such as the living environment and life rhythm of a user. The answers to the questionnaire 1 include information including time data such as the user's living environment and living rhythm such as bedtime and wake-up time for calculating SPB-SM and the recommended time based on SPB-SM. The measured data obtained from the measuring device includes data capable of monitoring the sleep state of the user and the measured time data or information of time zone.

[0045]

FIG. 3 is a flow diagram illustrating processing for the information processing device 110 according to an embodiment of the present invention. In each of the following embodiments, an example in which the server 11 is used as the information processing device 110 is shown, but the system 100 for presenting a daily lie schedule based on the circadian rhythm according to the present invention is not limited thereto, and the terminal may be used as the information processing device 110 and the following processing may be performed by the terminal alone. The information processing device 110 transmits a question to the terminal to calculate SPB-SM(S101). When the terminal includes a display device and an input device such as the PC 13, the mobile phone 15, the tablet terminal 17, and the wearable device 19, the terminal displays the question received from the information processing device 110 on the display device to prompt the user to answer. In the case where a printer is connected to the PC 13, the mobile phone 15, or the tablet terminal 17 by wired or wireless connection, the question received from the information processing device 110 can be printed by the printer, and the questionnaire 1 can be created.

[0046]

The user inputs an answer to the terminal (S103). The terminal transmits the input answer to the information processing device 110 via the network 50 (S105). In the case where the user inputs the answer on the questionnaire 1, a person (medical professional, etc.) who made the user answering the question

CLAIMS

1. A system for presenting a daily life schedule based on circadian rhythm comprising:

an information processing device having a subjective midnight calculation unit, the subjective midnight calculation unit calculating a subjective midnight;

wherein the information processing device determines whether an answer to a question based on a sleep time zone, or measured data corresponds to any of exception data of conditions (1) to (6):

condition (1): there is an excessive shading in a morning or an excessive light exposure at night;

condition (2): there is a sleep disorder or a psychiatric disorder which causes sleep or hypersomnia which has not been remitted yet;

condition (3): there is a non-24-time type sleep-wake rhythm disorder;

condition (4): there is a recent movement between different areas in standard times;

condition (5): there is ingesting psychotropic drugs or excessive wakefulness-inducing substances; and

condition (6): there is ingesting psychotropic drugs or excessive alcohol,

the answer to the question based on the sleep time zone includes bedtime and wake-up time, and the measured data includes information of time zone measured by a sensor capable of monitoring a sleep state selected from a group consisting of a pulse meter, a heart rate meter, a deep body thermometer, an acceleration sensor, or a device attached to a human body, clothes, or bedding,

the information processing device determines whether time-of-day data included in the answer or the measured data includes time-of-day data to be

excluded according to the conditions (1) to (6), if the answer to the question based on the sleep time zone, or the measured data corresponds to any of the exception data of the conditions (1) to (6),

the information processing device calculates the subjective midnight on the basis of the sleep time zone based on the time-of-day data included in the answer or measured data, if the time-of-day data to be excluded is not included; and

the information processing device calculates the subjective midnight on the basis of the sleep time zone based on the time-of-day data included in the answer or measured data in which the time-of-day to be excluded has been excluded from the time-of-day data included in the answer or measured data, if the time-of-day data to be excluded is included,

the information processing device calculates the subjective midnight by using any of calculation methods 1 to 7,

calculation method 1: the information processing device calculates, from the answer or the measured data, a distribution of a midpoint of sleep at an elapse of two weeks or the midpoint of sleep after the elapse of two weeks or an average time thereof as the subjective midnight on the basis of the sleep time zone if there is a period when there is no event or social schedule which affects a sleeping or waking for two weeks or more and a sleep during the period is sufficiently achieved,

calculation method 2: the information processing device calculates, from the answer or the measured data, a distribution of the midpoint of sleep on day 4 or the midpoint of sleep after day 4, or an average time thereof as the subjective midnight on the basis of the sleep time zone if there is a recent period with no event or social schedule which affects the sleeping or waking continuously for two weeks or more and the period of sufficient sleep during the period is less than two weeks, but there are consecutive holidays for four days or more with no social schedule which affects the sleeping or waking,

calculation method 3: in a case where there are no recent consecutive holidays for 4 days or more with no social schedule that affects the sleeping or waking, the information processing device calculates the subjective midnight on the basis of the sleep time zone at an age of an user at which the answer was obtained based on the calculation method 1 from the answer or the measured data in a range that can be traced back, including when the user was young, or the information processing device calculates the subjective midnight on the basis of the sleep time zone at an age of the user at which the answer was obtained, based on the calculation method 2, from the answer or the measured data in the range that can be traced back, including when the user was young,

calculation method 4: in a case where there is data for grasping whether a day is a scheduled day or a holiday in the measured data, the information processing device collates the data and calculates the subjective midnight on the basis of the sleep time zone according to the calculation method 1 or the calculation method 2,

calculation method 5: in a case where a plurality of the subjective midnights on the basis of the sleep time zone is obtained by the calculation methods 1 to 4, the information processing device determines the subjective midnights on the basis of the sleep time zone by any of following methods (1) to (5):

(1) the information processing device determines the subjective midnight on the basis of the sleep time zone as a distribution of ranges from its minimum value to the maximum value;

(2) the information processing device determines the average time of the subjective midnights on the basis of the sleep time zone as the subjective midnight on the basis of the sleep time zone;

(3) the information processing device determines an average obtained by excluding the time as time-of-day data to be excluded as the

subjective midnight on the basis of the sleep time zone;

(4) the information processing device calculates the physiological wake-up time based on a personal biological clock by an optimal wake-up time/bedtime calculation method based on the individual circadian rhythm from the respective subjective midnight on the basis of the sleep time zone, method of (2), method of (3), and a time of sleep corrected mid-sleep on free-days, and causes the user to answer at which time the user naturally wake-up, in a case where the user inputs an answer indicating that a single time matches, the information processing device determines the answered single time as the subjective midnight on the basis of the sleep time zone, or in a case where the user inputs an answer indicating that a plurality of times match, the information processing device determines an average of the answered plurality of times as the subjective midnight on the basis of the sleep time zone; and

(5) the information processing device calculates the "time at which sleepiness in a daytime occurs" by a method of calculating the sleepiness timing based on the individual circadian rhythm from the respective subjective midnight on the basis of the sleep time zone, the method of (2), the method of (3), and the time of sleep corrected mid-sleep on free-days, and causes the user to answer which of them matches the most present actual situation, in a case where the user inputs an answer indicating that a single time matches, the information processing device determines the answered single time as the subjective midnight on the basis of the sleep time zone, or in a case where the user inputs an answer indicating that a plurality of times match, the information processing device determines an average of the answered plurality of times as the subjective midnight on the basis of the sleep time zone,

calculation method 6: in a case where neither the data nor result of any of the calculation methods 1 to 5 is obtained, the information processing device determines subjective midnights on the basis of the sleep time zone by any or a

plurality of following methods (1) to (5):

(1) the sleep corrected mid-sleep on free-days is defined as the subjective midnight on the basis of the sleep time zone;

(2) the average time of midpoints of sleep during the measurement/answer period is defined as the subjective midnight on the basis of the sleep time zone;

(3) the midpoint of sleep on holiday is defined as the subjective midnight on the basis of the sleep time zone;

(4) the information processing device displays following options on a terminal: "If anything, you are (a) Morningness, (b) Neither, (c) Eveningness", and determines a specified time as the subjective midnight on the basis of the sleep time zone according to answer selected by the user, and

(5) the information processing device displays following options on the terminal: "If anything, you are (a) Very morningness, (b) morningness, (c) Neither, (d) Eveningness, (e) Very eveningness", and determines a specified time as the subjective midnight on the basis of the sleep time zone according to answer selected by the user,

calculation method 7: the information processing device presents the user with which of "(a) No particular specification", "(b) The original biological rhythm", or "(c) The biological rhythm in the most recent life" is prioritized, the information processing device calculates the data (a) to (c) by following calculation methods:

(a) the subjective midnight on the basis of the sleep time zone according to calculation methods 1 to 6 is calculated;

(b) the information processing device instructs the user to input the answer to be used for the calculation methods 1 to 6 when the user could be exposed to the morning sunlight and the user has not been exposed to artificial light after sunset or spent in environments with very low illuminance after sunset; and

(c) the information processing device causes the user to input how much the most recent period is desired to measure the rhythm and requests the terminal to input the answer during that period to be used in the calculation methods 1 to 6.

2. The system for presenting the daily life schedule based on the circadian rhythm according to claim 1,

wherein the information processing device sets a flag if exception data is included in the answer or measured data, and

the information processing device calculates the subjective midnight on the basis of the time-of-day data included in the answer or measured data which includes the exception data.

3. The system for presenting the daily life schedule based on the circadian rhythm according to claim 1,

wherein the information processing device determines whether a time-of-day at which the least number of people fall asleep corresponding to the user's age is included in a range of the answer to the question based on a sleeping time zone, and

the information processing device issues a warning if the information processing device determines that the time-of-day at which the least number of people fall asleep is included in the answer.

4. The system for presenting the daily life schedule based on the circadian rhythm according to claim 3,

wherein the information processing device calculates and updates the time-of-day at which the least number of people fall asleep in the answer by performing aggregation using the answer or measured data.

5. The system for presenting the daily life schedule based on the circadian rhythm according to claim 1,

wherein the information processing device determines which condition the answer for conditions corresponding to a plurality of calculation methods for calculating a required sleeping time applies to, and

the information processing device calculates the required sleeping time on the basis of the calculation method corresponding to the conditions applied to the answer.

6. The system for presenting the daily life schedule based on the circadian rhythm according to claim 5, comprising:

calculating a recommended wake up time by adding half of the required sleeping time to the subjective midnight;

calculating a recommended bedtime by subtracting the required sleeping time from the recommended wake up time; and

calculating a sleep forbidden zone by adding a predetermined time to the subjective midnight.

7. The system for presenting the daily life schedule based on the circadian rhythm according to claim 6, comprising:

calculating a recommended activity time for taking action for promoting falling asleep by adding or subtracting a predetermined reference value using the subjective midnight, the required sleeping time, the recommended wake up time, or the recommended bedtime.

8. The system for presenting the daily life schedule based on the circadian rhythm according to claim 7,

wherein the information processing device calculates the predetermined reference value by performing aggregation or regression analysis using the answer or measured data.

9. The system for presenting the daily life schedule based on the circadian rhythm according to claim 1,

wherein the information processing device calculates a first sleepiness time zone in which sleepiness may occur by adding a first reference value having a predetermined time range at the subjective midnight,

the information processing device calculates a second sleepiness time zone in which strong sleepiness may occur by adding a second reference value having a narrower time range than the first reference time to the subjective midnight, and

the information processing device calculates a third sleepiness time zone which is likely to be a peak of sleepiness by adding a third reference value having a narrower time range than the second reference time to the subjective midnight.

10. The system for presenting the daily life schedule based on the circadian rhythm according to claim 9,

wherein the information processing device calls attention if sleep deprivation, agrypnia, or hypersomnia is determined based on the answer or measured data.

11. The system for presenting the daily life schedule based on the circadian rhythm according to claim 9,

wherein the information processing device calculates and updates the first reference value, the second reference value, and the third reference value by performing aggregation or regression analysis using the answer or measured data.

12. The system for presenting the daily life schedule based on the circadian rhythm according to claim 9,

wherein the information processing device calculates a time zone from the time-of-day of the subjective midnight to a predetermined time as a recommended nap time zone.

13. The system for presenting the daily life schedule based on the circadian rhythm according to claim 1,

wherein the information processing device determines whether an activity time zone is fixed to a general activity time zone,

the information processing device calculates a first activity time zone at which physical and mental performance improves in a first half of a day by adding a fourth reference value having a predetermined time range to the subjective midnight, if the activity time zone is fixed to the general activity time zone, and

the information processing device calculates a second activity time zone at which physical and mental performance improves in a second half of the day by adding a fifth reference value which is set at a late time in a predetermined time range from the fourth reference value to the subjective midnight, and

the information processing device calculates a time zone between the first activity time zone and the second activity time zone as a recommended break time zone.

14. The system for presenting the daily life schedule based on the circadian rhythm according to claim 13,

wherein the information processing device calculates a recommended start time at which the physical and mental performance improves by adding a sixth reference value having a predetermined time range to the subjective midnight,

if the activity time zone is not fixed to a general activity time zone.

15. The system for presenting the daily life schedule based on the circadian rhythm according to claim 1,

wherein the information processing device calculates a time zone in which a high efficacy rate of a sedative-hypnotic psychotropic drug is expected by adding a seventh reference value having a predetermined time range to the subjective midnight,

the information processing device calculates a time zone of taking medicine with few side effects by adding an eighth reference value that is set in a narrow time range within a predetermined time range from the seventh reference value to the subjective midnight, and

the information processing device calculates a first recommended time zone based on the time zone in which the high efficacy rate is expected and the time zone of taking medicine with few side effects.

16. The system for presenting the daily life schedule based on the circadian rhythm according to claim 15,

wherein the information processing device determines whether the sedative-hypnotic psychotropic drug is an immediate release tablet,

the information processing device determines whether the sedative-hypnotic psychotropic drug is a delayed-action preparation, if the sedative-hypnotic psychotropic drug is not the immediate release tablet,

the information processing device calculates a second recommended time zone by subtracting a duration until the blood concentration or brain concentration of the drug being taken reaches an effective range or time until sleepiness actually appears after taking the drug from the first recommended time zone, if the sedative-hypnotic psychotropic drug is the delayed-action preparation, and

the information processing device calculates the second recommended time zone by subtracting a duration until the blood concentration or brain concentration of the drug being taken reaches an effective range or time until sleepiness actually appears after taking the drug from the first recommended time zone, if the sedative-hypnotic psychotropic drug is not the delayed-action preparation.

17. The system for presenting the daily life schedule based on the circadian rhythm according to claim 6,

wherein the information processing device determines whether a stay period to an area with a time difference is less than 5 days,

the information processing device determines whether the recommended wake up time and the recommended bedtime before making a voyage are earlier than a wakeup time and a bedtime when returning to a home country, if the stay period is less than 5 days,

the information processing device provides advice that the light environment at the destination may be earlier than that at a place of departure, if the recommended wake up time and the recommended bedtime before making a voyage are earlier than the wake-up time and the bedtime when returning to the home country, and

the information processing device provides advice that the light environment at the destination may be later than that at the place of departure, if the recommended wake up time and the recommended bedtime before making a voyage are later than the wake-up time and the bedtime when returning to the home country.

18. The system for presenting the daily life schedule based on the circadian rhythm according to claim 17,

wherein the information processing device calculates a time to desire to start an activity as mealtime, calculates a time just before bedtime as a time when meals are not recommended, and sets a certain fasting time in the time zone to desire to sleep.

19. The system for presenting the daily life schedule based on the circadian rhythm according to claim 17,

wherein the information processing device determines whether there is a large deviation between the recommended wake up time and the recommended bedtime before making a voyage and the recommended wake up time and the recommended bedtime at the destination,

the information processing device calculates a first sleepiness time zone by adding a first reference value having a predetermined time range to the subjective midnight, if the deviation is determined to be large,

the information processing device calculates a time from the start time of the first sleepiness time zone to a predetermined time as a recommended nap time zone, and

the information processing device calculates a sleep forbidden zone by adding a predetermined time to the subjective midnight.

20. The system for presenting the daily life schedule based on the circadian rhythm according to claim 19,

wherein the information processing device calculates a time in a range ±2 hours from each of the recommended bedtime and wake up time as an allowable bedtime and wake up time, if the deviation is determined to be small.

21. The system for presenting the daily life schedule based on the circadian rhythm according to claim 17,

wherein the information processing device inquires to a user whether it makes the body clock cycle shorter than 24 hours, if the stay period is 5 days or more,

the information processing device calculates a recommended light irradiation time zone based on the subjective midnight and sunrise and sunset times at the place of departure, if it is determined that making the body clock cycle shorter than 24 hours is selected,

the information processing device determines whether an actual sleep-wake time zone is advanced by the light irradiation of a subjective morningness,

the information processing device determines whether the sleep-wake time zone is advanced enough to a range which can accommodate a schedule at the destination, if the sleep-wake time zone is actually advanced,

the information processing device re-calculates the subjective midnight based on the advanced sleep-wake time zone until the sleep-wake time zone is advanced enough, and

the information processing device re-calculates the recommended light irradiation time zone based on the re-calculated subjective midnight and the sunrise and sunset times at the place of departure.

22. The system for presenting the daily life schedule based on the circadian rhythm according to claim 21,

wherein the information processing device calculates the recommended light irradiation time zone based on the subjective midnight and the sunrise and sunset times at the place of departure to recommend shading from the subjective midnight to sun meridian transit time and light irradiation until the subjective midnight after the sunset, if it is determined that the body clock cycle is longer than 24 hours;

information processing device determines whether the actual sleep-wake

time zone is delayed;

the information processing device determines whether the sleep-wake time zone is delayed enough to the range which can accommodate the schedule at the destination, if the sleep-wake time zone is actually delayed;

the information processing device re-calculates the subjective midnight based on the delayed sleep-wake time zone until the sleep-wake time zone is delayed enough; and

the information processing device re-calculates the recommended light irradiation time zone based on the re-calculated subjective midnight and the sunrise and sunset times at the place of departure.

23. The system for presenting the daily life schedule based on the circadian rhythm according to claim 1,

wherein the information processing device calculates a first recommended eating time zone which has little effect on body weight increase and relatively suppresses an increase in blood glucose levels by adding a ninth reference value having a predetermined time range to the subjective midnight; and

the information processing device calculates a first non-recommended eating time zone which significantly increases body weight and tends to increase blood glucose levels to a higher degree by adding a tenth reference value of a later time range than the ninth reference value to the subjective midnight.

24. The system for presenting the daily life schedule based on the circadian rhythm according to claim 23,

wherein the information processing device calculates a second recommended eating time zone which minimizes effects on body weight increase and almost no excessive increase in blood glucose levels by adding an eleventh reference value having a predetermined time range to the subjective midnight.

25. The system for presenting the daily life schedule based on the circadian rhythm according to claim 23,

wherein the information processing device calculates a third recommended eating time zone in which eating has little effect on body weight increase and increase in blood glucose levels by adding a twelfth reference value having a predetermined time range to the subjective midnight.