

TRAFFIC INFORMATION PROVIDING SYSTEM AND
TRAFFIC INFORMATION PROVIDING METHOD

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates to a traffic information providing system for and method of providing traffic information with a high degree of accuracy for vehicles wherever they are travelling in a specific country
10 such as Japan.

Description of the Prior Art

Fig. 11 is a schematic diagram showing the structure of a prior art navigation apparatus that can be mounted in a vehicle. In the figure, reference numeral 101 denotes a
15 first receive unit for receiving electric waves from three or more satellites, reference numeral 102 denotes a storage unit for storing map information on the whole of Japan, reference numeral 103 denotes a second receive unit for receiving traffic information from an optical beacon of a
20 roadside unit arranged on a roadside, reference numeral 104 denotes a processing unit for conducting a search for some routes based on several pieces of information from those units as mentioned above, reference numeral 105 denotes a display unit for displaying processing results obtained by
25 the processing unit 104, and reference numeral 106 denotes an information input unit for inputting necessary information.

In operation, when the first receive unit 101 receives electric waves from three or more satellites, the
30 processing unit 104 measures the position of the vehicle

based on the received signals, reads map information from the storage unit 102 based on this measured vehicle position, and then displays a mark indicating the vehicle position on the display unit 105 together with the map.

5 And, when information on a destination is set by way of the information input unit 106 while the vehicle is at the vehicle position, the processing unit 104 conducts a search for some routes from the vehicle position to the destination, calculates the distance to the destination for
10 each of the searched routes and the time required for the vehicle to reach the destination from the vehicle speed for each of the searched routes, and then displays them on the display unit 105.

On the other hand, when the navigation apparatus
15 disposed in the vehicle receives traffic information output from an optical beacon of a roadside unit disposed on a roadside by way of the second receive unit 103, the navigation apparatus displays the traffic information on the on-screen map together with the searched routes. Then,
20 when the displayed traffic information is the one on occurrence of a traffic jam or establishment of controls on traffic, the driver gives an instruction to make a search for a bypass, by way of the information input unit 106, to the processing unit 104. As an alternative, the processing
25 unit 104 automatically conducts a search for new routes and displays them on the display unit 105. The above-mentioned traffic information includes information on traffic jams, traffic accidents, controls on traffic, unoccupied parking lots, and road conditions dependent upon current weather
30 conditions (rainfall, snow, etc.).

A problem with a prior art system for providing information for travelling vehicles constructed as above is that although by using vehicle-mounted equipment every travelling vehicle can receive positioning electric waves from satellites and measure the position thereof, and can also conduct a search for some routes from the vehicle position to a destination and calculate the time required for the vehicle to reach the destination for each of the routes from the distance from the vehicle position, by way of each route, to the destination and the vehicle speed, each searched route and the calculated required time for each searched route lack accuracy. Furthermore, even if each travelling vehicle receives traffic information given by an optical beacon of a roadside unit disposed on a roadside, the traffic information is often the one associated with vicinity of a location where a traffic jam occurs or controls on traffic are established. The traffic information is usually like "The road father from here is jammed", and does not include any other necessary information indicating how the vehicle can reach the destination at the earliest possible time.

In addition, even if traffic information is given from an optical beacon, it is not real-time information. Since the frequency of traffic information given by a frequency modulation broadcasting is about one time per 1 hour, any travelling vehicle cannot occasionally receive the traffic information timely. Accordingly, vehicle-mounted navigation apparatuses cannot conduct a search for routes to the destination which do not include locations where traffic jams occur or controls on traffic are

established, and cannot precisely measure and display the best route which offers the shortest time required for the vehicle to reach the destination.

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SUMMARY OF THE INVENTION

The present invention is proposed to solve the above-mentioned problems, and it is therefore an object of the present invention to provide a traffic information providing system and method, by broadcasting road management basic information updated successively from a satellite to all vehicles travelling within a specific country, such as Japan, capable of enabling every vehicle-mounted equipment to accurately measure a vehicle position, and, even if the destination is at a distance from the starting point, to provide precise information on road conditions from the vehicle position to the destination for vehicle occupants in real time, and to measure and display the time required for the vehicle to reach the destination with a high degree of accuracy.

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In accordance with an aspect of the present invention, there is provided a traffic information providing system comprising: a vehicle-mounted unit for receiving information from a satellite so as to measure a position of a vehicle, for conducting a search for some routes to a destination of the vehicle and for calculating a time required for the vehicle to reach the destination from the measured vehicle position for each of the routes, for displaying the routes and the time required for the vehicle to reach the destination for each of the routes, and for outputting information on the vehicle position and

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vehicle information on the vehicle; a roadside unit arranged along roads, for receiving the vehicle position information and the vehicle information output from the vehicle-mounted unit and for transmitting the received
5 vehicle position information and vehicle information; a plurality of area-by-area information integration units respectively arranged for a plurality of areas, each for receiving information output from the roadside unit, and for generating and outputting new road management basic
10 information based on the received information, previous road management basic information, and information input from outside the traffic information providing system; and a satellite up-link unit for outputting a plurality of pieces of new road management basic information transmitted
15 from the plurality of area-by-area information integration unit to the satellite in a predetermined order. The traffic information providing system can thus broadcast information approximately indicating real traffic situations to all vehicles travelling within a specific
20 country, such as Japan, by way of the satellite up-link unit and the satellite. Accordingly, any vehicle travelling anywhere in the specific country can perform a search for some routes from the vehicle position to the destination based on the information approximately
25 indicating real traffic situations from the satellite, and can measure and provide the time required for the vehicle to reach the destination for each of the searched routes for the driver with a high degree of accuracy by taking information on traffic jams, road works, etc. into
30 consideration, by means of the vehicle-mounted unit.

In accordance with another aspect of the present invention, each of the plurality of area-by-area information integration unit includes an emergency notification unit for determining whether information
5 transmitted from the roadside unit includes emergency information indicating occurrence of an emergency and, if so, for notifying a jurisdiction organization of the emergency information. When an emergency occurs in a vehicle which is travelling within a specific country, such
10 as Japan, the vehicle can notify the nearest jurisdiction organization of the occurrence of the emergency, and therefore rescue of vehicle occupants in the vehicle can be done promptly.

In accordance with a further aspect of the present
15 invention, each of the plurality of area-by-area information integration unit includes a vehicle tracking unit for determining whether information transmitted from the roadside unit includes information on a crime and, if so, for tracking a vehicle that is outputting the
20 information on a crime and notifying a jurisdiction organization of information on the tracking. The traffic information providing system can collect information from a vehicle which is being suspected of involvement in a crime, track the vehicle that is sending out the information, and
25 notify the nearest jurisdiction organization of information on the tracking successively. Accordingly, the traffic information providing system allows the jurisdiction organization to track the vehicle based on the information and hence helps an early solution of the crime or the like.

30 In accordance with another aspect of the present

invention, each of the plurality of area-by-area information integration unit includes a server for storing information offered by an outside informer together with the new road management basic information, and for
5 outputting the information offered by the outside informer as well as the new road management basic information to the satellite up-link unit. The traffic information providing system can provide various pieces of service and business information associated with searched routes other than
10 traffic information as well as road management basic information, for the driver, and also can receive and search for various pieces of service and business information properly according to settings of the driver.

In accordance with a further aspect of the present
15 invention, the system comprises three or more satellites which are semi-zenith satellites. Accordingly, any vehicle travelling anywhere in a specific country, such as Japan, can surely receive electric waves, i.e., road management basic information and various pieces of service and
20 business information from the satellites.

In accordance with another aspect of the present invention, there is provided a traffic information providing method comprising the steps of: transferring a plurality of pieces of information transmitted from a
25 plurality of area-by-area information integration unit to a satellite in a predetermined order, allowing the satellite to transmit the plurality of received pieces of information to all vehicles travelling in a specific area, allowing a vehicle-mounted unit which has received the information
30 from the satellite to measure a position of a vehicle,

perform a search for some routes to a destination of the vehicle and calculate a time required for the vehicle to reach the destination from the measured vehicle position for each of the routes, display the routes and the time
5 required for the vehicle to reach the destination for each of the routes, and output information on the vehicle position and vehicle information on the vehicle, and allowing a roadside unit to receive and transmit the vehicle position information and the vehicle information
10 output from the vehicle-mounted unit to the one area-by-area information integration unit disposed in a corresponding area. Accordingly, the road management basic information is always updated according to traffic situations which vary with time, and any travelling vehicle
15 can acquire new road management basic information anytime.

As a result, any travelling vehicle can conduct a search for routes and measure the time required for the vehicle to reach a destination for each of the routes with a high degree of accuracy based on the measured vehicle
20 position. Furthermore, any travelling vehicle can determine whether traffic jams occur in each of the searched routes, and measure and provide the best route that offers the shortest required time for the vehicle to reach the destination. It is therefore expected that the
25 traffic information providing system enables the driver to take the best action according to traffic situations. Accordingly, the traffic information providing system provide advantages of being able to shorten the driving time, clear traffic jams, bring vehicle occupants' minds
30 into a condition of stability, and improve the usefulness

of the system.

Further objects and advantages of the present invention will be apparent from the following description of the preferred embodiments of the invention as
5 illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram showing the structure of a traffic information providing system according to a
10 first embodiment of the present invention;

Fig. 2 is a block diagram concretely showing an area-by-area information integration unit of the traffic information providing system according to the first embodiment of the present invention;

15 Fig. 3 is a flow chart explaining the operation of the traffic information providing system according to the first embodiment of the present invention;

Fig. 4 is a flow chart explaining the operation of the area-by-area information integration unit of the
20 traffic information providing system according to the first embodiment of the present invention;

Fig. 5 is a block diagram concretely showing an area-by-area information integration unit of a traffic information providing system according to a second
25 embodiment of the present invention;

Fig. 6 is a flow chart explaining the operation of the area-by-area information integration unit of the traffic information providing system according to the second embodiment of the present invention;

30 Fig. 7 is a block diagram concretely showing an area-

by-area information integration unit of a traffic information providing system according to a third embodiment of the present invention;

Fig. 8 is a flow chart explaining the operation of the area-by-area information integration unit of the traffic information providing system according to the third embodiment of the present invention;

Fig. 9 is a block diagram concretely showing an area-by-area information integration unit of a traffic information providing system according to a fourth embodiment of the present invention;

Fig. 10 is a flow chart explaining the operation of the area-by-area information integration unit of the traffic information providing system according to the fourth embodiment of the present invention; and

Fig. 11 is a schematic diagram showing a prior art navigation apparatus which can be installed in vehicles.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiment 1.

Fig. 1 is a schematic diagram showing the structure of a traffic information providing system according to a first embodiment of the present invention. In the figure, reference numeral 1 denotes an area-by-area information integration unit, reference numeral 2 denotes a satellite up-link unit, reference numeral 3 denotes a satellite, reference numeral 4 denotes a vehicle, and reference numeral 5 denotes a roadside unit. A wire circuit 6 connects a corresponding area-by-area information integration unit 1 to the satellite up-link unit 2, and a

set of wire circuits 7 connect a corresponding area-by-area information integration unit 1 to a plurality of roadside units 5. A radio link 8 connects the satellite up-link unit 2 to the satellite 3, a radio link 9 connects the satellite 3 to a vehicle 4, and a radio link 10 connects a vehicle 4 to a roadside unit 5. The traffic information providing system according to the first embodiment of the present invention collects traffic information on traffic situations in the whole of a specific country, such as Japan, and then provides the collected information to each vehicle while updating it successively.

By taking geographic situations, administrative areas, road conditions, the amount of collected information, and so on into consideration, the specific country can be divided into some areas. For example, Japan is divided into four areas: Hokkaido area, East Japan area, West Japan area, and Kyushu area including Okinawa. An area-by-area information integration unit 1 is disposed for each of the plurality of areas into which the specific country is divided.

Fig. 2 is a block diagram concretely showing each area-by-area information integration unit 1 of the traffic information providing system according to the first embodiment of the present invention. Each area-by-area information integration unit 1 is provided with a prediction information storage unit 11 for storing, as prediction information, road management basic information on roads within a corresponding area (i.e., quantified information indicating an influence of the traffic congestion degree of roads which is exerted upon the times

required for vehicles to reach their destinations), which was generated previously, an information input unit 12 for inputting necessary information from outside each area-by-area information integration unit 1, a traffic situation
5 determining unit 13 for determining a traffic situation of every vehicle that can transmit vehicle information with sampling information added thereto so as to acquire traffic information, a road management basic information automatic generation unit 14 for automatically generating new road
10 management basic information based on the traffic information from the traffic situation determining unit 13, prediction information, i.e., previous road management basic information from the prediction information storage unit 11, and information input from the information input
15 unit 12.

The satellite up-link unit 2 receives a plurality of pieces of information from a plurality of area-by-area information integration units 1, and sequentially transmits the plurality of pieces of received information to the
20 satellite 3 in order of their sources, e.g., Hokkaido area, East Japan area, West Japan area, and Kyushu area including Okinawa, at predetermined intervals. For example, the satellite 3 is a semi-zenith satellite that is launched into an orbit which is inclined against the equatorial
25 plane by a fixed angle. The track of this satellite is 8-shaped when viewing the earth from the satellite. If such three satellites are provided, at least one of them can be adapted to always fly at an elevation angle of 70 degrees or more when viewed from anywhere in the specific country
30 such as Japan. Each of the three satellites can receive

the plurality of pieces of information transmitted from the satellite up-link unit 2, and transmit the plurality of pieces of information to the whole of the specific country in the order in which they have been received using a
5 predetermined amount of power and also transmit an electric wave to allow each vehicle 4 to measure its position.

Each vehicle 4 is equipped with an apparatus for receiving information on road conditions, business information, etc. transmitted from the satellite 3, and is
10 also provided with equipment for receiving information from roadside units 5 when each vehicle cannot receive any electric wave directly from the satellite 3 because it is moving through a tunnel or the like. In addition, each vehicle 4 has a navigation apparatus for measuring the
15 position of each vehicle based on the received information and for providing information on conditions (road conditions associated with the travelling direction of each vehicle) in which each vehicle is placed for the driver. The navigation apparatus always provides the best route to
20 the destination and an estimation of the time required for the vehicle to reach the destination for the driver based on the received information. In this case, the navigation apparatus can provide a plurality of possible routes and suggest the best one of them. Furthermore, each vehicle 4
25 is equipped with an apparatus for transmitting the measured vehicle position and information on the vehicle while the vehicle is moving.

A plurality of roadside units 5 are arranged at locations and at predetermined intervals, where they need
30 to be provided, on roadsides of motorways in the whole of

the specific country, such as Japan, so as to ensure good receipt of electric waves. Furthermore, each roadside unit 5 can receive information from the satellite 3 so as to offer the information to vehicles which are travelling through a region, such as a tunnel, where they cannot receive any electric wave directly from the satellite 3. Each roadside unit 5 also receives information transmitted from every vehicle travelling within a receiving region thereof in which it can receive information from travelling vehicles and transmits the received information to one area-by-area information integration unit 1 disposed in a corresponding area in real time.

Fig. 3 is a flow chart explaining the operation of the traffic information providing system according to the first embodiment of the present invention. Each area-by-area information integration unit 1, in step ST1, outputs road management basic information to the satellite up-link unit 2 at all times. The satellite up-link unit 2, in step ST2, processes a plurality of pieces of information from the plurality of area-by-area information integration units 1 respectively arranged in the plurality of areas of the specific country, and sequentially sends out the plurality of pieces of processed information from the plurality of area-by-area information integration units 1, as electric waves, to the satellite 3 in order of their sources, e.g., in the case of Japan, Hokkaido area, East Japan area, West Japan area, and Kyushu area including Okinawa, at predetermined intervals.

When the satellite 3 receives the information from the satellite up-link unit 2, it, in step ST3, adds

information for specifying itself to the received information and then transmits the received information to the whole of the specific country using a predetermined amount of transmission power.

5 Each vehicle 4, in step ST4, receives an electric wave from the satellite 3 and measures its vehicle position. By taking the area-by-area road management basic information which has been transmitted from the satellite 3 into consideration, each vehicle 4 also conducts a search
10 for some routes to a destination and the time required for the vehicle to reach the destination for each of the routes from the measured vehicle position. Each vehicle 4 then provides the searched routes and the time required for the vehicle to reach the destination for each of the searched
15 routes for the driver and transmits information on the vehicle position and vehicle information on each vehicle.

Each roadside unit 5, in step ST5, receives information transmitted from all vehicles which are moving through a receiving region thereof, and transmits the
20 received information to one area-by-area information integration unit 1 disposed in a corresponding area in real time. Each roadside unit 5 can also receive information from the satellite 3 and offer the information to every vehicle which is travelling through a corresponding region,
25 such as a tunnel, where it cannot receive any electric wave directly from the satellite 3. Each area-by-area information integration unit, in step ST6, updates previous road management basic information stored therein so as to generate new road management basic information based on the
30 received information from a plurality of roadside units 5

arranged in a corresponding area.

Fig. 4 is a flow chart explaining the operation of each area-by-area information integration unit 1 of the traffic information providing system according to the first embodiment of the present invention. Each area-by-area information integration unit 1, in step ST11, determines whether each vehicle information received by each of a plurality of roadside units 5 disposed in a corresponding area has sampling information by means of the traffic situation determining unit 13. If so, each area-by-area information integration unit 1, in step ST12, automatically generates new road management basic information based on information from the traffic situation determining unit 13, the prediction information, i.e., the previous road management basic information from the prediction information storage unit 11 and information input by way of the information input unit 12, by means of the road management basic information automatic generation unit 14, and then outputs the newly-generated road management basic information to the satellite up-link unit 2. Each area-by-area information integration unit 1 then, in step ST13, updates the previous road management basic information stored in the prediction information storage unit 11. As a result, the road management basic information stored in the prediction information storage unit 11 is always updated according to real traffic situations. By automatically generating new road management basic information based on the prediction information stored in the prediction information storage unit 11, traffic information approximately indicating real traffic situations can be

provided for all vehicles in the whole of the specific country such as Japan.

As mentioned above, in accordance with the first embodiment of the present invention, the traffic
5 information providing system transfers a plurality of pieces of information output from the plurality of area-by-area information integration units in a predetermined order from the satellite up-link unit to at least a satellite, allows the satellite to transmit those pieces of
10 information to every vehicle travelling within a specific country, allows a vehicle-mounted apparatus disposed in every travelling vehicle to receive the pieces of information and measure the position thereof, and to conduct a search for some routes to a destination and
15 display the time required for every vehicle to reach the destination from the vehicle position for each of the searched routes, allows another vehicle-mounted apparatus disposed in every travelling vehicle to output information on the vehicle position and vehicle information on every
20 vehicle, and allows a plurality of roadside units to transmit the vehicle position information and the vehicle information from every travelling vehicle to one area-by-area information integration unit arranged in a corresponding area. Accordingly, the traffic information
25 providing system of the present embodiment can provide traffic information approximately indicating real traffic situations for all vehicles travelling within a specific country, such as Japan, at the same time.

As a result, any vehicle travelling anywhere in the
30 specific country can perform a search for some routes from

the vehicle position to a destination based on information approximately indicating real traffic situations, which has been transmitted from a satellite, and can measure the time required for the vehicle to reach the destination for each
5 of the searched routes by taking information on traffic jams, controls on traffic, road works, etc. into consideration. Accordingly, any travelling vehicle can provide the best route that enables the driver to accurately reach the destination at the earliest possible
10 time for the driver.

Embodiment 2.

Fig. 5 is a block diagram concretely showing each area-by-area information integration unit of a traffic
15 information providing system according to a second embodiment of the present invention. In the figure, the same components as those of Fig. 1 are designated by the same reference numerals and therefore the explanation of those components will be omitted hereafter. In Fig. 5,
20 reference numeral 15 denotes an emergency information collecting/notification unit, and reference numeral 16 denotes a jurisdiction organization.

Each vehicle 4 can have a function of automatically sending out an SOS signal, i.e., emergency information, and
25 information that can be identified from outside each vehicle, when each vehicle encounters an emergency, such as an accident, which is defined by standards unitedly set in the whole of a specific country, such as Japan, and the driver or fellow passengers are put in a critical situation
30 in which they cannot behave autonomously.

Each vehicle 4 can also have a function of, when a vehicle occupant determines that an emergency occurs and rescue is needed, sending out an SOS signal, i.e., emergency information, and information that can be
5 identified from outside each vehicle according to an operation of the vehicle occupant.

A plurality of roadside units 5 are arranged at locations and at predetermined intervals, where they need to be provided, on roadsides of motorways in the whole of
10 the specific country, such as Japan, so as to ensure good receipt of electric waves, each roadside unit 5 being provided with equipment for receiving an SOS signal transmitted from a vehicle which is travelling within a receiving region thereof and which has encountered an
15 emergency.

Fig. 6 is a flow chart explaining the operation of each area-by-area information integration unit 1 of the traffic information providing system according to the second embodiment of the present invention. The emergency
20 information collecting/notification unit 15, which is disposed in each area-by-area information integration unit 1, in step ST21, determines whether information has been transmitted from any roadside unit 5 disposed in a corresponding area. If so, the emergency information
25 collecting/notification unit 15, in step ST22, analyzes the information transmitted to the corresponding area-by-area information integration unit and determines whether the information includes emergency information. If the information includes emergency information, the emergency
30 information collecting/notification unit 15 then, in step

ST23, collects the emergency information and notifies the nearest jurisdiction organizations 16, such as a police office, a fire station, or an office of Japan Highway Public Corporation, of the emergency information. The
5 transmission of newly-generated road management basic information output from each area-by-area information integration unit 1 is performed in the same way as shown in the flow chart of Fig. 3, and therefore the explanation of the transmission of newly-generated road management basic
10 information will be omitted hereafter.

As mentioned above, in accordance with the second embodiment of the present invention, when an emergency occurs in a vehicle 4 which is travelling within a specific country, such as Japan, the vehicle 4 can notify the
15 nearest jurisdiction organization of emergency information indicating the occurrence of an emergency. Accordingly, rescue of vehicle occupants in the vehicle can be done promptly.

20 Embodiment 3.

Fig. 7 is a block diagram concretely showing each area-by-area information integration unit of a traffic information providing system according to a third
25 embodiment of the present invention. In the figure, the same components as those of Fig. 1 are designated by the same reference numerals and therefore the explanation of those components will be omitted hereafter. In Fig. 7, reference numeral 17 denotes a vehicle tracking unit.

Fig. 8 is a flow chart explaining the operation of
30 each area-by-area information integration unit 1 of the

traffic information providing system according to the third embodiment of the present invention. The vehicle tracking unit 17, which is disposed in each area-by-area information integration unit 1, in step ST31, determines whether
5 information has been transmitted from any roadside unit 5 disposed in a corresponding area. If so, the vehicle tracking unit 17 further, in step ST32, determines whether the received information includes information transmitted from a vehicle which is being suspected of involvement in a
10 crime or the like. If the received information includes information transmitted from a vehicle which is being suspected of involvement in a crime or the like, the vehicle tracking unit 17 then, in step ST33, automatically tracks the vehicle that is sending out the information, and
15 successively notifies a jurisdiction organization 16 of information on the tracking.

As mentioned above, in accordance with the third embodiment of the present invention, the traffic information providing system can collect information from
20 any vehicle which is being suspected of involvement in a crime or the like, automatically track the vehicle that is sending out the information, and successively notify the nearest jurisdiction organization of information on the tracking. Accordingly, the traffic information providing
25 system allows the jurisdiction organization to track any vehicle which is being suspected of involvement in a crime or the like based on tracking information and hence helps an early solution of the crime or the like.

30 Embodiment 4.

Fig. 9 is a block diagram concretely showing each area-by-area information integration unit of a traffic information providing system according to a fourth embodiment of the present invention. In the figure, the same components as those of Fig. 1 are designated by the same reference numerals and therefore the explanation of those components will be omitted hereafter. In Fig. 9, reference numeral 18 denotes a server for storing various pieces of service and business information, which have been provided by informers 19, and for, when an informer provides service and business information thereto, furnishing the provided service and business information to a satellite up-link unit 2. The informers 19 include tourist associations, municipalities, Japan Highway Public Corporation, restaurants, convenience stores, etc.

Fig. 10 is a flow chart explaining the operation of each area-by-area information integration unit 1 of the traffic information providing system according to the fourth embodiment of the present invention. The server 17, which is disposed in each area-by-area information integration unit 1, in step ST41, determines whether a piece of service and business information has been provided thereto, and, if so, outputs the piece of service and business information to the satellite up-link unit 2. The satellite up-link unit 2, in step ST42, processes road management basic information and one or more pieces of service and business information output from a plurality of area-by-area information integration units 1 respectively disposed in a plurality of areas, and then transmits them, as electric waves, to a satellite 3.

When the satellite 3 receives the road management basic information and one or more pieces of service and business information from the satellite up-link unit 2, the satellite 3, in step ST43, adds information for specifying
5 itself to the received road management basic information and service and business information and then transmits them to the whole of a specific country, such as Japan, using a predetermined amount of transmission power.

Each travelling vehicle 4 receives the road
10 management basic information and service and business information transmitted from the satellite 3 and measures the position of each vehicle. By taking the area-by-area road management basic information which has been transmitted from the satellite 3 into consideration, each
15 vehicle 4 also conducts a search for routes to a destination and provides the searched routes for the driver. Each travelling vehicle 4 further, in step ST44, provides information other than the traffic information associated with the searched routes based on the received
20 service and business information, which has been transmitted from the satellite, as well as the road management basic information, for the driver.

As mentioned above, in accordance with the fourth embodiment of the present invention, the traffic
25 information providing system can provide various pieces of service and business information other than traffic information associated with searched routes as well as road management basic information, for the driver, and also can receive and search for various pieces of service and
30 business information properly according to settings done by

the driver.

Embodiment 5.

As previously mentioned, the traffic information
5 providing system according to any one of the above-
mentioned embodiments, by using three semi-zenith
satellites at least one of which is adapted to always fly
at an elevation angle of 70 degrees or more when viewed
from anywhere in a specific country such as Japan, enables
10 any vehicle travelling anywhere in the specific country to
surely receive an electric wave from any one of the three
semi-zenith satellites. As an alternative, by using some
of a plurality of geostationary satellites which have been
used for communications, road management basic information
15 can be transmitted to the whole of the specific country,
such as Japan, at all times. In this variant, the same
advantages can be provided. In addition, either or all of
the above-mentioned second through fifth embodiments can be
combined to the above-mentioned first embodiment.

20 Many widely different embodiments of the present
invention may be constructed without departing from the
spirit and scope of the present invention. It should be
understood that the present invention is not limited to the
specific embodiments described in the specification, except
25 as defined in the appended claims.



WHAT IS CLAIMED IS:

1. A traffic information providing system comprising:
a vehicle-mounted means for receiving information
5 from a satellite so as to measure a position of a vehicle,
for conducting a search for some routes to a destination of
the vehicle and for calculating a time required for the
vehicle to reach the destination from the measured vehicle
position for each of the routes, for displaying the routes
10 and the time required for the vehicle to reach the
destination for each of the routes, and for outputting
information on the vehicle position and vehicle information
on the vehicle;

a roadside means arranged along roads, for receiving
15 the vehicle position information and the vehicle
information output from said vehicle-mounted means and for
transmitting the received vehicle position information and
vehicle information;

a plurality of area-by-area information integration
20 means respectively arranged for a plurality of areas, each
for receiving information output from said roadside means,
and for generating and outputting new road management basic
information based on the received information, previous
road management basic information, and information input
25 from outside said traffic information providing system; and

a satellite up-link means for outputting a plurality
of pieces of new road management basic information
transmitted from said plurality of area-by-area information
integration means to said satellite in a predetermined
30 order.



2. The traffic information providing system according to Claim 1, wherein each of said plurality of area-by-area information integration means includes an emergency notification means for determining whether information transmitted from said roadside means includes emergency information indicating occurrence of an emergency and, if so, for notifying a jurisdiction organization of the emergency information.

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3. The traffic information providing system according to Claim 1, wherein each of said plurality of area-by-area information integration means includes a vehicle tracking means for determining whether information transmitted from said roadside means includes information on a crime and, if so, for tracking a vehicle that is outputting the information on a crime and notifying a jurisdiction organization of information on the tracking.

4. The traffic information providing system according to Claim 1, wherein each of said plurality of area-by-area information integration means includes a server for storing information offered by an outside informer together with the new road management basic information, and for outputting the information offered by the outside informer as well as the new road management basic information to said satellite up-link means.

5. The traffic information providing system according to Claim 1, wherein said system comprises three or more



satellites that are semi-zenith satellites.

6. A traffic information providing method comprising the steps of: transferring a plurality of pieces of information transmitted from a plurality of area-by-area information integration means to a satellite in a predetermined order, allowing said satellite to transmit the plurality of received pieces of information to all vehicles travelling in a specific area, allowing a vehicle-mounted means which has received the information from said satellite to measure a position of a vehicle, perform a search for some routes to a destination of the vehicle and calculate a time required for the vehicle to reach the destination from the measured vehicle position for each of the routes, display the routes and the time required for the vehicle to reach the destination for each of the routes, and output information on the vehicle position and vehicle information on the vehicle, and allowing a roadside means to receive and transmit the vehicle position information and the vehicle information output from said vehicle-mounted means to said one area-by-area information integration means disposed in a corresponding area.