an AGNSS at an appropriate timing for the purpose of suppressing unneeded communication and reducing battery consumption.

Solution to Problem

[0008]

According to a first aspect of the invention, there is provided an in-vehicle device (10) including a determination information acquisition unit (11) that acquires determination information relating to a vehicle (1), and a timing decision unit (12) that decides a timing of downloading satellite orbit information based on the determination information.

In this way, since the timing of downloading the satellite orbit information from an AGNSS server is decided based on the determination information relating to the vehicle, download can be performed at an appropriate timing. Accordingly, frequent download is prevented, whereby unneeded communication between the in-vehicle device and the AGNSS server can be suppressed, and battery consumption due to communication of the in-vehicle device can be reduced.

[0009]

According to a second aspect of the invention, in the in-vehicle device (10) according to the first aspect of the invention, the determination information includes

a use situation of the vehicle of the user is changed, the predetermined time included in the determination information can be updated to maintain the accuracy.

[0013]

According to a sixth aspect of the invention, in the in-vehicle device (10) according to any one of the first aspect to the fifth aspect of the invention, the timing decision unit (12) decides the timing of downloading the satellite orbit information based on the determination information such that a download frequency is changed.

In this way, since the timing decision unit decides the timing of downloading the satellite orbit information based on the determination information such that the download frequency is changed, the number of times of download can be adjusted according to the need to download the satellite orbit information.

[0014]

According to a seventh aspect of the invention, in the in-vehicle device (10) according to the sixth aspect of the invention, the determination information includes information of a predetermined vehicle type, and the timing decision unit (12) decides the timing of downloading the satellite orbit information such that the download frequency becomes higher in a case where a vehicle type of the vehicle (1) is the predetermined

[0016]

According to a ninth aspect of the invention, there is provided a vehicle (1) in which the in-vehicle device (10) according to any one of the first aspect to the eighth aspect of the invention is mounted.

[0017]

According to a tenth aspect of the invention, there is provided a method for downloading satellite orbit information including a determination information step of acquiring determination information relating to a vehicle, and a timing decision step of deciding a timing of downloading the satellite orbit information based on the determination information.

[0018]

According to an eleventh aspect of the invention, there is provided a program for downloading satellite orbit information causing a computer as an in-vehicle device to function as a determination information unit that acquires determination information relating to a vehicle, and a timing decision unit that decides a timing of downloading the satellite orbit information based on the determination information.

Advantageous Effects of Invention

[0019]

With the in-vehicle device, the vehicle, the method

predetermined position from the determination information storage unit 16 as determination information and inputs the acquired information to the timing decision unit 12.

[0035]

The timing decision unit 12 decides the timing of downloading the satellite orbit information from the AGNSS server 3 through the cellular network N. The timing decision unit 12 decides the timing based on the determination information input from the determination information acquisition unit 11.

[0036]

The current position specification unit 13 is configured to specify a current position of the vehicle 1. The current position specification unit 13 calculates the distance between each of a plurality of GNSS satellites 2 and the vehicle 1 based on the time signal received by the satellite signal reception unit 15 from each of the GNSS satellites 2 and specifies the three-dimensional current position of the vehicle 1.

[0037]

The charging processing unit 14 is configured to provide a charging service as a predetermined service. Specifically, the charging processing unit 14 is configured to execute the charging processing to the vehicle 1 positioned within the predetermined charging

information of a predetermined position (charging map information) and information of a predetermined time (charging time information) as the determination information (Step S101). Specifically, the determination information acquisition unit 11 refers to the determination information storage unit 16 and acquires the charging map information and the charging time information stored in the determination information storage unit 16. The determination information acquisition unit 11 inputs the acquired charging map information and charging time information to the waiting timing decision unit 12.

[0044]

Next, the timing decision unit 12 decides the timing of downloading the satellite orbit information from the AGNSS server 3 based on the input determination information (charging map information as information of the predetermined position and charging time information as information of the predetermined time) (Step S102). Specifically, the timing decision unit 12 decides a timing, at which a current position of the vehicle 1 coincides with any one of predetermined positions included in the charging map information and a current time is a predetermined preparation time before a charging time, as the timing of downloading the satellite orbit information. The current position of the vehicle 1 is input from the

[0071]

In Fig. 8, the learning unit 21 finally stores information of "07:00:00 to 09:00:00" and "18:00:00 to 20:00:00" as information of the time having the high use frequency of the vehicle 1 in the determination information storage unit 16 as the determination information (information of the predetermined time).

[0072]

Next, the determination information acquisition unit 11 acquires information of the predetermined time as the determination information (Step S101). Specifically, the determination information acquisition unit 11 refers to the determination information storage unit 16, and acquires information of the time having the high use frequency of the vehicle 1 stored in the determination information storage unit 16. The determination information acquisition unit 11 inputs the acquired time having the high use frequency of the vehicle 1 to the waiting timing decision unit 12.

[0073]

Next, the timing decision unit 12 decides the timing of downloading the satellite orbit information from the AGNSS server 3 based on the input determination information (the time having the high use frequency of the vehicle 1 that is information of the predetermined time)

Industrial Applicability

[0081]

With the in-vehicle device, the vehicle, the waiting time management method, and the waiting time management program, download of the satellite orbit information using the AGNSS can be performed at an appropriate timing, and suppression of unneeded communication and reduction of battery consumption can be achieved.

Reference Signs List

[0082]

1: vehicle

2: GNSS satellite

3: AGNSS server

9: computer

10: in-vehicle device

11: determination information acquisition unit

12: timing decision unit

13: current position specification unit

14: charging processing unit

15: satellite signal reception unit

16: determination information storage unit

17: satellite orbit information storage unit

18: satellite orbit information reception unit

20: engine information storage unit

21: learning unit

The in-vehicle device according to claim 6,

wherein the determination information includes information of a predetermined vehicle type, and

the timing decision unit decides the timing of downloading the satellite orbit information such that the download frequency becomes lower in a case where a vehicle type of the vehicle is the predetermined vehicle type than in a case where the vehicle type is other than the predetermined vehicle type.

[Claim 9]

A vehicle in which the in-vehicle device according to any one of claims 1 to 8 is mounted.

[Claim 10]

A method for downloading satellite orbit information, the method comprising:

a determination information step of acquiring determination information relating to a vehicle; and

a timing decision step of deciding a timing of downloading the satellite orbit information based on the determination information.

[Claim 11]

A program for downloading satellite orbit information, the program causing a computer as an in-vehicle device to function as:

a determination information unit that acquires