

SYSTEM FOR PROVIDING VARIABLE CHARGING FEE INFORMATION OF ELECTRIC CHARGING STATIONS USING RENEWABLE ENERGY

Technical Field

The present invention relates to a system for providing electric charging station information. In particular, the present invention relates to a system for providing a user with information of electric charging stations that charge an electric vehicle using power generated by a renewable energy generation facility.

Background Art

Output power curtailment is a phenomenon in which the output of the generator is operated below the maximum power generation capacity due to involuntary reasons. Generally, the output power curtailment is measured as the proportion of reduced output power to actual output power.

Generally, the output power curtailment occurs in regions where the ratio of renewable energy generation such as solar photovoltaic power generation and wind power generation is high since the expansion of renewable energy generation investment causes the amount of power generation exceed the amount of power demand, and the lack of transmission facilities or the lack of transmission capacity makes power generation and power demand out of balance.

In particular, in areas where the amount of power demand is low and there are many wind power generation facilities, the phenomenon that the amount of power generation exceeds the amount of power demand at night time certainly appears.

Since electric vehicles become new consumers of electric power due to the expansion of electric vehicle industry, it is necessary to maintain a balance between power generation and power demand by using electric power generated from renewable energy generation facilities to charge electric vehicles.

Disclosure

Technical Problem

An object of a system for providing variable charging fee information of electric charging stations using renewable energy according to an embodiment of the present invention is to guide a user to an optimal electric charging station considering the renewable energy generation facility connected to each electric charging station.

Another object of the system for providing variable charging fee information of electric charging stations using renewable energy according to an embodiment of the present invention is to allow a user to charge an electric vehicle at low cost.

Another object of the system for providing variable charging fee information of electric charging stations using renewable energy according to an embodiment of the present invention is to enable the smooth use of renewable energy.

Technical Solution

A system for providing electric charging station information according to an embodiment of the present invention may comprises a user terminal for requesting electric charging station information; and a central server adapted to receive a request for the electric charging station information from the user terminal, determine electric charging stations related to a current location of an electric vehicle driven by a user, and transmit to the user terminal location information and charging fee information of each of the determined electric charging stations, wherein at least some of the electric charging stations charge the electric vehicle using power generated by base power generation and power generated by renewable energy power generation.

The central server may determine electric charging stations that can be reached with residual power from the current location of the electric vehicle.

The central server may sort the location information of the electric charging stations and the charging fee information in the order of the lowest charging fee.

The system may further comprise an electric charging station terminal adapted to

transmit the charging fee information to the central server, wherein the electric charging station terminal determines the charging fee in consideration of power storage amount of an ESS that stores electric power generated by a renewable energy facility connected to the electric charging station.

The central server may determine an electric charging station connected to a solar photovoltaic energy power generation facility as the renewable energy generation facility when the user terminal requests the electric charging station information at a predetermined daytime.

The central server may determine an electric charging station connected to a wind power energy generation facility as the renewable energy generation facility when the user terminal requests the electric charging station information at a predetermined night time.

The central server may obtain weather information when the user terminal requests the electric charging station information, and determine an electric charging station connected to a renewable energy generation facility preset as having excellent power generation efficiency for the obtained weather information.

A method for providing electric charging station information by a central server according to another embodiment of the present invention may comprises: receiving a request for the electric charging station information from a user terminal; determining electric charging stations related to a current location of an electric vehicle driven by a user; obtaining charging fee information of each of the determined electric charging stations; and transmitting to the user terminal location information and charging fee information of the determined electric charging stations, wherein at least some of the electric charging stations charge the electric vehicle using power generated by base power generation and power generated by renewable energy power generation.

Advantageous Effects

A system for providing variable charging fee information of electric charging stations using renewable energy according to an embodiment of the present invention

may guide a user to an optimal electric charging station considering the renewable energy generation facility connected to each electric charging station.

The system for providing variable charging fee information of electric charging stations using renewable energy according to an embodiment of the present invention may allow a user to charge an electric vehicle at low cost.

The system for providing variable charging fee information of electric charging stations using renewable energy according to an embodiment of the present invention may enable the smooth use of renewable energy.

However, the effect that the system for providing variable charging fee information of electric charging stations using renewable energy according to an embodiment of the present invention can achieve is not limited to those mentioned above, and other effects not mentioned will be apparent from the following description to those skilled in the art to which the present invention pertains.

Description of Drawings

For more complete understanding of the drawings recited herein, a brief description of each drawing is provided.

FIG. 1 is a diagram showing a system for providing electric charging station information according to an embodiment of the present invention.

FIG. 2 is a flowchart showing an operation of the system for providing electric charging station information according to an embodiment of the present invention.

FIG. 3 is an exemplary diagram showing information of the electric charging station registered in a central server.

FIG. 4 is a flow chart showing a method by which the central server determines electric charging stations to be guided to a user.

FIG. 5 is an exemplary diagram showing electric charging station information provided from the central server to a user terminal.

FIG. 6 is a block diagram showing a configuration of the central server according to an embodiment of the present invention.

Mode for Invention

The present invention may have various modifications and embodiments, and specific embodiments of the present invention will be described in detail with reference to the drawings. It is to be understood, however, that the present invention is not to be limited to the specific embodiments, but includes all modifications, equivalents, and alternatives falling within the spirit and scope of the present invention.

In the entire specification, a detailed description of known related arts will be omitted when it is determined that the gist of the present invention may be unnecessarily obscured. Further, numerals (e.g., first, second, etc.) used in the entire specification are merely an identifier for distinguishing one element from another.

In addition, in the entire specification, when a part is referred to as being “connected” with another part, it is not only a case where it is directly connected, but also a case where it is indirectly connected with another element therebetween, unless specifically stated otherwise.

In the entire specification, a component represented by 'unit', 'module', or the like refers to a case where two or more components are combined into one component, or one component is divided into two or more. In addition, each of the components described below may additionally perform some or all of the functions that are handled by other components in addition to its main functions, and some of the main functions that each component is responsible for may be performed entirely by other components.

Hereinafter, embodiments according to the technical idea of the present invention will be described in detail.

FIG. 1 is a diagram showing a system for providing electric charging station information according to an embodiment of the present invention.

Referring to FIG. 1, the system for providing electric charging station information according to an embodiment of the present invention may include a user terminal 100, a central server 300, and an electric charging station terminal 400.

The user terminal 100 is a terminal used by a user who operates an electric vehicle

200. Although FIG. 1 shows a smart phone, this is only one example. Specifically, the user terminal 100 may include a smart phone, a tablet PC, a laptop computer or the like that is portable by a user, or may include a terminal mounted on the electric vehicle 200, for example, a navigation terminal. The user terminal 100 may include various types of devices capable of communicating with the central server 300 via a network.

The user may access the central server 300 through the user terminal 100 to request electric charging station information for charging the electric vehicle 200. The central server 300 may provide the user with optimal electric charging station information at the request of the user terminal 100. The user can visit the electric charging station 500 and charge his or her electric vehicle 200 according to the information received from the central server 300.

The central server 300 may pre-store the information of the various electric charging stations 500 registered in the central server 300 to provide the optimal electric charging station information to the user. For example, the central server 300 can receive and store the electric charging station information from the electric charging station terminal 400 of each electric charging station 500.

According to an embodiment of the present invention, the electric charging station 500 may include a charger 520 and an ESS (Energy Storage System) 540. The battery of the electric vehicle 200 can be charged by the charger 520. At least some of the electric charging stations 500 may charge the electric vehicle 200 using the electric power generated by base power generation and the electric power generated by renewable energy power generation.

The base power generation means power generation by nuclear power and coal at low cost, which forms the foundation of power generation. The base power generation electric power may be managed by a central authority such as Korea Electric Power Corporation and provided to the electric charging station 500.

The renewable energy generation means power generation using renewable energy and may include, for example, wind energy generation, solar photovoltaic energy generation, bio-energy generation, geothermal energy generation, and tidal energy generation.

The ESS 540 of the electric charging station 500 stores the electric power generated by the renewable energy generation facility 600 and can charge the electric vehicle 200 using the stored electric power.

According to an embodiment of the present invention, since at least some of the electric charging station 500 uses the electric power generated through the renewable energy generation to charge the electric vehicle 200, the charging fee may vary depending on the amount of renewable energy generation, the amount of renewable energy storage, weather and time, and the central server 300 may provide the user with the optimal electric charging station information in consideration of the fluctuation of the charging fee.

FIG. 2 is a flowchart showing an operation of the system for providing electric charging station information according to an embodiment of the present invention.

In step S210, the user terminal 100 may request the central server 300 for the electric charging station information. The user terminal 100 may transmit the current location information of the electric vehicle 200 to the central server 300 when requesting the electric charging station information.

In step S220, the central server 300 may determine an electric charging station associated with the current location of the electric vehicle 200 among the electric charging stations registered therein in advance.

FIG. 3 is an exemplary diagram showing the information of the electric charging station registered in the central server. Referring to FIG. 3, for each electric charging station, the central server 300 may store at least one of the identification information (e.g., name), the location, the type of the renewable energy generation facility 600, the power generation capacity of the renewable energy generation facility 600, the charging fee, and the convenient facilities in advance. For example, the electric charging station A is located in Gangnam-gu, Seoul, and is connected to a solar photovoltaic power generation facility with a generation capacity of 150 kW. The charging fee of the electric charging station A is 1,500 won/kW, and the electric charging station A has facilities including parking facilities and mobile phone charging facilities. In the case of the electric charging station B, the information of the renewable energy generation facility 600 is

missing. This means that the electric charging station B charges electric vehicles only by the electric power generated by the base power generation.

The charging fee information shown in FIG. 3 may be updated according to the charging fee information received from the electric charging station terminal 400. As described later, the central server 300 may request the electric charging station terminal 400 to receive a new charging fee information from the electric charging station terminal 400, or the electric charging station terminal 400 may transmit the newly determined charging fee information to the central server 300 every predetermined period.

The central server 300 may determine the electric charging stations to be guided to the user in consideration of the information of the electric charging station shown in FIG. 3 and the current location information of the user's electric vehicle 200.

Specifically, the central server 300 may determine the electric charging stations associated with the current location of the electric vehicle 200 among the electric charging stations registered therein in advance. For example, the central server 300 may determine the electric charging stations that are located within a predetermined distance (e.g., 1 km) from the current location of the electric vehicle 200 among the electric charging stations that are registered in advance, or may determine the electric charging stations that can be reached with residual power of the electric vehicle 200 from the current location of the electric vehicle 200.

Referring again to FIG. 2, in step S230, the central server 300 requests the charging fee information to the electric charging station terminal 400 of the electric charging station determined in step S220. In step S240, the electric charging station terminal 400 transmits the charging fee information to the central server 300.

In order to transmit the charging fee information to the central server 300, the electric charging station terminal 400 may determine the charging fee in consideration of the amount of power stored in the ESS 540, the amount of power generated by the renewable energy generation facility 600, and the like. For example, in the daytime in which the solar photovoltaic power generation efficiency is excellent, the electric charging station terminal 400 of the electric charging station 500 connected to the solar photovoltaic power generation facility may determine the charging fee lower than the

charging fee of when the electric vehicle 200 is charged only by the electric power generated by the base power generation. Further, in the night time in which the wind power generation efficiency is excellent, the electric charging station terminal 400 of the electric charging station 500 connected to the wind power generation facility may determine the charging fee lower than the charging fee of when the electric vehicle 200 is charged only by the electric power generated by the base power generation.

Alternatively, when the amount of power stored in the ESS 540 is equal to or less than a predetermined amount, the electric charging station terminal 400 may determine the same charging fee as the charging fee of when the electric vehicle 200 is charged only by the electric power generated by the base power generation, or when the amount of power stored in the ESS 540 is greater than a predetermined amount, the electric charging station terminal 400 may determine the charging fee lower than the charging fee of when the electric vehicle 200 is charged only by the electric power generated by the base power generation.

In another embodiment, steps S230 and S240 may be omitted. In this case, the electric charging station terminal 400 may determine the charging fee information at predetermined intervals and transmit it to the central server 300.

In step S250, the central server 300 may transmit the location information and the charging fee information of the electric charging station determined in step S220 to the user terminal 100. In step S260, the user terminal 100 may display the location information and the charging fee information of the electric charging station on the screen.

FIG. 4 is a flow chart showing a method by which the central server 300 determines electric charging stations to be guided to a user. In the above description, the central server 300 considers the current location of the electric vehicle 200 when determining the electric charging stations, and according to the embodiment shown in FIG. 4, the central server 300 may further consider the weather information of when the user requests the electric charging station information.

In step S410, the central server 300 may confirm the current location of the electric vehicle 200 according to the electric charging station information request of the user terminal 100, and in step S420, the central server 300 may first determine electric

charging stations associated with the current location of the electric vehicle 200 among the electric charging stations registered in advance. For example, the central server 300 may first determine the electric charging stations that are located within a predetermined distance from the current location of the electric vehicle 200 among the electric charging stations that are registered in advance, or may first determine the electric charging stations that can be reached with residual power of the electric vehicle 200 from the current location of the electric vehicle 200.

In step S430, the central server 300 may confirm the current weather information of when the user terminal 100 requests the electric charging station information, and in step S440, the central server 300 may finally determine the electric charging stations having the renewable energy generation facilities having the excellent generating efficiency in the confirmed current weather.

For example, if the current weather is clear and no cloud, the central server 300 may finally determine the electric charging stations having the solar photovoltaic power generation facility, which are preset in response to the current weather. Alternatively, if the current weather is windy, the central server 300 may finally determine the electric charging stations having the wind power generation facility, which are preset in response to the current weather.

That is, the information on the renewable energy generation facilities 600 having excellent power generation efficiency in response to various weathers may be stored in advance, and the electric charging stations having the renewable energy generation facility 600 corresponding to the current weather may be finally determined. This is because the electric charging station equipped with the renewable energy generation facility 600 having excellent power generation efficiency in response to the current weather will set the charging fee low.

In another embodiment, when the time at which the user requests the electric charging station information is a predetermined daytime period (for example, between 14:00 and 17:00), the central server 300 may not consider the weather information, and may finally determine the electric charging stations connected to the solar photovoltaic power generation facility. Furthermore, when the time at which the user requests the

electric charging station information is a predetermined night time period (for example, between 18:00 and 24:00), the central server 300 may finally determine the electric charging stations connected to the wind power generation facility.

FIG. 5 is an exemplary diagram showing electric charging station information provided from the central server 300 to the user terminal 100.

Referring to FIG. 5, the central server 300 may provide the user terminal 100 with the electric charging station information, which may include at least one of the identification information (e.g., name) of the electric charging station, the location, the distance from the current location of the electric vehicle 200, the charging fee, and the convenient facilities.

The charging fee shown in FIG. 5 represents the latest charging fee information based on the time when the user terminal 100 requests the electric charging station information to the central server 300. In other words, if the central server 300 periodically receives the charging fee information from the charging station terminal 400, the central server 300 may provide the user with the charging fee information transmitted from the electric charging station terminal 400 to the central server 300 most recently before the user terminal 100 requests the electric charging station information. Alternatively, when the central server 300 receives an electric charging station information request from the user terminal 100, the central server 300 may request the charging fee information to the electric charging station terminal 400 and provide the user terminal 100 with the charging fee information transmitted from the electric charging station terminal 400 in response to the request.

The central server 300 may provide the electric charging station information to the user terminal 100 by sorting the electric charging station information according to a certain criterion so that the user can easily select.

For example, the central server 300 may sort the electric charging station information in the order of the lowest charging fee and provide it to the user terminal 100, or the central server 300 may sort the electric charging station information in the order of the shortest distance from the current location of the electric vehicle 200 and provide the sorted electric charging station information to the user terminal 100.

In another embodiment, the central server 300 may rank the electric charging stations in consideration of both the charging fee and the distance from the current location of the electric vehicle 200, sort the electric charging station information according to the ranking, and provide the sorted electric charging station information to the user terminal 100.

In another embodiment, when the destination is set through the navigation terminal of the electric vehicle 200, the central server 300 may sort the electric charging station information according to the time required for the electric vehicle 200 to arrive at the destination via each electric charging station (for example, in the order of the shortest required time) and provide the sorted electric charging station information to the user terminal 100.

In another embodiment, when the destination is set through the navigation terminal of the electric vehicle 200, the central server 300 may apply a predetermined weight to the time required for the electric vehicle 200 to arrive at the destination via each electric charging station and the charging fee of each electric charging station, sort the electric charging station information in the order of the sum of the weighted values and provide the sorted electric charging station information to the user terminal 100.

FIG. 6 is a block diagram showing a configuration of the central server 300 according to an embodiment of the present invention.

Referring to FIG. 6, the central server 300 according to an embodiment of the present invention may include a memory 310, a communication unit 330, and a control unit 350.

The memory 310, the communication unit 330, and the control unit 350 may be implemented by at least one processor, and the memory 310, the communication unit 330, and the control unit 350 may operate according to a program stored in the memory 310.

The memory 310 may store pre-registered electric charging station information. As described in connection with FIG. 3, the electric charging station information may include information on at least one of the identification information of each electric charging station, the location, the type of the renewable energy generation facility, the generation capacity, the charging fee, and the convenient facilities.

The communication unit 330 may receive a request for the electric charging station information from the user terminal 100. Also, the communication unit 330 may receive the electric charging station information (for example, charging fee information) from the charging station terminal 400.

The control unit 350 may determine the electric charging stations associated with the current location of the electric vehicle 200 operated by the user and confirm the charging fee information of each of the determined electric charging stations. The control unit 350 may transmit the location information and the charging fee information of the determined electric charging stations to the user terminal 100 through the communication unit 330, and the user terminal 100 may display the information.

Meanwhile, the above-described embodiments of the present invention may be made into a program that can be executed in a computer, and the created program may be stored in a medium.

The medium may be one that continues to store computer executable programs, or temporarily store them for execution or downloading. In addition, the medium may be a variety of recording means or storage means in the form of a combination of a single or a plurality of hardware, but is not limited to a medium directly connected to any computer system, and may be dispersed on a network. Examples of media include magnetic media such as hard disks, floppy disks and magnetic tape, optical recording media such as CD-ROM and DVD, magneto-optical media such as floptical disks, and object configured to store program instructions including ROM, RAM, flash memory, and the like. Examples of other media may include a recording medium or a storage medium that is managed by an application store that distributes applications, a site that supplies or distributes various software, a server, and the like.

Although the technical spirit of the present invention has been described in detail by way of preferred embodiments thereof, the technical spirit of the present invention is not limited to the above embodiments, and various changes and modifications may be made by those skilled in the art without departing from the spirit and scope of the present invention.

Reference Numerals

- 100: User terminal
- 200: Electric vehicle
- 300: Central server
- 310: Memory
- 330: Communication unit
- 350: Control unit
- 400: Electric charging station terminal
- 500: Electric charging station
- 520: Charger
- 540: ESS
- 600: Renewable energy generation facility

Claims

[Claim 1]

A system for providing electric charging station information, the system comprising:

a user terminal for requesting electric charging station information; and

a central server adapted to receive a request for the electric charging station information from the user terminal, determine electric charging stations related to a current location of an electric vehicle driven by a user, and transmit to the user terminal location information and charging fee information of each of the determined electric charging stations,

wherein at least some of the electric charging stations charge the electric vehicle using power generated by base power generation and power generated by renewable energy power generation.

[Claim 2]

The system according to Claim 1, wherein the central server determines electric charging stations that can be reached with residual power from the current location of the electric vehicle.

[Claim 3]

The system according to Claim 1, wherein the central server sorts the location information of the electric charging stations and the charging fee information in the order of the lowest charging fee.

[Claim 4]

The system according to Claim 1, further comprising:

an electric charging station terminal adapted to transmit the charging fee information to the central server,

wherein the electric charging station terminal determines the charging fee in

consideration of power storage amount of an ESS that stores electric power generated by a renewable energy facility connected to the electric charging station.

[Claim 5]

The system according to Claim 1, wherein the central server determines an electric charging station connected to a solar photovoltaic energy power generation facility as the renewable energy generation facility when the user terminal requests the electric charging station information at a predetermined daytime.

[Claim 6]

The system according to Claim 1, wherein the central server determines an electric charging station connected to a wind power energy generation facility as the renewable energy generation facility when the user terminal requests the electric charging station information at a predetermined night time.

[Claim 7]

The system according to Claim 1, wherein the central server obtains weather information when the user terminal requests the electric charging station information, and determines an electric charging station connected to a renewable energy generation facility preset as having excellent power generation efficiency for the obtained weather information.

[Claim 8]

A method for providing electric charging station information by a central server, the system comprising:

- receiving a request for the electric charging station information from a user terminal;

- determining electric charging stations related to a current location of an electric vehicle driven by a user;

- obtaining charging fee information of each of the determined electric charging

stations; and

transmitting to the user terminal location information and charging fee information of the determined electric charging stations,

wherein at least some of the electric charging stations charge the electric vehicle using power generated by base power generation and power generated by renewable energy power generation.