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(54) Title: TRAIL AND MONITORING SYSTEM USING SINGLE CAMERA PANORAMIC IMAGING

(57) Abstract: A system is provided for vehicle audit trail, where the vehicle audit trail system is fully automated to track the movements of the vehicle at any given time.

Trail And Monitoring System Using Single Camera Panoramic Imaging

Field of Invention

The present invention relates to the field of audit trail and monitoring in general and more particularly using an audit trail apparatus for automating the audit trail and monitoring system.

Background of Invention

There are many non-personal owned vehicles on the roads nowadays. These vehicles maybe those owned by public tranport companies, freight fleet companies or government bodies and examples of these vehicles are taxis, buses, trucks or patrol cars. For various reasons, the need for vehicle recording device and auto-vehicle recording for these types of motor vehicles have increased.

Vehicle recording devices are useful for a variety of applications pertaining to both operator and vehicle communication and control. In regard to the vehicle operator, the vehicle recording device may be used to log and report such items as the operator's driving time, trip time, electronic vehicle controller faults and other operating information. In regard to the vehicle itself, the recording device may be used to record fuel efficiency on a trip-by-trip basis, engine operating parameters and other related information. This information may be subsequently analyzed by a vehicle technician or vehicle owner for maintenance purposes.

Additionally, the information may be used in a business delivery environment by the operator's manager to optimize driver efficiency and performance, and to track deliveries made by the vehicle over a given period of time. Or in instances of government owned vehicles, it provides the posibility of ensuring that there is no abuse or misuse of government owned vehicles.

Apart from data such as speed and location of a vehicle, there is a need for audio visual data of a vehicle at a given time to be obtained. These data provide much more insight than data such as speed, especially in an investigation. Visual info such as the position of a vehicle at a point of impact during an accident is vital.

Therefore there is a need for a vehicle recording system that is able to process the information obtained by a vehicle recording device.

Summary of Invention

It is also an objective of the present invention to provide for an audit trail system and monitoring system, which is able to transmit wireless time tagged information to a remote location.

Description of Drawings

Figure 1 Audit trail apparatus on a car

Figure 2 Overview of Audit Trail and Monitoring System

Detailed Description

The present invention will now be detailed with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. The invention may, however be embodied in other different forms and should not be construed as being limited to the embodiments discussed herein, rather these embodiments are provided so that this disclosure will convey the concept of the invention to those skilled in the art. In the following description of the present invention, known methods and functions will be omitted as it would be already known to those skilled in the art.

The imaging deviceof the present invention is described in brief below and is described in further detail in co-owned and co-pending Malaysian application no. PI (to be furnished once made available). The imaging device comprises of a camera, a wide-angle lens, a reflective means, an illumination means and an audio acquisition means.

The entire imaging device arrangement as can be seen in Figure 1 is mounted on a horizontal plane parallel to the ground, such as the car roof.

The Audit Trail and Monitoring System comprises of the imaging device and an audio visual processing device.

The audio visual processing device is a dual function device i.e. it is a

a. Black box – stores data such as the speed and co-ordinates of the car in real time.
b. Information transmitter – transmits real time data such as the speed and co-ordinates of the car to a remote command center via 3G applications or GPRS.

The operations of audio visual processing device will be described in detail below.

An overview of the audio visual processing device can be seen as illustrated in Figure 3. The device is divided into several blocks of functions. The functions of each block will now be discussed in detail.

Block A

Audio signals are acquired from the Imaging device. The audio outputs are multiplexed using a microphone multiplexer (A1). The output of this multiplexer is a time multiplexed serial output, where each microphone in the microphone array will be allocated a slot in time.

The multiplexed audio signal is then fed into a Signal Receiver (A2), where the multiplexed audio signal is digitized. The audio signal then will go through a sampler and hold circuit and digitizer. The output of Signal Receiver (A2) is then fed into an Audio Compressor (A6) for recording purposes. The output is also fed into a Max amplitude detector (A3). In the Max amplitude detector (A3), the serial audio signals are compared to extract the audio signal that has the highest amplitude.

The highest amplitude and hence the source point of the sound is calculated as shown in the example below:

Let take the two highest amplitude, say between angle X and angle Y, amplitude for X is Ax and Amplitude of Y is Ay and the separation angle between X and Y is (Y-X), the angle calculation should be like this:

*Detected angle: X + (Ax/(Ax+ Ay) * (Y-X))*

The microphone that has been determined as the source of the sound is the referred to Direction Reference (A4) to extract the angle information i.e. the displacement angle from the reference angle, that would be fed to the Audio-Video Fusion unit (A5).

Block B

The video output from the Imaging device is fed to the Video Splitter (B1). The output of the Video Splitter is fed into two other components. First the output is fed to the Panoramic Image Transformation (B2). The output signal from Video Splitter is also fed into the video compression unite (B5) for recording preparation.

The output signal obtained from the Panoramic Image Transformation (B2) is fed into Background Subtraction unit (B3) and Motion Detection and Tracking unit (B4). The output received at B4 is a transformed panoramic image. This image is then fed into Audio-Video Fusion unit (A5).

Block C

Audit Trail and Monitoring System is also able to receive input from Global Positioning System (GPS). GPS is able to provide information such as time and location. This information is received by C1. The GPS information received by C1 is fed into Location and Time Input unit (C2). The output of C2 is fed into the Data Formatter, which will prepare the data for recording purposes.

Block D

In the present Audit Trail and Monitoring System, information such as the car speed and acceleration is also monitored and recorded. This information can be time tagged. This information is then fed into D2. The information from D2 is fed into Data Formatter (D3). The GPS information and Other Car Related Inputs received in Data Formatter (D3) is formatted and the output i.e. the formatter data will be fed into Recording Medium (E1).

Block E and F

The Recording Medium (E1) is connected to a Data Retrieval unit (F1). The Recording Medium (E1) receives inputs from Video Compression unit (B5) and also Data Formatter unit (D3). The output of the Recording Medium (E1) is fed into the Data Retrieval unit (F1) which outputs the information to an External Device (F1), which is a device that is able to read the stored data from the storage medium such as a computer.

The Wireless transmitter (E3) which receives inputs from Video Compression unit (A5), Audio Compression unit (A6) and Data Formatter (D3) transmits signal with encrypted data to the receiving station.

The Processed Video Output unit (F2) receives input from A5, and the processed panoramic video can be viewed via the output of (F2).

Block G

The Audit Trail and Monitoring System according to the present invention also provides for the automated adjustment of the field of view of the camera. This is achieved by using a mechanical motor to adjust the inputs of G1 and G2, to achieve the desired field of view. The inputs of G1 and G2 are fed into G3, which controls the mechanical movements of the camera.

While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention. Consequently, the scope of the invention should not be limited to the embodiments, but should be defined by the appended claims and equivalents thereof.

CLAIMS

1. An Audit Trail and Monitoring System comprising

at least one imaging device for capturing the audio and video signal of an area;

and a audio visual processing device for receiving the captured audio and video signal from the imaging device and transmitting the signals to at least one remote location.

wherein,

the visual signal captured by the imaging device are mirror reflected video signal captured by a panoramic camera; and

the audio signal captured by the imaging device are audio signals captured by a microphone ring; and

wherein

the audio visual processing device transmits the processed real time audio visual signal to a remote station; and

the audio visual processing device stores the processed real time audio visual signal in the system.

2. A system according to claim 1, wherein the A system according to claim 14, wherein the audit trail apparatus is according to claims 1 and 13.

3. audio visual processing device is according to the steps of

(a) Audio signals

(i.) audio signals received from the apparatus is fed to a microphone multiplexer for allocating each microphone in the microphone array a time slot ,

(ii.) the multiplexed signal is fed into a audio signal receiver for digitizing the audio signal,

(iii.) the audio signal receiver feeds the signals it has received to the Max amplitude detector for extracting the source of the highest amplitude; and

to audio compression unit for recording the audio signal,

(iv.) the information computed by Max amplitude detector is fed into the direction reference unit, for determining the exact location of the sound source of the highest amplitude

(v.) the output of direction reference is fed into the Audio/Video Fusion unit,

(b) Video signal

(i.) the video signal received from the apparatus is fed into a Video Splitter,

(ii.) the output of Video Splitter is fed into the Video Compression unit for recording; and

(iii.) Panoramic Image Transformation unit for converting the wide angle image to a rectangular representation

(iv.) the output signal from the Panoramic Image Transformation unit is fed into the Background Subtraction unit and Motion Detection and Tracking unit,

(v.) the output of Background Subtraction unit and Motion Detection and Tracking unit is fed into the Audio/Video Information fusion unit for transmitting

(c) GPS Input

(i.) GPS input of the vehicle is received by the GPS Input unit for locating the current co-ordinate of the vehicle and fed into the Location and Time unit

(ii.) the output of Location and Time unit is fed into a Data Formatter for data storage recording

(d) Miscellaneous Information

(i.) miscellaneous information of the vehicle such as speed and acceleration of the vehicle is computed into Miscellaneous unit

(ii.) the output of Miscellaneous unit is fed into Other Vehicle Related unit

(iii.) the output of Miscellaneous unit is fed into a Data Formatter

(e) Wireless Transmitter (E3) receives data from Video Compression unit (B5), Audio Compression unit (A6) and Data Formatter (D3) for transmitting audio visual data of the vehicle by wireless transmission to a remote station

(f) Recording Medium receives data from Video Compression Unit (B5) and Data Formatter unit (D3) for

(g) The data from step (f) is fed into Data Retrieval unit (E2).

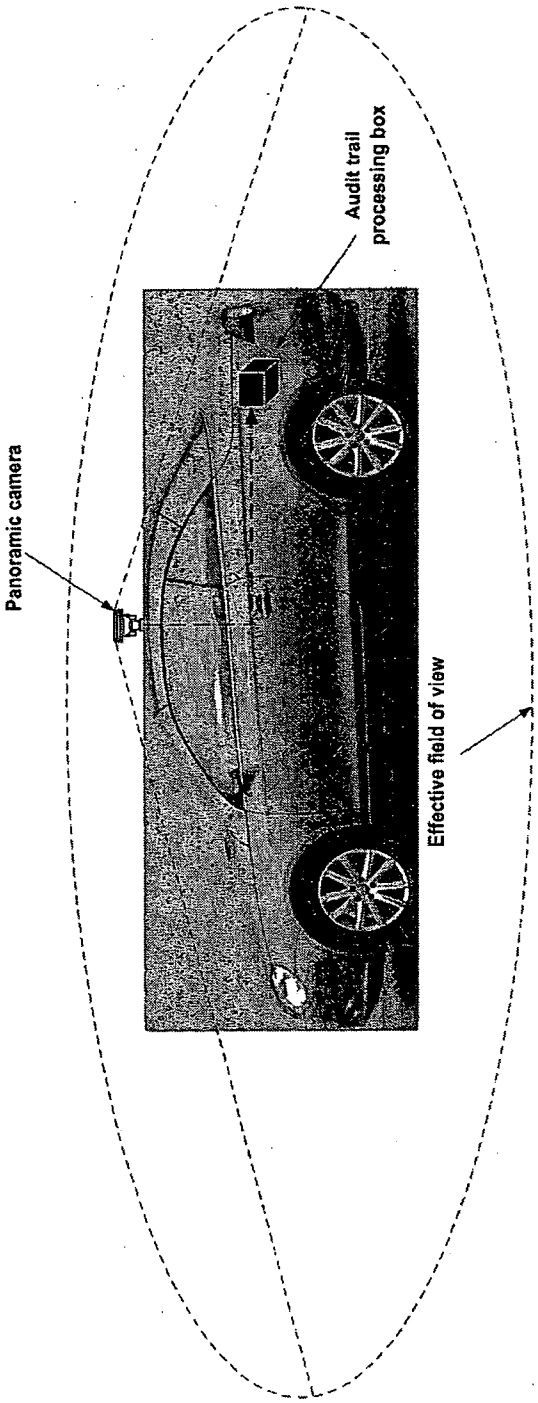
Audit trail processing box
Panoramic camera
Effective field of view

Figure 2

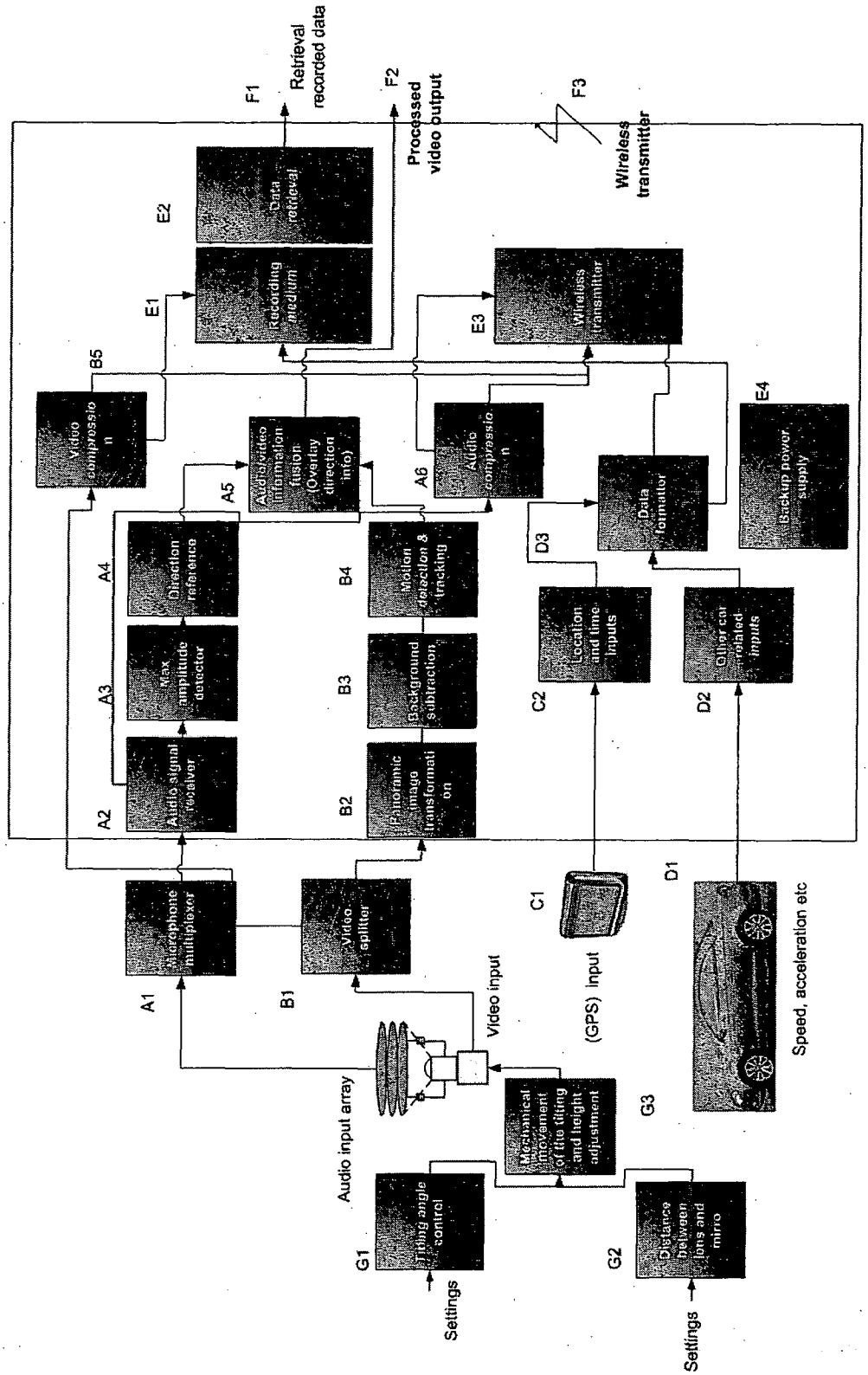
F1
Retrieval recorded data
F2
Processed video output
F3
Wireless transmitter
E2
Data retrieval
E1
Recording medium
E3
Wireless transmitter
E4
Backup power supply
B5
Video compressio n
A5
Audio/video information fusion (Overlay direction info)
A6
Audio compressio n
Data formatter
A4
Direction reference
B4
Motion detection & tracking
D3
A3
Max amplitude detector
B3
Background subtraction
C2
Location and time inputs
D2
Other car related inputs
A2
Audio signal receiver
B2
Panoramic image transformati on
Microphone multiplexer
Video splitter
C1
D1
A1
B1
Video input
(GPS) input
Speed, acceleration etc
Audio input array
Mechanical movement of the tilting and height adjustment
G3
G1
Tilting angle control
G2
Distance between lens and mirro
Settings
Settings

Figure 2