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(54) **Device for personal safety**

(57) The invention described here for which a patent is requested increases the safety level of the people staying (e.g. whilst working or involved in sport activity) in a potentially dangerous situations. The invention described is an intelligent device, which monitors the motion of the person and which in case of situations considered as dangerous, is immediately activated without any mechanical tie to frames or vehicles and without manual intervention.. The said protection is performed by an inflatable overalls, or a "personal airbag", activated by an inertial platform.

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Description

[0001] Up to now the personal safety of people involved in dangerous activities (for the human body) is insured by passive devices like hooks, ropes, safety barriers and other devices. Nowadays no an active device exists which is easy to wear, without any type of hassle, and which can automatically intervene during an accident, thus reducing or avoiding harm to the human body. The only patented device is a "personal airbag" for motorcyclists, which by means of a mechanical activator (cord connected to the motorcycle frame) protects the back of he who wears it in case he falls off whilst driving. If the wearer forgets to disconnect the cord before getting off the motorbike, the airbag will activate without unnecessarily necessity. Moreover, due to the nature of the mechanical activation, there is no possibility of inhibiting the device at low speed (or whilst stopped), when the protecting device is of no use. It has to be considered that for the device described above, a physical connection (string or whatsoever) between the device and a suitable fixing point (on the vehicle or other frame) is mandatory.

Otherwise the system could be manually activated, but in certain circumstances the manual activation could be very difficult or impossible (e.g. accident). The invention described here for which a patent is requested increases the safety level of the people staying (e.g. whilst working or involved in sport activity) in a potentially dangerous situations. The invention described is an intelligent device which monitors the motion of the person and which, in case of situations considered as dangerous, is immediately activated without any mechanical tie to frames or vehicles and without manual intervention. The said protection is performed by an inflatable overalls, or a "personal airbag", activated by an inertial platform which, by means of a special electronic circuitry analyses positions and accelerations of the body and predeceasing a real time intervention (in the order of a few milliseconds) in case the position and/or speed of the subject are greater than defined thresholds. The above described inertial platform is made of a sensor, which is able to measure the acceleration, gravity force and position on three orthogonal axes. After measuring the acceleration parameters, and performing the necessary computations, it can generate an electrical signal which can activate the inflate of safety devices (airbag, overalls, inflatable collar) which are worn by the person. In order to better clarify, the drawing shows a possible block diagram of the system.

[0002] The described device comprises one or more acceleration and trim sensors (1), a computing unit (2) connected to sensors (1) by means of analog to digital converters (3) able to generate trigger signals for the safety devices when the values measured by the sensors (1) are outside a prefixed range, typical of the particular application; all the constants relevant to the application are stored into the computing unit (2). The

sensors (1) are connected to the analog to digital converter (2) via a suitable conditioning circuitry, and are processed elaborated by the microprocessor (2) and stored in its working memory (4) (RAM).

The I/O device (5) enable the operator to program the type of activation desired and eventually retrieve data which were formerly stored on the microprocessor memory and is able to activate the trigger device too. The trigger device (6), which inflates the airbag, can be of the same type as used in the car industry.

Due to the very limited current consumption of the intelligent sensing device (in the order of tens of mW), built-in batteries or even solar cells can easily produce this power.

As for reference only, a list of possible electronic component is included:

sensor: ADXL202AD

converter AD574A

CPU MC68HC12

RAM 6116-6264

I/O 26LS31 26LS32

Inflating device: electropyrlic or compressed air

It should be noted that the proposed schematic is for reference only: by using alternative technologies it might be possible to eliminate the analog to digital conversion, the type of memory can be different or integrated into the CPU (which can be of a different type), the I/O could be integrated into the CPU. In some cases the microprocessor itself could be eliminated, or all the block diagram could be integrated into one component (GATE ARRAY).

[0003] In conclusion the invention serves to make a system that:

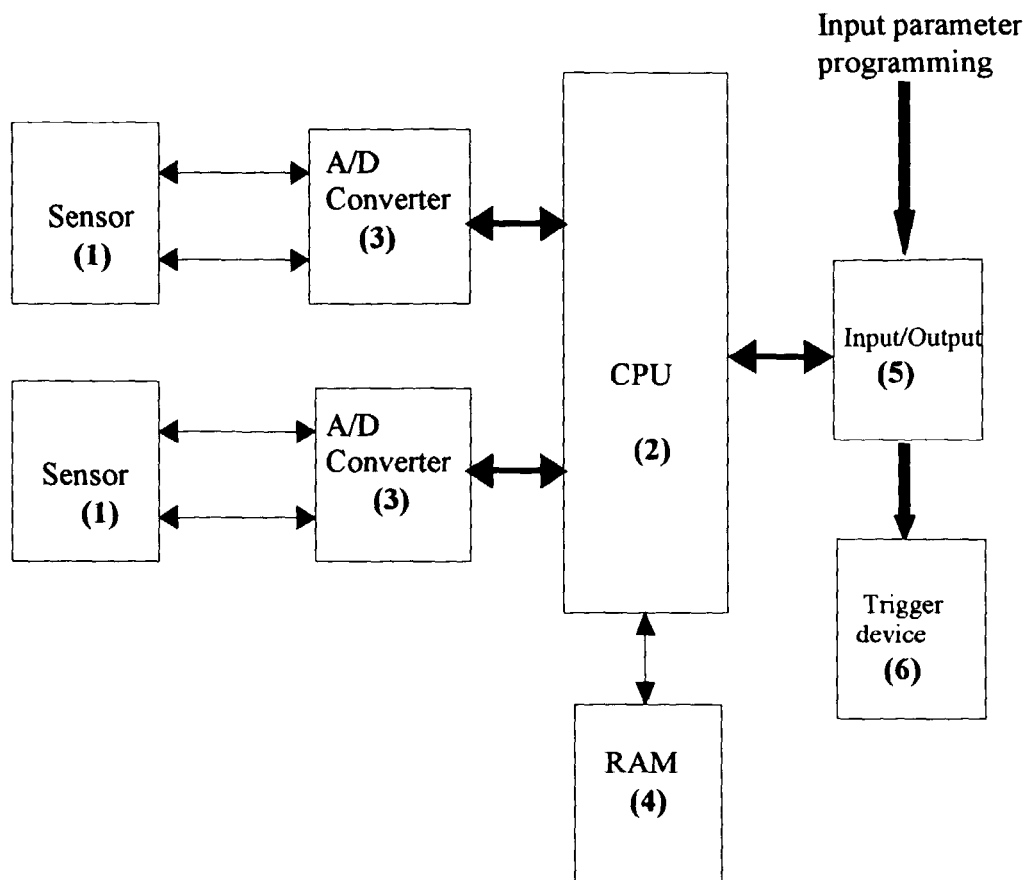
- Can be used with inflatable (or of different technology) devices in order to automatically protect the human body, or can be used "stand-alone" in order to produce alarms (personal safety and or security: it can produce alarms after given variations of trim/ speed/ acceleration/ position that is a fall, a particular position of the body, the exit from a defined area) or store the data relevant to the accident, for later processing.
- It is self contained, that is it does not require any exchange of signals or data with the outside world whilst functioning; moreover it does not require any binding or connection to any whatsoever structure or frame or vehicle.
- Due to the fact that the sensor and all the relevant electronics are miniaturised, it does not produce any harm or trouble to the wearer (it can be miniaturised to a level that it becomes unnoticeable)
- Enable the possibility of monitoring accelerations

from e.g. 0.8cm/sec^2 to 20m/sec^2 covering all the range of accelerations typical of the human body or its limbs being (or part of it like a leg)

- Has the capability of storing the relevant data of a route (course) in order to reply or analyse it 5
- Due to the low power consumption small batteries, solar cells or piezoelectric elements can power it. 10
- If worn by personnel working in an erection yard, it can operate the required safety devices, without binding the personnel no ties to structures or frames. 15

Claims

1. Device for personnel safety, eventually including the comprising means of personnel protection, worn by the person and which can be activated between a stand-by and protection condition, measuring trim and acceleration of the body (or part of it) and able to automatically trigger the activation of the protecting device or issuing an alarm. The activation will happen at the exceedence trespassing of defined thresholds. 20 25
2. Device, according to claim 1, which comprise at least one sensor able to measure acceleration, gravity and or position on three orthogonal axes. 30
3. Device, according to claim 2, which comprise also a computing unit operating on sensor data, compares the results with some thresholds, and generates (if necessary) an electrical signal to operate protection devices. 35
4. Device, according to claims 1,2,3 in which the processing unit can store the conditions which determined the activation of the personal protecting function. 40
5. Device, according to claims 1-4 in which the measuring and processing function are contained into an integrated circuit 45
6. Device according to claims 1-5 in which the protecting function is performed by an inflatable garment operated by the said electrical signal 50
7. Device according to claims 1-5 in which the protecting function is accomplished by an electronic device transmitting, by any mean, an alarm. 55





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EUROPEAN SEARCH REPORT

Application Number
EP 99 12 3463

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 40 03 683 A (W. A. JAKOBUS) 8 August 1991 (1991-08-08) * the whole document *	1-7	A41D13/00
X	WO 98 52433 A (MUNEZ MOYA) 26 November 1998 (1998-11-26) * page 7, line 7 - page 8, line 14 * * page 10, line 1 - page 12, line 20; claims 1-9; figures 1-7 *	1-6	
X	DE 295 00 264 U (CH. TUAL) 24 May 1995 (1995-05-24) * claims 1,2; figures 1,2 *	1-6	
X	WO 97 16084 A (N. WELSH) 9 May 1997 (1997-05-09) * page 27, line 5 - line 22 * * page 28, line 7 - line 15; claims 1,7,19-21,23,24 *	1-6	
X	DE 195 45 864 A (TEMIC BAYERN-CHEMIE AIRBAG GMBH) 12 June 1997 (1997-06-12) * column 1, line 52 - column 5, line 62; claims 1,4,5,10; figures 1-5B *	1,3,6,7	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
X,P	US 5 937 443 A (TSUYOSHI KAGEYAMA) 17 August 1999 (1999-08-17) * column 2, line 48 - column 4, line 55; figures 1-9 *	1-4,6	A41D
X	& JP 10 179776 A	1-4,6	
X,P	DE 197 54 541 A (R. RIX) 10 June 1999 (1999-06-10) * page 3, line 3 - page 5, line 42; claims 1,9-16; figures 1-9 *	1-4,6	
		-/--	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 March 2000	Examiner Garnier, F
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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Application Number
EP 99 12 3463

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	FR 2 735 661 A (A. BULTEL) 27 December 1996 (1996-12-27) * page 3, line 4 - page 8, line 7; claims 1-3; figures 1-4 * -----	1, 3, 4, 6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	15 March 2000	Garnier, F	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 12 3463

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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15-03-2000

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 4003683	A	08-08-1991	NONE		
WO 9852433	A	26-11-1998	ES	1037326 U	16-02-1998
DE 29500264	U	24-05-1995	NONE		
WO 9716084	A	09-05-1997	AU	7480596 A	22-05-1997
DE 19545864	A	12-06-1997	NONE		
US 5937443	A	17-08-1999	JP	10179776 A	07-07-1998
DE 19754541	A	10-06-1999	NONE		
FR 2735661	A	27-12-1996	EP	0833574 A	08-04-1998
			WO	9700624 A	09-01-1997