicle accident recording system for installation in or on a vehicle, comprising a system controller, at least one lamp for producing light at a wavelength which is invisible to humans and arranged to be controlled

10 according to data to be recorded, and at least one image recorder device which is sensitive to light at the wavelength generated by the lamp, whereby when the image recorder is arranged with the lamp in its field of view the image recorder records the information.

15 22. A process for recording images illustrative of a vehicular accident, the method including controlling at least one lamp which generates light at a wavelength invisible to a human user according to information to be recorded, the method further including arranging for at least one image recorder device to record images which include the lamp in the field of view, so that the images
20 recorded encode the information.

23. An infrared indicator device for use in a vehicle accident recording system according to claim 21, the indicator device comprising multiple inputs for connection to electrical components of a car, and a plurality of infrared lamps

connected to the inputs and illuminated according to the voltage values at the inputs.