

DESCRIPTION

WORK SYSTEM AND WORK ASSISTANCE SYSTEM

5

TECHNICAL FIELD

The present invention relates to a work system configured to place work objects at respective storage places and perform a predetermined work to the work objects, and to a work assistance system used in the work system.

10

BACKGROUND ART

In recent years, a plant factory that farms vegetable cultivation in an industrially practical form is operated commercial scale. In the plant factory, cultivation vessels in which plants, such as vegetables, are planted are placed at predetermined cultivation positions which are designated for each production lot in advance and work for cultivation, such as watering and fertilizing, is performed to each cultivation vessel. Such work for cultivation is performed according to a work-schedule for each crop. In the plant factory, a system in which a cultivation vessel or a cultivation position is individually specified and a work management is performed is introduced (see, for example, PTL 1). In a conventional system disclosed in PTL 1, a crop identification tag in which unique information of a crop which is planted in a cultivation vessel is recorded is attached to the cultivation vessel and a compartment identification tag in which unique information of a cultivation compartment at which the cultivation vessel is installed is attached to the cultivation compartment. When the cultivation vessel is installed at the cultivation compartment, an operator reads the recorded information on the

crop identification tag and the compartment identification tag with a portable terminal, and stores the cultivation compartment of each crop.

CITATION LIST

5 PATENT LITERATURE

PTL 1: Japanese Patent Laid-Open Publication No. 2014-18189

SUMMARY

A work system includes a storage body, a display unit, a work-schedule
 10 memory, and a work-instruction unit. The storage body has plural storage
 places constituting plural groups each including storage places out of the
 plural storage places adjacent to each other. The storage body is associated
 with plural position identifiers and plural group identifiers. Each of the
 plural position identifiers identifies respective one of the plural storage
 15 places. Each of the plural group identifiers identifies respective one of the
 plural groups. The display unit displays a work performed to work objects
 placed at the plural storage places. The work-schedule memory stores a
 schedule of the works. The work-instruction unit reads the schedule stored
 from the work-schedule memory and displays the work on the display unit
 20 based on the read schedule. The work-instruction unit is configured to
 select whether the work is performed to a certain group out of the plural
 groups of the plural storage places or to a work object stored in one of the
 plural storage places, and displays the work on the display unit.

A work assistance system is used in a work system including a storage
 25 body and an input unit. The storage body has plural storage places and
 plural position identifiers each identifying respective one of the plural
 storage places. The input unit receives an input of the plural position

identifiers by an operator. The work assistance system includes a display unit, a storage-body information memory, a work-schedule memory, and a work-instruction unit. The display unit displays a work to be performed on work objects placed on plural storage places. The storage-body information
 5 memory stores the position identifiers and group identifiers each identifying respective one of plural groups each including storage places out of the plural storage places adjacent to each other. The work-schedule memory stores a schedule of the work. The work-instruction unit reads the schedule stored in the work-schedule memory and displays the work on the display unit
 10 based on the read schedule. The work-instruction unit selects whether the work is performed to a certain group of the plural groups or to one of the plural storage places, and displays the work on the display unit.

The work system and the work assistance system improve work efficiency.

15

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1A is a schematic diagram of a work system in accordance with an exemplary embodiment.

FIG. 1B is a schematic diagram of a rack used in the work system in
 20 accordance with the embodiment.

FIG. 2A illustrates a placement of storage places of work objects in the work system in accordance with the embodiment.

FIG. 2B illustrates the placement of storage places of work objects in the work system in accordance with the embodiment.

FIG. 2C illustrates the placement of storage places of work objects in
 25 the work system in accordance with the embodiment.

FIG. 3 is a block diagram of a management system performing data

management in the work system in accordance with the embodiment.

FIG. 4 illustrates a data configuration of a location number indicating a storage position of the work object in the work system in accordance with the embodiment.

5 FIG. 5 is a flowchart illustrating a work instruction process in the work system in accordance with the embodiment.

FIG. 6A illustrates a screen displayed in a portable terminal in the work system in accordance with the embodiment.

FIG. 6B illustrates a screen displayed in the portable terminal in the
10 work system in accordance with the embodiment.

FIG. 7 is a flowchart illustrating a work instruction process in the work system in accordance with the embodiment.

FIG. 8 illustrates a condition input screen displayed in the portable terminal in the work system in accordance with the embodiment.

15 FIG. 9A illustrates a work history input screen displayed in the portable terminal in the work system in accordance with the embodiment.

FIG. 9B illustrates the work history input screen displayed in the portable terminal in the work system in accordance with the embodiment.

FIG. 10A illustrates the work history input screen displayed in the
20 portable terminal in the work system in accordance with the embodiment.

FIG. 10B illustrates the work history input screen displayed in the portable terminal in the work system in accordance with the embodiment.

DETAIL DESCRIPTION OF PREFERRED EMBODIMENT

25 FIG. 1A is a schematic diagram of plant cultivation system 1 which is a work system in accordance with an exemplary embodiment. Plant cultivation system 1 has a function of industrially cultivating plants, such as

vegetables, in cultivation house 2 of which the circumference is closed. Areas 2b are determined on floor surface 2a inside of cultivation house 2 according to a predetermined partitioning. A predetermined number of racks 3 are placed on each of areas 2b of floor surface 2a. In cultivation
 5 house 2, a predetermined cultivation work is performed to each rack 3 by an operator.

FIG. 1B is a schematic diagram of rack 3. In rack 3, storage place 3g for storing cultivation unit 34 having plant 33 (vegetable), a work object, planted therein. When a work is performed by the operator, the operator
 10 performs the work to storage place 3g designated in a work instruction transferred through portable terminal 4 possessed by the operator and inputs a performing result in portable terminal 4 as a work history by reading a bar code label.

Plant cultivation system 1 includes management system 5 for assisting
 15 the work in cultivation house 2, label printer 6, and wireless communication base station 7. Management system 5 is a device, such as a personal computer, having a data processing function and performs a process of managing a work history obtained by editing a work instruction or the performing result of the work based on a work schedule. Label printer 6
 20 prints a bar code label to be attached for identifying storage place 3g in rack 3 or a group including storage places 3g based on label data output from management system 5. Wireless communication base station 7 exchanges signals between portable terminal 4 possessed by the operator and management system 5 by wireless communications.

25 As illustrated in FIG. 1B, racks 3 for storing therein cultivation units 34, work objects, are placed in area 2b which is determined by partitioning floor surface 2a in cultivation house 2. Rack 3 includes bottom plate 3a

horizontally arranged at a predetermined height, top plate 3b horizontally arranged at a predetermined height, posts 3c connecting both side ends of bottom plate 3a to both ends of top plate 3b, and partition plates 3e provided between bottom plate 3a and top plate 3b. In accordance with the
 5 embodiment, rack 3 includes two partition plates 3e. Caster 3d is installed on the lower end of post 3c to cause rack 3 to be easily moveable on floor surface 2a.

Each of bottom plate 3a and partition plates 3e constitutes storage
 shelf 3f that stores cultivation unit 34 on a top surface thereof.
 10 Cultivation unit 34 includes tray 31 on which pots 32 having plants 33
 planted therein are loaded. In accordance with the embodiment, two pots
 32 are loaded on tray 31. Illumination units 30 are provided on lower
 surfaces of top plate 3b and partition plates 3e which are shelf members
 positioned above storage shelf 3f. Plants 33 in cultivation units 34 stored in
 15 each storage shelf 3f are irradiated with illumination light for cultivation
 emitted by illumination unit 30.

Storage places 3g are assigned to each storage shelf 3f. In accordance
 with the embodiment, four storage places 3g are assigned to each storage
 shelf 3f. In-shelf position labels 37 each having a bar code printed thereon
 20 corresponding to each storage place 3g are attached to storage shelves 3f
 (bottom plate 3a and partition plate 3e). Adjacent storage places 3g
 adjacent to each other in each storage shelf 3f constitute a single shelf group.
 Shelf label 36 having the bar code printed thereon is attached onto a position
 (an end of one side of each group in accordance with the embodiment)
 25 specifying each of storage shelves 3f corresponding to the shelf group.

Shelf groups adjacent to one another constitute a single rack group.
 Rack label 35 having a bar code printed thereon is attached onto a position (a

corner of top plate 3b in accordance with the embodiment) specifying rack 3 corresponding to the rack group. As illustrated in FIG. 1A, rack groups adjacent to one another similarly constitute a single area group in area 2b inside cultivation house 2. An area label having a bar code specifying area 2b printed thereon is attached onto a position specifying area 2b corresponding to the area group. In accordance with the embodiment, area label 61 is attached to other corner of each of top plates 3b of racks 3 placed in area 2b.

That is, storage places storing cultivation units 34, work objects, are provided in rack 3. In rack 3, in-shelf position labels 37 indicating in-shelf position identifiers each assigned to respective one storage place 3b for individually identifying storage places 3g, shelf labels 36 indicating group identifiers each assigned to identify respective one storage places 3g adjacent to one another as a group (a shelf group, a rack group, an area group), and a rack label 35 are attached. Area label 61 for specifying area 2b is attached to rack 3.

A rack group corresponding to rack 3 is an upper-order group with respect to the shelf groups each corresponding to respective one of bottom plate 3a and partition plates 3e. The area group corresponding to area 2b is an upper-order group with respect to rack groups each corresponding to respective one of racks 3. An upper-order group identifier identifying a group of storage shelves 3f adjacent to one another as a upper-order group is assigned to rack 3. Shelf groups constitute a single rack group and are included in the rack group. The rack groups constitute a single area group and are included in the area group.

Location number NL specifying storage place 3g assigned to rack 3 and position identifier specified by location number NL will be described with

reference to FIG. 4. FIG. 4 illustrates configurations of identifiers identifying storage places 3g for storing cultivation units 34 and the shelf group indicating storage places 3g adjacent to one another in cultivation house 2 and location numbers NL corresponding to the identifiers. In accordance with the embodiment, location number NL is configured by combining location elements of area number N(2b) which specifies area 2b, rack number N(3) which specifies rack 3, shelf number N(3f) which specifies one of bottom plate 3a and partition plates 3e which are storage shelf 3f, and in-shelf position number N(3g) which individually specifies one of storage positions in each storage shelf.

FIGs. 2A to 2C illustrate arrangements of storage places 3g and area identifiers ID (3) including location elements corresponding to the arrangements. Rack numbers N(3) are constituted by location elements (001), (002), and (003) assigned to racks 3A, 3B, and 3C in order to identify three racks 3A, 3B, and 3C illustrated in FIG. 2A, FIG. 2B, and FIG. 2C, respectively. Shelf numbers N(3f), as illustrated in FIG. 2C, are constituted by location elements (001), (002), and (003) assigned to three storage shelves 3f corresponding to two partition plates 3e and bottom plate 3a in the order from above. In-shelf position numbers N(3g) are constituted by location elements (001), (002), (003), and (004) assigned to storage places 3g determined in storage shelf 3f corresponding to bottom plate 3a in the order from the left.

The case where location element (000) is assigned to each of rack number N(3), shelf number N(3f), and in-shelf position number N(3g) indicates that rack 3, storage shelf 3f, and storage place 3g are not specified and all are covered. In accordance with the embodiment, location number NL has a hierarchical structure having levels. The hierarchical structure

has levels from the highest to the lowest in the order of area 2b, rack 3, storage shelf 3f, and storage place 3g.

In the case where storage places are specified with one area 2b which is a classification of a first level (the highest level) as a largest bundle, that is, in the case where all storage places belonging to area 2b are specified, only area number N(2b) (here, “ABCD”) is regarded as a location element indicating area 2b, as area identifier ID (2b) specifying corresponding area 2b, and location number NL (first level location number NL1) to which “000” is assigned is used for all location elements specifying lower levels than or equal to a second level.

In the case where storage positions are specified by rack 3 which is a classification of a second level, that is, in the case where all storage places belonging to corresponding rack 3 are specified, rack number N(3) (here, rack number “001”) indicating corresponding rack 3 is regarded as the location element specifying a second level storage place, as rack identifier ID (3) specifying rack 3, in addition to area number N(2b) (“ABCD”) indicating area 2b, and location number NL (second level location number NL2) to which “000” is assigned is used for all location elements specifying the storage place less than or equal to a third level.

In the case where storage positions are specified by one storage shelf 3f which is a classification of a third level, that is, in that case where all storage places belonging to corresponding storage shelf 3f are specified, shelf number N(3f) (here, shelf number “002”) indicating corresponding storage shelf 3f is regarded as a specific element of a third level, as shelf identifier ID (3f) specifying storage shelf 3f, in addition to area number N(2b) and rack number N(3) described above, and location number NL (third level location number NL3) to which “000” is assigned is used for all location elements

specifying specific elements of a fourth level of lower level.

In the case where each storage place 3g which is a classification of a fourth level which is the lowest level is specified, location number NL (fourth level location number NL4) which regards in-shelf position number N(3g) (here, in-shelf position number “004”) which indicates storage place 3g, in addition to area number N(2b), rack number N(3), and shelf number N(3f) described above, as a specific element of the fourth level is used, as in-shelf position identifier ID (3g) specifying corresponding storage place 3g.

A configuration and function of management system 5 will be described below. FIG. 3 is a block diagram of management system 5. Management system 5 includes work-schedule preparation unit 10, production-lot information memory 11, cultivation-recipe memory 12, location-information memory 13, work-schedule memory 14, work-instruction unit 15, work-history preparation unit 16, work-history memory 17, and display/input unit 18. Management system 5 can exchange signals with portable terminal 4 through wireless communication base station 7 (see FIG. 1A).

Portable terminal 4 is a small terminal device, such as a tablet type terminal, and includes at least BC reader 19 and display unit 20. BC reader 19 reads in-shelf position identifiers and location number NL from the bar code label attached to rack 3. The in-shelf position identifiers specify storage places 3g. Location number NL is a group identifier obtained by grouping the identifiers. Display unit 20 is a touch panel type display screen and displays a work instruction screen transmitted to an operator from management system 5, and allows an input operation regarding a predetermined input item to be performed on a display screen through operation of a touch panel by the operator. That is, display unit 20

has also a function as an input unit. Display/input unit 18 of management system 5 has the same function as display unit 20. The operator accesses management system 5 to display the work display screen, and performs the input operation on the display screen.

5 Processing functions of the units will be described below. Work-schedule preparation unit 10 prepares a work schedule for performing plant cultivation work in plant cultivation system 1. When the work schedule is prepared, work-schedule preparation unit 10 refers to production lot information previously stored in production-lot information memory 11, a
10 cultivation recipe previously stored in cultivation-recipe memory 12, and location information previously stored in location-information memory 13. The production lot information specifies types and the number of plants which are work objects cultivated in cultivation house 2 in time series. The cultivation recipe is data which prescribes details of cultivation works
15 performed to the plants for each type of the plants. The location information is a position identifier for specifying storage place 3g of cultivation unit 34 (see FIG. 1B) in racks 3 placed in cultivation house 2. In accordance with the embodiment, the location information is provided as location number NL illustrated in FIG. 4.

20 Work-schedule memory 14 stores a work schedule prepared by work-schedule preparation unit 10, and stores works performed according to the work schedule. That is, work-schedule memory 14 stores a schedule for the works performed to cultivation unit 34 which is the work object. Work-instruction unit 15 reads the work to be performed to cultivation unit
25 34 from work-schedule memory 14, and displays the read work on a display unit (display/input unit 18 or display unit 20 of portable terminal 4).

In accordance with the embodiment, the work performed to cultivation

unit 34 is displayed on display unit 20 of portable terminal 4. The operator inputs location number NL which is a position identifier to portable terminal 4 by reading location number NL with BC reader 19 of portable terminal 4. That is, a display unit displaying the work performed to cultivation unit 34 and an input unit receiving a position identifier and a group position identifier which are input by the operator are provided in portable terminal 4. In the following exemplary embodiment, the input unit and the display unit mean BC reader 19 and display unit 20 of portable terminal 4, respectively.

In the display processing described above, the work-instruction unit 15 selects whether the work is to be performed to cultivation unit 34 to a group, such as a unit of shelf group, a rack group, or an area group, which regards a group as a target of work or to a storage place which regards individual storage place 3g, and displays the work to be instructed on display unit 20.

In the case where position identifier from BC reader 19 for a work displayed on display unit 20 is input, work-history preparation unit 16 prepares and records work history information indicating the work performed to cultivation unit 34 loaded on storage place 3g indicated by the input position identifier. The recorded work history information is stored in work-history memory 17. Work-history preparation unit 16 is a work-history information recorder which records work history information of the work performed to cultivation unit 34 identified by the input position identifier.

In the case where a group identifier is input from display unit 20 for a work displayed on display unit 20, work-history preparation unit 16 prepares and records work history information indicating the work performed to cultivation units 34 identified by input group identifier. The recorded work history information is stored in work-history memory 17.

Thus, work-history preparation unit 16 is a work-history information recorder which records work history information which is information of the work performed to cultivation units 34 identified by the input group identifier.

5 Work-history preparation unit 16 as the work-history information recorder determines whether or not the position identifier input from display unit 20 is coincident with a position identifier of storage place 3g to which the work is scheduled based on a work schedule read by work-instruction unit 15. When the position identifiers are coincident with each other, the
10 work history information is prepared and recorded. When the position identifiers are not coincident with each other, a warning indicating that the position identifiers are not coincident with each other is performed to the operator.

 Work-history preparation unit 16 includes setting unit 16a which sets
15 whether the recording of work history information based on group identifier is limited or not. In the case where the recording of work history information is limited based on a group identifier due to setting described above by setting unit 16a, work-history preparation unit 16 does not prepare work history information even when a group identifier is input from display
20 unit 20. The recording limitation function of a work history can select an individual management mode and a collective management mode in work history preparation processing which will be described later.

 In the configuration described above and illustrated in FIG. 3, location-information memory 13, work-schedule memory 14,
25 work-instruction unit 15, work-history preparation unit 16, work-history memory 17, and display/input unit 18 of management system 5, and portable terminal 4 possessed by management system 5 constitute a work assistance

system used for assisting work management, data processing or the like in plant cultivation system 1 (see FIG. 1A) as a work system including rack 3 configured as described above and portable terminal 4 receiving rack label 35, shelf label 36, and in-shelf position label 37 which are position identifiers
 5 which are read by the operator. The function of the work assistance system, as will be described in the following, can automatically perform work instruction to the operator through portable terminal 4, and automatically perform the work history information preparation processing based on information which is a performed result of the work and is input through
 10 portable terminal 4 by the operator.

An instruction of a work performed by exchanging signals between management system 5 and portable terminal 4 will be described below. The instruction of the work is performed in order to instruct the work to be performed by the operator in cultivation house 2 and is performed by
 15 allowing the operator to operate display unit 20 (or display/input unit 18) which is an operation screen of portable terminal 4. Methods for requesting an instruction of work generally include a method for requesting an instruction of work by the operator inputting a work from portable terminal 4 and a method for requesting an instruction of the work by the operator
 20 accessing link information included in a message transmitted from management system 5.

The method for requesting an instruction of the work by the operator inputting a work condition from portable terminal 4 will be described below. FIG. 5 is a flowchart illustrating an instruction processing in plant
 25 cultivation system 1 which is the work system. Types of the work conditions to be input are not limited as long as the types are items, which are associated with work to be performed, such as a work type of work to be

performed, the date and time, a lot number which becomes a target of work, a plant name, operator information (ID) specifying an operator who is responsible performing the work.

FIG. 6A illustrates a screen displayed on display unit 20 of portable terminal 4. In FIG. 5, the operator first operates portable terminal 4 to perform a work instruction request which requests an instruction of a work (Step ST1). When the work instruction request is performed, a condition input screen illustrated in FIG. 6A is displayed on display screen 20a. In the illustrated example, the work type of a work to be performed is a condition. That is, work selection button 40a indicating a work of “Planting”, work selection button 40b indicating a work of “Watering”, work selection button 40c indicating a work of “Fertilizing”, work selection button 40d indicating a work of “Photographing”, work selection button 40e indicating a work of “Harvesting”, and work selection button 40f indicating a work of “Disposal” are displayed in work type field 40 on display screen 20a. When the operator touches one of the work selection buttons 40a to 40f to operate, a work corresponding to the operated work selection button is transmitted to management system 5 as a condition of the work instruction request. In the following, an operation of selecting and touching work selection button 40b corresponding to the work of “Watering” that supplies water to cultivation unit 34 will be described as the work.

When the work instruction request is transmitted to management system 5, management system 5 searches a work (Step ST2). That is, work-instruction unit 15 searches an item matched with the condition of the work instruction request from the work schedule stored in work-schedule memory 14. Next, management system 5 edits an instruction corresponding to the work instruction request (Step ST3), and transmits the

work instruction which instructs the operator to perform the work to portable terminal 4 that transmitted the work instruction request (Step ST4). The transmitted work instruction is received by portable terminal 4 (Step ST5) as to allow a work instruction screen that instructs the work to be
 5 displayed on display screen 20a of portable terminal 4.

FIG. 6B illustrates a work instruction screen displayed on display screen 20a of portable terminal 4. The work instruction screen is displayed on display screen 20a of portable terminal 4 in the case where work selection button 40b indicating “Watering” is selected as work in condition input
 10 screen illustrated in FIG. 6A. In this case, location number NL indicating a location of cultivation unit 34 that requiring needs a watering work is displayed in location number display field 43 of display screen 20a.

Location number NL includes location numbers NLa, NLb, NLc, NLd, and NLe. Each of location numbers NLa and NLb indicates storage places
 15 in the entire of a rack to which the work is performed. Each of location numbers NLc and NLd indicate storage places in the entire of a shelf to which the work is performed. Location number NLe indicates of storage places at the entire of an in-shelf position to which the work is performed. The number of storage places specified by location number NL, that is, the
 20 number of work objects is displayed in number-of-location display field 44. The display screen illustrated in FIG. 6B shows the number 44a of work objects of each of location numbers NLa to NLe and a total of the numbers of work objects 44b of location numbers NLa to NLe. The operator operates operation button 45 indicating “Work Completed” to input a result of the
 25 work performed in response to the work instruction and to perform a work history preparation process, which will be described later, as to prepare a work history.

The work instruction illustrated in FIG. 6B is performed by a processing function of work-instruction unit 15 of management system 5 illustrated in FIG. 3. That is, work-instruction unit 15 selects one of the case that the instructed work is performed to storage place 3g, the case that the instructed work is performed to a group including plural adjacent storage places 3g, and the case that the instructed work is performed to an upper-order group including plural adjacent groups. Work-instruction unit 15 determines the unit of display to which the instructed work is performed is displayed on display unit 20.

In accordance with the embodiment, the unit of display described above is determined according to whether works to be instructed are the same or not. As described above, an upper-order group identifier identifying plural adjacent groups as an upper-order group is given to rack 3. In the case where the same work is scheduled for all work objects stored in storage places 3g belonging to the same upper-order group, work-instruction unit 15 displays the instructed work in the unit of upper-order group that regards the same upper-order group as a target of work.

In accordance with the embodiment, the unit of display can be determined according to whether the production lots are the same or not, in addition to determination according to whether works to be instructed are the same or not. In the case where regarding all work objects stored in the storage places belonging to the same group, the production lots are the same and the same work is scheduled, work-instruction unit 15 displays works to be instructed as a group. In the case where regarding some of all work objects stored in the storage places belonging to the same group, a different work is scheduled or work is not scheduled, work-instruction unit 15 displays works to be instructed as a storage place. In the case where the production

lots are different, work-instruction unit 15 displays the instructed work as a storage place. In the case where all work objects stored in the storage places belonging to the same upper-order group, the production lots are the same and the same work is scheduled, work-instruction unit 15 displays works to be instructed as an upper-order group.

FIGs. 2A to 2C illustrate storage places of cultivation units 34 corresponding to plural location numbers NL listed in location number display field 43 of the work instruction screen illustrated in FIG. 6B.

In rack identifier ID(3) illustrated in FIG. 2A, rack identifier ID(3) corresponding to rack label 35 specifies rack 3A specified by location number NLa (ABCD001000000) illustrated in location number display field 43.

FIG. 2A illustrates that plants 33 are stored in all storage places 3g belonging to rack 3A which is the same group, all plants 33 match with the condition (the work "Watering" indicated by work selection button 40b) selected in inputting of a condition, and the production lots are the same and the same work is scheduled. In this case, the unit of display is determined such that the instructed work for an upper-order group (rack) is displayed.

In FIG. 2B, rack identifier ID(3) corresponding to rack label 35 specifies rack 3B specified by location number NLb (ABCD002000000) illustrated in location number display field 43. This example also illustrates that, although storage places 3g where plants 33 are not stored exist on partition plate 3e which is the same group. Regarding stored plants 33, all plants 33 match with the condition (the work "Watering" indicated by work selection button 40b) selected in inputting of a condition and correspond to the same production lot and the same work is scheduled.

Also, in this case, unit of display is determined such that works to be instructed in the unit of upper-order group (unit of rack) are displayed.

That is, in a case where the production lots are the same and the same work is scheduled regarding cultivation units 34 that are all work objects stored in storage places belonging to the same group, work-instruction unit 15 displays works to be instructed in unit of upper-order group.

5 In FIG. 2C, rack identifier ID(3) corresponding to rack label 35 specifies rack 3C not specified by first level location number NL1 (ABCD003000000) not indicated in location number display field 43 and a work instruction in unit of rack is not made. That is, the work instruction to a shelf and to an in-shelf position of low levels is made.

10 In FIG. 2C, location number NLc (ABCD003001000) and location number NLd (ABCD003002000) are included in location number display field 43 illustrated in FIG. 6B. The work is performed to plants loaded on storage places of two partition plates 3e (storage shelves 3f) respectively specified by location number NLc and location number NLd. Storage
15 shelves 3f are identified by shelf labels 36 corresponding to location numbers NLc and NLd.

Plants 33 to which the work is performed are stored in all storage places 3g on partition plate 3e (storage shelf 3f) out of two partition plates 3e (storage shelves 3f) corresponding to location number NLc. In partition
20 plate 3e (storage shelf 3f) specified by location number NLd, although storage places 3g where plants 33 are not stored exist, the production lots and the work conditions are the same regarding all storage places 3g belonging to storage shelves 3f. In this case, as described above, in the case
25 all work objects stored in storage places belonging to the same group, a work to be performed in a group (here, a shelf) is displayed.

In FIG. 2C, only single storage place 3g on bottom plate 3a (storage

shelf 3f) identified by location number NLe (ABCD003003001) included in location number display field 43 illustrated in FIG. 6B becomes a target of the work instruction. Single storage place 3g is identified by in-shelf position label 37 specified in location number NLe and cultivation unit 34 in
 5 which plant 33 matching with the work condition is stored in storage place 3g.

In storage shelf 3f (bottom plate 3a), storage places 3g corresponding to location number NL* which is not indicated in location number display field 43 and for which the work instruction is not made exist in addition to storage
 10 places 3g described above. In storage places 3g for which the work instruction is not made, cultivation units 34, in which plants 33 having the same type but not matching the condition (production lot, contents of work) selected in inputting of a condition or plants 33A and 33B that are different in a growth state or a type itself are planted, are stored. Cultivation units
 15 34 correspond to those cultivation units for which different type of work is scheduled or not scheduled, or the production lots are different.

That is, in FIG. 2C, two groups consisting of two sets of plural storage places 3g that are specified by location numbers NLc and NLd and a storage place of only single storage place 3g on bottom plate 3a specified by location
 20 number NLe are displayed together.

Regarding all storage places 3g belonging to each of two partition plates 3e that are respectively identified by location number NLc and location number NLd, the production lots are the same and the same work is scheduled. Accordingly, regarding storage places 3g, works to be instruct in
 25 two groups (shelves) consisting of two sets of plural storage places 3g are displayed.

Regarding storage places 3g specified by location number NLe, in some

of cultivation units 34 which are all work objects stored in storage place 3g belonging to a group (storage shelf 3f of bottom plate 3a) identified by the same shelf identifier ID (3f), it corresponds to a case where different work is scheduled, a case where selected work is not scheduled, or a case where the production lots differ. Accordingly, regarding storage place 3g specified by location number NLe, works to be instructed in a storage place are displayed.

Next, a method for performing a work instruction request by accessing link information included in a message transmitted from management system 5 among work instructions performed by transmitting/receiving a signal between management system 5 and portable terminal 4 will be described. FIG. 7 illustrates a flow of work instruction processing in the method. FIG. 8, FIG. 9A, FIG. 9B, FIG. 10A, and FIG. 10B are screens displayed on the portable terminal.

In this method, management system 5 prepares instructions previously by automatically editing instructions (Step ST11). That is, management system 5 edits work instructions to prepare data transmitted to portable terminal 4 by work-instruction unit 15 based on the work schedule stored in work-schedule memory 14.

Next, a needed message is added to the edited work instructions and is transmitted to portable terminal 4 possessed by the operator (Step ST12). The message is received by portable terminal 4 to display a message screen for work instructions illustrated in FIG. 8 on display screen 20a of portable terminal 4 (Step ST13). The message screen is configured by adding message display field 46 to a condition input screen for the work instructions illustrated in FIG. 6A.

A message, "You have a message of a work to be performed today" is displayed on message display field 46. Upon receiving the message, the

operator performs the same work instruction request as Step ST1 shown in FIG. 5 by accessing link information included in the message (Step ST14). That is, in work type field 40 displayed on display screen 20a, work selection buttons 40a, 40b, 40c, 40d, 40e, and 40f corresponding to works of “Planting”, “Watering”, “Fertilizing”, “Photographing”, “Harvesting”, and “Disposal” are displayed. When the operator touches a single work button out of work selection buttons 40a, 40b, 40c, 40d, 40e, and 40f to be operated, a work corresponding to the operated work selection button is transmitted to management system 5 as a condition of a work instruction request. In the following, an example in which work selection button 40b corresponding to, for example, the work of “Watering” is selected as the work is illustrated.

When the work instruction request corresponding to the work of watering selected through operation of work selection button 40b is transmitted to management system 5, management system 5 transmits the work instruction obtained by automatically editing in Step ST11 to portable terminal 4 of a work instruction request source (Step ST15). The work instruction is received by portable terminal 4 (Step ST16). Then, as illustrated in FIG. 9A, the same work instruction screen as FIG. 6B is displayed on display screen 20a of portable terminal 4. Location numbers NL listed in location number display field 43 in the work instruction screen correspond to storage placement examples illustrated in FIGs. 2A to 2C. The operator performs the work by confirming storage places 3g of location number NL displayed in location number display field 43 as according to the work instruction by displaying of the screen. When the works are completed, the operator performs a work completion processing by operating “Work Completed” operation button 45.

The above operation allows display screen 20a to display thereon the

work history input screen illustrated in FIG. 9B. The work history is for confirming that the work is actually performed and the work history is input by reading position identifier regarding the storage place of conducted work. In accordance with the embodiment, the work history is input such that the operator reads a bar code label, such as rack label 35, shelf label 36, or in-shelf position label 37, attached onto rack 3 as identifier by BC reader 19 of portable terminal 4, and the read identifier is transmitted to management system 5 from portable terminal 4. Work-history preparation unit 16 prepares work history information based on the identifier received by management system 5 and the prepared work history information is stored in work-history memory 17.

Management modes of the work history will be described below. In accordance with the embodiment, two types of management modes of an individual management mode and a collective management mode are selectively used depending on storage places are bundled to be designated. The individual management mode is a scheme of individually inputting an in-shelf position identifier for each storage place and has an advantage that an accurate work history can be prepared and a disadvantage that in-shelf position identifiers are required to read, and increases a workload.

In contrast, the collective management mode is a scheme of inputting an identifier (a group identifier) in a group for plural storage places bundled as a group. In this scheme, plural storage places are regarded as targets and only a single group identifier representative of an in-shelf position identifier of the storage places is needed and thus, has an advantage that a workload can be decreased and on the other hand, respective storage places are not regarded as targets for reading and thus, has a disadvantage of less accuracy.

Selection of the individual management mode and collective management mode described above is performed by a function of setting unit 16a of work-history preparation unit 16. That is, setting is performed as to limit recording of the work history information by setting unit 16a based on a group identifier, and thus, individual management mode is selected and only the piece of an in-shelf position identifier individually input for each storage place is received. Setting is performed as not to limit recording of the work history information by setting unit 16a based on a group identifier, and thus, the collective management mode is selected and it becomes possible to input an in-shelf position identifier of a group as a bundle.

The work history input screen illustrated in FIG. 9B illustrates an example in which the individual management mode is selected as displayed in management mode display field 49 of display screen 20a. Message display field 47 set in display screen 20a displays therein, a message, “Input Location No. at which Work is Completed” that prompts the operator to input an identifier. Upon receiving the message, the operator sequentially reads, with BC reader 19 of portable terminal 4, the bar code labels which are instructed in location number display field 43 of the work instruction screen illustrated in FIG. 9A and correspond to location numbers NL to which the work actually performed. The individual management mode described above is selected and thus, the operator sequentially reads only in-shelf position label 37 corresponding to in-shelf position identifier ID (3g). With this, in read-location number display field 43A of display screen 20a, location numbers NL (fourth level location numbers NL4) corresponding to in-shelf position label 37 which has been read are sequentially displayed.

First, in-shelf position identifiers ID (3g) of lower level included in location number NL_a and location number NL_b, that is, (ABCD001000000)

and (ABCD002000000), which are second level location numbers NL2, are to be read. Next, in-shelf position identifiers ID (3g) of lower level included in location number NLc and location number NLd, that is, (ABCD003001000) and (ABCD003002000), which are third level location numbers NL3, are to
 5 be read. Next, location number NLe, that is, (ABCD003003001), which is fourth level location number NL4, are to be read.

FIG. 9B illustrates an example in which some of in-shelf position identifiers ID (3g) indicating storage places 3g in rack 3 indicated by location number NLa are displayed. Here, the individual management mode is
 10 selected, and thus, management system 5 receives only an input of in-shelf position identifier ID (3g). In the case where the in-shelf position identifier ID (3g) for which the work instruction is made coincides with in-shelf position identifier ID (3g) of in-shelf position label 37 which has been read, an index, “OK”, representing that the reading result matches with the work
 15 instruction is displayed in collation result display field 48 and work history information is prepared by work-history preparation unit 16 based on the read in-shelf position identifier ID (3g).

FIG. 10A illustrates warning screen 50 displayed on display screen 20a in the individual management mode. When fourth level location number
 20 NL4 corresponding to in-shelf position identifier ID (3g) for which the work instruction is not made is read, warning screen 50 informing warning that the read location number is not a target for the work, for which the work instruction is made, is displayed to overlap in display screen 20a. When operation buttons of “Register” operation button 51 and “Re-Read” operation
 25 button 52 are prepared in warning screen 50 and warning screen 50 is displayed, the operator operates by selecting one of “Register” operation button 51 and “Re-Read” operation button 52, upon confirming whether or

not the work is actually performed to cultivation unit 34 of in-shelf position identifier ID (3g).

When “Register” operation button 51 is operated, even in the case where the work is performed to cultivation unit 34 which is not regarded as a target of the work instruction, a work history is prepared and registered in work history information for in-shelf position identifier ID (3g) the corresponding to cultivation unit 34. That is, a fact that work is actually performed is reflected as work history information. When “Re-Read” operation button 52 is operated, it is waited until a work is read by an operator without preparing the work history information.

That is, work-history preparation unit 16 which is a work-history information recorder determines whether or not in-shelf position identifier ID (3g) input with BC reader 19 which is an input unit to read in-shelf position label 37 is coincident with in-shelf position identifier ID (3g) of storage place 3g to which the work extracted by work-instruction unit 15 is scheduled. When the in-shelf position identifiers ID (3g) are coincident with each other, work history information is recorded by work-history preparation unit 16. When the in-shelf position identifiers ID (3g) are not coincident with each other, a warning is performed to the operator by displaying warning screen 50 described above.

Even in the case where shelf identifier ID (3f) and rack identifier ID (3) which are group identifiers are input with BC reader 19 reading shelf label 36 and rack label 35, work history information indicating that the work is performed is prepared by work-history preparation unit 16 and stored in work-history memory 17. That is, the work history information indicating that the work is conducted is prepared for storage places 3g of the group.

FIG. 10B illustrates an example of a work-history input screen in the

case where the collective management is selected as a history management. In this case, management mode display field 49 of display screen 20a displays thereon that it is a collective management mode while message display field 47 displays thereon a message, “Input Location No. to which
 5 Work is Completed” that prompts the operator to input a group identifier.

Upon receiving the message, the operator reads, with BC reader 19 of portable terminal 4, bar code labels corresponding to the location numbers of upper levels out of bar code labels for which instructed in location number display field 43 of the work instruction screen illustrated in FIG. 9A and
 10 which correspond to location number NL for which work is actually performed. Due to this operation, in-shelf position identifiers ID (3g) corresponding to the location numbers of lower level belonging to the location numbers read to be input in management system 5 are collectively displayed in read-location number display field 43A of display screen 20a similarly to
 15 the example illustrated in FIG. 9B. That is, this operation does not require any operation to individually read plural in-shelf position labels 37 and reduces a workload of the operator. In the collective management mode, for each location number collation processing of displaying the “OK” mark in collation result display field 48 is not basically performed.

20 As described above, in plant cultivation system 1 and the assistance system of the plant cultivation system described in the embodiment, work-instruction unit 15 reads a work from the work-schedule memory storing a schedule for works to be performed to cultivation units 34 and displays the read work on the display unit in work using rack 3 including
 25 plural storage places 3g of cultivation units 34 which are the work objects. Rack 3 has an in-shelf position identifier ID (3g) (in-shelf position label 37) assigned to each of storage places 3g in order to identify storage places 3g, a

shelf identifier ID (3f) (shelf label 36) which is a group identifier for identifying plural adjacent storage places 3g as a group, and a rack identifier ID (3) (rack label 35).

In the conventional system disclosed in PTL 1, although a database in which a cultivation vessel and a cultivation compartment of each type of crop are associated with each other is able to be constructed, a scheme for efficiently using identifiers included in the database is not specifically described. For this reason, a new scheme for facilitating improvement of work efficiency of cultivation work or refinement of a work history management is desired in operation of the database prepared at a considerable cost of large amount of labor and time with considerable effort.

In the work system in accordance with the embodiment, work-instruction unit 15 selects whether work is a unit of group which regards a group of storage places 3g as a target of work or a unit-of-storage place which regards individual storage place 3g as a target of work and displays the work to be instructed on the display unit. With this, in a case where the production lots or contents of the work to be conducted are the same, or the like, it is possible to appropriately select the unit of display as needed and it is possible to realize improvement of work efficiency in a work system in which a plurality of work objects are respectively placed on the storage places and predetermined work is performed.

Plant cultivation system 1 and the assistance system of the plant cultivation system disclosed in the exemplary embodiment further include an input unit and work-history preparation unit 16. The input unit receives the in-shelf position identifier ID (3g), the shelf identifier ID (3f), and the rack identifier ID (3) as inputs by the operator. Work-history preparation unit 16 prepares and records work history information indicating that the

work is performed to cultivation units 34 corresponding to the input in-shelf position identifier ID (3g), the shelf identifier ID (3f), and the rack identifier ID (3) in the case where the in-shelf position identifier ID (3g), the shelf identifier ID (3f), and the rack identifier ID (3) is input from the input unit
 5 for the work displayed on the display unit. This operation can refine the work history management in the work system in which plural work objects are placed at the storage places and a predetermined work is performed.

As described above, the work system includes a storage body, a display unit, a work-schedule memory, and a work-instruction unit. The storage
 10 body has plural storage places constituting plural groups each including storage places out of the plural storage places adjacent to each other. The storage body is associated with plural position identifiers and plural group identifiers. Each of the plural position identifiers identifies respective one of the plural storage places. Each of the plural group identifiers identifies
 15 respective one of the plural groups. The display unit displays a work performed to work objects placed at the plural storage places. The work-schedule memory stores a schedule of the works. The work-instruction unit reads the schedule stored in from the work-schedule memory and displays the work on the display unit based on the read
 20 schedule. The work-instruction unit is configured to select whether the work is performed to a certain group out of the plural groups of the plural storage places or to a work object stored in one of the plural storage places, and displays the work on the display unit.

The work-instruction unit may display the certain group together with
 25 the work in a case where the work is performed to all of work objects stored in storage places of the certain group. In this case, the work-instruction unit displays a work performed to the storage place together with the storage

place in the case where a different work is scheduled or a work is not scheduled for a part of all of the work objects stored in the storage places of the certain group.

The storage body may be further associated with plural upper-order
 5 group identifiers each identifying respective one of plural upper-order groups each including groups out of the plural groups adjacent to each other. In this case, the work-instruction unit displays a certain upper-order group out of the plural upper-order groups together with the work in the case where the work is scheduled for all of work objects stored in storage places out of
 10 the plural storage places of the certain upper-order group.

The work-instruction unit may display the certain group together with the work in the case where production lots of work objects stored in the storage places of the certain group are identical to one another and the work is scheduled for all of the work objects stored in the storage places of the
 15 certain group. In this case, the work-instruction unit displays the work performed on the storage place together with the storage place in the case where a different work is scheduled or not scheduled, or in the case where the production lots of some of all of the work objects stored in the storage places of the certain group are different from one another.

20 The storage body may be further associated with plural upper-order group identifiers each identifying respective one of plural upper-order groups each including groups out of the plural groups adjacent to each other. In the case where production lots of all of the work objects stored in storage places out of the plural storage places of the upper-order group are identical
 25 to one another or the work is scheduled for all of the work objects stored in the storage places of the upper-order group, the work-instruction unit displays the upper-order group together with the work.

A work assistance system is configured to be used in a work system including a storage body and an input unit. The storage body has plural storage places and plural position identifiers each identifying respective one
 5 of the plural storage places. The input unit receives an input of the plural position identifiers by an operator. The work assistance system includes the display unit, the storage-body information memory, the work-schedule memory, and the work-instruction unit.

10 INDUSTRIAL APPLICABILITY

A work system and a work assistance system according to the present invention improve work efficiency in the work system in which plural work objects are respectively placed at storage places and a predetermined work is performed, and are useful in a field performing farming, such as cultivation
 15 of vegetables in industrially practicable form.

REFERENCE MARKS IN DRAWINGS

- 2a floor surface
- 2b area
- 20 3 rack
- 3a bottom plate
- 3e partition plate
- 3f storage shelf
- 3g storage place
- 25 33 plant
- 34 cultivation unit (work object)
- 35 rack label

- 36 shelf label
- 37 in-shelf position label
- NL location number
- N(2b) area number
- 5 N(3) rack number
- N(3f) shelf number
- N(3g) in-shelf position number

CLAIMS

1. A work system comprising:

a storage body having a plurality of storage places constituting a plurality of groups each including storage places out of the plurality of storage places adjacent to each other, the storage body being associated with
5 a plurality of position identifiers and a plurality of group identifiers, each of the plurality of position identifiers identifying respective one of the plurality of storage places, each of the plurality of group identifiers identifying respective one of the plurality of groups;

10 a display unit that displays a work performed to work objects placed at the plurality of storage places;

a work-schedule memory that stores a schedule of the works; and

a work-instruction unit that reads the schedule stored in from the work-schedule memory and displays the work on the display unit based on
15 the read schedule,

wherein the work-instruction unit is configured to select whether the work is performed to a certain group out of the plurality of groups of the plurality of storage places or to a work object stored in one of the plurality of storage places, and displays the work on the display unit.

20

2. The work system of claim 1, wherein the work-instruction unit is configured to;

display the certain group together with the work in a case where the work is performed to all of work objects stored in storage places of the
25 certain group, and

display a work performed to the storage place together with the storage place in a case where a different work is scheduled or a work is not

scheduled for a part of all of the work objects stored in the storage places of the certain group.

3. The work system of claim 1 or 2,

5 wherein the storage body is further associated with a plurality of upper-order group identifiers each identifying respective one of a plurality of upper-order groups each including groups out of the plurality of groups adjacent to each other, and

 wherein the work-instruction unit is configured to display a
10 certain upper-order group out of the plurality of upper-order groups together with the work in a case where the work is scheduled for all of work objects stored in storage places out of the plurality of storage places of the certain upper-order group.

15 4. The work system of claim 1, wherein the work-instruction unit is configured to;

 display the certain group together with the work in a case where production lots of work objects stored in the storage places of the certain group are identical to one another and the work is scheduled for all of the
20 work objects stored in the storage places of the certain group; and

 display the work performed on the storage place together with the storage place in a case where a different work is scheduled or not scheduled, or in a case where the production lots of some of all of the work objects stored in the storage places of the certain group are different from one another.

25

5. The work system of claim 4,

 wherein the storage body is further associated with a plurality of

upper-order group identifiers each identifying respective one of a plurality of upper-order groups each including groups out of the plurality of groups adjacent to each other, and

wherein, in a case where production lots of all of the work objects
 5 stored in storage places out of the plurality of storage places of the upper-order group are identical to one another or the work is scheduled for all of the work objects stored in the storage places of the upper-order group, the work-instruction unit is configured to display the upper-order group together with the work.

10

6. A work assistance system configured to be used in a work system including a storage body and an input unit, wherein the storage body has a plurality of storage places and a plurality of position identifiers each identifying respective one of the plurality of storage places, and the input
 15 unit receives an input of the plurality of position identifiers by an operator, the work assistance system comprising:

a display unit that displays a work to be performed to work objects placed on a plurality of storage places;

a storage-body information memory that stores the position
 20 identifiers and group identifiers each identifying respective one of a plurality of groups each including storage places out of the plurality of storage places adjacent to each other;

a work-schedule memory that stores a schedule of the work; and

a work-instruction unit that reads the schedule stored in the
 25 work-schedule memory and displays the work on the display unit based on the read schedule,

wherein the work-instruction unit selects whether the work is

performed to a certain group of the plurality of groups or to one of the plurality of storage places, and displays the work on the display unit.

7. The work assistance system of claim 6, wherein the work-instruction
5 unit is configured to;

display the work to be performed to the group in a case where the work is scheduled for all of work objects stored in the storage places of the group; and

display the storage place together with the work in a case where a
10 different work is scheduled for a part of all of the work objects stored in the storage places of the certain group or a work is not scheduled for a part of all of the work objects stored in the storage places of the certain group.

8. The work assistance system of claim 6 or 7,
15 wherein the storage body further has a plurality of upper-order group identifiers each identifying respective one of a plurality of upper-order groups each including groups out of the plurality of groups adjacent to each other, and

wherein the work-instruction unit displays the certain
20 upper-order group together with the work in a case where the work is scheduled for all of work objects stored in the storage places of a certain upper-order group out of the plurality of upper-order groups.

9. The work assistance system of claim 6, wherein the work-instruction
25 unit is configured to;

display the certain group together with the work together in a case where production lots of all of work objects stored in the storage places

of the certain group are identical to each other and a work is scheduled for all of the work objects stored in the storage places of the certain group, and

display the work performed to the storage place together with the storage place in a case where different work is scheduled or not scheduled, or
5 in a case where the production lots of some of all of the work objects stored in the storage places of to the certain group are different from each other.

10. The work assistance system of claim 9,

wherein the storage body has a plurality of upper-order group
10 identifier each identifying respective one of a plurality of upper-order groups each including groups out of the plurality of groups adjacent to each other, and

wherein the work-instruction unit displays the work to be performed for the certain upper-order group together with the certain
15 upper-order group in a case where the production lots of all of the work objects stored in the storage places of to the certain upper-order group are identical to one another or the work is scheduled for all of the work objects stored in the storage places of the certain upper-order group.