



- (51) **International Patent Classification:**  
G07C 5/08 (2006.01)
- (21) **International Application Number:**  
PCT/GB20 14/052979
- (22) **International Filing Date:**  
2 October 2014 (02.10.2014)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**  
13 17562.5 3 October 2013 (03.10.2013) GB  
1412439.0 13 July 2014 (13.07.2014) GB
- (71) **Applicant:** INOVIA LTD [GB/GB]; Suite C, Lower Road, Garsington, Oxford Oxfordshire OX44 9DP (GB).
- (72) **Inventor:** TEW, Steve; 63 Old road, Wheatley, Oxon, Oxford Oxfordshire OX33 1NX (GB).
- (74) **Agent:** INOVIA LTD; Suite C, Lower road, Garsington, Oxford Oxfordshire OX44 9DP (GB).
- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

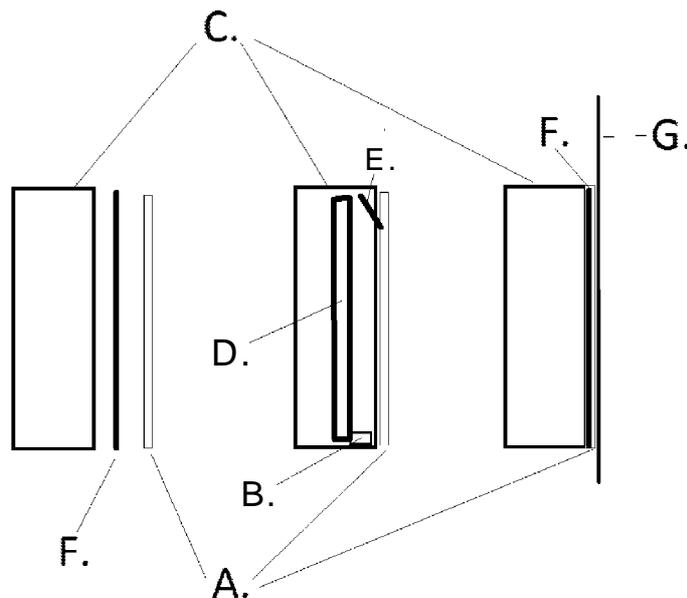
**Declarations under Rule 4.17:**

- as to the identity of the inventor (Rule 4.1 7(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.1 7(H))

[Continued on nextpage]

(54) **Title:** VEHICLE MONITORING DEVICE

Fig 1.



(57) **Abstract:** A vehicle monitoring device that is powered using energy harvesting technology, and once activated, data logs the distance travelled by a vehicle and also data logs and time stamps any damage to a vehicle when it occurs and also measures the speed of a vehicle and records the fastest speed and when it occurred and uploads the data to a server via GPRS.

WO2015/049522 A1

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(Hi))* — *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

**Published:**

— *with international search report (Art. 21(3))*

## Vehicle monitoring device

### Field of the invention

The present invention relates to a monitoring device. In particular, it relates to a device that indicates how the vehicle has been driven and whether a vehicle has received a predetermined level of shock, a certain level of acceleration and the distance travelled by the vehicle.

### Background

When buying vehicle insurance, insurance is based on age, experience, the type of vehicle driven, location and driving style. Also, when buying a vehicle, especially a second hand, it is ideal to know the mileage the vehicle has done, amount of owners of that vehicle, service history, whether the vehicle has sustained damage, as all these variables can dictate the price paid for the insurance or the vehicle.

For example a high mileage vehicle will typically be less expensive than a low mileage vehicle, but the vehicle can be "clocked". Clocking is the act of setting the odometer on a vehicle to a lower mileage. For example, a vehicle that has travelled 90,000 miles could be clocked to show only 50,000 - thus tricking the buyer into thinking the vehicle has been used less than it actually has.

This is illegal in the UK, but it doesn't stop unscrupulous sellers doing it. On older vehicles, clocking is done manually by physically opening the centre console and 'winding' back the mileage.

In another example, damage to a vehicle due to a crash may have an impact on the value too, as a vehicle could have been damaged, an insurance company paid out for the vehicle to be scrapped but the owner repairs the vehicle cheaply and sells the vehicle on. It's important to know if this has occurred as it'll affect the sale value.

There are many companies that sell data on vehicles. This data is offered for sale to the purchaser of a vehicle, for example, a purchaser may want to know the following: The make, model and fuel-type, the recorded mileage, estimated value, recorded accident and theft history, or if there is outstanding finance, as all of these influence the purchase decision and price ultimately paid.

The vehicle purchaser can usually obtain this information via a website or via mobile if they paid a fee. They then type in the vehicle registration details, and the information is given.

The problem to be solved is when a vehicle is involved in an accident is, the damage data is only recorded and available to data companies if the insurance company gets involved to pay for the damage, and many accidents are unrecorded as the person at fault may pay for the damage caused without involving the insurance company, because they don't want their insurance premium to go up in price.

The current invention offers a method to log accurate data on:

- Whether the vehicle has had recorded and unrecorded damage,
- The true distance the vehicle has travelled,
- Cornering and other driving styles
- Data logging of an accident or damage to a vehicle
- Visual recording of an accident or damage to a vehicle
- The fastest speed a vehicle has been driven; and
- In the event of a claim for whiplash, data can be collected and verified.

The vehicle monitoring device would be fixed to a vehicle, in one embodiment it would be the windscreen or another window or part of the chassis in the vehicle. All the logged data is stored in memory on the circuit board, there would be rules written in software to state if a certain event happens, for example an accident then the data is stored in memory can be uploaded to cloud server immediately for interrogation by the insurance company , other than that the data is uploaded at certain times of the day or week to a server using data services for example General Packet Radio Service (GPRS), but other data services may be available too, for example Wi-Fi or Bluetooth via a mobile phone.

The vehicle monitoring device could be offered to drivers via an insurance or data company for a low price or for free. In return they could receive discounted insurance premiums due to

driving the vehicle at the lower speeds, also for recording the true mileage and for recording all damage that the vehicle is exposed to.

This allows personalised insurance, the insurance premium charged being based on how a person drives, i.e. the speed they drive at, plus the true mileage driven, lower distance covered means less risk and lower premiums.

The data collected could then be monetised by the data companies and sold to a person wishing to purchase the vehicle.

For the electronic device to monitor, one or more of the following ambient monitoring component is required.

- Accelerometer to measure, distance, shock and acceleration
- Global Positioning System (GPS) to calculate location and speed
- A Charge-Coupled Device (CCD) to record accident information

The vehicle monitoring device would need to be powered but due to the power requirement for GPRS and GPS, the device would normally need to be powered by the vehicle battery which is expensive to install. The current invention would have a rechargeable battery(s) charged by a solar cell. This is preferred as a monitoring system wired into the vehicle existing electrical system can in some cases invalidate the vehicle manufacturer's warranty.

In one example, the device could be housed in a plastic case and fixed onto the windscreen via a gasket with adhesive between the windscreen and the monitoring device housing, this allows the device to pick-up daylight to charge the battery and also the windscreen is ideal for picking up a signal for GPS and transmitting GPRS. In another example a switch can be added, the switch would have two functions.

It would be inside the housing and placed behind the solar cell, so when the solar cell is pushed against the windscreen, it makes the switch operate. This would activate the circuit which in return would inform the cloud server via data services built in to the monitoring device that the device is now attached to a vehicle and activated. Once activated a message on the server or sent to a mobile device could state "Active" or similar notification, the switch now becomes a tamper switch. If the monitoring device is removed from the windscreen, it will inform the cloud server via data services that it has been tampered with and the insurance company may notify the vehicle owner or invalidate the insurance.

The anti-tamper function would stop fraudulent activity of a bad driver taking the device off their vehicle and putting the monitoring device onto a vehicle that a more conscientious/better driver drives, thus benefitting from lower insurance.

Thus the unit is independent of the car electrical system and can be installed by attaching the unit to a glass window in the vehicle, like the windscreen. For example, the unit would have a silicon, polyurethane or neoprene gasket that is attached to the unit by adhesive, it would have double sided tape ( for example 3M adhesive tape), the protective cover of the tape is taken off the gasket to expose the adhesive and the gasket then is pushed onto the windscreen to form a water resistant/ dust impervious bond/seal between the windscreen glass and the unit.

In another embodiment , the vehicle monitoring device could be powered directly or indirectly by the vehicle using kinetic energy, Radio Frequency charging or inducing current to power it, near/from the vehicle alternator.

#### Summary

According to a first aspect of the present invention, there is provided a monitoring circuit with a solar cell, accelerometer sensor and GPS and GPRS unit, for example in the event of crash damage/force to the vehicle, the recorded data, i.e. force above a set threshold could be recorded and stored in the memory of the circuit and read and transmitted via GPRS to a data server for interrogation perhaps by an insurance company/data company or other, so in the event of a claim from a person driving the vehicle being in the crash and claiming whiplash the captured data could be checked and calculated to see if the force was enough to cause whiplash, the distance the vehicle has travelled and the speed the vehicle has travelled at.

The monitoring circuit comprises added sensor or sensors, a battery and a processor. The processor is configured to determine from the output of the sensor(s) assembly and record events whether the sensor has been activated and what date and time.

According to a second aspect of the present invention, there is provided a monitoring circuit for use with any vehicle.

#### Description of the drawings

Figure 1. is a representation of a monitoring circuit according to the present invention;

- A. Solar Cell
- B. Camera
- C. Housing
- D. Circuit board
- E. Tamper switch
- F. Gasket
- G. Windscreen

#### Detailed description

A monitoring circuit for a vehicle is proposed. The monitoring circuit in one example is encased in housing, for example a plastic housing, but it could be another type of housing.

The monitoring circuit comprises a sensor assembly comprising at least one sensor, and a processor and a battery. The processor monitors the output from the sensor, and determines if the device has received an event from the output of the sensor assembly, the device also logs the GPS data. The events are logged in the processor, the processor can read the memory anytime as defined by rules in software and the logged data is uploaded to a server via data services (GPRS).

The processor may constantly monitor the sensors, and set a flag in memory when the condition of one of the rules is met, the output of the sensors may be logged in the memory, and the log compared to the rules when the input is activated.

The processor may be implemented as an electronically erasable programmable read only memory (EEPROM) integrated circuit or other Programmable Integrated Circuit (PIC) such as that made by Microchip™. The monitoring circuit may log data in a memory. This data can include a complete history of the sensor information, or details of any events where the sensor outputs exceed a threshold value, including a timestamp and details of the sensor outputs.

The monitoring circuit may be initiated by a switch or connector, the switch may be mechanical or electronic. When the circuit is switched on, the monitoring device is activated, data logging from the sensors begins, and the clock begins logging events and timing.

Although the invention has been described in terms of preferred embodiments as set forth above, it should be understood that these embodiments are illustrative only and that the

claims are not limited to those embodiments. Those skilled in the art will be able to make modifications and alternatives in view of the disclosure which are contemplated as falling within the scope of the appended claims.

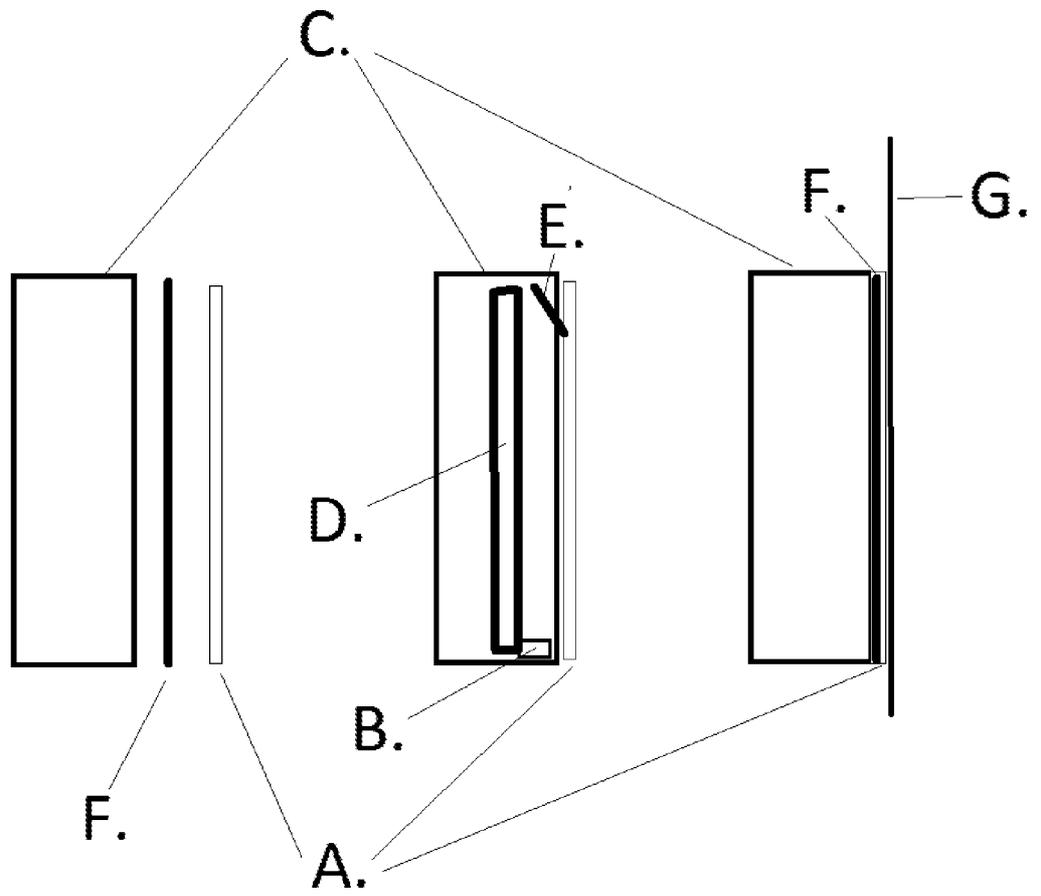
Each feature disclosed or illustrated in the present specification may be incorporated in the invention, whether alone or in any appropriate combination with any other feature disclosed or illustrated herein.

## CLAIMS:

1. An electronic vehicle monitoring circuit that captures and data logs and time stamps damage to a vehicle via an accelerometer.
2. An electronic vehicle monitoring circuit that captures and data logs and time stamps distance travelled by a vehicle via an accelerometer.
3. An electronic vehicle monitoring circuit that captures video and data logs and time stamps the video recorded to memory.
4. An electronic vehicle monitoring circuit that captures and data logs distance travelled by a vehicle via GPS using waypoints.
5. An electronic vehicle monitoring circuit that captures and data logs speed travelled by a vehicle via an accelerometer
6. An electronic vehicle monitoring circuit that captures and data logs speed travelled by a vehicle via GPS
7. The data captured according to any of claims 1 to 6, wherein the data is transferred to a server via GPRS.
8. The data captured according to any of claims 1 to 6, wherein the data is transferred to a server via WI-FI.
9. The data captured according to any of claims 1 to 6, wherein the data is transferred to a server via Bluetooth.
10. A monitoring circuit according to any of claims 1 to 5, wherein the circuit is housed in a holder on the windscreen.
11. A monitoring circuit according to any of claims 1 to 5, wherein the circuit is housed in a holder on the vehicle window.
12. A monitoring circuit according to any of claims 1 to 5, wherein the circuit is housed in a holder on the vehicle chassis.

13. A monitoring circuit according to any of claims 1 to 5, wherein the circuit is housed in a box.
14. The holder in claim being a vehicle tax disc holder.
15. A monitoring circuit according to any preceding claim, wherein at least some of the outputs of the sensor assembly are stored in the processor or memory.
16. A monitoring circuit according to claim 1, wherein at least some of the outputs of the sensor assembly are stored in the processor or memory and the output is sent to a server via GPRS.
17. A monitoring circuit according to claim 1, wherein at least some of the outputs of the sensor assembly are stored in the processor or memory and the output is sent to a server via Wi-Fi.
18. A charging circuit for the monitoring circuit that uses a solar cell to charge the batteries
19. A charging circuit for the monitoring circuit that uses a kinetic power to charge the batteries
20. A charging circuit for the monitoring circuit that uses power on Radio Frequency to charge the batteries
21. A housed monitoring circuit as claimed in claim 1, that has a switch that activates the monitoring circuit once placed on the windscreen.
22. A housed monitoring circuit as claimed in claim 1, that has a switch that activates the monitoring circuit.
23. A housed monitoring circuit as claimed in claim 1, that has a switch that activates the monitoring circuit once removed from the windscreen to indicate via data services that the monitoring device has been removed.
24. A housed monitoring circuit as claimed in claim 1, that has a switch that activates the monitoring circuit once removed from the vehicle to indicate via data services that the monitoring device has been removed.
25. A housed monitoring circuit as claimed in claim 1, that has gasket between the housing and the windscreen that adheres the two together.
26. The gasket claimed in claim 25 is a seal to make the housed monitoring circuit water resistant.

Fig 1.



**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/GB2014/052979

A. CLASSIFICATION OF SUBJECT MATTER  
**INV. G07C5/08**  
 ADD.  
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED  
 Minimum documentation searched (classification system followed by classification symbols)  
**G07C**

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
**EPO-Internal , WPI Data**

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 471 727 A (I MOB PLC [GB]) 12 January 2011 (2011-01-12)  abstract page 1 - page 2 claims 1-8 figure 1  -----	1,2, 4-20,25 , 26
X	GB 2 486 384 A (WRIGHT ANDREW WILLIAM [GB]) 13 June 2012 (2012-06-13) abstract figures 1-5 page 1, line 31 - page 17, line 14 page 21, line 13 - page 33, line 2  ----- -/--	1-17 , 21-26

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p>
---	---

Date of the actual completion of the international search  <b>13 February 2015</b>	Date of mailing of the international search report  <b>03/03/2015</b>
--	---

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  <b>Pafieda Fernandez , J</b>
--	--

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/GB2014/052979

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 012 276 A2 (KNIGHT IAN MELVYN [GB] ) 7 January 2009 (2009-01-07) abstract paragraph [0001] - paragraph [0040] figures 1-14	1-26
A	----- Wo 00/73990 AI (INTERMEC I P CORP [US] ; SCOTT DALE LARRY [US] ; HUGHES PETER SCOTT [US] ) 7 December 2000 (2000-12-07) abstract figures 1-6 claims 1-16 -----	18-26

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No <b>PCT/GB2014/052979</b>
--

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2471727	A	12-01-2011	NONE
-----			
GB 2486384	A	13-06-2012	NONE
-----			
EP 2012276	A2	07-01-2009	EP 2012276 A2 07-01-2009
			GB 2450507 A 31-12-2008
-----			
WO 0073990	A1	07-12-2000	AU 5035500 A 18-12-2000
			US 6121880 A 19-09-2000
			US 6275157 B1 14-08-2001
			WO 0073990 A1 07-12-2000
-----			