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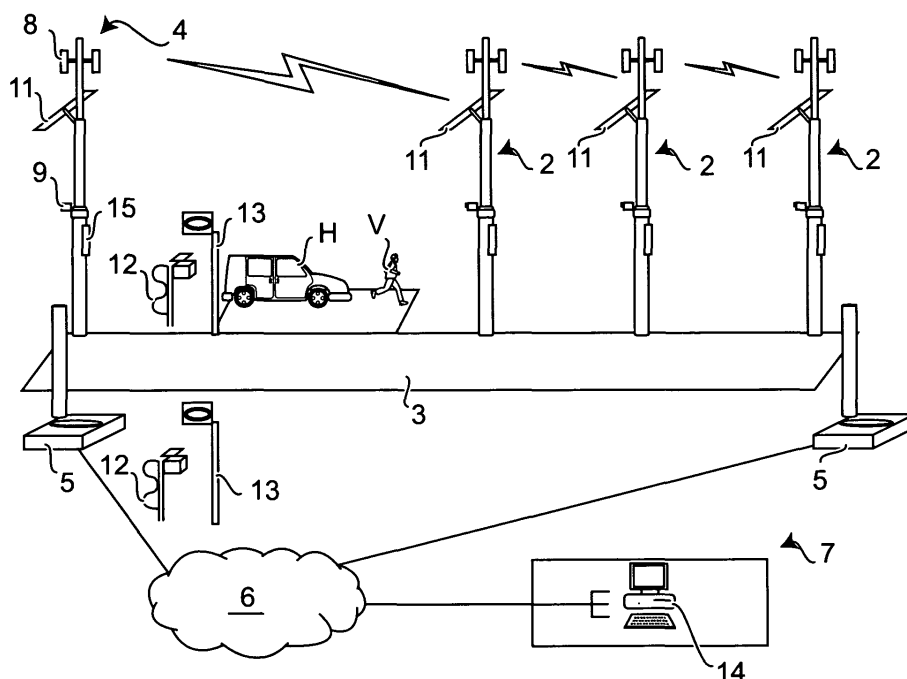
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(54) **Control and assistance system for managing vehicle traffic, particularly road traffic**

(57) The present invention relates to a control and assistance system (1) for managing vehicle traffic, particularly road traffic, comprising a signal transmission communication network (6), connected with a data control and processing unit (7), said system (1) being characterised in that it comprises a plurality of multifunctional units (2), installed in series along at least a course stretch (3) of said vehicles, said multifunctional units (2) comprising detection means (8, 9) for vehicle traffic and data transceiving means (4), each multifunctional unit (2) re-

ceiving, by said transceiving means (4), said data from the precedent multifunctional unit (2) and transmitting said data detected by said detection means to the next multifunctional unit (2) and vice versa; said system (1) further comprising at least an inlet unit (5) connected with said fixed communication network (6) and with at least one of said multifunctional units (2) by further transceiving means, by said further transceiving means collecting said data and sending them to said data control and processing unit (7).



**Fig. 3**

## Description

**[0001]** The present invention relates to a control and assistance system for managing vehicle traffic, particularly road traffic.

**[0002]** More specifically, the invention concerns a system permitting detecting and processing extra-urban and highway traffic data suitable to be installed along articulated paths and also able supporting wireless data communications.

**[0003]** Specification will be addressed in the following to application to highway networks, but it is well evident that the same must not be limited to this specific use.

**[0004]** As it is well known, different kind of systems exist for detecting traffic along highway network.

**[0005]** Said systems are for example based on positioning of cameras in correspondence of various detection points, such as fly-over and like or on suitable support beams. Information detected is transmitted to data processing units.

**[0006]** Spire for detection of motor vehicles can be provided on highways. This system has the drawback of very high maintenance costs.

**[0007]** These systems have the main technical problem of detecting traffic jams very late. Just to overcome this limitation, during days when a very heavy traffic is expected, e.g. in summer or for national holidays, helicopters monitor road network.

**[0008]** A further problem of the road network is that often SOS systems are inadequate. Particularly, they are too far each other or they can be difficultly obtained.

**[0009]** Therefore, it is the object of the present invention that of suggesting a system for supervising and surveying traffic, particularly road traffic, suitable permitting efficient data detection and processing, avoiding any delay.

**[0010]** A second object of the present invention is that of permitting managing traffic data by systems provided along the road network.

**[0011]** A third object of the invention is that of permitting control and integration of safety systems.

**[0012]** A further object of the present invention is that of permitting interfacing with known detection systems.

**[0013]** It is therefore specific object of the present invention a control and assistance system for managing vehicle traffic, particularly road traffic, comprising a signal transmission communication network, connected with a data control and processing unit, said system being characterised in that it comprises a plurality of multifunctional units, installed in series along at least a course stretch of said vehicles, said multifunctional units comprising detection means for vehicle traffic and data transceiving means, each multifunctional unit receiving, by said transceiving means, said data from the precedent multifunctional unit and transmitting said data detected by said detection means to the next multifunctional unit and vice versa; said system further comprising at least an inlet unit connected with said fixed communication network

and with at least one of said multifunctional units by further transceiving means, by said further transceiving means collecting said data and sending them to said data control and processing unit.

**[0014]** Always according to the invention, said multifunctional units can be installed in a plurality of stretches.

**[0015]** Still according to the invention, said system can comprise two access units placed at the ends of each stretch.

**[0016]** Furthermore according to the invention, said data control and processing unit can comprise one or more units for controlling said multifunctional units.

**[0017]** Still according to the invention, said data can include vehicle average speed and/or vehicle density.

**[0018]** Further, according to the invention said transceiving means comprise radio or cable transceiving means.

**[0019]** Preferably, according to the invention, said multifunctional units can be interfaced with data movable terminals or with voice terminal.

**[0020]** Always according to the invention, said multifunctional units can comprise a data pre-processing unit.

**[0021]** Preferably, according to the invention, said multifunctional units can comprise a pole provided in a basement plinth.

**[0022]** Still according to the invention, said multifunctional units can comprise electric supply means, said electric supply means comprising at least a solar panel, energy accumulators and/or a wind system.

**[0023]** Furthermore, according to the invention, said data detection means can comprise at least a camera and/or a traffic sensor.

**[0024]** Advantageously, according to the invention, said data transceiving means of said multifunctional units could comprise at least a radio module connected with a directional antenna.

**[0025]** Always according to the invention, said system can comprise radio repeater for connecting said multifunctional units.

**[0026]** Preferably according to the invention, each one of said multifunctional units can be connected by connection means to a SOS peripheral unit and to a signalling unit.

**[0027]** Still according to the invention, said connection means can include cables and/or further transceiving means.

**[0028]** Always according to the invention, said signalling unit can be activated/deactivated by said multifunctional unit following a control signal from said data control and processing centre.

**[0029]** The present invention will be now described, for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

figure 1 shows a scheme of control and assistance system for managing road traffic according to the present invention;

figure 2 shows an operation scheme of control system for managing road traffic according to the present invention;

figure 3 schematically shows an installation of the system of figure 2;

figure 4 shows the scheme of an embodiment of a multifunctional unit of system according to the present invention;

figure 5 schematically shows realisation of multifunctional unit according to figure 4; and

figure 6 shows a second embodiment of control and assistance system for managing road traffic according to the present invention.

**[0030]** Making reference to figure 1, it is possible observing the system for surveying traffic according to the invention, generically indicated by reference number 1.

**[0031]** Said system provides a plurality of multifunctional units 2, installed in series along a road network 3. Said multifunctional units 2 can communicate each other, sending detected data by transceiving means 4.

**[0032]** Each multifunctional unit 2 is connected with the adjacent one, thus creating a chain. Therefore, each unit 2 can be terminal for the following one and inlet point for the previous one.

**[0033]** Said plurality of multifunctional units 2 provides inlet units 5 or concentrators at their ends, said units 5 being connected with fixed communication network 6 of Highway Authority, said network 6 being connected with a data control and processing unit 7.

**[0034]** Said inlet units 5 are connected with the first multifunctional unit 2 of the chain. They further provide a protected supply main.

**[0035]** In case distance between said inlet unit 5 and said transceiving means 4 is bigger than the one acceptable for Ethernet connections, additional active/passive apparatuses are added to those indicated in the above (e.g. inlet switch/hub, HDSL modem, ecc.).

**[0036]** Each multifunctional unit 2 comprises traffic data detection means, said data being transmitted along the chain and by said inlet units 5 and said fixed network to said data control and processing unit 5.

**[0037]** It is also provided connection with movable terminals M, with voice terminals V or with fixed terminals F, placed in the monitored stretch.

**[0038]** It is noted that the same knot can be reached either following the rightward path and the leftward path.

**[0039]** Routing algorithm is of the dynamic and self-adaptive type. Therefore, changing of the connection state (e.g. failures) and of network topology (addition or removal of whole network parts) is automatically learnt by software without requiring manual configuration intervention.

**[0040]** Obviously, increasing the length of chain between the ends of a single stretch, it also increases failure probability and time required for data transmission.

**[0041]** Observing now figure 2, it is possible following data flows D through system 1 elements.

**[0042]** Particularly, each multifunctional unit 2 provides cameras 8 and traffic sensors 9, connected to an interface data pre-processing and control unit 10. Said unit 10 is connected with said transceiving means 4, always on. Said multifunctional units 2 are supplied by supply means 11.

**[0043]** Multifunctional units 2 are preferably installed along a highway stretch (aside the roadway and, for safety reasons, at about 1.4 m from protection (guard rail)) at a distance each other of 2 Km, in the most suitable position (left or right) for ensuring wireless connection (when making inspection, installation sites are chosen so that antennas of each multifunctional unit 2 are in an electromagnetic visibility condition).

**[0044]** Data control and processing unit 7 is connected with control units 14 of said multifunctional units 2, placed in one or more stretches.

**[0045]** Each multifunctional units 2 is provided, in each running direction, with signalling and SOS peripheral units, respectively indicated by reference numbers 12 and 13, placed in the most suitable positions for ensuring visibility if signalling devices and/or safe access to SOS peripheral unit 11. Said peripheral units 12 and 13 are connected with multifunctional unit 2 communicating by a wireless or by a wire communication subsystem.

**[0046]** Figure 3 shows in greater detail system 1 according to the invention.

**[0047]** Inlet units 5 are placed at the two ends of stretch (e.g. placed close to highway control - houses), communicating with Highway Authority network. Data control and processing unit 7 is reached by said network 6, said unit 7 comprising one or more control units 14.

**[0048]** In case the system is installed along roads without control - houses, such as state roads, network inlet points must be individuated on public network or realised by optical fibre connection or by radio link. Typical distance between access points is 20 Km, in order to ensure operation and sufficient quality of all the cameras 8 on the stretch at the same time.

**[0049]** Multifunctional units 2 are placed at a sufficient distance for ensuring electromagnetic visibility. They provide a cabinet 15 for housing pre-processing circuits. cameras 8 and supply means for their power autonomy are provided on the top of said units 2.

**[0050]** If the system is installed along paths with a complicated configuration, it is necessary providing repeater 2'. Said repeater 2' permits communication of two multifunctional units 2 that, due to territory orography and to road path, are not in an electromagnetic visibility condition.

**[0051]** Substantially, repeater 2' is not provided with cameras 8, sensors 9 and peripheral units 12 and 13.

**[0052]** Control units 14 are comprised of a suitably sized server for supporting, among others, the following specific applications:

- "Traffic Data" applicative software, for collection and concentration of data arriving from multifunctional

units 2;

- "Video Dispatcher" applicative software for concentration and distribution of video flows arriving from surveillance cameras 8;
- "Diagnostic" applicative software for collection and presentation of diagnostic and status data arriving from multifunctional units 2;
- "Control" applicative software for centralised managing of elements comprising the system (sensors, cameras, peripheral 2' and signalling 13 and SOS 12 units, processing units, continuous/discontinuous operation).

**[0053]** Unit 14 is interface with data control and processing unit actuating all upper level functions and that, particularly, manages and supervises video information, signalling units 13 and SOS units 12, processing traffic data.

**[0054]** System 1 according to the invention mainly permits:

- detecting vehicle traffic data and flow by a suitable sensor network;
- having a collection peripheral system of information detected by sensors integrated with a central managing system. The latter has supervising, concentration, processing and presentation functions;
- signalling to the users anomalous traffic events by a signalling device network (lamps, variable messages panels);
- having a self-sufficient supply system in order to ensure wide system availability.

**[0055]** It is further possible observing from the figure that data transmitted from multifunctional units 2, besides from cameras 8 and sensors 9, can be deduced from data mobile terminal M or from a voice terminal V.

**[0056]** Figure 4 shows block diagram of an embodiment of a multifunctional unit 2, which is power self-sufficient.

**[0057]** Particularly, said supply means 11 comprise a stabilisation and control module 11', a photovoltaic panel 11" provided with batteries 11'''. In a further embodiment (not shown in the figures) supply could be obtained from electric main, with a buffer battery system.

**[0058]** The following elements are connected to the pre-processing unit 10:

- one or more transceiving radio modules 4', each one respecting and fulfilling limits of the existing Radio-LAN rules;
- one or more data communication modules toward fixed network. 16.

**[0059]** Each transceiving radio module 4' is then connected to a suitably oriented directive antenna 4" for reaching, by radio, at least one of other communication network sites.

**[0060]** When installing and configuring the system, each radio module can be set for being an end element or an inlet point. Inlet point configuration, known in the radio transceiving technique, permits collecting data arriving from a plurality of terminals managing the dispute on radio means by standard protocols.

**[0061]** Figure 5 specifically shows multifunctional unit 2 of figure 4, providing a pole 2a as support element for all the components.

**[0062]** Main features of said unit 2 are:

- solar panel supply subassembly 11" provided with buffer battery 11''' installed in reinforced concrete basement - plinth 17 with a watertight sump;
- video surveillance by 2 cameras 8 or as alternative pivotable, with MPEG-4 codified video flow, remote controlled activation/deactivation and timed automatic switching off;
- one or more sensors 9 for traffic data detection (in function of the kind of sensor used, one or more of the following information can be detected: number of vehicles, kind and density of traffic per time unit, average speed);
- wireless communication subsystem;
- pre-processing unit 10, besides the above local pre-processing functions of data arriving from sensors and cameras provides: remote control self-diagnosis and fw/sw upgrade functions; WiFi communication managing functions; peripheral unit managing functions (PMV, SOS, sensors).

**[0063]** SOS units 12 provide means for emergency/aid calls (with synthetic message managing and operator talking) housed within a watertight housing. Furthermore, it is comprised a wireless communication sub-system.

**[0064]** As to the signalling unit 13, main features are the following:

- variable message/variable road sign panel and signalling lamp;
- wireless communication sub-system.

**[0065]** Said signalling unit 13 too can be obtained by an existing device integrating or replacing communication subsystem with the wireless one. Said unit 13 further permits introducing a further traffic data detection sensor 18.

**[0066]** Figure 6 represents a general view of structure shown in figure 1 scheme.

**[0067]** It is particularly possible observing that suitably combining multifunctional unit 2 chains with parts of fixed networks 6 by connections 19, it is possible creating data networks particularly suitable for highways, road and railways structures.

**[0068]** Furthermore, it is possible providing a connection of network 6 with Internet 20.

**[0069]** On the basis of the previous specification, it can

be noted that basic feature of the present invention is the fact of providing a system permitting monitoring and controlling highway network and that can be installed in various ways on the basis of the specific needings.

**[0070]** An advantage of the present invention is that said multifunctional units are self-adaptive.

**[0071]** A further advantage of the present invention is that of permitting integration of traditional data transmission systems.

**[0072]** The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is to be understood that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

## Claims

1. Control and assistance system for managing vehicle traffic, particularly road traffic, comprising a signal transmission communication network, connected with a data control and processing unit, said system being **characterised in that** it comprises a plurality of multifunctional units, installed in series along at least a course stretch of said vehicles, said multifunctional units comprising detection means for vehicle traffic and data transceiving means, each multifunctional unit receiving, by said transceiving means, said data from the precedent multifunctional unit and transmitting said data detected by said detection means to the next multifunctional unit and vice versa; said system further comprising at least an inlet unit connected with said fixed communication network and with at least one of said multifunctional units by further transceiving means, by said further transceiving means collecting said data and sending them to said data control and processing unit.
2. System according to claim 1, **characterised in that** said multifunctional units are installed in a plurality of stretches.
3. System according to one of the preceding claims, **characterised in that** said system comprises two access units placed at the ends of each stretch.
4. System according to one of the preceding claims, **characterised in that** said data control and processing unit comprises one or more units for controlling said multifunctional units.
5. System according to one of the preceding claims, **characterised in that** said data include vehicle average speed and/or vehicle density.
6. System according to one of the preceding claims, **characterised in that** said transceiving means comprise radio transceiving means.
7. System according to one of the preceding claims, **characterised in that** said transceiving means comprise cable transceiving means.
8. System according to one of the preceding claims, **characterised in that** said multifunctional units are interfaced with data movable terminals or with voice terminal.
9. System according to one of the preceding claims, **characterised in that** said multifunctional units comprise a data pre-processing unit.
10. System according to one of the preceding claims, **characterised in that** said multifunctional units comprise a pole provided in a basement plinth.
11. System according to one of the preceding claims, **characterised in that** said multifunctional units comprise electric supply means.
12. System according to claim 11, **characterised in that** said electric supply means comprise at least a solar panel.
13. System according to claim 11 or 12, **characterised in that** said electric supply means comprise energy accumulators.
14. System according to one of preceding claims 11 - 13, **characterised in that** said electric supply means comprise a wind system.
15. System according to one of the preceding claims, **characterised in that** said data detection means comprise at least a camera.
16. System according to one of the preceding claims, **characterised in that** said data detection means comprise a traffic sensor.
17. System according to one of the preceding claims, **characterised in that** said data transceiving means of said multifunctional units comprise at least a radio module connected with a directional antenna.
18. System according to one of the preceding claims, **characterised in that** said system comprises radio repeater for connecting said multifunctional units.
19. System according to one of the preceding claims, **characterised in that** each one of said multifunctional units is connected by connection means to a SOS peripheral unit and to a signalling unit.

20. System according to claim 19, **characterised in that** said connection means include cables and/or further transceiving means.

21. System according to one of the preceding claims, **characterised in that** said signalling unit is activated/deactivated by said multifunctional unit following a control signal from said data control and processing centre.

22. System according to each one of the preceding claims, substantially as illustrated and described.

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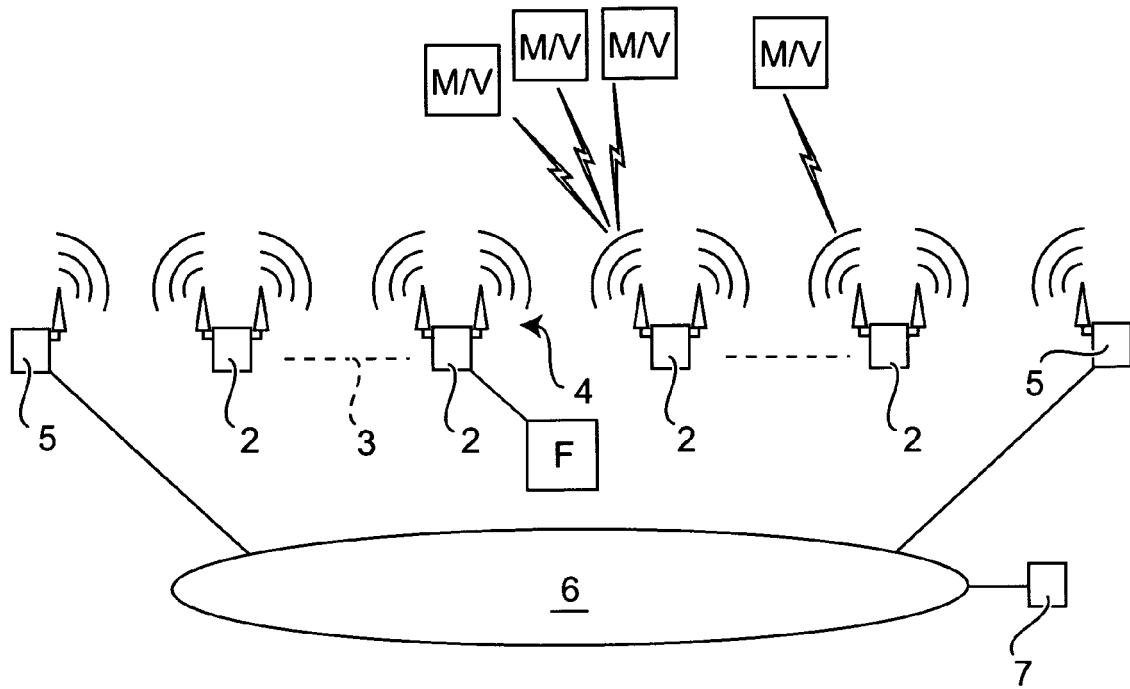
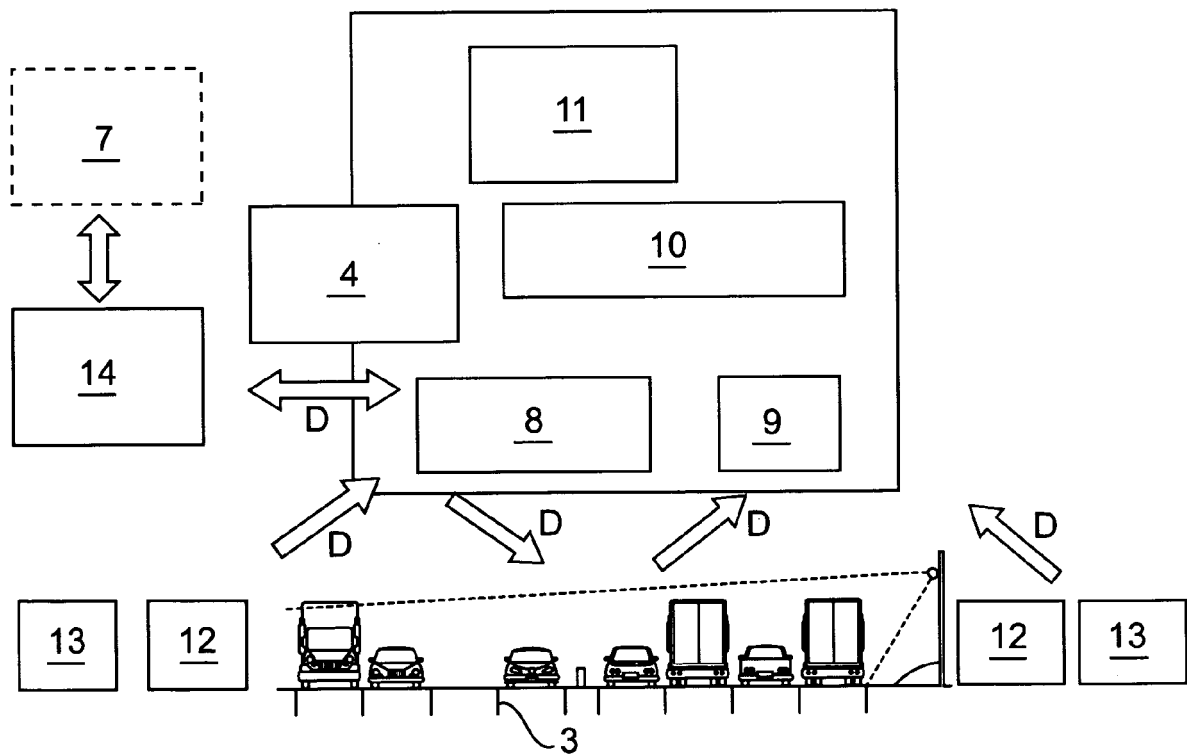


Fig. 1



**Fig. 2**

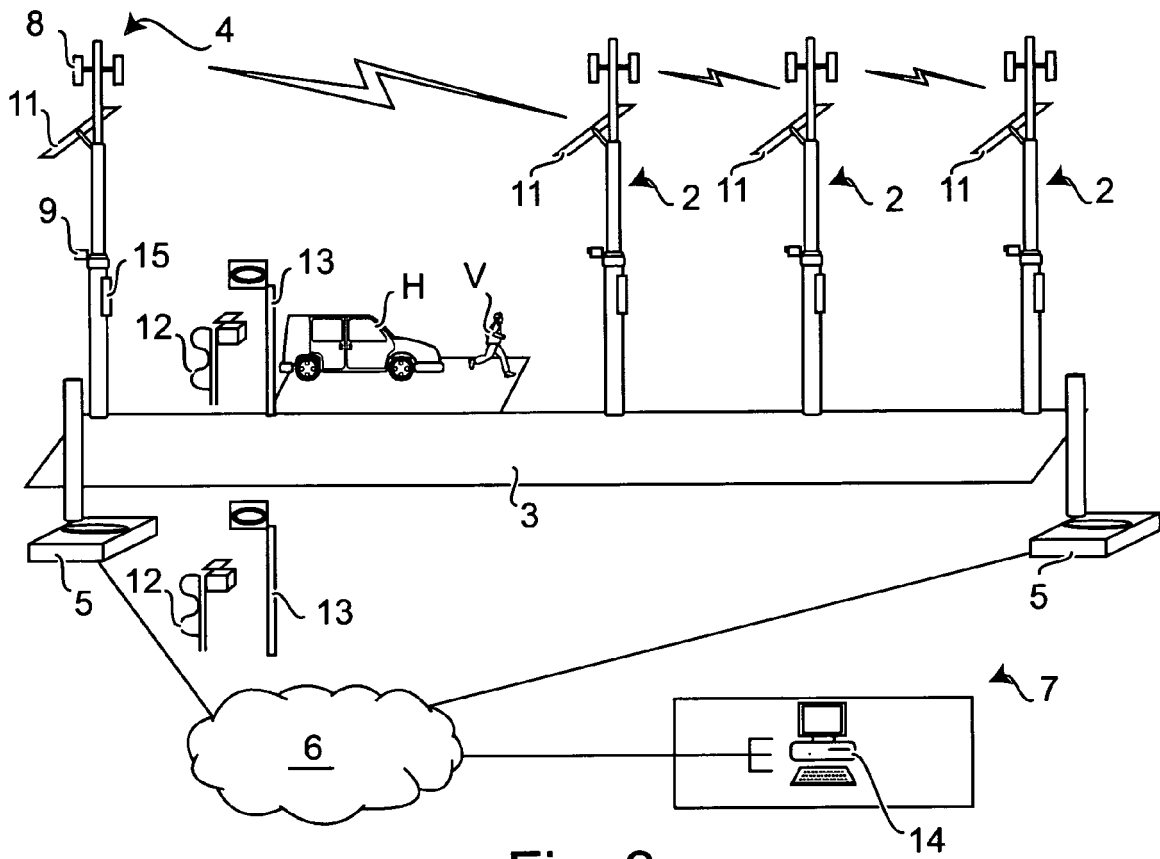


Fig. 3

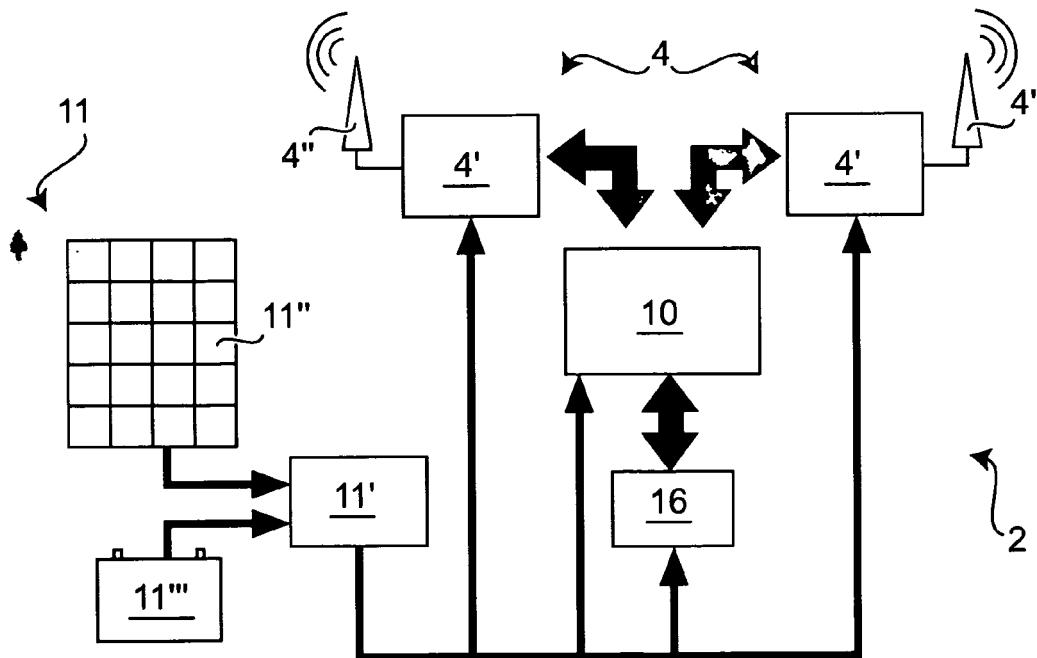


Fig. 4



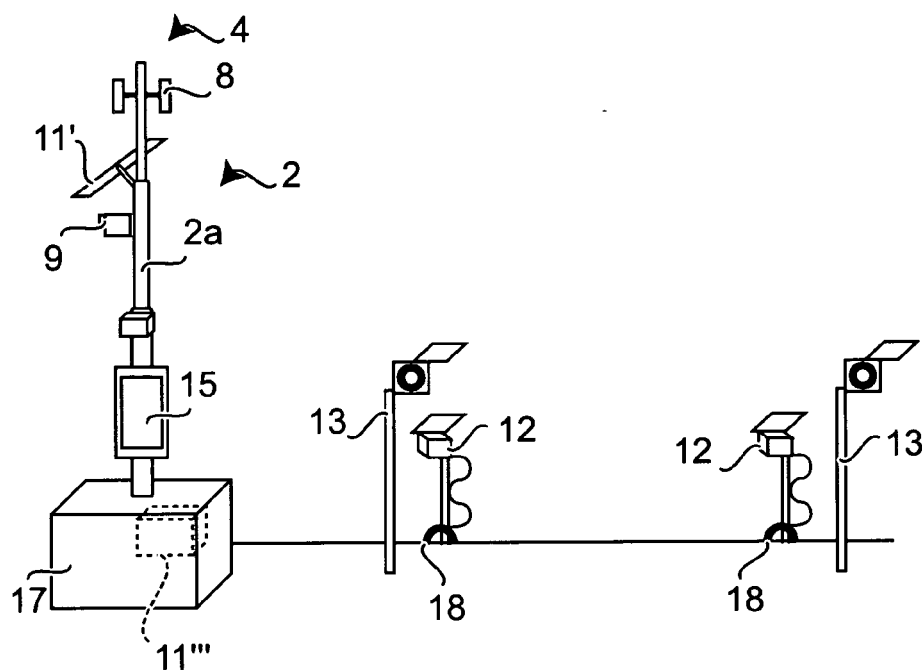


Fig. 5

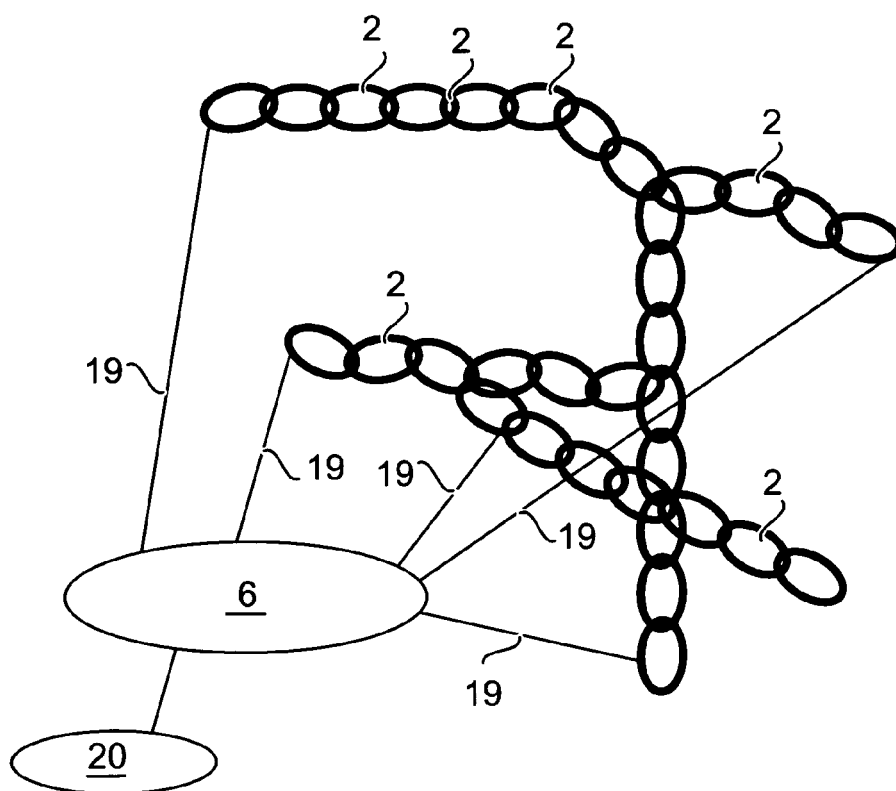


Fig. 6



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 06 42 5672

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 January 2007	Examiner Coffa, Andrew
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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EPO FORM 1503 03.82 (P04C01)

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

EP 06 42 5672

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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