



(11) **EP 2 942 259 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
04.07.2018 Bulletin 2018/27

(51) Int Cl.:
B61L 23/06 ^(2006.01)

(21) Application number: **14167480.4**

(22) Date of filing: **08.05.2014**

(54) **Method for warning and alerting an endangered person within a danger area**

Verfahren zur Warnung einer gefährdeten Person in einem Gefahrenbereich

Procédé pour avertir et alerter une personne en danger à l'intérieur d'une zone de danger

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(43) Date of publication of application:
11.11.2015 Bulletin 2015/46

(73) Proprietor: **Thales Management & Services
Deutschland GmbH
71254 Ditzingen (DE)**

(72) Inventors:
• **Schäfer, Michael
70806 Kornwestheim (DE)**
• **Eldegard, Anne
0781 Oslo (NO)**
• **Gourdon, Jean-Jacques
91883 Massy (FR)**
• **Naegele, Philippe
33160 Saint Médard en Jalles (FR)**

• **Rawlings, Ian
2063 Northbridge (AU)**

(74) Representative: **Kohler Schmid Möbus
Patentanwälte
Partnerschaftsgesellschaft mbB
Gropiusplatz 10
70563 Stuttgart (DE)**

(56) References cited:
**WO-A1-2012/031321 DE-A1-102004 053 163
DE-A1-102007 041 718 DE-A1-102008 020 700**

• **DURINA E ET AL: "AUTOMATISCHES
ROTTENWARNSYSTEM FUER DIE
NEUBAUSTRECKEN DER DEUTSCHEN
BUNDESBAHN", SIGNAL + DRAHT, TELZLAFF
VERLAG GMBH. DARMSTADT, DE, vol. 82, no. 1
/ 02, 1 January 1990 (1990-01-01), pages 20-26,
XP000244316, ISSN: 0037-4997**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

Background of the invention

[0001] The invention concerns a method for warning and/or alerting an endangered person within a danger area, the endangered person being equipped with a mobile device.

[0002] A device for an automated track warning is known from Ceccarelli et al. (IEEE 14th International Symposium of High Assurance Systems Engineering, 2012, p. 147-154).

[0003] Maintenance workers at railway tracks are especially endangered due to the high speed of approaching trains.

[0004] WO 2006/104996 A2 discloses a warning device comprising a display which can be fixed to the wrist to a person- The warning device generates physical sensation to alert the user of a warning. Information concerning the warning can be displayed.

[0005] Ceccarelli et al. propose a warning system for railway workers, the system comprising ear bone conductors and light emitting glasses for visual signals in order to signal approaching trains to the temporarily working railway maintenance staff by creating light signals directly in sight field of the temporarily working railway maintenance staff. Yet, there is a danger that railway maintenance workers take off the glasses or ignore the warning due to negligence or underestimation of the danger. WO 2012/031321 A1 discloses handheld devices carried by railway workers using which their location in a protection zone can be monitored. A further portable device is carried by a team-leader who is responsible for requesting and relinquishing a protection zone for the workers.

[0006] DE 10 2008 020 700 A1 discloses a wearable device to be worn by railway workers. Warnings are sent to the device on approach of a train and the device includes a button for the worker to acknowledge the warning, sending the acknowledgement signal to a portable unit. The portable unit compares the number of acknowledgements received to the number of devices to which a warning was sent.

Object of the invention

[0007] It is therefore an object of the invention to provide a method for warning and alerting endangered persons which ensures that the endangered person realizes the warning/alert reliably.

Description of the invention

[0008] This object is solved by a method according to claim 1.

[0009] The inventive method comprises:

- ascertainment of an endangered person;

- identification of an expected dangerous situation by means of a monitoring system;
- in case of an expected dangerous situation, sending at least one warning and/or alert to the mobile device of the endangered person;
- in case no feedback is given within a predetermined time slot, a notification is sent automatically to at least one other person, informing about a missing feedback of the endangered person. wherein
- the mobile device comprises a wearable display which is optical head mounted, and
- the endangered person is assigned to a partner being equipped with a further mobile device, and that the feedback is required to be given via the further mobile device. By sending a notification in case of a missing feedback, actions can be taken to take the endangered person out of the danger area or to defuse the critical situation. The notification is sent automatically if no feedback is detected within a predetermined time slot or until a predetermined period of time prior to the expected dangerous situation.

[0010] An endangered person can be a person staying in or beneath the danger area, or a previously registered person (e.g. a maintenance staff), who is supposed to stay within the danger area. Detection of a person staying within the danger area as well as a registration can be carried out by the mobile device.

[0011] The warning/alert which is sent to the endangered person can be optical and optionally also acoustical and/or tactile. In a preferred variant prior to sending the notification more than one warning or alert is sent to the endangered person, in particular comprising different optical, acoustical and/or tactile characteristics (e.g. different colors, increasing sound volume). According to the invention, the mobile device comprises a wearable display, which is optical head-mounted. The feedback can be given, e.g. by touching the mobile device or by gestures like nodding or blinking, etc.

[0012] The other person to whom the notification is sent can be a member of a previously defined team. Members of a team can be defined by registration or by assigning persons to a team who stay within a defined area, e.g. by means of GNSS(global navigation satellite system)-data. The notification may require the team member to look after the endangered person and to take care that the endangered person leaves the danger area and gives the required feedback. Provisions can be made that a feedback of the other person is accepted, too.

[0013] Alternatively or additionally the other person can be a traffic controller. The notification may require the traffic controller to decide whether action has to be taken to defuse the critical situation, e.g. by arranging an approaching train to be stopped or rerouted.

[0014] Alternatively or additionally the other person can be a train driver. The notification may require the train driver to stop or slow down the approaching train.

[0015] In a special variant vehicles approaching the

danger area are slowed down or stopped if no feedback is given within a further predetermined time slot. In train application a train can be slowed down by a signaling/interlocking/automatic train protection system. Alternatively a command for slowing down the approaching vehicle can be given to the train driver.

[0016] The inventive method is preferably applied to railway applications, in particular to signaling system, interlocking system, or an automated train protection system. In particular the inventive method can be applied to all signaling/interlocking systems that provide information about the status of the train which is involved with the imminent dangerous situation. E.g. the method could be easily integrated in Thales Signaling systems is possible where a HMI-proxy for MPTs or HHTs exists (e.g. SAR-NSR, DK F-Bane). It is also possible to apply the inventive method to aircraft applications at the airport.

[0017] Preferably a position determination of the endangered person is carried out, in particular via GNSS or via image recognition of typical elements of the danger area. In particular GALILEO can be used for position determination. In case of image recognition typical elements have to be determined in advance. Typical elements of the danger area of railway tracks are for example sleepers, rails and track fastening materials. In order to obtain the required images for carrying out image recognition, the mobile device may be equipped with a camera. A person can be detected to be within the danger area by analyzing an image recorded by his own mobile device (e.g. by taking into account the direction and angle the image has been taken) or by analyzing an image recorded by the mobile device of another person (e.g. of the maintenance team) which show the danger area. Image recognition is in particular interesting if head mounted mobile devices (e.g. glasses) are used, which are able to take images in viewing direction of the person. In case that the detected endangered person can be identified, it may be sufficient to send a warning/alert to the endangered person and to the team member whose mobile device took the relevant picture. Otherwise it is advisable to send the warning to the whole maintenance team.

[0018] In a highly preferred variant a check is carried out whether the endangered person left the danger area after receiving the warning or alert. In case the endangered person didn't leave the danger area within a predetermined time slot, the notification is sent automatically. In contrast to the before described variant (where the person is considered to be "safe" as soon as a feedback is detected), the person is considered to be "safe" not until the person left the danger area. I.e. to be considered as "safe" both is required: feedback and leaving the danger area. In case the endangered person hasn't left the danger area, a notification to the other person is sent, even though a feedback has been given. The determination whether the endangered person left the danger area can be carried out by a position determination (e.g. via the mobile device comprising a GNSS sensor) or by activating an acknowledgement device located outside

the danger area by the endangered person or by image recognition techniques. It may also be possible to accept the leaving of the danger area as "feedback". In order to be sure that the endangered person hasn't left the danger area only by chance, a new warning/alert has to be given to the endangered person as soon as the endangered person enters the danger area again. According to the inventive method the endangered person is assigned to a partner being equipped with a further mobile device, and the feedback is required to be given via the further mobile device. Preferably the feedback is required to be given via both, the mobile device of the endangered person as well as via the mobile device of the partner (four eyes principle). If any of the required feedbacks is missing the notification concerning missing feedback is sent.

[0019] In order to check the attention of endangered persons, it is advantageous to carry out test alarms by random. In case of a missing feedback in response to a test alarm, a decided person is informed, e.g. a supervisor.

[0020] In a special variant of the inventive method additional information is displayed by the mobile device, in particular information concerning the position of the endangered person, the position, speed, expected arrival of a vehicle (e.g. a train or a plane), or the blocking of areas. Additional information may contain: blocked tracks, arrival time until the train arrives at the maintenance worker (danger area), warning information about the imminent danger, etc.

[0021] Further advantages can be extracted from the description and the enclosed drawing. The features mentioned above and below can be used in accordance with the invention either individually or collectively in any combination. The embodiments mentioned are not to be understood as exhaustive enumeration but rather have exemplary character for the description of the invention.

Drawings

[0022] The invention is shown in the drawing.

FIG. 1 shows a flow scheme of a variant of the inventive method.

FIG. 2 shows a flow scheme of a preferred variant of the inventive method including position determination of an endangered person.

[0023] Fig. 1 shows the basic steps of the inventive method. First one or more endangered persons are determined, i.e. the mobile devices which are to receive the warnings/alerts are chosen. The determination of endangered persons can be carried out by registration in advance (previously chosen mobile devices) or by observation of the danger area. In the latter case people who enter the danger area are determined to be endangered persons. This can be done by checking which GNSS sensor is located within or near by a danger area. In this case

the GNSS sensor is preferably integrated within the mobile device. It is also possible to detect people staying within the danger area by image recognition.

[0024] The traffic controller monitors vehicles approaching the danger area via a monitoring system, e.g. a vehicle position information system. In case the remaining time until the vehicle arrives at the danger area falls below a predetermined time limit (e.g. 5 minutes) a warning/alert is sent to the mobile device of the endangered person. In addition to the warning/alert additional specific information can be given. Several warnings/alerts can be sent to the endangered person in intervals. In dependence of the urgency the warnings/alerts can comprise signals which are different in nature (e.g. different colors, sounds, vibrational frequencies or a combination thereof...)

[0025] According to the invention a feedback is required for stopping the warning-process. A feedback can be given via the mobile device, e.g. by touching, gestures or speech input. If no feedback is given within a predetermined time limit a notification is sent to another person, e.g. a team member who is on-site and therefore able to contact the endangered person in order to make the endangered person to leave the danger area and to give the required feedback. The notified person can also be a traffic controller who is able to reroute or slow down the approaching vehicle in order to give the endangered person more time to leave the danger area and to send the required feedback. If still no feedback is sent by the endangered person actions can be taken to defuse the danger situation, e.g. stopping the approaching vehicle. The defusing-action is preferably carried out automatically.

[0026] Fig. 2 shows a preferred variant of the inventive method. Different time limits are set on expiry of which different persons (corresponding to different escalation levels) are notified in case of a missing feedback. In the shown example on expiry of a first time limit a notification is sent to a team member, on expiry of a second time limit a notification is sent to a traffic controller, on expiry of a third time limit a notification is sent to a train driver of a train which may be involved in the expected critical situation. Alternatively an automated braking or rerouting of the vehicle can be initiated on expiry of the third time limit.

[0027] In order to ensure that the endangered person not only recognized the warning/alert but also left the danger area, the preferred embodiment comprises a position control of the endangered person. The endangered person is only considered to be safe if a feedback has been given and the endangered person is detected to stay outside the danger area. In the variant shown in fig. 2 the position control of the endangered area is only carried out if a feedback is given without notification of another person, since it is assumed that in case of a notification of another person the other person makes arrangements for removing the endangered person out of the danger area. Nevertheless it is possible to provide a

position control independent of the point in time the feedback has been given.

[0028] It is also possible to omit the position control. In this case a given feedback directly results in "no further action".

[0029] According to the invention a feedback from the endangered person is required in order to stop the notification process or to prevent the notification process to be started. Thereby it can be ensured that the endangered person understands the warning. The inventive method results in an increased safety of railway workers, decreased maintenance costs (less safety staff necessary) and a reduced stress for workers. Thus the maintenance staff can keep focus on work while a high safety level can be ensured.

Claims

1. Method for warning and/or alerting an endangered person within a danger area, the endangered person being equipped with a mobile device, the method comprising:

ascertainment of the endangered person;
identification of a dangerous situation by means of a monitoring system;
in case of a dangerous situation, sending at least one warning and/or alert to the mobile device of the endangered person;
in case no feedback is been given within a predetermined time slot, a notification is sent automatically to at least one other person, informing about a missing feedback of the endangered person **characterized in that** the mobile device comprises a wearable display which is optical head mounted, and **that** the endangered person is assigned to a partner being equipped with a further mobile device, and that the feedback is required to be given via the further mobile device.

2. Method according to any one of the preceding claims, **characterized in that** the other person is a member of a previously defined team.

3. Method according to any one of the preceding claims, **characterized in that** the other person is a traffic controller.

4. Method according to any one of the preceding claims, **characterized in that** the other person is a train driver.

5. Method according to any one of the preceding claims, **characterized in that** if no feedback is given within a further predetermined time slot, vehicles approaching the danger area are slowed down.

6. Method according to any one of the preceding claims, **characterized in that** the method is applied to railway applications, in particular to signaling system, interlocking system, or an automated train protection system.
7. Method according to any one of the preceding claims, **characterized in that** a position determination of the endangered person is carried out, in particular via GNSS or via image recognition of typical elements of the danger area.
8. Method according to any one of the preceding claims, **characterized in that** a check is carried out whether the endangered person left the danger area after receiving the warning or alert and that in case the endangered person didn't leave the danger area within a predetermined time slot, the notification is sent automatically.
9. Method according to any one of the preceding claims, **characterized in that** test alarms are carried out by random.
10. Method according to any one of the preceding claims, **characterized in that** additional information is displayed by the mobile device, in particular information concerning the position of the endangered person, position, speed, expected arrival of a vehicle, or blocking of areas.

Patentansprüche

1. Verfahren zum Warnen und/oder Alarmieren einer gefährdeten Person innerhalb einer Gefahrenzone, wobei die gefährdete Person mit einer mobilen Vorrichtung ausgestattet ist, wobei das Verfahren umfasst:
 Ermittlung der gefährdeten Person;
 Identifizieren einer gefährlichen Situation mittels eines Überwachungssystems; im Falle einer gefährlichen Situation, senden mindestens einer Warnung und/oder eines Alarms an die mobile Vorrichtung der gefährdeten Person;
 falls keine Rückmeldung innerhalb einer vorbestimmten Zeitspanne erfolgt, wird automatisch eine über eine fehlende Rückmeldung der gefährdeten Person informierende Benachrichtigung an mindestens eine andere Person gesendet,
dadurch gekennzeichnet,
dass die mobile Vorrichtung ein tragbares Display aufweist, das ein optisches am Kopf befestigtes ist, und
dass die gefährdete Person einem Partner zugeordnet ist, der mit einer weiteren mobilen Vor-

richtung ausgestattet ist, und dass die Rückmeldung über die weitere mobile Vorrichtung erfolgen muss.

2. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die andere Person ein Mitglied eines zuvor definierten Teams ist.
3. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die andere Person ein Fahrdienstleiter ist.
4. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die andere Person ein Zugführer ist.
5. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass**, wenn keine Rückmeldung innerhalb einer weiteren vorbestimmten Zeitspanne erfolgt, die sich der Gefahrenzone annähernden Fahrzeuge abgebremst werden.
6. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Verfahren bei Eisenbahnanwendungen, insbesondere bei einem Signalsystem, einem Stellwerk oder einem automatischen Zugsicherungssystem angewendet wird.
7. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** eine Positionsbestimmung der gefährdeten Person ausgeführt wird, insbesondere über GNSS oder über Bilderkennung von typischen Elementen der Gefahrenzone.
8. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** überprüft wird, ob die gefährdete Person die Gefahrenzone verlassen hat, nachdem sie die Warnung oder den Alarm erhalten hat und dass, falls die gefährdete Person die Gefahrenzone nicht innerhalb einer vorbestimmten Zeitspanne verlassen hat, die Benachrichtigung automatisch versendet wird.
9. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** Testalarme willkürlich ausgeführt werden.
10. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** zusätzliche Informationen von der mobilen Vorrichtung angezeigt werden, insbesondere Informationen bezüglich der Position der gefährdeten Person, der Position, der Geschwindigkeit, der erwarteten Ankunft eines Fahrzeugs oder des Blockierens von Bereichen.

Revendications

1. Procédé pour avertir et/ou alerter une personne en danger à l'intérieur d'une zone de danger, la personne en danger étant équipée d'un dispositif mobile, le procédé comprenant :

le constat de la personne en danger ;

l'identification d'une situation dangereuse au moyen d'un système de surveillance ;

dans le cas d'une situation dangereuse, l'envoi d'au moins un avertissement et/ou une alerte au dispositif mobile de la personne en danger ;

dans le cas où aucune réaction n'est fournie à l'intérieur d'une fenêtre temporelle prédéterminée, une notification est envoyée de manière automatique à au moins une autre personne, laquelle notification l'informe de l'absence de réaction de la personne en danger ;

caractérisé en ce que :

le dispositif mobile comprend un affichage portable optique qui est monté sur la tête ; et **en ce que :**

la personne en danger est attribuée à un partenaire qui est équipé d'un autre dispositif mobile ; et **en ce que** la réaction doit être fournie via l'autre dispositif mobile.
2. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce que** l'autre personne est un membre d'une équipe définie au préalable.
3. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce que** l'autre personne est un agent régulateur de la circulation.
4. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce que** l'autre personne est un conducteur de train.
5. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce que**, si aucune réaction n'est fournie à l'intérieur d'une autre fenêtre temporelle prédéterminée, des véhicules qui s'approchent de la zone de danger sont ralentis.
6. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce que** le procédé est appliqué à des applications de chemin de fer, en particulier à un système de signalisation, à un poste d'aiguillage ou à un système automatisé de protection des trains.
7. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce qu'**une détermination de position de la personne en danger est mise en oeuvre, en particulier via GNSS ou via une connaissance d'image d'éléments typiques de la zone de danger.
8. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce qu'**une vérification est mise en oeuvre pour déterminer si oui ou non la personne en danger a quitté la zone de danger après la réception de l'avertissement ou de l'alerte et **en ce que**, dans le cas où la personne en danger n'a pas quitté la zone de danger à l'intérieur d'une fenêtre temporelle prédéterminée, la notification est envoyée de manière automatique.
9. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce qu'**il est procédé à des alarmes de test de façon aléatoire.
10. Procédé selon l'une quelconque des revendications qui précèdent, **caractérisé en ce qu'**une information additionnelle est affichée par le dispositif mobile, en particulier une information qui concerne la position de la personne en danger, la position, la vitesse et l'arrivée prévue d'un véhicule, ou le blocage de zones.

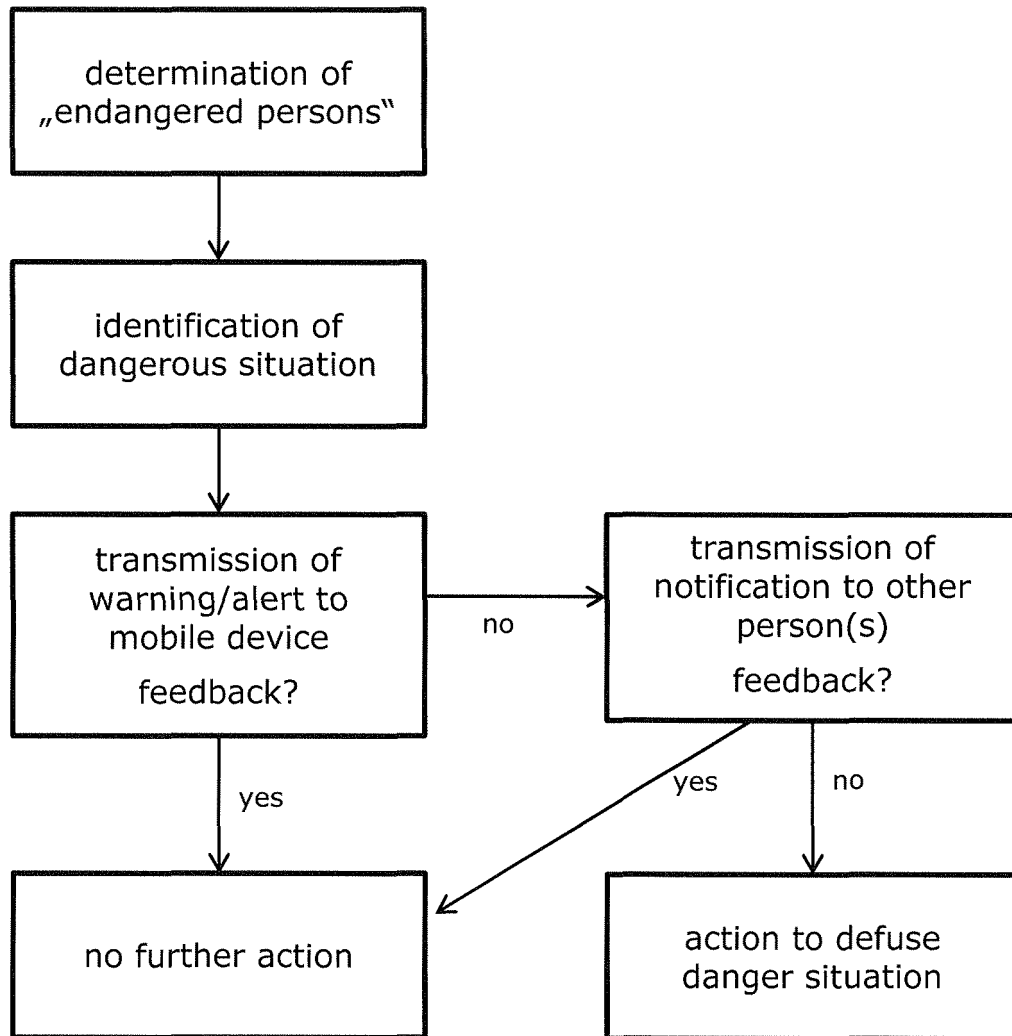


Fig. 1

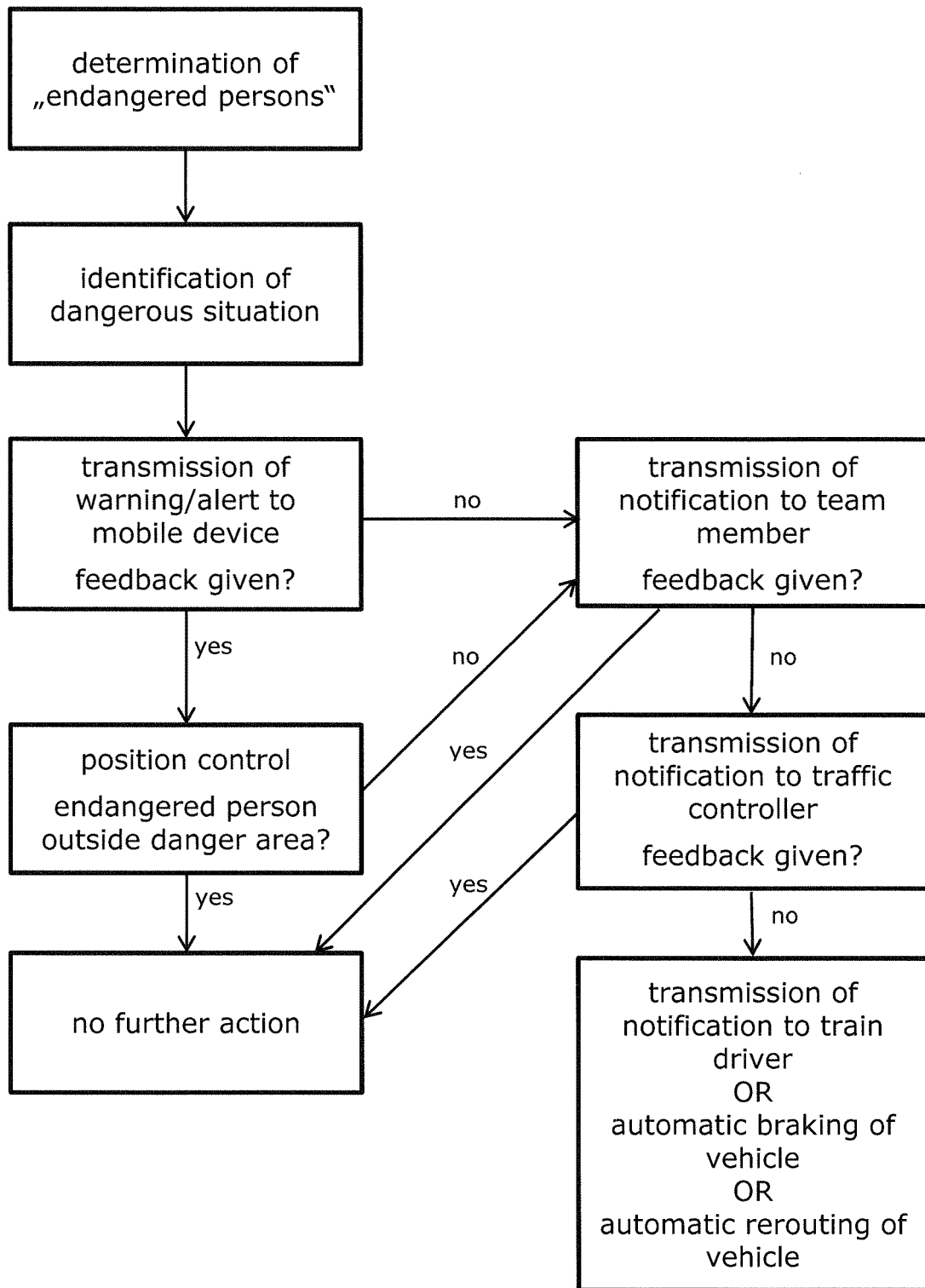


Fig. 2

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2006104996 A2 [0004]
- WO 2012031321 A1 [0005]
- DE 102008020700 A1 [0006]

Non-patent literature cited in the description

- *IEEE 14th International Symposium of High Assurance Systems Engineering*, 2012, 147-154 [0002]