

Description

Title of Invention: INFORMATION PROCESSING SYSTEM, INFORMATION PROCESSING APPARATUS, INFORMATION PROCESSING METHOD, AND PROGRAM

Technical Field

[0001] The present invention relates to an information processing system, an information processing apparatus, an information processing method, and a program.

Background Art

[0002] With wide spreading of a network such as the Internet and a wireless communication network, more and more, an image forming apparatus is used by a user in a state where it is connected to the network. When an image forming apparatus is connected to a network, it is possible for a server communicating with the image forming apparatus to provide various services to a user.

[0003] For example, a service is known in which the server provides a maintenance service to an image forming apparatus connected to the server via a network. The image forming apparatus transmits information useful for maintenance to the server. The server detects a symptom of an error by comparing the information with error information of various models obtained in the past, and determines necessary maintenance. As a result, if necessary, a customer engineer is sent to perform appropriate maintenance or conduct an inspection in order to prevent an error.

[0004] Further, in the case where a remaining toner amount of the image forming apparatus or a use amount of consumables including print paper, staples, etc., is transmitted to the server, it is possible for the server to provide a service to arrange shipping of the consumables (refer to, for example, Patent Document 1). Patent Document 1 describes a host computer which, in order to prevent out of stock conditions of consumables, records a per-month average use amount of consumables of a machine, and outputs an alarm when a request for replenishment of the consumables is not received in an estimated period.

Citation List

Patent Literature

[0005] PTL 1: Patent document 1: Japanese Patent No. 3720584

Summary of Invention

Technical Problem

[0006] However, in the conventional service, it is not determined whether a use amount of toner of the image forming apparatus is reasonable, which is a problem. How much

toner is used for forming an image by the image forming apparatus is controlled by a charging voltage of a photoconductor drum, etc. However, it is possible that the toner is consumed faster than expected for some reason.

[0007] In a case where the toner is consumed by the image forming apparatus more than expected for some reason, the toner of a whole toner cartridge will be consumed without printing an originally expected number of pages. In the case where such a symptom is detected, it is preferable that a customer engineer perform maintenance or inspection of the image forming apparatus.

[0008] In view of the above, an object of the present invention is to provide an information processing system that is capable of determining whether a decreased amount of the consumables is reasonable.

Solution to Problem

[0009] In view of the above, an information processing system including an information processing apparatus and equipment capable of communicating with each other via a network is provided. The equipment includes a transmission unit configured to transmit use amount information related to a use amount which increases in accordance with use of the equipment, and consumable information related to a consumable which decreases in accordance with the use of the equipment. The information processing apparatus includes a reception unit configured to receive the use amount information and the consumable information from the equipment, and a determination unit configured to determine whether a decreased amount of the consumable is reasonable based on the use amount information and the consumable information.

Advantageous Effects of Invention

[0010] The present invention can provide an information processing system that is capable of determining whether a decreased amount of the consumables is reasonable.

Brief Description of Drawings

[0011] [fig.1]Fig. 1 is an example of a drawing illustrating an outline of an equipment system.

[fig.2]Fig. 2 is an example of a configuration diagram of the equipment system.

[fig.3]Fig. 3 is an example of a hardware configuration diagram of a management apparatus.

[fig.4]Fig. 4 is an example of a hardware configuration diagram of an image forming apparatus.

[fig.5]Fig. 5 is an example of a functional block diagram of the management apparatus and the image forming apparatus included in the equipment system.

[fig.6]Fig. 6 is an example of a drawing illustrating an overall operation of the equipment system.

[fig.7]Fig. 7 is an example of a flowchart illustrating a procedure for determining

whether a remaining toner amount is reasonable.

[fig.8]Fig. 8 is a drawing illustrating an example of email of error report transmitted from the management apparatus to a service personnel PC.

[fig.9]Fig. 9 is another example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable.

[fig.10]Fig. 10 is an example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable (example 2).

[fig.11]Fig. 11 is an example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable (example 3).

[fig.12]Fig. 12 is an example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable (example 4).

[fig.13]Fig. 13 is a drawing illustrating an example of email of error notification transmitted from the management apparatus to a PC of a service person.

[fig.14]Fig. 14 is an example of a sequence diagram illustrating a procedure for transmitting use change information and for determining whether a remaining toner amount is reasonable.

Description of Embodiments

[0012] In the following, embodiments of the present invention will be described referring to accompanying drawings.

[0013] (Embodiment 1)

[0014] Fig. 1 is an example of a drawing illustrating an outline of an equipment system 100 of an embodiment 1. An image forming apparatus 20 (an example of equipment) and a management apparatus 40 (an example of an information processing apparatus) are connected and capable of communicating with each other via a network N. A user of the image forming apparatus 20 receives a service of an automated supply of consumables from the management apparatus 40. As a result, when the remaining toner amount of the image forming apparatus 20 is close to an end, the management apparatus 40 arranges shipping of a toner cartridge.

(1) The image forming apparatus 20 transmits remaining toner amount information (an example of consumable information) and counter information (an example of use amount information) to the management apparatus 40, for example, periodically.

(2) The management apparatus 40 determines whether a decreased amount of the remaining toner amount transmitted by the image forming apparatus 20 is reasonable based on the counter information transmitted at the same time by the image forming apparatus 20. For example, in the case where the image forming apparatus 20, a consumed toner amount of which is greater than normal, transmits a toner-near-end notification to the management apparatus 40, the management apparatus 40 compares a

number of print pages calculated from the past counter information with a number of print pages printable with the consumed toner amount. In the case where the number of print pages calculated from the past counter information is less than the number of print pages printable with the consumed toner amount, it is possible for the management apparatus 40 to determine that the toner amount consumed by the image forming apparatus 20 is greater than normal. In this case, it is possible to provide appropriate maintenance.

[0015] It should be noted that similar maintenance is possible in the case where the toner cartridge whose toner is in a toner-end state or a toner-near-end state is installed in the image forming apparatus 20. In other words, in the case where printing is not performed by the image forming apparatus 20 and a toner cartridge whose toner is in a toner-end state or a toner-near-end state is installed in the image forming apparatus 20, the image forming apparatus 20 transmits a toner-near-end notification to the management apparatus 40. The management apparatus 40 can detect that the toner is abnormally decreased when there is little increase in the counter information. As a result, it is possible for the management apparatus 40 to determine whether it is necessary to arrange shipping of a toner cartridge by, for example, asking a customer.

[0016] As described above, the management apparatus 40 according to an embodiment of the present invention can provide appropriate maintenance for the image forming apparatus 20 by comparing the consumed toner amount with the counter information.

[0017] <Terminology>

[0018] Terms used in the specification will be described.

[0019] A user is a person who operates the image forming apparatus 20 or an information terminal (which will be described later). An operator is a person who operates the management apparatus 40.

[0020] Use change information includes an accumulated number of pages printed in the past (hereinafter, referred to as "counter information") and remaining toner amount information. The counter information and the remaining toner amount information are transmitted to the management apparatus 40. The use change information may include a coverage (accumulated amount of an area ratio [%] occupied by the toner per A4-size sheet), a number of ejected pages, an accumulated number of rotations of a photoconductor drum, energized time of a fixing unit, etc., which are as useful as the counter information for the management apparatus 40 to determine the use amount of the image forming apparatus 20. Further, an increased amount of the counter information and a decreased amount of the remaining toner may be transmitted as the use change information to the management apparatus 40. The increased amount of the counter information and the decreased amount of the remaining toner are equivalent to the counter information and the remaining toner amount with respect to the usefulness for

determining whether the remaining toner amount is reasonable.

[0021] The use amount information enables to determine whether the remaining toner amount is reasonable, and is, for example, the counter information or the increased amount of the counter information. The consumable information enables to determine whether the remaining toner amount is reasonable, and is, for example, the remaining toner amount information or the decreased toner amount.

[0022] The term "toner-end" indicates that a remaining toner amount of a toner cartridge is zero or nearly zero. The term "toner-near-end" indicates that it is a good timing for supplementation of the toner cartridge. In general, a toner-near-end state transitions to a toner-end state. In the following, the term "toner-near-end" will be used without distinguishing the "toner-near-end" from "toner-end".

[0023] <Configuration example>

[0024] Fig. 2 is an example of a configuration diagram of the equipment system 100. The equipment system 100 includes the management apparatus 40, a sales server 60, the image forming apparatus 20, an information terminal 10, a service personnel PC 90, and a settlement institution 80, which are connected to each other via the network N. The equipment system 100 is an example of an information processing system.

[0025] The network N includes a LAN installed in an office in which the image forming apparatus 20 is included, a provider's network that connects the LAN to the Internet, lines provided by a telecommunications carrier, etc. Further, the network N may include the Internet. The network N may include a wired network, a wireless network, or a combination thereof. In the case where the image forming apparatus 20 is directly connected to a telecommunications network or a mobile telephone network, the image forming apparatus 20 can be connected to the provider's network without going through the LAN. Communications based on wireless communication standards such as Bluetooth (registered trademark), ZigBee (registered trademark), etc., may be used in a route for connecting to the LAN or in a connection between LANs.

[0026] The management apparatus 40 manages the image forming apparatus 20. The term "management" refers to storing customer information associated with the image forming apparatus 20 the customer uses, maintaining the image forming apparatus 20, performing a billing process based on counter information included in use change information, etc. For example, every month, a fee is calculated and charged by multiplying the increased amount of the counter information by unit price.

[0027] Further, the management apparatus 40 obtains the use change information of the image forming apparatus 20, makes a diagnosis, and detects an error or a symptom of an error of the image forming apparatus 20. According to a result of the detection, a further diagnosis is made from a remote site, or, a customer engineer is dispatched if necessary. Further, in the case where an error notification is received from the image

forming apparatus 20, a customer engineer is dispatched. Further, the management apparatus 40 obtains the remaining toner amount from the image forming apparatus 20 and arranges shipping of a toner cartridge if necessary. The management apparatus 40 obtains a number of ejected pages and arranges shipping of print paper if necessary. The management apparatus 40 obtains a use amount of staples and arranges shipping of the staples if necessary.

[0028] It should be noted that it is not necessary for the management apparatus 40 to perform all of the operations described above as long as it receives the remaining toner amount and the counter information and arranges shipping of a toner cartridge. Whether cost of the toner cartridge is charged or not depends on a type of a contract between the user and the sales server 60. The shipping of a toner cartridge will not be charged if the contract is a flat-rate type in which a predetermined fee is charged regardless of the number of printed pages and used consumables as long as the number of printed pages per month does not exceed a predetermined number. If the contract is a pay-per-use type, then the number of printed pages and the toner cartridge will be counted in the charge. It does not matter whether they are charged or not in an embodiment of the present invention.

[0029] Operations of the management apparatus 40 are performed by a sales company (dealer) that provides the image forming apparatus 20 to the customer, a manufacturing company (manufacturer) of the image forming apparatus 20, an associated company of the sales company or the manufacturing company, or the like. The operations of the management apparatus 40 may be performed by the same operator as that of the sales server 60, which will be described below.

[0030] The sales server 60 is used in selling various products and services. The sales server 60 provides a Web page in which various products and services can be displayed and selected. The sales server 60 transmits a request for settlement of the products and services selected by the customer to the settlement institution 80. Further, when the settlement is complete, the sales server 60 arranges shipping of the products and services for the customer. In other words, the sales server 60 provides a Web site capable of performing e-commerce. It should be noted that the sales server 60 transmits to the management apparatus 40 information of a contract signed with the customer with respect to the sales of the image forming apparatus 20 (customer ID, address, name, contact, etc.) The management apparatus 40 and an operator thereof can obtain the contract information when the contract is signed.

[0031] The settlement institution is, for example, a financial institution or a credit card company and performs settlement for various products and services purchased by the customer. For example, in the case of settlement by a credit card, the settlement institution 80 pays the price amount of the products or services to the sales company and

charges a fee to the customer. Further, in the case of the financial institution, the price amount of the products or services is withdrawn from an account of the customer and paid to the sales company. Further, in the case of settlement by a transfer form, the transfer form for payment of the price amount is mailed to the customer, the customer pays the price amount at a convenience store or the like, and the price amount is paid to the sales company.

- [0032] The image forming apparatus 20 performs printing documents input as electronic data, copying documents, scanning (reading) documents, fax transmission of documents, reception of faxed documents, etc. It should be noted that the image forming apparatus 20 has at least a printing function. Further, an image forming apparatus 20 with two or more functions of printing documents, copying documents, scanning documents, and fax transmission and fax reception, may be referred to as a multi-function peripheral/printer/product (MFP).
- [0033] The information terminal 10 is an apparatus referred to as a general-purpose information processing apparatus or a terminal. The customer applies for a purchase of various products or a rental of various services ("rental" and "lease" are not distinguished in an embodiment of the present invention and referred to as "rental") by operating the information terminal 10. Browser software for accessing the e-commerce Web site provided by the sales server 60 or equivalent application software with the similar functionality runs on the information terminal 10.
- [0034] The information terminal 10 is specifically, for example, a personal computer (PC), a smartphone, a tablet terminal, a mobile telephone, a personal digital assistant (PDA), a wearable computer (watch, sun glasses, head-mount display, etc.), an electronic white board, a video conference terminal, a projector, etc. Further, the image forming apparatus 20 may be used as the information terminal 10.
- [0035] It should be noted that it is assumed that the image forming apparatus 20 and the information terminal 10 are installed in an environment 9 of the customer who has purchased or rented the image forming apparatus 20, and are operated by the customer. It should be noted that the information terminal 10 may be portable.
- [0036] The service personnel PC 90 is a PC of a service person who performs the customer services. The service personnel PC 90 periodically accesses a POP server which stores email, and checks whether email for the service person's email account is received and stored. In the case where the email for the service person's email account is received and stored, the service personnel PC 90 arranges shipping of consumables to the customer or performs maintenance.
- [0037] <<Hardware configuration>>
- [0038] Next, referring to Figs. 3 and 4, a hardware configuration of the management apparatus 40, the sales server 60, the service personnel PC 90, the image forming

apparatus 20, etc., will be described. Fig. 3 is an example of a hardware configuration diagram of the management apparatus 40. The management apparatus 40 includes a central processing unit (CPU) 201, a read only memory (ROM) 202, a random access memory (RAM) 203 and an auxiliary storage device 204. Further, the management apparatus 40 includes an input unit 205, a display control unit 206, and a communication unit 207. It should be noted that the units of the management apparatus 40 are connected to each other via a bus 208. As a result, the management apparatus 40 has a function as an information processing apparatus.

- [0039] The CPU 201 executes various programs and an operating system (OS) stored in the auxiliary storage device 204. The ROM 202 is a non-volatile memory. The ROM 202 stores programs, data, etc., which are needed for the CPU 201 to execute the programs stored in the auxiliary storage device 204.
- [0040] The RAM 203 is a main storage device including a dynamic random access memory (DRAM), a static random access memory (SRAM), or the like. The programs stored in the auxiliary storage device 204 are read into the RAM 203 and executed by the CPU 201. The RAM 203 is used as a work area of the CPU 201.
- [0041] The auxiliary storage device 204 stores various kinds of programs (e.g., management program 4100) executed by the CPU 201, and various kinds of databases used when the CPU 201 executes the programs. The auxiliary storage device 204 is a non-volatile memory including a hard disk drive (HDD), a solid state drive (SSD), etc. It should be noted that the databases will be described later.
- [0042] The input unit 205 is an interface for an operator to input various kinds of instructions to the management apparatus 40. For example, the input unit 205 is a keyboard, a mouse, a touch panel, a voice-input device, etc. Further, an installation unit for a recording medium such as a USB interface (I/F) may be included.
- [0043] The display control unit 206 displays information in the management apparatus 40 on a display part 210 in various forms such as a cursor, a menu, a window, a character, or an image, according to a request from the CPU 201. The display control unit 206 is, for example, a graphic chip or a display interface (I/F).
- [0044] The communication unit 207 is a network interface (I/F) for communicating with the sales server 60 and the image forming apparatus 20 via the network N.
- [0045] It should be noted that it is assumed that the sales server 60, the information terminal 10, and the service personnel PC 90 have a similar hardware configuration to that of the management apparatus 40. It is not necessary for them to have exactly the same hardware configuration as the management apparatus 40. There will be no problem in describing an embodiment of the present invention even if there are some differences.
- [0046] The hardware configuration of the management apparatus 40, etc., shown in the figure indicates hardware elements the management apparatus 40, etc., preferably

have. However, it is not necessary for the hardware elements to be contained in a single housing as an apparatus. Further, in order to cooperate with cloud computing, the physical configuration of the management apparatus 40, etc., may not be fixed. The hardware resources of the management apparatus 40, etc., may be dynamically connected or disconnected according to load of the management apparatus 40, etc.

- [0047] Fig. 4 is an example of a hardware configuration diagram of the image forming apparatus 20. The image forming apparatus 20 includes a controller 320. The controller 320 includes a CPU 301, an application specific integrated circuit (ASIC) 305, a SDRAM 302, a flash memory 303, a HDD 304, and a network interface card (NIC) 306.
- [0048] The ASIC 305 is a multi-functional device board including a CPU interface, a SDRAM interface, a local bus interface, a PCI bus interface, a media access controller (MAC), a HDD interface, etc.
- [0049] The CPU 301 reads various programs (e.g., use management program) from the HDD 304 via the ASIC 305 and executes them.
- [0050] The SDRAM 302 functions as a program memory for storing the programs, or a work memory used by the CPU 301 executing the programs. It should be noted that the SDRAM 302 may be replaced by a DRAM or SRAM.
- [0051] The flash memory 303 is a non-volatile memory, and stores a boot loader (boot program) for starting the image forming apparatus 20, or an operating system (OS). Further, the flash memory 303 functions as an application memory for storing application software (e.g., including the use management program). Further, the flash memory 303 functions as a service memory for storing software of various services (copy service, print service, facsimile service). Further, the flash memory 303 functions as a firmware memory for storing firmware, or a data memory for storing a network address, a model number, and point setting information in which a number of points is set.
- [0052] It should be noted that the flash memory 303 may be replaced by a non-volatile RAM in which a RAM and a backup circuit with battery are integrated, or other non-volatile memories including an electrically erasable programmable read-only memory (EEPROM), etc.
- [0053] The HDD 304 is a non-volatile recording medium in which data is retained regardless of ON/OFF of the power supply of the image forming apparatus 20. The HDD 304 stores programs and data other than the programs and data stored in the flash memory 303. It should be noted that the HDD 304 may be used as a firmware memory.
- [0054] The NIC 306 is an interface for communicating with the management apparatus 40 via the network N (e.g., Ethernet (registered trademark) card). Communications with the management apparatus 40 are performed via the NIC 306.

- [0055] An operation unit 307 is connected to the controller 320. The operation unit 307 includes various operation keys, a character display device with touch panel including a liquid crystal display (LCD) or a CRT as a display device, and is used by a user when inputting various instructions to the image forming apparatus 20.
- [0056] Further, a fax control unit 308, a USB 309, a IEEE1394 310, a plotter engine 311, and a scanner engine 312 are connected to the controller 320 via a PCI bus 330. With the above arrangement, the image forming apparatus 20 can provide various services such as a copy service, a print service, facsimile service, etc. The plotter engine 311 may employ an electrophotography method or an inkjet method.
- [0057] It should be noted that the configuration shown in the figures is just an example. The hardware configuration of the image forming apparatus 20 is not limited to the one shown in Fig. 4. For example, the NIC 306 may be connected to the PCI bus 330. Further, the NIC 306 may be connected to the network N via a wire, or may be wirelessly connected to the network N, for example, by using Wi-Fi (registered trademark).
- [0058] Further, the NIC 306 may be replaced by, or used together with, a digital service unit (DSU) or a modem for connecting to a telephone network. A communication device for connecting to a mobile telephone network may be included. Further, for example, the image forming apparatus 20 may include a device used for communications using Bluetooth (registered trademark) communication standard, and connect to the network N via the device.
- [0059] <Functions of equipment system>
- [0060] Next, referring to Fig. 5, a functional configuration of the management apparatus 40 and the image forming apparatus 20 will be described. Fig. 5 is an example of a functional block diagram of the management apparatus 40 and the image forming apparatus 20 included in the equipment system 100. It should be noted that known functions are used for the sales server 60, the service personnel PC 90 and the settlement institution 80.
- [0061] <<Image forming apparatus>>
- [0062] The image forming apparatus 20 includes a basic function unit 22, an equipment use information management unit 21, and a network control unit 23. The above units of the image forming apparatus 20 are functions or means which are realized or provided by any one of elements shown in Fig. 4 which operates according to instructions from the CPU 301 which executes a use management program 2100 read from the HD 304 and written to the SDRAM 302.
- [0063] It should be noted that the use management program 2100 is delivered from a dedicated program-delivery server, or written to a computer readable recording medium, which medium is delivered.

- [0064] The basic function unit 22 is realized by the CPU 301, the ASIC 305, the fax control unit 308, the plotter engine 311, the scanner engine 312, etc., shown in Fig. 4, and provides functions of the image forming apparatus 20. In other words, the basic function unit 22 performs a print job, a copy job, a scanning job, a FAX transmission job, a FAX reception job, etc.
- [0065] The equipment use information management unit 21 is realized by the CPU 301, etc., shown in Fig. 4, collects information which changes according to a use situation of the image forming apparatus 20 (corresponding to the use change information), and transmits the collected information to the management apparatus 40. In other words, a remaining toner amount and counter information are transmitted.
- [0066] The network control unit 23 transmits the use change information to the management apparatus 40 via the network N in response to a request from the equipment use information management unit 21. The equipment use information management unit 21 transmits a request for transmission of the use change information at a predetermined time (in the case where the power supply of the image forming apparatus 20 is not ON at the predetermined time, after the power supply has been ON), or periodically at a certain transmission period. It should be noted that the transmission period may be once in two days, once a week, or once a month. Further, the transmission period may be twice or more a day. The transmission is not limited to periodic transmission. The request may be transmitted when load of the image forming apparatus 20 is decreased.
- [0067] Further, the network control unit 23 includes a mail transmission function unit 24 and a https communication function unit 25. The mail transmission function unit 24 transmits the use change information managed by the equipment use information management unit 21 to an email address of the management apparatus 40.
- [0068] The https-communication function unit 25 transmits the use change information managed by the equipment use information management unit 21 to a http server 44 of the management apparatus 40 by using http protocol. It should be noted that the use change information may be transmitted to the management apparatus 40 by using the http protocol, or may be transmitted by using email, which does not matter. Further, the use change information may be transmitted by using other communication protocols such as file transfer protocol (FTP).
- [0069] <<Management apparatus>>
- [0070] The management apparatus 40 includes a network connection unit 41, a display unit 42, a remaining toner amount determination unit 43, the http server 44, a POP server 45, a SMTP server 46, and an equipment information management unit 47. The above units of the management apparatus 40 are functions or means which are realized or provided by any one of elements shown in Fig. 3 which operates according to instructions from the CPU 201 which executes a management program 4100 read from

the auxiliary storage device 204 and written to the RAM 203.

[0071] It should be noted that the management program 4100 is delivered from the dedicated program-delivery server, or written to a computer readable recording medium, which medium is delivered.

[0072] Further, the management apparatus 40 has an equipment information DB 49 including the auxiliary storage device 204 and the RAM 203 shown in Fig. 3.

[Table 1]

NOTIFICATION DATE AND TIME	MODEL NUMBER	COUNTER INFORMATION	REMAINING TONER AMOUNT (%)
01/01/2015 12:00	A123-112233	123	100
01/02/2015 12:00	A123-112233	256	90
⋮	⋮	⋮	⋮
01/23/2015 12:00	A123-112233	1282	90
01/24/2015 12:00	A123-112233	1290	80
⋮	⋮	⋮	⋮
02/15/2015 12:00	A123-112233	2480	80
02/16/2015 12:01	A123-112233	2490	70
02/17/2015 12:00	A123-112233	2511	50
⋮	⋮	⋮	⋮

[0073] Table 1 is an illustration of an equipment information table stored in the equipment information DB 49. In the equipment information table, notification date and time is associated with a model number, counter information, and remaining toner amount. The notification date and time is the date and time when the use change information is received by the management apparatus 40. The model number is identification information specific to the image forming apparatus 20. The model number may be changed, but uniqueness of the model number is guaranteed. The counter information is an accumulated number of printed pages (based on single sided print) stored in the image forming apparatus 20. The remaining toner amount indicates how much toner is left in the toner cartridge. In Table 1, the remaining toner amount is expressed in percentage, but may be expressed in gram units or in dot units (pixels).

[0074] Further, in the case where the image forming apparatus 20 is capable of color

printing, remaining toner amount for each color of black, cyan, magenta, and yellow is recorded. In this case, the counter information for color printing and the counter information for monochrome printing are recorded separately.

[0075] In the equipment information table of Table 1, every day use change information of the image forming apparatus 20 of the same model number is shown. When there are plural image forming apparatuses 20, the use change information is transmitted to the management apparatus 40 from each of the image forming apparatuses 20.

[0076] (Functions of management apparatus)

[0077] Next, functions of the management apparatus 40 will be described. The network connection unit 41 is realized by the CPU 201, the communication unit 207, etc., shown in Fig. 3, accesses the network N, and connects the http server 44, the POP server 45, and the SMTP server 46 to the network N.

[0078] The display unit 42 is realized by the CPU 201, the display control unit 206, etc., shown in Fig. 3, and displays information in the management apparatus 40 on a display part 210 in various forms such as a cursor, a menu, a window, a character, an image, etc.

[0079] The remaining toner amount determination unit 43 is realized by the CPU 201, etc., shown in Fig. 3, analyzes the use change information transmitted from the image forming apparatus 20 by using a method described below, and determines whether the consumed toner amount is reasonable. "To determine whether the consumed toner amount is reasonable" is to determine whether the use amount (e.g., counter information) of the image forming apparatus 20 is appropriate with respect to the remaining toner amount (consumed toner amount). Further, when it is determined that the use amount is not appropriate, the remaining toner amount is not appropriate. "The remaining toner amount is not appropriate" can be expressed as "the remaining toner amount is not reasonable". Specifically, in the case where the use amount (e.g., an increased amount of counter information) of the image forming apparatus 20 is less with respect to the remaining toner amount, or in the case where the remaining toner amount is significantly decreased, it is determined that the remaining toner amount is not appropriate.

[0080] The http server 44 functions as a http server in response to a request from the https communication function unit 25 of the image forming apparatus 20, establishes communications with the image forming apparatus 20, and receives the use change information. It should be noted that the http server 44 is also capable of transmitting information to the image forming apparatus 20.

[0081] In the case where it is determined that the remaining toner amount is not appropriate, the SMTP server 46 transmits email to the POP server 45, which email's destination is an email address of the service personnel PC 90 (or email address of the service

person).

- [0082] The POP server 45 accepts email polling by the service personnel PC 90, and, in the case where there is email for the service personnel PC 90, transmits the email to the service personnel PC 90. Further, the POP server 45 receives email from the image forming apparatus 20, which email's destination is the management apparatus 40. In other words, the use change information is received from the image forming apparatus 20 by using email.
- [0083] The equipment information management unit 47 adds notification date and time to the use change information received by the http server 44 or the POP server 45, and stores them as a record in the equipment information DB 49.
- [0084] <Operation procedure>
- [0085] Next, referring to Fig. 6, a procedure for transmitting the use change information and determining whether the remaining toner amount is reasonable will be described. Fig. 6 is an example of a drawing illustrating an overall operation of the equipment system 100.
- [0086] S1: The https communication function unit 25 of the image forming apparatus 20 transmits the use change information to the http server 44 of the management apparatus 40. The use change information includes a model number for identifying the image forming apparatus 20.
- [0087] S2: The https communication function unit 25 of the image forming apparatus 20 transmits the use change information to the http server 44 of the management apparatus 40 periodically or at a predetermined timing. In other words, as shown in Table 1, the use change information is repeatedly transmitted to the http server 44.
- [0088] S3: The remaining toner amount determination unit 43 of the management apparatus 40 obtains the use change information from the http server 44, and determines whether the remaining toner amount is reasonable. The detailed description will be provided by referring to Fig. 7. Here, a case will be described in which it is determined that the remaining toner amount is not appropriate. In the case where it is determined that the remaining toner amount is appropriate, no error will be reported.
- [0089] S4: The http server 44 transmits an error notification indicating a possibility that the remaining toner amount is not appropriate to the SMTP server 46.
- [0090] S5: The SMTP server 46 transmits email to the POP server 45, in which email, an error notification is included and the email address of the service personnel of the service personnel PC 90 is specified as a destination.
- [0091] S6: The service personnel PC 90 checks whether there is email for the service personnel PC 90 by polling of the POP server 45.
- [0092] S6.1: The service personnel PC receives email in which an error notification is included.

- [0093] S7: Further, the http server 44 of the management apparatus 40 may transmit an error notification to the image forming apparatus 20. Direct communications from the management apparatus 40 to the image forming apparatus 20 are blocked by a firewall or the like, and thus, the https communication function unit 25 of the image forming apparatus 20 periodically queries the http server 44 of the management apparatus 40 to determine whether there is an error notification.
- [0094] S7.1: In response to the query, the http server 44 transmits an error notification to the image forming apparatus 20. Further, instead of transmitting an error notification to the image forming apparatus 20, or along with transmitting an error notification to the image forming apparatus 20, the management apparatus 40 may restrict the use of the image forming apparatus 20. To restrict the use is to disable all functions of the image forming apparatus 20 used by the user, or to disable a part of the functions of the image forming apparatus 20 used by the user. Upon receiving the error notification, the image forming apparatus 20 restricts accepting operations for the operation unit 307, or stops accepting print jobs for the operation unit 307. Further, the image forming apparatus 20 may restrict the number of print pages per day to be equal to or less than a predetermined number.
- [0095] <<Determination whether remaining toner amount is reasonable>>
- [0096] In step S3 of Fig. 6, the remaining toner amount determination unit 43 of the management apparatus 40 determines whether the decreased amount of the remaining toner amount is reasonable according to the remaining toner amount and the counter information. The determination method is, for example, as follows.
- [0097] First, in the case where the decreased amount of toner is 20% (as an example), the minimum number of printable pages is defined as a number of printable pages N. Further, the increased amount of the counter information when the remaining toner amount is decreased by 20% is defined as M (an example of increased amount). Therefore, in the case where "N > M" is satisfied, it can be determined that the remaining toner amount has decreased abnormally.
- [0098] The increased amount M can be calculated from the counter information in the past. Further, the number of printable pages N can be calculated by the following formula.
- $$N = (\text{"a number of printable dots when the remaining toner amount is 100\%"} \times 20\%) / (\text{number of dots when a page is printed at the maximum concentration})$$
- [0099] The number of printable dots when the remaining toner amount is 100% is known in advance (can be obtained experimentally or theoretically). "A page is printed at the maximum concentration" means that a page is printed with 100% coverage (coverage information), or a whole page is printed in black in the case of monochrome print. The number of dots when a page is printed at the maximum concentration (number-of-dots information) can also be obtained experimentally or theoretically. It does not happen

that the increased amount of the counter information is less than the number of print pages necessary for decreasing the toner by 20% in the case where the toner is maximally consumed (minimum number of print pages necessary for decreasing the toner by 20%). Therefore, in the case where " $N > M$ " is satisfied, it can be determined that the remaining toner amount is not appropriate. In this case, an error notification is transmitted in step S4 of Fig. 6.

- [0100] Fig. 7 is an example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable.
- [0101] The remaining toner amount determination unit 43 of the management apparatus 40 identifies the use change information, whose remaining toner amount is greater than the remaining toner amount of the received use change information by a threshold value and whose received date and time is the oldest (S10). In other words, the remaining toner amount determination unit 43 identifies the use change information, whose remaining toner amount is greater than the remaining toner amount included in the latest use change information by the threshold value and whose received date and time is the oldest. The threshold value is 20% in the above example, but may be a resolution of the remaining toner amount detectable by the image forming apparatus 20 (e.g., 1%), or may be a greater value less than 100%.
- [0102] The remaining toner amount determination unit 43 calculates an increased amount M of the counter information included in the received use change information and the oldest use change information (S20). In other words, the remaining toner amount determination unit 43 calculates a difference between the counter information included in the latest use change information and the counter information included in the use change information identified in step S10.
- [0103] Next, the remaining toner amount determination unit 43 calculates the minimum number of printable pages N necessary for consuming the threshold value amount of toner (S30). For example, if the minimum number of printable pages "n" necessary for consuming 1% amount of toner (number of printable pages at the maximum concentration) is retained beforehand and the threshold value is 20%, then the minimum number of printable pages N necessary for consuming the threshold value (20%) amount of toner can be calculated by $N = 20 \times n$.
- [0104] Next, the remaining toner amount determination unit 43 determines whether " $N > M$ " is satisfied (S40).
- [0105] In the case where the determination in step S40 is YES, the remaining toner amount determination unit 43 transmits an error notification (S50). In the case where the determination in step S40 is NO, the remaining toner amount determination unit 43 does not transmit an error notification.
- [0106] As described above, it is possible to determine whether the remaining toner amount

is appropriate by comparing the increased amount of the counter information M and the minimum number of printable pages N.

- [0107] Referring to an equipment information table shown in Table 1, a specific example will be described. It is assumed that the management apparatus 40 receives use change information indicating "02/16/2015, 12:01, 002490 pages, remaining toner amount: 70%".
- [0108] The oldest use change information in which the remaining toner amount 90%, which is greater than the remaining toner amount 70% by 20%, is included is "01/02/2015, 12:00, 000256 pages, remaining toner amount: 90%". In other words, 20% amount of toner is consumed during the above period. The increased amount of the counter information is "2234 (pages) = 2490 - 256".
- [0109] Here, it is assumed that the minimum number of printable pages N necessary for consuming 20% amount of toner is 200. It is determined that the remaining toner amount is appropriate because $N(200) < M(2234)$.
- [0110] Next, it is assumed that the management apparatus 40 receives use change information indicating "02/17/2015, 12:00, 002511 pages, remaining toner amount: 50%". The oldest use change information in which the remaining toner amount 70%, which is greater than the remaining toner amount 50% by 20%, is included is "02/16/2015, 12:01, 002490 pages, remaining toner amount: 70%". During the above period, 20% amount of toner is consumed. The increased amount of the counter information is "21 (pages) = 2511 - 2490". It is determined that the remaining toner amount is not appropriate because $N(200) > M(21)$.
- [0111] It should be noted that, in the case of color print, it can be determined in a similar manner. In the case of color print, it is not known in what ratios black toner, cyan toner, magenta toner, and yellow toner are used, and thus, it is assumed that each toner is used in the same ratio (25%). Therefore, the minimum number of printable pages N in the case where 20% amount of toner is consumed is calculated as follows.
- $$N = (\text{"number of printable dots when remaining amount is 100 \%"} \times 20\%) / (\text{number of dots when a page is printed at 25\% concentration})$$
- [0112] With the above operation, the number of printable pages N can also be determined in the case of color print. It should be noted that the number of printable pages N may be calculated in the case of color print similarly to the case of monochrome print.
- [0113] <Error notification>
- [0114] Fig. 8 is a drawing illustrating an example of email of error notification transmitted from the management apparatus 40 to the service personnel PC 90. The email includes a header 501, an error notification 502, equipment information 503, and contact information 504. It can be seen that it is possible that the remaining toner amount is not appropriate from a message of the error notification 502 "The toner is consumed ab-

normally. Please check it."

[0115] A customer service operating the service personnel PC 90 contacts or visits a person indicated in the contact information 504, performs maintenance of the image forming apparatus 20, and checks how the toner is used, etc.

[0116] <<Coverage>>

[0117] In a determination method shown in Fig. 7, in order to reduce an error of determining that the remaining toner amount is not appropriate when it actually is appropriate, it is assumed that pages are printed at the maximum concentration when the minimum number of printable pages N is calculated. However, if it is assumed that pages are printed at the maximum concentration, then it may prevent performing right determination whether the remaining toner amount is reasonable in the case where a number of printed pages is slightly greater than the minimum number of printable pages N. In other words, there is a risk of determining that the remaining toner amount is appropriate when it actually is not appropriate. For example, when a toner cartridge has been used in another image forming apparatus 20, and installed in the image forming apparatus 20, there is a risk of determining that the remaining toner amount is appropriate if a number of pages, slightly greater than the minimum number of printable pages N (200 pages in the above example), are printed.

[0118] Therefore, it is effective to calculate, not the minimum number of printable pages N necessary for consuming the decreased amount of toner, but an average number of printable pages P necessary for consuming the decreased amount of toner. Therefore, the image forming apparatus 20 transmits to the management apparatus 40 an everyday average coverage together with, or separately from the use change information.

[Table 2]

NOTIFICATION DATE AND TIME	MODEL NUMBER	COUNTER INFORMATION	REMAINING TONER AMOUNT (%)	COVERAGE (%)
01/01/2015 12:00	A123-112233	123	100	8
01/02/2015 12:00	A123-112233	256	90	9
⋮	⋮	⋮	⋮	⋮
01/23/2015 12:00	A123-112233	1282	90	6
01/24/2015 12:00	A123-112233	1290	80	3
⋮	⋮	⋮	⋮	⋮
02/15/2015 12:00	A123-112233	2480	80	5
02/16/2015 12:01	A123-112233	2490	70	5
02/17/2015 12:00	A123-112233	2511	50	4
⋮	⋮	⋮	⋮	⋮

[0119] Table 2 is an illustration of an equipment information table stored in the equipment information DB 49 in the case where a coverage is transmitted. It should be noted that a difference between Table 1 and Table 2 will be mainly described. The equipment information table of Table 2 includes a coverage. The coverage is, for example, an everyday average coverage. It should be noted that in the case where the image forming apparatus 20 is capable of color print, a coverage is stored for each color.

[0120] The remaining toner amount determination unit 43 calculates a number of printable pages P necessary for consuming the decreased amount of toner by, for example, using an average value, a median value, or a maximum value of the coverages in the last month (hereinafter, referred to as a statistical value of coverage).

[0121]
$$P = (\text{a number of printable dots when remaining toner amount is 100\%}) \times (\text{decreased toner amount}) / (\text{a number of printed dots when a page is printed with the statistical value of coverage})$$

[0122] The number of printed dots when a page is printed with the statistical value of coverage can be calculated from the statistical value of coverage because the number of printable dots when a page is printed at the maximum concentration is known in advance. For example, when the statistical value of coverage is 5%, the number of printed dots when a page is printed with the statistical value of coverage is one twentieth of the number of printable dots when a page is printed at the maximum concentration.

- [0123] The remaining toner amount determination unit 43 determines that the remaining toner amount is not appropriate in the case where " $P > M$ " or " $P - \alpha > M$ ". " α " is a parameter for reducing a risk of an error of determining that the remaining toner amount is not appropriate when it actually is appropriate. When the number of printable pages P is calculated by the statistical value of coverage, there is a risk of an error of determining that the remaining toner amount is not appropriate when it actually is appropriate in the case where the pages are printed by the image forming apparatus 20 with a coverage greater than the statistical value of coverage. Therefore, the error of determining that the remaining toner amount is not appropriate when it actually is appropriate, can be decreased by determining α as, for example, 10% of P .
- [0124] Fig. 9 is another example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable. A difference between Fig. 9 and Fig. 7 will be mainly described.
- [0125] After step S10, the remaining toner amount determination unit 43 calculates the statistical value of coverage (S15).
- [0126] The remaining toner amount determination unit 43 calculates an increased amount M of the counter information included in the received use change information and the oldest use change information (S20).
- [0127] Next, the remaining toner amount determination unit 43 calculates the number of printable pages P necessary for consuming the decreased amount of toner (S30). For example, if a number of printable pages p necessary for consuming 1% amount of toner (number of print pages based on the statistical value of coverage) is retained beforehand and the decreased toner amount is 20%, then the number of printable pages P necessary for consuming the decreased amount of toner can be calculated by $P = 20 \times p$.
- [0128] Next, the remaining toner amount determination unit 43 determines a parameter α (S35).
- [0129] Next, the remaining toner amount determination unit 43 determines whether " $P - \alpha > M$ " is satisfied (S40).
- [0130] In the case where the determination in step S40 is YES, the remaining toner amount determination unit 43 transmits an error notification (S50).
- [0131] As described above, a risk of an error of determining that the remaining toner amount is not appropriate when it actually is appropriate in the case where the number of printable pages P is calculated by the statistical value of coverage, can be decreased.
- [0132] <Comparison with determining whether the remaining toner amount is reasonable based on detection of toner cartridge replacement>
- [0133] If it is detected that the toner cartridge is replaced and it is detected that the remaining toner amount is in a toner-near-end state, then it is determined that the

remaining toner amount is not appropriate. The following descriptions are divided into a case where an IC chip is included in the toner cartridge and a case where an IC chip is not included in the toner cartridge. It is assumed that a chip number is stored in the IC chip.

[0134] - In the case where an IC chip is included in the toner cartridge

[0135] In this case, the equipment use information management unit 21 of the image forming apparatus 20 associates the remaining toner amount with the chip number, and stores them. For example, it is assumed that a toner cartridge whose toner is in a toner-near-end state is installed by a user in the image forming apparatus 20 when its power supply is OFF. It can be detected that the toner cartridge is replaced because the chip number detected right after the power supply ON is different from the chip number detected before the power supply OFF, and that the toner is in a toner-near-end state. Therefore, it can be determined whether the remaining toner amount is appropriate.

[0136] However, in the case where a toner cartridge is removed from the image forming apparatus 20, the toner cartridge is installed in another image forming apparatus 20, toner of the same cartridge is used by the other image forming apparatus 20, the cartridge is removed from the other image forming apparatus 20, and installed in the original image forming apparatus 20, the image forming apparatus 20 cannot detect that the toner cartridge is replaced because the chip number is the same.

[0137] - In the case where an IC chip is not included in the toner cartridge

[0138] It is assumed that a toner cartridge whose toner is in a toner-near-end state is installed by a user in the image forming apparatus 20 when its power supply is OFF. A chip number cannot be read by the image forming apparatus 20. As a result, the image forming apparatus 20 can only detect that the toner cartridge is in a toner-near-end state when the power supply is ON. In other words, the image forming apparatus cannot detect that the remaining toner amount is not appropriate because it cannot detect that the toner cartridge is replaced.

[0139] Also, in the case where a toner cartridge is removed from the image forming apparatus 20, the toner cartridge is installed in another image forming apparatus 20, toner of the same cartridge is used by the other image forming apparatus 20, the cartridge is removed from the other image forming apparatus 20, and installed in the original image forming apparatus 20, the image forming apparatus 20 cannot detect that the toner cartridge is replaced.

[0140] On the other hand, in a method for determining whether the remaining toner amount is appropriate according to an embodiment of the present invention, it is easy to detect that the remaining toner amount is not appropriate regardless whether an IC chip is included in the toner cartridge or not, because the decreased amount of the remaining toner amount is evaluated by using the counter information.

[0141] (Embodiment 2)

[0142] In an embodiment 2, a management apparatus 40 will be described in which it is determined whether the remaining toner amount is reasonable based on: the detection that the remaining toner amount is in a toner-near-end state; and the counter information.

[0143] When the remaining toner amount is in a toner-near-end state, it means that the image forming apparatus 20 has printed pages necessary for consuming toner of the whole toner cartridge. On the other hand, in the case where the toner is decreased abnormally due to some reason, or in the case where a toner cartridge whose toner is in a toner-near-end state is installed in the image forming apparatus 20, the image forming apparatus 20 has not printed the number of pages necessary for consuming the toner of the whole toner cartridge.

[0144] It should be noted that a block diagram of the management apparatus 40 and the image forming apparatus 20 according to the embodiment 2 is the same as shown in Fig. 5. Further, descriptions of the same elements may be omitted and only a difference may be described.

[0145] Fig. 10 is an example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable. The procedure shown in Fig. 10 starts when the use change information is received.

[0146] The remaining toner amount determination unit 43 of the management apparatus 40 determines whether the remaining toner amount of the use change information is in a toner-near-end state (S10). Instead of the use change information, a toner call requesting toner may be received. In the case where the determination in step S10 is NO, the management apparatus 40 does not transmit an error notification, and the process ends.

[0147] In the case where the determination in step S10 is YES, the remaining toner amount determination unit 43 of the management apparatus 40 identifies the oldest use change information, in which the remaining toner amount 100% is recorded.

[0148] Next, the remaining toner amount determination unit 43 calculates increased amount M of the counter information increased up to now (S30). In other words, the remaining toner amount determination unit 43 calculates the difference between the counter information of the use change information identified in step 20 and the counter information of the use change information received in step S10.

[0149] Next, the remaining toner amount determination unit 43 determines whether the increased amount M of the counter information is less than "F- β " (S40). F is a number of print pages when toner of a whole toner cartridge is consumed for printing. The value of F is calculated in advance based on a typical coverage. The value of F may be calculated based on the statistical value of coverage as described in the embodiment 1. " β " is a constant for preventing an error of determining that the remaining toner

amount is not appropriate when it actually is appropriate. By estimating fewer than F by β , an error of determining that the remaining toner amount is not appropriate when the image forming apparatus 20 actually has consumed toner of a whole toner cartridge can be prevented. The value of β is set as, for example, but not limited to, 10% of the value of F .

[0150] In the case where the determination in step S40 is YES, the remaining toner amount determination unit 43 transmits an error notification (S50).

[0151] The shipping of a toner cartridge is arranged in the case where the remaining toner amount is in a toner-near-end state. Therefore, the determination according to an embodiment of the present invention may be performed only in the case where toner of the toner cartridge is in a toner-near-end state. Therefore, process load of the management apparatus 40 is decreased, and it is determined whether the remaining toner amount is reasonable.

[0152] It should be noted that the method of determining whether the remaining toner amount is reasonable according to an embodiment can be applied to each of a black toner cartridge, a cyan toner cartridge, a magenta toner cartridge, and a yellow toner cartridge. Increased amount M of the print pages of monochrome print is calculated in the case where the remaining toner amount of the black toner cartridge is in a toner-near-end state. Increased amount M of the print pages of color print is calculated in the case where the remaining toner amount of the cyan, magenta, and yellow toner cartridges are in a toner-near-end state.

[0153] (Embodiment 3)

[0154] There is a case where the image forming apparatus 20 counts a number of printed dots. The number of printed dots is a number of points included in an image formed on print paper. It is natural that the toner is consumed as much as the points are formed. In other words, the consumed amount of the toner is proportional to the number of dots. In an embodiment 3, the number of dots is transmitted from the image forming apparatus 20 to the management apparatus 40. The management apparatus 40 determines whether the remaining toner amount is reasonable based on the number of dots. The number of dots is a value controlled by the image forming apparatus 20. Therefore, the number of dots is highly correlated to the actually consumed toner. Therefore, the accuracy of the determination of the remaining toner amount can be improved.

[Table 3]

NOTIFICATION DATE AND TIME	MODEL NUMBER	COUNTER INFORMATION	REMAINING TONER AMOUNT (%)	NUMBER OF DOTS (× 10000)
01/01/2015 12:00	A123-112233	123	100	1234
01/02/2015 12:00	A123-112233	256	90	2143
⋮	⋮	⋮	⋮	⋮
01/23/2015 12:00	A123-112233	1282	90	18725
01/24/2015 12:00	A123-112233	1290	80	20823
⋮	⋮	⋮	⋮	⋮
02/15/2015 12:00	A123-112233	2480	80	50823
02/16/2015 12:01	A123-112233	2490	70	53459
02/17/2015 12:00	A123-112233	2511	50	56789
⋮	⋮	⋮	⋮	⋮

[0155] Table 3 is an illustration of an equipment information table stored in the equipment information DB 49. It should be noted that a difference between Table 1 and Table 3 will be mainly described. The equipment information table of Table 3 includes a number of dots. The number of dots is an accumulated number of dots formed on the print paper by the image forming apparatus 20. It should be noted that in the case where the image forming apparatus 20 is capable of color print, the number of dots is stored for each color.

[0156] Fig. 11 is an example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable. A difference between Fig. 11 and Fig. 7 will be mainly described.

[0157] The remaining toner amount determination unit 43 of the management apparatus 40, upon receiving use change information, identifies the use change information, whose remaining toner amount is greater than the remaining toner amount of the received use change information by a threshold value and whose received date and time is the oldest (S10).

[0158] Next, the remaining toner amount determination unit 43 calculates increased amount

D of the number of dots from the received use change information and the oldest use change information (S20). In other words, the remaining toner amount determination unit 43 calculates a difference between the number of dots included in the latest use change information and the number of dots included in the use change information identified in step S10.

- [0159] Next, the remaining toner amount determination unit 43 reads from the auxiliary storage device 204 a number of dots Q necessary for consuming the threshold value amount of toner (S40). There is a proportional relationship between the consumed amount of toner and the number of formed dots. Therefore, an operator or the like may store in the auxiliary storage device 204 beforehand the number of dots Q, which dots can be formed by the threshold amount of toner.
- [0160] Next, the remaining toner amount determination unit 43 determines whether the increased amount D of the number of dots is less than " $Q-\gamma$ " (S40). " γ " is a constant for preventing an error of determining that the remaining toner amount is not appropriate when it actually is appropriate. The value of γ is set as, for example, but not limited to, 10% of the value of Q.
- [0161] In the case where the determination in step S40 is YES, the remaining toner amount determination unit 43 transmits an error notification (S50). In the case where the determination in step S40 is NO, the remaining toner amount determination unit 43 does not transmit an error notification.
- [0162] As described above, by using the number of dots, it is possible to determine whether the remaining toner amount is reasonable while reducing an error of determining that the remaining toner amount is appropriate when the remaining toner amount is actually not appropriate, and while reducing an error of determining that the remaining toner amount is not appropriate when the remaining toner amount is actually appropriate.
- [0163] <<Determination whether remaining toner amount is reasonable by using a toner-near-end state>>
- [0164] It is possible to determine whether the remaining toner amount is appropriate by using a toner-near-end state as shown in the embodiment 2.
- [0165] Fig. 12 is an example of a flowchart illustrating a procedure for determining whether a remaining toner amount is reasonable. A difference between Fig. 12 and Fig. 10 will be mainly described. Steps S10 and S20 are the same as in Fig. 10.
- [0166] In step S30, the remaining toner amount determination unit 43 calculates increased amount T of the number of dots increased up to now (S30). In other words, the remaining toner amount determination unit 43 calculates the increased amount T between the number of dots of the use change information identified in step 20 and the number of dots of the use change information received in step S10.
- [0167] The remaining toner amount determination unit 43 reads the number of dots U

necessary for consuming the toner of a whole toner cartridge (S40). Because the number of dots U, which dots can be formed by the toner of a whole toner cartridge, is known beforehand, an operator or the like may store the number of dots U in the auxiliary storage device 204 beforehand.

[0168] Next, the remaining toner amount determination unit 43 determines whether the increased amount T of the number of dots is less than "U-ε" (S50). "ε" is a constant for preventing an error of determining that the remaining toner amount is not appropriate when it actually is appropriate. The value of ε is set as, for example, but not limited to, 10% of the value of U.

[0169] In the case where the determination in step S50 is YES, the remaining toner amount determination unit 43 transmits an error notification (S60).

[0170] The determination procedure shown in Fig. 20 may be performed in the case where the toner of the toner cartridge is in a toner-near-end state. Therefore, process load of the management apparatus 40 is decreased, and it is determined whether the remaining toner amount is reasonable. Further, the accuracy of the determination of the remaining toner amount can be improved by using the number of dots.

[0171] (Embodiment 4)

[0172] In the embodiment 1, the minimum number of printable pages N necessary for consuming the threshold value amount of toner is used. In other words, it is not taken into consideration whether the user tends to consume a lot of toner (e.g., tends to print images) or the user tends to consume less toner (e.g., tends to print texts, tends to print pages with a lot of blank spaces). In an embodiment 4, the management apparatus 40, in which a number of estimated printable pages N is determined by considering the user's use record in the past and it is determined whether the toner has been abnormally decreased, will be described,

[0173] For example, it is assumed that the increased amount of the counter information is M when the remaining toner amount is decreased by 20%. The number of estimated printable pages N is a number of print pages necessary for consuming 20% of the toner when the image forming apparatus 20 is used by a user in the usual manner. It can be determined whether the remaining toner amount is reasonable by comparing the number of estimated printable pages N with the increased amount of the counter information M.

[0174] The number of estimated printable pages N, which is a threshold value, will be described. The counter information in the past is stored in the equipment information DB 49. N can be obtained by the following formula.

[0175]
$$N = \text{a number of pages printed by 100\% of the toner amount} \times 20\%$$

[0176] The number of pages printed by 100% of the toner amount is a number of pages printed from when the toner of the toner cartridge is 100% to when the toner of the

toner cartridge is 0%. It is not necessarily from when the toner of the toner cartridge is 100% to when the toner of the toner cartridge is 0% as long as 100% amount is included. Further, the number of pages printed by 100% of the toner amount may be an average value or a median value of the numbers of pages printed by n toner cartridges in the past.

[0177] If $N > M$, then there is a possibility that the increased amount of the counter information M is less as compared to the decreased amount of toner for the user (the remaining toner amount is not reasonable). It should be noted that the decreased toner amount for a user may not be constant. Therefore, it may be determined that the remaining toner amount is not reasonable in the case where, by taking into account a margin (allowance), " $N/2 > M$ " is satisfied. Further, it may be determined that the remaining toner amount is not reasonable in the case where " $3N/4 > M$ " or " $4N/5 > M$ " is satisfied. The greater the left-hand side value is, the more severe is the determination. Therefore, it can reduce the possibility of determining that the toner is not consumed abnormally when the toner is actually consumed abnormally. For example, in the case where the numbers of pages printed by n toner cartridges in the past vary a lot (variance is large), the margin (allowance) may be large (the larger the variance, the smaller α is used in " $\alpha N > m$ ").

[0178] Further, it is just an example that the determination timing is when 20% of toner is consumed. It is possible for the management apparatus 40 to determine every time the use change information is transmitted to the management apparatus 40. However, there is a risk of decreased accuracy of determination when the consumed toner amount is too little because the increased amount M tends to vary. On the other hand, there is a risk that the determination is delayed if it is determined when the consumed toner amount is large. Therefore, it may be determined at an appropriate timing. For example, it may be determined at a timing when 1% to 100% of the toner is consumed.

[Table 4]

NOTIFICATION DATE AND TIME	MODEL NUMBER	COUNTER INFORMATION	REMAINING TONER AMOUNT (%)
01/01/2015 12:00	A123-112233	123	100
01/02/2015 12:00	A123-112233	256	90
01/08/2015 12:00	A123-112233	375	80
01/15/2015 12:00	A123-112233	501	70
01/22/2015 12:00	A123-112233	620	60
01/28/2015 12:00	A123-112233	740	50
02/05/2015 12:00	A123-112233	866	40
⋮	⋮	⋮	⋮
02/25/2015 12:00	A123-112233	1280	0
⋮	⋮	⋮	⋮
02/26/2015 12:00	A123-112233	1282	100
03/05/2015 12:00	A123-112233	1400	90
03/15/2015 12:00	A123-112233	1520	80
03/16/2015 12:01	A123-112233	1530	60
⋮	⋮	⋮	⋮

[0179] Table 4 is an illustration of an equipment information table stored in the equipment information DB 49. It should be noted that a difference between Table 1 and Table 4 will be mainly described. Referring to the equipment information table of Table 4, a specific method for determining whether the remaining toner amount is reasonable will be described. First, the remaining toner amount determination unit 43 reads numbers of pages printed by a whole toner cartridge (100% of toner amount).

"1/1/2015, 12:00, 123 pages, remaining toner amount: 100%"

"1/2/2015, 12:00, 256 pages, remaining toner amount: 90%"

"2/25/2015, 12:00, 1280 pages, remaining toner amount: 0%"

- [0180] From the above reading, it is understood that 1157 (=1280-123) pages are printed for consuming 100% of the toner. Therefore, the number of estimated printable pages for consuming 20% of the toner $N = 1157 \times 20\% = 231.4$.
- [0181] Next, determining whether the remaining toner amount is reasonable will be described. First, the remaining toner amount determination unit 43 detects that the remaining toner amount has been decreased by 20%.
- "2/26/2015, 12:00, 1282 pages, remaining toner amount: 100%"
- "3/15/2015, 12:00, 1520 pages, remaining toner amount: 80%"
- [0182] The increased amount M while 20% of the toner is consumed = 238 (=1520-1282). Because " $N/2 > M$ " is not satisfied, the remaining toner amount determination unit 43 determines that the remaining toner amount is reasonable.
- [0183] Next, the remaining toner amount determination unit 43 detects that the remaining toner amount has been decreased by 20% from the last time of determination.
- "3/15/2015, 12:00, 1520 pages, remaining toner amount: 80%"
- "3/16/2015, 12:00, 1530 pages, remaining toner amount: 60%"
- [0184] The increased amount while 20% of the toner is consumed $M = 10$ (=1530-1520). Because " $N/2 > M$ " is satisfied, and thus, the increased amount M is too small compared to the consumed toner amount, the remaining toner amount determination unit 43 determines that the remaining toner amount is not reasonable. As a result, the management apparatus 40 transmits an error notification to the service personnel PC, etc.
- [0185] Fig. 13 is a drawing illustrating an example of email of error notification transmitted from the management apparatus 40 to the service personnel PC 90. A difference between Fig. 13 and Fig. 8 will be mainly described. In Fig. 13, a message "There is a possibility that the toner has been consumed abnormally. Please check." is displayed as an error notification 502.
- [0186] It should be noted that the operation procedure of the management apparatus 40 may be the same as FIG. 7. The method of calculating the number of estimated printable pages N in step S30 of Fig. 7 and the determination in step S40 are described.
- [0187] As described above, the management apparatus 40 can determine whether the remaining toner amount is reasonable according to the normal use manner of the image forming apparatus 20 of the user.
- [0188] It should be noted that it is preferable that the embodiment 4 may be combined with the embodiments 1 through 3 considering that there is a possibility that the toner may be decreased abnormally from the start of introduction of the image forming apparatus 20. For example, the error notification will be transmitted in the case where it is determined that the remaining toner amount is not reasonable in at least one of the embodiment 1 and the embodiment 4. With the above operation, the management

apparatus 40 can transmit an error notification to the service personnel PC 90, etc., in the case where the toner may be decreased abnormally from the start of introduction by the user of the image forming apparatus 20.

[0189] (Embodiment 5)

[0190] In the embodiments 1 through 4, the counter information and the remaining toner amount are transmitted from the image forming apparatus 20 to the management apparatus 40. In an embodiment 5, an equipment system 100 will be described in which the image forming apparatus 20 transmits the decreased toner amount and the increased amount of the counter information to the management apparatus 40.

[0191] Fig. 14 is an example of a sequence diagram illustrating a procedure for transmitting use change information and for determining whether a remaining toner amount is reasonable. It should be noted that a difference between Fig. 14 and Fig. 6 will be mainly described.

[0192] S1: The https communication function unit 25 of the image forming apparatus 20 transmits the use change information to the http server 44 of the management apparatus 40. The use change information in the embodiment 5 includes the decreased toner amount and the increased amount of the counter information.

[0193] S2: step S2 may be the same as step S1. Transmission of the use change information may be performed periodically, at a predetermined timing, or in the case where the remaining toner amount is decreased by a predetermined amount. The equipment use information management unit 21 of the image forming apparatus 20 associates the remaining toner amount with the counter information when the use change information is transmitted, and stores them. The equipment use information management unit 21 obtains the remaining toner amount and the counter information at the next timing for transmitting the use change information. Further, the equipment use information management unit 21 calculates a difference between the stored latest remaining toner amount and the obtained remaining toner amount, as the decreased toner amount, and calculates a difference between the stored latest counter information and the obtained counter information, as the increased amount of the counter information.

[0194] If the timing of transmitting the use change information is every time when the remaining toner amount is decreased by 20%, then the management apparatus 40 can determine whether the remaining toner amount is reasonable at the timing when the remaining toner amount is decreased by 20%. In the case where the timing of transmitting the use change information is not related to the remaining toner amount, the management apparatus 40 can detect that the remaining toner amount has been decreased by 20% by accumulating the decreased toner amount received in the past. It should be noted that 20% is just an example.

[0195] S3: The remaining toner amount determination unit 43 of the management apparatus

40 obtains the use change information from the http server 44, and determines whether the remaining toner amount is reasonable. Because the decreased toner amount and the increased amount of the counter information are transmitted to the management apparatus 40, similar to the embodiments 1 through 4, it can be determined whether the remaining toner amount is reasonable. For example, similar to the embodiment 1, if the minimum number of printable pages necessary for consuming 20% of toner (N) is 200 and the increased amount of the counter information is 2234, then $N(200) < M(2234)$. Therefore, it is determined that the remaining toner amount is reasonable. The following processes in steps S4 through S7.1 may be the same as the embodiment 1 or the like.

[0196] Therefore, the management apparatus 40 can also determine whether the remaining toner amount is reasonable in the case where the decreased toner amount and the increased amount of the counter information are transmitted from the image forming apparatus 20 to the management apparatus 40.

[0197] <Other application>

[0198] As described above, preferable embodiments are described. The present invention is not limited to the above-described embodiments. Various modifications and replacements may be possible in a range without departing from the spirit of the present invention.

[0199] For example, Fig. 5 is an example of a functional block diagram of the management apparatus 40 and the image forming apparatus 20, in which functions are divided according to main functions in order to facilitate understanding of processes performed by the management apparatus 40 and the image forming apparatus 20. The dividing method of the processes and names of the functions are not intended to limit the present invention. The processes of the management apparatus 40 and the image forming apparatus 20 may be further divided into smaller process units according to the content of the processes. Further, a process unit may be divided into further processes.

[0200] Further, the equipment information DB 49 in Fig. 5 may be included in a network.

[0201] Further, multiple management apparatuses 40 may be included in the equipment system 100, and the functions of the management apparatus 40 may be distributed in multiple servers.

[0202] Further, in an embodiment, the management apparatus 40 determines whether the remaining toner amount is reasonable, but it is possible for the image forming apparatus 20 to determine whether the remaining toner amount is reasonable. The image forming apparatus 20 receives its equipment management table from the management apparatus 40 that stores the equipment management table. Further, the image forming apparatus 20 performs processes shown in Figs. 7, 9, 10-12, and

transmits an error notification to the management apparatus 40 if the remaining toner amount is not reasonable.

- [0203] Further, it is determined whether the remaining toner amount is reasonable in an embodiment. However, in the case where the image forming apparatus 20 forms an image by using inkjet method, the similar determination may be performed for the remaining ink amount of the ink cartridge.
- [0204] Further, the counter information is used as a use amount of the image forming apparatus 20 in an embodiment, but a number of print pages ejected by the image forming apparatus 20 may be used. In this case, it is preferable that a number of ejected pages converted to a number of single-side print pages be used. The number of ejected pages can be handled in the same way as the counter information. Further, an accumulated number of rotations of a photoconductor drum may be used as the use amount. The management apparatus 40 can estimate the number of printed pages from the accumulated number of rotations, and thus, the estimated value is handled in the same way as the counter information. Further, energized time of a fixing unit may be used as the use amount. The management apparatus 40 can estimate the number of printed pages from the energized time of the fixing unit, and thus, the estimated value is handled in the same way as the counter information.
- [0205] Further, the image forming apparatus 20 is used as an example of an apparatus, which is sold (rented) to a user, and the use amount and consumables of which are managed by the management apparatus 40 in an embodiment, but the apparatus is not limited to the image forming apparatus 20. For example, the embodiments can be also applied to equipment which consumes consumables. For example, in the case of a PC, a wearable computer, application software, a video conference terminal, an electric white board, a projector, a car-navigation terminal, a camera, a game machine, medical equipment, etc., to which fee is charged according to use time, the use amount is energized time, etc., and the consumables are batteries, etc. Further, the consumables of the projector includes a lamp. Further, in the case of agricultural equipment such as a cultivator, a car, etc., the use amount is operation time of a motor, moving distance, etc., the consumables are fuel, etc.
- [0206] It should be noted that the equipment system 100 is an example of an information processing system, the https communication function unit 25 is an example of a transmission unit, the http server 44 is an example of an obtaining unit, the remaining toner amount determination unit 43 is an example of a determination unit, and the network connection unit 41 is an example of a notification unit. Further, a process performed by the equipment system 100 in an embodiment is an example of an information processing method.
- [0207] The present application is based on and claims the benefit of priority of Japanese

Priority Application No. 2015-130374 filed on June 29, 2015, and Japanese Priority Application No. 2016-089460 filed on April 27, 2016, the entire contents of which are hereby incorporated by reference.

Reference Signs List

- [0208] 20 image forming apparatus
21 equipment use information management unit
22 basic function unit
23 network control unit
24 mail transmission function unit
25 https communication function unit
40 management apparatus
41 network control unit
42 display unit
43 remaining toner amount determination unit
44 http server
45 POP server
46 SMTP server
47 equipment information management unit
49 equipment information DB
100 equipment system

[CLAIMS]

[Claim 1]

An information processing system comprising:

5 an information processing apparatus and equipment capable of communicating with each other via a network, wherein the equipment includes

a transmission unit configured to transmit use amount information related to a use amount

10 which increases in accordance with use of the equipment, and consumable information related to a consumable which decreases in accordance with the use of the equipment, and

the information processing apparatus includes

a reception unit configured to receive

15 the use amount information and the consumable information from the equipment, and

a determination unit configured to determine whether a decreased amount of the consumable is reasonable based on the use amount information and the

20 consumable information,

wherein the determination unit determines whether the decreased amount of the consumable with respect to an increased amount of the use amount information is reasonable by comparing the increased amount of the use

25 amount information with estimated use amount information

estimated from the decreased amount of the consumable,
wherein the determination unit determines that
the decreased amount of the consumable with respect to the
increased amount of the use amount information is
5 reasonable in the case where the increased amount of the
use amount information is less than the estimated use
amount information estimated from the decreased amount of
the consumable information.

[Claim 2]

10 The information processing system according
to claim 1, wherein

 in the case where the consumable information
is remaining toner amount and the use amount information
is counter information,

15 the determination unit determines that
decreased amount of the remaining toner amount with respect
to increased amount of the counter information is not
reasonable in the case where the increased amount of the
counter information is less than a minimum number of
20 printable pages estimated from the decreased amount of the
remaining toner amount.

[Claim 3]

 The information processing system according
25 to claim 1, wherein

in the case where the consumable information is remaining toner amount and the use amount information is counter information,

the reception unit of the information
5 processing apparatus receives the use amount information, the consumable information, and coverage information from the equipment, and

the determination unit determines that decreased amount of the remaining toner amount with respect
10 to increased amount of the counter information is not reasonable in the case where the increased amount of the counter information is less than a number of printable pages estimated from the decreased amount of the remaining toner amount and a statistical value of the coverage
15 information.

[Claim 4]

The information processing system according to claim 1, wherein

20 in the case where the consumable information is remaining toner amount and the use amount information is number-of-toner-dots information,

the determination unit determines that decreased amount of the remaining toner amount with respect
25 to increased amount of the counter information is not

reasonable in the case where the increased amount of the number-of-toner-dots information is less than a number of dots converted from the decreased amount of the remaining toner amount.

5

[Claim 5]

The information processing system according to claim 1, wherein

in the case where the consumable information
10 is remaining toner amount and the use amount information is counter information, and where the reception unit receives the consumable information indicating that the remaining toner amount is zero or nearly zero,

the determination unit determines that the
15 remaining toner amount received by the reception unit is not reasonable in the case where increased amount of the counter information when toner of a whole toner cartridge is decreased to zero or nearly zero is less than a number of pages printable by the toner of the whole toner
20 cartridge.

[Claim 6]

The information processing system according to claim 1, wherein

25 in the case where the consumable information

is remaining toner amount and the use amount information
is number-of-toner-dots information, and where the
reception unit receives the consumable information
indicating that the remaining toner amount is zero or
5 nearly zero,

the determination unit determines that the
remaining toner amount received by the reception unit is
not reasonable in the case where increased amount of the
number-of-toner-dots information when toner of a whole
10 toner cartridge is decreased to zero or nearly zero is less
than a number of dots printable by the toner of the whole
toner cartridge.

[Claim 7]

15 The information processing system according
to claim 1, wherein

in the case where the consumable information
is remaining toner amount and the use amount information
is counter information,

20 the determination unit determines that
decreased amount of the remaining toner amount with respect
to increased amount of the counter information is not
reasonable in the case where the increased amount of the
counter information is less than a number of printable
25 pages estimated from the decreased amount of the remaining

toner amount of the equipment in the past.

[Claim 8]

An information processing system comprising:

5 an information processing apparatus and equipment capable
of communicating with each other via a network, wherein
the equipment includes

a transmission unit configured to
transmit use amount information related to a use amount
10 which increases in accordance with use of the equipment,
and consumable information related to a consumable which
decreases in accordance with the use of the equipment, and
the information processing apparatus includes

a reception unit configured to receive
15 the use amount information and the consumable information
from the equipment, and

a notification unit configured to
transmit a notification to a predetermined destination or
the equipment based on whether the decreased amount of the
20 consumable with respect to the increased amount of the use
amount information is reasonable,

wherein the decreased amount of the consumable
with respect to the increased amount of the use amount
information is deemed to be reasonable by comparing the
25 increased amount of the use amount with the estimated use

amount information estimated from the decreased amount of the consumable,

wherein the decreased amount of the consumable with respect to the increased amount of the use amount
5 information is reasonable in the case where the increased amount of the use amount information is less than the estimated use amount information estimated from the decreased amount of the consumable information.

10 [Claim 9]

An information processing system comprising:
an information processing apparatus and equipment capable
of communicating with each other via a network, wherein
the equipment includes

15 a transmission unit configured to transmit use amount information related to a use amount which increases in accordance with use of the equipment, and consumable information related to a consumable which decreases in accordance with the use of the equipment, and

20 the information processing apparatus includes

a reception unit configured to receive the use amount information and the consumable information from the equipment, and

a notification unit configured to
25 transmit a notification indicating use restriction of the

equipment to the equipment based on whether the decreased amount of the consumable with respect to the increased amount of the use amount information is reasonable,

wherein the decreased amount of the consumable
5 with respect to the increased amount of the use amount information is deemed to be reasonable by comparing the increased amount of the use amount with the estimated use amount information estimated from the decreased amount of the consumable,

10 wherein the decreased amount of the consumable with respect to the increased amount of the use amount information is reasonable in the case where the increased amount of the use amount information is less than the estimated use amount information estimated from the
15 decreased amount of the consumable information.

[Claim 10]

An information processing apparatus comprising:

20 an obtaining unit configured to obtain from equipment, connected to the information processing apparatus via the information processing apparatus or a network, use amount information related to a use amount which increases in accordance with use of the equipment,
25 and consumable information related to a consumable which

decreases in accordance with the use of the equipment; and

a determination unit configured to determine whether a decreased amount of the consumable is reasonable based on the use amount information and the consumable
5 information,

wherein the determination unit determines whether the decreased amount of the consumable with respect to an increased amount of the use amount information is reasonable by comparing the increased amount of the use
10 amount information with estimated use amount information estimated from the decreased amount of the consumable,

wherein the determination unit determines that the decreased amount of the consumable with respect to the increased amount of the use amount information is
15 reasonable in the case where the increased amount of the use amount information is less than the estimated use amount information estimated from the decreased amount of the consumable information.

20 [Claim 11]

An information processing method for an information processing system including an information processing apparatus and equipment capable of communicating with each other via a network, the
25 information processing method comprising:

steps, performed by the equipment, of
transmitting use amount information related
to a use amount which increases in accordance with use of
the equipment, and consumable information related to a
5 consumable which decreases in accordance with the use of
the equipment, and

steps, performed by the information
processing apparatus, of
receiving the use amount information and the
10 consumable information from the equipment,
determining whether a decreased amount of the
consumable is reasonable based on the use amount
information and the consumable information,

determining whether the decreased amount of
15 the consumable with respect to an increased amount of the
use amount information is reasonable by comparing the
increased amount of the use amount information with
estimated use amount information estimated from the
decreased amount of the consumable, and

20 determining that the decreased amount of the
consumable with respect to the increased amount of the use
amount information is reasonable in the case where the
increased amount of the use amount information is less than
the estimated use amount information estimated from the
25 decreased amount of the consumable information.

[Claim 12]

A program causing an information processing apparatus to function as units, comprising:

5 an obtaining unit configured to obtain from equipment, connected to the information processing apparatus via the information processing apparatus or a network, use amount information related to a use amount which increases in accordance with use of the equipment,
10 and consumable information related to a consumable which decreases in accordance with the use of the equipment; and

 a determination unit configured to determine whether a decreased amount of the consumable is reasonable based on the use amount information and the consumable
15 information,

 wherein the determination unit determines whether the decreased amount of the consumable with respect to an increased amount of the use amount information is reasonable by comparing the increased amount of the use
20 amount information with estimated use amount information estimated from the decreased amount of the consumable,

 wherein the determination unit determines that the decreased amount of the consumable with respect to the increased amount of the use amount information is
25 reasonable in the case where the increased amount of the

use amount information is less than the estimated use amount information estimated from the decreased amount of the consumable information.