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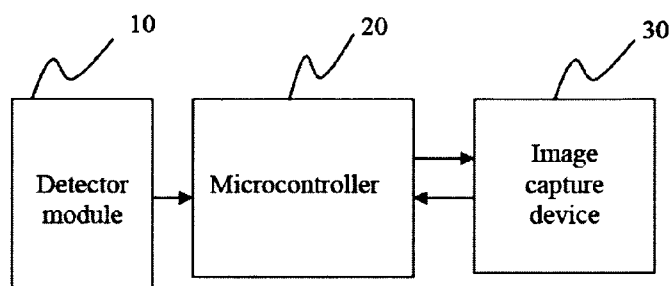
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(54) **Title:** SYSTEM AND METHOD FOR MOVING VEHICLE INFORMATION DETECTION USING SENSOR ARRAYS

FIG 1



(57) **Abstract:** The present invention provides a system for obtaining the motion information of moving vehicles, where the system comprises a detector module for providing the timing and duration information of moving vehicles crossing the detector module, a means for receiving the signals from the detector module, and a microcontroller electronically coupled with the signal receiving means for processing and deriving motion information of the moving vehicles.

SYSTEM AND METHOD FOR MOVING VEHICLE INFORMATION DETECTION USING SENSOR ARRAYS

Field of the Invention

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[0001] The present invention generally relates to technologies for monitoring moving objects, and more particularly to a system and method for obtaining motion information of moving vehicles using sensor arrays.

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Background of the Invention

[0002] Speeding is one of the main causes for road accidents, leading to loss of lives and properties. The most common way to identify a speeding violation is that an officer uses a microwave, radar or laser device to bounce signals off a moving vehicle so as to estimate the speed of the moving vehicle. It requires the physical presence of the officer but there are only a limited number of officers, posing a problem of personal constraints. It is also not suitable for identifying all speeding violations because vehicles move continuously on the road. Another way to identify a speeding violation uses infrared cutter to detect the cut of the infrared line; its implementation may not be suitable as the placement of the cutter would disturb road users.

[0003] The current approaches for identify speeding violation have many shortcomings. For example, it is difficult to continuously detect the speeds of fast moving vehicles on the road, especially at winding or mountainous roads where the placement of sensors needs to be extremely well designed. In addition, it is a challenge in light of the practicality of implementation and deployment of speed detection devices on roads, involving cost, physical labor and the like.

Summary of the Invention

30 [0004] One object of the present invention is to provide a system for obtaining the motion information of moving vehicles. In one embodiment the system comprises a detector module for providing the timing and duration information of moving vehicles

crossing the detector module; where the detector module comprises a plurality of detector element arrays configured in sequence, wherein each of the plurality of detector element arrays detects the changes of light levels when the moving vehicles cross the plurality of detector element arrays; a means for receiving the signals from the plurality of detector
5 element arrays, wherein the signals include the timing when the moving vehicles cross each of the detector element arrays and the duration when the moving vehicles cross two detector element arrays; and a microcontroller electronically coupled with the signal receiving means for processing and deriving motion information of the moving vehicles.

[0005] The objectives and advantages of the invention will become apparent from
10 the following detailed description of preferred embodiments thereof in connection with the accompanying drawings.

Brief Description of the Drawings

15 [0006] Preferred embodiments according to the present invention will now be described with reference to the Figures, in which like reference numerals denote like elements.

[0007] FIG 1 is an exemplary functional block view of the system for obtaining the motion information of moving vehicles in accordance with one embodiment of the present
20 invention.

[0008] FIG 2 shows an isometric view of a portion of the detector module in accordance with one embodiment of the present invention.

[0009] FIG 3 shows an illustration view of the detector module with the opening ends of the optical fibers being designated as detector elements in accordance with one
25 embodiment of the present invention.

[0010] FIG 4 is an illustration of the detector module with a single line-scan sensor to form multiple detector element arrays in accordance with one embodiment of the present invention.

[0011] FIG 5 shows (a) an illustration plan view and (b) side view of the detector
30 element array in accordance with one embodiment of the present invention.

[0012] FIG 6 is an exemplary configuration of the detector module in accordance with one embodiment of the present invention.

[0013] FIG 7 shows (a) a side view of a detector element array and (b) a top view of a bendable detector element array in accordance with one embodiment of the present invention.

[0014] FIG 8 shows an exemplary functional flow of the operation of the data from the detector element arrays to the microcontroller in accordance with one embodiment of the present invention.

[0015] FIG 9 shows the typical photodiodes that can be used as sensors (detector elements) in the present invention.

[0016] FIG 10 shows an exemplary functional flow of the operation of the data from the detector element arrays to the microcontroller in accordance with one embodiment of the present invention.

[0017] FIG 11 shows an exemplary functional flow chart of motion information derivation in accordance with one embodiment of the present invention.

[0018] FIG 12 is an illustration of the timing information of a moving vehicle crossing each detector element arrays

[0019] FIG 13 shows one exemplary deployment of the system in accordance with one embodiment of the present invention.

Detailed Description of the Invention

[0020] The present invention may be understood more readily by reference to the following detailed description of certain embodiments of the invention.

[0021] Throughout this application, where publications are referenced, the disclosures of these publications are hereby incorporated by reference, in their entireties, into this y describe the state of art to which this invention pertains.

[0022] One aspect of the present invention provides a system for obtaining the motion information of moving vehicles. FIG 1 provides an exemplary functional block view of the system in accordance with one embodiment of the present invention. The system 1 comprises a detector module 10 for providing the timing and duration information of moving vehicles crossing the detector module, a microcontroller 20 for processing and deriving motion information of the moving vehicles, and an image capture device 30 for taking snapshots of the moving vehicles. The detector module 10 is electronically coupled

with the microcontroller 20. The microcontroller 20 is electronically coupled with the image capture device 30 so that the microcontroller 20 provides instructions to the image capture device 30 to take snapshots of a speeding vehicle and feedback the taken snapshots to the microcontroller. It is to be noted that the electronic couplings can be wireless.

5 [0023] In one embodiment, the detector module 10 comprises a plurality of detector element arrays and a photon collecting device. The photon collecting device can be any suitable one such as a CCD line-scan camera and CMOS. Each detector element array comprises a line-scan sensor with a plurality of photosensitive elements such as CCD or CMOS and a plurality of optical fibers, where each of the plurality of optical fibers is
10 coupled with each of the plurality of photosensitive elements. With this coupling, the opening end of the optical fiber can be used as an extended light sensing device and the light level can be directly read by the photosensitive elements from the opening ends of the optical fibers as if it is directly sensing from the plurality of photosensitive elements. In other words, the ability of using a line-scan sensor to sense light level has been extended to
15 the opening end of the optical fiber; this provides flexibility for light sensing as optical fiber is bendable while keeping its light conveying capability.

[0024] The photon collecting device is coupled with the photosensitive elements so as to collect the lights directly from the opening ends of the optical fibers. Then the photon collecting device converts the collected lights into voltages and then into an image profile
20 that is sent to the microcontroller. The photon collecting device is an analogue camera, an IP camera or a digital camera. Assuming that the photon collecting device is an analogue camera, the signal is standard PAL or NTSC. the microcontroller will determine the voltage level, or to be more specific the microcontroller sees the signals as an image profile (from the first photosensitive element to the last photosensitive element) and interprets the
25 image profile as if there are line-scanned images. The same scenario can be applied to IP or digital cameras.

[0025] Now referring to FIG 2, there is provided an isometric view of a portion of the detector module 10 in accordance with one embodiment of the present invention. As shown in FIG 2, each of the optical fibers is coupled with a photosensitive element from
30 the line-scan sensor, where the opening ends of the optical fibers serve as the light sensing elements. For the convenience of narration, the opening ends of the optical fibers are referred to as detector elements in the following description. FIG 3 shows an illustration

view of the detector module with the opening ends of the optical fibers being designated as detector elements.

[0026] In one embodiment, the line-scan sensors from each detector element array can form a single line-scan sensor; in other words, the detector module may comprise a single line-scan sensor that is divided into a plurality of segments, where each segment forms the line-scan sensor for each detector element array. The single line-scan sensor in a detection module or line-scan sensors in detector element arrays may comprise any number of photosensitive elements depending upon applications. FIG 4 is an illustration of the detector module with a single line-scan sensor to form multiple detector element arrays in accordance with one embodiment of the present invention. As shown in FIG 4, the single line-scan sensor is able to form a plurality of detector element arrays (i.e., Detector element array 1, Detector element array 2...Detector element array N). In one embodiment, the number of the photosensitive elements is preferably in the range of 1000 to 4000. As described above, a same number of optical fibers are coupled with the photosensitive elements, resulting in the same number of detector elements. The detector elements are configured to form multiple detector element arrays. As an illustration, a single line-scan sensor has 2000 photosensitive elements that form 4 detector element arrays: this can be achieved by portioning the line-scan sensor into 4 segments: the first segment with the photosensitive elements 1-500 to form a first detector element array, the second segment with the photosensitive elements 501-1000 to form a second detector element array, the third segment with the photosensitive elements 1001-1500 to form a third detector element array, and the fourth segment with photosensitive elements 1501-2000 to form a fourth detector element array. It is to be noted that in order to form multiple detector element arrays, two or more line-scan sensors can be used.

[0027] The detector element arrays are arranged in a sequential configuration (either at equal distances or varied distances) so as to allow a moving vehicle to cross the detector element arrays in sequence, thereby the detector element arrays provide the timing when a moving vehicle crosses each detector element array and the time duration for the moving vehicle to cross two detector element arrays. The number of detector element arrays of a detector module is dependent upon the requirement of an application. Usually, at least two detector element arrays are needed to detect the speed of a moving vehicle, and at least three detector element arrays are needed to derive acceleration/deceleration of a

moving vehicle. As shown in FIG 5, four detector element arrays are employed in a detector module 10 with a plurality of detector elements 11. Furthermore, the number of detector elements in a detector element array is determined by a user for any application. In addition, the numbers of detector elements for all detector element arrays in a detector module are not necessarily the same.

[0028] Now referring to FIG 6, there is provided an exemplary configuration of the detector module in accordance with one embodiment of the present invention. The detector module 10 comprises four detector element arrays that are arranged in equal distance, where only one detector element array is depicted. The detector module 10 further comprises two clip-on pieces 13 and a frame 14. Each detector element array comprises a plurality of detector elements 11 that are disposed within a detector element container bar 12. The two clip-on pieces 13 clip the two ends of the detector element container bars, and the frame 13 holds the detector element container bars. The detector element container bars 12 can be made from any suitable materials, preferably bendable plastic material so that the arrays of detector elements can be bended into different configurations as shown in FIG 7. The clip-on pieces ensure quick assembly of the detector module. The frame allows the detector element arrays to be arranged in desired configurations.

[0029] Another aspect of the present invention provides a method for obtaining motion information of moving vehicles. Now referring to FIG 8, there is provided an exemplary functional flow of the operation of the data from the detector element arrays to the microcontroller in accordance with one embodiment of the present invention. First 100 is to define the segments used for different detector element arrays that correspond to the photosensitive elements on the line-scan sensor. Then at step 110, the light intensity from each photosensitive elements is converted and digitized to digital intensity value; for example, 8 bit digital intensity would be in the range of 0 to 255, where 0 represents the darkest black, 255 represents the lightest white, and any value falling between the two ends linearly increases the bright value from dark to white. The intensity values from all photosensitive elements form a line-scan sensor profile. The digital intensity values from the line-scan sensor profile are extracted and then a line profile segmentation is performed 120 so that the digital intensity values are assigned to different detector element arrays. The next step 130 would be acquiring the mean intensity value from the specific range of

detector elements and temporarily storing these values for comparison with the detector value of the individual detector elements. The next step 140 acquires the individual intensity value and sets up individual mean comparators according to the location of the sensor, thus the mean comparators are used as a reference for event detection. This provides adaptive reference to the system so that it can be used under day and night without recalibrating the system. The next step 150 is for time interval detection employing a detector intensity line profile, where the detector intensity line profile is the plot of intensity value against the detector number. for example, the intensity values vary from 0 to 255 in the Y-axis and if the detector has 4000 detector elements, the x-axis would be from 1 to 4000. The intensity values from the detector intensity line profile are then compared with the mean values from the mean comparators. If the detected signal is lower than the mean value, it is considered that detection has taken place and an event has been detected. The detected event will be sent to the microcontroller for further processing. This time information will then be used for motion information derivation.

[0030] In another embodiment of the present invention, each of the detector element arrays in the detector module 10 comprises a plurality of photodiodes, where the photodiodes function as detector elements for sensing the changes of light levels. FIG 9 shows the typical photodiodes that can be used as detector elements in the detector module of the present invention. It is to be noted that the detector elements can be any suitable ones such as capacitors and pressure sensors.

[0031] When photodiodes as detector elements are used to acquire light level information, they are electronically coupled with an electronic circuitry that comprises an amplifier, a voltage convertor, and an analog to digital convertor (ADC). In embodiment, the photodiode is electronically coupled to a transimpedance amplifier which is in turn electronically coupled with an Analogue to Digital convertor (ADC), where the transimpedance amplifier receives the light input from the photodiode and outputs analogue voltage proportional to the light input to the ADC, and the ADC converts the analogue voltage inputs into digital values proportional to the analogue voltage inputs. The digital values are output to the microcontroller for deriving the motion information. The electronic circuitry can be configured to be disposed within the detector module 10 or the microcontroller 20 or to be a standing alone component.

[0032] Now referring to FIG 10, there is provided an exemplary functional flow of the operation of the data from the detector element arrays of photodiodes to the microcontroller in accordance with one embodiment of the present invention. In steps 210, 220, the trans-impedance amplified analogue signal from each of the photodiodes is read out as a voltage value that is proportional to the light level detected. Then in step 230, the voltage value is converted to digital representation through an ADC. The signals from each individual photodiodes are serialized out, and the running average of the digital values in predetermined time periods is stored temporarily. Then in steps 240, 250, the mean or average light signals that have been detected by the detector element arrays are recorded and temporarily stored and constantly updated for comparison purposes; this provides adaptive reference to the system so that it can be used under day and night without recalibrating the system. The detected signal is then compared with the mean signal. If the detected signal is lower than the mean signal, it is considered that the detection has taken place and the event has been detected. The detected event will be sent to the microcontroller for further processing 260. FIG 10 shows the operation for all detector element arrays. At the end of the process, the timing and duration information will be obtained for all detector element arrays in a detector module. The time and duration information will then be used for motion information derivation as described below.

[0033] Now referring to FIG 11, there is provided an exemplary functional flow chart of motion information derivation in accordance with one embodiment of the present invention. When a car crosses the first detector element array, the time will be sent to the microcontroller for recording; when the car crosses the second detector element array, the first time interval is obtained and at this stage, no speed information is derived yet; when the car hits the third detector element array, two time interval information can be obtained and at this point the speed of the car is determined. At this juncture, if the detected speed is higher than the preset limit, the detector process will wait until the car hits the fourth detector element array to calculate the acceleration information. When the car hits the fourth detector element array, the speed and acceleration information will be calculated and the car violates the speed limit. At this point, the microcontroller will send a signal to the day/night operated camera placed strategic location in for example 200m away to take a snapshot of the car registration number. The speed and acceleration information will be recorded. For critical zones like parliament and school area, the speed limit is absolutely

important; however in highway or places with less pedestrian certain tolerance can be applied.

[0034] Now referring to FIG 12, there is provided an illustration of the timing information of a moving vehicle crossing each individual detector element array, where PA means Photosensitive array, 1- 4 represent 4 separate array, A is for acceleration and V is for velocity. In this example, t_1 to t_4 refers to the time when a moving vehicle crosses 1 to 4 detector element array; $t_n - t_{n-1}$ refers to the time duration for the moving vehicle to cross the detector element array n to the detector element array $n-1$; $t_n - 2t_{n-1} - t_{n-2}$ refers to the rate of change of the time durations for the moving vehicle to cross two consecutive linear sensor arrays.

[0035] The speed of a moving vehicle can be derived from the distance between two detector element arrays and the time duration for the moving vehicle to cross the two detector element arrays. For example, when the distance between two detector element arrays is 100 cm (0.001 Km) and the time duration for the moving vehicle to cross the distance is 0.03 second (0.0000083 hr), the velocity would be 120 Km/hr (0.001/0.0000083). The speeds for a moving vehicle crossing two or more detector element arrays can be calculated separately; therefore whether the moving vehicle is running with a constant speed or a varied speed can be determined.

[0036] Now referring to FIG 13, there is provided one exemplary deployment of the system in accordance with one embodiment of the present invention. The distance between the camera and the detector module can be adjusted according to practical requirements. In normal traffics, the preferable distance is about 200 to 300 m, providing about 1 second for the camera to take a snapshot of the registration plate number of a moving vehicle.

[0037] The apparatus and method of the present invention has many advantages. One is that it provides reliable data acquisition and interpretation of the motion information on fast moving vehicles. Another is that it is practical in terms of deployment under different road conditions without interrupting traffics.

[0038] The present invention can be tailored to various applications. One is for warning notification when the apparatus of the present invention is deployed in a speed control zone. When a driver sees the apparatus itself or the speeding sign shown on the apparatus, he can slow down his vehicle or keep speeding. If the driver slows down upon

seeing the warning sign of speeding, no ticket will be issued; if the driver keeps speeding, a snapshot of the vehicle registration number will be captured, resulting in a ticket.

[0039] While the present invention has been described with reference to particular embodiments, it will be understood that the embodiments are illustrative and that the invention scope is not so limited. Alternative embodiments of the present invention will become apparent to those having ordinary skill in the art to which the present invention pertains. Such alternate embodiments are considered to be encompassed within the scope of the present invention. Accordingly, the scope of the present invention is defined by the appended claims and is supported by the foregoing description.

CLAIMS

What is claimed is:

- 5 1. A system for obtaining the motion information of moving vehicles, said system comprising:
- a detector module for providing the timing and duration information of moving vehicles crossing the detector module; where the detector module comprises a plurality of detector element arrays configured in sequence, wherein each of the plurality of detector
- 10 element arrays detects the changes of light levels when the moving vehicles cross the plurality of detector element arrays:
- a means for receiving the signals from the plurality of detector element arrays, wherein the signals include the timing when the moving vehicles cross each of the detector element arrays and the duration when the moving vehicles cross two detector element
- 15 arrays; and
- a microcontroller electronically coupled with the signal receiving means for processing and deriving motion information of the moving vehicles.
2. The system of claim 1, wherein each of the plurality of detector element arrays
- 20 comprises a line-scan sensor with a plurality of photosensitive elements, and a plurality of optical fibers; wherein one end of each of the plurality of optical fibers is coupled with each of the plurality of photosensitive elements, and the other opening end of each optical fiber as detector elements senses lights;
- wherein the signal receiving means is a photon collecting means coupled with the
- 25 photosensitive elements so as to collect the lights directly from the opening ends of the optical fibers, where the photon collecting means converts the collected lights into voltage signals that are output as an image profile; and
- wherein the microcontroller is electronically coupled with the photon collecting means, receiving the output image profile and the timing information of the moving
- 30 vehicles and deriving the motion information of the moving vehicles based on the output image profile and the timing information.

3. The system of claim 2, wherein the photon collecting means is one selected from the group consisting of a CCD line-scan camera, a CMOS.
4. The system of claim 2, wherein the photosensitive elements are CCD or CMOS.
5. The system of claim 2, wherein the line-scan sensors from each of the plurality of detector element arrays are from a single line-scan sensor, where the line-scan sensor of one detector element array is a segment of the single line-scan sensor.
- 10 6. The system of claim 2, wherein the line-scan sensors from each of the plurality of detector element arrays are from two or more individual line-scan sensors, where the line-scan sensor of one detector element array is a segment of the individual line-scan sensor or the whole individual line-scan sensor.
- 15 7. The system of claim 1, wherein each of the detector element arrays comprises a plurality of sensors selected from the group consisting of photodiodes, capacitors and pressure sensors.
8. The system of claim 7, wherein each of the detector element arrays comprises a
20 plurality of photodiodes;
wherein the plurality of photodiodes are electronically coupled with an electronic circuitry that comprises an amplifier, a voltage convertor, and an analog to digital convertor (ADC); and
wherein the amplifier receives the light input from the photodiode and outputs
25 analogue voltage proportional to the light input to the ADC, and the ADC converts the analogue voltage inputs into digital values proportional to the analogue voltage inputs;
wherein the digital values are output to the microcontroller for deriving the motion information.
- 30 9. The system of claim 1, said system further comprises an image capture device for taking snapshots of the moving vehicles, wherein the image capture device is electronically

coupled with the microcontroller to receive instructions of whether to take snapshots of a speeding vehicle and feedback the taken snapshots to the microcontroller.

10. The system of claim 9, wherein the image capture device is a camera.

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11. The system of claim 1, wherein the detector element arrays are arranged in equal distances or varied distances.

12. The system of claim 1, wherein the detector module further comprises a plurality of detector element container bars, two clip-on pieces and a frame; wherein the each detector
10 detector element container bar holds the detector elements of each detector element array, the two clip-on pieces clip the two ends of the detector element container bars, and the frame holds the detector element container bars.

15 13. The system of claim 12, wherein the detector element container bars are made from bendable plastic material so that the detector element arrays can be bended into different configurations.

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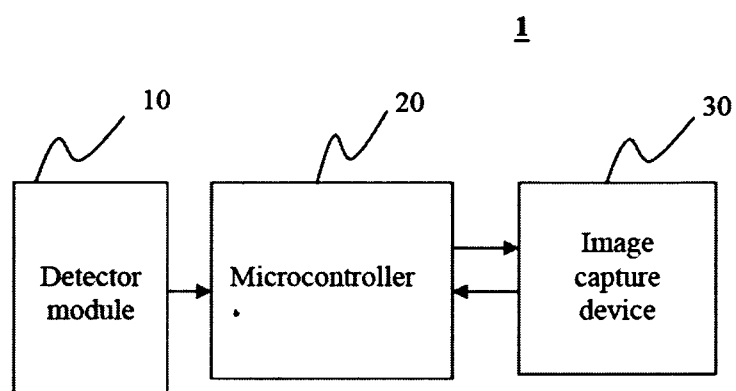


FIG 1

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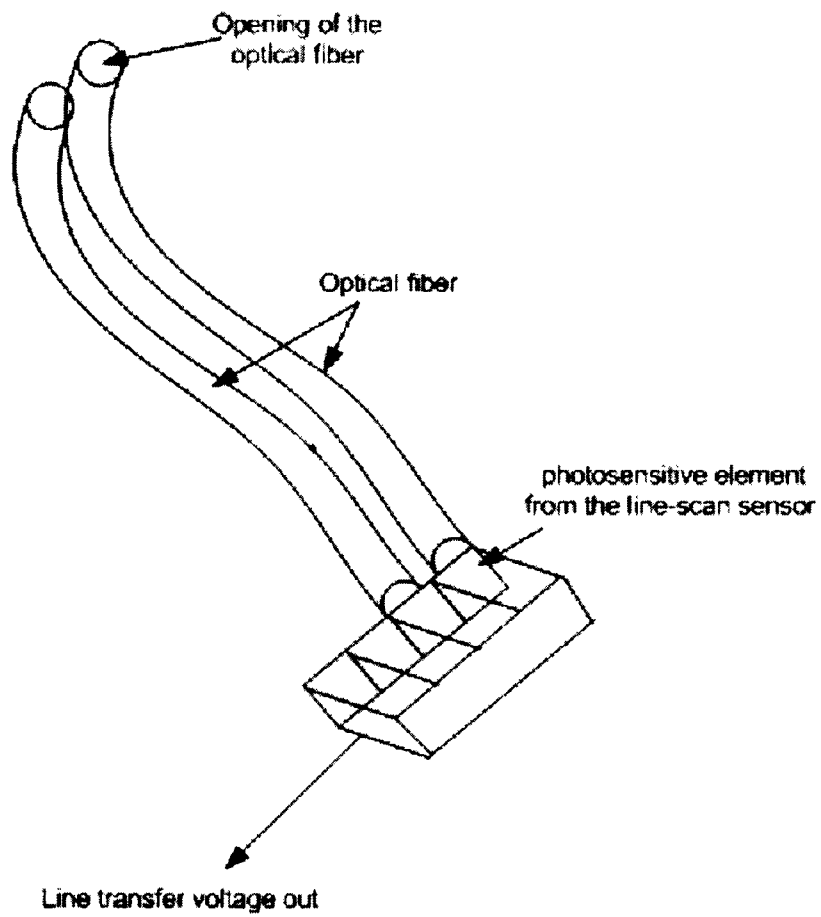


FIG 2

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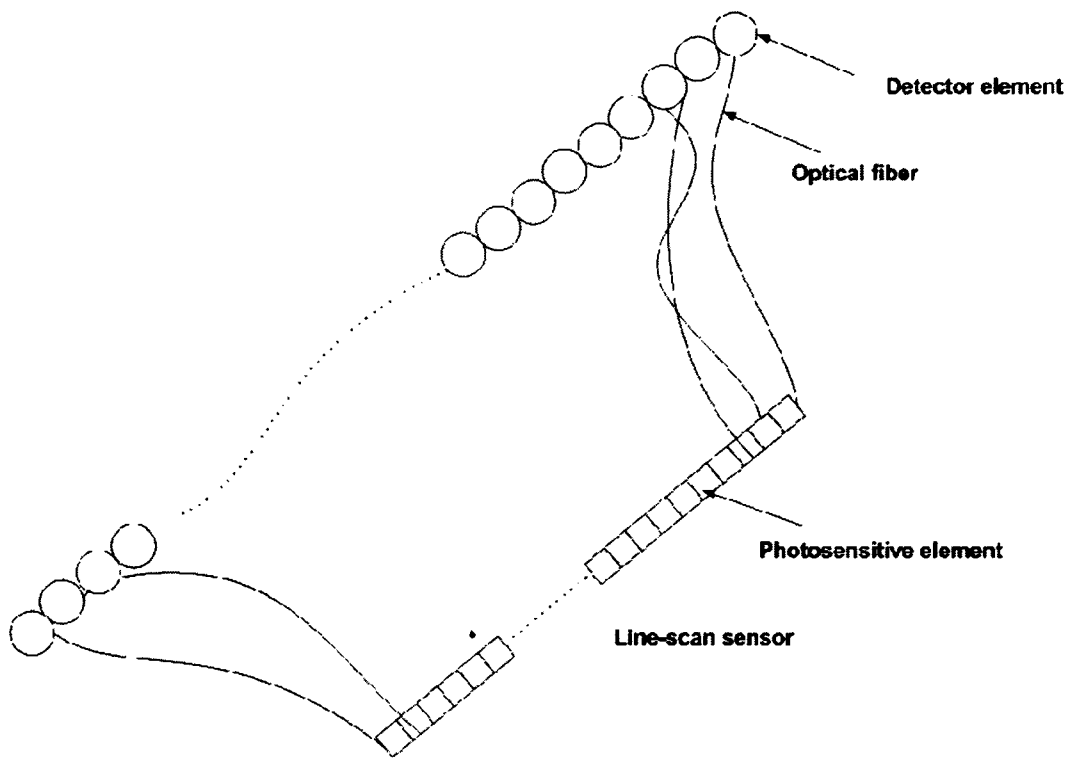


FIG 3

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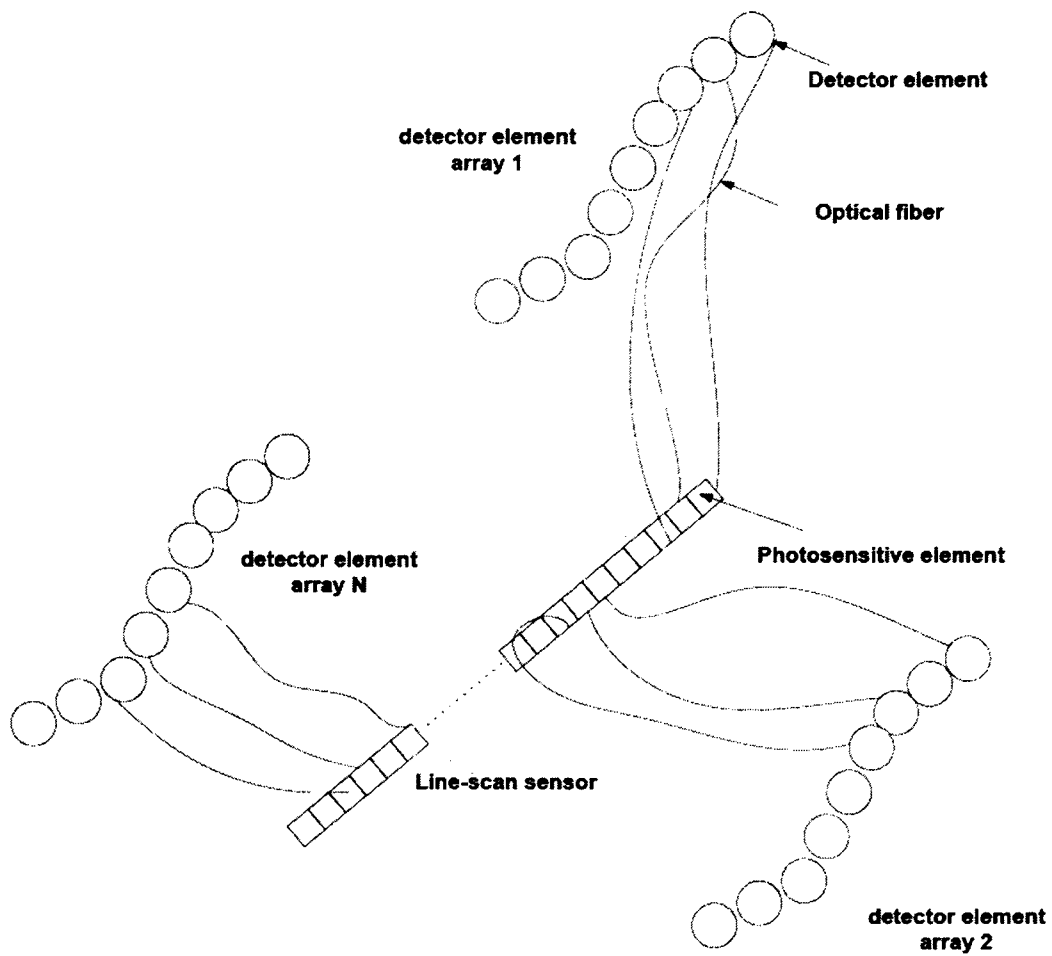


FIG 4

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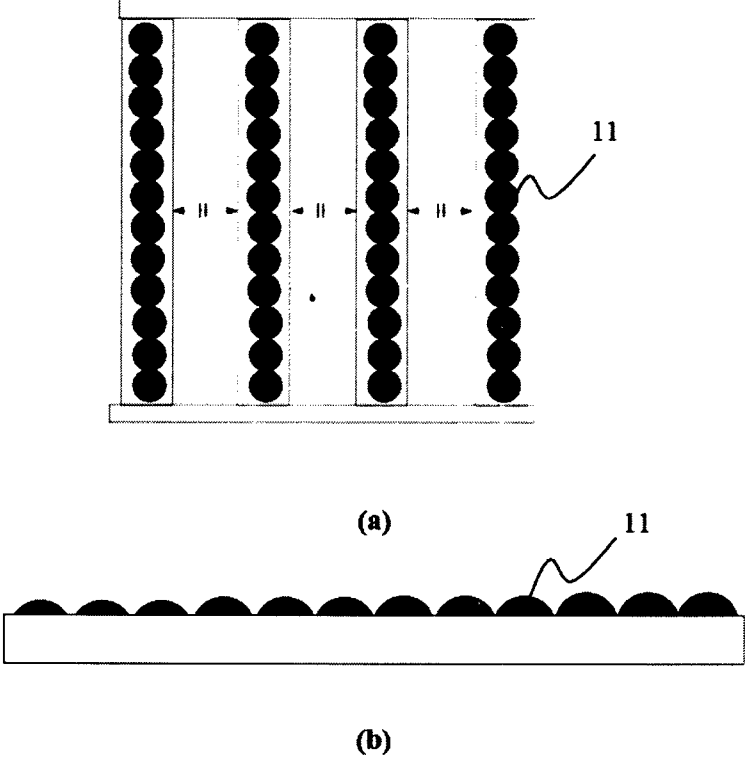


FIG 5

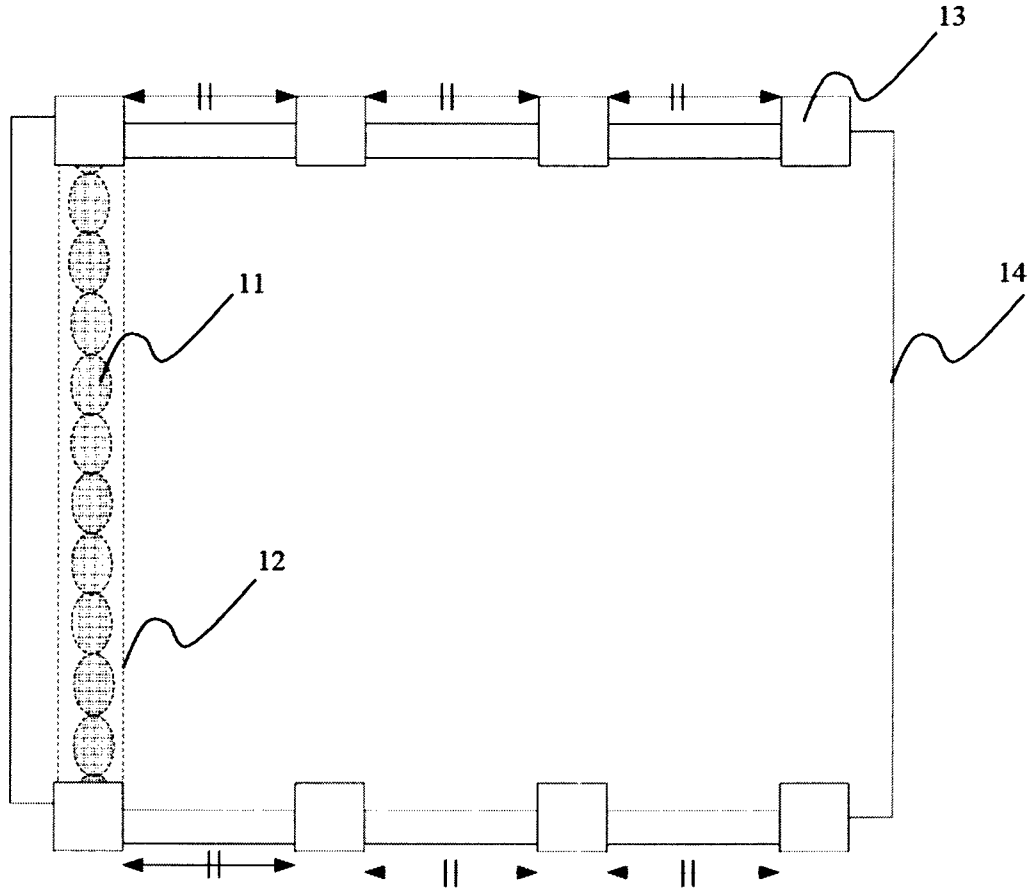


FIG 6

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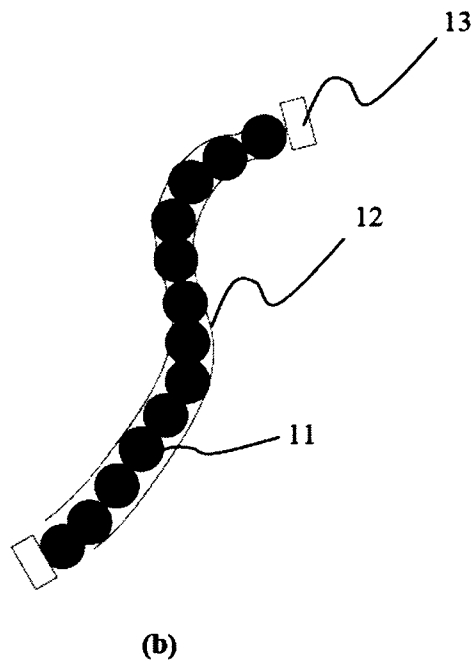
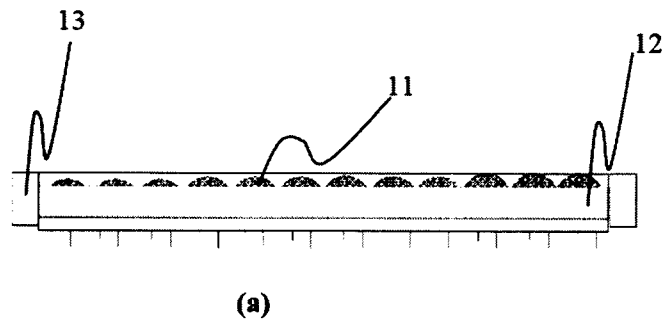


FIG 7

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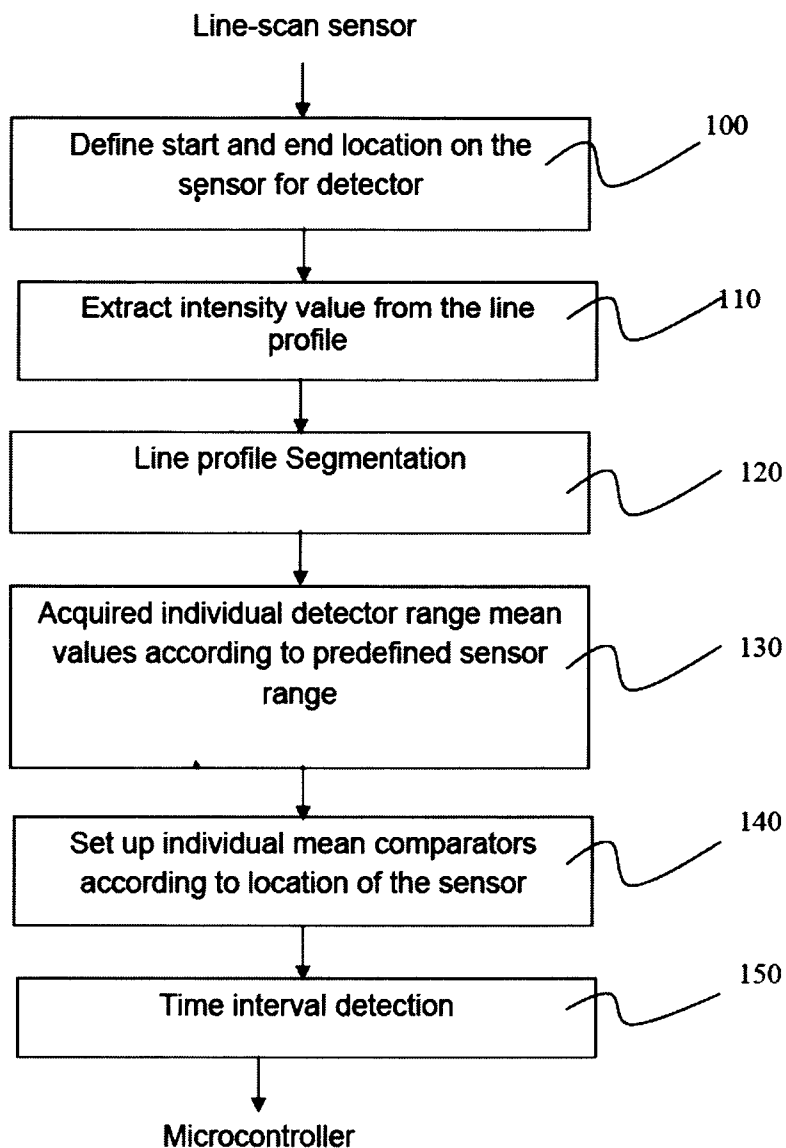


FIG 8

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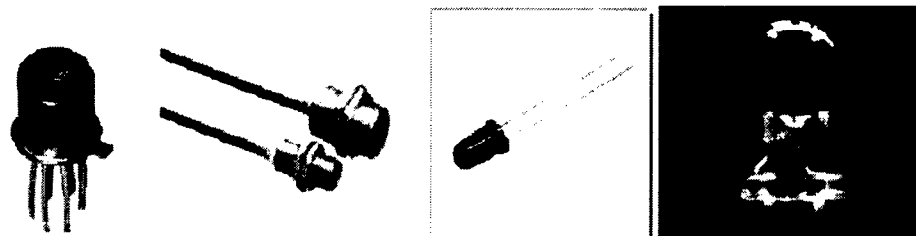


FIG 9

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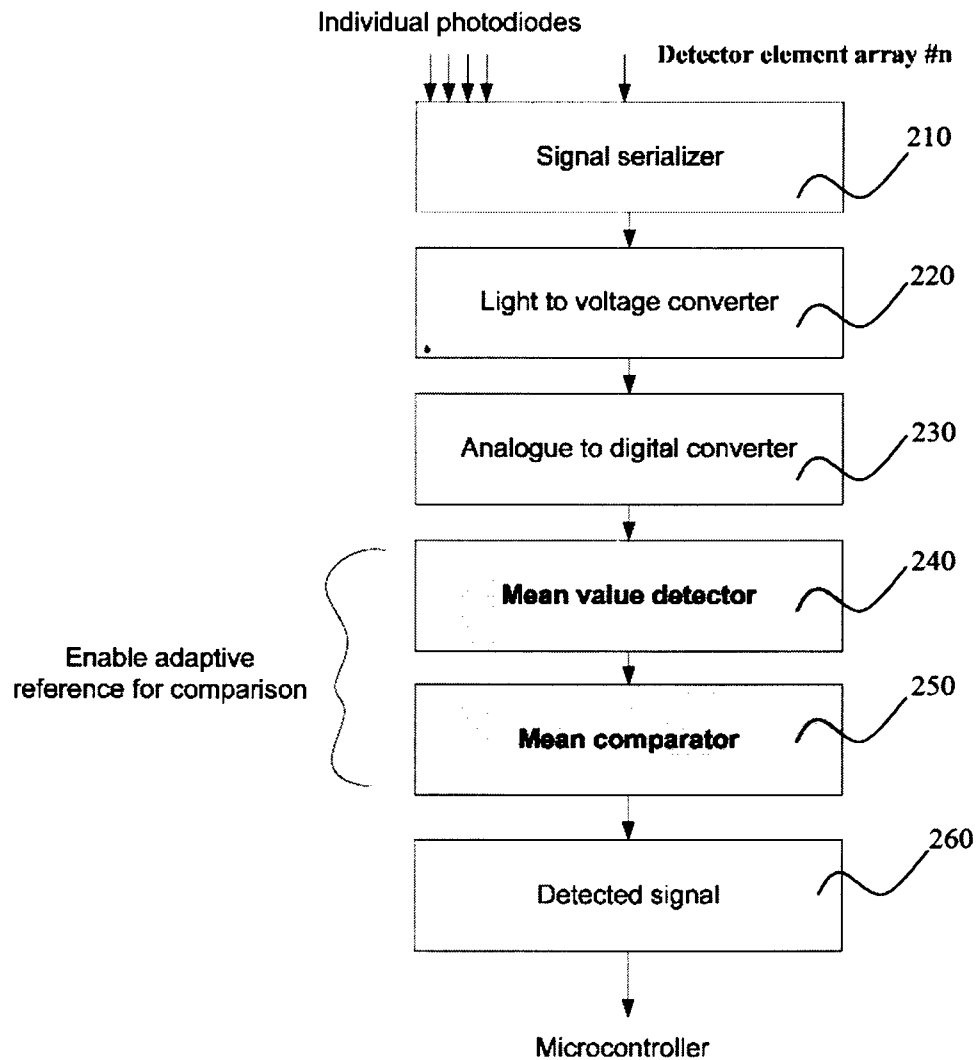


FIG 10

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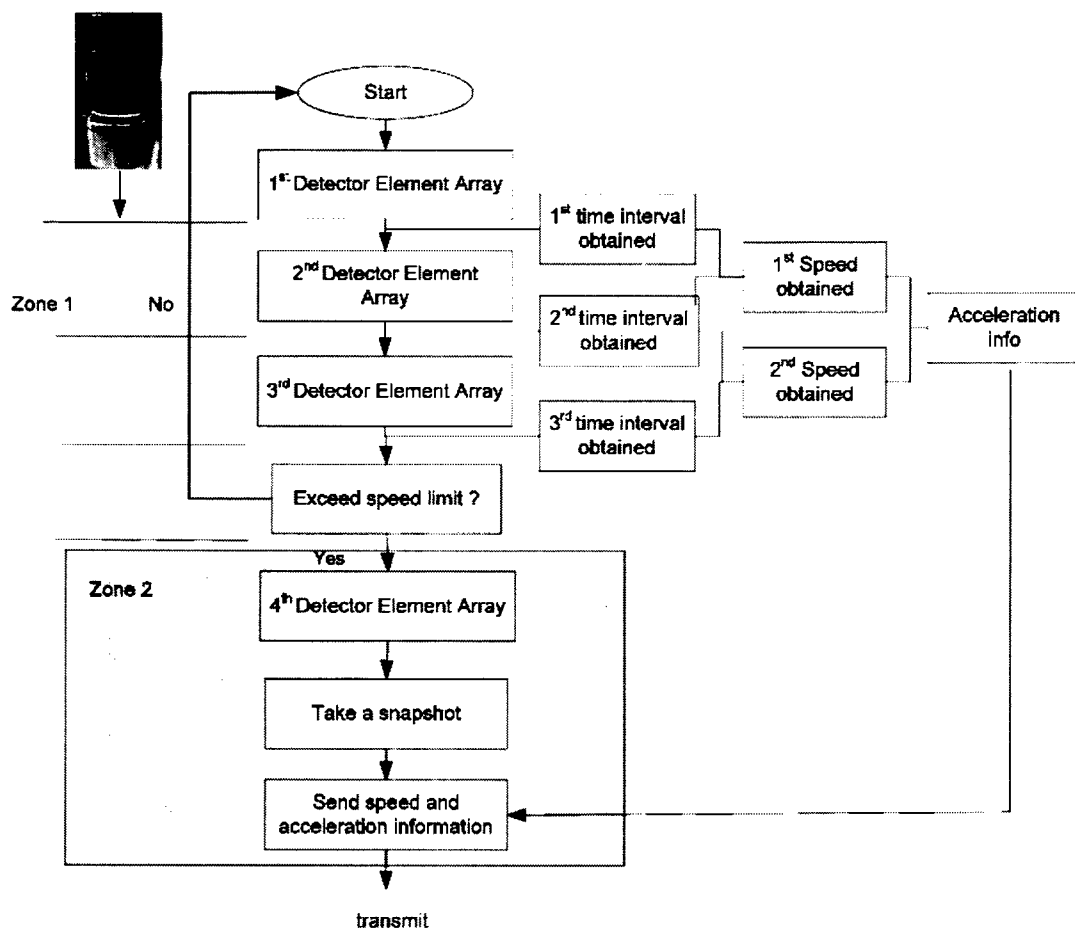


FIG 11

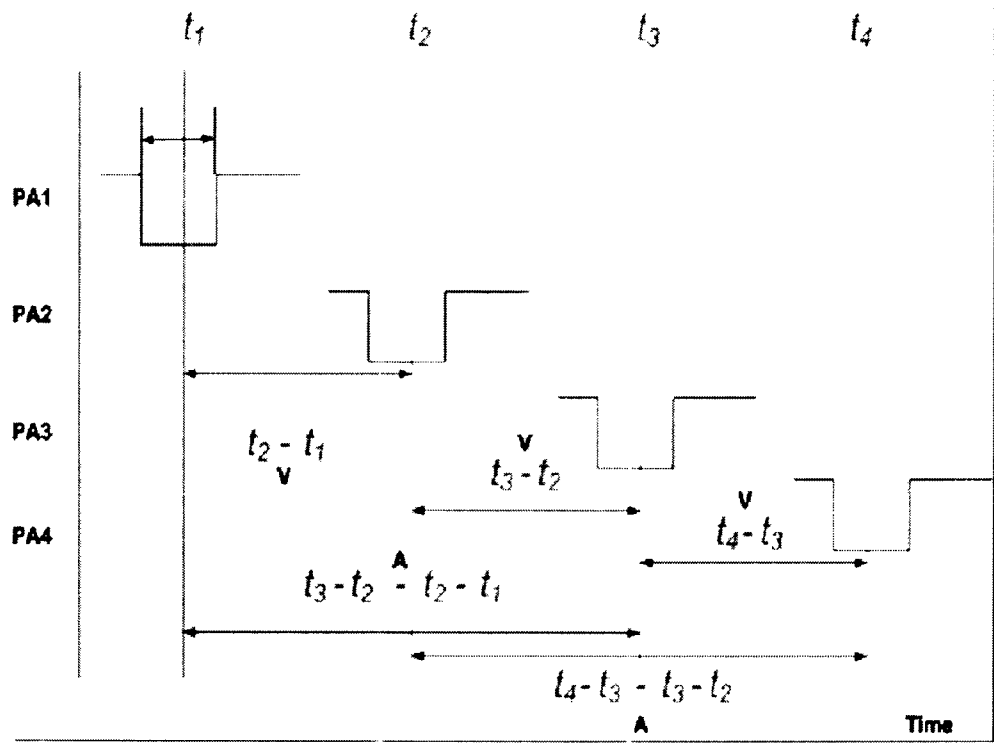


FIG 12

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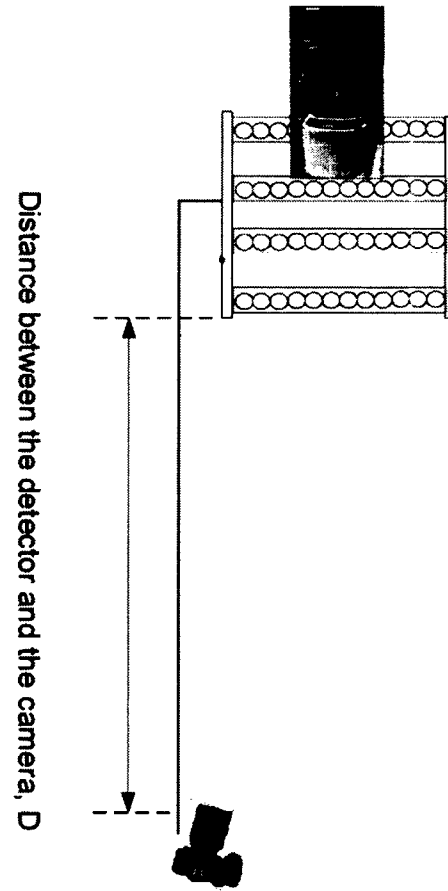


FIG 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/MY2011/000141

A. CLASSIFICATION OF SUBJECT MATTER												
Int. Cl.												
G08G 1/01 (2006.01) G08G 1/04 (2006.01)												
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)												
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)												
Internet, USPTO, EPODOC, WPI using keywords such as: vehicle, car, automobile, motion, speed velocity, detect, sense, photodetector, photocell, photonics, optical fibre, light level, array, cluster, series, sequence, duration,												
C. DOCUMENTS CONSIDERED TO BE RELEVANT												
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
Y	US 6075466 A (COHEN et al.) 13 June 2000 See whole document, in particular: Abstract; Fig 5; Column 1, Lines 54 – 58; Column 3, Lines 41 – 45; Column 6, Lines 2 – 6; Column 8, Lines 21 – 31 & 42 – 50; Column 9, Lines 1 - 15	1, 7 – 13										
A		2 - 6										
Y	WPI Online Abstract Accession No. 1998-035428, FR 2749086 A1 (TECHNICATOME) 28 November 1997 Abstract	1, 7 – 13										
A		2 - 6										
☒ Further documents are listed in the continuation of Box C ☒ See patent family annex												
* Special categories of cited documents: <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"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</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"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</td> </tr> <tr> <td>"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)</td> <td>"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</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance	"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	"E" earlier application or patent but published on or after the international filing date	"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	"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)	"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	"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed	
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Date of the actual completion of the international search 25 August 2011		Date of mailing of the international search report 25.08.2011										
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/MY2011/000141

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5617086 A (KLASHINSKY et al.) 1 April 1997 See whole document	
A	US 4961643 A (SAKAI et al.) 9 October 1990 See whole document	
A	EP 2085761 A2 (PALO ALTO RESEARCH CENTER INC) 5 August 2009 See whole document	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/MY2011/000141

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
US	6075466	AU	37980/97	CA	2261606	EP	0912969
		US	6137424	WO	9803950		
FR	2749086	NONE					
US	5617086	CA	2134717				
US	4961643	BR	8900679	CS	8901005	EP	0332293
		JP	1311279				
EP	2085761	EP	2085758	EP	2085759	EP	2085760
		EP	2085762	EP	2085763	EP	2085797
		JP	2009180723	JP	2009180724	JP	2009180725
		JP	2009180727	JP	2009180728	JP	2009180729
		JP	2009180730	US	2009195773	US	7701580
		US	2009194705	US	7763856	US	2009190121
		US	7817254	US	2009195852	US	7894068
		US	2010155572	US	2010155577	US	2010157291
		US	2010201988				
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.							
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