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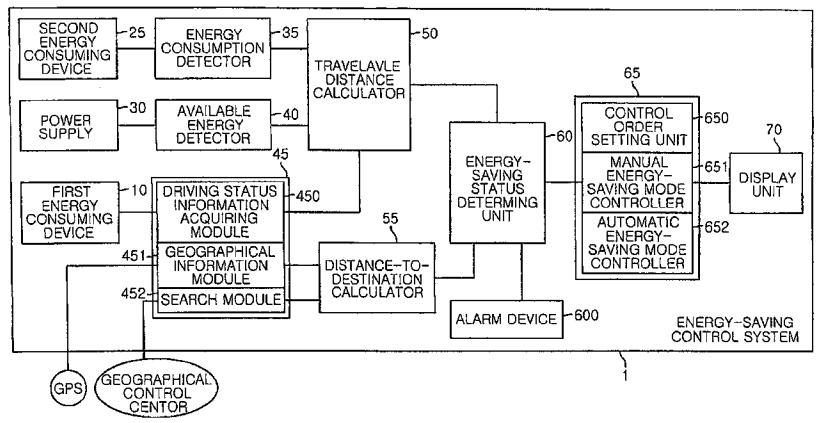
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(54) **Title**: CONTROL SYSTEM AND METHOD FOR CONTROLLING ELECTRICALLY-DRIVEN VEHICLE

[Fig. 1]



(57) **Abstract**: A vehicle control system for controlling a vehicle driven by an electric power and having a first energy consumption device for travelling, a second energy consumption device for operation other than said travelling, and one or more power supplies for supplying the electric power to the first and second power consuming device. The system includes a first distance calculating unit calculating a first distance travelable by the vehicle with a power available from the power supplies by using information on a driving status of the vehicle provided from the first energy consuming device, an amount of the power available from the power supplies, and an amount of power consumed by the second energy consuming device; a second distance calculating unit calculating a second distance between the vehicle and a destination; an energy-saving status determining unit comparing the first distance with the second distance and determining whether to operate the vehicle in an energy-saving mode; and an energy-saving mode control unit controlling the electric power supplied to the second energy consuming device.

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Description

Title of Invention: CONTROL SYSTEM AND METHOD FOR CONTROLLING ELECTRICALLY-DRIVEN VEHICLE

Technical Field

[1] The present invention relates to energy-saving control system and method for an electrically-driven moving object and, more particularly to a system for and a method of controlling an electric power to be supplied to an energy consuming device of an electrically-driven vehicle by comparing a travelable distance of the vehicle with a distance between the vehicle and a destination such that the vehicle may travel to the destination before the moving object is completely discharged.

[2]

Background Art

[3] In general, there may be several types of moving objects driven by supplying and consuming electrical energy. Recently, active researches for a moving object such as an electric vehicle, a hybrid electric vehicle, and an inductive charging electric vehicle are conducted.

[4] However, in the moving object driven by the electric energy, the electric energy that is recharged once may be not enough to travel for a long time and may be reduced by discharge and energy consumption for driving even when the electric energy is fully recharged. (e.g., International Publication No. WO 10/098547)

[5] In order for the moving object with insufficient energy to travel to an apparatus for supplying electric energy only with remaining electric energy, an energy-saving system and/or an energy-managing system are required to control an energy-consuming device and a power supply of the moving object based on information about power supply equipments for supplying electric energy.

[6] In particular, since the moving object such as an electric vehicle, a hybrid electric vehicle, and an inductive charging electric vehicle must be conveniently driven while being recharged at proper time and at a proper place, it is required a stepwise energy control system with respect to the movement to the power supply equipments for the recharging and a new energy control system for and/or method of controlling and distributing electric power suitable for the energy consuming device.

[7]

Disclosure of Invention

Technical Problem

[8] It is, therefore, an object of the present invention to provide a vehicle control system capable of preventing the electrically-driven vehicle from being completely discharged

and guaranteeing driving stability.

[9] Another object of the present invention is to provide a vehicle control method capable of preventing the electrically-driven vehicle from being completely discharged and guaranteeing driving stability.

[10]

Solution to Problem

[11] In accordance with an aspect of the present invention, there is provided a vehicle control system for controlling a vehicle driven by an electric power, the vehicle having a first energy consumption device for travelling, a second energy consumption device for operation other than said travelling, and one or more power supplies for supplying the electric power to the first and second power consuming device. The system includes a first distance calculating unit calculating a first distance which is a distance travelable by the vehicle with a power available from the power supplies, wherein the first distance calculating unit calculates the first distance by using information on a driving status of the vehicle provided from the first energy consuming device, an amount of the power available from the power supplies, and an amount of power consumed by the second energy consuming device; a second distance calculating unit calculating a second distance which is a distance between the vehicle and a destination; an energy-saving status determining unit comparing the first distance with the second distance and determining whether to operate the vehicle in an energy-saving mode in which the electric power supplied to the second power consuming device is reduced; and an energy-saving mode control unit controlling the electric power supplied to the second energy consuming device, wherein the energy-saving mode control unit reduces the power supplied to the second energy consuming device when it is determined to operate the vehicle in the energy-saving mode.

[12] In accordance with another aspect of the present invention, there is provided a vehicle control method for controlling, by using a vehicle control apparatus, a vehicle driven by an electric power, the vehicle having a first energy consumption device for travelling, a second energy consumption device for operation other than said travelling, and one or more power supplies for supplying the electric power to the first and second power consuming device. The method includes calculating a first distance which is a distance travelable by the vehicle with a power available from the power supplies by using information on a driving status of the vehicle provided from the first energy consuming device, an amount of the power available from the power supplies, and an amount of power consumed by the second energy consuming device; calculating a second distance which is a distance between the vehicle and a destination; comparing the first distance with the second distance and determining whether to operate the

vehicle in an energy-saving mode in which the electric power supplied to the second power consuming device is reduced; and reducing, at a energy-saving mode control unit of the vehicle control apparatus, the power supplied to the second energy consuming device when it is determined to operate the vehicle in the energy-saving mode.

Advantageous Effects of Invention

[13] With the vehicle control system of the present invention, the recharging of the electrically-driven moving object such as an electric car, a hybrid electric car, an inductive charging electric vehicle, an electric bicycle, an electric motorcycle, an electric train, an electric boat, and an electric aircraft, movement of the electrically-driven moving object to the power supply equipment, and the control of consuming energy may be determined rapidly and energy consumption may be reduced.

[14] Moreover, considering few charging stations and power supply equipments on the traveling course, according to the vehicle control system and method of the present invention, the driving of the electrically-driven moving object such as electric vehicles without stopping and driving stability may be guaranteed since it is possible to prevent the electrically-driven moving object from being completely discharged.

[15] Therefore, supply of energy to the electrically-driven moving object is controlled and undesired energy consumption is prevented so that energy management control system and method contributing the national economy may be provided.

[16]

Brief Description of Drawings

[17] The objects and features of the present invention will become apparent from the following description of embodiments given in conjunction with the accompanying drawings, in which:

[18] Fig. 1 is a block diagram illustrating a vehicle control system of an electrically-driven moving object according to an embodiment of the present invention;

[19] Fig. 2 is a flowchart illustrating a vehicle control method of an electrically-driven moving object according to an embodiment of the present invention; and

[20] Fig. 3 is a view illustrating an electrically-driven moving object to which the vehicle control system according to the embodiment of the present invention is applied.

[21]

Best Mode for Carrying out the Invention

[22] In this disclosure, since a vehicle control system and method for an electrically-driven moving object according to an embodiment of the present invention are applied to a vehicle, such as electric cars, hybrid electric cars, and inductive charging electric vehicles, electric bicycles, electric motorcycles, locomotive vehicles , and ships driven

with electric energy, the moving object refers to a vehicle.

[23] In a case of an electrically-driven vehicle using power supply equipments such as charging stations and recharging roads for supplying electric power, since the power supply equipments are installed at fixed places, it is very important to determine whether the electrically-drive moving object might travel to the next coming power supply equipment with the current remaining electric power for the continuous supply of the electric energy and the effective management of the energy possessed by the vehicle.

[24] In an embodiment of the present invention, it is provided a method of and a system for effective energy management of the electrically-driven moving object using power supply equipments such as charging stations and recharging roads, which includes detecting current power consumption per hour of an electrically-driven moving object and a total current-available electric power in real time to provide the detected current power consumption per hour and the total current-available electric power to a driver of the electrically-driven moving object, calculating a travelable distance with the total current-available electric power and a distance from the electrically-driven moving object to the nearest power supply equipment, and comparing the two distances with each other to control the electrically-driven moving object to travel in an energy-saving mode if the occasion arises.

[25] Hereinafter, embodiments of the present invention will be described in detail with reference to the accompanying drawings which form a part hereof. Well-known elements and description duplicated with the related art will be omitted or abstracted for the clarity and the simplicity.

[26] Fig. 1 shows a block diagram illustrating an energy-saving system 1 of an electrically-driven moving object according to an embodiment of the present invention.

[27] The vehicle control system 1 of an electrically-driven moving object includes an energy consumption detector 35 detecting energy consumption of an electrically-driven moving object, an available energy detector 40 detecting the amount of energy available for operation of the electrically-driven moving object, a driving information acquiring unit 45 acquiring and storing a position and driving status of the electrically-driven moving object in real time and positions and geometric information of power supply equipments to supply electric energy to the electrically-driven moving object, a travelable distance calculator 50 calculating a distance to travel while maintaining a current energy-consuming pattern, a distance-to-destination calculator 55 calculating a distance from a current position of the electrically-driven moving object to a destination, such as the power supply equipments for the electrically-driven moving object, an energy-saving status determining unit 60 comparing the travelable distance that are calculated by the travelable distance calculator 50 and the distance from the

current position of the electrically-driven moving object to the power supply equipment and determining whether an energy-saving mode is required to travel, and an energy-saving mode controller 65 providing required information and performing the control when the energy-saving mode is required to travel.

[28] First, several types of energy consuming devices in the electrically-driven moving object include a first energy consuming device 10 and a second energy consuming device 25. The first energy consuming device 10 includes an energy consuming device directly relating to the travel of the electrically-driven moving object such as a driving motor. The second energy consuming device 25 includes devices excluded from the first energy consuming device 10 such as an air conditioning device such as an air conditioner and a heater, an audio device such as a radio, a CD player, and the like, a display device to display information required when a driver drives the electrically-driven moving object and other information, a navigation system, a lightning device such as an indoor lamp, headlights, and the like, an electric opening device of doors and windows, and a built-in computer of the electrically-driven moving object, etc.

[29] The energy consumption detector 35 detects power consumption of the second energy consuming device of the electrically-driven moving object in real time and calculates power consumption per hour P_{Load}[kW] of the second energy consuming device 25.

[30] That is, the power consumption detector 35 detects energy consumption information data or load information data from the second energy consuming device 25. Since basically the first energy consuming device 10 driving the electrically-driven moving object must be excluded from energy-saving destinations, only the load information data about the second energy consuming device 25 is acquired.

[31] The power consumption of the second energy consuming device 25 is calculated by input voltage and current of respective second energy consuming devices 25, wherein the input voltages and the input currents of the respective second energy consuming device 25 are obtained through sensors and communication devices which are installed to the second energy consuming devices 25.

[32] When there are m second consuming devices 25 and power consumptions PL1, PL2, ..., PLm of the respective energy consuming devices 25, total power consumption of the second energy consuming devices 25 becomes P_{Load} [kW] = PL1 + PL2 + ... + PLm. As such, the power consumption detector 35 uses values inputted from the respective second energy consuming devices 25 to calculate the total power consumption of the second energy consuming devices 25, and transmits the calculated total power consumption to the travelable distance calculator 50.

[33] In this case, it is possible that each of the second energy consuming devices transmits corresponding information to the power consumption detector 35 through the commu-

nication devices or that the power consumption detector 35 is connected to the sensors of the respective second energy consuming devices 25 to detect the information directly from the respective second energy consuming devices 25.

[34] The available energy detector 40 detects power information data of a power supply 30 from the power supply 30. The term "power information data" refers to data for measuring power supplied from various power supplies of the electrically-driven moving object, including an output voltage and current.

[35] In other words, the available energy detector 40 detects electric power supplied by various power supply 30 in real time and calculates the amount of electric power suppliable to the electrically-driven moving object from the respective power supplied 30. Each of the power supply 30 includes a sensor or a communication device to transmit the power information data of a corresponding power supply 30 to the available power detector 40.

[36] The respective power supplies 30 may transmit corresponding information to the available power detector 40 through the communication devices. Also, the available power detector 40 could be connected to the sensors of the respective power supplies 30 such that the available power detector 40 directly detects the information.

[37] The power supplies 30 provided in the electrically-driven moving object may be batteries, in-vehicle chargers, capacitors, supercapacitors, etc. Since available power supplied from a battery PS1 is calculated based on a value of state of charge (SOC) and maximum power to be supplied, the value of SOC and the maximum power to be supplied are transmitted to the available energy detector 40.

[38] In an inductive charging electric vehicle as an example of the electrically-driven moving object, primary power is supplied from a in-vehicle charger collecting electric power supplied from power feed lines to the electrically-driven moving object. Since available power supplied from the in-vehicle charger PS2 is calculated based on an output voltage and an output current of the in-vehicle charger when the electrically-driven moving object is on the power feed lines, the output voltage and current of the in-vehicle charger are transmitted to the available energy detector 40. When the electrically-driven moving object is not on the power feed lines, the power supplied from the in-vehicle charger is 0 (zero).

[39] Although there are some different methods of measuring available power suitable for characteristics of other power supplies, since most calculations of power use output current and output voltage, basically currents and voltages of the respective power supplies are transmitted to the available energy detector 40.

[40] When the number of power supplies 30 of the electrically-driven moving object is n, available powers from the respective power supplies are PS1, Ps2, ..., PSn respectively and total available power of the power supplies 30 becomes P_{Source} [kWh] = PS1 + PS2

+ ... + PSn. As such, the available energy detector 40 uses inputs from the respective power supplies 30 to calculate total available power and transmits the calculated total available power of the power supplies 30 to the travelable distance calculator 50.

[41] The driving information acquiring unit 45 acquires travel information of the electrically-driven moving object from the first energy consuming device 10, positional information of the electrically-driven moving object from an GPS transmitter 15, and geographical information data requested by a navigation system, positional information and/or geographical information of a currently-traveling road, and distance information from a geographical information control center 20.

[42] The driving information acquiring unit 45 may include a driving status information acquiring module 450, a geographical information module 451, and a search module 452 which are distinguished according to types of acquired information data.

[43] In the embodiment of the present invention illustrated in Fig. 1, the travelable distance calculator 50 calculates a travelable distance based on the driving status information of the electrically-driven moving object obtained from the driving status information acquiring module 450, total power consumption P_{Load} of the electrically-driven moving object obtained from the energy consumption detector 35, and the total available power P_{Source} obtained from the available energy detector 40.

[44] In more detail, from the first energy consuming device 10, the travel information is provided to the travelable distance calculator 50 first. The travel information means driving status of a driving motor of the electrically-driven moving object and includes a driving torque τ [kgm], rotating speed ω [rpm], and driving efficiency η of the driving motor.

[45] When power consumption of the driving motor is P_{Motor} [kW], the power consumption P_{Motor} [kW] may be calculated as follows:

[46] Example of calculating the power consumption of the driving motor

[47] A braking horse power of the driving motor is $(2 \times \pi \times \tau \times \omega \times \eta)/(75 \times 60)$ and power consumption P_{Motor} [kW] of the driving motor is approximately a value of multiplying $(2 \times \pi \times \tau \times \omega \times \eta)/(75 \times 60)$ by 0.7457.

[48] The travel information of the driving motor may be provided from a motor control unit (MCU) installed in the driving motor using a controller area network (CAN).

[49] The travelable distance calculator 50 calculates a travelable time T using the calculated total power consumption P_{Load} [kW] of the electrically-driven moving object, the power consumption P_{Motor} [kW] of the driving motor, and the total available power P_{Source} [kW] as the following math equation 1(Math Figure 1).

[50]

[51] MathFigure 1

[Math.1]

$$T[h]=\frac{P_{Source}[kW]}{(P_{Load}[kW]+P_{Motor}[kW])}$$

[52]

[53] The travelable distance S [km] is calculated from the travelable time T as the following equation 2 (Math Figure 2).

[54]

[55] MathFigure 2

[Math.2]

$$S[km]=T\times V$$

[56] , where V is a vehicle speed [km/h].

[57]

[58] The calculated travelable distance S is transmitted to the energy-saving status determining unit 60.

[59] The distance-to-destination calculator 55 of Fig. 1 searches for the nearest power supply equipment from a current position of the electrically-driven moving object on the traveling course based on the geographical information from the geographical information module 451 and the positional information from the search module 452 and calculates the shortest distance to corresponding power supply equipment. Information about the traveling course of the electrically-driven moving object may be input from a travel course guide device such as a navigation system. The shortest distance to the corresponding power supply equipment may be calculated as a straight line distance using the positional information of the electrically-driven moving object and the power supply equipment only. More precisely, a navigation system provided in the electrically-driven moving object may be used to search for the course toward the power supply equipment and to calculate the distance on the course.

[60] The information about the power supply equipments and the roads may be constructed in a geographical information system of the geographical control center 20. In this case, inquiry for the information of power supply equipment nearest from the electrically-driven moving object is transmitted with the positional information of the electrically-driven moving object and the information of the travel course that is received from the navigation system to the geographical information system via a wireless line. The geographical information system searches for the nearest power supply equipment

while exploring the travel course, and calculates a distance D on the travel course between the position of the corresponding power supply equipment and the position of the electrically-driven moving object. The remote geographical information system may transmit the calculated distance D on the travel course to the electrically-driven moving object via a wireless line and the distance-to-destination calculator 55 may receive the distance D and may transmit the same to the energy-saving status determining unit 60.

[61] The energy-saving status determining unit 60 receives the travelable distance S from the travelable distance calculator 50 and the distance D to the next coming power supply equipment from the distance-to-destination calculator 55, respectively and determines the relationship therebetween.

[62] When the travelable distance S is shorter than the distance D, that is, when $S < D$, an alarm message signal is transmitted to the energy-saving mode controller 65 and an alarm device 600 in order to alarm the driver and to drive the electrically-driven moving object in an energy-saving mode. The alarm message signal includes information informing that an energy-saving mode control is required and information about the travelable distance S and the distance D to the nearest power supply equipment.

[63] The comparison between the travelable distance S and the distance D to the nearest power supply equipment is not performed to check simply whether which distance is longer or shorter. Even when the travelable distance S is longer than the distance D to the nearest power supply equipment, the alarm message signal may be generated and transmitted to the energy-saving mode controller 65 and the alarm device 600 when the travelable distance S has a margin, for instance 5% to 10% of the distance D to the nearest power supply equipment. In the case, the driver may take a measure for energy saving when there is a margin in the travelable distance.

[64] The alarm message signal is recognized by the driver through the alarm device 600. The alarm device 600 informs the alarm message to the driver when the alarm message is received from the energy-saving status determining unit 60. The driver may recognize the alarm message through a display device such as LED displays, by additionally displaying the alarm message on an existing display device such as the navigation system installed in the electrically-driven moving object, or by generating sound using a speaker.

[65] The energy-saving mode controller 65 controls the status of the energy consuming devices in the electrically-driven moving object such that the electrically-driven moving object may travel in the energy-saving mode when the alarm message signal is received from the energy-saving status determining unit 60. In this case, the energy-consuming devices indicate the second energy consuming devices 25.

[66] When the alarm message signal is received, the energy-saving mode controller 65 receives an input which one of a manual energy-saving mode and an automatic energy-saving mode the driver would select from the driver. When the driver does not input, the energy-saving mode controller 65 selects one of the manual energy-saving mode and the automatic energy-saving mode using information that has been input by the driver before.

[67] The manual energy-saving mode and the automatic energy-saving mode may be selected before traveling or during the traveling. Even when one mode is already selected and the electrically-driven moving object is driven in the selected energy-saving mode by the vehicle control system of the present invention, the selected mode may be switched to another mode by the driver's input.

[68] The energy-saving mode controller 65 includes a control order setting unit 650 determining an order of the second energy consuming devices 25 to be controlled according to power consumption, importance, and correlation with the driving of the respective second energy consuming devices 25 and driving environment, a manual energy-saving mode controller 651 interrupting supply of energy to the second energy consuming devices 25 or controlling power of the second energy consuming devices 25 according to an input signal from the driver, and an automatic energy-saving mode controller 652 automatically interrupting the supply of energy to the second energy consuming devices 25 or controlling the power of the second energy consuming devices 25 according to the control order of the second energy consuming devices 25.

[69] The second energy consuming devices 25 are controlled for the purpose of interrupting or reducing supplying of power to the second energy consuming devices 25 unrelated to the driving so that the travelable distance of the electrically-driven moving object may be increased. For the interrupt and control of the power to the second energy consuming devices 25, the control order setting unit 650 may set the importance of the second energy consuming devices 25 based on the power consumptions, the use, and the correlations with the driving of the respective second energy consuming devices 25.

[70] The correlations with the driving, the power consumption, and the driving environment are major factors of determining the importance. The second energy consuming devices 25 may be arranged according to the importance such that a low important second energy consuming device 25 is headed and a high important second energy consuming device is backward.

[71] When the second energy consuming devices 25 such as headlights, an indoor light, a radio, a CD player, and an air conditioner are currently used, the second energy consuming devices 25 may be arranged in the order of air conditioner-headlights-indoor light-CD player-radio during the driving in the daytime.

[72] Information on the major factors may be stored in a storage unit provided in the control order setting unit 650 in advance.

[73] The importance information and the arrangement order of the second energy consuming devices 25 are transmitted to the automatic energy-saving mode controller 652 and the manual energy-saving mode controller 651. The information including the importance information of the second energy consuming devices 25 determined by the control order setting unit 650 is displayed on a display unit 70 such that the driver may check the information.

[74] The manual energy-saving mode controller 651 receives the input from the driver and controls the second energy consuming devices 25. The driver inputs whether to interrupt or control power to the second energy consuming devices 25 based on the information are displayed on the display unit 70. In this case, a travelable distance S' modified according to the information on the interruption or the control of supplying power input from the driver may be displayed with the distance D to the nearest power supply equipment. The modified travelable distance S' is calculated using the original travelable distance S and the information on second energy consuming devices 25, which is interrupted or controlled. In this case, it is easy for the driver to determine whether or not the saved amount of energy is enough.

[75] The automatic energy-saving mode controller 652 automatically interrupts power supplied to the second energy consuming devices 25 as many as required. The second energy consuming devices 25 which are interrupted are selected according to the importance information and the arrangement order of the second energy consuming devices 25, received from the control order setting unit 650, without an input signal from the driver. In more detail, the automatic energy-saving mode controller 652 compares the travelable distance S and the distance D to the nearest power supply equipment received from the energy-saving status determining unit 60 to detect the amount of supplemental energy for the driving to the nearest power supply equipment, interrupts power supplied to the second energy consuming devices 25 according to the arrangement order to obtain the required supplementary energy, and controls settings of the second energy consuming devices 25. The automatic energy-saving mode controller 652 updates the required supplementary energy whenever controlling the respective second energy consuming devices 25 and determines whether to control the next second energy consuming device 25.

[76] Fig. 2 is a flowchart illustrating a vehicle control method of an electrically-driven moving object according to an embodiment of the present invention.

[77] First, the energy consumption detector 35 receives information from the second energy consuming devices 25 of the vehicle and detects the energy consuming status of the electrically-driven moving object (S10).

[78] The available energy detector 40 receives information from the power supply 30 and calculates additional available power to be supplied to the electrically-driven moving object (S11).

[79] Driving status information of a driving unit, the position of the electrically-driven moving object, and the position and the geographical information of the power supply equipment are received from the driving information acquiring unit 45 (S12).

[80] Next, the travelable distance calculator 50 receives information on energy consumed by the first energy consuming device 10 from the driving information acquiring unit 45 and the power consumption information from the energy consumption detector 35 and calculates the travelable distance S when maintaining a current energy consumption pattern of the electrically-driven moving object (S13).

[81] Moreover, the distance-to-destination calculator 55 calculates the distance D from the electrically-driven moving object to the power supply equipment using the geographical information received from the driving information acquiring unit 45. The power supply equipment may be a charging station for the electrically-driven moving object or power feed lines for the inductive charging electrically-driven moving object.

[82] The energy-saving status determining unit 60 compares the calculated travelable distance S with the distance D to the destination to determine whether the energy-saving mode is required (S14).

[83] In more detail, the energy-saving status determining unit 60 determines whether the travelable distance S is equal to or shorter than the distance D to the destination, or whether the travelable distance S is shorter than or equal to a distance which a distance corresponding to a preset ratio of the distance D is added to the distance D to the destination. The energy-saving status determining unit 60 determines whether the travelable distance S is within a critical range, and a energy-saving mode (S16) is performed when the travelable distance S is within the critical range.

[84] In other words, since the travelable distance S is within the critical range or a limit range when the travelable distance S is equal to or greater than the distance D or the distance obtained by adding the distance corresponding to the preset ratio of the distance D to the distance D to the destination, the energy-saving mode is performed when the travelable distance S is within the critical range.

[85] When travelable distance S is not within the critical range, the non-energy-saving mode (S15) is performed, that is, the energy-saving mode may be performed when the travelable distance S is shorter than or equal to the distance D or the distance obtained by adding the distance corresponding to the preset ratio of the distance D to the distance D to the destination.

[86] In the energy-saving mode, as described above, the alarm message signal may be generated and transmitted to the driver and the energy-saving mode controller 65.

[87] When the energy-saving mode is determined, the energy-saving mode controller 65 sets the energy-saving mode (S17). In other words, the energy-saving mode controller 65 generates information on the energy-saving order or level, the interruption of supplying power, or preset level of power reduction of the second energy consuming devices 25 to be controlled and controls the second energy consuming devices 25.

[88] The manual energy-saving mode controller 651 arranges the second energy consuming devices 25 according to a level of load and the correlation with the driving displays the second energy consuming devices 25 on the display unit 70 and provides a menu of turning off the second energy consuming devices 25 or of reducing energy supplied to the second energy consuming devices 25 to the driver. The automatic energy-saving mode controller 652 directly interrupts power supplied to the second energy consuming devices 25 or reduces the power to a preset level without the input from the driver (S18).

[89] As described above, the second energy consuming devices 25 are controlled by the automatic energy-saving mode controller 652 or the manual energy-saving mode controller 651 as occasion demands, and the control order and the control level of the second energy consuming devices 25 are determined in advance, so that the energy-saving management may be achieved to allow the driver to have a wide range for the energy-saving and may be applied in various forms according to the current energy of the electrically-driven moving object.

[90] Fig. 3 is a view illustrating a moving object 1 to which the vehicle control system 2 according to the embodiment of the present invention is applied.

[91] The charging of the electrically-driven moving object such as an electric car, a hybrid electric car, an inductive charging electric vehicle, an electric bicycle, an electric motorcycle, an electric train, an electric boat, and an electric aircraft, movement of the electrically-driven moving object to the power supply equipment, and the control of consuming energy may be determined rapidly and energy consumption may be reduced.

[92] Moreover, considering few charging stations and power supply equipments on the traveling course, according to the vehicle control system and method of the present invention, the driving of the electrically-driven moving object such as electric vehicles without stopping and driving stability may be guaranteed since it is possible to prevent the electrically-driven moving object from being completely discharged.

[93] Therefore, supply of energy to the electrically-driven moving object is controlled and undesired energy consumption is prevented so that energy management control system and method contributing the national economy may be provided.

[94] While the invention has been shown and described with respect to the embodiments, it will be understood by those skilled in the art that various changes and modification

may be made without departing from the scope of the invention as defined in the following claims.

Claims

[Claim 1] A vehicle control system for controlling a vehicle driven by an electric power, the vehicle having a first energy consumption device for travelling, a second energy consumption device for operation other than said travelling, and one or more power supplies for supplying the electric power to the first and second power consuming device, the system comprising:
a first distance calculating unit calculating a first distance which is a distance travelable by the vehicle with a power available from the power supplies, wherein the first distance calculating unit calculates the first distance by using information on a driving status of the vehicle provided from the first energy consuming device, an amount of the power available from the power supplies, and an amount of power consumed by the second energy consuming device;
a second distance calculating unit calculating a second distance which is a distance between the vehicle and a destination;
an energy-saving status determining unit comparing the first distance with the second distance and determining whether to operate the vehicle in an energy-saving mode in which the electric power supplied to the second power consuming device is reduced; and
an energy-saving mode control unit controlling the electric power supplied to the second energy consuming device, wherein the energy-saving mode control unit reduces the power supplied to the second energy consuming device when it is determined to operate the vehicle in the energy-saving mode.

[Claim 2] The vehicle control system of claim 1, wherein the first energy consuming device includes a driving motor of the vehicle, and
wherein the second energy consuming device includes at least one of a lighting device, a temperature controlling device, an audio device, a display device, a navigation system, an electric-driven opening device, and a built-in computer, which are provided in the vehicle.

[Claim 3] The vehicle control system of claim 1, further comprising:
an energy consumption detector calculating the amount of the power consumed by the second energy consuming device.

[Claim 4] The vehicle control system of claim 1, further comprising:
an available energy detector calculating the power available from the power supplies.

[Claim 5] The vehicle control system of claim 1, further comprising:
a driving information acquiring unit acquiring information on a position and the driving status of the vehicle from the first energy consuming device in real time and positional and geographical information of the destination.

[Claim 6] The vehicle control system of claim 1, wherein the vehicle is one of a rechargeable electric car, a hybrid electric car, an inductive charging electric vehicle, an electric bicycle, an electric motorcycle, an electric train, an electric boat, and an electric aircraft.

[Claim 7] The vehicle control system of claim 1, wherein the power supplies include at least one of a battery, a in-vehicle charger, and a capacitor.

[Claim 8] The vehicle control system of claim 5, wherein the driving information acquiring unit includes:
a driving status information acquiring module acquiring the information on the driving status of the vehicle from the first energy consuming device in real time and storing the acquired information;
a geographical information module receiving a position of the vehicle and positional and geographical information of the destination and storing the acquired information; and
a search module searching for the positions of the destination based on the geographical information.

[Claim 9] The vehicle control system of claim 1, wherein the energy-saving status determining unit determines to drive in the energy-saving mode when the first distance is shorter than or equal to the second distance or a distance obtained by adding a preset distance to the second distance.

[Claim 10] The vehicle control system of claim 1, wherein the energy-saving status determining unit generates an alarm message signal and transmits the alarm message signal to a driver of the vehicle and to the energy-saving mode control unit when it is determined to drive the vehicle in the energy-saving mode.

[Claim 11] The vehicle control of claim 1, wherein the energy-saving mode control unit includes:
a control order setting unit determining a control order of devices included in the second energy consuming device based on power consumption, importance, correlation with driving of the vehicle, and driving environment;
a manual energy-saving mode control unit controlling the electric power supplied to the second energy consuming device according to an

input from a driver of the vehicle; and
an automatic energy-saving mode control unit automatically controlling power supplied to the second energy consuming device according to the control order.

[Claim 12] A vehicle control method for controlling, by using a vehicle control apparatus, a vehicle driven by an electric power, the vehicle having a first energy consumption device for travelling, a second energy consumption device for operation other than said travelling, and one or more power supplies for supplying the electric power to the first and second power consuming device, the method comprising:
calculating a first distance which is a distance travelable by the vehicle with a power available from the power supplies by using information on a driving status of the vehicle provided from the first energy consuming device, an amount of the power available from the power supplies, and an amount of power consumed by the second energy consuming device;
calculating a second distance which is a distance between the vehicle and a destination;
comparing the first distance with the second distance and determining whether to operate the vehicle in an energy-saving mode in which the electric power supplied to the second power consuming device is reduced; and
reducing, at a energy-saving mode control unit of the vehicle control apparatus, the power supplied to the second energy consuming device when it is determined to operate the vehicle in the energy-saving mode.

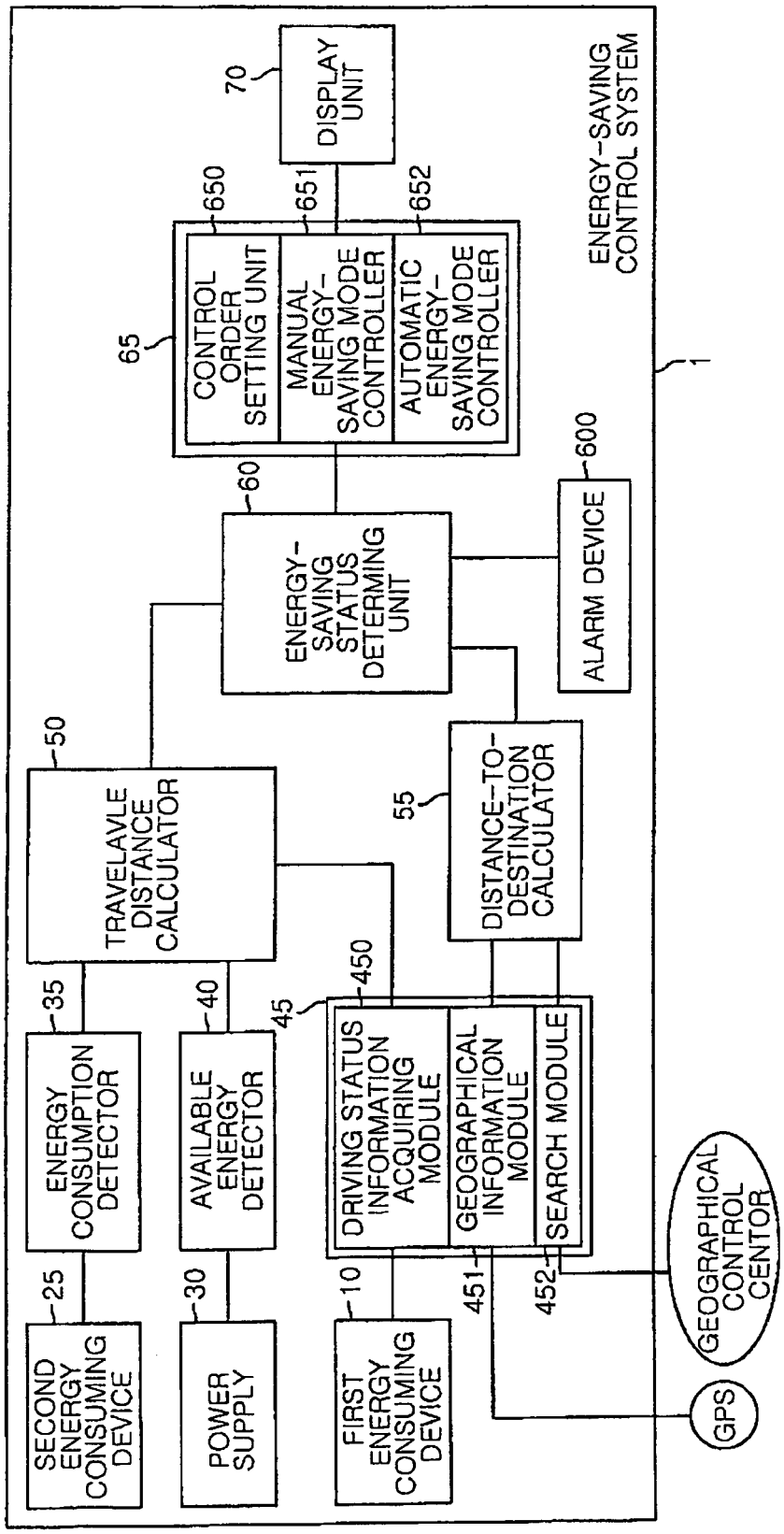
[Claim 13] The vehicle control method of claim 12, wherein the energy-saving mode is determined when the first distance is shorter than or equal to the second distance or a distance obtained by adding a preset distance to the second distance.

[Claim 14] The vehicle control method of claim 12, further comprising:
generating an alarm message signal transmitted to a driver and/or the energy-saving mode control unit when it is determined to drive the vehicle in the energy-saving mode.

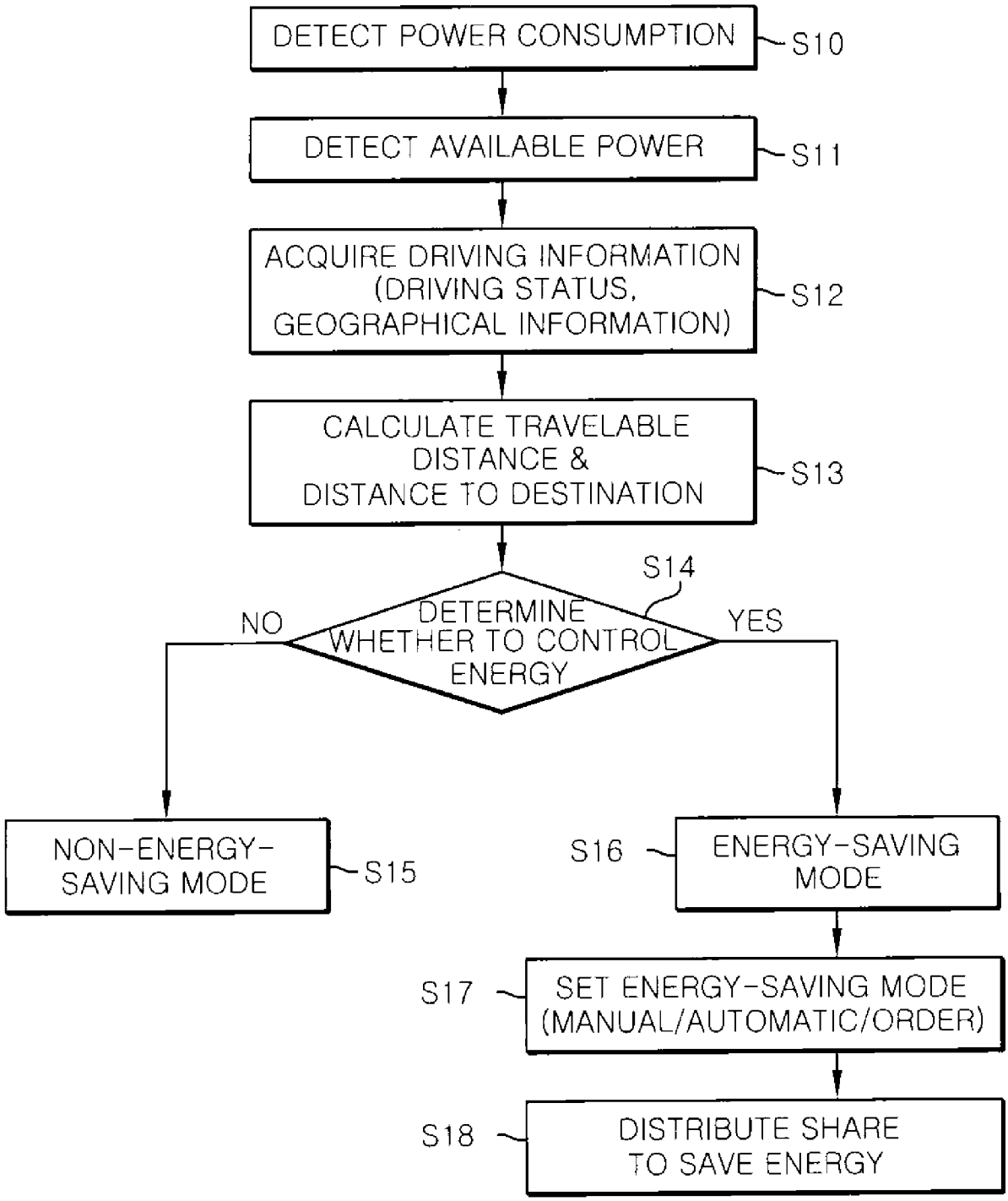
[Claim 15] The vehicle control method of claim 12, wherein the control of the electric power supplied to the second energy consuming device is performed based on a control order of devices included in the second energy consuming device, and
wherein the control order is determined according to power con-

sumption, importance, correlation with driving of the vehicle, and driving environment.

[Fig. 1]


ENERGY-SAVING CONTROL SYSTEM
1
DISPLAY UNIT
70
CONTROL ORDER SETTING UNIT
650
MANUAL ENERGY-SAVING MODE CONTROLLER
651
AUTOMATIC ENERGY-SAVING MODE CONTROLLER
652
65
ENERGY-SAVING STATUS DETERMING UNIT
60
ALARM DEVICE
600
TRAVELAVLE DISTANCE CALCULATOR
50
DISTANCE-TO-DESTINATION CALCULATOR
55
ENERGY CONSUMPTION DETECTOR
35
AVAILABLE ENERGY DETECTOR
40
DRIVING STATUS INFORMATION ACQUIRING MODULE
450
GEOGRAPHICAL INFORMATION MODULE
SEARCH MODULE
45
SECOND ENERGY CONSUMING DEVICE
25
POWER SUPPLY
30
FIRST ENERGY CONSUMING DEVICE
10
451
452
GEOGRAPHICAL CONTROL CENTOR
GPS

[Fig. 2]


DETECT POWER CONSUMPTION
S10
DETECT AVAILABLE POWER
S11
ACQUIRE DRIVING INFORMATION (DRIVING STATUS, GEOGRAPHICAL INFORMATION)
S12
CALCULATE TRAVELABLE DISTANCE & DISTANCE TO DESTINATION
S13
S14
DETERMINE WHETHER TO CONTROL ENERGY
NO
YES
NON-ENERGY-SAVING MODE
S15
S16
ENERGY-SAVING MODE
S17
SET ENERGY-SAVING MODE (MANUAL/AUTOMATIC/ORDER)
S18
DISTRIBUTE SHARE TO SAVE ENERGY

[Fig. 3]

