Personal Health Assistant on Android Mobile Device: Sleeping, Nutrition and Exercise

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Personal Health Assistant on Android Mobile Device:
Sleeping, Nutrition and Exercise

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Abstract. Good health can be achieved by maintaining good behaviors such as a good night sleep, enough exercise and good nutrition. However, the competitive environment nowadays prevents such good behaviors. Thus, this work aims to develop an application on mobile devices that is able to (1) record the daily sleeping, exercise and nutrition information, (2) analyze the collected information in order to provide a notification or an alarm, and (3) present the analyzed results in a simple and easy to understand format. The proposed application can collect data from other application and from the users. A set of simple data analysis methods is performed on the collected data in order to provide a personal health advice based on the user pre-defined preferences.

Introduction

Better health can be achieved by maintaining a simple lifestyle such as a good night sleep, enough exercises and good nutrition. People spend one third of their lives sleeping however most people do not understand the importance of sleep. Moreover, the lack of sleep can affect a person's memory and emotion. The exercise habit and nutrition can also lead to good health. Daily working life can be affected by lack of sleep such as drowsiness and long-term health problems [1,2]. Many researches have shown that not enough sleep or exercise can lead to many health problems such as GERD [3], Alzheimer's disease [4], hearth disease [5], sleep apnea [6] and insomnia [7].

In the competitive work environment, nowadays, it is not easy for many people to manage good sleeping and exercise habits. With busy work and personal life schedules, many people indulge themselves in a bad sleeping habit such as sleeping very late or waking up very late especially in young adults and teenagers. A good night sleep can also be affected by the person's exercise habits and nutrition consumption. The sleep, nutrition and exercise have more complicated relationship than many people have realized [8]. Enough exercise helps people sleep better and good nutrition also lead to better mood and better health. Thus, a that can automatically record personal information, produce a warning, and give personal advices to its owner in order to maintain good sleeping, exercise and nutrition habits is needed.

Today smart phone technology is a good candidate for this project because of its low cost, portability and capability which is similar or close to a personal computer. Moreover, a phone has become a typical device in daily activity. In addition, a current smart phone includes a lot of sensors such as an accelerometer, a microphone and a light sensor. These features make a smart phone suitable for collecting personal data in this work. Android is a Linux-based operating designed for touch screen mobile devices. Lately, Android becomes the world's most widely used smart phone platform [9]. Especially, its customizable features allow Androids to be the software of choice for many developers.

Thus, this project aims to develop an application for Android smart phones that has a capability (1) to record the information related to the duration and quality of sleeping, the types and duration

of exercise activities and the amount of nutrition consumed, (2) to analyze the collected data and provide a notification or an alarm in order to suggest or remind the user in taking care of his/her health; and (3) to present the analyzed results in a format that is easy to understand without the need of a deep medical knowledge. The rest of this document is organized as follows. Next, the design is given. Then, the results and discussions are given. The conclusion is given at the end.

Design

Three activities to be focused in this project are sleep, exercise and nutrition habits. Even though, lots of applications available in Google Play Store have a capability of collecting sleeping [10] or exercise [11,12] data or providing nutrition suggestions [13,14], no application offers all three features in a single application like what is proposed in this project. Next, the sleeping, exercise and nutrition related information to be collected in this application is given.

Sleeping. The amount of sleep each person needs may be different even among people with the same age and gender [15]. The normal sleep at night is approximately four to six sleeping cycles and each cycle consists of five stages. The first stage—light sleep—the muscle activity slows down with some movements. Stage 2-5 are considered in a stage of deep sleeps with slow breathing patterns and limited to no-movement of the body. Therefore, the body movement during sleeps can indicate the sleeping quality. In addition, the duration of sleep is also collected as another sleeping quality indicator.

Exercise. Regular exercise improves the wellness of human heart and blood pressure, builds bone and muscle, and helps reduce the stress and the muscle tension. In addition, exercise can even improve the mood. The efficiency of the exercise depends on the type of exercise and the duration of the exercise during the day [8]. Sound sleep is another benefit of exercise. In general, exercising makes it easily to fall asleep [16]. However, exercising before going to bed will make it difficult to fall asleep. The exercise must be done at least 3 hours before bedtime because exercise will increase the body temperature. As a result, it will take more time to fall asleep after an exercise due to the time to decrease the body temperature after an exercise. Thus, the duration of exercises and the period of time that the exercise occurs will be collected in the work.

Nutrition. There is a relation between the sleeping and eating habits. The results showed in [17] on the effects of partial sleep deprivation on food consumption and food choice. The experiments conducted on selected 50 undergraduate students at Private East Coast University, United State of America. The results showed that the food choices after a normal sleep are considered to be healthier than the food choices after a deprived sleep. Thus, the amount and type of food consumptions will be collected as the nutrition information in this work.

In addition, some notifications are also produced however the proposed application will consider producing a suitable notification format. For example, an alarm should not wake the user up during the stage of deep sleep if it is not really necessary. The proposed application also provides some helps to the users including the user manual and some health related references. This application is scheduled to be freely available on Google Play store later. Furthermore, the application developer will also provide an online forum for error/bug reports.

Results and Discussions

The proposed application is developed to be fully compatible with the Android 4.2.2. The mobile device must be able to connect to the Internet in order to use full features of the proposed application. The concept of the user interface is based on the Minimalism [18] meaning the user interface of the developed application will use as fewer items on the screen as possible. Fig 1-2 show the resulting main user interfaces of the developed application. With limited space, Fig 1 and 2 show three screens of the application. The interface is focusing on a simple and clean design (Fig 2), large image icons (last row in Fig 1), simple menu bar (second row in Fig 1), and a set of standard action icons (in the middle row in Fig 1). The user interface is mainly from the touch

screen events such as clicks and seeks which will generate an event signal. Then, the event handler will identify the component issued the event and forwards the command to an appropriate event handler for processing.
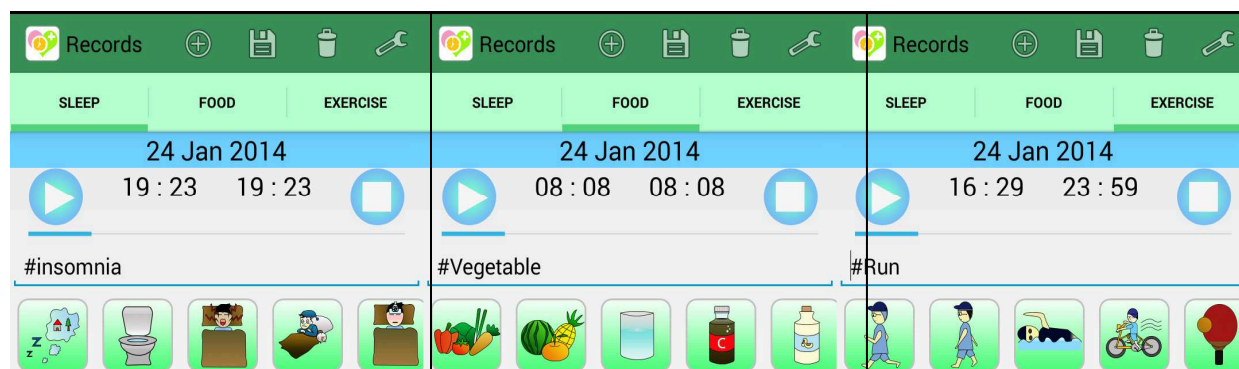

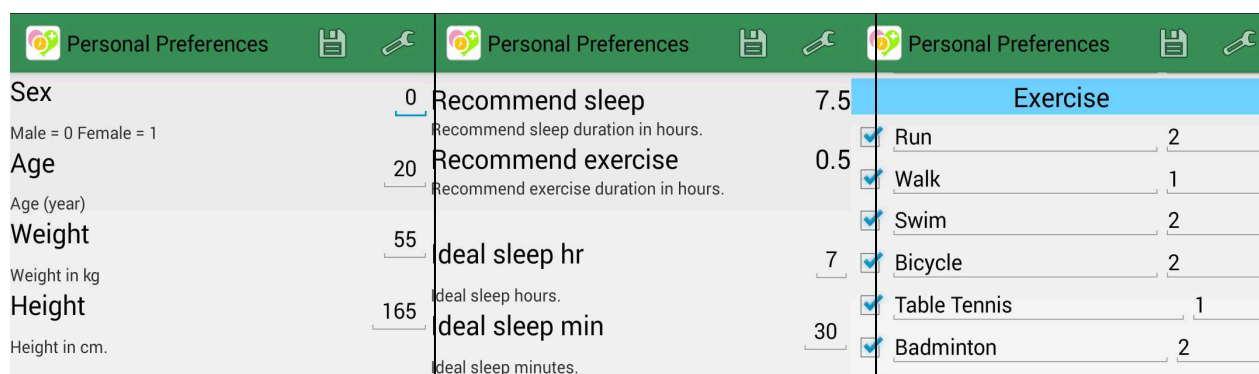Figure 1 User interface of sleep, food and exercise

Figure 2 Personal Preference

Two data collection methods are available in this work. First, the data is collected from the existing application API such as some sleeping data is collected from the Sleep as Android API [19] which uses the body movement to indicate the sleeping stage of the user. The second method is to collect the data from the user via the user interface of the application as shown in Fig 1. Fig 1 shows the user interface of the three main features of the proposed program which allows the user to select each feature from the menu bar on the second row of the screen. The list of icons at the last line of the screen acts as a list of hot menu items to record the user's activities. This list of icons can be personally customized by the user as shown in Fig 2 (the right most screen). Fig 2 shows the personal preference page of the program which allows the user to enter his/her personal information. This information will be used to provide the personalized health related recommendation information by the application. The value of each icon indicated on the right most screen is used for analysis purposes only. The value indicates the important level of the action while the sign indicates the type of habits. That is, a good habit is indicated by a value greater than zero while a bad habit is indicated by a value smaller than zero. A simple data analysis method is used by summing the values of all good habits and the bad habits separately. Fig 3 shows the analyzed result in the form of a pie chart. However, there is a limitation to this simple analysis method. That is, each user may have different standard such as a glass of water for each person does not have the same size. Therefore, each user must have a standard in mind for collecting his/her data for each activity. For example, amount of fresh water to be considered as 1 glass must be at least 16 ounces.

To make it easy for the user to understand the results, all analyzed results are presented in the forms of graphs and tables. Fig 3 uses a pie chart to clearly show the different between good and bad habits, while Fig 4 uses a bar chart to show the details of the amount of each activity of the user. The scope of the data is varied according to the user preference. That is, the analyzed results can be

calculated from a data set of one-day, one-week, one-month or specific periods. Fig 5 is an example of the sleeping duration data collected during a two-week period (i.e., December 15 to January 15). In addition, the recommended sleeping duration which is suitable for the user according to the user's personal information is also presented as a line in the chart. Moreover, a simple statistically measure such as an average is also provided by the proposed program. Fig 6 presents the average exercise duration of each day of the month which is clearly showing that the user does not have enough exercise on Tuesday, Thursday and Saturday. Due to the limited space, all results cannot be presented in the paper. However, the developed application will be demonstrated during the conference.
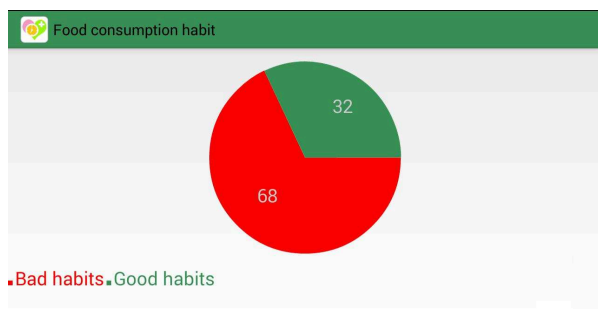

Figure 3 Food habits comparison

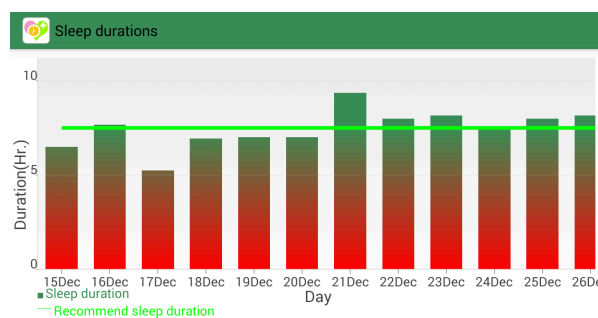Figure 4 Sleep and exercise frequency
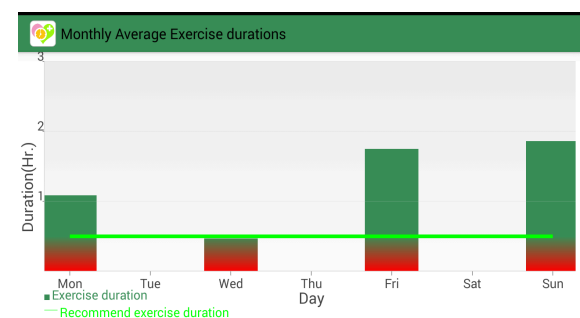

Figure 5 Sleeping duration information

Figure 6 Average exercise duration

Currently, the developed application is not available on the Google Play Store. Therefore, the developed program has been evaluated by a few selected faculty members from the Department of Computer Engineering at Prince of Songkla University. Positive feedbacks are on the clear and easy-to-use graphic user interfaces, especially the large image icons on the last row in Fig 1. Some suggestions on additional features are given including (1) an option to post the personal score on popular social network applications such as Facebook, and (2) the data backup capability. In addition, the proposed is now further developed to enable the data collection from personal health monitoring devices via the IEEE 11073 [20] and this newly developed project is now in the final round of the National Software Contest [21], Thailand.

Conclusions

In this work, a personal health assistant Android mobile application is designed and developed. The developed application allows the user to collect and analyze his/her personal health information related to sleep, exercise and nutrition. The application can collected a set of data from other Android applications and a set of data entered by the user. The collected data is analyzed using a set of simple data analysis methods. A set of pre-defined personal information and a set of pre-defined personal preferences are utilized by the proposed application in order to provide a set of personal health advices. The analyzed results are presented in a simple and easy to understand format such as a pie chart. The application can also issue a notification or alarm on a pre-defined event specified by

the user. The proposed application is developed using JAVA programming language and it is fully compatible with the Android 4.2.2.

Acknowledgements

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