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(54) **Building alarm system with occupants evavuation method**

(57) The present invention discloses a method for an emergency alarm system capable of directing building occupants to a safe location in real time during an emergency situation.

The method comprises a plurality of functionalities with the aim to monitor an emergency condition, to evaluate the data collected, to calculate accessible evacuation paths, and to send results to output devices which provide information about the emergency location and directional evacuation information to occupants. By com-

binning an analysis of the flow of evacuees and indications of presences with the evolution of an emergency state, the method combines situation-aware data with contextual information to provide the best available evacuation routes. In this manner, the method minimize problems due to congestion, potential panic of occupants, and changes in the emergency condition while increasing the probability that people will reach a safe location.

Finally, the method can be activated on demand, e.g., remotely, in circumstances of dangerous environmental situations, e.g., earthquake, etc.

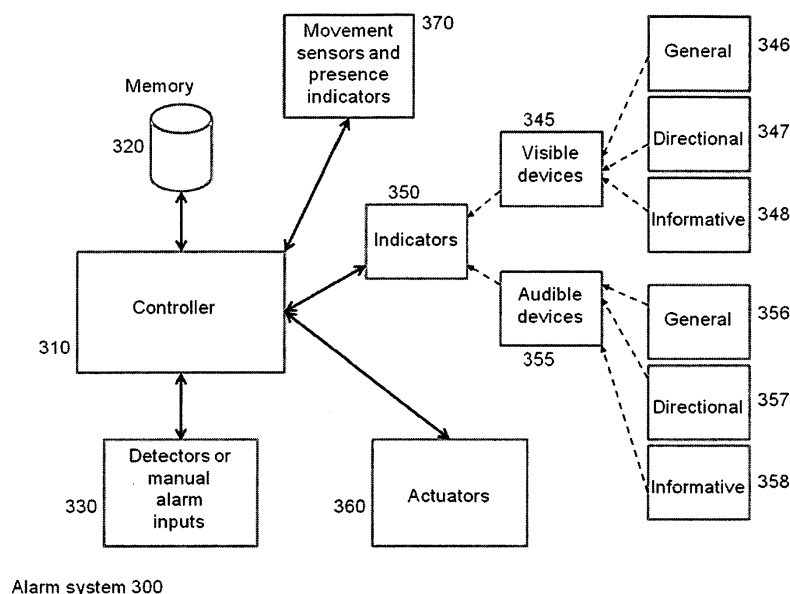


FIG. 3

Description

1. Background of the Invention

[0001] All emergency alarm systems used in buildings and areas are designed to safe material assets and more important lives. The most used and spread emergency alarm systems are regarding the fire and/or gas prevention. From the latter ones we can always conduct back to a more general emergency alarm systems. For this reason, in the following we present generic fire/gas alarm systems.

[0002] Generic fire/gas alarm systems comprise a number of components including devices such as smoke, heat, and gas sensors, indicators of emergency situation, manual alarm input, audible and visible notification devices, and actuator.

[0003] Indicators range from audible devices such as speakers, bells, horns, sirens, etc., to visual devices such as incandescent lights, strobe lights, illuminated exit signs, informative panels visualizing useful information, e.g., fire and evacuation plans for the occupants, etc. Furthermore, actuators comprehend electromechanical and electrical devices for automatically fire doors closing, gas closing, etc.

[0004] For instance, a first solution for a generic fire alarm system consists of a number of horns, bells, sirens, and/or vocal message devices, which are placed strategically within the premises and are connected to the alarm system control panel. Upon the detection of smoke, gas, or fire, the audible devices would activate and would be useful as audible indicators for an emergency situation.

[0005] A second solution for a generic fire alarm system consists of a number of strobe lights and visible indicators which are placed strategically within the premises and are connected to the alarm system control panel as visual indicators for an emergency situation. Among visible indicators, we could think also about directional devices such as serpentines of lights with the aim to guide the occupants.

[0006] A third solution derives from the complementarity of the two aforementioned solutions and it has the scope to combine both of them. In fact, numerous visible devices have a different impact than audible devices. For instance, strobe light can better notify deaf people or with hearing disability about an emergency situation. Furthermore, light is more effective particularly in nighttime situations or in darkness, or when the occupants are outside the audible devices' range. This is especially true in presence of malfunctions of the audible devices. As a consequent of the mechanical failure possibility, many fire alarm systems include several strobe lights. Vice versa is also valid.

[0007] Placement of devices in premises is determined by several factors such as building plans, entrances, room locations, lifts, exits, fire walls, fire doors, etc. Furthermore, some buildings have a greater capacity to reflect sounds and lights.

[0008] Operating characteristics of audible and visual signals determine the perception of how are caught by individuals. These characteristics include sound intensity and frequency, light color and intensity, flash duration, and flash frequency. Different buildings and area require different needs.

[0009] The primary goal of a generic fire alarm system is to alert occupants and let them evacuate or guide them to safety. One or several alarm tones or pre-recorded voice messages together with flashing lights may achieve this purpose, but it may not be sufficient.

[0010] We propose now a practical example of what a general fire alarm system can do. Let us imagine a customer in an hotel who may hear an evacuation signal in the middle of the night (obviously this example is useful to contextualize the instance, but does not limit or give advantages to our proposal for a fire alarm system than the already existing systems); the occupant, after opening the door of his room, must decide to take a right or left down the corridor to get to safety and he has fifty percent chance to take the correct and safe direction. This is because he does not have any information about the fire location. If he chose the wrong direction, he could be exposed to the fire and be fatal.

[0011] Accordingly, it is desirable to provide a method to indicate precisely a timely and direct path to safe areas during an emergency situation.

2.1. Graph and Network Flow

[0012] With our idea, the fire alarm evacuation system is arranged to compute, for each interesting physical place of the building, the minimum evacuation path, or towards safe areas, minimizing the occupants flows, with the intent to address and lead people in the shortest time to exits or safe areas without generating congestion.

[0013] The solution of such problem, of notable practical relevance, can be modeled with graphs and network flow.

Notations and definitions

[0014] A graph G is generically defined by a set of nodes or endpoints N and by a set of arcs or edges A . An edge has two endpoints in the set of nodes, and is said to connect the two nodes. An edge can thus be defined as a set of

two nodes.

[0015] A directed arc, or directed edge, is an ordered pair of endpoints that can be represented graphically as an arrow drawn between the nodes. In such an ordered pair the first vertex is called the initial vertex or tail; the second one is called the terminal vertex or head (because it appears at the arrow head). An undirected edge disregards any sense of direction and treats both endpoints interchangeably.

[0016] If the set of node pairs defining the arcs are undirected, then the graph is called *undirected graph*. In figure 1 is represented an undirected graph $G = (N, A)$, $N = \{1, 2, 3, 4, 5\}$, $A = \{\{1, 2\}, \{1, 4\}, \{1, 5\}, \{2, 3\}, \{2, 4\}, \{3, 4\}, \{4, 5\}\}$.

[0017] If the set of node pairs defining the arcs are directed, then the graph is called *directed graph*. In figure 2 is represented a directed graph $G = (N, A)$, $N = \{1, 2, 3, 4, 5\}$, $A = \{(1, 2), (1, 4), (1, 5), (2, 3), (2, 4), (4, 2), (4, 3), (4, 5), (5, 4)\}$.

[0018] Let consider a directed arc $a = (i, j)$, with node i as tail and node j as head of arc a . A graph is called *simple* if it has no loops (arcs with both head and tail identically), and no arcs are multiple (arcs sharing the same head and the same tail, i.e., at most one arc between any pair of vertices); particularly a directed graph $G = (N, A)$ is *simple* if for each pair of arcs of A , $a = (i, j)$ and $a' = (h, k)$, $i \neq h$, or $j \neq k$; furthermore $i \neq j$, and $h \neq k$. Let introduce now some definitions useful for the comprehension of the following formulae, related to directed graphs; such formulae can be extended also to undirected graphs whereas the direction is not merely relevant.

[0019] Exit star for a node i : $FS(i) = \{i \in N, j \in N : (i, j) \in A\}$.

[0020] Incoming star for a node j : $BS(j) = \{i \in N, j \in N : (i, j) \in A\}$.

[0021] A possible modeling for our application domain can be represented by a graph G defined by:

- a set of nodes N , namely **points of interest** such as both the interesting physical places of the area and the safe points as exits and safe meeting points;
- a set of arcs A , representing evacuation paths, or towards safe points, which are the paths existing between one generic point of interest and another one, according to the building plan.

Minimum Cost Flow

[0022] The minimum cost flow is a really general optimization problem on networks: both the maximum/minimum flow problem and the shortest path tree problem can be interpreted as particular cases of the minimum cost flow problem.

[0023] In details, the shortest path tree constitutes a modification to the model for the search of the minimum path between two nodes. The set of all shortest paths from a node r , the root, to all the other nodes in the graph can be computed. Such a set of the shortest paths is called shortest paths tree of root r . It is called tree because loops are not present.

[0024] Also, the maximum/minimum flow problem consists in finding the maximal/minimal flow that can be sent from one source node to one sink node (as explained hereafter), respecting the edge capacities and not allowing dispersion within the intermediate nodes.

[0025] A flow network is a directed graph $G = (N, A)$, where each node $i \in N$ has a value b_i , called the node balance, and each edge $e = (i, j)$ has a cost c_{ij} and a capacity u_{ij} . The amount of flow on an edge e cannot exceed the capacity c of the edge. The node balances govern the network flow. A node with balance $b_i = 0$ is called transit node, since it does neither require nor offer flow; a node with balance $b_i < 0$ is a source because inputs flow, while a node with $b_i > 0$ is a sink since it requires flow. Thus, a flow must satisfy the restriction that the amount of flow into a node equals the amount of flow out of it, except when it is a source, which has more outgoing flow, or sink, which has more incoming flow. In our idea, sink nodes can represent exits or safe points in the premises. Source nodes can represent places within the building where people stay or are detected by adequate devices. In the following we assume that the overall network balance is null, thus the sum of all b_i is zero: in practice all occupants evacuate. In this domain, with appropriate changes we can always consider a problem as a case of a network with null overall balance.

[0026] In optimization theory, the minimum cost flow consists determining, in a flow network, the maximum amount of flow on the network edges such that all the flow would be inputted from the sources, all flow would arrive to the sinks, the edge capacities would not be exceeded, and the overall flow cost would be minimum. Using flow variables x_{ij} on edges, the problem can be formulated as:

$$\begin{aligned}
& \min \sum_{(i,j) \in A} c_{ij} x_{ij} \\
& - \sum_{(i,j) \in FS(i)} x_{ij} + \sum_{(j,i) \in BS(i)} x_{ji} = b_i \quad \forall i \in N \\
& 0 \leq x_{ij} \leq u_{ij} \quad \forall (i,j) \in A
\end{aligned}$$

[0027] Let observe that the shortest paths tree, e.g., finding the shortest evacuation path from a generic point of interest, can be though as a minimum cost flow problem where the edge costs are given by their lengths, e.g., the distance in meter between two points of interest, the edge capacities are boundless and the balance at each node is: for the tree root r we consider an offer of $N-1$ flow units, thus $b_r = -(N-1)$, while for all the other nodes we consider a request of one flow unit, thus $b_i = 1$.

[0028] Finally, the maximum/minimum flow problem in the more general formulation, can be considered as a minimum cost flow problem. In fact, all the node balances are zero. What makes convenient to let circulate flow with respect to the null solution is the objective function. Upon the case of maximal/minimal flow we can fix all the edge costs to zero but for the fictitious return edge (t,s) , where s is the source, which we fix a cost of -1 for. In such a case can be found an evacuation path maximizing/minimizing the flow from a source node to a sink node, as an exit or a safe meeting point.

2. Summary of the Invention

[0029] The aforementioned needs are generically satisfied by the present invention, wherein the minimum, timely, and direct evacuation paths, or towards safe areas, minimizing the occupants flows are computed and indicated during an emergency situation.

[0030] In accordance with one aspect of the present idea, an emergency alarm system is provided, comprising: (1) a controller, (2) a plurality of detectors and/or manual alarm inputs, (3) a plurality of audible and/or visible indicators (in general indicators of an emergency situation), (4) a plurality of actuators, (5) and/or a plurality of movement sensors and presence indicators.

[0031] Movement sensors and presence indicators are connected to the system and they can serve as detectors of occupant flows. In case of movement sensors they can serve as automatic detection of individuals, while for presence indicators, we can think about manual input indicators triggered by individuals trapped into a location. Furthermore, as presence indicators can be thought also smart phones and tablet PCs connected to the central system requiring for rescue.

[0032] In more details, three typologies are defined for audible and visible devices:

- **General:** precisely they are all those devices which give a general information about an alarm status. For audible devices, they can be bells, horns, sirens, speakers, etc.; for visible devices, they can be incandescent lights, strobe lights, illuminated exit signs, lights which dynamically change their color or their emission frequency to better allow occupants to see in case of smoke, etc.
- **Informative:** they are all those devices informing occupants of a locale about the fire or gas location/s, and in general about more detailed information about the emergency situation in opposition to a generic and undefined alarm status. For what concerns audible devices, they can be speakers communicating the fire or gas location/s, or entry phones, phones, mobile phones, smart phones, tablet PC, intercoms, etc., which, in case of emergency, can be means informing occupants with automatic messages. Instead, for visible devices, they can be monitors, etc., indicating the fire or gas locations, etc.
- **Directional:** they are all those devices indicating an evacuation path or towards safe meeting points. For audible devices, they can be speakers that, placed in appropriate points which would not create ambiguity (e.g., before a door), specify the direction to take (e.g., right, left, or straight), etc. Instead, for visible devices, they can be light arrows, serpentine of lights with the aim to guide the occupants, etc.

[0033] One audible or visible device can belong to one or more typologies. For instance, it can be a speaker both *informative*, whereas provides an information about the emergency location, and *directional*, since it provides an evacuation direction.

[0034] Referring to figure 3, in accordance with another aspect of the present invention, an emergency alarm system is provided with multiple functionalities:

- (1) Assigning an identification address to each detector, manual alarm indicator (330), indicator as audible device

(355), visible device (345), actuator (360), movement sensor and presence indicator (370);

(2) Storing in memory (320) the above mentioned addresses;

(3) Correlating each stored address to a physical location of interest, hereafter called **point of interest**;

(4) Creating of a graph **G** defined by a plurality of nodes **N**, which are a subset of points of interest, and a plurality of arches **A**, which represent the eligible evacuation paths or paths towards safe locations, which exist between a generic point of interest and another one, according to the building plan;

(5) Defining of exits and safe meeting points, hereafter called **safe points**, and connecting them, if a connection is missing, to the graph **G** previously delineated; **safe points** are also considered **points of interest**;

(6) Defining the typology of audible devices (355) and visible devices (345) according the definitions (346, 347, 348) for visible devices (345), and (356, 357, 358) for audible devices (355);

(7) Specifying statically an entrance flow for each point of interest: the specification of an entrance flow for one point of interest defines the node as source, according to what described in the paragraph 2.1, and such flow represents approximately how many people are nearby that point of interest;

(8) Storing the optimal, or nearly, evacuation paths or generically toward safe points, which consider every, or nearly all points of interest of the area, according to the planning choices; an optimal path can be considered as such if it is the minimum evacuation path which minimizes the occupants distribution flows within the area;

(9) Activating each device of typology "general" (346, 356);

(10) Activating the actuators (360);

(11) Signaling of a point of interest as "in alarm" corresponding to detectors or manual alarm indicators (330) "in alarm" associated to that location;

(12)

a. The computation of new minimum evacuation paths from the point of interest "in alarm" toward safe points is computed accomplishing the flow minimization of occupants within the area;

b. The computation of new minimum evacuation paths from the point of interest "in alarm" toward the closest points of interest "not in alarm" is computed accomplishing the flow minimization of occupants within the area;

(13) Activating each device of typology "directional" (347, 357), which will indicate the evacuation direction following the computed paths;

(14) Activating devices of typology "informative" (348, 358), which will provide information about the alarm, e.g., where it is located. Also, the alarm may be communicated with diverse alarm grade; the alarm grade depends by the distance between the point of interest associated to the informative indicator and the closest point of interest "in alarm"; for instance, a diverse alarm grade can be associated to the frequency of the siren alarm tone: from less to more intense when the emergency is close; otherwise, a diverse alarm grade can be associated to the flash frequency or intensity of a light device;

(15) Monitoring/acquiring occupant flows within the protected area, for instance through movement sensors (370).

(16) Monitoring/acquiring presence indicators within the protected area, for instance through presence indicators (370) such as switches used as manual input indicators triggered by individuals trapped into a location. Furthermore, as presence indicators can be thought also smart phones and tablet PCs connected to the controller (310) indicating the presence of trapped or waiting for rescue people at a specific place within the protected premises.

(17) Providing information about the presence of occupants and occupant flows within the premises.

(18) The controller (310) can be connected via a network connection (e.g., a secure internet connection) and provide a functionality for generic emergency situations. In such case firemen could activate the evacuation system remotely, for example in circumstances of dangerous environmental situations (e.g., earthquake, etc.).

[0035] The functionalities presented at points (12.a) and (12.b) can be considered as alternatives to each other, according to planning choices, or according to the computational load to carry on by the system. In fact, it is evident that the work load required by (12.a) is higher and more onerous than the one required by (12.b).

[0036] In addition, as specified at points (12.a) and (12.b), evacuation paths towards safe points are dynamic, since are computed for all points of interest "in alarm". Thus, evacuation paths depend both by the initial place/s of the emergency (e.g., fire, gas, etc.), and by its/their propagation.

[0037] In accordance to still another aspect of the present idea, the emergency alarm system is provided comprising all hardware and software means for carrying out the several aforementioned functionalities.

[0038] So far, has been outlined, rather broadly, certain embodiments of the invention in order that the detailed description thereof herein may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional embodiments of the idea that will be described below and which will form the subject matter of the claims appended hereto.

[0039] In the respect, before explaining at least one embodiment of the invention in detail, it is to be understood that

the invention is not limited in its application to the details of implementation and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of embodiments in addition to those described and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein, as well as the abstract, are for the purpose of description and should not be regarded as limiting.

[0040] As such, experts in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for the designing of other architectures and methods for carrying out the several purposes of the present idea. It is important, therefore, that the claims be regarded as including such equivalent implementation insofar as possible they do not depart from the spirit and scope of the present invention.

3. Brief Description of the Drawings

[0041]

Figure 1 represents an undirected graph G.

Figure 2 represents a directed graph G.

Figure 3 represents a diagram of an emergency alarm system according to the preferred embodiment of the invention.

Figure 4 is a flowchart illustrating steps and functionalities may be followed in accordance with the preferred embodiment of figure 3.

Figure 5 is the continuation of the flowchart illustrated in Figure 4. Figure 5 is a flowchart illustrating steps and functionalities may be followed in accordance with the preferred embodiment of figure 3.

4. Detailed Description

[0042] The invention will now be described with reference to the drawing figures, according to the reference numerals reported on them.

[0043] Referring to figure 3, an embodiment in accordance with the present invention provides a controller (310) managing the entire alarm system having a memory (320) where will be stored all the needed information to let the system work, i.e., the points of interest, the safe points, the graph, the identification addresses and their connection to the points of interest, etc. The alarm system is provided with a set of manual alarm inputs and smoke and/or gas and/or heat detectors (330). The system has a multiplicity of actuators (360), audible indicators (335), and visible indicators (345). The latter two ones, i.e., (335) and (345), are detailed following the typologies in the aforementioned paragraph, such as *general* (346) and (356), *directional* (347) and (357), and *informative* (348) and (358). Finally, movement sensors (370) are connected to the system and they can serve as automatic detectors of occupant flows; also, presence indicators (370) are connected to the system and they can be considered like manual input indicators triggered by individuals trapped into a location, or also like smart phones and tablet PCs connected to the central system (310) requiring for rescue; furthermore, both movement sensors and presence indicators (370) may provide indications, whenever the firemen arrive, about the locations where still some occupant is present or trapped. The evacuation alarm system (300) evacuation system is arranged to compute the minimum evacuation path, or towards safe points, minimizing the occupants flows, with the intent to address and lead people in the shortest and timely time to exits or safe points without generating congestion. In conclusion, the alarm system (300) is also arranged to react dynamically to the evolution and spread of the emergency, with the aim to lead occupants to safe points.

[0044] In another embodiment, the controller (310) can be connected via a network connection (e.g., a secure internet connection) and provide a functionality for generic emergency situations. In such case firemen could activate the evacuation system remotely, for example in circumstances of dangerous environmental situations (e.g., earthquake, etc.).

[0045] In a further embodiment, the emergency alarm system (300) may provide guidance that allows safe passage or facilitates locating civilians. In such embodiment the occupants can be directly informed by the controller (310) about an evacuation path using views or graphical user interfaces visualized on tablet PCs or smart phone owned by the occupants. for instance, an application could be downloaded by the user with the plan of the building. Whenever an emergency situation occurs, the systems communicates directly with the application on the user's smart phone. In such a way, the system is aware if some individual is still trapped within the premises.

[0046] Referring to figures 3 and 4 and 5, operations and functionalities are herein described. Operations and functionalities from (405) till (440) constitute the initializing phase of the emergency alarm system (300).

- 405: Controller assigns an identification address to each detector, manual alarm indicator (330), indicator as audible device (335), visible device (345), actuator (360), movement sensors and presence indicators (370).
- 410: The above mentioned addresses are stored in memory (320).
- 415: Controller (310) or the planner correlates each stored address to one point of interest and stores such information

in memory (320).

- 420: Controller (310) or the planner creates one graph **G** defined by a plurality of nodes **N**, which are a subset of points of interest, and a plurality of arches **A**, which represent the eligible evacuation paths or paths towards safe locations, which exist between a generic point of interest and another one, according to the building plan.
- 425: The planner defines all **safe points** and connects them, if a connection is missing, to the graph G previously delineated; **safe points** are also considered **points of interest**.
- 430: The planner defines the typology of audible devices (355) and visible devices (345) according the definitions (346, 347, 348) for visible devices (345), and (356, 357, 358) for audible devices (355).
- 435: This step is optional. The planner specifies statically an entrance flow for some or all points of interest.
- 440: The planner defines and stores in memory (320) the optimal, or nearly, evacuation paths or generically toward safe points.

[0047] In the embodiment where the controller (310) is connected via a network connection, the initializing phase is enough to let occupants evacuate. At the activation of the evacuation system remotely, for example in circumstances of dangerous environmental situations, all devices of all typologies (i.e., general, informative, and directional) are activated and the evacuation paths are signaled according to the paths already stored at step (440).

- 445: Controller (310) monitors alarm detectors and manual alarm inputs (330) till at least one detector or manual alarm input is "in alarm" (450).
- 455: In case of at least one detector on manual alarm input "in alarm" (450), the controller activates each device of typology "general" (346, 356) and each actuator (360).
- 460: The controller (310) signs in memory (320) the point of interest as "in alarm" corresponding to detectors or manual alarm indicators (330) "in alarm" associated to that location.
- In parallel step (465) and sequence (470, 475, 480) are activated.

o 465: The controller (310) activates all devices of typology "informative" (348, 358), which will provide information about the alarm/s, e.g., where it/they is/are located. Also, the alarm may be communicated with diverse alarm grade; the alarm grade depends by the distance between the point of interest associated to the informative indicator and the closest point of interest "in alarm"; for instance, a diverse alarm grade can be associated to the frequency of the siren alarm tone: from less to more intense when the emergency is close; otherwise, a diverse alarm grade can be associated to the flash frequency or intensity of a light device.

o 470: This step is optional. The controller (310) monitors/acquires occupant flows within the protected area, i.e., automatically through movement sensors (370) or statically as at step (435).

o 475: This step is optional and in parallel with (470). The controller (310) monitors/acquires data from presence indicators within the protected area, for instance through presence indicators (370) such as switches used as manual input indicators triggered by individuals trapped into a location. Furthermore, as presence indicators can be thought also smart phones and tablet PCs connected to the controller (310) indicating the presence of trapped or waiting for rescue people at a specific place within the protected premises. The system provides information about the presence of occupants and occupant flows within the premises if triggered, e.g., if firemen connect to the system.

o 480: For each new point of interest "in alarm", the controller (310) computes new minimum evacuation paths or towards safe points minimizing the occupants flows.

o 485: The controller (310) activates each device of typology "directional" (347, 357), which will indicate the evacuation direction following the computed paths.

- 495: The controller (310) monitors alarm detectors and manual alarm inputs (330) till at least one detector or manual alarm input is "in alarm" associated to points of interest not previously "in alarm" (490), then the system re-starts the procedure from step (460).

Claims

1. A method of directing evacuation of an area during an emergency condition comprising several functionalities:

- a. assigning an identification address to each detector, manual alarm indicator (330), indicator as audible device (355), visible device (345), actuator (360), movement sensors and presence indicators (370);
- b. storing in memory (320) the above mentioned addresses, previous point "a";
- c. correlating each stored address to a physical location of interest, hereafter called *point of interest*;

d. creating of a graph G defined by a plurality of nodes N , which are a subset of points of interest, and a plurality of arches A , which represent the eligible evacuation paths or paths toward safe locations, which exist between a generic point of interest and another one, according to the building plan;

e. defining of exits and safe meeting points, hereafter called *safe points*, and connecting them, if a connection is missing, to the graph G previously delineated at the previous point "d"; *safe points* are also considered *points of interest*;

f. defining the typology of audible devices (355) and visible devices (345) according the definitions (346, 347, 348) for visible devices (345), and (356, 357, 358) for audible devices (355);

g. storing the evacuation paths or generically toward safe points, which consider every or nearly all, following the planning choices, the points of interest of the area;

h. activation of the evacuation system on demand, also remotely; in such a case all devices of all typologies (i.e., general, informative, and directional) are activated and the evacuation paths are signaled according to the paths already stored at step "g";

i. signaling of a point of interest as "in alarm" corresponding to detectors or manual alarm indicators (330) "in alarm" associated to that location;

j. activating each device of typology "general" (346, 356);

k. for each point of interest "in alarm", computing new minimum evacuation paths from the point of interest "in alarm" toward safe locations;

l. activating all actuators (360), according to the computed evacuation paths, with the aim not to block any evacuation paths calculated;

m. activating devices of typology "informative" (348, 358), which will provide information about the alarm status;

n. activating each device of typology "directional" (347, 357), which will indicate the evacuation direction following the computed paths;

o. monitoring data from presence indicators (370), in order to acquire information about occupants trapped and waiting for a rescue within the premises;

p. providing information about the system status;

q. providing information about the presence of occupants and occupant flows within the premises.

2. A method according to claim 1, wherein alternatively to the functionality described at point "k", there is the functionality:

a. for each point of interest "in alarm", computing new minimum evacuation paths from the point of interest "in alarm" toward the closest points of interest "not in alarm".

3. A method according to claims 1 or 2, further comprising the functionality:

a. specifying statically an entrance flow for each point of interest: the specification of an entrance flow for one point of interest defines the node as source, according to what described in the paragraph 2.1, and such flow represents approximately how many people are nearby that point of interest.

4. A method according to claims 1 or 2 or 3, further comprising the functionality:

a. the computation of new minimum evacuation paths from the point of interest "in alarm" toward safe locations or toward the closest points of interest "not in alarm" is computed accomplishing the flow minimization of occupants within the area.

5. A method according to claim 4, further comprising the functionality:

a. Acquiring automatically occupant flows within the protected area.

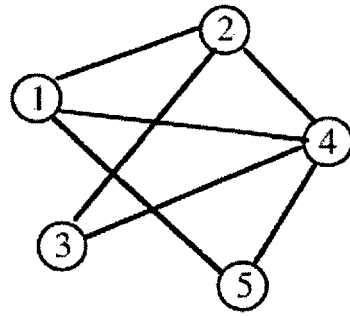


FIG. 1

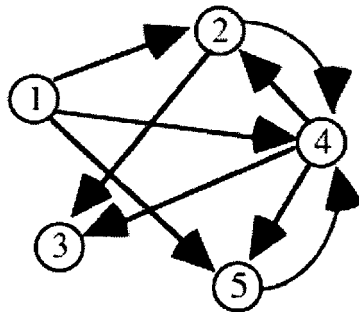


FIG. 2

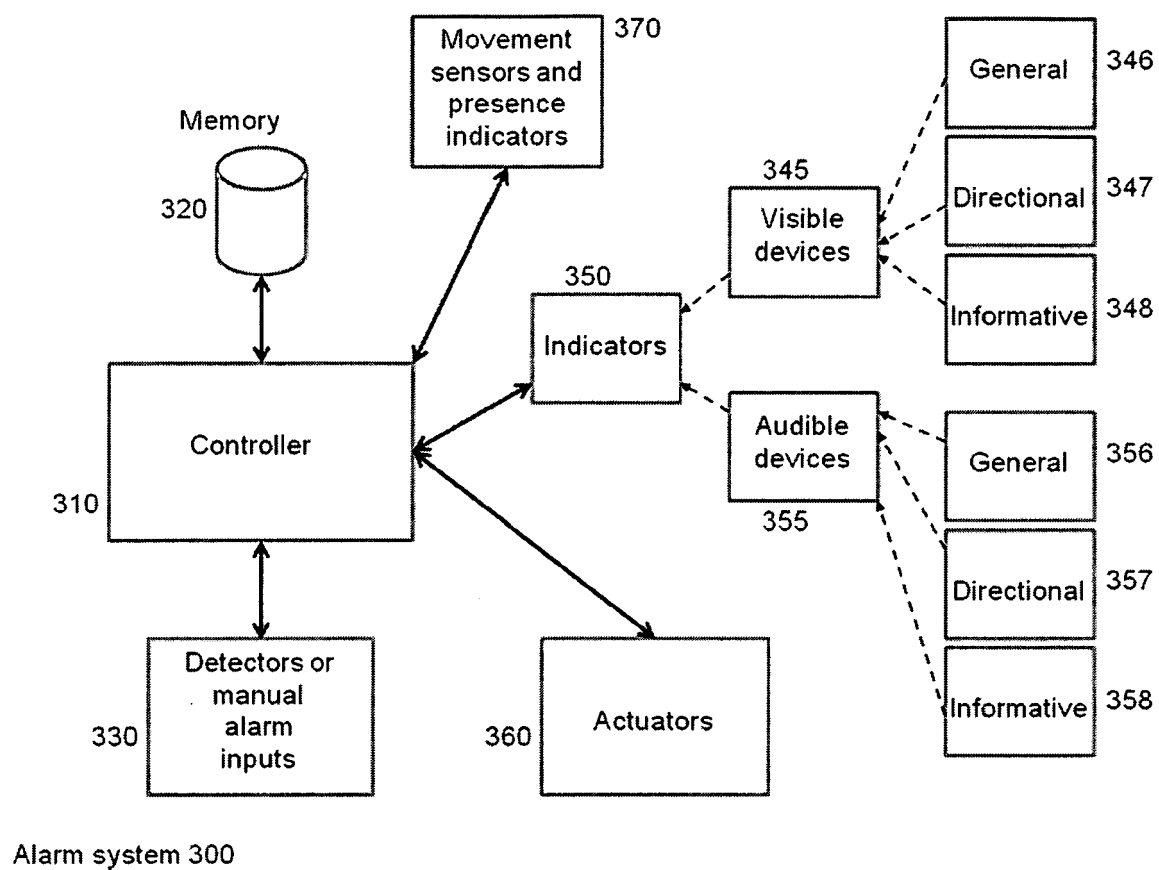


FIG. 3

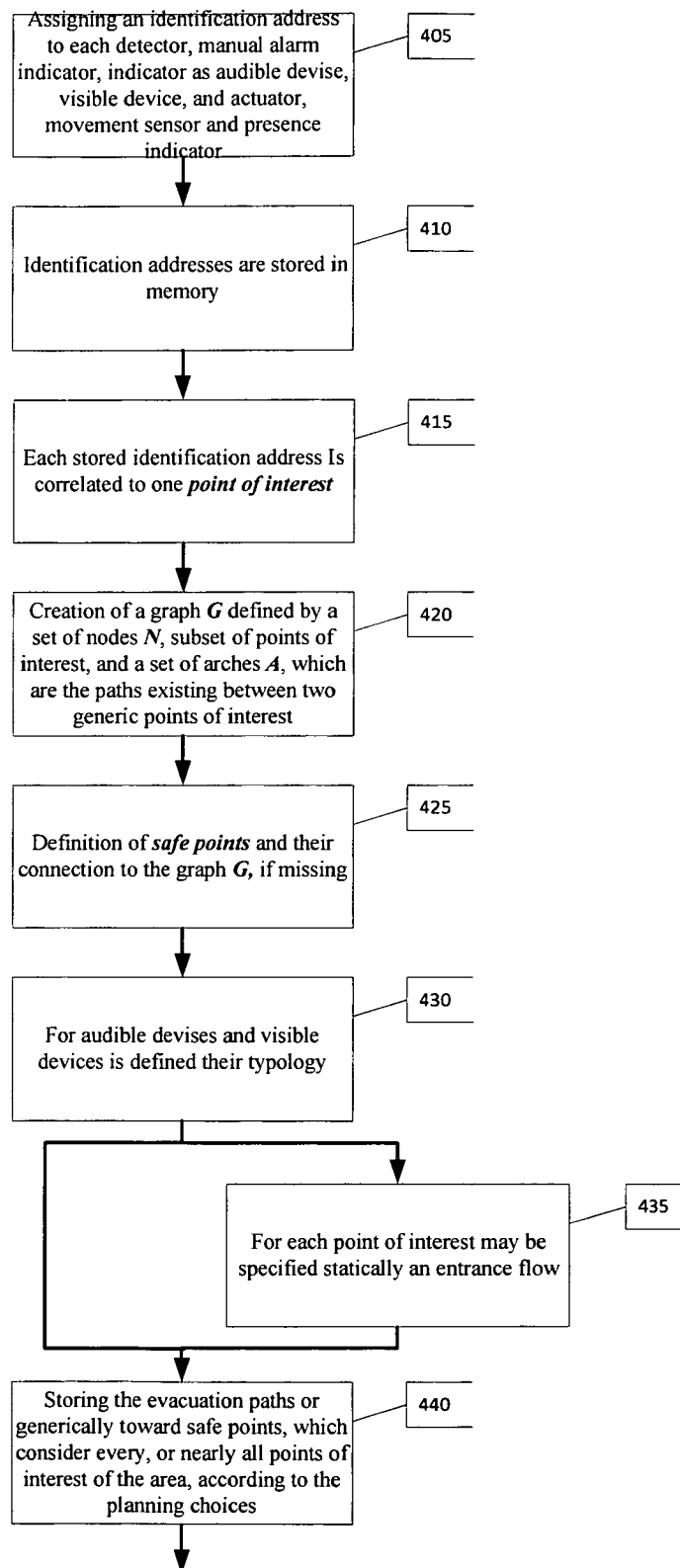


FIG. 4

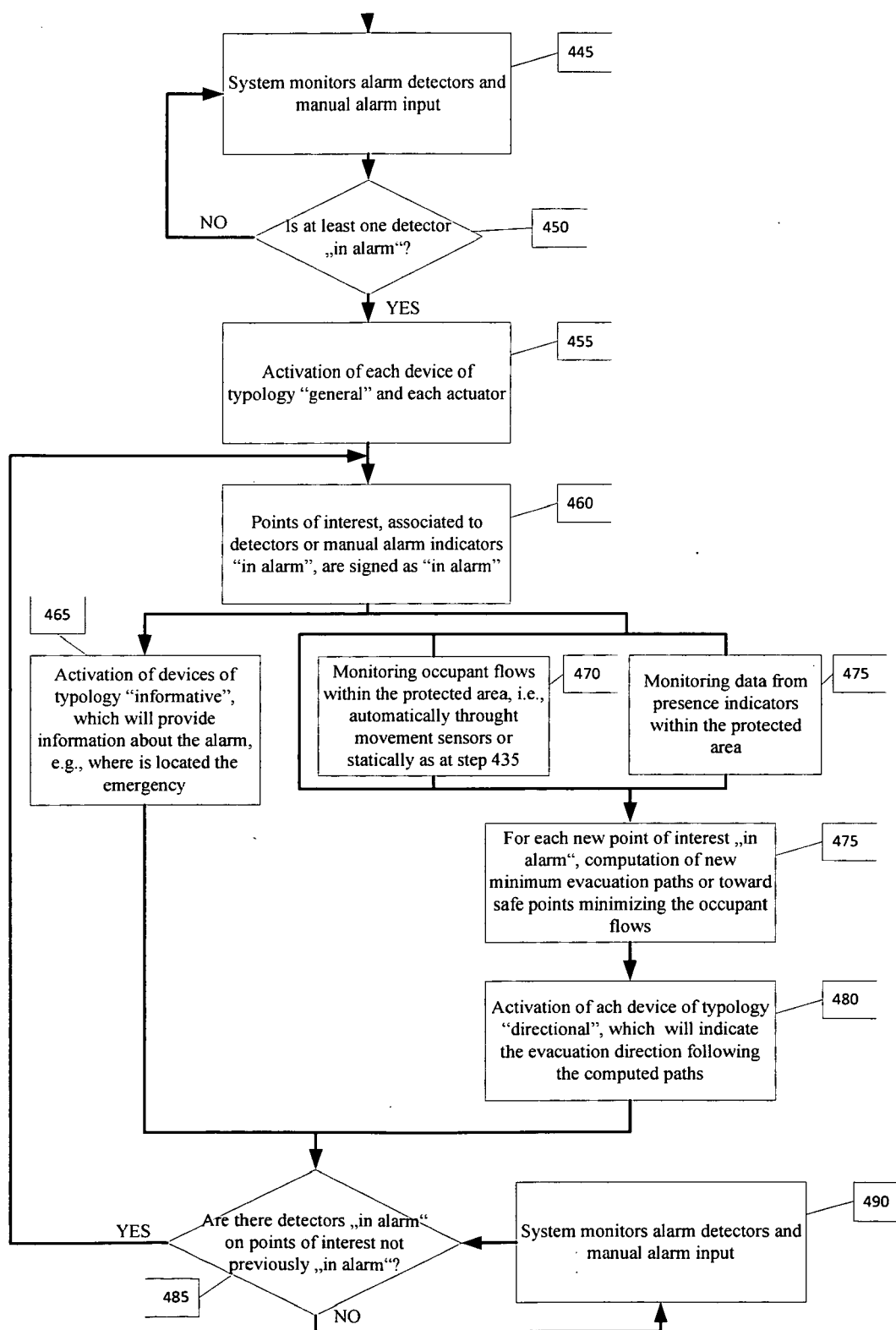


FIG. 5



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