

DESCRIPTION

TITLE OF INVENTION: PASSAGE INFORMATION NOTIFICATION
SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

5 [0001]

The present application is based on Japanese Patent Application No. 2016-078869 filed on April 11, 2016, the disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

10 [0002]

The present disclosure relates to a passage information notification system notifying passage information of a vehicle and/ or a pedestrian on a road.

BACKGROUND ART

15 [0003]

Conventionally, a technology attaching a vehicle information display device to a traffic mirror is proposed as driving assist for a driver in a vehicle (a subject vehicle), the vehicle information display device notifying a driver of approach of another vehicle at intersection or the like (see Patent Literature 1, 20 for example). In a system according to Patent Literature 1, a vehicle detection method configured from a terrestrial sensor detecting passage of a vehicle is embedded in a road separated from an installation place of the traffic mirror at a predetermined distance. A wireless communication device transmits to a display device, vehicle passage detection information detected 25 by the vehicle detection method. The display device is configured to display information of the approach of the vehicle when the display device receives the vehicle passage detection information.

PRIOR ART LITERATURE

PATENT LITERATURE

30 [0004]

SUMMARY OF INVENTION

[0005]

However, the vehicle information display device described in Patent
5 Literature 1 has a following difficulty. That is, Patent Literature 1 only
describes that a distance between a position of the display device (traffic
mirror) installed at the intersection and a burying position of the terrestrial
sensor is a “predetermined distance”. The specific example does not exist
in Patent Literature 1. When the distance is relatively long, it is unclear
10 whether the vehicle detected by the terrestrial sensor (a geomagnetic sensor)
actually reaches the intersection installed with the display device. Detection
accuracy of the vehicle becomes low. That is, it is considered that the
vehicle turns right or left on the way and does not pass the intersection, or it
is considered that the vehicle stops at a middle destination.

15 [0006]

In this case, when the distance between the display device (a curve
mirror) and the magnetic sensor is set to a relatively short distance, the
accuracy of vehicle detection becomes high. However, since the distance is
short, a time until the vehicle actually reaches the intersection becomes short.
20 Therefore, the vehicle may pass through the intersection without sufficient
time for a user to confirm display. Even when a malfunction occurs in the
magnetic sensor for vehicle detection, there is a failure that the malfunction is
not easily recognized.

[0007]

25 It is an object of the present disclosure to provide a passage
information notification system enabling a user to confirm a notification with a
time margin while predicting whether a vehicle and/or a pedestrian actually
passes a notification point with high accuracy.

[0008]

30 According to one aspect of the present disclosure, a passage
information notification system that notifies passage information on a vehicle
and/or a pedestrian on a road, the passage information notification system
includes: a management server; multiple information collection terminals,
each of the information collection terminal being installed at one of multiple
35 observation points on a key point of the road; and multiple information

notification terminals, each of the information notification terminals being installed at one of multiple notification points on a key point of the road. Each of the information collection terminals includes a detection device that is configured to detect passage of the vehicle and/or the pedestrian at each of the observation points, and a detection information transmission device that is configured to transmit passage record detected by the detection device to the management server in real time. The management server includes a reception device that is configured to receive the passage record transmitted from each of the information collection terminals, a database that is configured to store the received passage record, a prediction device that is configured to comprehensively predict passage of the vehicle and/or the pedestrian at each of the notification points, based on the passage record received in real time and the passage record stored in a past in the database, and a prediction information transmission device that is configured to transmit passage prediction information predicted by the prediction device to a notification terminal at a corresponding notification point. Each of the notification terminals includes a reception device that is configured to receive the passage prediction information transmitted from the management server, and a notification device that is configured to notify the passage of the vehicle and/or the pedestrian at a corresponding notification point, based on the passage prediction information.

[0009]

With this, multiple information collection terminals transmit a passage record of the vehicle and/or the pedestrian detected by the detection device to the management server in real time, each of the multiple information collection terminals being installed at one of multiple observation points. In the management server, the prediction device comprehensively predicts the passage of the vehicle and/or the pedestrian at each notification point, based on history of a real time passage record and a past passage record. In the case, it may be possible to perform a high accurate passage prediction by using the passage record at the multiple observation points.

[0010]

On the basis of the passage prediction information being transmitted from the management server, in each of the notification terminals installed at one of multiple notification points, the notification device performs the notification of the passage by the vehicle and / or the pedestrian. It may be

possible to perform the prediction based on the passage records at the multiple observation points before reaching the notification point. Therefore, it may be possible to transmit the prediction information to the notification terminal at sufficient earlier time than a moment at when the vehicle and/or the pedestrian pass the notification point. Hence, it may enable the user to confirm the notification with a time margin while predicting whether the vehicle and/or the pedestrian actually pass the notification point with high accuracy.

BRIEF DESCRIPTION OF DRAWINGS

[0011]

The above and other objects, features and advantages of the present disclosure will become more apparent from the following detailed description made with reference to the accompanying drawings. In the drawings:

FIG. 1 is a block diagram roughly showing a configuration of a main part of system according to one embodiment;

FIG. 2 is a view schematically showing an installation state of a notification apparatus on a road in a city;

FIG. 3 is a view illustrating one example of a situation where the display device is installed at an intersection;

FIG. 4A is a view showing a display example for a driver of a vehicle (first);

FIG. 4B is a view showing a display example for the driver of the vehicle (second);

FIG. 5A is a view showing a display example for a pedestrian (first);

FIG. 5B is a view showing a display example for the pedestrian (second);

FIG. 6 is a flowchart showing a processing procedure of a passage detection of a vehicle performed by a notification apparatus;

FIG. 7 is a diagram showing sequence of a flow of a communication processing until notification of whether the pedestrian can safely pass is performed;

FIG. 8 is a view explaining a case where a malfunction occurs;

FIG. 9A is a view explaining a case where an error detection occurs (first); and

FIG. 9B is a view explaining a case where the error detection occurs (second).

DESCRIPTION OF EMBODIMENTS

[0012]

5 Hereinafter, one embodiment will be described with reference to the attached drawings. The embodiment is explained by exemplifying, for convenience, a case where a passage information notification system 1 according to the embodiment is installed in a certain specific area (city), as shown in FIG. 2 (and FIG. 8, FIG. 9A, FIG. 9B), for example. In the city,
10 multiple roads S (community road) where a vehicle V (a car) and a pedestrian P both pass extend in the east-west direction (a direction from right to left in the view) and in the south-north direction (a direction from down to top in the view) in a square shaped.

[0013]

15 In this case, the roads S extending in the east-west direction (left and right in the view) are expressed, with subscripts, as the road S(a), road S(b), road S(c), and road S(d) in order from a north side (top side of the view), when it is required to distinguish multiple roads S in FIG. 2 or the like. By contrast, the roads S extending in the south-north direction (top and bottom in
20 the view) are expressed, with subscripts, as the road S(1), road S(2), road S(3), and road S(4) in order from a west side (left side of the view).

[0014]

Thereby, there are 16 intersection points (crossroads) C in all by the multiple roads S. As described later, the intersections C are set to
25 observation points and notification points. Then, for example, the intersection C formed by the road S(b) and the road S(1) is set to an intersection C(b1), and the intersection C formed by the road S(c) and the road S(4) is set to an intersection C(c4) when it is required to identify any of the multiple intersections C. The subscript showing two roads is applied to
30 the back of a reference symbol C in parentheses.

[0015]

FIG. 1 roughly shows a hardware configuration of the passage information notification system 1 according to the embodiment. The passage information notification system 1 includes a management server 2
35 and multiple notification apparatuses 3 installed at key points of the road S.

According to the embodiment, the notification apparatus 3 has functions of both an information collection terminal installed at an observation point and a notification terminal installed at a notification point. The notification apparatus obtained by integrating the information collection terminal and the notification terminal. The observation point and the notification point are common, and also the multiple notification points are set to portions of each intersection on the road S described above. That is, each of the notification apparatuses 3 are installed at sixteen intersection portions as shown in FIG. 2.

[0016]

The management server 2 includes a calculator 4 configured from a computer mainly. The management server 2 includes a database 5 that is connected to each of the calculators 4 and accumulates and stores a passage record. The management server 2 includes a communication device 6 to perform wireless communication with each of the notification apparatuses 3 (a communication device 8). As described later in detail, in the management server 2, the communication device 6 receives the passage record of the vehicle V and the pedestrian P in real time from each of the notification apparatuses 3. Then, the passage record includes a position of the intersection C (an observation point), a time at when each of vehicles V or the pedestrians P pass, an entering direction into the intersection C, an exiting direction (proceeding) from the intersection C. The passage record of the vehicle V additionally includes number plate information and speed information or the like. The database 5 accumulates and stores the received passage information.

[0017]

The database 5 also stores road map data or the like. The management server 2 receives data of various kinds of road situations including real time traffic information such as a passage prohibition zone, whether it is preference road, presence or absence of construction, a traffic jam situation, presence of on-street parking, whether the accident occurs frequently, or the like.

[0018]

The calculator 4 mainly performs prediction processing comprehensively predicting the passage of the vehicle V and the pedestrian P at the intersection C at which each notification point, that is, the notification

apparatus 3 is installed, by the software configuration mainly. The prediction processing is performed based on the passage record received in real time, and the passage record received in the past and furthermore the road state data stored in the database 5. In the case, timing at when the arbitrary vehicle V and the arbitrary pedestrian P pass the certain intersection C is determined(predicted).

[0019]

When the calculator 4 predicts the passage of the vehicle V and the pedestrian P at the arbitrary intersection C, the communication device 6 transmits the passage prediction information to the notification apparatus 3 (a communication device 8 described later) installed at the corresponding intersection C. Then, the passage prediction information includes also information indicating a timing at when (after a few seconds) the vehicle V or the prediction P enters the corresponding intersection C and a direction where the vehicle V or the prediction P enters the intersection C. The calculator 4 transmits to the notification apparatus 3, determination information indicating determination as to whether the pedestrian P can safely pass the intersection C, when the pedestrian P exists near the intersection C.

[0020]

The notification apparatus 3 includes a calculator 7 configured from the computer mainly, and also the communication device 8, a pedestrian detection device 9, a vehicle detection device 10, and a display device 11 that are connected to the calculator 7. The communication device 8 transmits to the management server 2, the real time passage record at each of intersections, by wireless communication with the communication device 6. The communication device 8 receives the passage prediction information transmitted from the management server 2.

[0021]

The pedestrian detection device 9 detects the passage of the pedestrian P at the intersection C installed with the notification apparatus 3. The vehicle detection device 10 detects the passage of the vehicle V at the intersection C. Although a detail drawing is omitted, the pedestrian detection device 9 and the vehicle detection device 10 are configured from various kinds of sensors for a moving body detection such as a camera, an image processing device, or a laser radar.

[0022]

Thereby, the pedestrian detection device 9 detects the passage record such as an entering exiting time at the intersection by the pedestrian P and an entering exiting direction at the intersection C by the pedestrian P.

5 The vehicle detection device 10 detects the passage record such as an entering exiting time at the intersection by the vehicle V and an entering exiting direction at the intersection C by the vehicle V, the number plate information photographed by the camera, or the speed information. The real time passage record of the detected vehicle V and the detected
10 pedestrian P are transmitted from each of the notification apparatuses 3 to the management server 2.

[0023]

The display device 11 notifies the driver or the pedestrian P of the passage prediction information received from the management server 2, that
15 is, approach information of another vehicle V or another pedestrian P by display. As shown in FIG. 3 also, the display device 11 is installed on the notification apparatus 3 at one of the intersections C with multiple display screens facing in different directions, for example. That is, the multiple display images are installed so as to be visible in separate directions. It is
20 configured to display approach information in the multiple display screens of the display device 11. According to an example in FIG. 3, the display device 11 and furthermore a whole of the notification apparatus 3 are configured to be installed at a traffic sign pole 12. It may be configured to be attached to a telegraph pole, a curve mirror, or the like.

25 [0024]

FIG. 4A, FIG. 4B, FIG. 5A, and FIG. 5B are display examples of the approach information on the screen of the display device 11. FIG. 4A and FIG. 4B are views notifying the driver of the vehicle V coming to the intersection C, of the approach of the pedestrian to the intersection. The
30 example of FIG. 4A attracts caution by showing that the pedestrian comes to the intersection C from a right direction after a few seconds. The example of FIG. 4B shows a situation that the pedestrian approaches from the left direction after a few seconds.

[0025]

35 FIG. 5A and FIG. 5B show an example in a case of notifying the driver of the vehicle V coming to the intersection C (and the pedestrian P) of the

approach of another vehicle V excluding the subject vehicle to the intersection. The example of FIG. 5A attracts caution by showing that another vehicle V enters the intersection C from a right direction after a few seconds. The example of FIG. 5B attracts caution by showing that another vehicle V enters the intersection C from a left direction after a few seconds.

[0026]

According to the embodiment, in a case of displaying for the pedestrian P, when the notification apparatus 3 detects that the pedestrian P enters the intersection C, the notification apparatus 3 requests management server 2 to predict as to whether the pedestrian P can safely pass the intersection C. The notification apparatus 3 causes the display device 11 to display the caution or the like, based on the prediction result from the management server 2. In the case, although FIG. 5A and FIG. 5B does not show in the drawing, it may be possible to display that the pedestrian P can safely pass in the display device 11 for the pedestrian P when it is determined as safe in the management server 2.

[0027]

As described in the following operation explanation, the calculator 4 of the management server 2 predicts the passage of the vehicle V and the pedestrian P at each of the notification points (intersections C). Then, the calculator 4 comprehensively determines when (after a few seconds) the vehicle V or the pedestrian P passes the corresponding intersection C, based on the passage record received in real time and the past passage record stored in the database 5. In particular, when predicting the traveling direction of the vehicle V, the prediction is performed with reference to the past passage history of the vehicle V based on the vehicle identification information (the number plate information).

[0028]

As described above, when receiving a request of safe determination of the pedestrian P from the notification apparatus 3, the calculator 4 of the management server 2 predictively determines whether the pedestrian P can safely pass the intersection C. The calculator 4 of the management server 2 transmits the prediction result to the notification apparatus 3. In particular, according to the embodiment, the calculator 4 of the management server 2 determines error detections or instrument abnormalities in the pedestrian detection device 9 and the vehicle detection device 10 when inconsistency

occurs in information among multiple passage records transmitted from each of the notification apparatuses 3.

[0029]

The operation of the passage information notification system 1 configured as described above is described with reference to FIGs. 6 to 9B. A flowchart of FIG. 6 shows a processing procedure relating to the detection of the passage of the vehicle V, the detection being performed by the calculator 7 of the notification apparatus 3.

[0030]

That is, in a step S1, the vehicle detection device 10 determines whether the entering to the intersection C by the vehicle V is detected. When the vehicle V is detected (Yes in the step S1), (1) entrance (for example, entering from any of north, south, east and west direction) of the intersection C is identified in a step S2. In a step S3, (2) the entering time is recorded. Furthermore, in a step S4, (3) the number plate of the vehicle V is identified.

[0031]

In a next step S5, it is determined whether the vehicle V exists in the intersection C. When it is determined that the vehicle V exists in the intersection C (Yes in the step S5), (4) exit (for example, exiting towards any of north, south, east and west direction) is identified in a step S6. In a next step S7, (5) the exiting time is recorded. In a step S8, information of (1) to (5) is transmitted to the management server 2 as the passage record of the vehicle V.

[0032]

A specific example is described with reference to FIG. 2. As shown by a dotted arrow in FIG. 2, it is supposed that a specific vehicle V enters a road S(c) from the east side, proceeds straight (travels west) in order of the intersection C(c4), the intersection C(c3), the intersection C(c2), and turns right (exit to the north direction) at the intersection C(c1). Then, the notification apparatus 3 at the intersection C(c4) transmits to the management server 2 in real time, the passage record such as the number plate information of the vehicle V, information that the vehicle V enters the intersection C(c4) from east and exits the intersection C(c4) to the west (proceeds straight), and the passage (entering, exiting) time.

[0033]

The notification apparatus 3 at the intersection C(c3) transmits to the management server 2 in real time, the passage record that the vehicle V proceeds straight at the immediately following time. The notification apparatus 3 at the intersection C(c2) transmits to the management server 2 in real time, the passage record that the vehicle V proceeds straight at the immediately following time. The notification apparatus 3 at the intersection C(c1) transmits to the management server 2 in real time, the passage record including information that the vehicle V enters from east and exits (turns right) to north at the immediately following time.

[0034]

The calculator 4 of the management server 2 comprehensively predicts how the vehicle V passes the intersection C, based on the road situation including the passage record received in real time, the history information of the passage record relating to the vehicle V stored in the database 5 and other traffic information. In the case, the calculator 4 predicts that probability of the vehicle V turning right at the intersection C(b1) is lowest. In a case of proceeding straight or turning left, when pattern of habitually proceeding straight occurs frequently, the calculator 4 predicts that the probability of proceeding straight is highest based on the past history of the corresponding vehicle V, for example. In consideration of the road situation, when a road in a case of proceeding straight clogs, the calculator 4 predicts that the probability of turning left is high, for example.

[0035]

For example, when the calculator 4 determines (predicts) that the probability of proceeding straight is highest, the management server 2 transmits to the notification apparatus 3 at the next intersection C(a1), the passage prediction information indicating a timing at when (after a few seconds) the vehicle V enters the intersection C(a1) and a direction where the vehicle V enters the intersection C(a1). As shown in FIG. 5A and FIG. 5B, the notification apparatus 3 receiving the passage prediction information at the intersection C(a1) displays that the vehicle V enters the intersection C from which direction after a few seconds in the display device 11. Thereby, the driver of another vehicle V or the pedestrian around the intersection C(a1) may be possible to understand the timing at when the vehicle V approaches and the direction where the vehicle V approaches from, by viewing the display of the display device 11.

[0036]

A processing in a case where the notification apparatus 3 transmits the request of the safe determination for the pedestrian P to the management server 2 is described with reference to FIG. 7. FIG. 7 shows the communication sequence among the notification apparatus 3 detecting the pedestrian P, n notification apparatuses 3 around the detecting notification apparatus 3 (two notification apparatuses 3 of first and n-th are shown as an example in the drawing), and the management server 2.

[0037]

As described above, when the n notification apparatuses 3 around the detecting notification apparatus 3 detect the vehicle V, the surrounding n notification apparatuses 3 transmit the passage record of the vehicle V to the management server 2. In FIG. 7, while the first notification apparatus 3 transmits the passage record to the management server 2 (communication processing T1), the n-th notification apparatus 3 transmits the passage record to the management server 2 (communication processing T2). The management server 2 receiving the passage record of the vehicle V stores the passage record into the database 5.

[0038]

By contrast, the notification apparatus 3 detecting the pedestrian P by the pedestrian detection device 9 requests the management server 2 to predict (determine) whether the pedestrian P can safely pass the intersection C (communication processing T3). The calculator 4 of the management server 2 predicts comprehensively whether the pedestrian P can safely pass, based on the information of the following I to III. The information of I is the real time passage information of the vehicle V from the n surrounding notification apparatuses 3. The information of II is the accumulated past passage information. The information of III is the information of the road situation around the intersection C.

[0039]

The notification apparatus 3 predicts whether the pedestrian P can safely pass the intersection C, and transmits the prediction result to the notification apparatus 3 at the intersection C (communication processing T 4). The notification apparatus 3 displays the caution or the like in the display device 11, based on the prediction result transmitted from the management server 2. In the case, when the vehicle V approaches, a display prompting

the caution as shown in FIG. 5A and FIG. 5B is displayed on the screen of the display device 11.

[0040]

Then, when the notification apparatus 3 (pedestrian detection device 9) detects the approach of the pedestrian P, the display device 11 displays that the pedestrian P approaches, as shown in FIG. 4A and FIG. 4B. The driver of the vehicle V may be possible to easily understand that the pedestrian P approaches, for example, even at the intersection C where the intersecting road side is a blind spot.

[0041]

By the way, in the passage information notification system 1, the calculator 4 of the management server 2 detects the vehicle V or the like regarding multiple intersections C as an observation point. Therefore, when the inconsistency occurs in information among multiple passage records, the calculator 4 may be possible to determine that the error detection or the instrument abnormality occurs somewhere.

[0042]

FIG. 8 illustrates a case where it can be determined that a malfunction occurs in the instrument. That is, when a certain vehicle V travels from the east to the west of the road S(c), the notification apparatus 3 may detect the vehicle in order of the notification apparatus 3 at the intersection C(c4), the notification apparatus 3 at the intersection C(c3), the notification apparatus 3 at the intersection C(c2). However, in a case where after the notification apparatus 3 at the intersection C(c4) detects the vehicle V and, next, the notification apparatus 3 at the intersection C(c2) detects the vehicle V, it may be possible to determine that the notification apparatus 3 at the intersection C(c3) has malfunction, for example, the vehicle detection device 10 has malfunction.

[0043]

FIG. 9A and FIG. 9B illustrate a case where the error detection occurs. It is supposed that the notification apparatus 3 at the intersection C(c3) detects that the vehicle V turns right (northward) and also the notification apparatus 3 at the intersection C(c2) detects that the vehicle V proceeds straight (westward) after the notification apparatus 3 at the intersection C(c4) detects that the vehicle V proceeds straight (westward), as shown in FIG. 9A. In the case, since the inconsistency occurs in the detection of the vehicle V, it

may be possible to determine that the error detection occurs in either the notification apparatus 3 at the intersection C(c3) or the notification apparatus 3 at the intersection C(c2).

[0044]

5 In such a case, it may be possible to determine that the error detection occurs in which notification apparatus 3, based on the traveling record at others intersections C. In FIG. 9B, the notification apparatus 3 at the intersection C(c3) detects that the vehicle V turns right (northward), and then, sequentially, the notification apparatus 3 at the intersection C(b3)
10 detects that the vehicle V proceeds straight (northward). Furthermore, the notification apparatus 3 at the intersection C(a3) detects that the vehicle V turns left (westward), and then, the notification apparatus 3 at the intersection C(a2) detects that the vehicle V proceeds straight (westward), and then, the notification apparatus 3 at the intersection C(a1) detects that the vehicle V
15 proceeds straight (westward). Further, it is supposed that the remaining notification apparatuses 3 do not detect the vehicle V.

[0045]

Thereby, in this case, it may be possible to determine that the error detection occurs in the notification apparatus 3 at the intersection C(c2).

20 When the inconsistency of the information occurs among the passage records of the multiple notification apparatuses 3, the calculator 4 of the management server 2 may be possible to detect that the error detection or the instrument abnormality occurs. It may be possible to easily identify the notification apparatus 3 having the error detection or the instrument
25 abnormality. As a result, it may be possible to promptly deal with the notification apparatus 3 determined as the error detection or the abnormality.

[0046]

According to the passage information notification system 1, the calculator 4 of the management server 2 may be possible to comprehensively
30 predict the passage of the vehicle V and the pedestrian at each of notification points (intersections C), based on the history of the real time passage record and the past passage record at the multiple observation points (intersections C) or the like. As a result, it may be possible to perform more accurate passage prediction. It may be possible to perform the prediction based on
35 the passage records at the multiple observation points before reaching the notification point. Therefore, it may be possible to transmit the prediction

information to each of the notification apparatuses 3 at sufficient earlier time than a moment at when the vehicle V and/or the pedestrian P pass the notification point.

[0047]

5 According to the embodiment, it may be possible to obtain an excellent effect that the user can confirm the notification with a time margin while predicting whether the vehicle V and/or the pedestrian P actually passes the intersection C being the notification point with high accuracy. It is considered that the prediction by the calculator 4 of the management
10 server 2 is not appropriate. However, it may be possible to predict with gradually improving the accuracy by using the experience that the prediction by the prediction is not appropriate for the next prediction.

[0048]

15 In particular, according to the embodiment, since the notification point is set at the intersection C of the road S, for example, it may be possible to notify the user of the passage of another vehicle V, the pedestrian P, or the like from the side becoming a blind spot at the intersection C, which is effective. The embodiment is configured to install the notification apparatus 3 integrated with the information collection terminal and the notification
20 terminal at the point where the observation point and the notification point are set as common. Therefore, it may be possible to ease installation, handling, maintenance, or the like for the information collection terminal and the notification terminal.

[0049]

25 It may be possible to accumulate data regarding to the identified vehicle V since the embodiment is configured to identify the vehicle V by the number plate and to cause the passage record to include the vehicle identification information. Thereby, it may be possible to calculate what kind of the route the vehicle V travels on in the past, whether the vehicle V decides
30 the habitually traveling route or time, or the like, and whether the vehicle V has custom at when selecting the route. It may be possible to predict which route the vehicle travels on with higher accuracy.

[0050]

35 The display device 11 that is visible to the driver of the vehicle V is installed in the notification apparatus 3 so that the approach information that another vehicle V or the pedestrian P approaches the notification point is

displayed on the screen of the display device 11. Thereby, it may be possible to notify useful information when driving, and to improve safety or the like. Together with this, the display device 11 that is visible to the driver of the vehicle V is installed in the notification apparatus 3 so that the
5 approach information that arbitrary vehicle V approaches the notification point is displayed on the screen of the display device 11. As the result, it may be possible to notify the pedestrian of the useful information that the vehicle V approaches, and to improve the safety. Then, it is set that the management server 2 transmits to the notification apparatus 3, the
10 determination information determining whether the pedestrian P can safely pass the notification point. Therefore, it may be possible to improve the safety for the pedestrian P.

[0051]

Furthermore, according to the embodiment, the calculator 4 of the
15 management server 2 is configured to determine error detection or instrument abnormality in the detection device of the notification apparatus 3 when the inconsistency occurs in information among multiple passage records. The passage information notification system 1 according to the embodiment has multiple observation points. Therefore, when the
20 inconsistency in information occurs among multiple passage records, it may be possible to determine that the error detection or the device abnormality occurs somewhere, and identification becomes easy. It may be possible to promptly provide the address.

[0052]

25 According to the above embodiment, the observation point and the notification point are configured to be common. However, it may not be always set that the observation point and the report point are exactly similar, and the information collection terminal and the notification terminal may be separately installed in another device as the separated device. According to
30 the embodiment described above, the notification apparatus is installed at the intersection C portion. However, it may be also possible to install the information collection device or the notification terminal at the key point of the road such as a branch point of the road, a sharp curve point.

[0053]

35 Furthermore, the embodiment described above is configured to notify both the driver of the vehicle V and the pedestrian P of the passage of the

vehicle V or the pedestrian P. However, the embodiment described above can be configured to collect the passage information towards only the vehicle V, for example, and to perform the notification, or the like. It can be configured to distinguish not only an automobile but also a motorcycle or the like, and to detect as the vehicle V. In addition, it may be possible to provide various modifications as a configuration of the detection device that detects the vehicle or the pedestrian.

[0054]

Although the present disclosure has been described in accordance with the embodiments, it is understood that the present disclosure is not limited to the embodiments and structures disclosed therein. The present disclosure may cover various modification examples and equivalent arrangements. Furthermore, various combination and formation, and other combination and formation including one, more than one or less than one element may be made in the present disclosure.

CLAIMS

1. A passage information notification system (1) that notifies passage information on a vehicle and/or a pedestrian on a road, the passage information notification system comprising:

5 a management server (2);

a plurality of information collection terminals (3), each of the information collection terminal being installed at one of a plurality of observation points on a key point of the road; and

10 a plurality of information notification terminals (3), each of the information notification terminals being installed at one of a plurality of notification points on a key point of the road,

wherein:

each of the information collection terminals (3) includes

15 a detection device (9, 10) that is configured to detect passage of the vehicle and/or the pedestrian at each of the observation points, and

a detection information transmission device (6) that is configured to transmit passage record detected by the detection device (9, 10) to the management server (2) in real time;

the management server includes

20 a reception device (6) that is configured to receive the passage record transmitted from each of the information collection terminals,

a database (5) that is configured to store the received passage record,

25 a prediction device (4) that is configured to comprehensively predict passage of the vehicle and/or the pedestrian at each of the notification points, based on the passage record received in real time and the passage record stored in a past in the database, and

30 a prediction information transmission device (6) that is configured to transmit passage prediction information predicted by the prediction device (4) to a notification terminal (3) at a corresponding notification point; and

each of the notification terminals (3) includes

35 a reception device (8) that is configured to receive the passage prediction information transmitted from the management server (2), and

a notification device (11) that is configured to notify the passage of the vehicle and/or the pedestrian at a corresponding notification point, based on the passage prediction information.

5 2. The passage information notification system according to claim 1, wherein:

the notification point is set at a point of an intersection on the road.

10 3. The passage information notification system according to claim 1 or claim 2, wherein:

the observation point and the notification point are common, and

the information collection terminal and the notification terminal (3) are provided as an integrated mode.

15 4. The passage information notification system according to any one of claims 1 to 3, wherein:

the detection device (9, 10) includes a vehicle identification device that is configured to identify a vehicle based on a number plate; and

20 the passage record includes vehicle identification information of the vehicle.

5. The passage information notification system according to any one of claims 1 to 4, wherein:

25 the notification device (11) includes a display device that is visible from a driver of the vehicle; and

the notification device causes the display device on a screen to display approach information that a different vehicle or the pedestrian approaches the notification point.

30 6. The passage information notification system according to any one of claims 1 to 5, wherein:

the notification device (11) includes a display device that is visible from the pedestrian, and

35 the notification device causes the display device on a screen to display approach information that arbitrary vehicle approaches the notification point.

7. The passage information notification system according to claim 6, wherein:

5 the management server (2) is configured to transmit to the notification terminal (3), determination information determining whether the pedestrian can safely pass the notification point, when the pedestrian exists near the notification point.

10 8. The passage information notification system according to any one of claims 1 to 7, wherein:

the management server (2) includes a determination device that is configured to determine error detection or instrument abnormality in the detection device (9, 10) when inconsistency occurs in information among a plurality of passage records.

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