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(54) **WORKER MANAGEMENT APPARATUS, WORKER MANAGEMENT METHOD, AND RECORDING MEDIUM HAVING WORKER MANAGEMENT PROGRAM STORED THEREON**

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(57) **ABSTRACT**

A worker management apparatus includes: a work performance information generation unit generating work performance information representing a performance state of work by a worker; an acquisition unit acquiring physical information representing a physical condition relating to the worker; an estimation unit estimating an influence of the physical condition upon the performance state, based on the work performance information, the physical information, and information representing a characteristic of the worker; and an improvement measure generation unit generating improvement measure information representing a measure to improve the performance state relating to the worker, according to an estimation result by the estimation unit, thereby presenting a suitable measure to improve the work performance of the worker by managing with high precision the work performance state and physical condition relating to the worker.

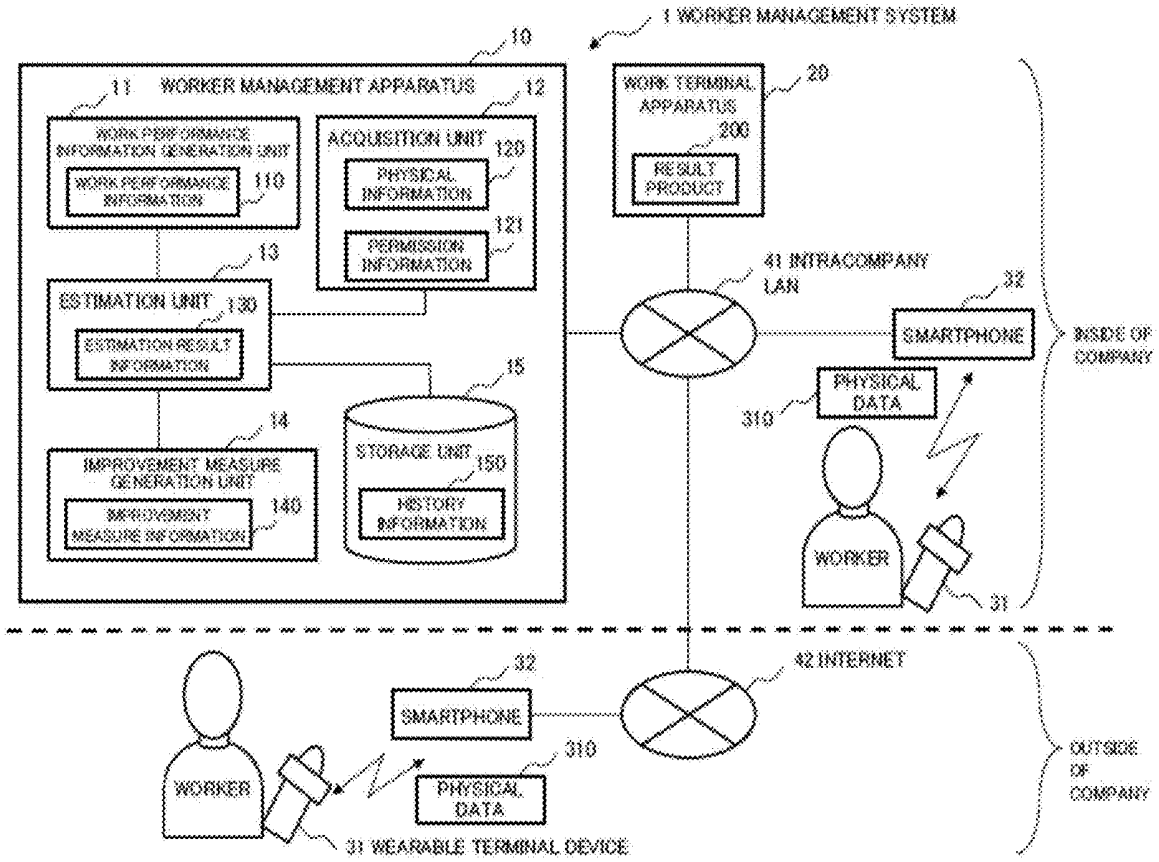


Fig.1

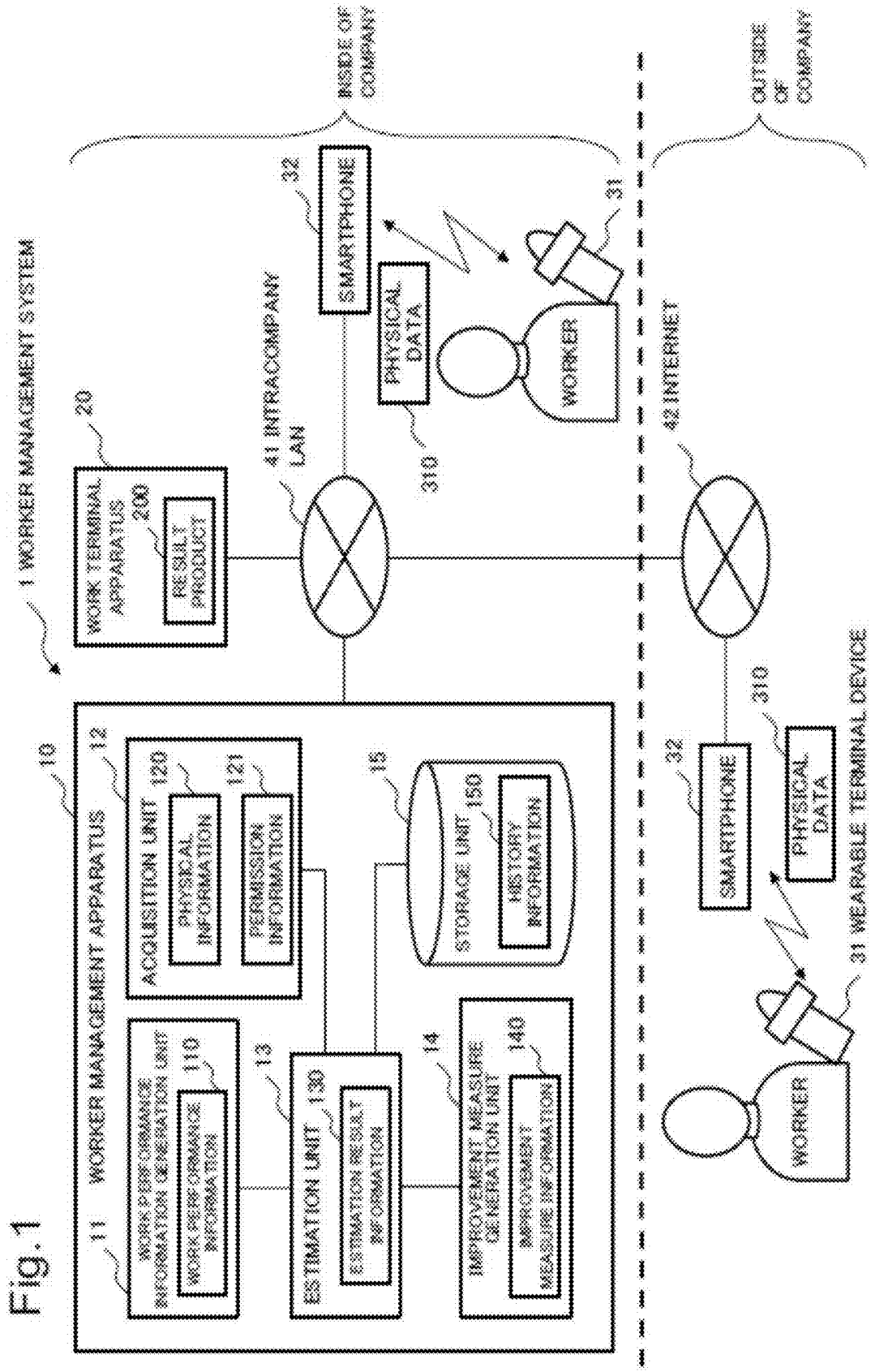

1 WORKER MANAGEMENT SYSTEM
INSIDE OF COMPANY
OUTSIDE OF COMPANY
10 WORKER MANAGEMENT APPARATUS
11 WORKER PERFORMANCE INFORMATION GENERATION UNIT
110 WORK PERFORMANCE INFORMATION
12 ACQUISITION UNIT
120 PHYSICAL INFORMATION
121 PERMISSION INFORMATION
13 ESTIMATION UNIT 130
ESTIMATION RESULT INFORMATION
14 IMPROVEMENT MEASURE GENERATION UNIT 140
IMPROVEMENT MEASURE INFORMATION
15 STORAGE UNIT 150
HISTORY INFORMATION
20 WORK TERMINAL APPARATUS 200
RESULT PRODUCT
41 INTRACOMPANY LAN
42 INTERNET
32 SMARTPHONE
310 PHYSICAL DATA
31 WEARABLE TERMINAL DEVICE
WORKER

Fig.2

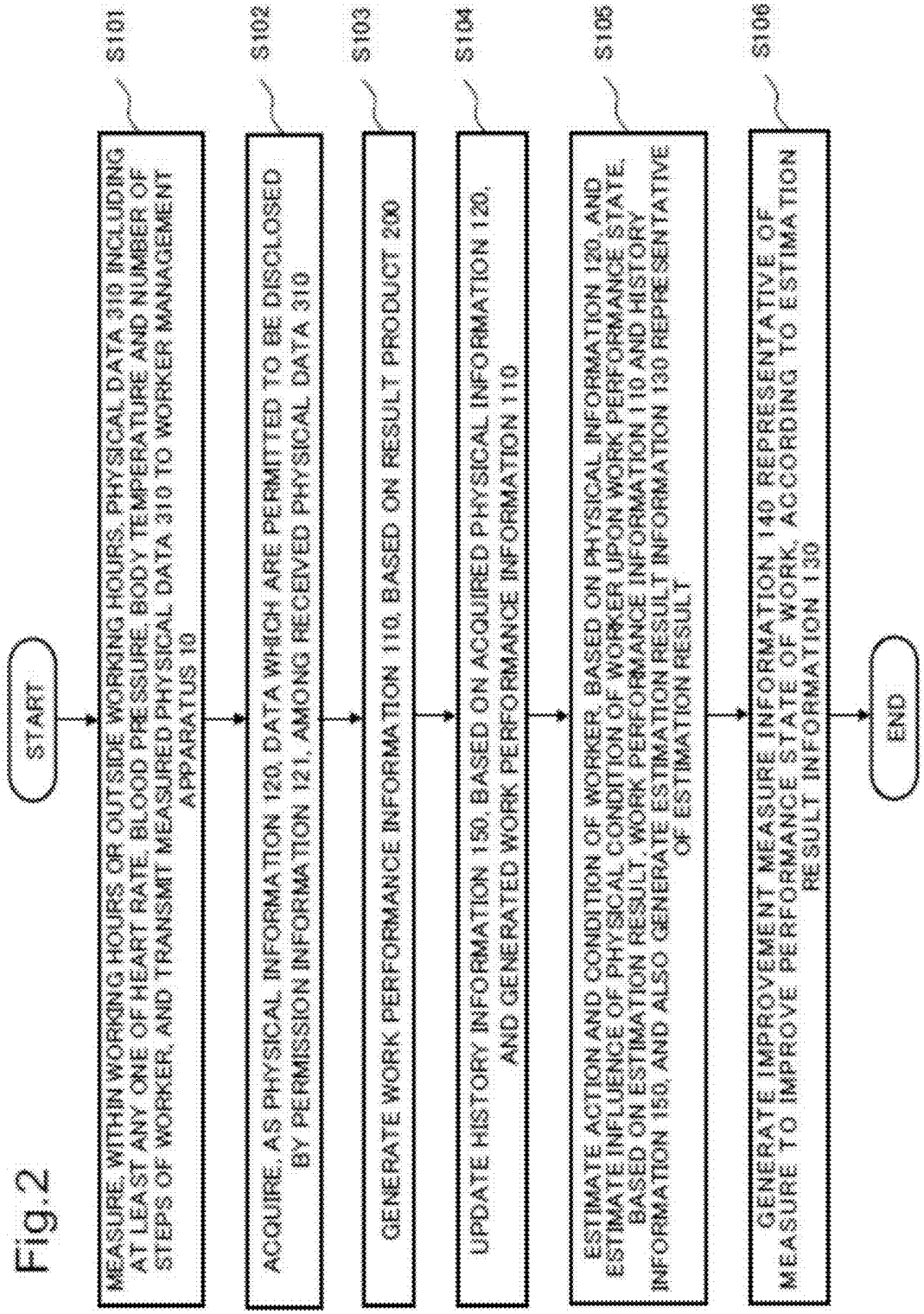

START
S101
MEASURE, WITHIN WORKING HOURS OR OUTSIDE WORKING HOURS, PHYSICAL DATA 310 INCLUDING AT LEAST ANY ONE OF HEART RATE, BLOOD PRESSURE, BODY TEMPERATURE AND NUMBER OF STEPS OF WORKER, AND TRANSMIT MEASURED PHYSICAL DATA 310 TO WORKER MANAGEMENT APPARATUS 10
S102
ACQUIRE, AS PHYSICAL INFORMATION 120, DATA WHICH ARE PERMITTED TO BE DISCLOSED BY PERMISSION INFORMATION 121, AMONG RECEIVED PHYSICAL DATA 310
S103
GENERATE WORK PERFORMANCE INFORMATION 110, BASED ON RESULT PRODUCT 200
S104
UPDATE HISTORY INFORMATION 150, BASED ON ACQUIRED PHYSICAL INFORMATION 120, AND GENERATED WORK PERFORMANCE INFORMATION 110
S105
ESTIMATE ACTION AND CONDITION OF WORKER, BASED ON PHYSICAL INFORMATION 120, AND ESTIMATE INFLUENCE OF PHYSICAL CONDITION OF WORKER UPON WORK PERFORMANCE STATE, BASED ON ESTIMATION RESULT, WORK PERFORMANCE INFORMATION 110 AND HISTORY INFORMATION 150, AND ALSO GENERATE ESTIMATION RESULT INFORMATION 130 REPRESENTATIVE OF ESTIMATION RESULT
S106
GENERATE IMPROVEMENT MEASURE INFORMATION 140 REPRESENTATIVE OF MEASURE TO IMPROVE PERFORMANCE STATE OF WORK, ACCORDING TO ESTIMATION RESULT INFORMATION 130
END

Fig.3

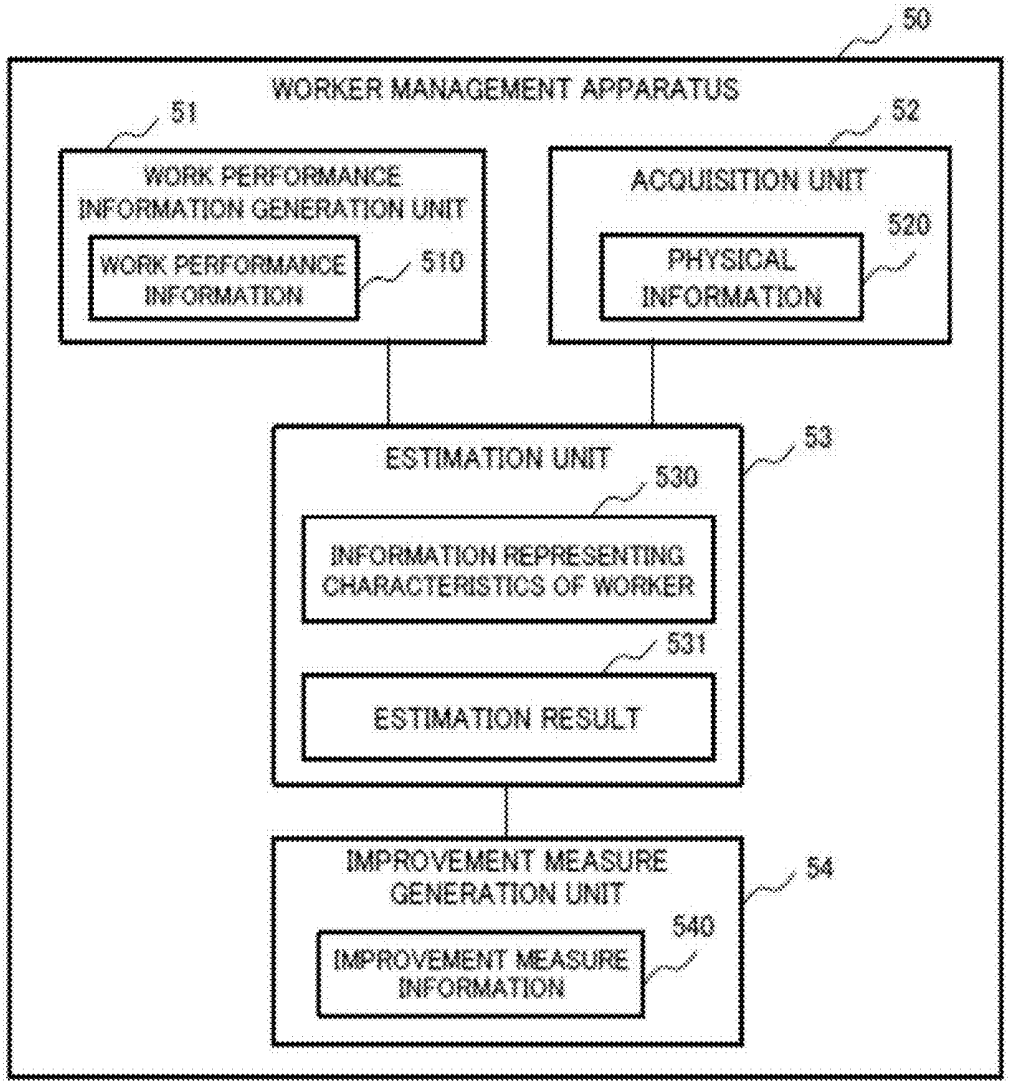
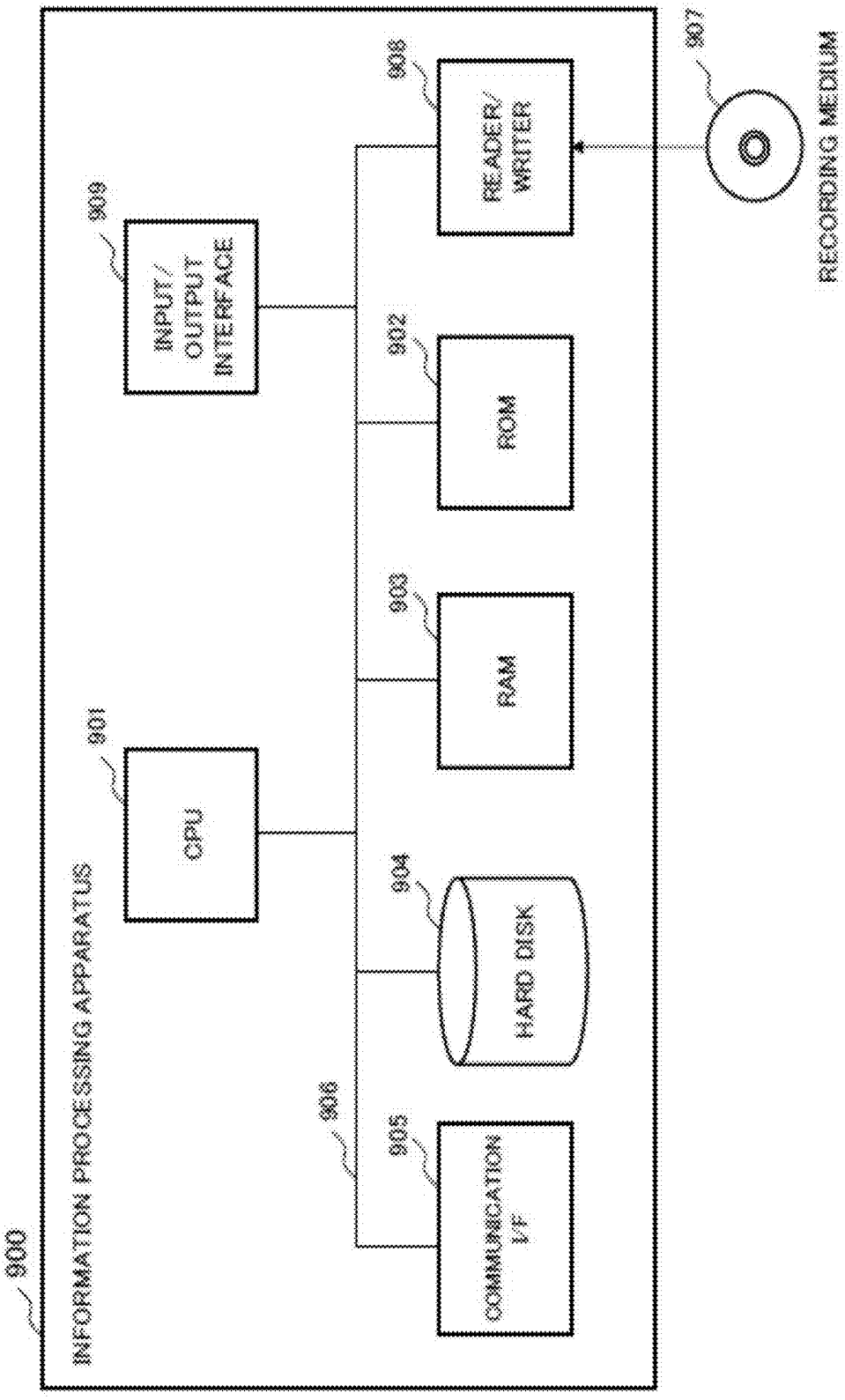

50
WORKER MANAGEMENT APPARATUS
51
WORK PERFORMANCE INFORMATION GENERATION UNIT
WORK PERFORMANCE INFORMATION
510
52
ACQUISITION UNIT
PHYSICAL INFORMATION
520
ESTIMATION UNIT
53
530
INFORMATION REPRESENTING CHARACTERISTICS OF WORKER
531
ESTIMATION RESULT
IMPROVEMENT MEASURE GENERATION UNIT
54
540
IMPROVEMENT MEASURE INFORMATION

Fig.4


900
INFORMATION PROCESSING APPARATUS
CPU
901
RAM
903
ROM
902
INPUT/ OUTPUT INTERFACE
909
READER/ WRITER
908
907
RECORDING MEDIUM
HARD DISK
904
COMMUNICATION I/F
905
906

WORKER MANAGEMENT APPARATUS, WORKER MANAGEMENT METHOD, AND RECORDING MEDIUM HAVING WORKER MANAGEMENT PROGRAM STORED THEREON

[0001] This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2018-134876, filed on Jul. 18, 2018, the disclosure of which is incorporated herein in its entirety by reference.

TECHNICAL FIELD

[0002] The present invention relates to a technology for managing a work performance state and a physical condition relating to a worker.

BACKGROUND ART

[0003] In recent years, much attention has been paid to work style reforms as one of challenges to be tackled by the administration, companies, or the like, against a backdrop of social problems such as a decrease in work performance efficiency due to work environment, living habit, and the like, and an increase in cost of health insurance. In promoting the work style reforms, expectations are rising for a technology for enabling implementation of appropriate improvement measures for improving work performance of a worker, by efficiently and suitably managing, with use of information technology (IT), a work performance state and a physical condition (health condition) relating to the worker.

[0004] As a related technology to the above technology, PTL 1 (International Publication No. WO 2010/146811) discloses an action proposing apparatus which estimates an action of a person, based on biological information such as sleeping hours, the number of steps, and an amount of exercise, and presents an improving means for improving the health index and the like. This apparatus classifies, as a habitual action, biological information (sensor data) representative of an identical feature in an identical time slot, from biological information and an action history (information) of a person acquired by a sensor node over a long period of time, and calculates, by an action guidance generation program, a correlation between time points, lengths of time, or a transitional relation of habitual actions, and target index data on which a user requests improvement. In addition, this apparatus displays major actions of the user in a time-series manner, and at the same time generates and presents on a display the optimal time and length of time for actions for improving the target index, and more specific examples of actions and comments for achieving the optimal time and length of time for the actions, by utilizing an action history which the user input and recorded in the past by himself/herself, and action history data input by other persons.

[0005] In addition, PTL 2 (Japanese Unexamined Patent Application Publication No. 2017-182393 A) discloses a biological information communication apparatus which enables easy sharing of biological information in a manner conforming with a user's intent. This apparatus receives biological information of a first user from the first user's user terminal being a transmission source, adds a restriction to the received biological information, and transmits the biological information, to which the restriction is added, to a user terminal of a second user, which is a transmission destination. This apparatus reads out, based on an acquired degree of correlation between the first user and the second user, restriction information that is associated with the degree of correlation and is stored in a restriction information storage unit, and adds a restriction to the biological information to be transmitted to the second user being a counter part of sharing, based on the read-out restriction information.

[0006] Additionally, PTL 3 (Japanese Unexamined Patent Application Publication No. 2017-108977 A) discloses a work support system which provides support information for facilitating work according to a health condition, and improves work efficiency of a worker. This system includes a fingertip pulse wave sensor which detects biological information. This system generates support information relating to work, based on the biological information, and provides the support information.

[0007] Additionally, PTL 4 (Japanese Unexamined Patent Application Publication No. 2014-191716 A) discloses a work management support system which supports management of a working state of a worker in such a way that the working state may be carried out as planned. This system supports management of the working state, based on working state data stored in a storage unit which stores working state data indicative of a working state of a worker being a target. This system detects working states of target workers on a worker-by-worker basis, based on working state data indicative of a working state of a target worker and working plan data indicative of a working plan of the target worker. Further, this system notifies a manager of a target worker of a message prompting a study of a work style reform of the target worker, in connection with whom a difference between the working plan of the target worker and the working state of the target worker exceeds a predetermined range.

[0008] Additionally, PTL 5 (Japanese Unexamined Patent Application Publication No. 2013-027550 A) discloses a vital signs measuring apparatus which detects vital signs and also detects necessary support information, and correctly reads vital signs while reducing a load on a subject and a doctor who conducts diagnosis. This apparatus detects vital signs of the subject, and outputs the vital signs as vital data. This apparatus detects support information representing a state of the subject at a time when the vital signs are detected, and outputs the support information as support data. Further, this apparatus performs evaluation as to whether the vital data is effective or not, based on the support data.

SUMMARY

[0009] In order to make it possible to present a suitable measure to improve work performance of a worker by managing with high precision a physical condition based on physical information (biological information) of the worker and a work performance state of the worker, it is necessary, for example, to perform management by considering that physical characteristics and work performance ability vary from worker to worker. For example, there is a case in which, as regards two workers whose sleeping hours are equal, there is no particular problem in work performance efficiency of one of the workers, while work performance efficiency of the other worker lowers due to deficiency in sleep. In addition, for example, as regards creation of materials having similar contents, in the case where a certain

worker requires three days for the creation while another worker requires four days for the creation, when work performance efficiency is evaluated, it is not possible to perform with high precision management as to whether the work performance efficiency of a worker lowers or not, unless consideration is given to such a difference in work performance ability. Further, when a work performance state and a physical condition relating to a worker fail to be managed with high precision, it is difficult to present a suitable measure to improve the work performances of the worker. PTLs 1 to 5 make no particular mention on such a problem, and it cannot be said that PTLs 1 to 5 are sufficient with respect to management with high precision of a work performance state and a physical condition relating to a worker. A main object of the present invention is to provide a worker management apparatus and the like which solve the problem.

Solution to Problem

[0010] A worker management apparatus according to one mode of the present invention includes: a work performance information generation means for generating work performance information representing a performance state of work by a worker; an acquisition means for acquiring physical information representing a physical condition relating to the worker; an estimation means for estimating an influence of the physical condition upon the performance state, based on the work performance information, the physical information, and information representing a characteristic of the worker; and an improvement measure generation means for generating information representing a measure to improve the performance state relating to the worker, according to an estimation result by the estimation means.

[0011] In another aspect to achieve the above object, a worker management method according to one mode of the present invention includes causing an information processing apparatus to execute: generating work performance information representing a performance state of work by a worker; acquiring physical information representing a physical condition relating to the worker; estimating an influence of the physical condition upon the performance state, based on the work performance information, the physical information, and information representing a characteristic of the worker; and generating information representing a measure to improve the performance state relating to the worker, according to a result of the estimating.

[0012] In addition, in still another aspect to achieve the above object, a worker management program according to one mode of the present invention causes a computer to execute: generating work performance information representing a performance state of work by a worker; acquiring physical information representing a physical condition relating to the worker; estimating an influence of the physical condition upon the performance state, based on the work performance information, the physical information, and information representing a characteristic of the worker; and generating information representing a measure to improve the performance state relating to the worker, according to an estimation result by the estimation processing.

[0013] Further, the present invention can be achieved by a computer-readable nonvolatile recording medium having the worker management program (computer program) stored thereon.

Advantageous Effects of Invention

[0014] The present invention makes it possible to present a suitable measure to improve a performance state of a worker, by managing with high precision a work performance state and a physical condition relating to the worker.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. **1** is a block diagram which conceptually illustrates a configuration of a worker management system **1** according to a first example embodiment of the present invention;

[0016] FIG. **2** is s flowchart illustrating an operation of the worker management system **1** according to the first example embodiment of the present invention;

[0017] FIG. **3** is a block diagram which conceptually illustrates a configuration of a worker management apparatus **50** according to a second example embodiment of the present invention; and

[0018] FIG. **4** is a block diagram illustrating a configuration of an information processing apparatus **900** which can implement the worker management apparatuses according to the example embodiments of the present invention.

EXAMPLE EMBODIMENT

[0019] Hereinafter, example embodiments of the present invention will be described in detail with reference to the accompanying drawings.

First Example Embodiment

[0020] FIG. **1** is a block diagram which conceptually illustrates a configuration of a worker management system **1** according to a first example embodiment of the present invention. The worker management system **1** is a system which mainly includes a worker management apparatus **10**, a work terminal apparatus **20**, a wearable terminal device (measuring device) **31**, and a smartphone **32**, and in which these constituent elements are communicably connected via an intracompany local area network (LAN) **41** and Internet **42**.

[0021] The wearable terminal device **31** is a device which can measure physical data **310** relating to at least one worker who is a management target of the worker management system **1**, when necessary, regardless of working hours, the wearable terminal device **31** being, for example, wound around the arm of the worker, or being attached to the clothes of the worker. Note that the physical data **310** are, for example, data representing the physical condition of the worker, such as a heart rate, blood pressure, body temperature, and number of steps relating to the worker. The wearable terminal device **31** (or smartphone **32**) may include, for example, a time-measuring function, and a function of acquiring position information utilizing a Global Navigation Satellite System (GNSS).

[0022] The wearable terminal device **31** and the smartphone **32** that the worker possesses can communicate by using a short-range communication function such as Bluetooth (trademark), and the wearable terminal device **31** transmits the measured physical data **310** to the smartphone **32**. When the worker is outside the company (e.g. at home or on a commuting path), the smartphone **32** transmits the physical data **310**, which is received from the wearable terminal device **31**, to the worker management apparatus **10**

through an access point (not illustrated) via the Internet **42** and intracompany LAN **41**. When the worker is in the company, the smartphone **32** transmits the physical data **310**, which is received from the wearable terminal device **31**, to the worker management apparatus **10** through the access point via the intracompany LAN **41**. Note that the wearable terminal device **31** may include a communication function which can transmit the physical data **310** to the worker management apparatus **10** without intervention of the smartphone **32**.

[0023] The worker management apparatus **10** is an information processing apparatus which manages, with respect to at least one worker, the work performance state and physical condition of the worker, and can present, when there is a problem with the work performance state or physical condition of the worker, a measure to improve the work performance of the worker to the worker or a superior (manager) or the like of the worker.

[0024] The worker management apparatus **10** includes a work performance information generation unit **11**, an acquisition unit **12**, an estimation unit **13**, an improvement measure generation unit **14**, and a storage unit **15**. The storage unit **15** is, for example, a storage device such as an electronic memory or a magnetic disk, which can store various pieces of information which the worker management apparatus **10** refers to or generates.

[0025] The work performance information generation unit **11** generates work performance information **110** representing the performance state of work (operation) by the worker. The work performance information generation unit **11** acquires a result product **200** from the work terminal apparatus **20**, and generates the work performance information **110**, based on the acquired result product **200**. Note that the work terminal apparatus **20** is, for example, an information processing apparatus such as a personal computer, which the worker uses when doing work. The result product **200** is various materials to be considered, or the like, which the worker created as a result of the performance of work.

[0026] The work performance information **110** generated by the work performance information generation unit **11** is, for example, information representing the state of progress of creation of the result product **200** with reference to a creation schedule of the result product **200** (i.e. information indicating whether the creation of the result product **200** is earlier or later than the creation schedule). It is assumed, however, that the creation schedule is created depending on the work performance ability of the worker. The work performance information generation unit **11** can create the work performance information **110** by comparing a result of analyzing the content of the result product **200** by using an existing technology such as a syntax analysis technology, and information (not illustrated) representing the creation schedule.

[0027] Alternatively, the work performance information generation unit **11** may create the work performance information **110**, based on information (not illustrated) representing a working state by the worker. Note that the information representing the working state by the worker is, for example, a report material representing the progress state of work, which was created by the worker himself/herself, or a management material which the superior of the worker created in order to manage the progress state of work by the worker. Alternatively, the information representing the working state by the worker may be, for example, a work quantity (e.g. the number of processed products) performed by the worker who performs work in a manufacturing line, the work quantity being acquired by an apparatus which can manage the work quantity.

[0028] Further, the work performance information generation unit **11** may generate the work performance information **110** representing the progress state of work per unit time (i.e. the efficiency of work), based on the progress state of work by the worker in a certain time slot.

[0029] The acquisition unit **12** acquires, based on permission information **121**, the physical data **310** as physical information **120**, the physical data **310** being measured by the wearable terminal device **31** and transmitted to the worker management apparatus **10**. Note that the permission information **121** is information indicating which of the measured physical data **310** are permitted to be disclosed to the worker management apparatus **10**, and is, for example, information created by the worker. Specifically, among the received physical data **310**, the acquisition unit **12** acquires, as the physical information **120**, only the data which are permitted to be disclosed by the permission information **121** by the worker.

[0030] The permission information **121** is, for example, information representing at least any one of items in the physical data **310**, a time slot in which the physical data **310** were measured, and a range of values indicated by the physical data **310**. For example, when the worker does not wish to disclose the heart rate, among the physical data **310** including the heart rate, blood pressure, body temperature and number of steps, the worker creates the permission information **121** indicating that the data of the items other than the heart rate are permitted to be disclosed to the worker management apparatus **10**.

[0031] Alternatively, for example, when the worker does not wish to disclose the data measured in a specified time slot, among the physical data **310**, the worker creates the permission information **121** indicating that the data measured in time slots excluding the specified time slot are permitted to be disclosed to the worker management apparatus **10**. It is assumed, however, that the physical data **310** are associated with times at which the physical data **310** were measured, by the wearable terminal device **31** or smartphone **32**, which includes a time-measuring function. Alternatively, the physical data **310** may be associated with times at which the worker management apparatus **10** received the physical data **310**, by the worker management apparatus **10** which includes a time-measuring function.

[0032] Alternatively, for example, when the worker does not wish to disclose that the blood pressure, among the physical data **310**, has become higher (or lower) than a specified value, the worker creates the permission information **121** indicating that the data relating to the blood pressure are permitted to be disclosed to the worker management apparatus **10** when the blood pressure is lower (or higher) than the specified value.

[0033] The permission information **121** may be stored in the storage unit **15** in the worker management apparatus **10**, or may be stored in the wearable terminal device **31** or smartphone **32**. For example, when the permission information **121** is stored in the smartphone **32**, the smartphone **32** transmits to the worker management apparatus **10** only the data, the permission of disclosure of which is indicated by the permission information **121**, among the physical data **310** received from the wearable terminal device **31**.

[0034] The estimation unit **13** estimates an influence of the physical condition of the worker upon the work performance state, based on the work performance information **110** generated by the work performance information generation unit **11**, the physical information **120** acquired by the acquisition unit **12**, and the characteristics of the worker represented by history information **150** stored in the storage unit **15**.

[0035] The history information **150** is information representing histories (states transitioning with the passing of time) of the work performance information **110** and physical information **120** relating to the worker, and is updated by the work performance information generation unit **11** and acquisition unit **12**. Specifically, the history information **150** represents the relation between the performance state of work by the worker and the physical condition of the worker, with respect to a certain time slot in the past.

[0036] In addition, the estimation unit **13** estimates the action and condition of the worker, based on the history information **150** (the physical information **120** included in the history information **150**). For example, when the history information **150** indicates that, in a certain time slot in the past, the worker stayed in the same position and the heart rate, blood pressure or the like meets a predetermined condition, the estimation unit **13** estimates that the worker was sleeping in the time slot.

[0037] Alternatively, for example, based on the heart rate, number of steps, speed of movement, etc., of the worker in a certain time slot in the past, which are indicated in the history information **150**, the estimation unit **13** estimates that the worker performed exercise in the time slot. Alternatively, for example, based on the heart rate, body temperature, etc., of the worker in a certain time slot in the past, which are indicated in the history information **150**, the estimation unit **13** estimates that the worker took a meal in the time slot. Alternatively, for example, when the history information **150** indicates that, in a certain period (e.g. several days) in the past, the body temperature of the worker was higher than an average value (e.g. normal temperature) relating to the worker, the estimation unit **13** estimates that the worker was sick in the period.

[0038] For example, based on the sleeping hours of the worker in a certain day, which is indicated in the history information **150** (the physical information **120** included in the history information **150**), and the work efficiency of the worker in the next day, which is indicated in the history information **150** (the work performance information **110** included in the history information **150**), the estimation unit **13** estimates an influence of the sleeping hours upon the work performance state of the next day with respect to the worker. For example, in the case where the history information **150** indicates that when the sleeping hours of the worker were less than six hours, the work efficiency of the worker of the next day tends to lower, the estimation unit **13** estimates that the worker has such characteristics that when the sleeping hours are less than six hours, the work efficiency of the next day lowers. Note that the estimation unit **13** can detect the tendency that the work efficiency lowers, based on the actual result of the work efficiency of the worker in the past, which is indicated by the history information **150**. In addition, for example, the estimation unit **13** estimates that the work efficiency of the worker lowers due to the fact that the sleeping hours of the worker are less than six hours in recent successive days.

[0039] Alternatively, for example, in the case where the history information **150** indicates that when the worker did not take breakfast, the work efficiency of the worker in the day tends to lower, the estimation unit **13** estimates that the worker has such characteristics that when the worker does not take breakfast, the work efficiency of the worker in the day tends to lower. In addition, for example, the estimation unit **13** estimates that the work efficiency of the worker lowers due to the fact that the worker did not take breakfast in recent successive days.

[0040] Alternatively, for example, in the case where the history information **150** indicates that when the amount of exercise of the worker in a certain period meets a standard, the work efficiency of the worker in the period tends to improve, the estimation unit **13** estimates that the worker has such characteristics that when the worker takes suitable exercise, the work efficiency improves. In addition, for example, the estimation unit **13** estimates that the work efficiency of the worker lowers due to the fact that the worker has not recently taken suitable exercise.

[0041] Alternatively, for example, when the work efficiency of the worker has lowered, despite no problem being found in the daily life of the worker indicated in the history information **150**, the estimation unit **13** estimates that the amount of work assigned to the worker is too large in consideration of the work performance ability of the worker.

[0042] As described above, the estimation unit **13** generates, as estimation result information **130**, a result of estimation of the influence of the physical condition of the worker (the estimated action, etc. of the worker) upon the work performance state, based on the work performance information **110**, the physical information **120**, and the characteristics of the worker represented (estimated) by the history information **150**.

[0043] The improvement measure generation unit **14** generates improvement measure information **140** representing a measure to improve the performance state relating to the worker, according to the estimation result information **130** generated by the estimation unit **13**.

[0044] For example, when the estimation result information **130** indicates that the work efficiency of the worker lowers due to the fact that the sleeping hours of the worker are less than six hours in successive days, the improvement measure generation unit **14** generates the improvement measure information **140** which prompts the worker to make it sure to have six or more sleeping hours.

[0045] Alternatively, for example, when the estimation result information **130** indicates that the work efficiency of the worker lowers due to the fact that the worker did not take breakfast in recent successive days, the improvement measure generation unit **14** generates the improvement measure information **140** which prompts the worker to take breakfast.

[0046] Alternatively, for example, when the estimation result information **130** indicates that the work efficiency of the worker lowers due to the fact that the worker does not take suitable exercise, the improvement measure generation unit **14** generates the improvement measure information **140** which prompts the worker to take suitable exercise.

[0047] Alternatively, for example, when the estimation result information **130** indicates that the amount of work assigned to the worker is too large in consideration of the work performance ability, the improvement measure generation unit **14** generates the improvement measure infor-

mation **140** representing information which prompts the superior of the worker to reduce the work load on the worker.

[0048] The improvement measure generation unit **14** may present the generated improvement measure information **140** to the worker or the superior of the worker, via the work terminal apparatus **20** or a terminal apparatus (not illustrated) which the superior of the worker uses.

[0049] Next, referring to a flowchart of FIG. **2**, a detailed description will be given of an operation (processing) of the worker management system **1** according to the present example embodiment.

[0050] The wearable terminal device **31** measures, within working hours or outside working hours, the physical data **310** including at least any one of the heart rate, blood pressure, body temperature and number of steps of the worker, and transmits the measured physical data **310** to the worker management apparatus **10**, for example, via the smartphone **32** (step S**101**).

[0051] The acquisition unit **12** in the worker management apparatus **10** acquires, as the physical information **120**, the data which are permitted to be disclosed by the permission information **121**, among the received physical data **310** (step S**102**). The work performance information generation unit **11** generates the work performance information **110** by analyzing the result product **200** stored in the work terminal apparatus **20**, for example, by using a syntax analysis technology or the like (step S**103**). Note that the processing of step S**102** and the processing of step S**103** are executed in no particular order, and may be executed, for example, in parallel.

[0052] The acquisition unit **12** updates the history information **150**, based on the acquired physical information **120**, and the work performance information generation unit **11** updates the history information **150**, based on the generated work performance information **110** (step S**104**). The estimation unit **13** estimates the action and condition of the worker, based on the physical information **120**, and estimates the influence of the physical condition of the worker upon the work performance state, based on this estimation result, the work performance information **110** and the history information **150**, and also generates the estimation result information **130** representing this estimation result (step S**105**). The improvement measure generation unit **14** generates the improvement measure information **140** representing a measure to improve the performance state of the worker, according to the estimation result information **130** (step S**106**), and thus the entire processing ends.

[0053] The worker management apparatus **10** according to the present example embodiment can present a suitable measure to improve the work performance of the worker, by managing with high precision the work performance state and the physical condition relating to the worker. The reason for this is that the worker management apparatus **10** estimates the influence of the physical condition of the worker upon the work performance state, based on the work performance information **110** and physical information **120** relating to the worker, and the characteristics of the worker, and generates the improvement measure information **140** representing the measure to improve the work performance state relating to the worker, according to this estimation result.

[0054] Hereinafter, advantageous effects achieved by the worker management apparatus **10** according to the present example embodiment will be described in detail.

[0055] In order to make it possible to present a suitable measure to improve the work performance of a worker by managing with high precision the physical condition based on the physical information of the worker and the work performance state of the worker, it is necessary, for example, to perform the management by considering that the physical characteristics and work performance ability vary from worker to worker. For example, there is a case in which, as regards two workers whose sleeping hours are equal, there is no particular problem in the work performance efficiency of one of the workers, while the work performance efficiency of the other worker lowers due to the deficiency in sleep. In addition, for example, as regards the creation of materials having similar contents, in the case where a certain worker requires three days for the creation while another worker requires four days for the creation, when the work performance efficiency is evaluated, it is not possible to perform with high precision the management as to whether the work performance efficiency of workers lowers or not, unless consideration is given to such a difference in work performance ability. Further, when the work performance state and physical condition relating to workers fail to be managed with high precision, it is difficult to present suitable measures to improve the work performances of workers.

[0056] To cope with such problems, the worker management apparatus **10** according to the present example embodiment includes the work performance information generation unit **11**, acquisition unit **12**, estimation unit **13**, and improvement measure generation unit **14**, and operates as described above with reference to, for example, FIG. **1** and FIG. **2**. Specifically, the work performance information generation unit **11** generates the work performance information **110** representing the performance state of work by the worker. The acquisition unit **12** acquires the physical information **120** representing the physical state relating to the worker. The estimation unit **13** estimates the influence of the physical condition of the worker upon the work performance state, based on the work performance information **110**, the physical information **120**, and information representing the characteristics of the worker. In addition, the improvement measure generation unit **14** generates the improvement measure information **140** representing the measure to improve the performance state of work relating to the worker, according to the estimation result information **130** generated by the estimation unit **13**.

[0057] Specifically, the worker management apparatus **10** according to the present example embodiment can present a suitable measure to improve the performance state of a worker, by managing with high precision the work performance state and physical condition relating to the worker, taking into account the characteristics of the worker.

[0058] Additionally, the worker management apparatus **10** according to the present example embodiment stores in the storage unit **15** the history information **150** in which the history of the work performance information **110** and the history of the physical information **120** relating to the worker are associated, and estimates the influence of the physical condition of the worker upon the work performance state, by generating the information representing the characteristics of the worker, based on the history information **150**. Thereby, since the worker management apparatus **10**

according to the present example embodiment can estimate the characteristics of the worker with high precision, the worker management apparatus **10** can present a more suitable measure to improve the work performance of the worker.

[0059] Additionally, the estimation unit **13** according to the present example embodiment estimates the action or state (sleep, exercise, meal, etc.) of the worker, based on the physical information **120**, and estimates, by using the estimation result, the influence of the physical condition of the worker upon the work performance state. Thereby, the worker management apparatus **10** according to the present example embodiment can enhance the precision when estimating the influence of the physical condition of the worker upon the work performance state.

[0060] Note that the estimation unit **13** according to the present example embodiment may use information different from the information based on the above-described history information **150**, as the information representing the characteristics of the worker, which is used when estimating the influence of the physical condition of the worker upon the work performance state. Such information may be, for example, information in which a result of a questionnaire relating to the physical condition (including the condition of daily life, the state of felt stress, etc.), which was conducted to a worker, and the work performance state of the worker are associated.

[0061] Additionally, the worker management apparatus **10** according to the present example embodiment acquires, outside working hours (i.e. private time) as well as within working hours, the physical information **120** in order to manage with higher precision the physical condition of the worker. Accordingly, it is possible that the physical information **120** collected by the worker management apparatus **10** includes information which may greatly affect the worker in case of information leakage. Since the acquisition unit **12** according to the present example embodiment acquires the physical information **120** on the basis of the permission information **121** representing a permission by the worker to disclose the physical information **120** (i.e. the acquisition unit **12** does not acquire, as the physical information **120**, the information, which the worker does not wish to disclose, among the measured physical data **310**), the risk of the above-described information leakage can be avoided.

[0062] Additionally, the acquisition unit **12** according to the present example embodiment may acquire, as the physical information **120**, for example, information representing the result of a health examination conducted on the worker, in addition to the physical data **310** measured by the wearable terminal device **31**. In this case, since the worker management apparatus **10** according to the present example embodiment can estimate the influence of the physical condition of the worker upon the work performance state by taking into account the physical data which cannot be measured by the wearable terminal device **31**, the worker management apparatus **10** can present a more suitable measure to improve the work performance of the worker.

[0063] Additionally, the work performance information generation unit **11** according to the present example embodiment generates the work performance information **110**, based on the result product **200** which the worker created in connection with work, or the information representing the working state by the worker, or the like. Thereby, since the worker management apparatus **10** according to the present example embodiment can manage with high precision the work performance state of the worker, the worker management apparatus **10** can present a suitable measure to improve the work performance of the worker.

[0064] Additionally, the improvement measure generation unit **14** according to the present example embodiment may generate the improvement measure information **140** which also includes information or the like representing the result of an improvement of the work performance state of the worker, the result of the improvement being acquired by the worker implementing the improvement measure that was previously presented to the worker. Thereby, the worker management apparatus **10** according to the present example embodiment can help the superior of the worker to properly manage the worker.

Second Example Embodiment

[0065] FIG. **3** is a block diagram which conceptually illustrates a configuration of a worker management apparatus **50** according to a second example embodiment of the present invention.

[0066] The worker management apparatus **50** according to the present example embodiment includes a work performance information generation unit **51**, an acquisition unit **52**, an estimation unit **53**, and an improvement measure generation unit **54**.

[0067] The work performance information generation unit **51** generates work performance information **510** representing the performance state of work by a worker.

[0068] The acquisition unit **52** acquires physical information **520** representing the physical condition relating to the worker.

[0069] The estimation unit **53** estimates an influence of the physical condition of the worker upon the work performance state, based on the work performance information **510**, the physical information **520**, and information **530** representing characteristics of the worker.

[0070] The improvement measure generation unit **54** generates improvement measure information **540** representing a measure to improve the performance state of work relating to the worker, according to an estimation result **531** by the estimation unit **53**.

[0071] The worker management apparatus **50** according to the present example embodiment can present a suitable measure to improve the work performance of the worker, by managing with high precision the work performance state and physical condition relating to the worker. The reason for this is that the worker management apparatus **50** estimates the influence of the physical condition of the worker upon the work performance state, based on the work performance information **510** and physical information **520** relating to the worker, and the information **530** representing the characteristics of the worker, and generates the improvement measure information **540** representing the measure to improve the work performance state relating to the worker, according to the estimation result **531**.

[0072] [Example of Hardware Configuration]

[0073] In each of the above-described example embodiments, the respective units in the worker management apparatuses illustrated in FIG. **1** and FIG. **3** can be achieved by exclusive HW (HardWare) (electronic circuitry). In addition, in FIG. **1** and FIG. **3**, at least the configuration described below can be understood as function (processing) units (software modules) of a software program.

[0074] Work performance information generation units **11** and **51**,

[0075] Acquisition units **12** and **52**,

[0076] Estimation units **13** and **53**, and

[0077] Improvement measure generation units **14** and **54**.

[0078] It should be noted, however, that the division of the units illustrated in the drawings is a configuration for the purpose of convenience of description, and various configuration can be assumed in implementation. An example of a hardware environment in this case will be described with reference to FIG. **4**.

[0079] FIG. **4** is a view for illustratively describing a configuration of an information processing apparatus **900** (computer) which can implement the worker management apparatuses according to the example embodiments of the present invention. Specifically, FIG. **4** illustrates a hardware environment which is a configuration of a computer (information processing apparatus) that can implement the worker management apparatuses illustrated in FIG. **1** and FIG. **3**, and which can implement the respective functions in the above-described example embodiments.

[0080] The information processing apparatus **900** illustrated in FIG. **4** includes the following as constituent elements:

[0081] CPU (Central_Processing_Unit) **901**,

[0082] ROM (Read_Only_Memory) **902**,

[0083] RAM (Random_Access_Memory) **903**,

[0084] Hard disk (storage device) **904**,

[0085] Communication interface **905**,

[0086] Bus **906** (communication line),

[0087] Reader/writer **908** capable of reading/writing data stored in a recording medium **907** such as a CD-ROM (Compact_Disc_Read_Only_Memory), and

[0088] Input/output interface **909** such as a monitor, a speaker, a keyboard, etc.

[0089] Specifically, the information processing apparatus **900** including the above constituent elements is a general computer in which these constituent elements are connected via the bus **906**. There is a case in which the information processing apparatus **900** includes a plurality of CPUs **901**, and there is another case in which the information processing apparatus **900** includes the CPU **901** composed of multiple cores.

[0090] Further, the present invention described by taking the above-described example embodiments as examples provides a computer program which enables the information processing apparatus **900** illustrated in FIG. **4** to implement the following functions. The functions are the above-described configurations in the block configuration diagrams (FIG. **1** and FIG. **3**) which were referred to in the description of the example embodiments, or the functions of the flowchart (FIG. **2**). The present invention is then achieved by reading the computer program into the CPU **901** of the hardware, and interpreting and executing the computer program. Besides, the computer program which was supplied into the apparatus may be stored in a readable/writable volatile memory (RAM **903**) or in a nonvolatile storage device such as the ROM **902** or hard disk **904**.

[0091] Additionally, in the above case, a procedure, which is a general one at present, can be adopted as the method of supplying the computer program into the hardware. The procedure is, for example, a method of installing the computer program into the apparatus via the recording medium **907** of any kind such as a CD-ROM, or a method of downloading the computer program from the outside via a communication network such as the Internet. In such a case, the present invention can be understood as being composed by the code that constitutes the computer program, or by the recording medium **907** that stores the code.

[0092] While the invention has been particularly shown and described with reference to example embodiments thereof, the invention is not limited to these embodiments. It will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the claims.

1. A worker management apparatus comprising:

a processor; and

a memory storing instructions to be executed by the processor by causing the processor to execute:

generating work performance information representing a performance state of work by a worker;

acquiring physical information representing a physical condition relating to the worker;

estimating an influence of the physical condition upon the performance state, based on the work performance information, the physical information, and information representing a characteristic of the worker; and

generating information representing a measure to improve the performance state relating to the worker, according to a result of the estimating.

2. The worker management apparatus according to claim **1**, wherein

the processor acquires the physical information, based on permission information representing a permission by the worker to disclose the physical information.

3. The worker management apparatus according to claim **2**, wherein

the permission information represents at least any one of an item in the physical information, a time slot in which the physical information is measured, and a range of a value indicated by the physical information.

4. The worker management apparatus according to claim **1**, wherein

the processor generates the work performance information, based on a result product which the worker creates in connection with the work, or information representing a working state by the worker.

5. The worker management apparatus according to claim **1**, wherein

the processor estimates an action or a state of the worker, based on the physical information.

6. The worker management apparatus according to claim **1**, wherein

the memory stores history information in which a history of the work performance information and a history of the physical information relating to the worker are associated with each other, and

the processor generates the information representing the characteristic of the worker, based on the history information.

7. The worker management apparatus according to claim **1**, further comprising

a measuring device configured to measure data included in the physical information, and to transmit the measured data to the processor.

8. The worker management apparatus according to claim 7, wherein

the measuring device is configured to measure, as the data, at least any one of a heart rate, a blood pressure, a body temperature, and a number of steps relating to the worker.

9. A worker management method comprising

causing an information processing apparatus to execute:

generating work performance information representing a performance state of work by a worker;

acquiring physical information representing a physical condition relating to the worker;

estimating an influence of the physical condition upon the performance state, based on the work performance information, the physical information, and information representing a characteristic of the worker; and

generating information representing a measure to improve the performance state relating to the worker, according to a result of the estimating.

10. A recording medium having a worker management program stored thereon, the program causing a computer to execute:

generating work performance information representing a performance state of work by a worker;

acquiring physical information representing a physical condition relating to the worker;

estimating an influence of the physical condition upon the performance state, based on the work performance information, the physical information, and information representing a characteristic of the worker; and

generating information representing a measure to improve the performance state relating to the worker, according to an estimation result by the estimation processing.

* * * * *

专利名称(译)	工人管理装置，工人管理方法以及其上存储有工人管理程序的记录介质		
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摘要(译)

工人管理装置包括：工作绩效信息生成单元，其生成表示工人的工作绩效状态的工作绩效信息；以及 获取单元，获取表示与工人有关的身体状况的身体信息； 估计单元，基于工作绩效信息，身体信息和表示工人的特征的信息，估计身体状况对工作状态的影响； 改进措施生成单元根据估计单元的估计结果，生成表示改进该工人的工作状态的措施的改进措施信息，从而提出一种适当的措施，通过高管理来改善工人的工作绩效精度与工人有关的工作绩效状态和身体状况。