

DESCRIPTION

Title of Invention

INFORMATION COLLECTION DEVICE, INFORMATION COLLECTION
METHOD, AND PROGRAM

Technical Field

[0001]

The present invention relates to an information collection device, an information collection method, and a program.

Priority is claimed on Japanese Patent Application No. 2014-198406, filed September 29, 2014, the content of which is incorporated herein by reference.

Background Art

[0002]

A technology in which a vehicle-mounted device mounted on a vehicle collects probe information including a position, a speed, or the like at which a vehicle actually travels at predetermined time intervals or predetermined travel distances, and transmits the probe information to a roadside device provided on the road side is known (see, for example, PTL 1). Roadside devices are provided at respective places, and traffic information indicating traffic jam or a traffic jam situation is

generated in a center server or the like on the basis of the probe information collected from a plurality of roadside devices and provided to a user.

Citation List

Patent Literature

[0003]

PTL 1: Japanese Unexamined Patent Application

Publication No. 2008-070974

Summary of Invention

Technical Problem

[0004]

Incidentally, in such a vehicle-mounted device, for example, in a case where a vehicle travels at a curve or an intersection, it is desirable to acquire as much continuous probe information as possible during turning. Meanwhile, from the viewpoint of suppression of the amount of communication with the roadside device or the center server, it is desirable to reduce the number of acquisitions of the probe information in a case where the vehicle travels at low speed or stops due to traffic jam or the like in order to reduce the information amount of the probe information.

[0005]

However, in some cases, for example, a required amount of probe information cannot be acquired during

turning by merely acquiring the probe information at predetermined time intervals or at predetermined travel distance intervals. Meanwhile, in a case where the time interval or the travel distance interval for acquisition of the probe information is narrowed, the acquired information amount of the probe information greatly increases, and a communication amount when the probe information is transmitted to the center server or the like increases. Therefore, it is difficult to appropriately collect necessary probe information while suppressing a communication amount of the probe information.

[0006]

The present invention has been made in view of such circumstances, and an object thereof is to provide an information collection device, an information collection method, and a program capable of appropriately collecting necessary probe information according to a status change of a moving body.

Solution to Problem

[0007]

An information collection device according to an aspect of the present invention includes: a probe information generation unit (102) that generates probe

information indicating at least a position of a moving body in a case where an elapsed time or a movement distance of the moving body satisfies a predetermined basic condition, using a reference point corresponding to generation of the probe information as a starting point; a condition monitoring unit (104) that monitors whether an additional condition different from the basic condition is satisfied on the basis of a status change of the moving body; a generation command unit (105) that causes the probe information generation unit to generate the probe information in a case where the condition monitoring unit determines that the additional condition is satisfied; and a probe information output unit (103) that outputs the probe information generated by the probe information generation unit.

With this configuration, the information collection device can collect at least the probe information generated in a case where the elapsed time or the movement distance of the moving body satisfies the basic condition, and can further collect the probe information generated in a case where the additional condition is satisfied. Therefore, it is possible to appropriately generate necessary probe information on the basis of the status change of the moving body while suppressing an information amount of the generated probe information.

[0008]

Further, according to an aspect of the present invention, in the information collection device described above, the probe information generation unit generates the probe information on the basis of an instruction of the generation command unit in a case where the condition monitoring unit determines that the additional condition is satisfied before the basic condition is satisfied.

With this configuration, the information collection device can collect at least the probe information generated in a case where the elapsed time or the movement distance of the moving body satisfies the basic condition, and can further collect the probe information generated in a case where the additional condition is satisfied. Therefore, it is possible to appropriately generate necessary probe information on the basis of the status change of the moving body while suppressing an information amount of the generated probe information.

[0009]

Further, according to an aspect of the present invention, in the information collection device described above, the probe information generation unit determines whether or not the basic condition is satisfied after the condition monitoring unit determines that the additional condition is not satisfied, and generates the probe

information in a case where the probe information generation unit determines that the additional condition or the basic condition is satisfied.

With this configuration, the information collection device can determine whether or not the probe information is generated in consideration of the additional condition in preference to the basic condition.

[0010]

Further, according to an aspect of the present invention, in the information collection device described above, the condition monitoring unit monitors whether the additional condition is satisfied in a period from a time point serving as a starting point using the time point different from the reference point when the basic condition is determined as the starting point.

With this configuration, the information collection device can freely set the reference point of the basic condition and the reference point of the additional condition.

[0011]

Further, according to an aspect of the present invention, in the information collection device described above, the condition monitoring unit determines that the additional condition is satisfied in a case where a change amount from the reference point indicating a status change

of the moving body exceeds a predetermined threshold value.

With this configuration, the information collection device can generate necessary probe information in a case where the status of the moving body greatly changes, on the basis of the change amount of the status change of the moving body having exceeded the threshold value.

[0012]

Further, according to an aspect of the present invention, in the information collection device described above, the condition monitoring unit determines that the additional condition is satisfied in a case where a change amount of an orientation indicating a traveling direction of the moving body as the change amount indicating the status change of the moving body exceeds a predetermined threshold value.

With this configuration, the information collection device can generate necessary probe information by determining that the additional condition is satisfied due to the change amount of the orientation exceeding a predetermined threshold value when a vehicle turns around a curve or an intersection. Therefore, it is possible to generate probe information necessary for recognition of movement of a moving body when a vehicle turns around a curve or an intersection.

[0013]

Further, according to an aspect of the present invention, in the information collection device described above, the condition monitoring unit determines that the additional condition is satisfied in a case where a change amount of a charging status of a storage battery included in the moving body as the change amount indicating the status change of the moving body exceeds a predetermined threshold value.

With this configuration, the information collection device can generate necessary probe information by determining that the additional condition is satisfied due to the change amount in a residual storage amount of the moving body exceeding a predetermined threshold value. Therefore, it is possible to generate probe information necessary for monitoring of the residual storage amount of the moving body.

[0014]

Further, according to an aspect of the present invention, in the information collection device described above, the condition monitoring unit determines that the additional condition is satisfied in a case where a change amount of a moving speed of the moving body as a change amount indicating a status change of the moving body exceeds a predetermined threshold value.

With this configuration, the information collection

device can generate necessary probe information by determining that the additional condition is satisfied due to the change amount in a movement speed of the moving body exceeding a predetermined threshold value. Therefore, it is possible to generate probe information necessary for monitoring of a movement status of the moving body of which a moving speed abruptly changes.

[0015]

Further, according to an aspect of the present invention, in the information collection device described above, the condition monitoring unit determines that the additional condition is satisfied in a case where occurrence of an abnormality in the moving body is detected.

With this configuration, the information collection device can generate necessary probe information by determining that the additional condition is satisfied on the basis of occurrence of an abnormality in the moving body having been detected. Therefore, it is possible to generate the probe information necessary to analyze the abnormality occurring in the moving body.

[0016]

Further, according to an aspect of the present invention, in the information collection device described above, the condition monitoring unit determines that the

additional condition is satisfied in a case where a predetermined operation from a user is input to the moving body.

With this configuration, the information collection device can generate necessary probe information by determining that the additional condition is satisfied on the basis of a predetermined operation from the user having been input to the moving body. Therefore, it is possible to generate the probe information necessary to analyze a travel situation or the like according to the operation of the user.

[0017]

Further, an information collection method according to an aspect of the present invention includes: a probe information generation step of generating probe information indicating at least a position of a moving body in a case where an elapsed time or a movement distance of the moving body satisfies a predetermined basic condition, using a reference point corresponding to generation of the probe information as a starting point; a condition monitoring step of monitoring whether an additional condition different from the basic condition is satisfied on the basis of a status change of the moving body; a generation command step of generating the probe information in a case where it is determined in the

condition monitoring step that the additional condition is satisfied; and a probe information output step of outputting the probe information generated on the basis of the generation command step.

With this configuration, it is possible to collect at least the probe information generated in a case where the elapsed time or the movement distance of the moving body satisfies the basic condition, and to further collect the probe information generated in a case where the additional condition is satisfied. Therefore, it is possible to appropriately generate necessary probe information on the basis of the status change of the moving body while suppressing an information amount of the generated probe information.

[0018]

A program according to an aspect of the present invention is a program for causing a computer to function as: probe information generation means for generating probe information indicating at least a position of a moving body in a case where an elapsed time or a movement distance of the moving body satisfies a predetermined basic condition, using a reference point corresponding to generation of the probe information as a starting point; condition monitoring means for monitoring whether an additional condition different from the basic condition is

satisfied on the basis of a status change of the moving body; generation command means for causing the probe information generation means to generate the probe information in a case where the condition monitoring means determines that the additional condition is satisfied; and probe information output means that outputs the probe information generated by the probe information generation means.

With this configuration, it is possible to collect at least the probe information generated in a case where the elapsed time or the movement distance of the moving body satisfies the basic condition, and to further collect the probe information generated in a case where the additional condition is satisfied. Therefore, it is possible to appropriately generate necessary probe information on the basis of the status change of the moving body while suppressing an information amount of the generated probe information.

[0019]

Further, an information collection device according to an aspect of the present invention includes a condition monitoring unit (104) that determines whether or not a condition for irregularly generating probe information indicating at least a position of a moving body is satisfied, on the basis of a change amount indicating a

status change of a moving body regardless of an elapsed time or a movement distance of the moving body using a reference point corresponding to generation of the probe information as a starting point, a probe information generation unit (502) that generates the probe information in a case where the condition monitoring unit determines the condition is satisfied, and a probe information output unit (103) that outputs the probe information generated by the probe information generation unit.

With this configuration, the information collection device can appropriately generate probe information necessary to recognize the status change of the moving body regardless of an elapsed time or the movement distance of the moving body while suppressing an information amount of probe information to be generated.

Advantageous Effects of Invention

[0020]

According to the information collection device, the information collection method, and the program described above, it is possible to appropriately collect necessary probe information according to the status change of the moving body.

Brief Description of Drawings

[0021]

Fig. 1 is a schematic diagram illustrating an example of an information collection system according to a first embodiment of the present invention.

Fig. 2 is a block diagram illustrating a configuration example of an information collection device according to the first embodiment of the present invention.

Fig. 3 is a flowchart illustrating an example of a probe information generation process according to the first embodiment of the present invention.

Fig. 4 is a flowchart illustrating another example of the probe information generation process according to the first embodiment of the present invention.

Fig. 5 is a flowchart illustrating an example of an application condition determination process according to the first embodiment of the present invention.

Fig. 6 is a diagram illustrating an acquisition example of probe information in the information collection device according to the first embodiment of the present invention.

Fig. 7 is a block diagram illustrating a configuration example of an information collection device according to a second embodiment of the present invention.

Fig. 8 is a flowchart illustrating an example of a probe information generation process according to the second embodiment of the present invention.

Fig. 9 is a block diagram illustrating a configuration example of an information collection device according to a third embodiment of the present invention.

Fig. 10 is a flowchart illustrating an example of a probe information generation process according to the third embodiment of the present invention.

Description of Embodiments

[0022]

[First Embodiment]

Hereinafter, an example of an information collection system 1 according to an embodiment of the present invention will be described. Fig. 1 is a schematic diagram illustrating an example of an information collection system 1 according to an embodiment of the present invention.

[0023]

(Overall configuration)

As illustrated in Fig. 1, the information collection system 1 includes an information collection device 100, a roadside device 200, and a center server 300.

The information collection device 100 is mounted on a vehicle 400 and collects probe information. The probe information includes at least information indicating a position of the vehicle 400. However, the probe

information may include information indicating a travel speed of the vehicle 400, information indicating a status change of the vehicle, or the like. The vehicle 400 is an example of a moving body, and is not limited thereto. For example, the vehicle 400 may be a moving body such as an airplane or a person.

[0024]

The roadside device 200 is provided on a predetermined roadside such as an intersection. The roadside device 200 is connected to a roadside antenna 201 provided on the roadside and communicates with the information collection device 100 that is in a communication area via the roadside antenna 201. The roadside device 200 requests the communicatable information collection device 100 to transmit probe information and receives the probe information from the information collection device 100. Here, the information collection device 100 transmits all pieces of probe information generated after previous communication with the roadside device 200, to the roadside device 200.

[0025]

The center server 300 receives the probe information from the roadside device 200 provided in various places, and generates traffic information indicating presence or absence of a traffic jam, a place at which it is easy for

dangerous driving to is performed, a place at which there is a dangerous curve, or the like on the basis of the received probe information.

[0026]

(Configuration of information collection device 100)

Next, a configuration example of the information collection device 100 will be described with reference to Fig. 2. Fig. 2 is a block diagram illustrating a configuration example of the information collection device 100.

The information collection device 100 includes a communication unit 11, a clock 12, a position information acquisition unit 13, a vehicle status detection unit 14, a CPU 15, and a storage unit 16.

The communication unit 11 performs, for example, short-distance communication with the roadside device 200.

The clock 12 measures current date and time, and outputs information indicating the current date and time to the CPU 15.

The position information acquisition unit 13 acquires, for example, position information indicating a current position of the vehicle 400 using a satellite positioning system, and outputs the position information to the CPU 15.

[0027]

The information collection device 100 includes, as the vehicle status detection unit 14, an acceleration sensor, a geomagnetic sensor, a charging rate calculation device, a sensor that detects a magnitude of impact on the vehicle 400, an operating unit (for example, a wiper, an air conditioner, or a horn) of the vehicle 400, a sensor that detects a rotation speed of an engine in the vehicle status detection unit 14, or the like, and acquires information indicating a change in a status of the vehicle 400.

The vehicle status detection unit 14 is a detection unit that detects a change in a status of the vehicle 400. For example, the vehicle status detection unit 14 calculates information indicating a traveling direction (hereinafter referred to as orientation information) of the vehicle 400 on the basis of a detection result of the acceleration sensor, the geomagnetic sensor, or the like, and outputs the information. Further, the vehicle status detection unit 14 is a charging rate calculation device and calculates a charging rate (SOC: state of charge) on the basis of a detection value of a current flowing through a storage battery of the vehicle 400 or a inter-terminal voltage, and outputs information indicating the charging rate (hereinafter referred to as SOC information) of the storage battery of the vehicle 400 (hereinafter

referred to as SOC information). Further, the vehicle status detection unit 14 outputs information indicating a magnitude of detected impact (hereinafter referred to as impact amount information) on the basis of a detection result from a sensor or the like that detects the magnitude of the impact on the vehicle 400. Further, the vehicle status detection unit 14 is communicatably connected to the vehicle 400, and acquires operation information indicating operation content regarding an operation of a wiper, an air conditioner, a horn, or the like of the vehicle 400 performed by the user. The operation information is output from the operating unit of the vehicle 400 to the vehicle status detection unit 14 by the operating unit being operated by the user. Further, the vehicle status detection unit 14 detects a rotation speed of the engine of the vehicle 400, and outputs information indicating the detected rotation speed of the engine.

[0028]

The CPU 15 is a control unit that generally controls the information collection device 100. The CPU 15 includes a speed information acquisition unit 101, a probe information generation unit 102, a probe information output unit 103, a condition monitoring unit 104, a generation command unit 105, and an output command unit

106.

[0029]

The speed information acquisition unit 101 acquires a moving speed of the vehicle 400 on the basis of a detection result of the vehicle status detection unit 14. For example, the speed information acquisition unit 101 calculates the moving speed of the vehicle 400 on the basis of the information indicating a rotation speed of an engine input from the vehicle status detection unit 14.

[0030]

The probe information generation unit 102 generates probe information in a case where the elapsed time or the movement distance of the moving body satisfies a predetermined basic condition using a reference point corresponding to the generation of the probe information as a starting point. The basic condition is a condition for regularly generating the probe information according to the elapsed time or the movement distance, which is a condition that defines an interval for regular generation of the probe information. The probe information generation unit 102 includes a timer that measures the elapsed time from the reference point, and a counter that measures the movement distance from the reference point. The probe information generation unit 102 determines whether or not the elapsed time or the movement distance

of the moving body satisfies a predetermined basic condition on the basis of a measurement result of the timer or the counter. Further, the probe information generation unit 102 generates probe information in a case where generation of the probe information is instructed from the generation command unit 105.

In this embodiment, the probe information generation unit 102 sets a first reference point in a case where the information collection device 100 is powered on and the position information acquisition unit 13 is ready to acquire position information. The probe information generation unit 102 determines whether or not to generate probe information on the basis of the set reference point. The probe information generation unit 102 resets the reference point each time the probe information is generated. The probe information generation unit 102 determines whether or not to generate the next probe information on the basis of the reset reference point. The present invention is not limited thereto and the probe information generation unit 102 may set a cumulative value of a time when previous probe information is generated or the travel distance of the vehicle 400 using the elapsed time or the movement distance as the reference point.

[0031]

The probe information output unit 103 outputs the

probe information generated by the probe information generation unit 102 to the roadside device 200 via the communication unit 11. The probe information output unit 103 outputs probe information when output of the probe information is instructed from the output command unit 106.

[0032]

The condition monitoring unit 104 monitors whether an additional condition different from the basic condition is satisfied on the basis of the status change of the vehicle 400. The additional condition is a condition that defines a timing at which the probe information is irregularly generated according to the status change of the vehicle 400 regardless of the elapsed time or the movement distance of the moving body. The condition monitoring unit 104 is communicatably connected to the vehicle 400 and acquires operation information indicating the operation content input by the user to the vehicle 400.

In this embodiment, the condition monitoring unit 104 determines whether the additional condition is satisfied after the probe information is generated using a time at which previous probe information is generated as a reference point. That is, the reference point of the basic condition is the same as the reference point of the additional condition. Hereinafter, an example in which the reference point of the basic condition is the same as

the reference point of the additional condition will be described, but other embodiments are not limited thereto. For example, the reference point of the basic condition may be different from and the reference point of the additional condition.

Further, in this embodiment, the condition monitoring unit 104 performs a process of determining the additional condition in parallel with the process of determining the basic condition in the probe information generation unit 102.

[0033]

In a case where the condition monitoring unit 104 determines that the additional condition is satisfied, the generation command unit 105 outputs a command (hereinafter referred to as a generation command) for instructing generation of the probe information to the probe information generation unit 102 so that the probe information is generated.

[0034]

In a case where a predetermined output timing is determined to have been reached or in a case where the condition monitoring unit 104 determines that the additional condition is satisfied, the output command unit 106 outputs a command (hereinafter referred to as an output command) for instructing output of the probe

information to the probe information output unit 103 so that the probe information is output. The predetermined output timing may be when a predetermined time has elapsed or when the vehicle has traveled a predetermined distance within an area of communication with the roadside device 200.

[0035]

The storage unit 16 stores basic condition information 161 and additional condition information 162.

The basic condition information 161 includes information (for example, one minute) indicating a time interval T defined in the basic condition or information (for example, 500 m) indicating a movement distance D defined in the basic condition.

The additional condition information 162 includes information indicating a timing at which the probe information defined in the additional condition is generated. For example, the additional condition information 162 includes a threshold value according to a change amount of the status change of the vehicle 400.

More specifically, the additional condition information 162 includes a threshold value that is compared with the change amount of an orientation indicating the traveling direction of the vehicle 400. Further, the additional condition information 162 includes

a threshold value that is compared with the change amount of a charging status of the storage battery of the vehicle 400. Further, the additional condition information 162 includes a threshold value that is compared with a change amount of the moving speed of the vehicle 400. Further, the additional condition information 162 includes events determined as the additional condition in advance. As the events, occurrence of an abnormality in the vehicle 400 and input of a predetermined operation from the user to the vehicle 400 are specifically determined. For example, as the occurrence of the abnormality in the vehicle 400, a case where the magnitude of the impact detected by the vehicle status detection unit 14 is equal to or greater than a threshold value, a case where the engine does not start and engine failure is suspected even when a key is turned on, a case where a trunk or a door is not completely closed (a half door state), or the like is determined. Further, as the input of a predetermined operation from the user to the vehicle 400, a case where the wiper, the air conditioner, the horn, or the like of the vehicle 400 is operated by the user, or the like is determined.

[0036]

(Example of probe information generation process)

Next, an example of the process of generating probe

information in the information collection device 100 will be described with reference to Fig. 3. Fig. 3 is a flowchart illustrating an example of a process of generating probe information in the information collection device 100.

[0037]

(Step ST101)

First, when the vehicle 400 is powered on, the information collection device 100 is also powered on. If the information collection device 100 is powered on, the probe information generation unit 102 sets the reference point and notifies the condition monitoring unit 104 that the reference point has been set. Further, the probe information generation unit 102 starts measurement of the timer from a time when the reference point is set.

[0038]

If the condition monitoring unit 104 is notified that the reference point has been set, the condition monitoring unit 104 determines whether or not the additional condition is satisfied after the reference point has been set on the basis of the status change of the vehicle 400. In a case where at least one of a plurality of additional conditions is satisfied, the condition monitoring unit 104 determines that the additional condition is satisfied. A process of the

condition monitoring unit 104 will be described below with reference to Fig. 5. In a case where the condition monitoring unit 104 determines that the additional condition is satisfied, the generation command unit 105 outputs a generation command for instructing generation of probe information to the probe information generation unit 102.

[0039]

(Step ST102)

The probe information generation unit 102 determines whether or not the generation command has been input from the generation command unit 105.

[0040]

(Step ST103)

In a case where the probe information generation unit 102 does not determine that the generation command has been input from the generation command unit 105 (step ST102: NO), the probe information generation unit 102 determines whether or not a time T determined in the basic condition has elapsed from the reference point set in step ST101 on the basis of the current time measured by the clock 12 by referring to the basic condition information 161 of the storage unit 16. For example, in a case where the timer starting the measurement from the time at which the reference point has been set measures the time T, the

probe information generation unit 102 determines that the time T has elapsed from the time at which the reference point has been set. When the probe information generation unit 102 does not determine that the time T has elapsed from the time at which the reference point has been set (step ST103: NO), the probe information generation unit 102 returns to step ST102 to repeat the process.

[0041]

(Step ST104)

In a case where the probe information generation unit 102 determines that the generation command has been input from the generation command unit 105 in step ST102 (step ST102: YES), or in a case where the probe information generation unit 102 determines that the time T has elapsed from the time at which the reference point has been set in step ST103 (step ST103: YES), the probe information generation unit 102 regards the position information input from the position information acquisition unit 13 at a timing the generation command is input or at a timing at which the probe information generation unit 102 determines that the time T has elapsed from the time at which the reference point has been set, as information indicating the current position of the vehicle 400. Further, the probe information generation unit 102 regards the speed information input from the

speed information acquisition unit 101 at a timing at which the generation command has been input or at a timing at which the probe information generation unit 102 determines that the time T has elapsed from the time at which the reference point has been set, as information indicating the moving speed of the vehicle 400. Further, the probe information generation unit 102 regards information indicating a type of additional condition determined to satisfy the condition among the additional conditions, as trigger information. The probe information generation unit 102 associates the information indicating the current position of the vehicle 400, the information indicating the moving speed of the vehicle 400, and the trigger information with one another to generate the probe information. The probe information generation unit 102 outputs the generated probe information to the probe information output unit 103. The probe information generation unit 102 may cause information indicating content of the additional condition determined to satisfy the condition among the additional conditions to be included as the trigger information. Specifically, in a case where the change amount of the charging status of the storage battery of the vehicle 400 exceeds a threshold value, the probe information generation unit 102 may cause information indicating a residual storage amount of the

storage battery to be included in the trigger information.

[0042]

(Step ST105)

The probe information generation unit 102 causes, for example, a count value of the timer to return to zero or the time T at a timing at which the probe information has been generated, to reset the reference point, and notifies the condition monitoring unit 104 that the reference point has been reset. The condition monitoring unit 104 determines whether or not the additional condition is satisfied after the reference point is reset. In a case where the condition monitoring unit 104 determines that the additional condition is satisfied, the generation command unit 105 outputs the generation command to the probe information generation unit 102, and the probe information generation unit 102 executes the process of step ST103. That is, the probe information generation unit 102 determines whether the time T has elapsed from the time at which the reference point has been reset (a time at which the previous probe information has been generated).

The probe information generation unit 102 is not limited to the process of resetting the reference point of the built-in timer, and may be configured to determine whether a predetermined time has elapsed from the time at

which the previous probe information has been generated. For example, the probe information generation unit 102 may store the time at which the previous probe information has been generated, as the reference point, and may generate the probe information in a case where a time after a predetermined time from the stored time is reached.

[0043]

(Step ST106)

The probe information generation unit 102 determines whether or not the process ends. For example, when the vehicle 400 is powered off, the probe information generation unit 102 determines that the process ends (step ST106: YES), and ends the process.

On the other hand, in a case where the probe information generation unit 102 does not determine to end the process (step ST106: NO), the probe information generation unit 102 returns to step ST102 to repeat the process.

[0044]

(Another example of the probe information generation process)

Next, another example of the process of generating the probe information in the information collection device 100 will be described with reference to Fig. 4. Fig. 4 is a flowchart illustrating another example of the process of

generating the probe information in the information collection device 100. This process is mainly different from the process described with reference to Fig. 3 in that it is determined whether the time T has elapsed from the reference point, but is substantially the same process as the process described with reference to Fig. 3. Therefore, detailed description of the same processes will be omitted.

[0045]

(Step ST201)

First, the information collection device 100 is also powered on due to the vehicle 400 being powered on. If the information collection device 100 is powered on, the probe information generation unit 102 sets a reference point and notifies the condition monitoring unit 104 that the reference point has been set. The probe information generation unit 102 starts counting of the counter measuring the movement distance from the time at which the reference point has been set.

In a case where it is notified that the reference point has been set, the condition monitoring unit 104 determines whether the additional condition is satisfied, after the reference point is set, on the basis of the status change of the vehicle 400. In a case where the condition monitoring unit 104 determines that the

additional condition has been satisfied, the generation command unit 105 outputs the generation command for instructing the generation of the probe information to the probe information generation unit 102.

[0046]

(Step ST202)

The probe information generation unit 102 determines whether or not the generation command has been input from the generation command unit 105.

[0047]

(Step ST203)

In a case where the probe information generation unit 102 does not determine that the generation command is input from the generation command unit 105 (step ST202: NO), the probe information generation unit 102 determines whether or not the vehicle has moved by the movement distance D determined in the basic condition from the set reference point set in the step ST201 on the basis of the movement distance of the vehicle 400 acquired by the vehicle status detection unit 14 by referring to the basic condition information 161 in the storage unit 16. The probe information generation unit 102 determines whether or not the vehicle has moved by the movement distance D, for example, from a point at which the reference point has been set. The probe information generation unit 102

determines that the vehicle has moved by the movement distance D from the point at which the reference point has been set, for example, in a case where the counter having started measurement of the movement distance from the point at which the reference point has been set has measured the movement distance D. The probe information generation unit 102 returns to the step ST202 to repeat the process in a case where the probe information generation unit 102 does not determine that the vehicle has moved by the movement distance D from the point at which the reference point has been set (Step ST203: NO).

[0048]

(Step ST204)

In a case where the probe information generation unit 102 determines that the generation command has been input from the generation command unit 105 in step ST202 (step ST202: YES), or in a case where the probe information generation unit 102 determine that the vehicle has moved by the movement distance D from the point at which the reference point has been set in step ST203 (step ST203: YES), the probe information generation unit 102 regards the position information input from the position information acquisition unit 13 at a timing at which the generation command has been input or at a timing at which the probe information generation unit 102 determines that

the vehicle has moved by the movement distance D from the point at which the reference point has been set, as information indicating the current position of the vehicle 400. Further, the probe information generation unit 102 regards the speed information input from the speed information acquisition unit 101 at a timing at which the generation command has been input or at a timing at which the probe information generation unit 102 determines that the vehicle has moved by the movement distance D from the point at which the reference point has been set, as information indicating the moving speed of the vehicle 400. Further, the probe information generation unit 102 regards information indicating a type of additional condition determined to satisfy the condition among the additional conditions, as trigger information. The probe information generation unit 102 associates the information indicating the current position of the vehicle 400, the information indicating the moving speed of the vehicle 400, and the trigger information with one another to generate the probe information. The probe information generation unit 102 outputs the generated probe information to the probe information output unit 103.

[0049]

(Step ST205)

The probe information generation unit 102 causes,

for example, a count value of the timer to return to zero or the movement distance D at a timing at which the probe information has been generated, to reset the reference point, and notifies the condition monitoring unit 104 that the reference point has been reset. The condition monitoring unit 104 determines whether or not the additional condition is satisfied after the reference point is reset. In a case where the condition monitoring unit 104 determines that the additional condition is satisfied, the generation command unit 105 outputs the generation command to the probe information generation unit 102, and the probe information generation unit 102 executes the process of step ST203. That is, the probe information generation unit 102 determines whether or not the vehicle has moved by the movement distance D from the point at which the reference point has been reset (a point at which the previous probe information has been generated).

The probe information generation unit 102 is not limited to the process of resetting the reference point of the embedded counter and may be configured to be able to determine whether the vehicle has moved by a predetermined distance from the time at which the previous probe information has been generated. For example, the probe information generation unit 102 may store a cumulative

value of the travel distance of the vehicle 400 when the previous probe information has been generated, as the reference point, and may generate probe information in a case where the cumulative value of the travel distance of the vehicle 400 reaches a value obtained by adding a predetermined distance to the stored cumulative value.

[0050]

(Step ST206)

The probe information generation unit 102 determines whether or not the process ends. For example, when the vehicle 400 is powered off, the probe information generation unit 102 determines that the process ends (step ST206: YES), and ends the process.

On the other hand, in a case where the probe information generation unit 102 does not determine that the process ends (step ST206: NO), the probe information generation unit 102 returns to step ST202 to repeat the process.

[0051]

(Example of additional condition determination process)

Next, an example of an additional condition determination process in the condition monitoring unit 104 will be described with reference to Fig. 5. Fig. 5 is a flowchart illustrating an example of an additional

condition determination process in the condition monitoring unit 104. In this embodiment, the condition monitoring unit 104 executes the following process when the condition monitoring unit 104 is notified, for example, that the reference point is set or reset from the probe information generation unit 102. Other embodiments are not limited thereto, and the condition monitoring unit 104 may set or reset the reference point at which an additional condition determination process is executed at predetermined intervals, and execute the following process according to the reference point having been set or reset.

[0052]

(Step ST301)

The condition monitoring unit 104 determines whether or not the change amount in an orientation indicating the traveling direction of the vehicle 400 exceeds a predetermined threshold value on the basis of the orientation information output from the vehicle status detection unit 14 by referring to the additional condition information 162 of the storage unit 16.

(Step ST302)

In a case where it is not determined that the change amount in the orientation indicating the traveling direction of the vehicle 400 has exceeded the predetermined threshold value (step ST301: NO), the

condition monitoring unit 104 determines whether or not the change amount of the charging status of the storage battery included in the vehicle 400 has exceeded a predetermined threshold value on the basis of the SOC information output from the vehicle status detection unit 14.

(Step ST303)

In a case where it is not determined that the change amount of the charging status of the storage battery included in the vehicle 400 has exceeded a predetermined threshold value (step ST302: NO), the condition monitoring unit 104 determines whether or not the change amount in the moving speed of the vehicle 400 has exceeded the predetermined threshold value on the basis of the moving speed of the vehicle 400 acquired by the speed information acquisition unit 101.

(Step ST304)

In a case where it is not determined that the change amount in the moving speed of the vehicle 400 has exceeded the predetermined threshold value (step ST303: NO), the condition monitoring unit 104 determines whether an abnormality has occurred in the vehicle 400.

(Step ST305)

In a case where it is not determined that an abnormality has occurred in the vehicle 400 (step ST304:

NO), the condition monitoring unit 104 determines whether or not a predetermined operation has been input from the user to the vehicle 400.

[0053]

(Step ST306)

In step ST301, in a case where the change amount in the orientation indicating the traveling direction of the vehicle 400 is determined to have exceeded a predetermined threshold value on the basis of the orientation information from the vehicle status detection unit 14 (step ST301: YES), the condition monitoring unit 104 determines that the additional condition is satisfied. Specifically, the condition monitoring unit 104 may determine that the additional condition is satisfied in a case where the orientation indicating the traveling direction has exceeded a predetermined angle threshold value, or may determine that the additional condition is satisfied in a case where the acceleration detected by the acceleration sensor has exceeded a threshold value (a value corresponding to a predetermined orientation threshold value).

In step ST302, in a case where the change amount of the charging status of the storage battery included in the vehicle 400 is determined to have exceeded a predetermined charging threshold value on the basis of the SOC

information from the vehicle status detection unit 14 (step ST302: YES), the condition monitoring unit 104 determines that the additional condition is satisfied.

In step ST303, in a case where the change amount in the moving speed of the vehicle 400 is determined to have exceeded a predetermined speed threshold value on the basis of the moving speed of the vehicle 400 from the speed information acquisition unit 101 (step ST303: YES), the condition monitoring unit 104 determines that the additional condition is satisfied.

In step ST304, in a case where a magnitude of the impact detected by the vehicle status detection unit 14 is determined to be equal to or greater than the threshold value, for example, on the basis of impact information from the vehicle status detection unit 14, the condition monitoring unit 104 determines that an abnormality has occurred in the vehicle 400 (step ST304: YES), and the condition monitoring unit 104 determines that the additional condition is satisfied.

In step ST305, in a case where an operation input to the vehicle 400 has been a predetermined operation which is determined in advance, for example, on the basis of operation information indicating the operation input to the vehicle 400, the condition monitoring unit 104 determines that a predetermined operation from the user

has been input to the vehicle 400 (step ST305: YES), and the condition monitoring unit 104 determines that the additional condition is satisfied.

[0054]

(Step ST307)

In a case where the condition monitoring unit 104 determines that the additional condition is satisfied, the generation command unit 105 outputs a generation command for instructing generation of the probe information to the probe information generation unit 102.

(Step ST308)

On the other hand, in step ST305, in a case where a predetermined operation from the user is not determined to have been input to the vehicle 400 (step ST305: NO), the condition monitoring unit 104 does not determine that the additional condition is satisfied.

[0055]

(Example of acquisition of probe information)

Next, an example of acquisition of the probe information in the information collection device 100 according to this embodiment will be described with reference to Fig. 6. Fig. 6 is a diagram illustrating an example of acquisition of the probe information in the information collection device 100 according to this embodiment.

For example, the vehicle 400 travels along a road from a starting point and generates probe information P1 to P15. A state in which the generated probe information P1 to P15 are aligned on the basis of the information indicating the current position of the vehicle 400 included in the probe information is illustrated in Fig. 6.

In this example, the probe information generation unit 102 generates probe information P2 at a timing at which one minute has elapsed from a time at which the probe information P1 has been generated. This shows that the additional condition is not determined to be satisfied and the travel distance from the time of the generation of the probe information P1 is 500 m or less in a period from the time of the generation of the probe information P1 to the elapse of one minute.

Further, the probe information generation unit 102 generates probe information P4 at a timing at which the vehicle has moved by 500 m from a time at which the probe information P3 has been generated. This shows that the additional condition is not determined to be satisfied and an elapsed time from the time of the generation of the probe information P3 is one minute or less in a period from the time of the generation of the probe information P3 to the movement by 500 m.

Further, the probe information generation unit 102

generates probe information P10 at a timing at which a traveling direction of the vehicle 400 has turned 15° from a time at which the probe information P9 has been generated. This shows that an elapsed time from the time of the generation of the probe information P9 is one minute or less, and the travel distance from the time of the generation of the probe information P9 is 500 m or less in a period from the time of the generation of the probe information P9 to the 15° turn of the traveling direction of the vehicle 400.

[0056]

[Second Embodiment]

Next, a second embodiment according to the present invention will be described with reference to Fig. 7. Fig. 7 is a block diagram illustrating a configuration example of an information collection device 500 according to this embodiment.

The information collection device 500 includes a communication unit 11, a clock 12, a position information acquisition unit 13, a vehicle status detection unit 14, a CPU 55, and a storage unit 16. Since the communication unit 11, the clock 12, the position information acquisition unit 13, and the vehicle status detection unit 14 have the same configurations as those in the first embodiment, detailed description thereof will be omitted.

[0057]

The CPU 55 includes a speed information acquisition unit 101, a probe information generation unit 502, a probe information output unit 103, a condition monitoring unit 104, a generation command unit 105, and an output command unit 106. Since the speed information acquisition unit 101, the probe information output unit 103, the condition monitoring unit 104, the generation command unit 105, and the output command unit 106 have the same configurations as those in the first embodiment, detailed description thereof will be omitted.

[0058]

The probe information generation unit 502 determines whether or not the basic condition is satisfied after the condition monitoring unit 104 determines that the additional condition is not satisfied, in consideration of the additional condition in preference to the basic condition.

In a case where the probe information generation unit 502 determines that the additional condition or the basic condition is satisfied, the probe information generation unit 502 generates the probe information.

[0059]

(Example of probe information generation process)

Next, an example of the process of generating probe

information in the information collection device 500 will be described with reference to Fig. 8. Fig. 8 is a flowchart illustrating an example of a process of generating probe information in the information collection device 500.

[0060]

(Step ST401)

First, when the vehicle 400 is powered on, the information collection device 500 is also powered on. If the information collection device 500 is powered on, the probe information generation unit 502 sets the reference point and notifies the condition monitoring unit 104 that the reference point has been set.

[0061]

(Step ST402)

If the condition monitoring unit 104 is notified that the reference point has been set, the condition monitoring unit 104 determines whether or not the additional condition is satisfied on the basis of the status change of the vehicle 400. In a case where the condition monitoring unit 104 determines that the additional condition is satisfied, the generation command unit 105 outputs a generation command for instructing generation of probe information to the probe information generation unit 502. On the other hand, if the additional

condition is determined not to be satisfied, the condition monitoring unit 104 notifies the probe information generation unit 502 that the additional condition is not satisfied.

The probe information generation unit 502 determines whether or not the condition monitoring unit 104 determines that the additional condition is satisfied.

[0062]

(Step ST403)

In a case where the condition monitoring unit 104 determines that the additional condition is not satisfied (step ST402: NO), the probe information generation unit 502 determines whether or not whether or not the basic condition is satisfied on the basis of the reference point set in step ST401. For example, the probe information generation unit 502 determines whether or not the time T has elapsed from a time at which the reference point has been set or whether the vehicle has moved by the movement distance D from a point at which the reference point has been set. In a case where the probe information generation unit 502 determines that the basic condition is not satisfied, the probe information generation unit 502 returns to step ST402 to repeat the process.

[0063]

(Step ST404)

In a case where it is determined in step ST402 that the additional condition is satisfied (step ST402: YES), or in a case where it is determined in step ST403 that the basic condition is satisfied (step ST403: YES), the probe information generation unit 102 regards the position information input from the position information acquisition unit 13 at a timing at which the additional condition is determined to be satisfied or at a timing at which the basic condition is determined to be satisfied, as information indicating the current position of the vehicle 400. The probe information generation unit 102 associates the information indicating the current position of the vehicle 400, the information indicating the moving speed of the vehicle 400, and the trigger information with one another to generate the probe information.

[0064]

(Step ST405)

The probe information generation unit 102 resets the reference point at a timing at which the probe information has been generated, and notifies the condition monitoring unit 104 that the reference point has been reset.

[0065]

(Step ST406)

The probe information generation unit 502 determines whether or not the process ends. For example, when the

vehicle 400 is powered off, the probe information generation unit 502 determines that the process ends (step ST406: YES) and ends the process.

On the other hand, in a case where the probe information generation unit 502 does not determine that the process ends (step ST406: NO), the probe information generation unit 502 returns to step ST402 to repeat the process.

[0066]

[Third Embodiment]

Next, a third embodiment according to the present invention will be described with reference to Fig. 9. Fig. 9 is a block diagram illustrating an example of a configuration of an information collection device 600 according to this embodiment.

The information collection device 600 includes a communication unit 11, a clock 12, a position information acquisition unit 13, a vehicle status detection unit 14, a CPU 65, and a storage unit 16. Since the communication unit 11, the clock 12, the position information acquisition unit 13, and the vehicle status detection unit 14 have the same configurations as those in the first embodiment, detailed description thereof will be omitted.

[0067]

The CPU 55 includes a speed information acquisition

unit 101, a probe information generation unit 602, a probe information output unit 103, a condition monitoring unit 604, a generation command unit 105, and an output command unit 106. Since the speed information acquisition unit 101, the probe information output unit 103, the generation command unit 105, and the output command unit 106 have the same configurations as those in the first embodiment, detailed description thereof will be omitted.

[0068]

The condition monitoring unit 604 sets the reference point of the additional condition. For example, the condition monitoring unit 604 sets the reference point for determining generation of the next probe information after the reference point of the additional condition is reset due to the generation of the previous probe information.

[0069]

The probe information generation unit 602 determines whether or not the basic condition is satisfied on the basis of the reference point of the basic condition different from the reference point of the additional condition. Further, the probe information generation unit 602 determines whether or not the probe information is generated in consideration of the additional condition in preference to the basic condition. Specifically, the probe information generation unit 602 sets the reference point

of the basic condition different from the reference point of the additional condition after the condition monitoring unit 104 determines that the additional condition is not satisfied, and determines whether or not the basic condition is satisfied. In a case where the probe information generation unit 502 determines that the additional condition or the basic condition is satisfied, the probe information generation unit 502 generates the probe information.

[0070]

(Example of probe information generation process)

Next, an example of process of generating the probe information in the information collection device 600 will be described with reference to Fig. 10. Fig. 10 is a flowchart illustrating an example of process of generating the probe information in the information collection device 600.

[0071]

(Step ST501)

First, if the vehicle 400 is powered on, the information collection device 600 is also powered on. If the information collection device 600 is powered on, the condition monitoring unit 604 sets the reference point of the additional condition.

[0072]

(Step ST502)

After the reference point of the additional condition is set, the condition monitoring unit 604 determines whether or not the additional condition is satisfied on the basis of the status change of the vehicle 400. In a case where the condition monitoring unit 104 determines that the additional condition is satisfied, the generation command unit 105 outputs the generation command for instructing generation of the probe information to the probe information generation unit 502. On the other hand, in a case where the additional condition is determined not to be satisfied, the condition monitoring unit 604 notifies the probe information generation unit 602 that the additional condition is not satisfied.

[0073]

(Step ST503)

When the probe information generation unit 602 is notified that the additional condition is not satisfied from the condition monitoring unit 604 (step ST502: NO), the probe information generation unit 602 sets the reference point of the basic condition. In a case where the reference point of the basic condition has already been set (in a case where the previous reference point of the basic condition has not been reset), the probe information generation unit 602 does not set the reference

point of the basic condition.

[0074]

(Step ST504)

After the reference point of the basic condition is set, the probe information generation unit 502 determines whether or not the basic condition is satisfied. For example, the probe information generation unit 502 determines whether or not the time T has elapsed from a time at which the reference point of the basic condition is set or whether the vehicle has moved by the movement distance D from a point at which the reference point of the basic condition has been set.

In a case where the probe information generation unit 502 determines that the basic condition is not satisfied, the probe information generation unit 502 returns to step ST502 and determines whether the additional condition is satisfied again. In a case where the probe information generation unit 502 determines that the additional condition is not satisfied, the probe information generation unit 502 determines whether or not the basic condition is satisfied on the basis of the reference point of the basic condition that has been already set.

[0075]

(Step ST505)

In a case where it is determined in step ST502 that the additional condition is satisfied (step ST502: YES), or in a case where it is determined in step ST504 that the basic condition is satisfied (step ST504: YES), the probe information generation unit 602 regards the position information input from the position information acquisition unit 13 at a timing at which the additional condition is determined to be satisfied or at a timing at which the basic condition is determined to be satisfied, as information indicating the current position of the vehicle 400. The probe information generation unit 602 associates the information indicating the current position of the vehicle 400, the information indicating the moving speed of the vehicle 400, and the trigger information with one another to generate the probe information.

[0076]

(Step ST506)

The probe information generation unit 602 instructs the condition monitoring unit 604 to reset the reference point of the additional condition at a timing at which the probe information has been generated. The condition monitoring unit 604 resets the reference point of the additional condition according to the instruction from the probe information generation unit 602. In the case where the reference point of the basic condition is set, the

probe information generation unit 602 resets the reference point of the basic condition.

[0077]

(Step ST507)

The probe information generation unit 602 determines whether or not the process ends. For example, in a case where the vehicle 400 is powered off, the probe information generation unit 602 determines that the process ends (step ST507: YES) to end the process.

On the other hand, in a case where the probe information generation unit 602 does not determine that the process ends (step ST507: NO), the probe information generation unit 602 returns to step ST501 to repeat the process.

[0078]

(Other replacement or modification of each configuration)

The components in the above-described embodiment can be appropriately replaced with the well-known components without departing from the scope of the present invention. Further, the technical scope of the present invention is not limited to the above embodiment, and various changes can be made without departing from the scope of the present invention.

[0079]

For example, in a case where it is determined whether the time T has elapsed from the reference point as the basic condition as described with reference to Fig. 3, a process of determining whether the vehicle has moved by the movement distance D from the reference point may be added as the additional condition. Further, in a case where it is determined whether the vehicle has moved by the movement distance D as the basic condition as described with reference to Fig. 4, a process of determining whether the time T has elapsed from the reference point may be added as the additional condition. Further, the probe information generation unit 102 may execute both of the determination as to whether the time T has elapsed from the reference point as the basic condition and the determination as to whether the vehicle has moved by the movement distance D as the basic condition.

[0080]

Further, the example in which the probe information generation unit 102 or 502 resets the reference point each time the probe information generation unit generates the probe information has been described in the above embodiment, but the present invention is not limited thereto. The probe information output unit 103 may reset the reference point each time the probe information output

unit 103 transmits the probe information.

[0081]

The determination as to whether the additional condition is satisfied is not limited to the above-described order.

Further, the determination as to whether the additional condition is satisfied may be performed in parallel by preparing the condition monitoring units 104, which determine whether the additional condition is satisfied from the reference point, by the number of the additional conditions. Similarly, the determination as to whether or not the basic condition is satisfied may be performed in parallel by preparing determination units by the number of the basic conditions.

[0082]

Further some devices included in the vehicle status detection unit 14 (for example, an acceleration sensor, a geomagnetic sensor, a charging rate calculation device, a sensor that detects a magnitude of impact on the vehicle 400, an operating unit of the vehicle 400, and a sensor that detects the rotation speed of the engine in the vehicle status detection unit 14) may be mounted in the vehicle 400 having the vehicle information collection device 100 mounted thereon, instead of being mounted in the vehicle information collection device 100.

[0083]

Further, the example in which the generation command unit 105 causes the probe information generation unit 102 or 502 to generate the probe information in a case where the condition monitoring unit 104 determines that the additional condition is satisfied has been described in the above embodiment, but the present invention is not limited thereto. For example, the information collection device 100 or 500 may include a probe information generation unit that generates probe information on the basis of an instruction of the generation command unit 105, which is an independent probe information generation unit separate from the probe information generation unit 102 or 502. In this case, the generation command unit 105 causes the independent probe information generation unit separate from the probe information generation unit 102 or 502 to generate the probe information.

[0084]

(Operation and effects)

As described above, the information collection device 100 or 500 according to this embodiment includes the condition monitoring unit 104 that irregularly monitors whether or not the additional condition for generating the probe information is satisfied on the basis of the change amount indicating the status change of the

vehicle 400 that changes regardless of the elapsed time or the movement distance of the vehicle 400, and the probe information generation unit 102 or 502 generates the probe information in a case where the condition monitoring unit 104 determines that the additional condition is satisfied.

With this arrangement, the information collection device 100 or 500 can determine that the additional condition is satisfied if the change amount indicating the status change of the vehicle 400 exceeds the threshold value or if the status change of the specific vehicle 400 is detected, and can generate the probe information. Therefore, it is possible to appropriately generate probe information necessary to recognize the status change of the moving body regardless of whether the vehicle has traveled for a predetermined time or by a predetermined distance. Further, it is possible to suppress information amount of the generated probe information by appropriately generating the necessary probe information.

[0085]

Further, in the information collection device 100, 500, or 600 according to this embodiment, in a case where the condition monitoring unit 104 determines that the additional condition is satisfied before the elapsed time or the movement distance of the moving body satisfies the basic condition, the generation command unit 105 instructs

the probe information generation unit 102 to generate the probe information.

With this configuration, the information collection device 100, 500, or 600 can collect at least the probe information generated in a case where the elapsed time or the movement distance of the moving body satisfies the basic condition, and further collect the probe information generated in a case where the additional condition is satisfied. Therefore, it is possible to appropriately generate necessary probe information on the basis of the status change of the moving body while suppressing an information amount of the generated probe information.

[0086]

Further, in the information collection device 100, 500, or 600 according to this embodiment, the probe information generation unit 102, 502, or 602 determines whether or not the basic condition is satisfied after the condition monitoring unit 104 or 604 determines that the additional condition is not satisfied, and generates the probe information in a case where the probe information generation unit determines that the additional condition or the basic condition is satisfied.

With this arrangement, the information collection device 100, 500, or 600 can determine whether or not the probe information is generated in consideration of the

additional condition in preference to the basic condition. Accordingly, the information collection device 100, 500, or 600 can generate the probe information each time in a case where the additional condition is satisfied, and generate the probe information in a case where a predetermined time has elapsed from a time when previous probe information has been collected or in a case where the vehicle has moved by a predetermined distance from a point at which the previous probe information has been collected. Therefore, it is possible to appropriately generate necessary probe information on the basis of the status change of the moving body while suppressing an information amount of the generated probe information.

[0087]

Further, in the information collection device 100, 500, or 600 according to this embodiment, the condition monitoring unit 104 or 604 monitors whether the additional condition is satisfied in a period from the time point serving as the starting point using the time point different from the reference point when the basic condition is determined as the starting point.

With this arrangement, the information collection device 100, 500, or 600 can freely set the reference point of the basic condition and the reference point of the additional condition according to superiority or

inferiority of the condition. For example, the reference point of the basic condition is assumed to be set only in a case where the additional condition is considered in preference to the basic condition and a case where the additional condition is determined not to be satisfied. Thus, since the reference point of the basic condition is not set as long as the additional condition is determined to be satisfied, the determination process based on the basic condition is not executed and it is possible to suppress generation of unnecessary probe information.

[0088]

Further, the information collection device 100 or 500 according to this embodiment includes the condition monitoring unit 104 that determines that the additional condition is satisfied in a case where the change amount indicating the status change of the vehicle 400 exceeds the predetermined threshold value.

With this configuration, the information collection device 100 or 500 can generate necessary probe information in a case where the status of the moving body greatly changes, on the basis of the change amount of the status change of the vehicle 400 having exceeded the threshold value. Thus, it is possible to generate probe information necessary to recognize the status change of the vehicle 400.

[0089]

For example, as the additional condition is determined to be satisfied on the basis of the change amount of the orientation indicating the traveling direction of the vehicle 400 exceeding the threshold value, the probe information generation unit 102 or 502 generates the probe information. Thus, the probe information generation unit 102 or 502 can generate the probe information necessary to recognize the movement of the vehicle 400 when the vehicle turns around a curve or an intersection.

[0090]

As the additional condition is determined to be satisfied on the basis of the change amount of the residual storage amount of the storage battery of the vehicle 400 exceeding the threshold value, the probe information generation unit 102 or 502 generates the probe information. Thus, the probe information generation unit 102 or 502 can generate the probe information necessary to monitor the residual storage amount of the vehicle 400.

[0091]

As the additional condition is determined to be satisfied on the basis of the change amount of the moving speed of the vehicle 400 exceeding the speed threshold value, the probe information generation unit 102 or 502

generates the probe information. Thus, the probe information generation unit 102 or 502 can generate the probe information necessary to monitor the movement status of the vehicle 400 of which the moving speed abruptly changes.

[0092]

As the additional condition is determined to be satisfied on the basis of an abnormality having occurred in the vehicle 400, the probe information generation unit 102 or 502 generates the probe information. Thus, the probe information generation unit 102 or 502 can generate the probe information necessary to analyze the abnormality occurring in the vehicle 400.

[0093]

As the additional condition is determined to be satisfied on the basis of a predetermined operation from the user being input to the vehicle 400, the probe information generation unit 102 or 502 generates the probe information. Thus, the probe information generation unit 102 or 502 can generate the probe information necessary to analyze a travelling situation or the like according to an operation input by the user.

[0094]

Further, in a case where the probe information generation unit 102 or 502 determines that the additional

condition is satisfied and generates the probe information, the probe information generation unit can include trigger information in the probe information. With this configuration, it is possible to specify a condition satisfied when the probe information is generated and to acquire information useful when a traffic state or the like is analyzed on the basis of the probe information.

[0095]

The process may be performed by recording a program for realizing the functions of the information collection device 100 or 500 in each embodiment described above on a computer-readable recording medium, loading the program recorded on the recording medium into a computer system, and executing the program. Here, the "computer system" is assumed to include an OS or hardware such as a peripheral device. Further, the "computer system" is assumed to include a WWW system including a homepage providing environment (or display environment). Further, the "computer-readable recording medium" refers to a portable medium such as a flexible disk, a magneto-optical disc, a ROM, or a CD-ROM, or a storage device such as a hard disk embedded in the computer system. Further, the "computer-readable recording medium" is also assumed to include a recording medium that holds a program for a certain period of time, such as a volatile memory (RAM) inside a computer

system including a server or a client when the program is transmitted over a network such as the Internet or a communication line such as a telephone line.

[0096]

Further, the above program may be transmitted from a computer system in which the program is stored in a storage device or the like to other computer systems via a transmission medium or by transmission waves in the transmission medium. Here, the "transmission medium" for transmitting the program refers to a medium having a function of transmitting information, such as a network (communication network) such as the Internet or a communication line such as a telephone line. Further, the above program may be a program for realizing some of the above-described functions. Further, the program may be a program capable of realizing the above-described functions in combination with a program previously recorded in a computer system, that is, a so-called differential file (a differential program).

Industrial Applicability

[0097]

According to the information collection device, the information collection method, and the program described above, it is possible to appropriately collect necessary probe information according to the status change of the

moving body.

Reference Signs List

[0098]

- 1: information collection system
- 100: information collection device
- 200: roadside device
- 201: roadside antenna
- 300: center server
- 500: information collection device
- 11: communication unit
- 12: clock
- 13: position information acquisition unit
- 14: vehicle status detection unit
- 15: CPU
- 16: storage unit
- 101: speed information acquisition unit
- 102: probe information generation unit
- 103: probe information output unit
- 104: condition monitoring unit
- 105: generation command unit
- 106: output command unit

CLAIMS

[Claim 1]

An information collection device, comprising:

a probe information generation unit that generates probe information indicating at least a position of a moving body in a case where an elapsed time or a movement distance of the moving body satisfies a predetermined basic condition, using a reference point corresponding to generation of the probe information as a starting point;

a condition monitoring unit that monitors whether an additional condition different from the basic condition is satisfied on the basis of a status change of the moving body;

a generation command unit that causes the probe information generation unit to generate the probe information in a case where the condition monitoring unit determines that the additional condition is satisfied; and

a probe information output unit that outputs the probe information generated by the probe information generation unit,

wherein the condition monitoring unit determines that the additional condition is satisfied in a case where a change amount indicating a status change of the moving body exceeds a predetermined threshold value, and

wherein the condition monitoring unit determines

that the additional condition is satisfied in a case where a change amount of an orientation indicating a traveling direction of the moving body as the change amount indicating the status change of the moving body exceeds a predetermined threshold value.

[Claim 2]

The information collection device according to claim 1,

wherein the probe information generation unit generates the probe information on the basis of an instruction of the generation command unit in a case where the condition monitoring unit determines that the additional condition is satisfied before the basic condition is satisfied in a period from the reference point.

[Claim 3]

The information collection device according to claim 1 or 2,

wherein the probe information generation unit determines whether or not the basic condition is satisfied after the condition monitoring unit determines that the additional condition is not satisfied, and generates the probe information in a case where the probe information generation unit determines that the additional condition or the basic condition is satisfied.

[Claim 4]

The information collection device according to any one of claims 1 to 3,

wherein the condition monitoring unit monitors whether the additional condition is satisfied in a period from a time point serving as a starting point using the time point different from the reference point when the basic condition is determined as the starting point.

[Claim 5]

The information collection device according to any one of claims 1 to 4,

wherein the condition monitoring unit determines that the additional condition is satisfied in a case where a change amount of a charging status of a storage battery included in the moving body as the change amount indicating the status change of the moving body exceeds a predetermined threshold value.

[Claim 6]

The information collection device according to any one of claims 1 to 5,

wherein the condition monitoring unit determines that the additional condition is satisfied in a case where a change amount of a moving speed of the moving body as a change amount indicating a status change of the moving body exceeds a predetermined threshold value.

[Claim 7]

The information collection device according to any one of claims 1 to 6,

wherein the condition monitoring unit determines that the additional condition is satisfied in a case where occurrence of an abnormality in the moving body is detected.

[Claim 8]

The information collection device according to any one of claims 1 to 7,

wherein the condition monitoring unit determines that the additional condition is satisfied in a case where a predetermined operation from a user is input to the moving body.

[Claim 9]

An information collection method, comprising:

a probe information generation step of generating probe information indicating at least a position of a moving body in a case where an elapsed time or a movement distance of the moving body satisfies a predetermined basic condition, using a reference point corresponding to generation of the probe information as a starting point;

a condition monitoring step of monitoring whether an additional condition different from the basic condition is satisfied on the basis of a status change of the moving

body;

a generation command step of generating the probe information in a case where it is determined in the condition monitoring step that the additional condition is satisfied; and

a probe information output step of outputting the probe information generated on the basis of the generation command step,

wherein the condition monitoring step is a step of determining that the additional condition is satisfied in a case where a change amount of an orientation indicating a traveling direction of the moving body exceeds a predetermined threshold value.

[Claim 10]

A program for causing a computer to function as:

probe information generation means for generating probe information indicating at least a position of a moving body in a case where an elapsed time or a movement distance of the moving body satisfies a predetermined basic condition, using a reference point corresponding to generation of the probe information as a starting point;

condition monitoring means for monitoring whether an additional condition different from the basic condition is satisfied on the basis of a status change of the moving body;

generation command means for causing the probe information generation means to generate the probe information in a case where the condition monitoring means determines that the additional condition is satisfied; and

probe information output means that outputs the probe information generated by the probe information generation means,

wherein the condition monitoring means determines that the additional condition is satisfied in a case where a change amount of an orientation indicating a traveling direction of the moving body exceeds a predetermined threshold value.