Intensity Allocation Apparatus, Intensity Allocation System, Intensity Allocation Program, and Intensity Allocation Method

[Technical Field]

[0001]
The present invention relates to an intensity allocation apparatus, an intensity allocation system, an intensity allocation program, and an intensity allocation method. The present invention claims priority to Japanese Patent Application No. 2025-031503 filed on February 28, 2025, and, for designated States in which incorporation by reference of a document is permitted, the contents described in that application are incorporated herein by reference.

[Background Art]

[0002]
Technologies related to calculation of greenhouse gas emissions are in the midst of remarkable development.

[0003]
For example, a method for supporting calculation of greenhouse gas emissions disclosed in Patent Document 1 is a technology for calculating, with high accuracy, GHG (greenhouse gas) emissions of metal products. In this technology, types of energy (electricity, coke, LNG, etc.) used in the manufacture of a metal product are finely analyzed using manufacturing information, and a GHG emission intensity is calculated. Specifically, Patent Document 1 discloses a greenhouse gas emission calculation support apparatus including: first acquisition means for acquiring manufacturing information regarding a target item of a metal product; first calculation means for calculating, based on the acquired manufacturing information, a GHG emission intensity derived from manufacturing-linked energy consumed in conjunction with manufacture of the target item; second calculation means for calculating a GHG emission intensity derived from fixed energy corresponding to manufacture of the target item, the fixed energy being a portion of common fixed energy that is not directly linked to manufacture of the target item and is incidentally consumed in manufacture of the metal product; and third calculation means for calculating a total GHG emission intensity of the target item

using the GHG emission intensity derived from the manufacturing-linked energy and the GHG emission intensity derived from the fixed energy.

[Prior Art Documents]
[Patent Documents]
[0004]
[Patent Document 1] Japanese Unexamined Patent Application Publication No. 2024-108427

[Summary of the Invention]
[Problem to be Solved by the Invention]
[0005]
When calculating LCA (Life Cycle Assessment)/CFP (Carbon Footprint of Products) for quantitatively evaluating environmental impact of a product, it is necessary to allocate an emission intensity to each of raw materials constituting the product. Since emission intensities number in the thousands or more even as defined by an inventory database, it is extremely inefficient to manually allocate emission intensities one by one for all raw materials. When an emission intensity is allocated, it becomes possible to identify an emission factor predetermined for the emission intensity, and by multiplying this by an activity amount, LCA can be calculated.

[0006]
However, in many cases, names of raw materials and names of emission intensities in the inventory database do not match, and it is difficult to solve this only by a string matching method generally considered in the related art. Therefore, it is conceivable to use generative AI to allocate, for each raw material, an appropriate emission intensity that corresponds thereto in consideration of the meaning of the item. However, generative AI generates an answer probabilistically using a language model, and thus does not necessarily find a correct answer depending on various factors. Further, since there is a phenomenon called hallucination in which an answer with low accuracy is generated, it is not possible to completely trust the answer. Detecting emission intensities that are erroneously allocated requires extremely high man-hours.

[0007]

An object of the present invention has been made in view of the above points, and is to provide a technology for allocating an appropriate intensity to a target item.

[Means for Solving the Problem]

[0008]
This application includes a plurality of means for solving at least a part of the above problem, and an example thereof is as follows. An intensity allocation apparatus according to one aspect of the present invention comprises: a question reception unit configured to receive a target item name to be subjected to allocation of an intensity; an intensity candidate extraction unit configured to extract, for the target item name, candidates of corresponding item names from intensity item names of an emission factor master; an intensity candidate allocation unit configured to transmit the candidates and cause a predetermined AI service to allocate one intensity item name from the candidates for the target item name; and an allocation result output unit configured to output the intensity item name allocated by the intensity candidate allocation unit.

[0009]
In the intensity allocation apparatus described above, the intensity candidate extraction unit may determine similarity by unifying predetermined full-width characters included in the target item name and the intensity item names of the emission factor master into half-width characters.

[0010]
In the intensity allocation apparatus described above, the intensity candidate extraction unit may determine similarity by performing conversion into phonetic readings and space removal for the target item name and the intensity item names of the emission factor master.

[0011]
In the intensity allocation apparatus described above, the intensity candidate extraction unit may determine similarity by unifying predetermined full-width characters included in the target item name and the intensity item names of the emission

factor master into half-width characters, and by performing conversion into phonetic readings and space removal.

[0012]
In the intensity allocation apparatus described above, the intensity candidate allocation unit may cause the predetermined AI service to answer by presenting answer examples.

[0013]
In the intensity allocation apparatus described above, the intensity candidate allocation unit may cause the predetermined AI service to perform stepwise inference by presenting estimation reasons.

[0014]
In the intensity allocation apparatus described above, the intensity candidate allocation unit may search for attribute information related to the target item name and the candidates, respectively (for example, any one of "item classification", "item material", and "item HS code", or information including such information; however, the attribute information is not limited thereto), and may cause the predetermined AI service to allocate by providing the attribute information related to the target item name and the candidates, respectively.

[0015]
An intensity allocation system according to another aspect of the present invention comprises: a question reception unit configured to receive a target item name to be subjected to allocation of an intensity; an intensity candidate extraction unit configured to extract, for the target item name, candidates of corresponding item names from intensity item names of an emission factor master; an intensity candidate allocation unit configured to transmit the candidates and cause a predetermined AI service to allocate one intensity item name from the candidates for the target item name; and an allocation result output unit configured to output the intensity item name allocated by the intensity candidate allocation unit.

[0016]
An intensity allocation program according to another aspect of the present invention causes an information processing apparatus to

execute: a question reception step of receiving a target item name to be subjected to allocation of an intensity; an intensity candidate extraction step of extracting, for the target item name, candidates of corresponding item names from intensity item names of an emission factor master; an intensity candidate allocation step of transmitting the candidates and causing a predetermined AI service to allocate one intensity item name from the candidates for the target item name; and an allocation result output step of outputting the intensity item name allocated in the intensity candidate allocation step.

[0017]
An intensity allocation method according to another aspect of the present invention is an intensity allocation method using an information processing apparatus, the method causing the information processing apparatus to execute: a question reception step of receiving a target item name to be subjected to allocation of an intensity; an intensity candidate extraction step of extracting, for the target item name, candidates of corresponding item names from intensity item names of an emission factor master; an intensity candidate allocation step of transmitting the candidates and causing a predetermined AI service to allocate one intensity item name from the candidates for the target item name; and an allocation result output step of outputting the intensity item name allocated in the intensity candidate allocation step.

[Advantageous Effects of the Invention]

[0018]
According to the present invention, an appropriate intensity can be allocated to a target item.

[0019]
Problems, configurations, and effects other than those described above will be made clear by the following description of embodiments.

[Brief Description of the Drawings]

[0020]
Fig. 1 is an example of a block diagram of an intensity allocation system according to an embodiment.

Fig. 2 is a diagram showing an example of a data structure of an item master.
Fig. 3 is a diagram showing an example of a data structure of an emission factor master.
Fig. 4 is a diagram showing an example of a hardware configuration of an intensity allocation apparatus.
Fig. 5 is a diagram showing an example of a hardware configuration of an operation terminal.
Fig. 6 is a diagram showing an example of a flow of intensity candidate extraction processing.
Fig. 7 is a diagram showing an example of a flow of intensity candidate allocation processing (by few-shot prompting).
Fig. 8 is a diagram showing an example of a flow of intensity candidate allocation processing (by COT).
Fig. 9 is an example of a block diagram of an intensity allocation system according to a second embodiment.
Fig. 10 is a diagram showing an example of a flow of intensity candidate allocation processing (by RAG).

[Detailed Description of the Embodiments]
[0021]
Hereinafter, an intensity allocation system 1 to which an embodiment according to one aspect of the present invention is applied will be described with reference to the drawings.

[0022]
In general, notation of raw materials constituting a product includes notation variations. For example, variations occur in katakana notation when English raw materials are written in Japanese; variations in Japanese notation even for languages other than English; differences between full-width/half-width characters; differences between uppercase/lowercase; and variations in hiragana, katakana, Roman letters, and Chinese numerals. Further, for emission intensities as well, notation may differ for the same thing depending on the package used. If allocation is performed by generative AI without absorbing these variations, there is a possibility that erroneous information may be allocated as noise information in some cases.

[0023]
By using the intensity allocation system 1 according to the present embodiment, an appropriate intensity can be allocated to a

target item. As a result, it becomes possible to improve response speed and suppress occurrence of hallucinations by reducing noise information, which is meaningful.

[0024]
Fig. 1 is an example of a block diagram of an intensity allocation system according to the present embodiment. The intensity allocation system 1 includes an intensity allocation apparatus 100, a generative AI service 200, and an operation terminal 300.

[0025]
The operation terminal 300 is a terminal owned and used by a user of the intensity allocation system 1, for example, a contact person of a company. The operation terminal 300 is communicably connected to the intensity allocation apparatus 100 via a network 50.

[0026]
The network 50 is a communication network such as a LAN (Local Area Network), a WAN (Wide Area Network), the Internet, or a cellular phone network. The network 50 may be a VPN (Virtual Private Network) on a wireless communication network such as a cellular phone communication network.

[0027]
The intensity allocation apparatus 100 is a so-called server apparatus. However, the present invention is not limited thereto, and the intensity allocation apparatus 100 may be various information processing apparatuses such as a personal computer, a smartphone, a workstation, a PDA (Personal Data Assistant), or a tablet device. The intensity allocation apparatus 100 may be the same apparatus as the operation terminal 300.

[0028]
The intensity allocation apparatus 100 receives, via the network 50, an allocation request from the operation terminal 300, and, in response to the allocation request, extracts intensity candidates for each target item, passes the extracted intensity candidates to the generative AI service 200, and instructs allocation, thereby realizing an intensity allocation function. The intensity allocation apparatus 100 obtains an answer from the generative AI

service 200 and transmits the answer to the operation terminal 300 via the network 50.

[0029]
Upon receiving a predetermined answer from the intensity allocation apparatus 100 via the network 50, the operation terminal 300 performs output processing such as display, printing, and data storage. Further, the operation terminal 300 transmits, as information (such as a file path) indicating a storage location of an item master 121 for which allocation is requested, input information received from an input device and the like (described later) included in the operation terminal 300, via the network 50 to the intensity allocation apparatus 100.

[0030]
The operation terminal 300 includes a processing unit 310, an input reception unit 320, a display unit 330, and a communication unit 340. The processing unit 310 includes an allocation request unit 311.

[0031]
The allocation request unit 311 receives a file path of the item master 121 via the input reception unit 320 and passes the file path to the intensity allocation apparatus 100. Further, when receiving a predetermined answer from the intensity allocation apparatus 100, the allocation request unit 311 outputs the answer via the display unit 330.

[0032]
The input reception unit 320 receives an input instruction from an operator of the operation terminal 300, for example, a contact person, and transmits the input instruction to the intensity allocation apparatus 100. The display unit 330 draws, on a display device, screen information in a predetermined format received from the communication unit 340 as instructed to be displayed by the intensity allocation apparatus 100. The communication unit 340 performs communication with the intensity allocation apparatus 100 via the network 50.

[0033]
The generative AI service 200 is a service that provides, via an API (Application Programming Interface) or the like, a function of

so-called generative AI such as GPT (registered trademark) and Gemini. The generative AI service 200 gives an instruction (prompt) in natural language to generative AI to generate a desired result. The generative AI service 200 includes an AI processing unit 210 and a communication unit 220.

[0034]
In the present embodiment, when receiving an instruction via, for example, an API, the generative AI service 200 causes the generative AI to generate answer information, and transmits the result to an instruction source as a return value of the API. At that time, the generative AI can receive related information necessary for an answer as RAG information, read the RAG information as a part of information additionally considered, and reflect the RAG information in generation of an answer.

[0035]
For example, the generative AI service 200 determines an intensity to be allocated to a raw material with reference to information of work processes for a certain product. Alternatively, the generative AI service 200 may obtain such information by searching, at runtime, from another apparatus via the Internet or the like.

[0036]
The intensity allocation apparatus 100 includes a processing unit 110, a storage unit 120, and a communication unit 130. The processing unit 110 includes a question reception unit 111, an intensity candidate extraction unit 112, an intensity candidate allocation unit 113, an answer request unit 114, and an allocation result output unit 115. The storage unit 120 includes an item master 121 and an emission factor master 122.

[0037]
Fig. 2 is a diagram showing an example of a data structure of the item master. The item master 121 is information including a list regarding one or more items to which an intensity is to be allocated. In the item master 121, an item name 121a, an item group 121b, and an HS code 121c are stored in association with each other.

[0038]

The item name 121a is information that displays, in language, raw materials and their unit quantities and the like. For example, the item name 121a includes an item indicated as a raw material such as “dark chocolate drop 50% (1 kg)”. The item group 121b is information that specifies a predetermined group to which the item specified by the item name 121a belongs. For example, the item group 121b includes a raw material group such as “Cake ingredients”. The HS code 121c is information that specifies an HS code of the item specified by the item name 121a. For example, the HS code 121c includes an HS code for a raw material for which an HS code is clear in advance, such as “HS180632”.

[0039]
Fig. 3 is a diagram showing an example of a data structure of the emission factor master. The emission factor master 122 is information including, for each item name serving as an intensity, information for specifying an emission factor. In the emission factor master 122, an inventory database 122a, an item name 122b, a location 122c, an emission factor 122d, and an effective period 122e are stored in association with each other.

[0040]
The inventory database 122a is information that specifies an inventory database in which emission factor information is defined. For example, the inventory database 122a includes information specifying an inventory database that defines an emission intensity, such as “3EID”, “IDEA”, and “ecoinvent”. The item name 122b is information that displays, in language, an intensity and its unit quantity and the like. For example, the item name 122b includes an item indicated as an intensity, such as “chocolate”. The location 122c is information that specifies a country or region to which an emission intensity specified by the item name 122b and its emission factor are applied. For example, the location 122c includes a country name such as “JP”.

[0041]
The emission factor 122d is information of an emission factor applied to an emission intensity specified by the item name 122b in a combination of the inventory database 122a and the location 122c. For example, the emission factor 122d includes an emission factor such as “1.9 $kgCO_2e$/kilogram”. The effective period 122e is information that specifies a period during which the emission

factor 122d is effective. For example, the effective period 122e includes a start date and an end date of a period indicated by a calendar year such as “yyyy/mm/dd to yyyy/mm/dd”.

[0042]
Returning to the description of Fig. 1. The question reception unit 111 receives a target item name to be subjected to allocation of an intensity. Specifically, the question reception unit 111 receives the target item name to be subjected to allocation of an intensity, or a file path of the item master 121 including the target item name. When the file path is received, the question reception unit 111 acquires a plurality of item names 121a of the item master 121 specified by the file path, and extracts intensity candidates for each of the acquired item names 121a. When the target item name is received, the question reception unit 111 extracts intensity candidates limited to the target item.

[0043]
The intensity candidate extraction unit 112 extracts, for the target item name, candidates of corresponding item names from the item names 122b of the emission factor master 122 by correcting notation variations. For example, in correction of notation variations, the intensity candidate extraction unit 112 unifies predetermined full-width characters included in the target item name and the intensity item names 122b of the emission factor master 122 into half-width characters, performs conversion into phonetic readings and space removal, and determines similarity. The intensity candidate extraction unit 112 does not necessarily have to correct notation variations, and may perform only a part of unification into half-width characters, conversion into phonetic readings, and space removal, or perform any combination thereof.

[0044]
The intensity candidate allocation unit 113 causes the answer request unit 114 to transmit intensity candidates to the generative AI service 200. Then, the intensity candidate allocation unit 113 causes the answer request unit 114 to instruct the generative AI service 200 to allocate one intensity item name from the intensity candidates for the target item. Then, the intensity candidate allocation unit 113 passes the allocated

intensity item name to the allocation result output unit 115 and causes the allocation result output unit 115 to output the result.

[0045]
The intensity candidate allocation unit 113 may configure a prompt so as to present a small number of specific answer examples to the generative AI service 200 to teach a specific task (few-shot prompting), and cause the answer request unit 114 to instruct accordingly.

[0046]
Further, the intensity candidate allocation unit 113 may configure a prompt so as to cause the generative AI service 200 to perform stepwise inference by presenting estimation reasons (chain-of-thought prompting), and cause the answer request unit 114 to instruct accordingly.

[0047]
Further, the intensity candidate allocation unit 113 may search for attribute information related to the target item name and the intensity candidates, respectively, and may configure a prompt so as to cause the generative AI service 200 to allocate intensity candidates by providing attribute information related to the target item name and attribute information related to the intensity candidates, respectively (RAG: Retrieval Augmented Generation), and cause the answer request unit 114 to instruct accordingly.

[0048]
The answer request unit 114, upon receiving an instruction from the intensity candidate allocation unit 113, transmits the intensity candidates extracted by the intensity candidate extraction unit 112 to the generative AI service 200. Further, the answer request unit 114 instructs the generative AI service 200, using a prompt or the like, to allocate one intensity item name from the intensity candidates for the target item.

[0049]
The allocation result output unit 115 outputs the intensity item name allocated by the intensity candidate allocation unit 113.

[0050]

The communication unit 130 performs communication with other apparatuses, namely, the generative AI service 200 and the operation terminal 300, via the network 50.

[0051]
Fig. 4 is a diagram showing an example of a hardware configuration of the intensity allocation apparatus. The intensity allocation apparatus 100 includes a processor 101, a memory 102, a storage 103, a communication device 104, and a bus 105 that connects the devices. In addition, the intensity allocation apparatus 100 may include an input device.

[0052]
The processor 101 is a computing device such as a CPU (Central Processing Unit) or a GPU (Graphics Processing Unit), and executes processing according to a program recorded in the memory 102 or the storage 103. In the intensity allocation apparatus 100, processing is performed by the processor 101 that operates according to a program read onto the memory 102 or the storage 103. The processing unit 110, the question reception unit 111, the intensity candidate extraction unit 112, the intensity candidate allocation unit 113, the answer request unit 114, and the allocation result output unit 115 realize their respective functions by the processor 101 executing the program.

[0053]
The memory 102 is a storage device such as a RAM (Random Access Memory) or a flash memory, and functions as a storage area into which programs and data are temporarily read. The storage 103 is a storage device that is writable and readable. The storage unit 120 realizes its function by the memory 102 or the storage 103. The storage unit 120 may realize its function by a storage device connected via the communication device 104.

[0054]
The communication device 104 is an interface for communicably connecting the intensity allocation apparatus 100 to an external apparatus. For example, the communication device 104 performs wireless communication using an antenna capable of using a predetermined radio wave (for example, a 5 GHz band, a 2.4 GHz band, etc.) that establishes a connection with the generative AI

service 200 and the operation terminal 300 in accordance with the Wi-Fi standard.

[0055]
Processing of each component of the intensity allocation apparatus 100 may be executed by one hardware component or by a plurality of hardware components. Further, processing of each component of the intensity allocation apparatus 100 may be realized by one program or by a plurality of programs.

[0056]
The communication unit 130 of the intensity allocation apparatus 100 described above is realized by the communication device 104. The above is an example of the hardware configuration of the intensity allocation apparatus 100.

[0057]
Each configuration of the intensity allocation apparatus 100 can be classified into further more components in accordance with processing contents. Further, one component can also be classified so as to execute further more processing.

[0058]
Further, each processing unit (the processing unit 110, the question reception unit 111, the intensity candidate extraction unit 112, the intensity candidate allocation unit 113, the answer request unit 114, and the allocation result output unit 115) may be constructed by dedicated hardware (ASIC, GPU, etc.) that realizes the respective function. Further, processing of each processing unit may be executed by one hardware component or by a plurality of hardware components.

[0059]
Fig. 5 is a diagram showing an example of a hardware configuration of the operation terminal. The operation terminal 300 includes an input device 301, a processor 302, a storage 303, a memory 304, a display 305, a communication device 306, and a bus 307 connecting the devices.

[0060]
The input device 301 is various input devices such as a keyboard, a mouse, and a touch panel. The input reception unit 320 of the

operation terminal 300 is realized by the input device 301 and the processor 302. The processor 302 is a computing device such as a CPU or a GPU, and executes processing according to a program recorded in the memory 304 or the storage 303. In the operation terminal 300, processing is performed by the processor 302 that operates according to a program read onto the memory 304 or the storage 303. The processing unit 310 and the allocation request unit 311 realize their respective functions by the processor 302 executing the program.

[0061]
The memory 304 is a storage device such as a RAM (Random Access Memory) or a flash memory, and functions as a storage area into which programs and data are temporarily read. The storage 303 is a storage device that is writable and readable.

[0062]
The display 305 is a display device such as, for example, a liquid crystal display or an organic EL display. The display unit 330 is realized by the display 305 and the processor 302.

[0063]
The communication device 306 is an interface for communicably connecting the operation terminal 300 to an external apparatus. For example, the communication device 306 performs wireless communication using an antenna capable of using a predetermined radio wave (for example, a 5 GHz band, a 2.4 GHz band, etc.) that establishes a connection with the intensity allocation apparatus 100 in accordance with the Wi-Fi standard. The communication unit 340 of the operation terminal 300 is realized by the communication device 306 and the processor 302.

[0064]
Processing of each component of the operation terminal 300 may be executed by one hardware component or by a plurality of hardware components. Further, processing of each component of the operation terminal 300 may be realized by one program or by a plurality of programs.

[0065]
The input device 301, the processor 302, the storage 303, the memory 304, the display 305, and the communication device 306 are

connected to each other by connection wirings such as the bus 307. The above is an example of the hardware configuration of the operation terminal 300.

[0066]
Each configuration of the operation terminal 300 can be classified into further more components in accordance with processing contents. Further, one component can also be classified so as to execute further more processing.

[0067]
Further, each processing unit (the processing unit 310, the allocation request unit 311, the input reception unit 320, the display unit 330, and the communication unit 340) may be constructed by dedicated hardware (ASIC, GPU, etc.) that realizes the respective function. Further, processing of each processing unit may be executed by one hardware component or by a plurality of hardware components.

[0068]
The generative AI service 200 is a service provided outside the intensity allocation system 1 that uses generative AI. However, the present invention is not limited thereto, and the intensity allocation system 1 may use generative AI held by the intensity allocation system 1. In that case, the generative AI includes generative AI using large language models (LLMs). The generative AI is a trained model obtained by machine learning or deep learning of a large language model by a neural network (NN) using language data in advance, for example, GPT-4 (registered trademark), etc. The generative AI is not limited to a neural network (NN), and other known methods may be used.

[0069]
Next, operation of the intensity allocation system 1 in the present embodiment will be described.

[0070]
First, in the present embodiment, a user of the intensity allocation system 1, for example, a contact person of a company, acts as an operator, and uses the operation terminal 300 to input, as text, an intensity allocation request from a customer or a collaborator. This becomes inquiry text (query), and an answer is

requested from the operation terminal 300 to the intensity allocation apparatus 100, and the generative AI service 200 or the intensity allocation apparatus 100 responds with an answer to the operation terminal 300, whereby the request is completed.

[0071]
Fig. 6 is a diagram showing an example of a flow of intensity candidate extraction processing. The flow of intensity candidate extraction processing is started when the operation terminal 300 receives an intensity allocation instruction from the operator.

[0072]
First, the allocation request unit 311 of the operation terminal 300 transmits an allocation request to the intensity allocation apparatus 100 (Step S001). The allocation request includes receiving, via the input reception unit 320, a name of the item master 121, that is, a file path of the item master 121, and passing the file path to the intensity allocation apparatus 100.

[0073]
Then, the question reception unit 111 of the intensity allocation apparatus 100 receives the file path of the item master 121. Then, the question reception unit 111 retrieves target item names from the item master (Step S002). When a plurality of target item names are included in the item master, the question reception unit 111 performs repetitive processing so as to perform Steps S003 to S006 described later for each of the plurality of target item names.

[0074]
Then, the intensity candidate extraction unit 112 unifies predetermined full-width characters of the target item name into half-width characters (Step S003). For example, the intensity candidate extraction unit 112 unifies predetermined full-width characters included in the target item name into half-width characters.

[0075]
Then, the intensity candidate extraction unit 112 performs conversion to phonetic reading and space removal of the target item name (Step S004). For example, the intensity candidate extraction unit 112 performs conversion of kanji included in the

target item name into phonetic readings and performs space removal.

[0076]
Then, the intensity candidate extraction unit 112 unifies predetermined full-width characters of the intensity item name 122b of the emission factor master 122 into half-width characters and performs conversion to phonetic reading and space removal (Step S005). For example, the intensity candidate extraction unit 112 unifies predetermined full-width characters of the intensity item name 122b of the emission factor master 122 into half-width characters and performs conversion of kanji into phonetic readings and performs space removal.

[0077]
Then, the intensity candidate extraction unit 112 extracts, from the emission factor master 122, a plurality of item names including a character string similar to the target item name, as intensity candidates (Step S006). Specifically, the intensity candidate extraction unit 112 determines similarity between the phonetic reading of the target item name converted in Step S004 and the phonetic reading of the intensity item name of the emission factor master 122 converted in Step S005, and for each target item name, extracts, as intensity candidates, a plurality of item names including a character string with similarity equal to or greater than a predetermined level from the emission factor master 122. In the similarity determination, the intensity candidate extraction unit 112 applies an existing string matching determination method or a method using measurement of string distance.

[0078]
The above is an example of the flow of intensity candidate extraction processing. According to the example of the flow of intensity candidate extraction processing, since a plurality of intensity candidates can be extracted with high accuracy, it is possible to increase matching accuracy and response speed of intensity candidates related to target items.

[0079]
Fig. 7 is a diagram showing an example of a flow of intensity candidate allocation processing (by few-shot prompting). The

example of the flow of intensity candidate allocation processing (by few-shot prompting) is started following the flow of intensity candidate extraction processing.

[0080]
First, the intensity candidate allocation unit 113 makes an inquiry to the generative AI service 200 by few-shot prompting. Specifically, for each of one or more target items that are target items in the intensity candidate extraction processing, the intensity candidate allocation unit 113 instructs the answer request unit 114 to perform processing for requesting the generative AI service 200 to allocate an intensity. The answer request unit 114 passes, to the generative AI service 200, one or more target items that are target items in the intensity candidate extraction processing and a plurality of intensity candidates extracted as candidates from the emission factor master 122, performs few-shot prompting using a predetermined prompt, and instructs allocation from the intensity candidates for each of the one or more target items that are target items in the intensity candidate extraction processing (Step S101). The instruction (prompt) to the generative AI service 200 may include an "instruction to cause allocation of an intensity by including, in a determination criterion, meaning (for example, meaning based on materials and uses included in the target item name) of the target item, rather than using only the name of the target item as a determination criterion". Thereby, it is possible to allocate a more appropriate intensity in consideration of CO_2 emissions, rather than capturing the target item superficially.

[0081]
Then, the AI processing unit 210 of the generative AI service 200 allocates, for each of one or more target items that are target items in the intensity candidate extraction processing, an intensity from the passed intensity candidates (Step S102). Specifically, in accordance with the task inquired by few-shot prompting, the AI processing unit 210 selects one from the passed intensity candidates for each target item and allocates the intensity. Then, the AI processing unit 210 transmits the allocated intensity to the intensity allocation apparatus 100 for each target item.

[0082]

Then, the allocation result output unit 115 outputs, as an answer, the allocated intensity candidates to the operation terminal 300 (Step S103).

[0083]
The above is an example of the flow of intensity candidate allocation processing (by few-shot prompting). According to the example of the flow of intensity candidate allocation processing (by few-shot prompting), since AI can be caused to select an intensity from among candidates of item names similar to target items, it is possible to allocate an intensity with high accuracy and with increased response speed.

[0084]
In the intensity candidate allocation processing (by few-shot prompting) described above, in Step S101, an inquiry to the generative AI is made by few-shot prompting; however, the present invention is not limited thereto. For example, it is also possible to apply chain-of-thought prompting to the generative AI service 200 to cause stepwise inference by presenting estimation reasons, thereby improving intensity allocation accuracy.

[0085]
Fig. 8 is a diagram showing an example of a flow of intensity candidate allocation processing (by COT). The example of the flow of intensity candidate allocation processing (by COT) is basically the same as the intensity candidate allocation processing (by few-shot prompting) described above, but differs in that Step S201 described below is performed in place of Step S101. Hereinafter, Step S201 will be described.

[0086]
First, the intensity candidate allocation unit 113 makes an inquiry to the generative AI service 200 by chain-of-thought (COT). Specifically, for each of one or more target items that are target items in the intensity candidate extraction processing, the intensity candidate allocation unit 113 instructs the answer request unit 114 to perform processing for requesting the generative AI service 200 to allocate an intensity. The answer request unit 114 passes, to the generative AI service 200, one or more target items that are target items in the intensity candidate extraction processing and a plurality of intensity candidates

extracted as candidates from the emission factor master 122, performs COT prompting using a predetermined prompt, and instructs allocation from the intensity candidates for each of the one or more target items that are target items in the intensity candidate extraction processing (Step S201).

[0087]
For example, as COT prompting, the intensity candidate allocation unit 113 instructs the answer request unit 114 to cause the generative AI service 200 to provide an intermediate answer, and to request allocation of an intensity from among the plurality of intensity candidates extracted as candidates from the emission factor master.

[0088]
The above is an example of the flow of intensity candidate allocation processing (by COT). According to the example of the flow of intensity candidate allocation processing (by COT), since AI can be caused to select an intensity from among candidates of item names similar to target items, it is possible to allocate an intensity with high accuracy and with increased response speed. Further, by performing COT prompting, it becomes possible to guide reasoning for the determination criteria of generative AI to some extent, and thus it is possible to reduce the possibility that an intensity allocation result will become largely inappropriate.

[0089]
The intensity allocation system 1 to which the embodiment according to the present invention is applied has been described above. According to the embodiment, an appropriate intensity can be allocated to a target item.

[0090]
The present invention is not limited to the above embodiment. The above embodiment can be modified in various ways within the scope of the technical idea of the present invention. For example, in the above embodiment, an inquiry is made to generative AI by few-shot prompting or COT to improve allocation accuracy; however, the present invention is not limited thereto, and allocation with high accuracy may be performed using RAG data. Such an embodiment will be described with reference to Figs. 9 and 10. An intensity allocation system according to a second embodiment is basically

the same as the above intensity allocation system 1, but differs in that generative AI is used using RAG data. Hereinafter, differences will be mainly described.

[0091]
Fig. 9 is an example of a block diagram of an intensity allocation system according to the second embodiment. In an intensity allocation system 1′ according to the second embodiment, a RAG database 400 communicable with the intensity allocation apparatus 100 via the network 50 is included, and the processing unit 110 of the intensity allocation apparatus 100 includes a RAG data acquisition unit 116.

[0092]
The RAG database 400 includes a plurality of pieces of various information including target item names related to intensities, item groups, and HS codes, and the like. The RAG data acquisition unit 116 acquires, as related information, results of searching the RAG database 400 for each target item name using the target item name, item group, and HS code.

[0093]
Fig. 10 is a diagram showing an example of a flow of intensity candidate allocation processing (by RAG). The example of the flow of intensity candidate allocation processing (by RAG) is basically the same as the intensity candidate allocation processing (by few-shot prompting) described above, but differs in that Steps S301 to S303 described below are performed in place of Step S101, and in that RAG data is used in Step S102 (Step S102′). Hereinafter, Steps S301 to S303 and Step S102′ will be mainly described.

[0094]
First, the RAG data acquisition unit 116 makes an inquiry about attribute information for a target item (Step S301). Specifically, the RAG data acquisition unit 116 makes an inquiry about attribute information to the RAG database 400 for a target item name to which an intensity is to be allocated.

[0095]
The RAG database 400 searches for attribute information related to the target item (Step S302). For example, for each target item name, the RAG database 400 searches the target item name, item

group, and HS code. Then, the RAG database 400 transmits the searched RAG data to the intensity allocation apparatus 100.

[0096]
Then, the intensity candidate allocation unit 113 adds attribute information to the plurality of intensity candidates extracted as candidates from the emission factor master 122, and causes a request to allocate an intensity to be made to the generative AI service 200. Specifically, for each of one or more target items that are target items in the intensity candidate extraction processing, the intensity candidate allocation unit 113 instructs the answer request unit 114 to perform processing for requesting the generative AI service 200 to allocate an intensity. The answer request unit 114 passes, to the generative AI service 200, one or more target items that are target items in the intensity candidate extraction processing, a plurality of intensity candidates extracted as candidates from the emission factor master 122, and attribute information added to the intensity candidates, and instructs allocation from the intensity candidates for each of the one or more target items that are target items in the intensity candidate extraction processing using a predetermined prompt (Step S303).

[0097]
Then, the AI processing unit 210 of the generative AI service 200 allocates, for each of one or more target items that are target items in the intensity candidate extraction processing, an intensity from the passed intensity candidates using RAG data (Step S102′). Specifically, the AI processing unit 210 allocates an intensity by selecting, from the passed intensity candidates for each target item, one that is similar in consideration of the RAG data. This similarity generation criterion is a unique similarity criterion held by the generative AI service 200, but generally is within a range in which information within the range described in the RAG data is prioritized and used. For example, when an HS code or the like is provided as RAG data, the AI processing unit 210 identifies an HS code similar to the target item from the RAG data and determines similarity. Alternatively, the answer request unit 114 may instruct the generative AI service 200 in advance on an answer criterion. Then, the AI processing unit 210 transmits the allocated intensity to the intensity allocation apparatus 100 for each target item.

[0098]
The above is an example of the flow of intensity candidate allocation processing (by RAG). According to the example of the flow of intensity candidate allocation processing (by RAG), by guiding similarity determination using RAG data, it is possible to reduce the possibility that a generative AI intensity allocation result will become largely inappropriate.

[0099]
The above is an example of an intensity candidate system according to the second embodiment. According to the intensity candidate system according to the second embodiment, it becomes possible to allocate an appropriate intensity to a target item.

[0100]
Further, technical elements of the above embodiments may be applied alone, or may be applied by being divided into a plurality of parts such as program parts and hardware parts. Note that processing performed by the answer request unit 114 described above may be performed by the intensity candidate allocation unit 113.

[0101]
The present invention has been described above mainly with reference to embodiments.

[Description of Reference Numerals]

[0102]
1: intensity allocation system; 50: network; 100: intensity allocation apparatus; 110: processing unit; 111: question reception unit; 112: intensity candidate extraction unit; 113: intensity candidate allocation unit; 114: answer request unit; 115: allocation result output unit; 120: storage unit; 121: item master; 122: emission factor master; 130: communication unit; 200: generative AI service; 210: AI processing unit; 220: communication unit; 300: operation terminal; 310: processing unit; 311: allocation request unit; 320: input reception unit; 330: display unit; 340: communication unit.

Claims

[Claim 1]

An intensity allocation apparatus comprising:

a question reception unit configured to receive a target item name to be subjected to allocation of an intensity;

an intensity candidate extraction unit configured to extract, for the target item name, candidates of corresponding item names from intensity item names of an emission factor master;

an intensity candidate allocation unit configured to transmit the candidates and cause a predetermined AI service to allocate one intensity item name from the candidates for the target item name; and

an allocation result output unit configured to output the intensity item name allocated by the intensity candidate allocation unit.

[Claim 2]

The intensity allocation apparatus according to claim 1, wherein

the intensity candidate extraction unit is configured to determine similarity by unifying predetermined full-width characters included in the target item name and the intensity item names of the emission factor master into half-width characters.

[Claim 3]

The intensity allocation apparatus according to claim 1, wherein

the intensity candidate extraction unit is configured to determine similarity by performing conversion into phonetic readings and space removal for the target item name and the intensity item names of the emission factor master.

[Claim 4]

The intensity allocation apparatus according to claim 1, wherein

the intensity candidate extraction unit is configured to determine similarity by unifying predetermined full-width characters included in the target item name and the intensity item names of the emission factor master into half-width characters, and by performing conversion into phonetic readings and space removal.

[Claim 5]
The intensity allocation apparatus according to claim 1, wherein
the intensity candidate allocation unit is configured to cause the predetermined AI service to answer by presenting answer examples.

[Claim 6]
The intensity allocation apparatus according to claim 1, wherein
the intensity candidate allocation unit is configured to cause the predetermined AI service to perform stepwise inference by presenting estimation reasons.

[Claim 7]
The intensity allocation apparatus according to claim 1, wherein
the intensity candidate allocation unit is configured to search for attribute information related to the target item name and the candidates, respectively, and to cause the predetermined AI service to allocate by providing the attribute information related to the target item name and the candidates, respectively.

[Claim 8]
The intensity allocation apparatus according to claim 1, wherein
the intensity candidate allocation unit is configured to cause the predetermined AI service, when allocating the intensity item name to the target item name, to include, in a determination criterion, meaning based on materials and uses of the target item name, and to allocate the intensity item name.

[Claim 9]
An intensity allocation system comprising:
a question reception unit configured to receive a target item name to be subjected to allocation of an intensity;
an intensity candidate extraction unit configured to extract, for the target item name, candidates of corresponding item names from intensity item names of an emission factor master;
an intensity candidate allocation unit configured to transmit the candidates and cause a predetermined AI service to allocate

one intensity item name from the candidates for the target item name; and

an allocation result output unit configured to output the intensity item name allocated by the intensity candidate allocation unit.

[Claim 10]

An intensity allocation program causing an information processing apparatus to execute:

a question reception step of receiving a target item name to be subjected to allocation of an intensity;

an intensity candidate extraction step of extracting, for the target item name, candidates of corresponding item names from intensity item names of an emission factor master;

an intensity candidate allocation step of transmitting the candidates and causing a predetermined AI service to allocate one intensity item name from the candidates for the target item name; and

an allocation result output step of outputting the intensity item name allocated in the intensity candidate allocation step.

[Claim 11]

An intensity allocation method using an information processing apparatus, the method comprising:

a question reception step of receiving a target item name to be subjected to allocation of an intensity;

an intensity candidate extraction step of extracting, for the target item name, candidates of corresponding item names from intensity item names of an emission factor master;

an intensity candidate allocation step of transmitting the candidates and causing a predetermined AI service to allocate one intensity item name from the candidates for the target item name; and

an allocation result output step of outputting the intensity item name allocated in the intensity candidate allocation step.