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(54) **AUTOMATIC ANALYZER**

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(57) **ABSTRACT**

A work schedule of a user who uses an automatic analyzer is input from an input unit **120**. A planning section **112** schedules in advance task events required for using the automatic analyzer. A schedule preparing section **113** prepares, from the work schedule input from the input unit and the task events scheduled by the planning section, a time-series task schedule as a list of tasks to be performed by the user within a period of time allocated to him or her. A display unit **130** displays the task schedule prepared by the schedule preparing section. The foregoing arrangements enable specific tasks to be performed by the user within the period of time allocated to him or her to be predicted in advance, the tasks to be efficiently scheduled according to the work schedule of the user, and each and every task to be performed without any omission.

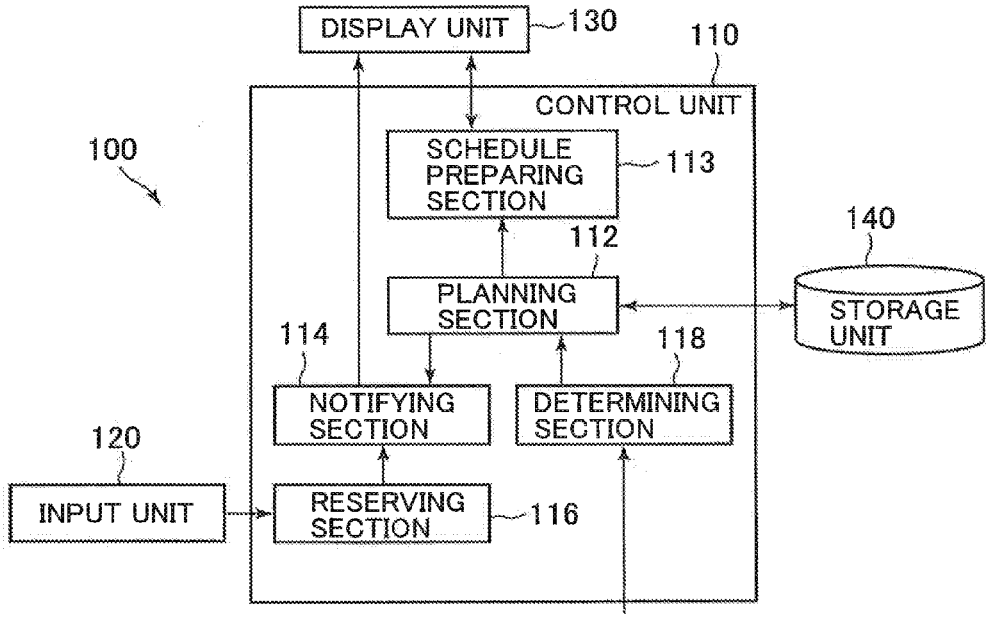


FIG. 1

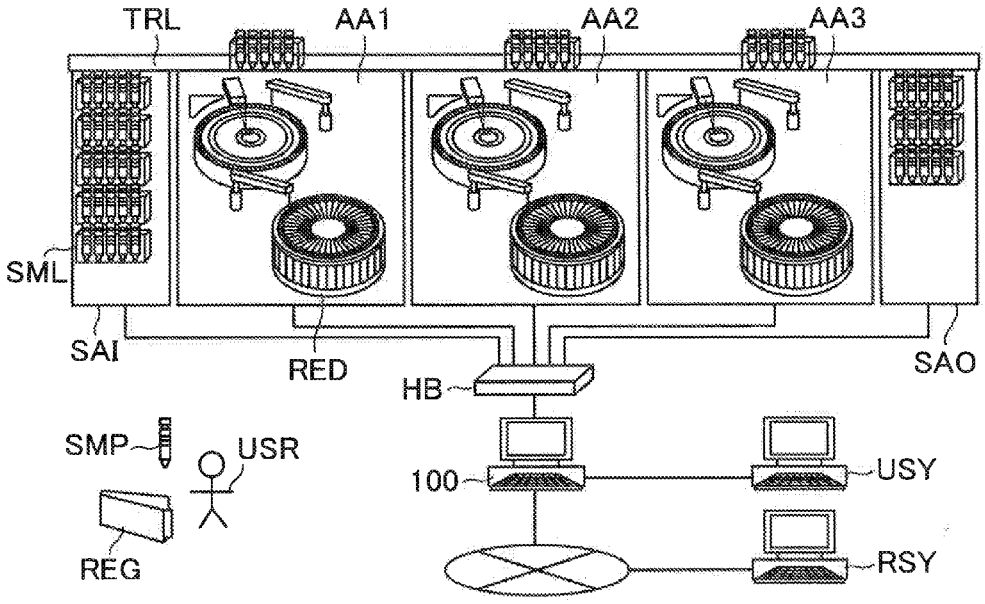

TRL
AA1
AA2
AA3
SML
SAI
RED
HB
SAO
SMP
USR
REG
100
USY
RSY

FIG. 2

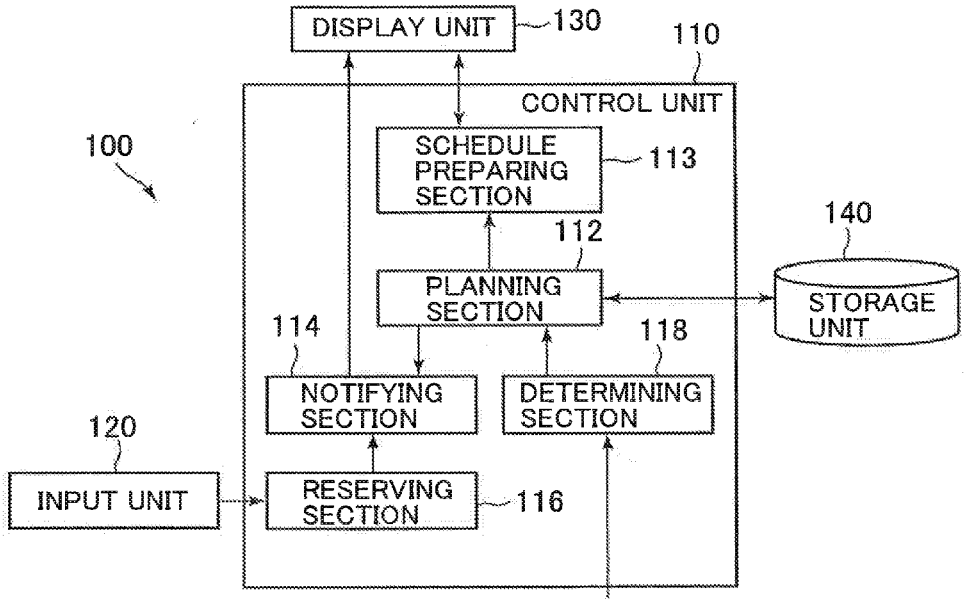

DISPLAY UNIT
130
110
CONTROL UNIT
100
SCHEDULE PREPARING SECTION
113
112
140
PLANNING SECTION
STORAGE UNIT
114
118
NOTIFYING SECTION
DETERMINING SECTION
120
INPUT UNIT
RESERVING SECTION
116

FIG. 3

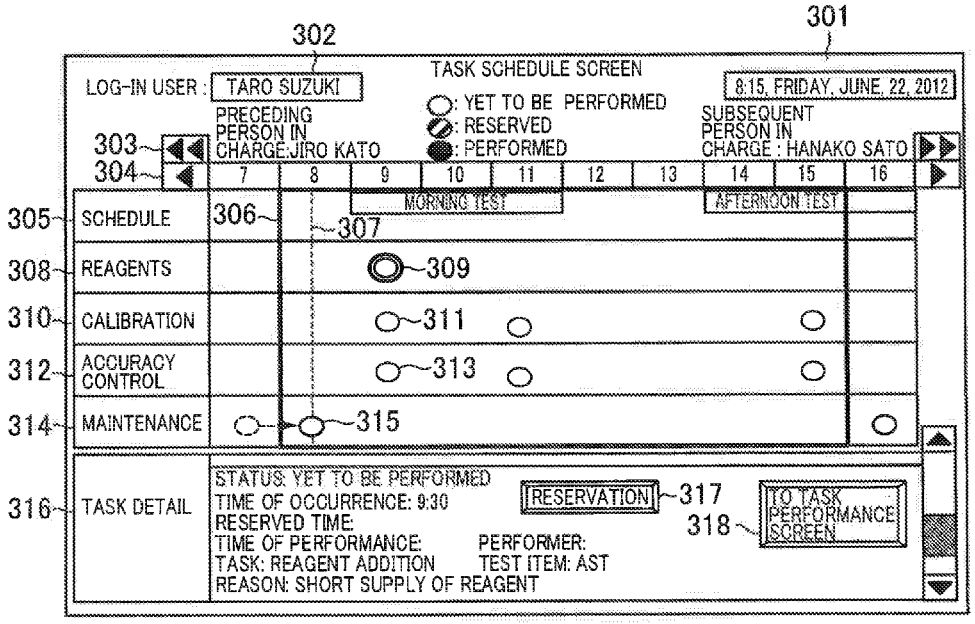

301
302
TASK SCHEDULE SCREEN
LOG-IN USER : TARO SUZUKI
8:15, FRIDAY, JUNE, 22, 2012
: YET TO BE PERFORMED
: RESERVED
: PERFORMED
PRECEDING PERSON IN CHARGE:JIRO KATO
SUBSEQUENT PERSON IN CHARGE : HANAKO SATO
303
304
7 8 9 10 11 12 13 14 15 16
MORNING TEST
AFTERNOON TEST
305 SCHEDULE
306
307
308 REAGENTS
309
310 CALIBRATION
311
312 ACCURACY CONTROL
313
314 MAINTENANCE
315
316 TASK DETAIL
STATUS: YET TO BE PERFORMED
TIME OF OCCURRENCE: 9:30
RESERVED TIME:
TIME OF PERFORMANCE:
PERFORMER:
TASK: REAGENT ADDITION
TEST ITEM: AST
REASON: SHORT SUPPLY OF REAGENT
RESERVATION
317
318
TO TASK PERFORMANCE SCREEN

FIG. 4

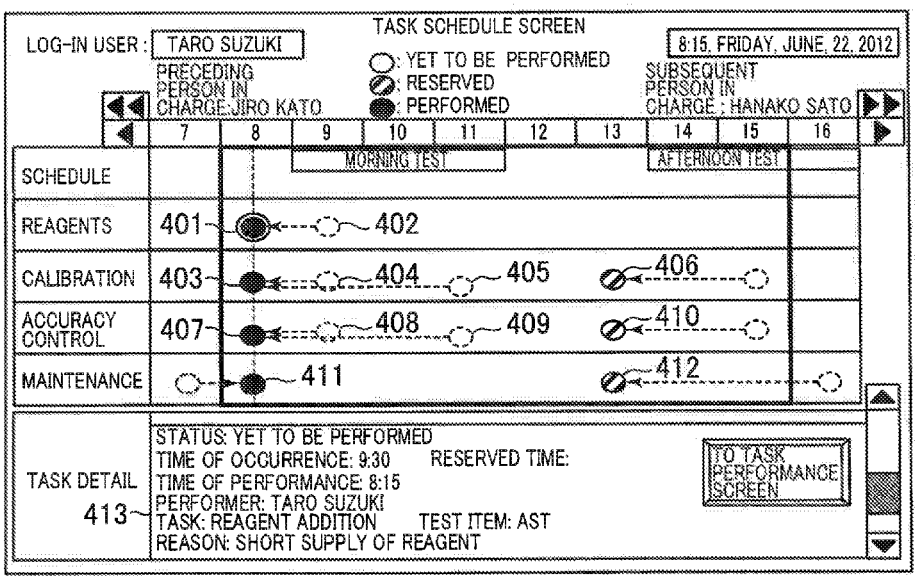

TASK SCHEDULE SCREEN
LOG-IN USER : TARO SUZUKI
8:15, FRIDAY, JUNE, 22, 2012
: YET TO BE PERFORMED
: RESERVED
: PERFORMED
PRECEDING PERSON IN CHARGE:JIRO KATO
SUBSEQUENT PERSON IN CHARGE : HANAKO SATO
7 8 9 10 11 12 13 14 15 16
MORNING TEST
AFTERNOON TEST
SCHEDULE
REAGENTS
401
402
CALIBRATION
403
404
405
406
ACCURACY CONTROL
407
408
409
410
MAINTENANCE
411
412
TASK DETAIL
413
STATUS: YET TO BE PERFORMED
TIME OF OCCURRENCE: 9:30
RESERVED TIME:
TIME OF PERFORMANCE: 8:15
PERFORMER: TARO SUZUKI
TASK: REAGENT ADDITION
TEST ITEM: AST
REASON: SHORT SUPPLY OF REAGENT
TO TASK PERFORMANCE SCREEN

FIG. 5

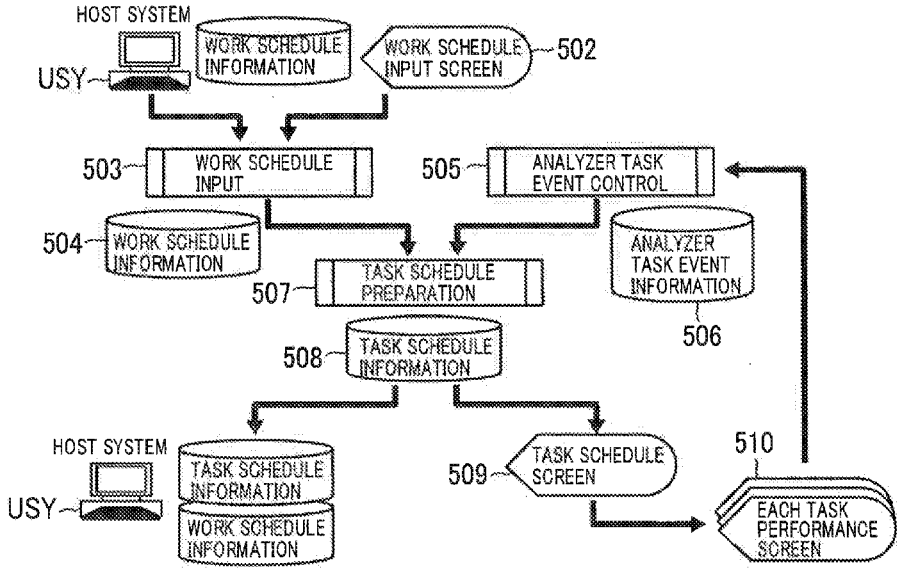

HOST SYSTEM
USY
WORK SCHEDULE INFORMATION
WORK SCHEDULE INPUT SCREEN
502
503
WORK SCHEDULE INPUT
505
ANALYZER TASK EVENT CONTROL
504
WORK SCHEDULE INFORMATION
507
TASK SCHEDULE PREPARATION
ANALYZER TASK EVENT INFORMATION
506
508
TASK SCHEDULE INFORMATION
HOST SYSTEM
USY
TASK SCHEDULE INFORMATION
WORK SCHEDULE INFORMATION
509
TASK SCHEDULE SCREEN
510
EACH TASK PERFORMANCE SCREEN

FIG. 6

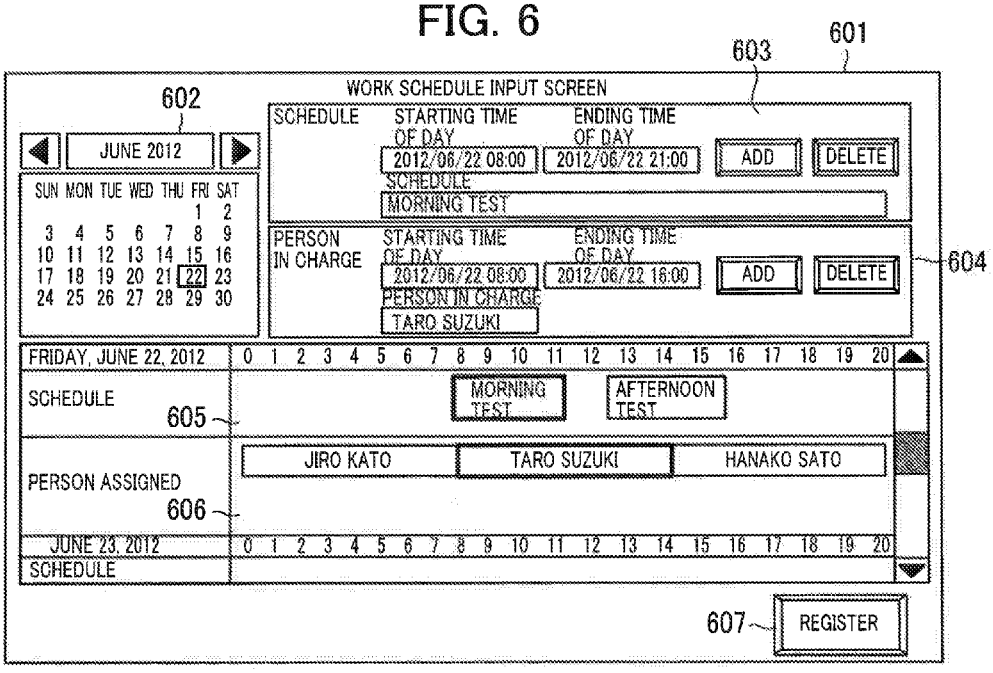

601
603
WORK SCHEDULE INPUT SCREEN
602
JUNE 2012
SUN MON TUE WED THU FRI SAT
1 2
3 4 5 6 7 8 9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30
SCHEDULE
STARTING TIME OF DAY
ENDING TIME OF DAY
2012/06/22 08:00
2012/06/22 21:00
ADD
DELETE
SCHEDULE
MORNING TEST
PERSON IN CHARGE
STARTING TIME OF DAY
ENDING TIME OF DAY
2012/06/22 08:00
2012/06/22 16:00
ADD
DELETE
PERSON IN CHARGE
TARO SUZUKI
604
FRIDAY, JUNE 22, 2012
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
SCHEDULE
605
MORNING TEST
AFTERNOON TEST
PERSON ASSIGNED
606
JIRO KATO
TARO SUZUKI
HANAKO SATO
JUNE 23, 2012
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
SCHEDULE
607
REGISTER

FIG. 7

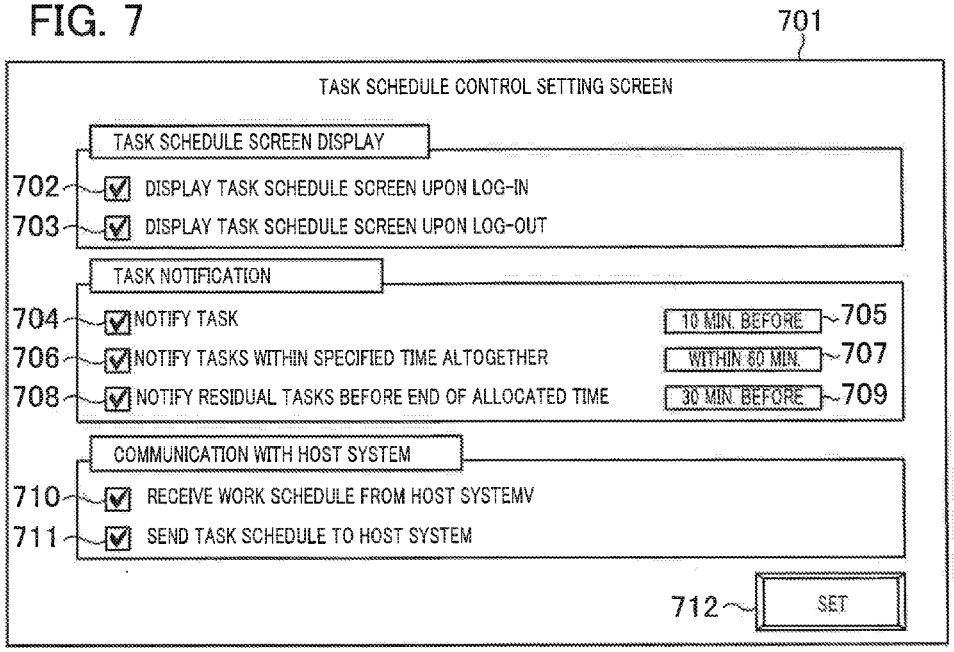

701
TASK SCHEDULE CONTROL SETTING SCREEN
TASK SCHEDULE SCREEN DISPLAY
702
DISPLAY TASK SCHEDULE SCREEN UPON LOG-IN
703
DISPLAY TASK SCHEDULE SCREEN UPON LOG-OUT
TASK NOTIFICATION
704
NOTIFY TASK
10 MIN. BEFORE
705
706
NOTIFY TASKS WITHIN SPECIFIED TIME ALTOGETHER
WITHIN 30 MIN.
707
708
NOTIFY RESIDUAL TASKS BEFORE END OF ALLOCATED TIME
30 MIN. BEFORE
709
COMMUNICATION WITH HOST SYSTEM
710
RECEIVE WORK SCHEDULE FROM HOST SYSTEMV
711
SEND TASK SCHEDULE TO HOST SYSTEM
712
SET

FIG. 8

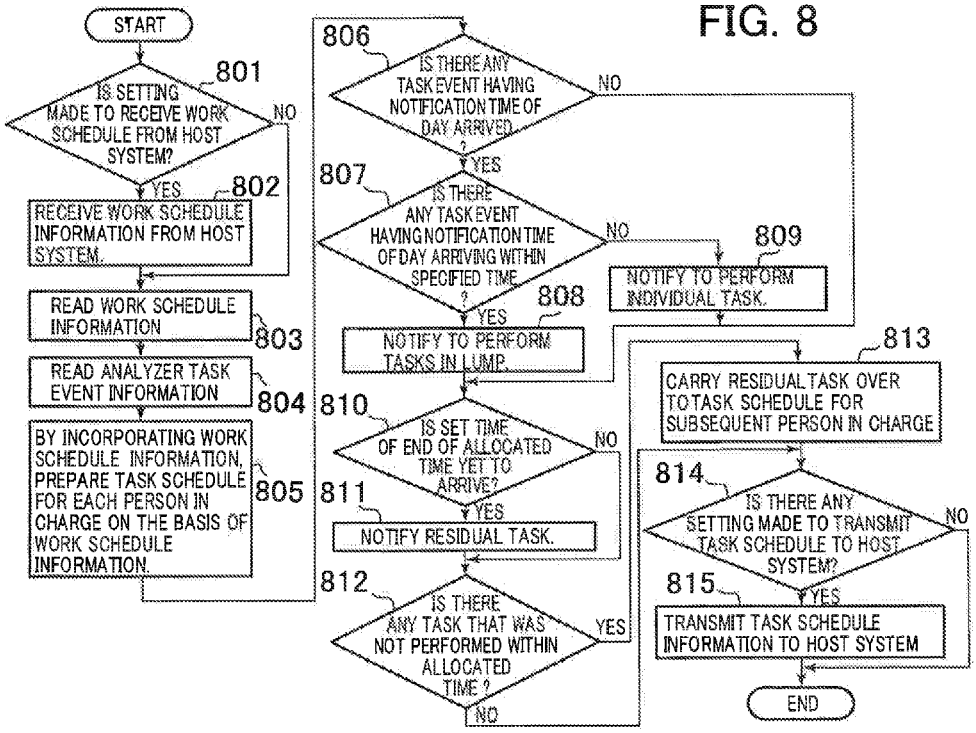
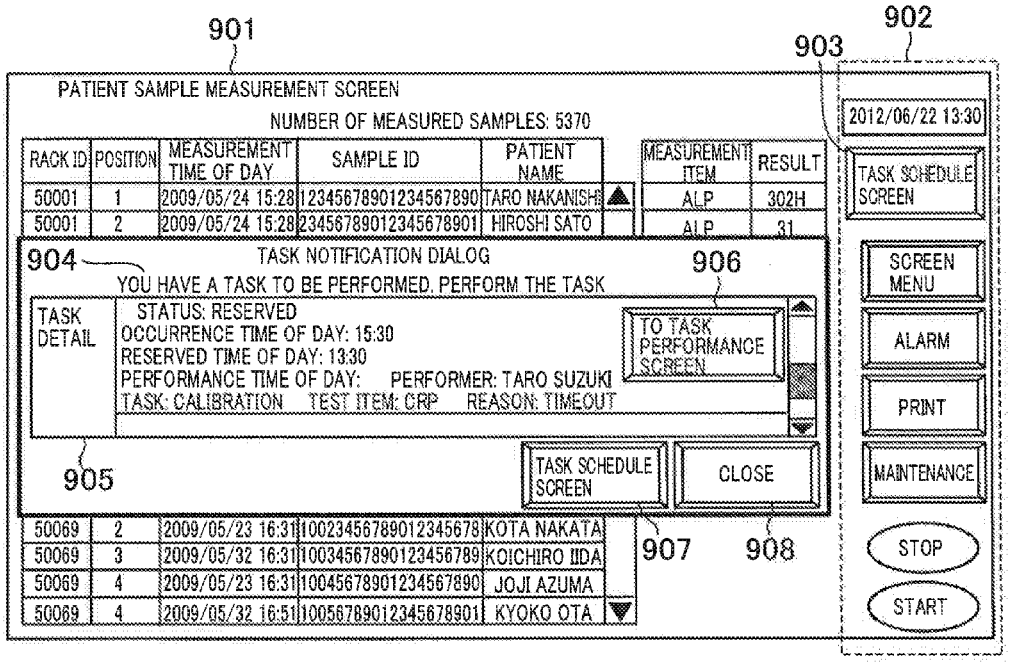

START
801
IS SETTING MADE TO RECEIVE WORK SCHEDULE FROM HOST SYSTEM?
NO
YES
802
RECEIVE WORK SCHEDULE INFORMATION FROM HOST SYSTEM.
READ WORK SCHEDULE INFORMATION
803
READ ANALYZER TASK EVENT INFORMATION
804
BY INCORPORATING WORK SCHEDULE INFORMATION, PREPARE TASK SCHEDULE FOR EACH PERSON IN CHARGE ON THE BASIS OF WORK SCHEDULE INFORMATION.
805
806
IS THERE ANY TASK EVENT HAVING NOTIFICATION TIME OF DAY ARRIVED ?
NO
YES
807
IS THERE ANY TASK EVENT HAVING NOTIFICATION TIME OF DAY ARRIVING WITHIN SPECIFIED TIME ?
NO
809
NOTIFY TO PERFORM INDIVIDUAL TASK.
YES
808
NOTIFY TO PERFORM TASKS IN LUMP.
810
IS SET TIME OF END OF ALLOCATED TIME YET TO ARRIVE?
NO
YES
811
NOTIFY RESIDUAL TASK.
812
IS THERE ANY TASK THAT WAS NOT PERFORMED WITHIN ALLOCATED TIME ?
YES
NO
813
CARRY RESIDUAL TASK OVER TO TASK SCHEDULE FOR SUBSEQUENT PERSON IN CHARGE
814
IS THERE ANY SETTING MADE TO TRANSMIT TASK SCHEDULE TO HOST SYSTEM?
NO
YES
815
TRANSMIT TASK SCHEDULE INFORMATION TO HOST SYSTEM
END

FIG. 9


901
902
903
PATIENT SAMPLE MEASUREMENT SCREEN
NUMBER OF MEASURED SAMPLES: 5370
2012/06/22 13:30
RACK ID
POSITION
MEASUREMENT TIME OF DAY
SAMPLE ID
PATIENT NAME
MEASUREMENT ITEM
RESULT
50001 1 2009/05/24 15:28 12345678901234567890 TARO NAKANISHI ALP 302H
50001 2 2009/05/24 15:28 23456789012345678901 HIROSHI SATO ALP 31
TASK SCHEDULE SCREEN
SCREEN MENU
ALARM
PRINT
MAINTENANCE
904
TASK NOTIFICATION DIALOG
906
YOU HAVE A TASK TO BE PERFORMED. PERFORM THE TASK
TASK DETAIL
STATUS: RESERVED
OCCURRENCE TIME OF DAY: 15:30
RESERVED TIME OF DAY: 13:30
PERFORMANCE TIME OF DAY: PERFORMER: TARO SUZUKI
TASK: CALIBRATION TEST ITEM: CRP REASON: TIMEOUT
TO TASK PERFORMANCE SCREEN
905
TASK SCHEDULE SCREEN
CLOSE
907
908
50069 2 2009/05/23 16:31 10023456789012345678 KOTA NAKATA
50069 3 2009/05/32 16:31 10034567890123456789 KOICHIRO IIDA
50069 4 2009/05/23 16:31 10045678901234567890 JOJI AZUMA
50069 4 2009/05/32 16:51 10056789012345678901 KYOKO OTA
STOP
START

AUTOMATIC ANALYZER

TECHNICAL FIELD

[0001] The present invention relates generally to automatic analyzers that measure biological samples such as blood and urine and, more particularly, to an automatic analyzer that includes a user interface for efficiently planning and controlling a task schedule for a user in the automatic analyzer.

BACKGROUND ART

[0002] Automatic analyzers that perform analysis using a biological sample, such as blood and urine, and a reagent require calibration as an operation to calibrate a calibration curve and accuracy control for allowing the automatic analyzer to maintain its best possible condition at the start of analysis or at predetermined intervals established according to each reagent or as necessary during an analysis process.

[0003] Examples of factors mandating the calibration or accuracy control include, but are not limited to, the lapse of a predetermined period of time for periodically performing the calibration or accuracy control, after a change of reagent bottles, and re-measurement following a measurement failure.

[0004] Calibration is performed using a standard solution having a concentration established according to each item. The calibration or the accuracy control has its own validity period established according to each analysis item. Expiration of the validity period thus calls for new calibration or new accuracy control. The new calibration or the new accuracy control also needs to be performed when, in each analysis item, the reagent in one reagent bottle is used up and a reagent in a new reagent bottle is to be used.

[0005] A known automatic analyzer automatically detects, for example, the lapse of the predetermined period of time established according to each reagent, the expiration of the validity period, and the changeover from one reagent bottle to another and notifies the user that the calibration or the accuracy control needs to be performed (see, for example, Patent Document 1).

PRIOR ART DOCUMENTS

Patent Document

Patent Document 1

[0006] JP-2006-53164-A

SUMMARY OF THE INVENTION

Problem to be Solved by the Invention

[0007] The function of the technique disclosed in patent document 1 is indeed effective in indicating the necessity for calibration or accuracy control for each analysis item immediately at a particular point in time. It is, however, an impending moment when the user knows the necessity for the performance with respect to any one of the factors. No means have so far been available for predicting the necessity for the calibration or accuracy control and preparing an analysis schedule with respect to a predetermined period of time in the future. It has thus been difficult for the user to prepare a standard calibration sample, an accuracy control sample, and reagents for analyzing these samples, and perform analysis according to a planned schedule.

[0008] Recent years have witnessed devices offering higher precision and higher sensitivity to achieve improved performance of the automatic analyzer, which is accompanied by an increase in the number of maintenance functions for maintaining and controlling the automatic analyzer. An example of the maintenance functions includes necessity for replacing a light source of a photometer incorporated in an automatic analyzer at predetermined intervals. Such a maintenance function requires periodic performance and known automatic analyzers did have a function of controlling a time limit. As with the calibration and accuracy control mentioned above, however, it was the last moment when the user knew the necessity for the performance and it has been difficult to perform maintenance on a scheduled basis.

[0009] Furthermore, many of laboratories using automatic analyzers are operated for 24 hours and a plurality of users works in shifts to operate the laboratories. It is thus important for each individual user to perform each and every task event occurring during a period of time allocated to him or her and to transfer his or her duties to the subsequent user.

[0010] The known automatic analyzer, however, had no means of inputting a user's work schedule. The known automatic analyzer simply notifies the user of an event at irregular intervals not operatively associated with the user's work schedule. The automatic analyzer's inability to efficiently schedule tasks and let the user perform the tasks on a scheduled basis can cause omission of a task, posing a serious problem impeding assurance of performance.

[0011] A large-scale testing facility that includes a large number of analyzers to be operated by users and a plurality of users working simultaneously involves occurrence of omission of a task, leading to an even greater possibility of inefficient work.

[0012] It is therefore an object of the present invention to provide an automatic analyzer that enables specific tasks to be performed by a user within a period of time allocated to him or her to be predicted in advance, the tasks to be efficiently scheduled according to a work schedule of the user, and each and every task to be performed without any omission.

Means for Solving the Problem

[0013] To achieve the foregoing object, the present invention provides an automatic analyzer including: an input unit that inputs a work schedule for a user who uses the automatic analyzer; a planning section that schedules in advance task events required for using the automatic analyzer; a schedule preparing section that prepares, from the work schedule input from the input unit and the task events scheduled by the planning section, a time-series task schedule as a list of tasks to be performed by the user within a period of time allocated to him or her; and a display unit that displays the task schedule prepared by the schedule preparing section.

[0014] The foregoing arrangements enable specific tasks to be performed by a user within the period of time allocated to him or her to be predicted in advance, the tasks to be efficiently scheduled according to the work schedule for the user, and each and every task to be performed without any omission.

Effect of the Invention

[0015] The present invention enables specific tasks to be performed by a user within a period of time allocated to him or her to be predicted in advance, the tasks to be efficiently

scheduled according to a work schedule of the user, and each and every task to be performed without any omission.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. **1** is a system configuration diagram showing a general configuration of an automatic analyzer according to an embodiment of the present invention.

[0017] FIG. **2** is a block diagram showing a configuration of an operator unit PC incorporated in the automatic analyzer according to the embodiment of the present invention.

[0018] FIG. **3** is an explanatory drawing illustrating an exemplary task schedule screen in the automatic analyzer according to the embodiment of the present invention.

[0019] FIG. **4** is an explanatory drawing illustrating an exemplary task schedule screen after tasks have been performed and reserved in the automatic analyzer according to the embodiment of the present invention.

[0020] FIG. **5** is an explanatory diagram illustrating a flow of data relating to a task schedule control function in the automatic analyzer according to the embodiment of the present invention.

[0021] FIG. **6** is an explanatory drawing illustrating an exemplary work schedule input screen in the automatic analyzer according to the embodiment of the present invention.

[0022] FIG. **7** is an explanatory drawing illustrating an exemplary task schedule control setting screen in the automatic analyzer according to the embodiment of the present invention.

[0023] FIG. **8** is a flowchart showing steps of task schedule preparing and control processes in the automatic analyzer according to the embodiment of the present invention.

[0024] FIG. **9** is an explanatory drawing illustrating an exemplary task notifying dialog screen in the automatic analyzer according to the embodiment of the present invention.

MODES FOR CARRYING OUT THE INVENTION

[0025] A configuration and operations of an automatic analyzer according to an embodiment of the present invention will be described below with reference to FIGS. **1** to **9**.

[0026] A general configuration of the automatic analyzer according to the embodiment will first be described with reference to FIG. **1**.

[0027] FIG. **1** is a system configuration diagram showing a general configuration of the automatic analyzer according to the embodiment of the present invention.

[0028] The automatic analyzer according to the embodiment includes, for example, three analyzing units AA**1**, AA**2**, and AA**3** connected in series with each other. The automatic analyzer, though including three analyzing units in this embodiment, may include any other numbers of analyzing units including one. The automatic analyzer further includes a transfer line TRL that transfers sample racks. The transfer line TRL is disposed adjacent to each of the analyzing units AA**1**, AA**2**, and AA**3**. Additionally, the automatic analyzer includes a sample loading unit SAI disposed on a first end portion side of each of the analyzing units AA**1**, AA**2**, and AA**3** and a sample storing unit SAO disposed on a second end portion side.

[0029] A user USR mounts a sample SMP to be subjected to calibration measurement, accuracy control sample measurement, and patient sample measurement on a sample rack SML. A plurality of samples can be mounted on the sample rack SML. The sample rack SML on which samples are mounted is disposed at the sample loading unit SAI. The sample racks SML thus disposed are loaded in sequence onto the transfer line TRL and conveyed onto the analyzing units AA**1**, AA**2**, and AA**3** that perform analysis on the samples. The analyzing units AA**1**, AA**2**, and AA**3** each recognize the sample rack SML and the sample SMP and perform analysis required for the sample SMP. The analyzing units AA**1**, AA**2**, and AA**3** each include a reagent disk RED that houses a plurality of reagents REG used for performing analysis. The reagents REG required for the analysis are loaded in the reagent disk RED by the user in advance of the analysis. The sample rack SML that has undergone the required analysis is conveyed onto the sample storing unit SAO.

[0030] The sample loading unit SAI, the analyzing units AA**1**, AA**2**, and AA**3**, and the sample storing unit SAO are each connected through a network cable to an operator unit PC **100** of the automatic analyzer via a hub HB. The operator unit PC **100** is connected to a host system USY over a network.

[0031] The user makes an analysis request (measurement request) for each sample from the host system USY or the operator unit PC **100** and mounts the sample to be analyzed on the sample rack SML and loads the sample rack SML onto the sample loading unit SAI. Information of the analysis request is transmitted to the analyzing units AA**1**, AA**2**, and AA**3** over the network and analyses by the analyzing units AA**1**, AA**2**, and AA**3** are transmitted to the operator unit PC **100** and the host system USY.

[0032] The operator unit PC **100** is also connected to a remote system RSY via a public network. The remote system RSY stores information, such as analysis parameters that represent analysis condition information using reagents to be used in the automatic analyzer. The remote system RSY delivers the analysis parameters upon request from the operator unit PC **100**. The delivered analysis parameters are stored in the operator unit PC **100** and transmitted to the analyzing units AA**1**, AA**2**, and AA**3** during analysis of samples.

[0033] A task schedule control function according to the embodiment can achieve the best possible result from standpoints of system configuration and operability when the operator unit PC **100** includes a screen interface. The operator unit PC **100** creates task schedule information for each person in charge using work schedule information input from the operator unit PC **100** or the host system USY or the remote system RSY that assumes an upper system of the automatic analyzer and task event information of the automatic analyzer controlled by the operator unit PC **100**.

[0034] The user can check specific tasks to be performed by him or her on a task schedule screen displayed on the operator unit PC **100** to thereby formulate an efficient task plan in line with a work schedule.

[0035] Alternatively, the host system or the remote system as an upper system may include a task schedule control unit according to a use mode of the user, thereby achieving the function through an exchange of information via the network between the operator unit PC and the analyzing unit.

[0036] A configuration of the operator unit PC **100** incorporated in the automatic analyzer according to the embodiment will be described below with reference to FIG. **2**.

[0037] FIG. **2** is a block diagram showing a configuration of the operator unit PC incorporated in the automatic analyzer according to the embodiment of the present invention.

[0038] The operator unit PC **100** mainly includes a control unit **110**, an input unit **120**, a display unit **130**, and a storage

unit **140**. The input unit **120** includes a keyboard and a mouse. The input unit **120** allows a button displayed on the display unit **130** to be depressed (clicked with the mouse) and a numeral or a character to be input into an input field displayed on the display unit **130**. The input unit **120** and the display unit **130** constitute a graphical user interface (GUI).

[0039] The control unit **110** includes a planning section **112**, a schedule preparing section **113**, a notifying section **114**, a reserving section **116**, and a determining section **118**. Functions and operations of these sections will be described later.

[0040] The storage unit **140** stores the work schedule information and the task event information. The planning section **112** uses the foregoing information to prepare a task schedule.

[0041] An exemplary task schedule screen in the automatic analyzer according to the embodiment will be described below with reference to FIG. **3**.

[0042] FIG. **3** is an explanatory drawing illustrating an exemplary task schedule screen in the automatic analyzer according to the embodiment of the present invention.

[0043] A task schedule screen **301** is displayed on the display unit **130** shown in FIG. **2**. The task schedule screen **301** displays as a time schedule a list of tasks to be performed by the user who has logged in to the operator unit PC **100** within a period of time allocated to him or her.

[0044] A log-in user **302** field displays the name of the user who has currently logged in. By default, the task schedule screen **301** displays the task schedule of the log-in user during a corresponding time slot at the center thereof, making the display optimum for the operating user.

[0045] Person-in-charge advance/retreat buttons **303** are used to display the task schedule for persons-in-charge who precede and follow the log-in user. Time advance/retard buttons **304** are used to scroll up and down the display of the task schedule by the hour. Using the person-in-charge advance/retreat buttons **303** and the time advance/retard buttons **304**, the user can check not only the task schedule of him or her own, but also statuses of tasks of the preceding person in charge and tasks scheduled for the subsequent person in charge.

[0046] A schedule display area **305** displays schedules of a hospital and a laboratory. A reagent task display area **308** displays a reagent task event **309**, such as a reagent addition necessitated as a result of a short reagent supply. A calibration task display area **310** displays a calibration task event **311**, such as calibration measurement that accompanies a reagent addition or a timeout. An accuracy control task display area **312** displays an accuracy control task event **313**, such as accuracy control measurement that accompanies a reagent addition or a timeout. A maintenance task display area **314** displays a maintenance task event **315**, such as maintenance performance that accompanies a timeout or a part replacement. Preferably, to enhance visibility, a mark that represents each of these task events is changed according to the status of performance of the task.

[0047] Additionally, the task schedule screen **301** displays an allocated time frame **306** of the log-in user and a current time of day line **307**.

[0048] The foregoing display allows the person in charge to readily check the tasks to be performed within the period of time allocated to him or her and to confirm a specific timing at which each of the tasks in the schedules of the hospital and the laboratory occurs, thereby enabling the person in charge to determine whether the tasks can be performed efficiently.

[0049] The type of the task events displayed on the screen is optimally concerned with the most critical reagent, calibration, accuracy control, and maintenance in terms of assurance of performance as the automatic analyzer, as exemplified on the exemplary screen; preferably, however, the type of the task events can be customized according to the purpose of the user. In the display example shown in FIG. **3**, it is known that the reagent task event **309**, the calibration task event **311**, the accuracy control task event **313**, and the like can be predicted to occur during the afternoon test, so that the morning test is likely to be interrupted. It is noted that the maintenance task event **315**, displayed by a broken-line circle and a solid-line circle connected to each other, indicates that the task not performed by the preceding person in charge is carried over to the log-in user.

[0050] A task detail display area **316** displays details of the task event selected on the screen. FIG. **3** shows an exemplary condition in which the reagent task event **309** is selected. In FIG. **3**, the reagent task event **309** in the reagent task display area **308** is encircled by a thick-line ring, indicating that reagent task event **309** is exemplarily selected. In actual screens, the circle mark of, for example, a selected event is colored differently from others, indicating that the event is selected.

[0051] The task detail display area **316** displays task performance status, occurrence time of day, reserved time of day, performance time of day, performer, and task detail. The task detail display area **316** includes a task reserving button **317** used for reserving a task in advance at a convenient time of day when the occurrence time of day falls at an inconvenient time for reasons of scheduling as described above. The task detail display area **316** further includes a task performance screen shift button **318** that allows each task performance screen for performing a corresponding task to be directly accessed for quick performance of the task. Automatically displaying the task schedule screen **301** as described above upon a user's login to the operator unit PC **100** enables the user to check the specific task to be performed within the period of time allocated to him or her, thereby formulating an efficient task plan. In addition, automatically displaying the task schedule screen **301** upon the user's log-out from the operator unit PC **100** enables the user to check that none of the tasks are left undone during the period of time allocated to him or her.

[0052] The following describes with reference to FIG. **4** an exemplary task schedule screen after tasks have been performed and reserved in the automatic analyzer according to the embodiment of the present invention.

[0053] FIG. **4** is an explanatory drawing illustrating the exemplary task schedule screen after tasks have been performed and reserved in the automatic analyzer according to the embodiment of the present invention.

[0054] In the display example shown in FIG. **3**, it is known that the reagent task event, the calibration task event, the accuracy control task event, and the like can be predicted to occur during the afternoon test, so that the morning test is likely to be interrupted.

[0055] In contrast, the user performs each of a reagent task event **402**, calibration task events **404** and **405**, accuracy control task events **408** and **409**, and a maintenance task event **411** prior to the morning test. This results in a display of "performed" statuses, such as a reagent task event **401**, a calibration task event **403**, an accuracy control task event **407**, the maintenance task event **411**, and a task detail display area

413. In addition, connected lines and broken lines are used to facilitate a ready understanding of correspondence to the task events **402**, **404**, **405**, **408**, and **409** originally displayed at the occurrence time of day. Specifically, a task indicated by a broken-line circle (e.g., the task event **402**) is displayed as a solid-black circle, performed task (e.g., the task event **401**) and the broken-line circle and the solid-black circle are connected to each other by a broken-line arrow.

[0056] In addition, to ensure that the calibration task event, the accuracy control task event, and the maintenance task event that can be predicted to occur during the afternoon test can be performed in advance of the afternoon test, tasks are reserved as with task events **406**, **410**, and **412** prior to the afternoon test. Specifically, a task indicated by a broken-line circle is displayed as a hatched circle (e.g., the task event **406**) and the broken-line circle and the hatched circle are connected to each other by a broken-line arrow. Performance of a task to be performed during the period of time allocated to the subsequent person in charge, such as the task event **412**, in particular, can be expected to achieve a benefit of, for example, reducing a workload on the subsequent person in charge particularly when, for example, the subsequent person in charge is a novice at the automatic analyzer.

[0057] Additionally, a comprehensive schedule control not only for the task events on the automatic analyzer but also in working can be achieved by a function that allows the user to register any desired schedule provided in the schedule display area **305** shown in FIG. **3**. The display and task reserving functions as described above enables task performance statuses to be readily checked and an efficient task plan to be formulated in line with the work schedule.

[0058] The following describes with reference to FIG. **5** a flow of data relating to a task schedule control function in the automatic analyzer according to the embodiment of the present invention.

[0059] FIG. **5** is an explanatory diagram illustrating a flow of data relating to the task schedule control function in the automatic analyzer according to the embodiment of the present invention.

[0060] A work schedule input process **503** creates work schedule information **504** through a reception from the host system USY connected to the network or an input from a work schedule input screen **502** on the operator unit PC **100**.

[0061] An analyzer task event control process **505** creates and controls analyzer task event information **506** relating to the reagent, calibration, accuracy control, and maintenance tasks that can be predicted to occur from parameter and reagent information registered in the analyzer and measurement and maintenance records.

[0062] A task schedule preparing process **507** creates task schedule information **508** for each person in charge on the basis of the work schedule information **504** and the analyzer task event information **506**. The created task schedule information **508** is displayed on a task schedule screen **509**. Additionally, the task schedule information **508** is transmitted to the host system USY connected to the network.

[0063] The user checks the task on the task schedule screen and accesses each task performance screen **510** to perform each task. The performed task event is fed back to the analyzer task event control process **505** and the analyzer task event information **506** is then updated.

[0064] The following describes a correspondence between the elements shown in FIG. **2** and those shown in FIG. **5**.

[0065] The planning section **112** shown in FIG. **2** schedules in advance the task events required for using the analyzer, performing the analyzer task event control process **505** shown in FIG. **5**.

[0066] The schedule preparing section **113** shown in FIG. **2** prepares, on the basis of the work schedule and task events, a time-series task schedule chart that represents a list of tasks to be performed by the user within the period of time allocated to him or her. The schedule preparing section **113** performs the task schedule preparing process **507** shown in FIG. **5**.

[0067] The notifying section **114** shown in FIG. **2** prompts the user to perform a task when a reserved time of day arrives by way of a task notifying dialog screen **904** to be described later with reference to FIG. **9**.

[0068] The reserving section **116** shown in FIG. **2** allows the user to set any scheduled performance time of day for a task event on the task schedule. Data input by an operator is set through depression of the task reserving button **317** shown in FIG. **3**.

[0069] The determining section **118** shown in FIG. **2** recognizes the task performed on the analyzer to thereby automatically determine whether a task event displayed on the task schedule chart has been, or has yet to be, performed. The determining section **118** performs the analyzer task event control process **505** shown in FIG. **5**.

[0070] The input unit **120** shown in FIG. **2** allows a work schedule of a user who uses the analyzer to be input. As described earlier, the input unit **120**, and the display unit **130** that displays whether tasks have been performed or not on the task schedule chart, constitute the GUI.

[0071] The storage unit **140** shown in FIG. **2** stores the work schedule information **504**, the analyzer task event information **506**, and the task schedule information **508** shown in FIG. **5**.

[0072] The following describes an operation of each element with reference to a specific example.

[0073] The schedule preparing section **113** prepares, on the basis of the work schedule and task events, a time-series task schedule chart that represents a list of tasks to be performed by the user within the period of time allocated to him or her. The prepared task schedule chart is displayed, for example, on the task schedule screen **301** shown in FIG. **3**. For example, a person in charge who has logged in views the task schedule screen **301** and depresses the task performance screen shift button **318** in an attempt to perform the reagent task event **309**. This causes the display screen on the display unit **130** to display a procedure for a reagent addition task. Following the procedure, the person in charge performs the reagent addition task. On completing the reagent addition, the person in charge depresses, for example, a "reagent addition completion" button displayed on the display unit **130**. This causes the schedule preparing section **113** to recognize that the task in question has been completed.

[0074] Meanwhile, the schedule preparing section **113** recognizes that the task in question is yet to be performed until the "reagent addition completion" button is depressed. It is noted that the determining section **118** shown in FIG. **2** determines, for example, whether a task is yet to be performed.

[0075] For example, when the time slot shifts from that of the preceding person in charge to that of the current person in charge when the maintenance task to be performed by the preceding person in charge displayed in the maintenance task display area **314** of FIG. **3** is yet to be performed, the schedule preparing section **113** displays the maintenance task yet to be

performed as the maintenance task event **315** of the person in charge in question in the task schedule screen **301** of FIG. **3**.

[0076] Alternatively, when the reagent task event **402** relating to the reagent addition shown in FIG. **4** is performed ahead of schedule, for example, the task performance screen shift button **318** is depressed and a procedure for the reagent addition task displayed on the display screen of the display unit **130** is followed and performed. When the reagent addition is then completed, the "reagent addition completion" button displayed on the display unit **130** is depressed. This results in the reagent addition task in question being assumed to be completed in the analyzer task event control process **505** shown in FIG. **5**, so that the analyzer task event information **506** is updated. Through the task schedule preparing process **507**, the schedule preparing section **113** refers to the analyzer task event information **506** to thereby recognize that the task in question has been completed. The task in question is then displayed as the performed task event **401** of FIG. **4** on the task schedule screen **301**.

[0077] To reserve a task ahead of the afternoon test in order for the calibration task event **406** shown in FIG. **4** to be performed ahead of the afternoon test, the calibration task event **406** is selected. Then, the detail of the calibration task event **406** is displayed as in the task detail display area **316** of FIG. **3**. The person in charge then enters, for example, "8:30" in the "reserved time of day" field and depresses the task reserving button **317**. As a result, through the analyzer task event control process **505** shown in FIG. **5**, the analyzer task event information **506** is updated to incorporate the changed reserved time of day. Through the task schedule preparing process **507**, the schedule preparing section **113** refers to the analyzer task event information **506** to thereby display the revised task schedule on the task schedule screen **301** like the calibration task event **406** of FIG. **4**.

[0078] The following describes with reference to FIG. **6** an exemplary work schedule input screen in the automatic analyzer according to the embodiment of the present invention.

[0079] FIG. **6** is an explanatory drawing illustrating an exemplary work schedule input screen in the automatic analyzer according to the embodiment of the present invention.

[0080] A work schedule input screen **601** is used by a user in the capacity of an administrator or equivalent to register a daily test schedule and assignment of persons in charge. The work schedule input screen **601** is mounted on the operator unit PC of the automatic analyzer or the host system connected by the network. Large-scale hospitals and laboratories have a large number of analyzers and a large number of persons in charge, so that it is efficient and ideal to mount the work schedule input screen **601** in the host system thereby achieving integrated control.

[0081] A calendar **602** is used for selecting a date of the test schedule and personnel assignment. With respect to the selected date, specific times of day are specified to set up a schedule in a schedule input area **603**. The input schedule is displayed in a schedule display area **605**.

[0082] In addition, times of day is specified and the person in charge is entered in a person in charge input area **604**. A personnel assignment display area **606** displays the entered persons in charge assigned.

[0083] The input information on the schedule and personnel assignment is saved by the depression of a register button **607**. It is noted that a configuration of the work schedule input screen **601** mounted on the host system involves control of a plurality of automatic analyzers. As a result, information for identifying a specific automatic analyzer is added and the screen is laid out to allow a schedule for each individual automatic analyzer to be input.

[0084] The following describes with reference to FIG. **7** an exemplary task schedule control setting screen in the automatic analyzer according to the embodiment of the present invention.

[0085] FIG. **7** is an explanatory drawing illustrating an exemplary task schedule control setting screen in the automatic analyzer according to the embodiment of the present invention.

[0086] A task schedule control setting screen **701** provides a screen for setting, for example, screen display, task notification, and communication with the host system in the task schedule control function.

[0087] A log-in task schedule display setting field **702** is used to set whether or not to automatically display the task schedule screen of the log-in user when a user logs in to the system on the operator unit PC.

[0088] Similarly, a log-out task schedule display setting field **703** is used to set whether or not to automatically display the task schedule screen of the log-in user when the user logs out from the system.

[0089] The task schedule screen display function described above allows the user to check the schedule of a specific task he or she is required to perform within the period of time allocated to him or her upon his or her log-in to the system, thereby allowing the user to formulate an efficient task plan. In addition, the task schedule screen display function allows the user to check that none of the tasks are left undone when he or she logs out from the system.

[0090] A task notification setting field **704** is used to set whether or not to give a notification display that prompts the user to perform a task when an occurrence time of day of each task event arrives or a reserved time of day when the user so sets arrives. A task notification time setting field **705** is used to set a time at which an advance task notification is performed.

[0091] A collective task notification setting field **706** and a collective task notification time setting field **707** are used to set, when a first task event encounters a task time of day, whether or not to give a notification display for recommending collective performance of tasks that encounter respective task times of day within a predetermined period of time that begins with the task time of day of the first task event.

[0092] An advance task notification before allocated time end setting field **708** and an advance task notification before allocated time end time setting field **709** are used to set to notify residual tasks before a predetermined period of time of an allocated time end arrives. The foregoing task notification functions prompt the user to perform tasks, thus preventing omission of a task.

[0093] The times set in the task notification setting field **704**, the task notification time setting field **705**, the collective task notification setting field **706**, the collective task notification time setting field **707**, the advance task notification before allocated time end setting field **708**, and the advance task notification before allocated time end time setting field **709** are controlled by the notifying section **114** shown in FIG. **2**. When a reserved time arrives, the notifying section **114** notifies the user of performance of a corresponding task using the task notifying dialog screen **904** to be described later with reference to FIG. **9**.

[0094] A work schedule host system reception setting field **710** is used to set whether or not to receive the work schedule

information required for creating the task schedule information from the host system connected to the network. A task schedule host system transmission setting field **711** is used to set whether or not to transmit the created task schedule information to the host system.

[0095] Providing the foregoing functions to communicate with the host system enables information to be shared between the host system and the automatic analyzer, thus allowing the host system to efficiently provide integrated control of a plurality of automatic analyzers and a plurality of users in large-scale hospitals and testing facilities.

[0096] The information input through the task schedule control setting screen **701** is saved by depression of a set button **712**.

[0097] The following describes with reference to FIG. **8** steps of task schedule preparing and control processes in the automatic analyzer according to the embodiment of the present invention.

[0098] FIG. **8** is a flowchart showing steps of the task schedule preparing and control processes in the automatic analyzer according to the embodiment of the present invention.

[0099] In step **801**, it is determined whether a setting is made to receive a work schedule from the host system. If the setting is made, the work schedule information is received from the host system connected to the network in step **802**.

[0100] In step **803**, work schedule information is read. If it is determined in step **801** that the setting is not made, the work schedule information registered in the work schedule input screen on the operator unit PC is to be read.

[0101] Then in step **804**, analyzer task event information relating to the reagent, calibration, accuracy control, and maintenance tasks that can be predicted to occur from parameter and reagent information registered in the analyzer and measurement and maintenance records is read.

[0102] In step **805**, a task schedule for each person in charge is prepared on the basis of the work schedule information read in step **803** and by incorporating the analyzer task event information read in step **804**. The steps up to step **805** constitute a process for preparing the task schedule.

[0103] Subsequent steps constitute a process for controlling the task schedule. In step **806**, it is determined whether there is any task event having the notification time of day arrived. If it is determined that there is such a task event, it is then determined in step **807** whether there is any task event having the notification time of day arriving within a specified period of time. If it is determined that there is such a task event, the user is notified in step **808** to perform applicable tasks collectively. If it is determined that there is no such task events, the user is notified in step **809** to perform the individual task.

[0104] Exemplary cases in which it is appropriate to perform tasks collectively include the following. For example, with respect to the reagent addition task, timing at which to add the reagent depends on the amount of reagent still available for use, thus varying from one reagent to another. Assume, however, a case, for example, in which a task event for adding a second reagent is scheduled to occur 10 minutes after a task event for adding a first reagent. Labor of reagent addition can be saved if the addition of the first reagent and the addition of the second reagent are successively performed. It is determined to be appropriate to perform tasks collectively in such a case.

[0105] It is common practice to perform calibration at predetermined time intervals for fear of deterioration of the reagent. In contrast, accuracy control is typically performed each time a predetermined number of samples have been measured. In a case, for example, in which the calibration and the accuracy control for a particular reagent are scheduled to occur at different timings apart slightly from each other, performing the calibration and the accuracy control in sequence is more efficient. In such a case, it is determined to be appropriate to perform the tasks collectively.

[0106] Then, in step **810**, it is determined whether a set time of the end of an allocated period of time is yet to arrive. If it is determined that the set time is yet to arrive, the user is notified in step **811** to perform task events yet to be performed within the allocated period of time as residual tasks.

[0107] In step **812**, it is determined whether there is any task that was not performed within the allocated period of time. If it is determined that there is such a task, the residual task is carried over to the task schedule for the subsequent person in charge in step **813**.

[0108] Finally in step **814**, it is determined whether there is any setting made to transmit the task schedule to the host system. If it is determined that there is such a setting made, the task schedule information is transmitted to the host system in step **815**.

[0109] The following describes with reference to FIG. **9** an exemplary task notifying dialog screen in the automatic analyzer according to the embodiment of the present invention.

[0110] FIG. **9** is an explanatory drawing illustrating an exemplary task notifying dialog screen in the automatic analyzer according to the embodiment of the present invention.

[0111] When a task performance time of day arrives, the task notifying dialog screen **904** appears to prompt the user to perform the task. FIG. **9** represents a case in which the task notifying dialog screen **904** is displayed while the user is using a patient sample measurement screen **901**.

[0112] The task notifying dialog screen **904** displays details of a specific task prompted to be performed in a task detail display area **905**. A plurality of tasks, if involved, is displayed in a list format. Depression of a task performance screen shift button **906** displayed for each task causes the screen to shift directly to each task performance screen for performing the corresponding task, allowing the task to be quickly performed.

[0113] Depression of a task schedule screen shift button **907** causes the screen to shift to the task schedule screen, allowing the task schedule to be confirmed.

[0114] Depression of a close button **908** closes the task notifying dialog screen.

[0115] Providing the task notification function as described above allows the user to be notified of a task at a scheduled time of day even when he or she is performing another task, thus preventing omission of a task.

[0116] A task schedule screen shift button **903** is used to display the task schedule screen. Preferably, the task schedule screen shift button **903** is disposed in a global screen-independent display area **902** that is not dependent on the display of each screen such that the task schedule screen can be accessed and displayed from any other screen.

[0117] As described heretofore, in the embodiment, the advance input of the user's work schedule allows the time-series task schedule chart that represents a list of tasks to be performed by the user within the period of time allocated to him or her to be displayed when the user logs in to the operator

unit of the automatic analyzer. The user can thereby check the specific task to be performed at the start of work, thus being able to formulate an efficient task plan in line with his or her work schedule.

[0118] In addition, the function of automatically notifying the user of the scheduled time of day for a task and of a task yet to be performed to thereby prompt the user to perform the tasks and the function of carrying a task yet to be performed over to the subsequent person in charge prevent omission of tasks. Additionally, an inquiry about task schedules of the preceding and subsequent persons in charge enables a task performance status to be confirmed and a task to which the person in charge is not accustomed to be performed ahead of the schedule.

[0119] Additionally, providing the communication function that receives information on the user's work schedule from the host system that integrally controls a plurality of automatic analyzers connected over the network and transmits information on the prepared task schedule to the host system enables the host system to integrally control the task schedule encompassing tasks to be performed by the user for the automatic analyzers within the period of time allocated to him or her. A workload on the user can thus be lessened and an efficient control of the task schedule can be achieved in a large-scale testing facility.

DESCRIPTION OF REFERENCE SYMBOLS

[0120] **100** Operator unit PC
[0121] **110** Control unit
[0122] **120** Input unit
[0123] **130** Display unit
[0124] **140** Storage unit
[0125] **112** Planning section
[0126] **113** Schedule preparing section
[0127] **114** Notifying section
[0128] **116** Reserving section
[0129] **118** Determining section
[0130] AA Analyzing unit
[0131] HB Hub
[0132] RED Reagent disk
[0133] REG Reagent
[0134] RSY Remote system
[0135] SAI Sample loading unit
[0136] SAO Sample storing unit
[0137] SML Sample rack
[0138] SMP Sample
[0139] TRL Transfer line
[0140] USR User
[0141] USY Host system
[0142] **301** Task schedule screen
[0143] **302** Log-in user
[0144] **303** Person-in-charge advance/retreat buttons
[0145] **304** Time advance/retard buttons
[0146] **305** Schedule display area
[0147] **306** Allocated time frame
[0148] **307** Current time of day line
[0149] **308** Reagent task display area
[0150] **309** Reagent task event
[0151] **310** Calibration task display area
[0152] **311** Calibration task event
[0153] **312** Accuracy control task display area
[0154] **313** Accuracy control task event
[0155] **314** Maintenance task display area
[0156] **315** Maintenance task event
[0157] **316** Task detail display area
[0158] **317** Task reserving button
[0159] **318** Task performance screen shift button
[0160] **401**, **402** Reagent task event
[0161] **403** to **406** Calibration task event
[0162] **407** to **410** Accuracy control task event
[0163] **411**, **412** Maintenance task event
[0164] **413** Task detail display area
[0165] **502** Work schedule input screen
[0166] **503** Work schedule input process
[0167] **504** Work schedule information
[0168] **505** Analyzer task even control process
[0169] **506** Analyzer task event information
[0170] **507** Task schedule preparing process
[0171] **508** Task schedule information
[0172] **509** Task schedule screen
[0173] **510** Each task performance screen
[0174] **601** Work schedule input screen
[0175] **602** Calendar
[0176] **603** Schedule input area
[0177] **604** Person in charge input area
[0178] **605** Schedule display area
[0179] **606** Personnel assignment display area
[0180] **607** Register button
[0181] **701** Task schedule control setting screen
[0182] **702** Log-in task schedule display setting
[0183] **703** Log-out task schedule display setting
[0184] **704** Task notification setting
[0185] **705** Task notification time setting
[0186] **706** Collective task notification setting
[0187] **707** Collective task notification time setting
[0188] **708** Advance task notification before allocated time end setting
[0189] **709** Advance task notification before allocated time end time setting
[0190] **710** Work schedule host system reception setting
[0191] **711** Task schedule host system transmission setting
[0192] **712** Set button
[0193] **801** to **815** Flowchart steps
[0194] **901** Patient sample measurement screen
[0195] **902** Screen-independent display area
[0196] **903** Task schedule screen shift button
[0197] **904** Task notifying dialog screen
[0198] **905** Task detail display area
[0199] **906** Task performance screen shift button
[0200] **907** Task schedule screen shift button
[0201] **908** Close button

1. An automatic analyzer comprising:
an input unit that inputs a work schedule for a user who uses the automatic analyzer;
a planning section that schedules in advance task events required for using the automatic analyzer;
a schedule preparing section that prepares, from the work schedule input from the input unit and the task events scheduled by the planning section, a time-series task schedule as a list of tasks to be performed by the user within a period of time allocated to him or her; and
a display unit that displays the task schedule prepared by the schedule preparing section.

2. The automatic analyzer according to claim **1**, further comprising:
a reserving section that allows the user to set any scheduled performance time of day for a task event on the task schedule; and

a first notifying section that prompts the user to perform the task when the time of day reserved by the reserving section arrives.

3. The automatic analyzer according to claim **1**, wherein the task events to be scheduled by the planning section include:

a task involving control of a reagent used in measurement;

a task involving calibration and accuracy control measurement; and

a task involving maintenance.

4. The automatic analyzer according to claim **1**, wherein the display unit automatically displays, upon a log-in to, or a log-out from, a system by a user, a task schedule for the user for a corresponding time slot.

5. The automatic analyzer according to claim **1**, further comprising:

a determining section that recognizes the task performed on the automatic analyzer to thereby automatically determine whether a task event displayed on the task schedule has been performed or has yet to be performed, wherein

the display unit displays on the task schedule whether or not a task has been performed.

6. The automatic analyzer according to claim **5**, further comprising:

a second notifying section that prompts, when a set time of the end of an allocated period of time arrives, the user to perform a task event yet to be performed.

7. The automatic analyzer according to claim **5**, wherein the schedule preparing section automatically carries a task event not performed within the allocated period of time over to the task schedule for a subsequent person in charge.

8. The automatic analyzer according to claim **2**, wherein the first notifying section notifies a user of a recommendation that a plurality of tasks occurring within a predetermined period of time be performed collectively.

9. The automatic analyzer according to claim **1**, the automatic analyzer being connected to a host system that stores information on a work schedule of operators, wherein the information on the work schedule is acquired from the host system.

10. The automatic analyzer according to claim **1**, wherein information on the prepared task schedule is transmitted to a host system.

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