

DESCRIPTION

TITLE OF INVENTION:

CARBON DIOXIDE REDUCTION ACCELERATING SYSTEM, SERVICE PROVIDER APPARATUS, REDUCTION OPERATOR APPARATUS, CARBON DIOXIDE REDUCTION ACCELERATING METHOD, AND SERVICE PROVIDER APPARATUS PROGRAM

TECHNICAL FIELD

[0001]

The present disclosure relates to a carbon dioxide reduction accelerating system, a service provider apparatus, a reduction operator apparatus, a carbon dioxide reduction accelerating method, and a service provider apparatus program. This application claims the benefit of Japanese Patent Application No. 2023-026321 filed on February 22, 2023, which is hereby incorporated by reference herein in its entirety.

BACKGROUND ART

[0002]

PTL 1 discloses a system that achieves a reduction in carbon dioxide emissions through the earning of carbon dioxide credits corresponding to the usage records of energy-saving devices in each residence of a multiple dwelling house.

[0003]

PTL 2 discloses a system that manages eco points granted to users by associating the amount of CO₂ reduction corresponding to a travel distance calculated from the amount of charge of a battery electric vehicle with a corresponding one of the users, who drives the battery electric vehicle.

[0004]

PTL 3 discloses a method of converting carbon dioxide into a carbonate of a high-valent metal, which is a harmless substance, to achieve immobilization by contacting microparticles or aggregates of microparticles of a substance containing a metal or a low-valent metal in the presence of water.

CITATION LIST

PATENT LITERATURE

[0005]

PTL 1: Japanese Unexamined Patent Application Publication No. 2022-139068

PTL 2: Japanese Unexamined Patent Application Publication No. 2012-059197

PTL 3: Japanese Unexamined Patent Application Publication No. 2007-075773

SUMMARY OF INVENTION

[0006]

A carbon dioxide reduction accelerating system according to an aspect of the present disclosure includes a user terminal and a service provider apparatus. The user terminal includes a usage record transmission unit configured to transmit usage records of application software by a user and user identification information unique to the user to the service provider apparatus, and a point receiving unit configured to receive contribution points corresponding to the usage records from the service provider apparatus. The service provider apparatus includes a usage record receiving unit configured to receive the usage records and the user identification information from the user terminal, a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records, a request information transmission unit configured to transmit the request information to a reduction operator apparatus, a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus, a reduction value transmission unit configured to transmit the reduction record value to a supervisor apparatus, a credit receiving unit configured to receive carbon dioxide credits corresponding to the reduction record value from the supervisor apparatus, a point calculation unit configured to calculate the contribution points based on the carbon dioxide credits and the usage records, and a point transmission unit configured to transmit the contribution points to the user terminal.

BRIEF DESCRIPTION OF DRAWINGS

[0007]

FIG. 1 is a conceptual diagram illustrating the basic configuration of a carbon dioxide reduction accelerating system according to an embodiment.

FIG. 2 is a diagram illustrating the configuration of the carbon dioxide reduction accelerating system according to the embodiment.

FIG. 3 is a diagram showing an example of a functional internal configuration of a user terminal.

FIG. 4 is a diagram showing an example of a functional internal configuration of a service provider apparatus.

FIG. 5 is a diagram showing an example of a functional internal configuration of a reduction operator apparatus.

FIG. 6 is a diagram illustrating the configuration of a carbon dioxide reduction accelerating system according to a second embodiment.

FIG. 7 is a diagram showing an example of a functional internal configuration of a service provider apparatus.

FIG. 8 is a perspective view schematically showing an example of a capture device.

FIG. 9 is a diagram schematically showing a cross section taken along line II-II in the capture device of FIG. 8.

DETAILED DESCRIPTION

[0008] [Problems to be Solved by Present Disclosure]

Demand for carbon dioxide reduction has been increasing more and more. As disclosed in PTL 1 and PTL 2, the entities promoting the reduction are not limited to authorities and companies, but the reduction is also being encouraged at the individual level. With the proliferation of smartphones and personal computers in recent years, there is an increasing trend in electric power consumption at the individual level. In particular, the expansion of the use of various application software represented by music, video, games, and social media in the so-called entertainment field will lead to no small increase in electric power consumption. Measures that individuals who are users of application software take to contribute to carbon dioxide reduction are any of reducing the amount of usage of application software to decrease electric power consumption itself and replacing energy used with so-called green energy.

[0009]

The above measures only contribute to the reduction of carbon dioxide emissions. The above measures have not reduced the carbon dioxide actually emitted into the atmosphere. The disclosures in PTL 1 and PTL 2 are limited to reducing carbon dioxide emissions through the use of energy-saving devices, the use of battery electric vehicles, and the like. There is no disclosure regarding the reduction of carbon dioxide actually present in the atmosphere.

[0010]

An object of the present disclosure is to mainly promote carbon dioxide reduction activities at the individual level and to accelerate the reduction of carbon dioxide actually

present in the atmosphere, by allowing individuals to quantitatively acquire the advantageous effects of carbon dioxide reduction.

[0011] [Advantageous Effects of Present Disclosure]

According to the present disclosure, carbon dioxide reduction activities are mainly promoted at the individual level by quantitatively acquiring the advantageous effects of carbon dioxide reduction. Furthermore, the reduction of carbon dioxide present in the atmosphere is accelerated.

[Description of Embodiments of Present Disclosure]

Hereinafter, embodiments of the present disclosure will be listed and described.

[0012]

(1) A carbon dioxide reduction accelerating system according to an embodiment of the present disclosure includes a user terminal and a service provider apparatus. The user terminal includes a usage record transmission unit configured to transmit usage records of application software by a user and user identification information unique to the user to the service provider apparatus, and a point receiving unit configured to receive contribution points corresponding to the usage records from the service provider apparatus. The service provider apparatus includes a usage record receiving unit configured to receive the usage records and the user identification information from the user terminal, a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records, a request information transmission unit configured to transmit the request information to a reduction operator apparatus, a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus, a reduction value transmission unit configured to transmit the reduction record value to a supervisor apparatus, a credit receiving unit configured to receive carbon dioxide credits corresponding to the reduction record value from the supervisor apparatus, a point calculation unit configured to calculate the contribution points based on the carbon dioxide credits and the usage records, and a point transmission unit configured to transmit the contribution points to the user terminal.

[0013]

With the carbon dioxide reduction accelerating system of the above (1), reduction activities at the individual level are mainly promoted by quantitatively acquiring the advantageous effects of carbon dioxide reduction. In addition, the reduction of carbon

dioxide actually present in the atmosphere is accelerated.

[0014]

(2) A carbon dioxide reduction accelerating system according to another embodiment of the present disclosure includes a user terminal and a service provider apparatus. The user terminal includes a usage record transmission unit configured to transmit usage records of application software by a user and user identification information unique to the user to the service provider apparatus, and a credit receiving unit configured to receive carbon dioxide credits from a supervisor apparatus. The service provider apparatus includes a usage record receiving unit configured to receive the usage records and the user identification information from the user terminal, a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records, a request information transmission unit configured to transmit the request information to a reduction operator apparatus, a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus, a distribution record value calculation unit configured to calculate a distribution record value allocated to the user from the reduction record value, and a distribution record value transmission unit configured to transmit the distribution record value along with the user identification information to the supervisor apparatus.

[0015]

With the carbon dioxide reduction accelerating system of the above (2), a user can directly earn carbon dioxide credits obtained as official certification. Carbon dioxide reduction activities at the individual level are mainly promoted through the earning of carbon dioxide credits. In addition, the reduction of carbon dioxide actually present in the atmosphere is accelerated.

[0016]

(3) In the above (1) or (2), the carbon dioxide reduction accelerating system may further include a record storage unit configured to store the usage records and the user identification information in association with each other. As a result, the carbon dioxide reduction accelerating system can easily store usage records and user identification information.

[0017]

(4) In the above (1) or (2), the service provider apparatus may further include a

record storage unit configured to store the usage records and the user identification information in association with each other. As a result, a service provider can easily reference usage records and user identification information.

[0018]

(5) In any one of the above (1) to (4), the carbon dioxide reduction accelerating system may further include a capture device configured to perform the carbon dioxide reduction work, wherein the capture device may include a carbon dioxide capture material, a solution in which the carbon dioxide capture material is immersed, a supply portion configured to supply a target gas to the solution, and a storage tank in which the solution is stored, and the carbon dioxide capture material may include at least any of layered double hydroxides, basic metal oxides, basic metal hydroxides, iron, and iron compounds.

[0019]

As an example of the capture device, the applicant of the present application has been developing a carbon dioxide capture device related to the technology disclosed in PTL 3. The device uses the carbon dioxide capture material, which is a layered double hydroxide, a basic metal oxide, a basic metal hydroxide, iron, or an iron compound, to reduce carbon dioxide in a gas as captured products, such as ferrous carbonate. In other words, by using the capture device, it is possible to capture and reduce carbon dioxide actually present in a gas, such as the atmosphere, to reduce the amount of carbon dioxide.

[0020]

With the carbon dioxide reduction accelerating system of the above (5), the reduction of carbon dioxide actually present in the atmosphere can be accelerated, and reduction activities at the individual level are mainly promoted by quantitatively acquiring the advantageous effects of carbon dioxide reduction.

[0021]

(6) A service provider apparatus of the present disclosure includes a usage record receiving unit configured to receive usage records of application software by a user and user identification information from a user terminal, a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records, a request information transmission unit configured to transmit the request information to a reduction operator apparatus, a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus, a reduction value

transmission unit configured to transmit the reduction record value to a supervisor apparatus, a credit receiving unit configured to receive carbon dioxide credits corresponding to the reduction record value from the supervisor apparatus, a point calculation unit configured to calculate contribution points based on the carbon dioxide credits and the usage records, and a point transmission unit configured to transmit the contribution points to the user terminal.

[0022]

The service provider apparatus of the above (6) is used in the configuration of the carbon dioxide reduction accelerating system of the above (1). With the carbon dioxide reduction accelerating system of the above (1), reduction activities at the individual level are mainly promoted by quantitatively acquiring the advantageous effects of carbon dioxide reduction. In addition, the reduction of carbon dioxide actually present in the atmosphere is accelerated.

[0023]

(7) A service provider apparatus used in a carbon dioxide reduction accelerating system, which is another embodiment of the present disclosure, includes a usage record receiving unit configured to receive usage records of application software by a user and user identification information from a user terminal, a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records, a request information transmission unit configured to transmit the request information to a reduction operator apparatus, a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus, a distribution record value calculation unit configured to calculate a distribution record value allocated to the user from the reduction record value, and a distribution record value transmission unit configured to transmit the distribution record value along with the user identification information to a supervisor apparatus.

[0024]

The service provider apparatus of the above (7) is used in the configuration of the carbon dioxide reduction accelerating system of the above (2). With the carbon dioxide reduction accelerating system of the above (2), a user can directly earn carbon dioxide credits obtained as official certification. Carbon dioxide reduction activities at the individual level are mainly promoted through the earning of carbon dioxide credits. In

addition, the reduction of carbon dioxide actually present in the atmosphere is accelerated.

[0025]

(8) The service provider apparatus of the above (6) or (7) may further include a record storage unit configured to store the usage records and the user identification information in association with each other. As a result, a service provider can easily reference the record of each user.

[0026]

(9) A reduction operator apparatus according to an embodiment of the present disclosure includes a request information receiving unit configured to receive request information for carbon dioxide reduction work from a service provider apparatus, and a reduction value transmission unit configured to transmit a reduction record value to the service provider apparatus.

[0027]

The reduction operator apparatus of the above (9) is used in the configuration of the carbon dioxide reduction accelerating system of the above (1) or (2). With the carbon dioxide reduction accelerating system of the above (1) or (2), reduction activities at the individual level are mainly promoted by quantitatively acquiring the advantageous effects of carbon dioxide reduction. In addition, the reduction of carbon dioxide actually present in the atmosphere is accelerated.

[0028]

(10) A carbon dioxide reduction accelerating method according to an embodiment of the present disclosure is a carbon dioxide reduction accelerating method with which a user earns contribution points corresponding to usage records of application software. The carbon dioxide reduction accelerating method includes storing the usage records in association with user identification information unique to the user, requesting carbon dioxide reduction work from a carbon dioxide reduction operator, receiving a reduction record value resulting from completion of the carbon dioxide reduction work from the carbon dioxide reduction operator, providing the reduction record value to a carbon dioxide emission supervisor, receiving carbon dioxide credits corresponding to the reduction record value from the carbon dioxide emission supervisor, and granting the contribution points calculated based on the carbon dioxide credits and the usage records to the user.

[0029]

With the carbon dioxide reduction accelerating method of the above (10), reduction activities at the individual level are mainly promoted by quantitatively acquiring the advantageous effects of carbon dioxide reduction. In addition, the reduction of carbon dioxide actually present in the atmosphere is accelerated.

[0030]

(11) A carbon dioxide reduction accelerating method according to an embodiment of the present disclosure is a carbon dioxide reduction accelerating method with which a user earns carbon dioxide credits corresponding to usage records of application software. The carbon dioxide reduction accelerating method includes storing the usage records in association with user identification information unique to the user, requesting carbon dioxide reduction work from a carbon dioxide reduction operator, receiving a reduction record value resulting from completion of the carbon dioxide reduction work from the carbon dioxide reduction operator, providing a distribution record value allocated to the user from the reduction record value along with the user identification information to a carbon dioxide emission supervisor, and receiving the carbon dioxide credits corresponding to the distribution record value by the user from the carbon dioxide emission supervisor.

[0031]

With the carbon dioxide reduction accelerating method of the above (11), a user can directly earn carbon dioxide credits obtained as official certification. Carbon dioxide reduction activities at the individual level are mainly promoted through the earning of carbon dioxide credits. In addition, the reduction of carbon dioxide actually present in the atmosphere is accelerated.

[0032]

(12) A service provider apparatus program according to an embodiment of the present disclosure is a service provider apparatus program used in a service provider apparatus included in a carbon dioxide reduction accelerating system. The service provider apparatus program causes the service provider apparatus to function as a usage record receiving unit configured to receive usage records of application software by a user and user identification information from the user terminal, a record storage unit configured to store the usage records and the user identification information in association with each other, a request information creating unit configured to create request information for

carbon dioxide reduction work based on the usage records, a request information transmission unit configured to transmit the request information to a reduction operator apparatus, a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus, a reduction value transmission unit configured to transmit the reduction record value to a supervisor apparatus, a credit receiving unit configured to receive carbon dioxide credits corresponding to the reduction record value from the supervisor apparatus, a point calculation unit configured to calculate contribution points based on the carbon dioxide credits and the usage records, and a point transmission unit configured to transmit the contribution points to the user terminal.

[0033]

When the service provider apparatus program of the above (12) is implemented in the service provider apparatus of the above (6), reduction activities at the individual level are mainly performed by quantitatively acquiring the advantageous effects of carbon dioxide reduction. In addition, the reduction of carbon dioxide actually present in the atmosphere is accelerated.

[0034]

(13) A service provider apparatus program according to an embodiment of the present disclosure is a service provider apparatus program used in a service provider apparatus included in a carbon dioxide reduction accelerating system. The service provider apparatus program causes the service provider apparatus to function as a usage record receiving unit configured to receive usage records of application software by a user and user identification information from a user terminal, a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records, a request information transmission unit configured to transmit the request information to a reduction operator apparatus, a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus, a distribution record value calculation unit configured to calculate a distribution record value allocated to the user from the reduction record value, and a distribution record value transmission unit configured to transmit the distribution record value along with the user identification information to a supervisor apparatus.

[0035]

When the service provider apparatus program of the above (13) is implemented in

the service provider apparatus of the above (7), reduction activities at the individual level are mainly performed by quantitatively acquiring the advantageous effects of carbon dioxide reduction. In addition, the reduction of carbon dioxide actually present in the atmosphere is accelerated.

[0036]

(14) The service provider apparatus program of the above (12) or (13) may further cause the service provider apparatus to function as a record storage unit configured to store the usage records and the user identification information in association with each other. As a result, the contents of usage records and user identification information can be easily stored in association with each other.

[0037] [Details of Embodiments of Present Disclosure]

Embodiments of the present disclosure will be described with reference to the drawings. The embodiments described below illustrate specific examples of the present disclosure. The numerical values, shapes, materials, component elements, arrangements and connection forms of the component elements, procedures, and the like, described below are examples of the embodiments. The drawings are schematic diagrams and are not always strictly drawn. Like reference signs denote the same component elements in the drawings. The description of the functions and the like of the same component elements is omitted as needed. In the following description and drawings, carbon dioxide may be represented by the molecular formula CO_2 .

[0038] <Embodiments>

(Basic Configuration of Carbon Dioxide Reduction Accelerating System)

The basic configuration of a carbon dioxide reduction accelerating system 10 of the present disclosure will be described with reference to FIG. 1. FIG. 1 illustrates the case of two users and shows User 1 and User 2. User 1 is using a user terminal 11, and User 2 is using a user terminal 12. Each of the user terminals 11 and 12 has installed application software (hereinafter, which may be referred to as "app") that is provided from a service provider 20 or managed by the service provider 20.

[0039]

In the present disclosure, the term "app" broadly includes software that is operated by a user on, for example, a user terminal and software that serves as an interface to provide services to the user. In the present disclosure, installation is not limited to

deploying software onto a user terminal and operating the software on the user terminal. For example, it can be interpreted that installation also includes bringing into a state where services can be provided on a user terminal by operating software placed on an external server or in the cloud via a network from an app on the user terminal. Similarly, using an app on a user terminal includes both directly operating on the user terminal and indirectly operating software through a network. The following description illustrates two users; however, the number of users is not limited thereto. In the system of the present disclosure, one or more multiple users are assumed. User terminals are, for example, smartphones, tablet terminals, game consoles, or personal computers. An app may be used on a terminal provided by a service provider.

[0040]

The service provider 20, which is the provider or managing operator of an app, manages a service provider apparatus 21. The service provider apparatus 21 is an apparatus that performs various data processing related to the service provider 20, and is typically a general-purpose computer, such as a personal computer, a workstation, and a server. The service provider apparatus 21 can communicate with the user terminals 11 and 12 through a network 50. Through communication between the service provider apparatus 21 and the user terminals 11 and 12, the service provider apparatus 21 can grasp the usage status of the app on the user terminals 11 and 12.

[0041]

A carbon dioxide reduction operator 30 is a business operator that manages a carbon dioxide reduction device 32. The carbon dioxide reduction operator 30 activates the carbon dioxide reduction device 32 upon request from others and reports the amount of carbon dioxide reduced to the client. The carbon dioxide reduction device 32 is a device that reduces, captures, and reduces carbon dioxide from gases, such as the atmosphere and various exhaust gases. A specific example of the carbon dioxide reduction device 32 will be described later. The carbon dioxide reduction operator 30 manages the reduction operator apparatus 31. The reduction operator apparatus 31 is an apparatus that, for example, processes requests from outside sources and processes data related to carbon dioxide reduction by the carbon dioxide reduction device 32. The reduction operator apparatus 31 is typically a general-purpose computer, such as a personal computer, a workstation, and a server. The reduction operator apparatus 31 can communicate with

other apparatuses through the network 50.

[0042]

A carbon dioxide emission supervisor 40 is, for example, a national or local authority, or a public institution, or a business operator commissioned from them. The carbon dioxide emission supervisor 40 certifies the amount of reduction in carbon dioxide and the amount of emission reduced upon receiving those reports. Certification refers to, for example, proving contribution of reduction or the like, or granting compensation corresponding to reduction or the like. The carbon dioxide emission supervisor 40 owns and manages a supervisor apparatus 41. The supervisor apparatus 41 is an apparatus that performs data processing related to the above certification, and is typically a general-purpose computer. The supervisor apparatus 41 can communicate with other apparatuses through the network 50.

[0043] <First embodiment>

One of the embodiments of the present disclosure is a carbon dioxide reduction accelerating system 10 with which User 1 who uses an app provided by the service provider 20 on the user terminal 11 earns contribution points corresponding to usage records of the app from the service provider 20. In the following description of the system, User 1 is used as a representative; however, there may be multiple users in the embodiment, and the number of users is not limited.

[0044]

The operation of the carbon dioxide reduction accelerating system 10 according to first embodiment of the present disclosure will be described with reference to FIGS. 1 and 2.

[0045]

The service provider apparatus 21 receives usage records 81 of the app and user identification information 82 from the user terminal 11 through communication with the user terminal 11. The usage records 81 are stored in the service provider apparatus 21 in association with the user identification information 82 of User 1. The service provider apparatus 21 creates request information 83. The request information 83 includes the amount of carbon dioxide reduction work corresponding to the usage records 81. The service provider apparatus 21 transmits the created request information 83 to the reduction operator apparatus 31. The service provider apparatus 21 receives a reduction record

value 84 from the reduction operator apparatus 31 upon completion of the carbon dioxide reduction work. The service provider apparatus 21 transmits the reduction record value 84 to the supervisor apparatus 41. The supervisor apparatus 41 issues carbon dioxide credits 85 corresponding to the reported reduction record value 84. The service provider apparatus 21 receives the carbon dioxide credits 85 from the supervisor apparatus 41. The service provider apparatus 21 calculates contribution points 86 based on the received carbon dioxide credits 85 and the usage records 81 of the user terminal 11. The service provider apparatus 21 transmits the calculated contribution points 86 to the user terminal 11.

[0046]

The transmission of contribution points 86 to the user terminal 11 is not limited to directly transmitting the contribution points 86 themselves. As is commonly implemented in many point systems, the points themselves may be virtual values and may be managed as numeric values (for example, point balances) granted to registered users on the server of the business operator that manages the points. In this case, it is assumed that the contribution points 86 have been transmitted to the user terminal 11 when the user terminal 11 is notified of the addition of the contribution points 86. In addition, the transmission of contribution points 86 to the user terminal 11 is not limited to active transmission from the service provider apparatus 21 and may also be a notification in the form of returning numeric values in response to data references from User 1 to the service provider apparatus 21 or the like.

[0047]

The above description relates to User 1 and the user terminal 11. When there are multiple users, for example, there is additional User 2, the same applies to each user. When there are multiple users, the request information 83 transmitted from the service provider apparatus 21 to the reduction operator apparatus 31 may consolidate requests related to multiple users into single request information 83. In addition, the reduction record value 84 transmitted from the service provider apparatus 21 to the supervisor apparatus 41, and the carbon dioxide credits 85 received from the supervisor apparatus 41 may also be a total value concerning multiple users.

[0048]

In the present disclosure, entities that have economic value and are tradable among

tangible and intangible entities granted as certification are collectively referred to as carbon dioxide credits 85. In an example, at the time of filing the present application, J-Credit Scheme is being managed in Japan (see URL: <https://japancredit.go.jp/>). The Scheme is described that "Under the J-Credit Scheme, the government certifies the amount of greenhouse gas emissions (such as CO₂) reduced or removed by introducing energy-saving devices or using renewable energy and appropriately manage forests, as 'credit'. This scheme, which was created by expansively integrating the Domestic Credit Scheme and the Offset Credit (J-VER; Japan's verified emissions reduction) Scheme, is administered by the central government. Credits created under the scheme can be used for various purposes, such as achieving the targets of the Nippon Keidanren's Carbon Neutrality Action Plan and carbon offset". The owner of the credits can obtain economic benefits and social benefits through various methods, such as selling the credits.

[0049] (User terminal)

User 1 is, for example, an individual or corporation that owns the user terminal 11. Owning may be a concept that includes not only legal relationships but also those who substantially receive a benefit related to the user terminal 11. The user terminal 11 is typically a smartphone, a tablet terminal, or a personal computer, used by User 1. The user terminal 11 is configured to be able to communicate via the network 50.

[0050]

Referring to FIG. 3, the user terminal 11 has an installed app 110 that is provided by the service provider 20. The user terminal 11 includes a usage record transmission unit 120. The usage record transmission unit 120 transmits the usage records 81 of the app 110 and the user identification information 82 unique to User 1 and the user terminal 11 to the service provider apparatus 21 owned by the service provider 20. In addition, the user terminal 11 includes a point receiving unit 130 that receives contribution points 86 from the service provider apparatus 21. Other than the above, the basic configuration that the user terminal 11 originally includes is not illustrated. When, for example, the user terminal 11 is a smartphone, the basic configuration includes an input unit, a communication unit, a display unit, and the like.

[0051]

User 1 uses the user terminal 11 to use the app 110. The usage record transmission unit 120 has the function of compiling the usage records 81 from the app 110 and

transmitting the usage records 81 to the service provider apparatus 21 at a predetermined timing. The usage records 81 are a period of time during which the app 110 is mainly used and may include specific conditions of use, such as a date and time and place of use and operation details of the app 110. The timing at which the usage records 81 are transmitted is not limited in particular and may be the end of use of the app 110, regular intervals such as once a day or once an hour, times designated by the user, or the like. The usage record transmission unit 120 transmits the user identification information 82 unique to User 1 or the user terminal 11 to the service provider apparatus 21 in addition to the transmission of the usage records 81. The user identification information 82 may be information, such as the name of User 1 and an ID assigned in advance to User 1. In addition, the user identification information 82 may be a device number, address information, or the like, unique to the user terminal 11.

[0052]

The point receiving unit 130 receives contribution points 86, provided by the service provider 20, from the service provider apparatus 21. The contribution points 86 here are not limited in particular as long as User 1 can directly or indirectly enjoy economic benefits. Contribution points 86 may be, for example, points known as various point systems, miles in frequent flyer programs, electronic money, virtual currencies, or discount coupons. The point receiving unit 130 and the usage record transmission unit 120 may be configured as software integrated with the app 110. In other words, the point receiving unit 130 and the usage record transmission unit 120 may be configured as part of the functions of the app 110.

[0053] (Service provider apparatus and reduction operator apparatus)

As shown in FIG. 1, the service provider apparatus 21 is an apparatus managed by the service provider 20. The reduction operator apparatus 31 is an apparatus managed by the carbon dioxide reduction operator 30. As shown in FIG. 2, the service provider apparatus 21 is an apparatus for performing a series of operations in which the service provider 20 grasps the usage records 81 of the app 110 used by User 1, requests the carbon dioxide reduction work corresponding to the usage records 81 from the carbon dioxide reduction operator 30, reports the reduction record value 84 to the carbon dioxide emission supervisor 40 to receive carbon dioxide credits 85, and grants contribution points 86, corresponding to the carbon dioxide credits 85, to User 1. The reduction operator

apparatus 31 is an apparatus for performing operations including receiving the request information 83 for carbon dioxide reduction by the carbon dioxide reduction operator 30 and transmitting the reduction record value 84 to the service provider apparatus 21.

[0054]

As shown in FIG. 4, the service provider apparatus 21 is an apparatus that includes at least a processing unit 210, a communication unit 220, and a storage unit 230. The service provider apparatus 21 may include a common display unit, a common input unit, and the like; however, those are not shown in FIG. 4. The service provider apparatus 21 can be composed of a computer that includes, for example, a central processing unit (CPU), a random access memory (RAM), a read only memory (ROM), a communication interface, and an input/output interface. The processing unit 210, the communication unit 220, the storage unit 230, and the like, are connected to one another via a bus 240. The storage unit 230 is composed of volatile or nonvolatile memory elements. The storage unit 230 stores a program and data. For example, the program stored in the ROM is deployed into the RAM, and the functions of the processing unit 210 are realized by running the program on the CPU. The communication unit 220 is, for example, configured to transmit and receive Ethernet frames, which are data generated by the processing unit 210, to and from outside sources via the network 50, which is Ethernet (registered trademark). Referring to FIG. 5, the reduction operator apparatus 31 is an apparatus that includes at least a processing unit 310, a communication unit 313, and a storage unit 314. The reduction operator apparatus 31 may include a common display unit, a common input unit, and the like; however, those are not shown in FIG. 5. The reduction operator apparatus 31 can be composed of a computer that includes, for example, a central processing unit (CPU), a random access memory (RAM), a read only memory (ROM), a communication interface, and an input/output interface. The processing unit 310, the communication unit 313, the storage unit 314, and the like, are connected to one another via a bus 315. The storage unit 314 is composed of volatile or nonvolatile memory elements. The storage unit 314 stores a program and data. For example, the program stored in the ROM is deployed into the RAM, and the functions of the processing unit 310 are realized by running the program on the CPU. The communication unit 313 is, for example, configured to transmit and receive Ethernet frames, which are data generated by the processing unit 310, to and from outside sources via the network 50,

which is Ethernet (registered trademark).

[0055]

Hereinafter, the functional units of the processing unit 210 will be described with reference to FIGS. 2 and 4. Each of these functional units is implemented by the program stored in the storage unit 230 and run by a processor.

[0056]

The processing unit 210 includes a usage record receiving unit 211 that receives the usage records 81 and the user identification information 82 from the user terminal 11. The contents of the usage records 81 and user identification information 82 are as described above. The processing unit 210 includes a record storage unit 212 that stores the usage records 81 and the user identification information 82 in association with each other. The record storage unit 212 writes how much each user has used the app 110 in the storage unit 230. The service provider apparatus 21 does not need to include the record storage unit 212. In this case, for example, a cloud service or an external storage medium may be used to store the usage records 81 and the user identification information 82 in association with each other.

[0057]

The processing unit 210 includes a request information creating unit 213 that creates request information 83 for carbon dioxide reduction work based on the stored usage records 81. Request information 83 includes the amount of carbon dioxide reduction to be requested from the carbon dioxide reduction operator 30, and is common information, such as client information and a delivery deadline. The amount of carbon dioxide reduction included in the request information 83 is a value calculated from the usage records 81. The amount of carbon dioxide reduction is, for example, calculated as follows. When the usage records 81 are, for example, the usage time of the app 110, the estimated electric power consumption is calculated from the usage time. The amount of carbon dioxide generated, corresponding to the electric power consumption, is calculated with a predetermined method. The calculated amount of carbon dioxide generated may also be used as the requested amount of carbon dioxide reduction. In other words, it is the idea of determining the amount of energy consumed by User 1 or the user terminal 11 according to the use of the app 110 and reducing the amount of carbon dioxide corresponding to the amount of carbon dioxide generated, estimated from the amount of

energy. A calculation method for the amount of carbon dioxide reduction from the usage records 81 can be determined in various ways and is not limited. These calculations may be performed using predetermined formulas or by consulting a table of a numerical relationship that has been previously stored in the storage unit 230. The calculation method is implemented in the program as the function of the request information creating unit 213. When the requested amount of carbon dioxide reduction is calculated, various circumstances, such as a separate request for purchasing the amount of carbon dioxide reduction from User 1, the acquisition of the amount of carbon dioxide reduction according to the occurrence of events in the app 110, may be taken into consideration.

[0058]

The timing at which the request information 83 is created can be optionally determined according to the timing at which the service provider 20 requests work from the carbon dioxide reduction operator 30. In addition, the request information 83 may include the amount of carbon dioxide reduction corresponding to the usage records 81 for each user, or may include the amount of carbon dioxide reduction corresponding to the total value obtained by compiling the usage records 81 of multiple users. The service provider 20 may create request information 83 that includes the amount of carbon dioxide reduction, determined in advance regardless of the usage records 81. The service provider 20 can request carbon dioxide reduction work based on the request information 83 created in advance to obtain the reduction record value 84 at its own timing.

[0059]

The request information transmission unit 214 executes the process of transmitting the request information 83 to the reduction operator apparatus 31. The reduction value receiving unit 215 executes the process of receiving the reduction record value 84 from the reduction operator apparatus 31. The carbon dioxide reduction operator 30 activates the carbon dioxide reduction device 32 to perform carbon dioxide reduction work, according to the request information 83. The amount of carbon dioxide actually reduced is stored in the reduction operator apparatus 31 as the reduction record value 84 and is transmitted from the reduction operator apparatus 31 to the service provider apparatus 21.

[0060]

Hereinafter, the functional units of the processing unit 310 will be described with reference to FIG. 5. Each of these functional units is implemented by the program stored

in the storage unit 314 and run by a processor.

[0061]

The processing unit 310 includes a request information record receiving unit 311 that receives the request information 83 for carbon dioxide reduction work, transmitted from the service provider apparatus 21. The processing unit 310 includes a reduction value transmission unit 312 that transmits the reduction record value 84 to the service provider apparatus 21.

[0062]

The transmission of information from the service provider apparatus 21 to the reduction operator apparatus 31 and the reception of information from the reduction operator apparatus 31 at the service provider apparatus 21 are performed by the function of the communication unit 220 of the service provider apparatus 21. These transmission and reception are not limited to communication via the Internet by the communication unit 220. For example, instead of communication via the Internet, a method in which the service provider apparatus 21 uses the request information transmission unit 214 to output the created transmission information and transmits the output transmission information to the reduction operator apparatus 31 via another means may be employed. Instead of communication via the Internet, a method in which the reduction value receiving unit 215 receives, via another input means, information output from the reduction operator apparatus 31 may be employed.

[0063]

The processing unit 210 includes a reduction value transmission unit 216 that transmits the reduction record value 84, received from the reduction operator apparatus 31, to the supervisor apparatus 41. In addition, the processing unit 210 includes a credit receiving unit 217 that receives carbon dioxide credits 85 corresponding to the reduction record value 84 from the supervisor apparatus 41.

[0064]

The timing to transmit the reduction record value 84 can be optionally determined. The reduction record value 84 to be transmitted may be a value corresponding to each individual piece of request information 83 or may be a total value obtained by compiling values corresponding to pieces of request information 83 to be transmitted over multiple times.

[0065]

The carbon dioxide emission supervisor 40 issues carbon dioxide credits 85 according to the reduction record value 84. The issued carbon dioxide credits 85 are stored in the supervisor apparatus 41 and transmitted from the supervisor apparatus 41 to the service provider apparatus 21.

[0066]

The transmission of information from the service provider apparatus 21 to the supervisor apparatus 41 and the reception of information from the supervisor apparatus 41 at the service provider apparatus 21 are performed by the function of the communication unit 220 of the service provider apparatus 21. These transmission and reception are not limited to communication via the Internet by the communication unit 220. For example, instead of communication via the Internet, a method in which the service provider apparatus 21 uses the reduction value transmission unit 216 to output the created transmission information and transmits the output transmission information to the supervisor apparatus 41 via another means may be employed. Instead of communication via the Internet, a method in which the credit receiving unit 217 receives, via another input means, information output from the supervisor apparatus 41 may be employed.

[0067]

The processing unit 210 includes a point calculation unit 218 that calculates contribution points 86 based on the carbon dioxide credits 85 received from the supervisor apparatus 41 and the usage records 81 of User 1. As described above, the service provider 20 can determine the relationship between the usage records 81 and the contribution points 86 based on various conditions. In other words, determining the contribution points 86 based on conditions other than the usage records 81 is not excluded. In addition, the calculated contribution points 86 are transmitted to the user terminal 11 by a point transmission unit 219. The contribution points 86 transmitted from the service provider apparatus 21 are received by the point receiving unit 130 (see FIG. 3) at the user terminal 11.

[0068]

Through the above flow, User 1 is able to receive contribution points 86 corresponding to the usage records 81 of the app 110. User 1 is able to find the acquisition of the contribution points 86 by displaying the app 110 on the user terminal 11.

In the present embodiment, the amount of carbon dioxide emissions estimated from the energy consumption resulting from the use of the app 110 by User 1 corresponds to the amount of carbon dioxide actually reduced from the atmosphere. As a result, emissions of carbon dioxide into the atmosphere are cancelled out, and the user can enjoy the benefits of the contribution points 86.

[0069] <Second embodiment>

The second embodiment of the present disclosure is a carbon dioxide reduction accelerating system 10 with which User 1 who uses an application provided by the service provider 20 on the user terminal 11 earns carbon dioxide credits 85 corresponding to usage records 81 of the app 110 from the carbon dioxide emission supervisor 40. In the following description of the system, User 1 is used as a representative; however, there are multiple users in the embodiment, and the number of users is not limited. The description overlapping that of the first embodiment is omitted.

[0070]

The operation of the carbon dioxide reduction accelerating system 10 according to the second embodiment of the present disclosure will be described with reference to FIGS. 1 and 6.

[0071]

The service provider apparatus 21 receives usage records 81 of the application and user identification information 82 from the user terminal 11 through communication with the user terminal 11. The usage records 81 are stored in the service provider apparatus 21 in association with the user identification information 82 of User 1. The service provider apparatus 21 creates request information 83. The request information 83 includes the amount of carbon dioxide reduction work corresponding to the usage records 81. The service provider apparatus 21 transmits the created request information 83 to the reduction operator apparatus 31. The service provider apparatus 21 receives a reduction record value 84 from the reduction operator apparatus 31 upon completion of the carbon dioxide reduction work. The service provider apparatus 21 calculates a distribution record value 87 to be allocated to User 1 from the reduction record value 84 based on the usage records 81 of User 1. The service provider apparatus 21 creates data that associates the distribution record value 87 with the user identification information 82. The service provider apparatus 21 transmits the data that associates the distribution record value 87

with the user identification information 82 to the supervisor apparatus 41. In other words, the data to be transmitted to the supervisor apparatus 41 is data consisting of a combination of a user identified by the user identification information 82 and the distribution record value 87 to be allocated to the user. The supervisor apparatus 41 issues carbon dioxide credits 85 corresponding to each distribution record value 87 reported. The supervisor apparatus 41 transmits, to the user terminal 11, the carbon dioxide credits 85 to be given to User 1 toward the user terminal 11. The user terminal 11 receives the carbon dioxide credits 85 from the supervisor apparatus 41.

[0072]

The above description relates to User 1 and the user terminal 11. When there are multiple users, for example, there is additional User 2, the same applies to each user. When there are multiple users, the request information 83 transmitted from the service provider apparatus 21 to the reduction operator apparatus 31 may consolidate requests related to multiple users into a single request.

[0073] (User terminal)

The components and functions of the user terminal 11 in the second embodiment are similar to those of the user terminal 11 in the first embodiment. The description of similar components to those of the first embodiment is omitted. Referring to FIG. 3, in the second embodiment, the point receiving unit 130 receives carbon dioxide credits 85 from the supervisor apparatus 41. In other words, it only needs to be interpreted that carbon dioxide credits 85 are received as contribution points 86.

[0074] (Service provider apparatus and reduction operator apparatus)

The service provider apparatus 21 is an apparatus managed by the service provider 20. The service provider apparatus 21 is an apparatus for performing a series of operations in which the service provider 20 grasps the usage records 81 of the app 110 used by User 1, requests carbon dioxide reduction work corresponding to the usage records 81 from the carbon dioxide reduction operator 30, organizes the reduction record value 84 as the distribution record value 87 for each user, and reports the distribution record value 87 for each user to the carbon dioxide emission supervisor 40. The configuration and functions of the reduction operator apparatus 31 are the same as those of the first embodiment, so the description is omitted.

[0075]

As shown in FIG. 7, the service provider apparatus 21 is an apparatus that includes at least a processing unit 210, a communication unit 220, and a storage unit 230. The service provider apparatus 21 may include a common display unit, a common input unit, and the like; however, those are not shown in FIG. 7. The service provider apparatus 21 can be composed of a computer that includes, for example, a central processing unit (CPU), a random access memory (RAM), a read only memory (ROM), a communication interface, and an input/output interface. The processing unit 210, the communication unit 220, the storage unit 230, and the like, are connected to one another via a bus 240. The storage unit 230 is composed of volatile or nonvolatile memory elements. The storage unit 230 stores a program and data. For example, the program stored in the ROM is deployed into the RAM, and the functions of the processing unit 210 are realized by running the program on the CPU. The communication unit 220 is, for example, configured to transmit and receive Ethernet frames, which are data generated by the processing unit 210 and the like, to and from outside sources via the network 50, which is Ethernet (registered trademark).

[0076]

Hereinafter, the functional units of the processing unit 210 will be described with reference to FIGS. 6 and 7. Each of these functional units is implemented by the program stored in the storage unit 230 and run by a processor. Among the functional units of the processing unit 210, the usage record receiving unit 211, the record storage unit 212, the request information creating unit 213, the request information transmission unit 214, and the reduction value receiving unit 215 are the same as those of the first embodiment. The description of these functional units is omitted.

[0077]

The processing unit 210 includes a distribution record value calculation unit 251 and a distribution record value transmission unit 252. The distribution record value calculation unit 251 calculates the amount of carbon dioxide reduction to be associated with the usage records 81 of the user terminal 11 from the reduction record value 84 received from the reduction operator apparatus 31, as the distribution record value 87. The distribution record value transmission unit 252 performs the process of transmitting the calculated distribution record value 87 to the supervisor apparatus 41 along with the user identification information 82 that identifies the user terminal 11 to which the

distribution record value 87 is linked.

[0078]

The timing to transmit the distribution record value 87 can be optionally determined. The distribution record value 87 to be transmitted may be a value corresponding to each individual piece of request information 83 or may be a total value obtained by compiling values corresponding to pieces of request information 83 over multiple times.

[0079]

The carbon dioxide emission supervisor 40 issues carbon dioxide credits 85 according to each individual distribution record value 87. The issued carbon dioxide credits 85 are stored in the supervisor apparatus 41 and transmitted from the supervisor apparatus 41 to the corresponding user terminal 11.

[0080]

The transmission of information from the service provider apparatus 21 to the supervisor apparatus 41 and the reception of carbon dioxide credits 85 from the supervisor apparatus 41 at the user terminal 11 are not limited to communication via the Internet. For example, instead of communication via the Internet, a method in which the service provider apparatus 21 outputs transmission information obtained by organizing data of the user terminal 11 and the distribution record value 87 and transmits the output transmission information to the supervisor apparatus 41 via another means may be employed. Instead of communication via the Internet, a method in which the user terminal 11 or User 1 him or herself receives, via another input means, carbon dioxide credits 85 output from the supervisor apparatus 41 may be employed.

[0081]

Through the above flow, User 1 is able to receive carbon dioxide credits 85 corresponding to the usage records 81 of the app 110. In the present embodiment, the amount of carbon dioxide emissions estimated from the energy consumption resulting from the use of the app 110 by User 1 corresponds to the amount of carbon dioxide actually reduced from the atmosphere. As a result, emissions of carbon dioxide into the atmosphere are cancelled out, and the user can receive carbon dioxide credits 85 in return for the contribution.

[0082]

The processing of each functional unit in the above-described embodiments is realized by a processing circuit (circuitry) that includes one or more processors. The processing circuit may be composed of an integrated circuit or the like, in which one or more memories, various analog circuits, and various digital circuits are combined in addition to one or more processors. One or more memories store programs (instructions) that cause one or more processors to run each process. One or more processors may execute each process in accordance with a program read from one or more memories, or may execute each process in accordance with a logical circuit designed in advance to execute each process. The processor may be one of various types of processors suitable for controlling computers, such as a central processing unit (CPU), a graphics processing unit (GPU), a digital signal processor (DSP), a field programmable gate array (FPGA), and an application specific integrated circuit (ASIC). Multiple physically separated processors may collaborate with each other to execute each process. For example, processors respectively installed in multiple physically separated computers may collaborate with each other to execute each process via a network, such as a local area network (LAN), a wide area network (WAN), and the Internet. The program can be installed in a memory via a network from an external server device or the like, or the program can be distributed in a state of being stored on a recording medium, such as a compact disc read only memory (CD-ROM), a digital versatile disk read only memory (DVD-ROM), and a semiconductor memory, and installed from the recording medium into a memory.

[0083] <Carbon dioxide reduction device>

The carbon dioxide reduction device 32 managed by the carbon dioxide reduction operator 30 will be described. The carbon dioxide reduction device 32 is a device that reduces, captures, and reduces carbon dioxide from gases, such as the atmosphere and various exhaust gases. The carbon dioxide reduction device 32 described in the present disclosure is a generic name for equipment that includes a capture device that reduces carbon dioxide, and its ancillary facilities, pipes, a controller, a power supply, and the like.

[0084] <Capture device>

A device that uses carbon dioxide capture materials in a solution to immobilize carbon dioxide into captured products to reduce carbon dioxide will be described as an example of a capture device. The capture device applicable to the carbon dioxide

reduction accelerating system 10 of the present disclosure is not limited to the device described below, and various devices capable of separating and reducing carbon dioxide in gases can be applied. The capture device specifically described below can reduce and reduce carbon dioxide with a simple configuration and can immobilize carbon dioxide in a gas as captured products and reduce carbon dioxide, so the capture device can be applied to the carbon dioxide reduction accelerating system 10 of the present disclosure.

[0085]

The configuration of a capture device 500 will be described with reference to FIGS. 8 and 9. A target gas 512 that is a gas containing carbon dioxide is supplied to the capture device 500. Carbon dioxide in the target gas 512 is captured by the action of the carbon dioxide capture materials 510 in the solution 520.

[0086]

The size of the capture device 500 is set as needed according to a place of use and a purpose. Hereinafter, the capture device 500 will be described in detail.

[0087]

The capture device 500 includes a storage tank 501, the carbon dioxide capture materials 510, the solution 520 that covers the carbon dioxide capture materials 510, and a supply portion 530 that supplies the target gas 512 containing carbon dioxide to the solution 520. Carbon dioxide becomes carbonate ions in the solution 520. The capture device 500 may include a dissolution accelerating mechanism 540 that accelerates the dissolution of carbon dioxide into the solution 520, a dispersing mechanism 550 that disperses the multiple carbon dioxide capture materials 510 in the solution 520, and porous supports 571 where the carbon dioxide capture materials 510 are disposed. In addition, the capture device 500 may include a solution adjustment mechanism 560 that supplies at least one of an acidic substance, a reducing agent, a sequestering agent, and a builder to the solution 520.

[0088] (Carbon dioxide capture material)

The carbon dioxide capture materials 510 are in particle or powder form. In the present embodiment, the carbon dioxide capture materials 510 are particles having iron or an iron compound as a main component. The carbon dioxide capture materials 510 having iron as a main component are, for example, iron and iron alloys. Iron alloys may include iron, and manganese, chromium, molybdenum, aluminum, copper, zinc, nickel, or

the like. Iron compounds include iron (II) hydroxide, iron (II) hexacyanoferrate (II), and the like. The carbon dioxide capture materials 510 may be layered double hydroxides, basic metal oxides, or basic metal hydroxides, other than iron.

[0089]

The carbon dioxide capture materials 510 have iron or iron compounds as the main component, so the carbon dioxide capture materials 510 can easily capture carbonate ions and the like in the solution 520. Iron ions are produced from iron and similar materials that are the carbon dioxide capture materials 510 in the solution 520. Carbonate ions and iron ions present in the solution 520 precipitate as ferrous carbonate and are reduced as captured products.

[0090]

The mean particle diameter of the multiple carbon dioxide capture materials 510 may be, for example, 5 nm to 500 μm , may be 10 nm to 200 μm , or may be 15 nm to 100 μm .

[0091] (Support)

Multiple carbon dioxide capture materials 510 are disposed on or in the supports 571. Since the capture device 500 includes the supports 571, the carbon dioxide capture materials 510 can be stably held. In addition, it is possible to easily reduce and wash away the captured products that are ferrous carbonate adhering to the carbon dioxide capture materials 510.

[0092]

The supports 571 of the present embodiment are porous sheets. Multiple carbon dioxide capture materials 510 are disposed on or in a single porous sheet. Since the supports 571 are porous sheets, it is possible to easily and reliably bring carbonate ions and the like into contact with the carbon dioxide capture materials 510. In addition, multiple carbon dioxide capture materials 510 are arranged at intervals on or in a single porous sheet. Since multiple carbon dioxide capture materials 510 are arranged with space between the multiple carbon dioxide capture materials 510, the aggregation of the carbon dioxide capture materials 510 is suppressed, so it is easier to improve the capture effect of carbonate ions and the like by the carbon dioxide capture materials 510.

[0093]

The supports 571 are, for example, fabric, nonwoven fabric sheets, woven fabric

sheets, sponge sheets, cellulose fiber sheets such as Japanese paper, carbon fiber sheets, ceramic fiber sheets made of alumina or similar materials, or metal fiber sheets made of copper, stainless steel, or similar materials. The carbon dioxide capture materials 510 may be disposed on the surface of the supports 571 or may be disposed in the supports 571. The supports 571 are not limited to porous sheets. For example, the supports 571 may be porous particles or may be porous threads.

[0094]

When the capture device 500 includes multiple supports 571, the multiple supports 571 may be arranged with space between each other. With such a configuration, it is possible to easily and stably hold the multiple carbon dioxide capture materials 510 in a state of being easier to contact carbonate ions and the like.

[0095]

When multiple supports 571 are arranged with space between each other, these supports 571 may be disposed with a spacer 572 in between. In FIGS. 8 and 9, the multiple supports 571 are arranged alternately with the spacers 572 in the thickness direction. The spacers 572 have, for example, a plate shape. The spacers 572 are arranged alternately with the supports 571 in a state where the plate surfaces are in contact with the corresponding supports 571. The spacers 572 are porous bodies. Since the spacers 572 are porous bodies, passages through which carbonate ions and the like reach the carbon dioxide capture materials 510 are provided. The spacers 572 are, for example, mesh bodies and sponge bodies. The spacer 572 is not limited to a plate shape. The spacer 572 may be a rod-like member that contacts only part of the support 571. With the spacers 572, the multiple supports 571 can be easily disposed at high density while maintaining space from each other.

[0096] (Supply portion)

The supply portion 530 supplies the target gas 512, which is a gas containing carbon dioxide, to the solution 520. The supply portion 530 includes, for example, a supply pipe capable of supplying a gas containing carbon dioxide from the lower part of the storage tank 501 into the storage tank 501.

[0097] (Solution)

The solution 520 constantly covers the multiple carbon dioxide capture materials 510. In the capture device 500, multiple carbon dioxide capture materials 510 are

immersed in the solution 520.

[0098]

The pH of the solution 520 and the potential of the carbon dioxide capture materials 510 may be controlled within the range where divalent iron ions or divalent iron hydroxide are stable on the potential-pH diagram. In other words, the pH of the solution 520 and the potential of the carbon dioxide capture materials 510 may be controlled to increase the content of divalent iron ions or divalent iron hydroxide in the solution 520.

[0099]

The solution 520 includes water as a solvent. In addition, the solution 520 may contain a solubilizing agent that accelerates the dissolution of carbon dioxide into the solution 520, and the solution 520 may contain a pH buffer. The solution 520 may contain a salt that exhibits acidity in the solution 520 to reduce the pH of the solution 520. The solution 520 may contain a carbonation accelerator 521 to accelerate the carbonation of iron ions eluted from the carbon dioxide capture materials 510. The solubilizing agent is, for example, a carbonic anhydrase. A carbonic anhydrase promotes the production of bicarbonate ions (HCO_3^-). A pH buffer (buffer) makes it easier to maintain the pH of the solution 520 at a desired value. Examples of the pH buffers include sodium tartrate, sodium acetate, sodium borate, sodium citrate, ammonium chloride, and sodium phosphate. Examples of the salt that exhibits acidity in the solution 520, that is, the salt that exhibits acidity when dissolved in the solution 520, include sodium hydrogen sulfate, ammonium hydrogen sulfate, sodium dihydrogen phosphate, iron (II) sulfate, and iron (II) chloride. When the solution 520 includes salt in this way, the pH of the solution 520 can be easily reduced. In the present embodiment, the carbonation accelerator 521 is in particle form. The carbonation accelerator 521 includes ferrous carbonate or iron bicarbonate. The carbonation accelerator 521 can be a seed crystal for carbonating iron ions.

[0100]

A gas containing carbon dioxide is supplied from the supply portion 530 into the solution 520. As a result, carbonate ions (CO_3^{2-}) or hydrogen carbonate ions (HCO_3^-) are produced in the solution 520.

[0101] (Dissolution accelerating mechanism)

The dissolution accelerating mechanism 540 accelerates the dissolution of carbon

dioxide into the solution 520 as described above. When the capture device 500 includes the dissolution accelerating mechanism 540, it is easier to increase the amount of carbon dioxide in the solution 520. Therefore, the efficiency of capturing carbon dioxide is further improved.

[0102]

The dissolution accelerating mechanism 540 is, for example, a bubble generator capable of generating fine bubbles, such as nanobubbles and microbubbles, in the solution 520, an ultrasonic generator capable of generating cavitation bubbles in the solution 520, and a temperature and pressure controller capable of decreasing the water temperature of the solution 520 and increasing the partial pressure of carbon dioxide.

[0103]

In FIGS. 8 and 9, the capture device 500 includes a bubble generator as the dissolution accelerating mechanism 540. The bubble generator is disposed in a flow channel for a gas containing carbon dioxide, the flow channel extending from the supply portion 530 to the storage tank 501. The bubble generator produces fine bubbles from a gas containing carbon dioxide and supplies the fine bubbles into the solution 520.

[0104] (Dispersing mechanism)

The dispersing mechanism 550 disperses the multiple carbon dioxide capture materials 510 in the solution 520. The dispersing mechanism 550 maintains the mean particle diameter of the multiple carbon dioxide capture materials 510. The dispersing mechanism 550 functions particularly effectively when the multiple carbon dioxide capture materials 510 are easy to aggregate. As the dispersing mechanism 550, a device that generates a water flow in the solution 520 can be used, and an ultrasonic generator, a stirring device, or the like, can be used. FIG. 8 shows an ultrasonic generator as the dispersing mechanism 550. In addition, a device that attracts, fractionates, and immobilizes the carbon dioxide capture materials 510 (at specific positions) by using magnetic force can be used as the dispersing mechanism 550. Such a device is, for example, a magnetic separator.

[0105] (Solution adjustment mechanism)

The solution adjustment mechanism 560 supplies an acidic substance to the solution 520 when, for example, the pH of the solution 520 has increased. Examples of the acidic substance include the above-described salts and solutions in which the salts are dissolved.

[0106] (Storage tank)

The solution 520 is stored in the storage tank 501. The capture device 500 includes a degassing mechanism 503 that emits gas released from the solution 520. In the present embodiment, the storage tank 501 has a porous membrane 502 for disposing the above-described carbonation accelerator 521 with space from the carbon dioxide capture materials 510 and the supports 571.

[0107] (Porous membrane)

As shown in FIG. 9, the porous membrane 502, for example, vertically separates the carbonation accelerator 521 from the carbon dioxide capture materials 510 and the supports 571 inside the storage tank 501. The carbonation accelerator 521 may be disposed below the porous membrane 502, and the carbon dioxide capture materials 510 and the supports 571 may be disposed above the porous membrane 502. When the porous membrane 502 separates the carbonation accelerator 521 from the carbon dioxide capture materials 510 and the supports 571, it is possible to easily reduce ferrous carbonate or the like, which uses the carbonation accelerator 521 as a seed crystal, as described above.

[0108]

The porous membrane 502 may be configured to suppress the passage of ferrous carbonate or the like and allow the passage of carbonate ions or the like. Since the porous membrane 502 suppresses the passage of ferrous carbonate or the like, it is possible to inhibit the coating of the carbon dioxide capture materials 510 with ferrous carbonate or the like using the carbonation accelerator 521 as a seed crystal, so it is possible to further suppress a decrease in the activation of the carbon dioxide capture materials 510. In addition, when the porous membrane 502 allows the passage of carbonate ions or the like, the supply of carbonate ions or the like to the carbon dioxide capture materials 510 is easily accelerated.

[0109] (Degassing mechanism)

The degassing mechanism 503 is disposed at the top part of the storage tank 501. The degassing mechanism 503 discharges the gas rising through the solution 520 and released from the liquid surface of the solution 520 to the outside of the capture device 500. Furthermore, the degassing mechanism 503 discharges gas to the outside of the capture device 500 so as to reduce the pressure of gas that contacts the solution 520. When the pressure of the gas that is in contact with the solution 520 is reduced in this way,

the degassing mechanism 503 reduces the content of dissolved oxygen in the solution 520. As a result, the oxidation effect due to dissolved oxygen in the solution 520 is reduced, making it easier to maintain a state where the ratio of divalent iron ions in the solution 520 is increased.

[0110]

The embodiments described above are illustrative and not restrictive in all respects. The present invention is not limited to these examples. The present invention is defined by the claims, and is intended to encompass all modifications within the scope of the claims and equivalents thereof.

REFERENCE SIGNS LIST

[0111]

- 1, 2 user
- 11, 12 user terminal
- 110 application (app)
- 120 usage record transmission unit
- 130 point receiving unit
- 10 carbon dioxide reduction accelerating system
- 20 service provider
- 21 service provider apparatus
- 210 processing unit
- 211 usage record receiving unit
- 212 record storage unit
- 213 request information creating unit
- 214 request information transmission unit
- 215 reduction value receiving unit
- 216 reduction value transmission unit
- 217 credit receiving unit
- 218 point calculation unit
- 219 point transmission unit
- 251 distribution record value calculation unit
- 252 distribution record value transmission unit
- 220 communication unit

230 storage unit
240 bus
30 carbon dioxide (CO₂) reduction operator
31 reduction operator apparatus
310 processing unit
311 request information receiving unit
312 reduction value transmission unit
313 communication unit
314 storage unit
315 bus
32 carbon dioxide (CO₂) reduction device
40 carbon dioxide (CO₂) emission supervisor
41 supervisor apparatus
50 network
81 usage records
82 user identification information
83 request information
84 reduction record value
85 carbon dioxide (CO₂) credit
86 contribution points
87 distribution record value
500 capture device
501 storage tank
502 porous membrane
503 degassing mechanism
510 carbon dioxide capture material
512 target gas
520 solution
521 carbonation accelerator
530 supply portion
540 dissolution accelerating mechanism
550 dispersing mechanism

- 560 solution adjustment mechanism
- 571 support
- 572 spacer

CLAIMS

[Claim 1]

A carbon dioxide reduction accelerating system comprising:

a user terminal; and

a service provider apparatus, wherein

the user terminal includes

a usage record transmission unit configured to transmit usage records of application software by a user and user identification information unique to the user to the service provider apparatus, and

a point receiving unit configured to receive contribution points corresponding to the usage records from the service provider apparatus, and

the service provider apparatus includes

a usage record receiving unit configured to receive the usage records and the user identification information from the user terminal,

a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records,

a request information transmission unit configured to transmit the request information to a reduction operator apparatus,

a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus,

a reduction value transmission unit configured to transmit the reduction record value to a supervisor apparatus,

a credit receiving unit configured to receive carbon dioxide credits corresponding to the reduction record value from the supervisor apparatus,

a point calculation unit configured to calculate the contribution points based on the carbon dioxide credits and the usage records, and

a point transmission unit configured to transmit the contribution points to the user terminal.

[Claim 2]

A carbon dioxide reduction accelerating system comprising:

a user terminal; and

a service provider apparatus, wherein

the user terminal includes

a usage record transmission unit configured to transmit usage records of application software by a user and user identification information unique to the user to the service provider apparatus, and

a credit receiving unit configured to receive carbon dioxide credits from a supervisor apparatus, and

the service provider apparatus includes

a usage record receiving unit configured to receive the usage records and the user identification information from the user terminal,

a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records,

a request information transmission unit configured to transmit the request information to a reduction operator apparatus,

a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus,

a distribution record value calculation unit configured to calculate a distribution record value allocated to the user from the reduction record value, and

a distribution record value transmission unit configured to transmit the distribution record value along with the user identification information to the supervisor apparatus.

[Claim 3]

The carbon dioxide reduction accelerating system according to claim 1 or 2, further comprising a record storage unit configured to store the usage records and the user identification information in association with each other.

[Claim 4]

The carbon dioxide reduction accelerating system according to claim 1 or 2, wherein the service provider apparatus further includes a record storage unit configured to store the usage records and the user identification information in association with each other.

[Claim 5]

The carbon dioxide reduction accelerating system according to any one of claims 1 to 4, further comprising

a capture device configured to perform the carbon dioxide reduction work, wherein the capture device includes

a carbon dioxide capture material, a solution in which the carbon dioxide capture material is immersed, a supply portion configured to supply a target gas to the solution, and a storage tank in which the solution is stored, and

the carbon dioxide capture material includes at least any of layered double hydroxides, basic metal oxides, basic metal hydroxides, iron, and iron compounds.

[Claim 6]

A service provider apparatus comprising:

a usage record receiving unit configured to receive usage records of application software by a user and user identification information from a user terminal;

a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records;

a request information transmission unit configured to transmit the request information to a reduction operator apparatus;

a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus;

a reduction value transmission unit configured to transmit the reduction record value to a supervisor apparatus;

a credit receiving unit configured to receive carbon dioxide credits corresponding to the reduction record value from the supervisor apparatus;

a point calculation unit configured to calculate contribution points based on the carbon dioxide credits and the usage records; and

a point transmission unit configured to transmit the contribution points to the user terminal.

[Claim 7]

A service provider apparatus comprising:

a usage record receiving unit configured to receive usage records of application software by a user and user identification information from a user terminal;

a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records;

a request information transmission unit configured to transmit the request

information to a reduction operator apparatus;

a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus;

a distribution record value calculation unit configured to calculate a distribution record value allocated to the user from the reduction record value; and

a distribution record value transmission unit configured to transmit the distribution record value along with the user identification information to a supervisor apparatus.

[Claim 8]

The service provider apparatus according to claim 6 or 7 further comprising a record storage unit configured to store the usage records and the user identification information in association with each other.

[Claim 9]

A reduction operator apparatus comprising:

a request information receiving unit configured to receive request information for carbon dioxide reduction work from a service provider apparatus; and

a reduction value transmission unit configured to transmit a reduction record value to the service provider apparatus.

[Claim 10]

A carbon dioxide reduction accelerating method with which a user earns contribution points corresponding to usage records of application software, the carbon dioxide reduction accelerating method comprising:

storing the usage records in association with user identification information unique to the user;

requesting carbon dioxide reduction work from a carbon dioxide reduction operator;

receiving a reduction record value resulting from completion of the carbon dioxide reduction work from the carbon dioxide reduction operator;

providing the reduction record value to a carbon dioxide emission supervisor;

receiving carbon dioxide credits corresponding to the reduction record value from the carbon dioxide emission supervisor; and

granting the contribution points calculated based on the carbon dioxide credits and the usage records to the user.

[Claim 11]

A carbon dioxide reduction accelerating method with which a user earns carbon dioxide credits corresponding to usage records of application software, the carbon dioxide reduction accelerating method comprising:

storing the usage records in association with user identification information unique to the user;

requesting carbon dioxide reduction work from a carbon dioxide reduction operator;

receiving a reduction record value resulting from completion of the carbon dioxide reduction work from the carbon dioxide reduction operator;

providing a distribution record value allocated to the user from the reduction record value along with the user identification information to a carbon dioxide emission supervisor; and

receiving the carbon dioxide credits corresponding to the distribution record value by the user from the carbon dioxide emission supervisor.

[Claim 12]

A service provider apparatus program used in a service provider apparatus included in a carbon dioxide reduction accelerating system, the service provider apparatus program causing

the service provider apparatus to function as:

a usage record receiving unit configured to receive usage records of application software by a user and user identification information from a user terminal;

a record storage unit configured to store the usage records and the user identification information in association with each other;

a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records;

a request information transmission unit configured to transmit the request information to a reduction operator apparatus;

a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus;

a reduction value transmission unit configured to transmit the reduction record value to a supervisor apparatus;

a credit receiving unit configured to receive carbon dioxide credits corresponding to the reduction record value from the supervisor apparatus;

a point calculation unit configured to calculate contribution points based on the carbon dioxide credits and the usage records; and

a point transmission unit configured to transmit the contribution points to the user terminal.

[Claim 13]

A service provider apparatus program used in a service provider apparatus included in a carbon dioxide reduction accelerating system, the service provider apparatus program causing

the service provider apparatus to function as:

a usage record receiving unit configured to receive usage records of application software by a user and user identification information from a user terminal;

a request information creating unit configured to create request information for carbon dioxide reduction work based on the usage records;

a request information transmission unit configured to transmit the request information to a reduction operator apparatus;

a reduction value receiving unit configured to receive a reduction record value from the reduction operator apparatus;

a distribution record value calculation unit configured to calculate a distribution record value allocated to the user from the reduction record value; and

a distribution record value transmission unit configured to transmit the distribution record value along with the user identification information to a supervisor apparatus.

[Claim 14]

The service provider apparatus program according to claim 12 or 13, further causing the service provider apparatus to function as a record storage unit configured to store the usage records and the user identification information in association with each other.