

WORK INFORMATION MANAGEMENT SYSTEM AND WORK INFORMATION MANAGEMENT METHOD

CLAIM OF PRIORITY

5 The present application claims priority from Japanese patent application JP 2022-70759 filed on April 22, 2022, the content of which is hereby incorporated by reference into this application.

BACKGROUND OF THE INVENTION

10 The present invention relates to a work information management system.

 When a failure occurs in production equipment or infrastructure equipment, the equipment needs quick repair. At this point, a repair worker carries out repairs and sequentially makes work records about finished repairs to report the completed works to a manager. The manager analyzes the works according to the work records. For
15 example, the manager measures the work level of the worker.

 However, the repair time of the worker is reduced by the having to record his own works. Furthermore, it is difficult for the manager to use the work records as work analysis data because the levels of recording works vary among workers. Thus, the recording of works needs to be simplified suitably for analysis data.

20 JP 2012-141929 A is a background art in the field of the present technique. JP 2012-141929 A describes a work information recorder that records, in a recording device, work information about a work performed by a worker in a production line, the work information recorder including: an action detecting device that detects a predetermined action performed by the worker; an operation device that receives an
25 operation from the worker; time acquisition means that acquires the finish time of the work by the detection of the action detecting device; contents acquisition means that acquires contents information about the contents of the work via the operation device after the time acquisition means acquires the finish time of the work; and work information creation means that creates the work information including the finish time

acquired by the time acquisition means and the contents information acquired by the contents acquisition means.

SUMMARY OF THE INVENTION

5 The work information recorder described in Patent Literature 1 automatically collects the start and finish times of works by using a process for a certain facility as a work unit. However, a necessary work in repair can be freely selected by a worker and a repair work for the facility is not determined in advance. Thus, the order relation of works is ambiguous and the work times of workers are hard to compare, leading to
10 difficulty in analyzing work records.

 An object of the present invention is to provide a work record management system that automatically creates daily work reports by recording works according to a workflow, in which work units are set, and enables accurate analysis of work records.

 The representative one of inventions disclosed in this application is outlined as
15 follows. There is provided a work information management system that acquires information about works to be performed by a worker, the work information management system comprising: a work display unit configured to generate data for displaying contents of the works on a terminal used by the worker, on a basis of a workflow indicating an order of the works; a work record recording unit configured to
20 record work times of the works performed by the worker; a time registration unit configured to acquire information about the works from the terminal and records the work times in the work record recording unit; a particular work-time calculation unit configured to calculate the work times of the respective works from the work times recorded in the work record recording unit; and a result display unit configured to
25 generate data for displaying the works and the work times of the corresponding works according to the order of the works in the workflow.

 According to an aspect of the present invention, work record data enabling accurate analysis can be collected. Problems, configurations, and effects other than those of the foregoing description will be clarified by the description of the following

embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a diagram for illustrating an outline of a work information management system according to an embodiment of the present invention.

Fig. 1B is a diagram for illustrating an example of an interface provided by a result display unit according to an embodiment of the present invention.

Fig. 2 is a flowchart of processing performed by the work information management system according to a first embodiment of the present invention.

Fig. 3 is a functional block diagram of the work information management system according to the first embodiment of the present invention.

Fig. 4A is a diagram for illustrating a configuration example of a work record table according to the first embodiment of the present invention.

Fig. 4B is a diagram for illustrating a configuration example of a project management table according to the first embodiment of the present invention.

Fig. 5 is a flowchart of processing performed by a work information management system according to a second embodiment of the present invention.

Fig. 6A is a diagram for illustrating an example of a work result screen displayed on a terminal according to the second embodiment of the present invention.

Fig. 6B is a diagram for illustrating an example of a daily work report displayed on a terminal according to the second embodiment of the present invention.

Fig. 7 is a flowchart of processing performed by a work information management system according to a third embodiment of the present invention.

Fig. 8 is a diagram for illustrating an example of a work analysis screen displayed on a computer used by a manager according to the third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments will be described below with reference to the accompanying

drawings.

<First Embodiment 1>

Fig. 1A is a diagram for illustrating the outline of a work information management system 109 according to an embodiment of the present invention. Fig. 1B is a diagram for illustrating an example of an interface provided by a result display unit 107.

The work information management system 109 of the present embodiment is configured with a computer including an arithmetic unit for executing a predetermined program and a storage device (memory or auxiliary storage device) for storing data to be used for arithmetic processing. The work information management system 109 includes a work time registration unit 102, a work time comparison unit 103, a result evaluation unit 104, a workflow management unit 105, and an average-work-time calculation unit 106.

In order to use the work information management system 109, which has a Web server function, via a terminal 101, a worker 100 in charge of repair inputs a URL on a Web browser to log in (110). The terminal 101 of the present embodiment is used for displaying and inputting works. The terminal 101 is, for example, a smartphone or a smart device. The terminal 101 is connected to the work information management system 109. The terminal 101 and the work information management system 109 may be connected to each other by radio communications (e.g., a mobile telephone network or WiFi). Alternatively, the terminal 101 and the work information management system 109 may be connected to each other via a 5G mobile telephone network. 5G connection between the terminal 101 and the work information management system 109 enables stable communications even if workers 100 gather in a specific area. Moreover, high-definition images can be transmitted, thereby providing a specific instruction to the worker 100. Furthermore, a report with detailed images can be received from the worker 100.

A manager 108 registers a workflow, which is created for each failure type, in advance in the workflow management unit 105 of the work information management

system 109 (112). The workflow in the present embodiment is a flow in which a plurality of works to be performed by the worker 100 are organized chronologically for each failure type of equipment. The workflow indicates the overall works to be performed by the worker 100. The manager 108 is also a person who manages the overall works and has a role of supporting and evaluating the work of the worker 100. The registered workflow is displayed on the terminal 101 of the worker. The worker 100 performs works according to the workflow displayed on the terminal 101 and inputs work records on the terminal 101 (111). The work time registration unit 102 records works registered by the worker 100. As for work records, the contents and finish times of the works are preferably recorded.

The work information management system 109 manages past work records. The average-work-time calculation unit 106 calculates the average value of the work times of works in the workflow using the past work records. The work time comparison unit 103 calculates a work time by using the finish time of each work and the finish time of the preceding work and calculates a difference between the average value of the work times and the work time of the work of the current worker, the average value being calculated from the past work records. The result evaluation unit 104 then determines whether the current work time is longer or shorter than the work time calculated from the past work records, and evaluates the work result.

The result display unit 107 automatically creates daily work reports including the evaluation of the work result. The manager 108 can refer to the result display unit 107 to determine whether the current worker 100 has completed the work in a shorter time or required a longer time for the work as compared with the past work records (113). The result display unit 107 preferably provides an interface that allows the manager 108 to view a list of work times of the worker 100 (114 in Fig. 1B).

In this way, the manager 108 can objectively determine which one of the workers 100 can perform a work in a short time or has required a long time for the work. As described above, the output of the work information management system 109 can be used as a criterion for the evaluation of the worker 100 or can be used as useful

analysis data for, for example, the selection of the worker 100 to be trained. Daily work reports are automatically created only by inputting work records to the terminal 101 by the worker 100, thereby shortening the time for creating daily work reports.

Fig. 2 is a flowchart of processing performed by the work information management system 109.

After the completion of works in a workflow, the worker operates the terminal 101 and confirms the subsequent work of the workflow. At this point, the preceding work is completed and a time when the worker 100 has operated the terminal is set as a work completion time in order to confirm the subsequent work. The work time registration unit 102 records the work completion time in a registration date/time 406 (Fig. 4A) of a work record table 304 (201). The average-work-time calculation unit 106 calculates the work time of each work in the workflow of the current worker 100 according to the registration times of work times registered in the work record table 304 (202).

The average-work-time calculation unit 106 calculates the average work time of works in the workflow according to past work records registered in the work record table 304 (203).

Thereafter, the work time comparison unit 103 compares the work time of the current worker 100 and the average work time (204). After the comparison, the result evaluation unit 104 determines whether the work times of the works of the current worker 100 are shorter or longer than past work records and evaluates the work of the worker 100 (205).

The result display unit 107 associates a work date/time, the worker, the work time of each work, and the evaluation result with one another and outputs display data to be displayed to the worker 100 and the manager 108 (206).

Fig. 3 is a functional block diagram of the work information management system 109.

In a project management table 301, data for managing a workflow performed by the worker is stored. A work display unit 302 outputs display data for displaying

the contents of a workflow to be performed by the worker and works included in the workflow. The worker performs works according to the displayed workflow. At the completion of each work in the workflow, the worker operates the terminal 101 (e.g., a press to a button on the screen of the terminal 101 or an input of a work result) and displays the subsequent work. A time registration unit 303 detects an operation at the completion of each work and records time information in the work record table 304. Instead of a work finish time recorded at the completion of each work, a work start time may be registered at the start of each work.

The work record table 304 holds information about the past work records of workers 100 who have worked in the same workflow in the past, in addition to the work time of the current worker 100. Thus, a past average work-time calculation unit 306 calculates the average of the past work times. The work time of the current worker in the work record table 304 can be calculated from the registration time of each work. Thus, a particular work-time calculation unit 305 determines the work time of each work in the workflow. A comparison evaluation unit 307 compares the calculated work time and past average work times and determines whether the work time of each work is shorter or longer than the work times of past work records.

A project information processing unit 309 acquires information about the workflow associated with the project management table 301. A result creation unit 308 creates diary work reports including information from the project information processing unit 309, the worker, the name of the worker, the work time of each flow, and the evaluation. A result display unit 310 generates display data for displaying the created diary work reports to the worker.

Fig. 4A is a diagram for illustrating a configuration example of the work record table 304.

The work record table 304 is a table for registering a work record when the worker performs a work. The work record table 304 includes a navigation type ID 401, a building code 402, a project number 403, a person in charge 404, a date of handling 405, a registration date/time 406, and a current node ID 407. The navigation type ID

401 is identification information for uniquely identifying a workflow. The building code 402 is identification information for uniquely identifying the location of a facility where a work is to be performed. The project number 403 is unique information assigned to a failure of equipment. The person in charge 404 is the name of a worker who has performed the work. The date of handling 405 is a date when the work is performed. The registration date/time 406 is the working date and time of the work (e.g., a date and time at the end of the work). A time when the contents of the work are displayed on the terminal 101 may be recorded as a work start time. The current node ID 407 is identification information about the work being performed in the workflow.

Fig. 4B is a diagram for illustrating a configuration example of the project management table 301.

The project management table 301 is a table for storing data for managing a workflow performed by the worker. The project management table 301 includes the navigation type ID 401, the building code 402, the project number 403, a node ID 408, detailed information 409 on navigation definitions, and flow display information 410. The node ID 408 is identification information sequentially assigned to works included in the workflow and indicates the order of works in the workflow. The detailed information 409 on navigation definitions is information about the detail of works. The flow display information 410 is information about the display of the workflow (e.g., a shape and color of the flow).

<Second Embodiment>

The present embodiment describes an application example of the present invention more specifically than generalized the first embodiment 1. In the second embodiment, determination results are clearly displayed in layers in an operation workflow to a worker and a manager. If the determination results are displayed only in a table like a daily work report 602, it is difficult to visually identify whether a work has been completed in a short time or required a long time. Thus, the determination results are displayed in the form of an operation workflow.

Fig. 5 is a flowchart of processing performed by a work information management system of the second embodiment.

First, a worker 100 accesses a URL assigned to the worker and inputs data that specifies a workflow, the data including a building code, a project number, and a management code. A work information management system 109 retrieves a navigation type ID for identifying the workflow by using, as a key, the data inputted by the worker 100, and sends the display data to display the workflow to a Web browser (501).

The work information management system 109 retrieves registration dates/times, which are dates and times when work units (node IDs) are completed, by using the retrieved navigation type ID as a key (502) and acquires the average work time of work units (node IDs) from a workflow management unit 105 according to information about the retrieved registration dates/times (503). The work information management system 109 calculates the work time of the current worker for each work unit with reference to work times registered in a work record table 304 (504).

Thereafter, the average work time and the work time of the worker are compared with each other for each work unit (node ID) (505). Thus, if the work time of the worker is shorter than the average work time by a predetermined threshold time (e.g., three minutes) or more, the work is changed to blue (506). If the work time of the worker is longer than the average work time by a predetermined threshold time (e.g., three minutes) or more, the work is changed to red (508). If a difference between the average work time and the work time of the worker is smaller than the predetermined threshold time (e.g., three minutes), the color of the work is not changed (507). The predetermined threshold time is, for example, three minutes, which can be dynamically changed by a manager to clearly indicate the determination result for the worker. Moreover, a difference from the average work time may be expressed numerically.

Finally, display data is generated for displaying a workflow indicating works in different forms according to the degree of a difference from the average work time, and

then the data is transmitted to a Web browser (509).

Alternatively, workers may be determined in a hierarchical format according to the skill level. Workers are categorized into three groups by years of experience, for example, a group of the first to fifth years, a group of the sixth to tenth years, and a group of the tenth year and later, and the work time is compared with the average work time in the same group. In the final analysis, for example, it is possible to make judgements such as: a work time was shorter than the average of all workers, but was around the same among workers in the same group.

Fig. 6A is a diagram for illustrating an example of a work result screen displayed on a terminal 101 used by the worker 100. Fig. 6B is a diagram for illustrating an example of a daily work report displayed on the terminal 101.

As shown in Fig. 6A, at the completion of a series of works displayed as a work flow by the worker 100, a screen 601 for indicating the daily work report 602 is displayed. As illustrated in Fig. 6B, the daily work report 602 includes performed works, work times, and the evaluation results of comparisons with average work times in addition to basic information including persons in charge, work dates, and work names. A workflow overview 604 is displayed by pressing a “display workflow” button 603 provided under the daily work report 602. In the workflow overview 604, the results of comparisons between the work times of works performed by a worker and average work times are superimposed over the workflow. This can visually identify whether the work time is shorter or longer than the average work time. The worker can review a time-consuming work in the performed workflow. Moreover, an alarm about an extended work time can be issued to a manager 108.

The screen in Fig. 6A can be also viewed by the manager 108 as well as the worker 100.

<Third Embodiment>

Third embodiment displays the frequency of performing works in a visually enhanced manner. The ratios of conditional branches of past workflows are

visualized and displayed on a workflow by using data on work records. According to the third embodiment, a manager 108 can recognize frequently performed works and construct measures for more smoothly and efficiently performing works. For example, the manager 108 can devise the order of the steps of the frequently performed works or provide training for the works.

Fig. 7 is a flowchart of processing performed by a work information management system. Fig. 8 is a diagram for illustrating an example of a work analysis screen displayed on a computer used by the manager 108.

By selecting a specific navigation ID, a workflow is selected (701). The number of selections of the selected navigation ID is calculated with reference to data on the number of uses of each pattern held in a work record table 304 (702). Moreover, data on the number of uses of each node ID (each work) held in the work record table 304 is tallied (703).

Thereafter, the number of uses of each node ID is divided by the total number of selections of the navigation ID, thereby calculating the execution rate of each node ID, that is, the frequency of performing each work (704). Branching occurs according to the value of the calculated frequency of performing each work, so that the display pattern of each work is changed in the flow (705). For example, the work of a node ID with a calculation result equal to or larger than a predetermined judgment threshold (e.g., 0.50) is deep-colored (706), whereas the work of a node ID with a calculation result smaller than the predetermined judgment threshold (e.g., 0.50) is light-colored (707). The judgment threshold is expressed as a predetermined judgment threshold of, for example, 0.50, which can be dynamically changed by a manager to clearly indicate the determination result for the worker.

Finally, display data is generated for displaying a workflow in which the frequencies of performing works are displayed in different colors, and then the data is transmitted to a computer used by the manager 108 (708). As shown in Fig. 8, a work directly under a branch 801 is displayed in a deep color 802 or a light color 803 in a work analysis screen 800. The subsequent works may also be displayed in the deep

color 802 or the light color 803 in addition to the work directly under the branch.

According to the third embodiment, a frequently performed work and a less frequently performed work are displayed in different forms, thereby displaying the frequency of performing each work in a visually enhanced manner after branching.

5 As described above, the work information management system according to the embodiments of the present invention includes the work display unit 302 that generates, on the basis of a workflow indicating the order of works, data for displaying the contents of the works on the terminal 101 used by the worker, the work record recording unit (work record table 304) that records the work times of the works
10 performed by the worker, the time registration unit 303 that acquires information on the works from the terminal 101 and records the work times in the work record table 304, the particular work-time calculation unit 305 that calculates the work times of the works from the recorded work times, and the result display unit 310 that generates, according to the order of the works in the workflow, display data for displaying the works and the
15 work times of the corresponding works. This can collect work record data that does not vary among workers, enabling accurate analysis. In other words, the manager registers the workflow of repair in advance, and the worker views the registered workflow on the terminal, performs the work according to the workflow, registers the work record, and records the registration time of the work record. This can calculate
20 a work time for each work unit of the workflow. Furthermore, the workflow unifies the granularity and order of the works, so that the work level of each worker can be calculated at the level of the work unit.

Moreover, a work time is recorded for each worker and each work unit, thereby analyzing the work level of each worker by aggregation. For example, it is assumed
25 that a worker A has required ten minutes from the start to the end of a work when “current measurement of device A” is registered in his workflow. If the average value of the work times of other workers is 15 minutes for this work, it can be determined that the worker A has completed the work “current measurement of device A” faster than the average.

The work information management system further includes the past average work-time calculation unit 306 that calculates the average work time of a plurality of workers in each work on the basis of work times recorded in the work record table 304, and the comparison evaluation unit 307 that compares the work time of the
5 corresponding worker and the average work time. Since the result display unit 310 generates data for displaying a daily work report including the result of comparison, the burden of the worker can be reduced and repair time can be secured by automatically creating the daily work report.

The result display unit 310 generates data for displaying the comparison result
10 superimposed on the workflow, thereby displaying the determination result in a visually enhanced manner.

Furthermore, the result display unit 310 generates data for displaying the comparison result in a different form (for example, in a different color) according to the comparison result, thereby displaying the determined result in a visually enhanced
15 manner.

The calculation unit is further provided for calculating, at a conditional branch in the workflow, the frequency of selecting processing subsequent to the conditional branch. The result display unit 310 generates data for displaying the calculated frequency of branching such that the frequency is superimposed on the workflow.
20 This can measure the frequency of performing each work subsequent to branching. Thus, the manager 108 can recognize frequently performed works and construct measures to perform works more smoothly and efficiently. For example, the manager 108 can devise the order of the steps of the frequently performed works or provide training for the works.

The result display unit 310 generates data for displaying the calculated frequency of branching in a different form according to the frequency. Thus, the frequency of performing each work subsequent to branching can be displayed in a visually enhanced manner.

This invention is not limited to the above-described embodiments but includes

various modifications. The above-described embodiments are explained in details for better understanding of this invention and are not limited to those including all the configurations described above. A part of the configuration of one embodiment may be replaced with that of another embodiment; the configuration of one embodiment
5 may be incorporated to the configuration of another embodiment. A part of the configuration of each embodiment may be added, deleted, or replaced by that of a different configuration.

The above-described configurations, functions, processing modules, and processing means, for all or a part of them, may be implemented by hardware: for
10 example, by designing an integrated circuit, and may be implemented by software, which means that a processor interprets and executes programs providing the functions.

The information of programs, tables, and files to implement the functions may be stored in a storage device such as a memory, a hard disk drive, or an SSD (a Solid
15 State Drive), or a storage medium such as an IC card, or an SD card.

The drawings illustrate control lines and information lines as considered necessary for explanation but do not illustrate all control lines or information lines in the products. It can be considered that almost of all components are actually interconnected.

What is claimed is:

1. A work information management system that acquires information about works to be performed by a worker, the work information management system comprising:

5 a work display unit configured to generate data for displaying contents of the works on a terminal used by the worker, on a basis of a workflow indicating an order of the works;

 a work record recording unit configured to record work times of the works performed by the worker;

10 a time registration unit configured to acquire information about the works from the terminal and records the work times in the work record recording unit;

 a particular work-time calculation unit configured to calculate the work times of the respective works from the work times recorded in the work record recording unit; and

15 a result display unit configured to generate data for displaying the works and the work times of the corresponding works according to the order of the works in the workflow.

2. The work information management system according to claim 1, further comprising:

20 a past average work-time calculation unit configured to calculate an average work time of a plurality of workers in each of the works on a basis of the work times recorded in the work record recording unit; and

 a comparison evaluation unit configured to compare a work time of the
25 corresponding worker and the average work time,

 wherein the result display unit is configured to generate data for displaying a daily work report including a result of the comparison.

3. The work information management system according to claim 2, wherein

the result display unit is configured to generate data for displaying the comparison result superimposed on the workflow.

4. The work information management system according to claim 3, wherein
5 the result display unit is configured to generate data for displaying the comparison result in a different form according to the comparison result.

5. The work information management system according to claim 1, further
comprising a calculation unit is configured to calculate a frequency of selecting
10 processing subsequent to the conditional branch at a conditional branch in the workflow,

wherein the result display unit is configured to generate data for displaying the calculated frequency such that the frequency is superimposed on the workflow.

15 6. The work information management system according to claim 5, wherein the result display unit is configured to generate data for displaying the calculated frequency in a different form according to the frequency.

7. A work information management method that acquires information about
20 works to be performed by a worker,

the work information management system including an arithmetic unit that executes predetermined arithmetic processing and a storage device that stores data to be used for the arithmetic processing,

the work information management method comprising:

25 a work display step of generating, by the arithmetic unit, data for displaying contents of the works on a terminal used by the worker, on a basis of workflow information indicating an order of the works;

a time registration step of acquiring, by the arithmetic unit, information about the works from the terminal and records work times;

a particular work-time calculating step of calculating, by the arithmetic unit, the work times of the respective works from the recorded work times; and

a result displaying step of generating, by the arithmetic unit, data for displaying the works and the work times of the corresponding works according to the order of the

5 works in the workflow information.