

A MONITORING AND WARNING SYSTEM

FIELD OF INVENTION

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This invention relates to a system for monitoring and providing a warning for a pre-determined region of interest, for example, traffic light crossings, railway crossings and pedestrian crossings.

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SUMMARY OF THE INVENTION

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According to the invention, there is provided a monitoring and warning system for monitoring a region of interest including a sensing mechanism directed at the region of interest, to sense the presence of a pre-determined object of interest within the region of interest, an image recorder to record the image of the pre-determined object of interest within the region of interest and a warning mechanism to provide at least one signal wherein the sensing mechanism further includes a triggering mechanism to activate the image recorder to record an image when the pre-determined object of interest is sensed within the region of interest.

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Preferably, the sensing mechanism is an image pickup device.

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Still preferably, the sensing mechanism further includes a database of at least one pre-determined object parameter.

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Preferably, the image obtained by the image pickup device is compared with the database of at least one pre-determined object parameter, to determine if the image obtained is a pre-determined object of interest.

Preferably, the at least one pre-determined object parameter is a height of the pre-determined object.

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In a preferred embodiment, the at least one pre-determined object parameter is a width of the pre-determined object.

Preferably, the image recorder records the image of the pre-determined object of interest when said pre-determined object of interest is within the region of interest.

5 In a preferred embodiment, the warning mechanism provides at least a first signal of a visual, audio or wireless form of a signal.

In yet another preferred embodiment, the warning mechanism further includes at least one speed detector.

10 Preferably, the speed detector detects the speed of a vehicle at a plurality of pre-determined locations.

Still preferably, the speed detector further includes a comparator to compare the speed detected at the plurality of pre-determined locations

15 Preferably, the comparator triggers the warning mechanism to activate a second warning signal when the speed detected at a second location is faster than the first location.

20 In the preferred embodiment, the second location is in closer proximity to the region of interest than the first location.

Preferably, the second warning signal is one of a visual, audio or wireless form of a signal.

25 Still preferably, the pre-determined object parameter may be modified.

According to another aspect of the invention, there is provided a method of monitoring a region of interest including sensing a presence of a pre-determined object of interest within the region of interest, recording the image of the pre-determined object of interest
30 within the region of interest, activating the image recorder to record when a pre-determined object of interest is sensed within the region of interest and indicating a warning signal.

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DESCRIPTION OF FIGURES

In order that the invention might be more fully understood, embodiments of the invention will be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a first embodiment of the monitoring and warning system,

Figure 2 shows a second embodiment of the monitoring and warning system,

Figure 3 shows a first embodiment of the monitoring and warning system,

Figure 4 shows a method of a first and second embodiment of monitoring a region of interest, and

Figure 5 shows a method of a third embodiment of monitoring a region of interest.

The attached drawings are not necessarily drawn to scale.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. The preferred embodiments of the invention are not intended to limit the invention in its broadest aspect to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the embodiments, numerous specific details are set forth in order to provide an understanding of the present embodiments.

Referring to the drawings, an embodiment of a monitoring and warning system 100 is shown in Figure 1. This system 100 includes a sensing mechanism 10, an image recorder 20, and a warning mechanism 30, in communication with one another. The sensing mechanism 10 is directed towards a region of interest 60 being monitored. In the description that follows, the region of interest 60 monitored is a pedestrian crossing. However, it is to be understood that the region of interest may be any other region determined to be of interest, for example a traffic light crossing or a railway crossing.

The sensing mechanism 10 shown in the preferred embodiment is in the form of an image pickup device 11. This image pickup device 11 is directed towards, and continuously monitors the pedestrian crossing.

- 5 The sensing mechanism 10 further includes a database of at least one object parameter of the pre-determined object of interest. In this embodiment, the object of interest is a human, and the at least one parameter is a height of the object. The database may include further object parameters, for example, a height-to-width ratio and/ or a generic human form template.

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The pre-determined object parameter may be modified by an operator of the monitoring and warning system 100.

- 15 When the image pickup device 11 picks up an image of an object within the pedestrian crossing, the image obtained is compared with the database containing the height of the pre-determined object of interest. Therefore, in this example, the object parameter is an object height of at least 0.4m. Therefore, an object image obtained by the image pickup device 11 with a height of at least 0.4m will then be recognised as a positive event. A triggering mechanism 12 of the sensing mechanism 10 will then trigger the image recorder 20, to start recording the image of the object, positively identified as a pre-determined object of interest. In other words, once a human is identified as walking on the pedestrian crossing, the triggering mechanism 12 triggers the image recorder 20 to record the image of the human.

- 25 The image pickup device 11 and the image recorder 20 may be separate units, or it may be integral in one unit.

- 30 In the other object parameters considered, a positive event will be recognised when the height-to-width ratio is more than 0.9, and/or the object image obtained by the image pickup device 11 matches the generic human form template of the database.

- Other variations of the object parameters include having a generic animal form template, or other types of life form templates, to allow the image pickup device 11 to recognise as a positive event, when an animal or life form is on the pedestrian crossing. Examples of these animals of life forms include various breeds of dogs and cats, sheep, horses, or cattle.

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When a positive event is identified, the triggering mechanism 12 will then trigger the image recorder 20 to record the image of the object, positively identified as an object of interest.

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In the present embodiment, the triggering mechanism 12 will continuously trigger the image recorder 20 to record the image of the object, positively identified as a human, on the pedestrian crossing, until such time the human leaves the field of vision of the image pickup device 11. The field of vision of the image pickup device 11 is determined as at least the region of interest 60, and in this example, the pedestrian crossing.

It is to be understood that the pre-determined object parameter reduces the incidence of error, when triggering the image recorder 20. For example, a leaf falling through the field of vision of the image pickup device 11 will not trigger the image recorder 20 to record the image.

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Correspondingly, the triggering mechanism 12 triggers the warning mechanism 30 once a positive identification for a human pedestrian is made. The warning mechanism 30 provides a warning to oncoming vehicles approaching the pedestrian crossing, when a pedestrian is positively identified, and on the pedestrian crossing.

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The warning mechanism includes an indicator to provide a warning to oncoming vehicles by providing at least one type of a first signal, for example, a visual, audio, or wireless signal to the oncoming vehicles.

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In the preferred embodiment, the warning mechanism 30 provides a visual signal in the form of coloured lights provided for example, by an LED. The coloured lights may be provided at a frequency, so that the first signal is in the form of lights flashing at a frequency of 50 Hz, given as an example.

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The warning mechanism 30 further includes a speed detector 32, in the form of a radar detector, to detect the speed of vehicles at a first location.

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In an embodiment, the speed detector 32 detects the speed of the vehicle at a first location, a first distance away from the pedestrian crossing. When the speed detected at this first location is higher than a pre-determined speed, for example, 30km/hr, the speed

detector 32 triggers the indicator of the warning mechanism to provide a second warning signal to the oncoming vehicle. The indicator for the first and second warning signal may be located at two differing locations, or it may be incorporated onto a common indicator, just as long as a driver of the vehicle is able to see the warning lights provided.

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It is to be understood that the pre-determined speed may be modified by an operator of the monitoring and warning system 100.

10 The second warning signal is at least one type of a visual, audio or wireless signal. The second warning signal is preferably different from the first warning signal. In this way, a driver of an oncoming vehicle will be able to appreciate that the second warning signal requires added attention, and a response from the driver.

15 In the present embodiment of the invention, the second warning signal is in the form of lights flashing at a higher frequency of 100 Hz, as compared to the first warning signal.

Therefore, when a pedestrian is positively identified on the pedestrian crossing, the triggering mechanism will trigger the warning mechanism to provide a visual signal, and detects a speed of the oncoming vehicle. Should the speed of the oncoming vehicle be
20 above 30km/hr, a second warning signal is then indicated to the oncoming vehicle.

In a second embodiment of the present invention as seen in Figure 2, the first location is at or very near the pedestrian crossing. The speed detector 32 detects the speed of the oncoming vehicle when it is at the pedestrian crossing, or almost approaching the
25 pedestrian crossing. When the speed detected at this location is not zero, a trigger is made to the indicator, to provide a second warning signal. This happens when vehicle does not come to a complete stop at the pedestrian crossing.

In the second embodiment, the image recorder 20 will record the image of the offending
30 vehicle, when it is identified that the vehicle did not stop at the pedestrian crossing. This is especially useful in a situation where a pedestrian has just stepped onto the pedestrian crossing, or is beginning to do so as the vehicle is almost at the pedestrian crossing. This situation is defined as a "near miss" situation, where the vehicle does not come to a complete stop at the pedestrian crossing when a pedestrian is just or about to step onto
35 the pedestrian crossing. An image of the offending vehicle will be captured by the image recorder 20, for future action by the authorities, if need be.

It is to be understood that the second warning signal is different from the first warning signal, to indicate a difference in the level of warning provided to a driver of the vehicle. The first warning signal provides a warning to a driver of the vehicle, that a pedestrian is on the pedestrian crossing. The second warning signal is provided when the driver of the vehicle fails to respond to the first signal, by slowing down or coming to a complete stop, depending on the pre-determined speed of the speed detector 32.

In a third embodiment of the invention as shown in Figure 3, the speed detector 32 is able to detect the speed of the vehicle at two locations, namely a first location and a second location. In this third embodiment, the first location is at a distance further away from the pedestrian crossing than the second location. The speed detected at the first location 40 is compared with the speed detected at the second location 50, by a comparator. The comparator triggers a second warning signal when the speed detected at the second location 50 is faster than the speed detected at the first location 40. In this scenario, the vehicle is not slowing down as it moves towards the pedestrian crossing, when a pedestrian is detected to be on the pedestrian crossing.

It is envisioned that further embodiments of the invention may be possible, by detecting the speed of oncoming and approaching vehicles at differing locations.

It is to be appreciated that the trigger mechanism triggers the image recorder and the warning mechanism only when at least a pedestrian is positively identified to be on the pedestrian crossing. In this way, where there are no pedestrians on the pedestrian crossing, the warning mechanism 30 will not be triggered.

In further embodiments of the warning signal, the audio signal may be communicated to an oncoming vehicle by way of playing pre-recorded messages, or having sirens, at an amplitude large enough to obtain the attention of a driver of an oncoming vehicle.

Where the warning signal is a wireless signal, the warning mechanism further includes a transmitter, to transmit warning information to a receiver of an oncoming vehicle. Examples of receivers may be an ERP (electronic road pricing) reader commonly found in Singaporean vehicles, or the in-vehicle radio units found in most vehicles.

Further embodiments of the speed detector 32 include speed strips or laser guns.

Figure 4 shows a method of monitoring and providing a warning to a region of interest of the first and second embodiment of the invention. The method includes the steps of sensing the pedestrian crossing, determining if an object within the pedestrian crossing is a pedestrian, if the object within the pedestrian crossing is a human, a trigger is sent to the image recorder to record the image for as long as the human is on the pedestrian crossing. Concurrently while the image recorder is triggered, the warning mechanism is triggered to provide a first warning signal. At the same time, a speed detector detects the speed of an oncoming vehicle to determine if it is below a pre-determined speed. If it is above the pre-determined speed, a second warning signal is triggered, and/ or an image of the vehicle will be taken.

Figure 5 shows another method of monitoring and providing a warning to a region of interest of the third embodiment of the invention. The method includes the steps of sensing the pedestrian crossing, determining if an object within the pedestrian crossing is a pedestrian, if the object within the pedestrian crossing is a human, a trigger is sent to the image recorder to record the image for as long as the human is on the pedestrian crossing. Concurrently while the image recorder is triggered, the warning mechanism is triggered to provide a first warning signal. At the same time, a speed detector detects a first speed, and then a second speed, a distance apart, to determine if the vehicle is slowing down as it approaches the pedestrian crossing. If the vehicle is identified to be not slowing down, a second warning signal is triggered, and/ or an image of the vehicle will be taken.

The embodiments have been advanced by way of example only, and modifications are possible within the scope of the invention as defined by the appended claims.

CLAIMS

1. A monitoring and warning system for monitoring a pre-determined region of interest including
 - a sensing mechanism directed at the pre-determined region of interest, to sense the presence of a pre-determined object of interest within the pre-determined region of interest;
 - an image recorder to record the image of the pre-determined object of interest within the pre-determined region of interest; and
 - a warning mechanism to provide at least one signal;
 - wherein the sensing mechanism further includes a triggering mechanism to activate the image recorder to record an image when the pre-determined object of interest is sensed within the pre-determined region of interest.
2. A monitoring and warning system for monitoring a pre-determined region of interest according to claim 1, wherein the sensing mechanism is an image pickup device.
3. A monitoring and warning system for monitoring a pre-determined region of interest according to claim 2, wherein the sensing mechanism further includes a database of at least one pre-determined object parameter.
4. A monitoring and warning system for monitoring a pre-determined region of interest according to any one of claims 2 or 3, wherein the image obtained by the image pickup device is compared with the database of at least one pre-determined object parameter, to determine if the image obtained is a pre-determined object of interest.
5. A monitoring and warning system for monitoring a pre-determined region of interest according to any one of claims 3 or 4, wherein the at least one pre-determined object parameter is a height of the pre-determined object
6. A monitoring and warning system for monitoring a pre-determined region of interest according to any one of claims 3 or 4, wherein the at least one pre-determined object parameter is a width of the pre-determined object.

7. A monitoring and warning system for monitoring a pre-determined region of interest according to any one of the preceding claims, wherein the image recorder records the image of the pre-determined object of interest when said pre-determined object of interest is within the pre-determined region of interest.
8. A monitoring and warning system for monitoring a pre-determined region of interest according to claim 1 wherein the warning mechanism provides at least a first signal of a visual, audio or wireless form of a signal.
9. A monitoring and warning system for monitoring a pre-determined region of interest according to claim 8, wherein the warning mechanism further includes at least one speed detector.
10. A monitoring and warning system for monitoring a pre-determined region of interest according to claim 9, wherein the speed detector detects the speed of a vehicle at a plurality of pre-determined locations.
11. A monitoring and warning system for monitoring a pre-determined region of interest according to any one of claims 9 or 10, wherein the speed detector further includes a comparator to compare the speed detected at the plurality of pre-determined locations
12. A monitoring and warning system for monitoring a pre-determined region of interest according to claim 11, wherein the comparator triggers the warning mechanism to activate a second warning signal when the speed detected at a second location is faster than the first location.
13. A monitoring and warning system for monitoring a pre-determined region of interest according to claim 12, wherein the second location is in closer proximity to the pre-determined region of interest than the first location.
14. A monitoring and warning system for monitoring a pre-determined region of interest according to any one of claims 9 to 12, wherein the speed detector is a radar.

15. A monitoring and warning system for monitoring a pre-determined region of interest according to any one of claims 12 or 13, wherein the second warning signal is one of a visual, audio or wireless form of a signal.
16. A monitoring and warning system for monitoring a pre-determined region of interest according to any one of claims 3 to 14, wherein the pre-determined object parameter may be modified.
17. A method of monitoring a pre-determined region of interest including
 - sensing a presence of a pre-determined object of interest within the pre-determined region of interest;
 - recording the image of the pre-determined object of interest within the pre-determined region of interest;
 - activating the image recorder to record when a pre-determined object of interest is sensed within the pre-determined region of interest; and
 - indicating a warning signal.