

Schedule Display Method and Apparatus

Field of the Invention

5 The present invention relates to editing and displaying personal schedule information by using a computer system. A user can record his schedule by utilizing an electronic notebook rather than a general notebook.

Description of Related Prior Art

10 A conventional electronic notebook displays the schedule via a time axis. For example, in the "Schedule+" software developed by Microsoft Corporation, a schedule display screen is shown in Fig. 2, wherein a time axis and a schedule display area are used to display schedule distribution and schedule content. The schedule display area is parallel to the time axis, and the schedule content is displayed in the schedule display area at a position in accordance with the start and end time points of a schedule event.

15 The prior art described above can provide an acceptable function for recording schedule events, but there are several problems as follows.

(A) In writing a note, most users usually record the schedule events in a continuous way by stipulating the time in front of the note of dates. A time axis is used for reference during planning the schedule. Conventional schedule display in a computer is inconvenient for traditional habit. Though a schedule time distribution can be shown in the time axis, a free time interval between two schedule events still occupies a certain display area in the schedule display. This results in an unduly long display screen so that the schedule needs to be browsed by scrolling the screen very often. All schedule event data can not be displayed continually. The display space can not be effectively used for more information.

(B) There is no special display design for distinguishing the schedule events. All schedule events are displayed in one schedule display area such that it is difficult for user to advantageously understand the attribution of schedule event.

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Summary of the Invention

To solve the above problems, this invention provides a schedule display method, which can edit and display personal schedule information by using a computer system, comprising:

5 a first step for constructing a schedule display table of M columns and N rows in a memory of computer, wherein the schedule data of one day are recorded in a cell of the schedule display table, every cell records a pointer indicating a temporary storage address of the schedule data of one day, a schedule event number before duty time, a schedule event number after duty
10 time and the start position, end position and height value of every schedule event;

 a second step for managing the schedule display table by judging the editing or browsing actions from user so as to update the schedule display table;

15 a third step for detecting the modified part in the schedule display table, which can judge whether it is necessary to update the schedule display table in accordance with the editing or browsing action from user;

 a fourth step for plotting a time axis with schedule time distribution according to the modified part in the schedule display table, two adjusting
20 buttons of duty time and a display switch of a secondary schedule display area; and

 a fifth step for preparing a primary schedule display area listing all schedule data within duty time and a secondary schedule display area listing all schedule data before and after duty time in accordance with the updated
25 schedule display table.

Additionally, this invention provides a schedule display apparatus, which can edit and display personal schedule information by using a computer system, comprising:

 a schedule display table of M columns and N rows constructed in a

memory of computer, wherein each cell stores a day's display record and a day's schedule display table, the day's display record includes a pointer indicating the address of the day's schedule display table, schedule item number before and after the duty time, and a pointer indicating the temporary storage position of schedule data, and the day's schedule display table stores the data of the start position, end position and height value of every schedule event;

a schedule display table managing section, for judging the type of actions from user by input through an input device belongs to edition, browsing or modification, and for performing the corresponding insertion, modification, deletion, and reload of a schedule display table;

a modified area detecting section, for searching a schedule display table and calculating the modified part in display area according to the specified display mode and action from user by input through the input device, so as to determine whether the time axis and the primary and secondary schedule display areas need to be changed by editing or browsing the schedule display table or modifying the duty time;

a schedule displaying section, for obtaining a pointer of schedule data of the day to be displayed, based on the specified display mode and searched schedule display position table, reading the schedule data from a schedule data storage section by using the pointer, judging whether the schedule event is within duty time or not, detecting whether there is any overlap of schedule events, and displaying the content of schedule events in the primary and secondary schedule display areas respectively; and

a time axis displaying section, for plotting a time axis in accordance with the duty time set by user, detecting whether there is any overlap of modified schedule events to plot a schedule time distribution, and plotting two adjusting buttons of duty time and a display switch of secondary schedule display area.

The schedule display apparatus according to this invention can provide

two display modes, i.e. vertical mode and horizontal mode. Under the mode specified by user, a corresponding schedule display table is constructed in a memory so as to manage and show necessary information. After the user edits, browses or modifies the schedule display table, the schedule display table managing section will update a new schedule display table, and the modified area detecting section will detect the modified part in the display area. A time axis having two adjusting buttons of duty time and the primary and secondary schedule display areas are displayed so that the user can browse and edit the schedule display table.

10 Brief Description of the Drawings

The above and other objects, features and advantages of this invention will become apparent when considered with reference to the following description and the accompanying drawings, wherein:

15 Fig. 1 is a block diagram showing the schedule display apparatus according to one embodiment of this invention;

Fig. 2 is an illustration showing a conventional schedule display screen;

Fig. 3 is an illustration showing the data structure of schedule display table according to one embodiment of this invention;

20 Fig. 4 is a schematic flow chart of the schedule display table managing section according to one embodiment of this invention;

Fig. 5 is a schematic flow chart illustrating the processing steps of the modified area detecting section according to one embodiment of this invention with different program blocks A, B and C being shown respectively in
25 Figs. 5A, 5B and 5C;

Fig. 6 is a schematic flow chart illustrating the processing steps of the time axis displaying section according to one embodiment of this invention;

Fig. 7 is a schematic flow chart illustrating the processing steps of the schedule displaying section according to one embodiment of this invention;

Fig. 8 is an illustration showing one embodiment of this invention, wherein a schedule display position table of August 15, 1996 is displayed in a vertical mode;

5 Fig. 9 is the corresponding schedule record and schedule display position table of Fig. 8;

Fig. 10 is an illustration showing the primary schedule display area of Fig. 8 after the user sets the duty time to be from 08:00 AM to 17:00 PM;

Fig. 11 is an illustration showing both the primary and secondary schedule display area of Fig. 10;

10 Fig. 12 is an illustration showing the schedule display table of Fig. 11 in horizontal mode;

Fig. 13 is an illustration showing the reduced schedule display table of Fig. 12;

15 Fig. 14 is an illustration of Fig. 13, wherein the scrolling axis of secondary schedule display area is scrolled down;

Fig. 15 is an illustration of Fig. 14, wherein the scrolling axis of primary schedule display area is scrolled down;

20 Fig. 16 is an illustration of Fig. 15 when the user moves a mouse to the location of schedule event 10:00~12:00 and clicks the left button to edit the schedule event 10:00~12:00; and

Fig. 17 is an illustration of Fig. 16 when the schedule event 10:00~12:00 is deleted.

Detailed Description of The Preferred Embodiment

25 The object of the schedule display apparatus according to this invention is to process schedule data in a computer system by means of a schedule display position table constructed in a memory for managing and displaying schedule information. The schedule display apparatus according to this invention can provide vertical and horizontal display modes so that user can promptly and conveniently edit and browse the schedule. In a vertical display

mode, a time axis is arranged vertically and parallelly to the primary schedule display area. In a horizontal display mode, a time axis is arranged horizontally above the primary schedule display area. Under the vertical display mode, the schedule data in the primary schedule display area are displayed at locations corresponding to the time of schedule event. Under the horizontal display mode, the schedule data in the primary schedule display area are continually displayed in sequence. In both vertical and horizontal modes, the schedule data in the secondary schedule display area are continually displayed in sequence. According to the duty time set by user, the schedule events within duty time are displayed in the primary schedule display area, while the schedule events out of duty time are displayed in the secondary schedule display area. In addition, there are two adjusting buttons of duty time and a display switch of secondary schedule display area in display screen. One adjusting button of duty time is used to adjust the start point of duty time, while the other adjusting button of duty time is used to adjust the end point of duty time. The display switch of secondary schedule display area is used to control whether the secondary schedule display area should be shown.

Fig. 1 is a block diagram showing the schedule display apparatus according to one embodiment of this invention. In Fig. 1, the reference numeral 10 designates an input device constituted by a keyboard and a mouse, wherein the keyboard is used for entering the schedule data, and the mouse is used for adjusting the start and end points of duty time, indicating the schedule event to be modified and moving the schedule event. The reference numeral 40 designates a schedule editing section providing a schedule editor to edit the content of a schedule event. By using the schedule editor, the user can modify the time period of schedule event, confirm the schedule event, delete the schedule event, set an alarm, choose a sets of predetermined schedule contents such as meeting and trip etc., input or change the schedule content. The reference numeral 31 designates a schedule display table. The schedule

display table is an array of M columns and N rows. In a typical example, M is 7 and N is 6. In this example, the schedule display table has totally 42 cells. A day's display record and a day's schedule display table for a day are stored in each cell. The day's display record includes a pointer indicating the temporary
5 storage position of memory where the schedule data are stored, and a pointer indicating the day's schedule display table in which all schedule event data are stored. The reference numeral 50 designates a schedule data storing zone in which the schedule data are stored. The day's display record also includes two numbers cLeft and cRight, indicating the number of schedule events before and
10 after duty time respectively. The day's schedule display table stores the start point, end point and height value of schedule display area for each schedule event. The reference numeral 30 designates a schedule display table managing section for judging the type of action based on the position where the mouse is clicked. If the mouse is moved to the browse button or scrolling bar and clicked at its left button, the action is to be judged as a schedule browsing
15 action. If the mouse is moved to the schedule display area where there is NO schedule event and clicked at its left button, the action is to be judged as a schedule adding action. On the other hand, if the mouse is moved to the schedule display area where there is a schedule event and clicked at its left
20 button, the action is to be judged as a schedule modifying action or a schedule moving action. If the position of releasing the mouse is different from the position of clicking the mouse, the action is to be judged as a schedule moving action. Otherwise, the action is to be judged as a schedule modifying action. The schedule editor of the schedule editing section 40 is actuated to edit the
25 content of a schedule event. After the edition is completed, the schedule display table managing section 30 updates the schedule display table 31. When the schedule event is moved or edited, the display area will be modified accordingly. The modified area detecting section 21 detects the modified part in display area. Then the time axis displaying section 22 and schedule displaying

section 23 show the time axis and schedule data respectively, by searching the number of schedule events before and after duty time, the start point, end point and height value of schedule display area for modified schedule event.

5 The schedule display table managing section 30 is a basic control section of this invention. As shown in Fig. 1, the schedule display table managing section 30 manages the schedule display table 31 stored in the schedule data storing zone 50. In the schedule display table 31, the start point, end point and height value for each schedule event are recorded so that the modified part of schedule can be easily detected and the schedule data can be
10 directly displayed.

Fig. 3 is an illustration showing the data structure of schedule display table 31 according to one embodiment of this invention. The schedule display table of M columns and N rows is constructed in a memory of computer. A day's display record and a day's schedule display table are stored in each cell
15 of the schedule display table 31. The day's display record includes a pointer (ptToDayTable) indicating the table in which all schedule data for one day are stored, a pointer (ptToDayStorage) indicating the temporary storage position of schedule data, a number (cLeft) indicating the item number of schedule event before duty time, and a number (cRight) indicating the item number of schedule
20 event after duty time. The day's schedule display table includes the start point, end point and height value for each schedule event.

In a typical example, the schedule display table 31 has 7 columns and 6 rows. Totally, there are 42 cells in the schedule display table 31 for storing the schedule data of 42 days.

25 Fig. 4 is a schematic flow chart illustrating the processing steps of the schedule display table managing section 30 according to one embodiment of this invention. Step S71 judges whether there is a schedule browsing action. If the result is NO, the process goes to step S72 for determining the type of schedule editing action. At step S72, the type of schedule editing action is

determined. If the schedule editing action is addition, the process goes to steps S73 and S74 for searching a proper position and inserting a new schedule event in the schedule display, respectively. If the schedule editing action is deletion, the process goes to step S75. If the schedule editing action is modification, the process goes to step S76. At step S76, the height of display range is modified. If the schedule editing action is movement, the process goes to step S77. The step S77 is used for moving a schedule event, wherein an old schedule event is deleted first, and then a new schedule event is added. If the action does not belong to one of addition, deletion, modification and movement, the process goes to END. If the result of step S71 is YES, the process goes to step S78 for judging whether the data to be browsed is not within the displayable range. If the data to be browsed is not within the displayable range, the process goes to step S80 for calculating a new displayable range. After the new displayable range is calculated, the process goes to step S81 for searching each schedule data and calculating a display record. Then the process goes to step S82, all schedule display position tables are loaded in a monthly schedule display table. Then the process goes to END. If the data to be browsed is within the displayable range, the process goes to step S79 for judging whether the duty time is changed. If the result is NO, the process goes to END. If the result is YES, the process goes to step S83 for calculating the start and end points of duty time on a time axis. Then the process goes to step S84 for calculating the number of schedule events before and after the new duty time and modifying the display record.

Fig. 5 is a schematic flow chart illustrating the processing steps of the modified area detecting section 21 according to one embodiment of this invention. When the schedule events within duty time occupy an area larger than the display area, it is necessary to use a scrolling bar to view the schedule in the primary schedule display area. In a vertical mode, the time axis is vertically arranged and the height value of a schedule event corresponds to the

time period. Therefore, the time axis and the display area are synchronously moved when the scrolling bar is moved in the vertical mode. In a horizontal mode, the time axis is horizontally arranged above the display area, and thus only the schedule display list is moved when the scrolling bar is moved. The
5 schedule data before and after the duty time are continuously displayed in the secondary schedule display area. In the secondary schedule display area, the schedule data are displayed in a horizontal mode.

Now refer to Fig. 5, a flow chart of the modified area detecting section 21 according to one embodiment of this invention will be described as
10 follows. The step S90 detects whether the modified part exists. If the modified part results from schedule edition, the process goes to step S100 to execute steps S101-S114. If the modified part results from scrolling the primary schedule display area, the process goes to step S120 to execute steps S121-S128 for searching the modified part in the time axis and primary schedule
15 display area. If the modified part results from scrolling the secondary schedule display area, the process goes to step S140 to execute steps S141-S147 for searching the modified part in the secondary schedule display area. Else, if the modified part does not exist, the process goes to step S150 to execute other actions.

20 Step S101 classifies the schedule editing actions into five categories: schedule deletion/addition in vertical mode, schedule movement in vertical mode, schedule deletion in horizontal mode, schedule addition in horizontal mode and schedule movement in horizontal mode etc. Steps S102-S105 detect the modified part of primary schedule display area in vertical mode,
25 and steps S106-S113 detect the modified part of primary schedule display area in horizontal mode. In horizontal mode, it is necessary to execute step S113 for detecting the modified part in time axis. In vertical mode, the modified part for the schedule addition or deletion is confined between the start and end position of a schedule event. Step S102 is used for calculating the start position "s" and

end position "e" in time axis for a target schedule event. When a schedule event is moved, step S103 detects whether the target schedule event and the source schedule event are on the same screen. If the result is YES, then the process goes to step S104 for calculating the start position "s" and end position "e" of the union of a target schedule event and a source schedule event. If the result is NO, then the process goes to step S102. Step S105 transforms the positions "s" and "e" into the coordinates "sy" and "ey". The left upper corner of display area is set to be an origin with coordinate (0,0). Step S114 calculates the coordinate range of modified part of primary schedule display area in vertical mode (0,sy,x,ey), wherein "x" is the width of primary schedule display area, and also calculates the coordinate range of modified part in time axis (0,sy,x1,ey), wherein "x1" is the width of time axis.

Further, in horizontal mode, when a schedule event is deleted, the schedule events after the deleted schedule event would be influenced. By searching the schedule display table 31, steps S106 and S107 calculate the height of start position of target schedule event "sy" and the height of end position of target schedule event "ey" in display area, respectively. The schedule addition is completed by user entering schedule data in a blank area of schedule display list. Under horizontal mode, the blank area is below all schedule events. Therefore, upon adding a schedule event in horizontal mode, by searching the schedule display position table, step S108 calculates the height of start position of target schedule event "sy" in display area. Step S109 calculates the height of end position of target schedule event "ey" in display area. Furthermore, when a schedule event is moved, step S110 judges whether the source schedule event and target schedule event are on the same display screen. If the result is YES, then the process goes to step S111 to calculate the union of display areas occupied by the source schedule event and target schedule event. If the result is NO, similar to the schedule deletion, "sy" and "ey" are calculated. In response to the modification of time period for

schedule event, the time axis in horizontal mode is modified. Therefore, after detecting the modified part in primary schedule display area under horizontal mode, step S113 executes an according edition similar to vertical mode and detects the modified part in time axis. Under horizontal mode, for the modification in primary schedule display area and time axis, step S114 calculates the coordinate range of modified part in primary schedule display area (0, sy, x, ey) and the coordinate range of modified part in time axis (sy1, 0, ey1, y), wherein x is the width of primary schedule display area; y is the height corresponding to the time period in time axis; sy1 and ey1 correspond to the "sy" and "ey" value calculated by step S113.

Steps S121-S128 deal with the detection for modification when the primary schedule display area is scrolled. After searching the schedule display position table31, step S121 obtains a display record "i" of the first schedule event in primary schedule display area. Step S122 judges whether the display record "i" is within duty time so as to determine whether the scrolling can be executed. If it is determined that the scrolling can be executed, then the process goes to step S123 for determining the type of scrolling. For the scrolling in horizontal mode, step S124 judges whether it is down scrolling. If the result is YES, then the process goes to step S125 subtracting 1 from "i" which means the preceding record. Step S126 sets "n" to be the height occupied by the i_{th} display record. For the scrolling in vertical mode, the display area is scrolled by a schedule event. Step S127 sets "n" to be the height corresponding to the time period in time axis. Step S128 obtains the modified part in primary schedule display area and time axis. The coordinate range of modified part in primary schedule display area is (0, 0, x, n) when the schedule display is scrolled down and (0, y-n, x, y) when the schedule display is scrolled up, while the coordinate range of modified part in time axis is (0, 0, x1, n) when the schedule display is scrolled down in vertical mode and (0, y1-n, x1, y1) when the schedule display is scrolled up in vertical mode, wherein "x" is the

width of primary schedule display area; "y" is the height of primary schedule display area; and "y1" is the height corresponding to the time period in time axis.

Next, about the processing of scrolling for secondary schedule display area. since the secondary schedule display area can only be continuously displayed in horizontal mode, there is no vertical mode scrolling for secondary schedule display area. Refer to Fig. 5C, after searching the schedule display table, step S131 obtains the record "i" of the first schedule event shown in secondary schedule display area. Step S132 examines whether the record "i" is the first or last display record so as to judge whether the scrolling can be executed, and detects the modified part in display area. Step S133 determines the scrolling type of secondary schedule display area. For down scrolling, step S134 judges whether the record "i" is the first display record after duty time. If the result is YES, the down scrolling needs to jump the duty time period. In the case that the number of schedule events before duty time is "cLeft", step S135 sets the record "i" to be cLeft which indicates the last schedule event before duty time. If the result is NO, step S136 subtracts 1 from "i" which means the preceding record. Step S137 sets "n" to be the height occupied by the i_{th} display record and detects the coordinate range of modified part in secondary schedule display area is (0, 0, x, n) when the schedule display is scrolled down and (0, y-n, x, y) when the schedule display is scrolled up, wherein "x" is the width of secondary schedule display area and "y" is the height of secondary schedule display area.

Fig. 6 shows a schematic flow chart illustrating the processing steps of time axis display section 22 according to one embodiment of this invention. In this embodiment, the time axis is a long bar on display screen which stands the duration of one day, wherein the time period is divided by 5, 10, 15, 20, 30 or 60 minutes as the user may specify. The length of time axis is display by L pixels which correspond to the coordinates of 0 to L-1 so that the time period from 1 to 1440 minutes can be shown. For the time "t" (by minute),

it is located at the position $tl=t*L/1440$. For displaying the schedule in more detail, usually the pixel number L is larger than that can be displayed by a screen in vertical mode or horizontal mode, and thus it is necessary to scroll the screen. Under vertical mode, a screen with " y " pixels is used as a viewport and a time unit " u " is plotted by " n " pixels. If " ls " is the coordinate of the beginning of duty time and " rs " is the coordinate of the end of duty time in the time axis, then $ls=l*L/1440$ and $rs=r*L/1440$. In this case, if the point with coordinate " rs " can be scrolled to the end of the viewport, it is allowed to scroll the range $rs-ls$. If we set the left upper corner to be an origin of screen with coordinate $(0, 0)$ and the origin is indicated by " yo ", then yo is located between rs and ls and the coordinate in time axis for any time " t " is expressed by $(tl-yo)*n/u$. Also, for any point " yi " in the viewport, the corresponding time thereof " yt " is expressed by $yt=(yo+yi*u/n)*1440/L$. When the time axis display section plots a time axis, the time " ti " is calculated by the coordinate in time axis for the left upper corner of viewport. If the time axis is scrolled by a time unit every time, then ti corresponds to a certain time period. Therefore, the time axis can be plotted from the origin of viewport to the bottom of viewport, with a time unit shown by $n/4$ pixels.

Fig. 6 is a schematic flow chart illustrating the processing steps of time axis display section 22 according to one embodiment of this invention. First, step S141 respectively obtains the position of " tl " and " tr " in the time axis, which define the duty time of one day. S142 plots a time axis and moves " tl " and " tr " to an appropriate position. S143 plots the scales for time period unit and indicates the time value. Furthermore, step S144 finds the first display record " i " which has an end position value bigger than " tl ". Step S145 determines whether the start position " s " of the display record " i " is before " tl ". If the result is YES, then the process goes to step S146 setting the value of " s " to be " tl ". If the result is NO, the process goes to step S147 determines whether the end position " e " of display record " i " is after " tr ". If the result is YES, then

step S148 setting the value of "e" to be "tr". If the result is NO, step S149 calculates the display length of schedule event "i" as "e-s". After the calculation of the display length is completed, the process goes to step S150 plotting a time distribution on time axis according to the display length. Step S151 examines
5 whether there is next schedule event "i". If the result is YES, then step S152 examines whether the start position "s" of the display record "i" is before "tl", if the result is Yes, the process goes to step S153. If the result of step S152 is NO, then steps S147-S151 are repeated. If the result of step S151 is NO, then it means there is NO next schedule event or the start position of next schedule
10 event is after "tr", and the process goes to step S153 examining whether both ends of time axis are covered by "tl" and "tr". If the result is NO, the plotting of time axis is finished. If the result is YES, the process goes to step S154 plotting the time end point symbols and secondary schedule display area switch symbol at both ends of time axis. Furthermore, under horizontal mode, the time axis is
15 plotted transversely, with horizontal and vertical coordinates interchanged.

Fig. 7 shows a schematic flow chart illustrating the processing steps of schedule displaying section 23 according to one embodiment of this invention. By searching the schedule display table 31, step S162 obtains the first schedule display record "i" in primary schedule display area, which has a
20 start position overlapping the modified part. Subsequently, step S163 judges whether it is under horizontal mode. If the display is under vertical mode, then the process goes to step S176 executing steps S144-S152 shown in Fig. 6. If the display is under horizontal mode, steps S164-S167 displays the schedule data of primary schedule display area. First, step S164 judges whether the start
25 position of display record "i" overlaps the modified part. If the result is YES, then the process goes to step S165 showing the schedule event data of the i_{th} display record. Subsequently, the process goes to step S166 setting $i=i+1$. Thereafter, the process goes to step S167 judging whether the record "i" is the last display record before the right end point of duty time. If the result is NO,

then the process goes to step S164 to repeat plotting procedures until the start position of display record "i" overlaps the modified part or the display record "i" is after the right end point of duty time. By searching the schedule display table 31, step S169 obtains the first schedule display record "i" in secondary
5 schedule display area, which has a start position overlapping the modified part. Subsequently, step S170 judges whether the start position of display record "i" overlaps the modified part. If the result is YES, then the process goes to step S171 showing the schedule event data of this display record in secondary schedule display area. Subsequently, the process goes to step S172 setting
10 $i=i+1$. Thereafter, the process goes to step S173 judging whether the record "i" is the last display record before the left end point of duty time. If the result is YES, then the process goes to step S174 adjusting the record to be the first schedule record after the right end point of duty time. Subsequently, step S175 judges whether the record "i" is the last display record. If the result is NO, steps
15 S170-S175 are repeated until the start position of display record "i" overlaps the modified part or the display record "i" is the last display record.

Hereinafter, an example is used to explain the schedule display table according to this invention. Fig. 8 shows an example according to this application, wherein the schedule of Mr. Oyan on August 15, 1996 is displayed
20 in vertical mode without setting the left and right end time points of duty time, the length L of time axis is set to be 1440 pixels and the width of schedule display area is set to be 300 pixels. Fig. 9 shows a day's schedule display table and a display data record in accordance with Fig. 8. After the duty time is set within a period from 08:00AM to 17:00PM, through the procedures of the flow
25 chart of the schedule display table managing section 30, step S79 judges whether the left and right end points of duty time are changed, as shown in Fig. 4. Step S83 calculates the coordinate of the start point (left time point) of duty time to be $s=480$ and calculates the coordinate of the end point (right time point) of duty time to be $e=1020$. Step S84 calculates the numbers of schedule

events before and after the new duty time. In this case, both CLeft and CRight are 1. When the time period of duty time is changed, the modified part in display area is not detected. Therefore the schedule display table includes a primary schedule display area, a secondary schedule display area and a time axis display area. The time axis displaying section 22 and schedule displaying section 23 modify the primary schedule display area as shown in Fig. 10 through the flow charts shown in Figs. 6 and 7. When the user selects to display the schedule events before and after the duty time, the secondary schedule display area is shown in Fig. 11 through the flow chart shown in Fig. 7 and the primary schedule display area remains unchanged. When the user changes the vertical mode into horizontal mode, the schedule display list is displayed as shown in Fig. 12 through the flow chart shown in Fig. 7. When the user selects to reduce the display screen, the schedule display list is displayed as shown in Fig. 13, wherein the height value of the primary schedule display area is changed from 133 to 106 pixels and the height value of the secondary schedule display area is changed from 76 to 24 pixels. If the user scrolls up the secondary schedule display area, according to the flow chart shown in Fig. 5, step S131 obtains the first display record ($i=0$) of the secondary schedule display area. Since there are two display records in the secondary schedule display area, step S132 determines that the secondary schedule display area can be scrolled up. By searching the schedule display table 31, step S137 sets the display height of display record "i" to be $n=24$. Accordingly, the coordinate range of modified part is expressed by $(0, y-n, x, y)=(0, 52, 300, 76)$, wherein the width of the secondary schedule display area is expressed by $x=300$. In response to the modified part, through the procedures in the flow chart shown in Fig. 7, steps S169 and S170 determines there is no display record overlapping with the modified part, and so it does not execute the plotting action. The result of scrolling up the secondary schedule display area is shown in Fig. 14. When the user wants to scroll up the primary schedule display area, through the

procedures in the flow chart of Fig. 5, step S121 obtains the first display record ($i=0$) of the primary schedule display area. Step S122 determines the scrolling can be executed. Steps S123 and S124 determine that the type of scrolling is horizontal up. By searching the schedule display table, step S126 obtains the display height of the record "i", which is expressed by $n=24$. Step 127 executes scrolling in the vertical display mode step. S128 obtains the modified part in the primary schedule display area. The coordinate range of modified part is expressed by $(0, y-n, x, y)=(0, 82, 300, 106)$. In response to the modified part, through the flow chart shown in Fig. 7, the result of scrolling up the primary schedule display area is shown in Fig. 15. If the user wants to delete the schedule event of 10:00-12:00 AM, by clicking a mouse pointing at the position of the desired schedule event, he may access to the schedule editing means so as to perform deletion. The result is shown in Fig. 16. After the desired schedule event is deleted, through the flow chart of schedule display table managing section 30, the steps S71 and S72 shown in Fig. 4 determine the type of edition is a schedule deletion in horizontal mode. Step S75 deleted the third schedule record in the primary schedule display area. After deletion, step S101 detects the type of edition is a schedule deletion in horizontal mode, and then the process goes to step S106. Since the schedule event to be deleted is the first schedule event on display screen, step S106 calculates the display height of the target schedule event, which is expressed by $sy=0$, and step S107 calculates the height of end position of target schedule event in display area, which is expressed by $ey=106$. At the same time, it is necessary to execute the detection of modified part in time axis. Step S113 executes a similar deletion to vertical mode so as to detect the modified part. In other words, like step S102, the start and end positions of the target schedule event in time axis are calculated, wherein $s=600$ and $e=720$. Thereafter, step S114 calculates the coordinate range of modified part of primary schedule display area, which is expressed by $(0, sy, x, ey)=(0, 0, 300, 106)$, and also calculated the coordinate

range of modified part of time axis (600, 0, 720, y), wherein "y" is the display height of time axis. In this preferred embodiment, the display height of time axis is shown by 24 pixels, and the unit time period (60 minutes) is shown by 48 pixels. After calculation, the coordinate range of modified part of time is (96, 0, 192, 24). Through the flow charts shown in Figs. 6 and 7, a final result of primary schedule display area and time axis is shown in Fig. 17.

As described above, in the schedule display table, there are recorded the start and end time points in time axis and the height occupied in schedule display area for each individual schedule event. Utilizing the schedule display table, it is not necessary for the modified area detecting section to perform a repeated calculation, and the modified parts in the time axis, primary schedule display area and secondary schedule display area can be detected in a faster and simpler way. Therefore, the time axis display section can plot a time axis with schedule time distribution very fast and easy in accordance with the schedule display table. All schedule events for one day are displayed in the primary schedule display area and secondary schedule display area, respectively. By the start and end time points of duty time, the attribution of schedule event can be distinguished. The schedule event data are managed in a way that each schedule event can be browsed and edited clearly and efficiently.



What is claimed is:

1. A schedule display method, which can edit and display personal schedule information by using a computer system, comprising:

a first step for constructing a schedule display table of M columns and N rows in a memory of computer, wherein the schedule data of one day are recorded in a cell of the schedule display table, every cell records a pointer indicating a temporary storage address of the schedule data of one day, a schedule event number before duty time, a schedule event number after duty time and the start position, end position and height value of every schedule event;

a second step for managing the schedule display table by judging the editing or browsing actions from user so as to update the schedule display table;

a third step for detecting the modified part in the schedule display table, which can judge whether it is necessary to update the schedule display table in accordance with the editing or browsing action from user;

a fourth step for plotting a time axis with schedule time distribution according to the modified part in the schedule display table, two adjusting buttons of duty time and a display switch of a secondary schedule display area; and

a fifth step for preparing a primary schedule display area listing all schedule data within duty time and a secondary schedule display area listing all schedule data before and after duty time in accordance with the updated schedule display table.

2. A schedule display apparatus adaptive to edit and display



personal schedule information by using a computer system, comprising:

a schedule display table of M columns and N rows constructed in a memory of computer, wherein each cell stores a day's display record and a day's schedule display table, the day's display record includes a pointer indicating the address of the day's schedule display table, schedule item number before and after the duty time, and a pointer indicating the temporary storage position of schedule data, and the day's schedule display table stores the data of the start position, end position and height value of every schedule event;

a schedule display table managing section, for judging the type of actions from user by input through an input device belongs to edition, browsing or modification, and for performing the corresponding insertion, modification, deletion, and reload of a schedule display table;

a modified area detecting section, for searching a schedule display table and calculating the modified part in display area according to the specified display mode and action from user by input through the input device, so as to determine whether the time axis and the primary and secondary schedule display areas need to be changed by editing or browsing the schedule display table or modifying the duty time;

a schedule displaying section, for obtaining a pointer of schedule data of the day to be displayed, based on the specified display mode and searched schedule display position table, reading the schedule data from a schedule data storage section by using the pointer, judging whether the schedule event is within duty time or not, detecting whether there is any overlap of schedule events, and displaying the content of schedule events in the primary and



secondary schedule display areas respectively; and

a time axis displaying section, for plotting a time axis in accordance with the duty time set by user, detecting whether there is any overlap of modified schedule events to plot a schedule time distribution, and plotting two adjusting buttons of duty time and a display switch of secondary schedule display area.

3. The schedule display apparatus as defined in claim 2, further comprises a mode selection switch for user to select vertical or horizontal display mode.

4. The schedule display apparatus as defined in claim 2, further comprises a display switch for secondary schedule display area to control whether the secondary schedule display area should be displayed or not.