An Implementation of Interactive Healthy Eating Index and Healthcare System on Mobile Platform for College Students

Shyh-Wei Chen  
Graduate Institute of Biomedical Electronics and Bioinformatics  
National Taiwan University, Taipei, Taiwan

Dai-Lun Chiang  
Graduate Institute of Biomedical Electronics and Bioinformatics  
National Taiwan University, Taipei, Taiwan

Tzer-Shyong Chen  
Department of Information Management  
Tunghai University, Taichung, Taiwan  
arden@thu.edu.tw

Han-Yu Lin  
Department of Electrical Engineering  
Tunghai University, Taichung, Taiwan

Yufang Chung  
Department of Electrical Engineering  
Tunghai University, Taichung, Taiwan

Feipei Lai  
Graduate Institute of Biomedical Electronics and Bioinformatics  
National Taiwan University, Taipei, Taiwan

Abstract  
Background: This research aims to conduct those college students who have not yet left their family before. At this phrase, students tend to form erroneous diet habits. These situations will lead to obesity and chronic diseases. The purpose of this research is to develop and design the smart Healthcare System for college students. Therefore, we hope to utilize the technology of
information to make college students understand their dietary and whether they have enough physical activity or not.

**Objective:** The objectives of this study is to develop an application. This application provide students a method to understand their habits both on the diet and the exercise. An interactive healthy diet evaluation and healthcare system is established in this research. With the convenience of mobile phones, the users can easily record the dietary contents, nutrient, and exercise process. According to the past dietary habits and exercise records, it also provides suggestions of nutrient allowance. The system, containing diet module and exercise module, can automatically offer suggestions according to the users’ basic information, including age, gender, favorite types of food, and amount of exercise. Students can inspect the nutrients they take to adjust their dietary and exercising habit. This can avoid the obesity which caused by the unbalanced long-term diet and the chronic diseases which might happen in the future.

**Methods:** The mobile device application is applied at the system interface, the graphic interface, diagrams and images can effectively provide the users with various diets and exercise information. The users can use their own mobile devices whenever and wherever they need. They are not limited by the time and the space. Meanwhile, the system could record the amount of exercise by integrating with Google Map and rapidly inquire the past exercise records for the reference of self-inspection. In this research, we invite 80 students to conduct this experiment. We divide this experiment into two periods. For the first four weeks, students have to use hard paper to record the diet and exercise information. Students have to record at least three days within a week. We require two weekdays and one weekend and then we can assume the nutrients they have taken in a week. For the rest four weeks, every step is the same but the only difference is that students need to access the application of the mobile phones.

**Results:** The diet module analysis system will give proper suggestions and calculate the required nutrients for users, so that the users can change their dietary habits. Moreover, the system will recommend the users suitable types of food in the criteria. It will automatically remind the users of excessive or insufficient nutrient so as to give the users a way to select a suitable food for individuals and not to cause the body overwhelmed by the unbalanced nutrients. The exercise module will analyze the dietary records, suggesting appropriate running distance for proper exercise, and store the running data and distance records into the database. We invite 80 college students to conduct in this experiment. We can view the success rate via recording the three meals on the mobile phones. 60 students can fulfill the record of breakfast, which is 75 percent; 72 students can fulfill the record of lunch, which is 90 percent; 74 students can fulfill the record of dinner, which is 75.4 percent; as for the other
snacks, 56 students can fulfill it, which is 70 percent. Compared with the first stage of recording on the hard paper, we have inspected that the success rate of lunch and dinner achieve 70 percent and even more.

**Conclusions:** This system can store exercise data by integrating with Google Map and rapidly inquire the past exercise records for the reference of self-inspection. In this case, the users can understand whether the diet and exercise conform to the healthy demands of daily health records and further learn to select suitable food and improve the exercise habits. College students can bring the application conveniently and record the nutrients they take. This indeed can change the situation and the willingness. New generation needs to have a new tool and method to help them form good habits of dietary and exercise.

Keywords: Smart Diet, Nutrients Control, Diet Records, Smartphones.

**I. INTRODUCTION**

Being fat is one of modern illnesses. According to the healthy index, the value of BMI higher than 24 can be called over weight, and if higher than 27 is fat. Due to the change of lifestyle in modern societies, stress of life, being easy to obtain food and lack of related knowledge of the nutrient may cause body function degeneration and endocrine imbalance. The followings are some reasons result in fat.

1. **Under heavy stress**

   Being under a long time stress will have a negative impact on a person’s body and mind and even chronic illnesses, such as being fat. The fat stocks in a person’s stomach are the main reason to lead to hypertension, hyperglycemia and hyperlipidemia.

2. **Lack of exercise**

   World Health Organization (Global recommendations on physical activity for health) [1] suggests people exercising 15 minutes a day to live longer and adults doing medium intensity exercise 150 minutes per week. Lack of exercise will weaken down the functions of insulin and compose fat.

3. **Diet change**

   Heredity can be one of the elements being obese; however, the change of lifestyle and being fast food junkies are the key factors. According to the 2009 Taiwan Health Agency statistics, approximately 85% of salary men ate outside five days a week, and chronic illnesses were closely related to diet. Chronic illnesses are caused by bad lifestyle month after month. The best way against chronic illnesses is to prevent from it. Unhealthy and lack of exercise is one of the primary factors in obesity, being fat is also the important cause of chronic illnesses, and eight of the causes of death are relevant. For now, 51% male in Taiwan
are over weighted, and 36% female are over weighted. To maintain ideal weights, people should intake every type of food and cut down salt, oil and sugar to prevent from chronic illnesses.

(4) Lack of nutrient knowledge

Research on eating outside in 2008 indicated that only 5% interviewers could answer the whole knowledge about six types of food, protein and calories, and up to 40% interviewers ate more than five kinds of meat, whose amount was higher than the recommendation of Health Promotion Administration, Ministry of Health and Welfare. The result showed that people still lacked the knowledge of nutrient; and according to the research, only 70% interviewers would read the ingredients before purchasing the product and more than 80% interviewers regarded the ingredient tag being able to help them eat healthier [2].

In conclusion, people eating too much meat and lacking the knowledge of nutrition may be the dangerous causes of chronic illnesses. People have forgotten the importance of health in a delicate life. In the past, diseases were the main causes of death, but now they turn to chronic diseases. Figure 1 shows the top 3 death causes of cancer, heart attack and cerebrovascular disease, which, as a big issue, cannot being ignored anymore [3].

![Proportion of all deaths(%)](chart)

Figure 1. Ten Leading Causes of Death in Taiwan [4]

Keeping balanced nutrition and exercise can prevent from getting fat and chronic diseases. Glanz and some people said that nutrition, diet and health were the interaction of being healthy [5]. American College of Sports Medicine (ACSM) [6] indicated being fat and
having chronic diseases as international health problems and also emphasized the advantage of doing exercise regularly. Combining diet control with exercise not only can reduce medical costs but also promote the quality of life.

A good habit of balanced diet can increase the metabolism and also prevent from illnesses. For the immature diet thought, good habits can be controlled by tracking the diet records. Through the sport records, users can review themselves and prevent from illnesses, and the proper exercise can release the stress and keep a person in good body shape. Users can understand the nutrition and prevent from illnesses by this system.

In the past, using the App for sport and diet usually needs to sign up as a member and key in complicated data. The above problems cause users unwillingly using the App. For the rapid development of technology when everyone holds a smart device, shown in Figure 2, there still hasn’t any App combining diet and sport in current market. When such App is able to be developed, users can order their own meals by personal diet records through the Internet and review their exercise habits in personal sport records.

![Worldwide Smartphone OS Market Share](image)

The research purpose requires a user keying in personal data on the smart phone, and then the system will suggest diet recommendation based on personal data. After selecting the meal from the diet module, the system will record it and suggest the calories consumption by the sport module. The system can integrate the long-term diet with sport records to help users complete personal nutrition evaluation and sport management. This system will apply on improving college students’ dietary. For many students, it is their first time living away from home. However, they probably lack a correct knowledge of nutrition and then choose the food that is high fat, high calories, and high sugar. As the time passes, students will keep a terrible dietary habit which will cause the obesity and the chronic diseases in the future. Therefore,
the best method is to record all nutrients students take in a day and the calories students spend when they exercise. Students can know the situation of dietary and exercise. By this, they can control things they eat or choose substitution food. This research conducts the experiment on the 80 students in Tunghai University. In order to know whether the system can assist student change the wrong life habit by technology through recording dietary.

II. LITERATURE REVIEWS

Recently, the eat-out proportion is growing every year. How to let the excessively busy modern people have balanced diet and eat out safely and healthily is the topic being pondered deeply. Observing international studies on diet noted down and the relevant materials of users will note down and deposit in the server for medical personnel reference only; however, it couldn’t offer an individual to keep personal dietary records yet. Matsumoto [8] and Antoniou [9] referred to the mechanism of intelligent ration in personal diet project commonly depending on user’s complicated operation and input personal information including height, weight, age, interest, and hobby in detail to conduct the calculation and analyses. It was apt to cause the user's inconvenience and affect the willingness to use it. For this reason, the customer-oriented way, combining with the mechanism capable of taking down the habit of exercise, can be used for designing a convenient, easy-using interactive system of healthy diet estimation and health protection for all users. This paper will discuss the problem in modern diet custom (eating habits) to find out the importance of exercise in preventive medicine and explore the combination of mobile devices in the field of healthcare system-related applications.

2.1 Problem in Modern Diet Custom

The type of compatriot occupation has changed from agriculture, industry to service and hi-tech industry, revealing that jobs have changed from consuming a large number of calories into merely maintaining basic physical strength. Because the change in the life style of modern people gradually leads to the calorie being absorbed more than being consumed, the diet choice agrees more with the starch food of high calories, while having the meals cooked outsides with large amount of oil, excessive starch, high sugar, and high salt causes the majority's eating habits tending to the heavy taste gradually and additional burdens on the body. In the environment of diet such as the induce of American fast food restaurant, taking McDonald as an example, where the meal adds highly fried food with sugar beverage mostly, it is apt to cause fat compositions to let consumers absorb excessive oil and saccharides, etc. Actually, employment type attitudes and the change of cooking culture are closely bound up. For instance, rotation system, responsibility system, and indefinite overtime work may cause modern people not eating on time and sleeping deficiently because of overwhelming stress. It tends to cause the unhealthy situations of eating and drinking immoderately and absorb too
much calories that cause the fat.

Ministry of Health and Welfare referred to ten major dead reasons of countrymen in 2012 that 80% of death was related to improper eating habits. For example, patients with diabetes needed to strictly control blood sugar to suppress sickness; kidney patients needed to strictly control the salt (sodium) in food; and, cardiovascular patients needed to control the fat in food.

Based on above-mentioned points, proper diet control is closely linked to health. Compatriot's nutrition health status demonstrates the growth of fat and increasing chronic diseases in recent years. It is not only a method to control chronic diseases to implement correct diet knowledge, but to prevent from chronic diseases. Healthy diet has great impact on human. Research pointed out that improper diet for a long time could easily cause obesity and produce fatal chronic disease. The habit of healthy diet should be cultivated from childhood. In 2003, WHO (Would Health Organization) demonstrated the five states of personal diet, including the nutrition absorbed when fetus developed in womb affected the fetus health, deficiency nutrient in infancy tending to cause innate cardiovascular disease, body and adolescent taking in adequate protein and healthy fat to support development energy, and adulthood and the elderly containing individual diet to reduce the risk of cardiovascular and chronic diseases. This is the correct and healthy diet recommended by WHO and the basic way to prevent from chronic diseases [10]. As the result, in the research of Hsiao, correct diet selection was quite important for resisting various chronic diseases. With correct diet to prevent from chronic diseases and control sickness is also the design principle of this paper [11].

2.2 Application of Mobile Devices Combined with Medical Care Field

It was mostly cumbersome and inconvenient to carry medical instrument in the past, which even needed to be used in the particular location. Thanking for the development of technology, the functions of large machines can be replaced by mobile or wearing devices to reach the goal of conveniently portable and to use it without restrictions to space. Hsu indicated that exercising was a quite common prescription in clinical medical treatment. Using intelligent mobile phones for matching the acceleration detecting device in this research allows detecting the information which examines a plurality of positions of human bodies, passes the information collected to the intelligent mobile phone for analyzing and distinguishing movements through blue bud technology, and records the time that movements pass to really grasp the patient's sport situation [12]. In the research of Jones, regular exercise could remarkably improve the conditions of patients with chronic diseases [13].

Studies on CAST/Center for Aging Services Technology referred that the elderly often lacked activities due to physical mechanism degeneration and the reduction of food variety, making the problems in daily diet quality and balance [14]. They also used RFID technology
for recording the daily diet habits and building up the long-term and continual diet records for doctor survey and loaded a RFID CF Card Reader on PDA to return data (Tag ID) back to the server by Wi-Fi. By this mechanism, the long-term diet situation and the change of diet habits could be known, and the disease could also be found out earlier.

In addition, some studies used the action apparatus and information system for people to keep fit. For example, the research of My Meal Mate [15] from Britain referred that diet record and diet suggestion, the UbiFit Garden [16] for mobile devices uses blue tooth equipment to record daily activities, the virtual garden [17] record the growth of flowers and that more exercise the flowers do the more fast they grow. Besides, the research of Smart Diet offered the following functions of diet records, diet evaluation and exercise planning.

In website's information system, in the research of Dhillon’s work for the old man offers the health to note down, let the healthy status of the old man can be cared about [18]. In the research of Fujimura, noting down the user's state of walking, the friends could see mutual records and encourage each other [19].

**III. RESEARCH METHOD**

3.1 System Architecture

Figure 3 shows the design of interactive health diet and healthcare system, which can be separated by three parts, namely smart phone App, website, and server. Using App for recording and analyzing all diet and exercise processes also gives some suggestions and then sends the data back to the server, so that the App and server can share the data through the internet. After the user installs the App and keys in personal data, the system will analyze the user's health conditions. When all of these steps are done, the App will give some recommendation about eating and exercise. Besides, the records are able to be reviewed at any time. The server is to collect and manage the data in PC so that managers and medical workers can apply the data to medical services through this system.

![System Architecture Diagram](image)

Figure 3. System Architecture

- CPU: Intel I7 3650
- Memory: 8G
- Hard Disk: 1TB
- OS: Windows 7 Professional
- Service: Apache Server
- Database: SQLite
- Client: Mobile device
In the front, the smart phone App is developed based on the Android mobile operation system to record a user’s basic diet and exercise data, analyze the diet and exercise records, convert them into health suggestions, and then send the results back to the server. The back-end is constructed by Apache server to receive and manage data; if needed, managers and medical personnel can have those records for medical purposes. In this case, it is more convenient for medical workers finding out users’ unbalance diet or lack of exercise and then noticing the users to make improvement immediately.

3.2 Design of System Flow

As in Figure 4, it is necessary for users typing in personal data when using the App for the first time, in order to provide personal data for front-end and back-end. After the preparation works, the system will come up with the first health evaluation information and analyze whether the users are healthy or not. Based on the evaluation, the system will give appropriate diet plans and exercise distances for being sent to the diet and sport modules in the front-end App. Both modules are evaluated in a cycle of one day, the diet module calculates the total calories that have been taken and the sport module records the total distance of exercise which is then converted into calories that have been burned. Through the evaluation of these two modules, the system will determine the diet and exercise being balanced or not. If it is balanced, the data will be stored in the server database; or, if it is not, the system will give some advices and analyze them again. However, if diet and exercise are still not balanced, the data will be recorded and sent back to the server.

The managers and medical workers have the access authority to visit the historical records through the Internet browser. When the diet and exercise conditions are not in normal value for a long time, the user would be contacted and offered some guideline.
3.3 System Function

There are two parts of front-end and back-end in the interactive health diet assessment and healthcare system; the front-end is the mobile Android App, while the back-end is an Apache server to implement PHP and MySQL. Personal Data (PD), Diet Module (DM), Sport Module (SM), Multi Data Evaluation Module (MDEM), Record Module (RM) and JsonParser are all included in the front-end App. The back-end is run by an Apache server to write the website functions, and MySQL is used as a database.
The following are the 5 functions of front-end.

(1) Personal Data Module: To manage the users’ relative data such as height, weight and blood group, then store those data into the mobile phone’s SQLite database, and create the compatible MySQL list on the back-end system. The historical records can be used for comparing the difference before and after and further giving suggestions according to the diet module and the sport module.

(2) Diet Module:
   2.1 Diet Survey: This function will look into the mobile phone’s SQLite database and calculate the balance in diet and sport modules. If it is in balance, the system won’t give users any suggestions, otherwise it will tell the users the amount of calories that need to be consumed or supplied in a day, then the data will be sent to the diet suggestion module and the sport suggestion module.
   2.2 Diet Suggestion: To receive the data after the calculation with Diet Survey and translate the weight into calories that a person should absorb a day; finally, to give suggestions of diet and different kinds of exercise and then send back the records and food available for the mobile SQLite database.

(3) Sport Module:
   3.1 Basic Module: Users can set up the exercise time and distance freely and insert the data and route in the mobile. The SQLite database can be shown on the Google Map for user inquiring their exercise experiences.
   3.2 Suggestion Module: To accept the data from Diet Survey and convert the over-supplied calories into exercise distance based on the user's weight and then write the suggestion data, running data and route in the mobile phone's SQLite database.

(4) Multi Data Evaluation Module: Running at the background and evaluating whether the diet module and the sport module should be updated or not to dynamically send the renew data to the diet module and the sport module immediately.

(5) Record Module: Record Module shows the health conditions according to the diet module and the sport module by graphs in order to reach self-survey. Use JsonParser for sending the data to the back-end server. Currently, Android can’t directly send the SQLite data to MySQL database of Apache server. Thus, it needs JsonParser to send information to PHP of Apache server for transforming to MySQL database.

3.4 Experiment Design

Most college students tend to eat the food which is high calories and high fat. This situation will cause a heavy burden on the body and form a bad dietary habit.

Students can use this application to record their food and drink which helps students know the nutrients which can keep the body from too much burden. The application will provide the dietary feedback curve that students can identify themselves and avoid the diseases from happening.
We invite 80 students from the engineering college to conduct this experiment. For the previous four weeks, students have to record the diet on the paper; for the rest four weeks, they have to record on the application. Each student has to record at least three days in a week. The record should include two weekdays and on weekend. They need to record a complete content including breakfast, lunch, dinner, and other snacks. This experiment mainly utilizes different tools to test whether students can record a correct dietary habit or not. Moreover, it is also possible to know whether electronic tools can help students improve the inconvenience of paper records.
IV. SYSTEM IMPLEMENTATION

4.1 System Developing Environment

The system developing environment could be used as the developing tool as follows.

(1) Environment: MacBook Pro 15” Retina, CPU 2.3GHz, RAM 16GB, SSD 256GB.
(2) Server: Synology DS1511+, CPU 1.7GHz, RAM 3GB, Storage 10TB.
(3) Mobile Device: Samsung Galaxy Nexus, CPU 1.2GHz, RAM 1GB, Storage 16GB.

4.2 SQLite and MySQL Synchronization

Healthcare system App is designed for mobile equipment. In the database design, Android mobile device with SQLite is used. Its advantages contain being more compatible with most of the SQL software in the market, such as MySQL and Microsoft SQL Server, light and convenient, and available in Android App without installation. When the healthcare system App has recorded user’s records and data, it can send the data to the server behind every 24 hours to offer managers and system maintainers checking whether it has problems that the healthcare system App will send the records and data to the back-end for maintainers to inspect, synchronize and backup. The back-end healthcare system uses Apache server and MySQL database as the back-end to record and backup the user’s data. Besides analyses and data feedback, it also let users retrieve data when they reinstall the App again. Figure 5 shows the synchronization process of healthcare system’s SQLite and MySQL data list. The Json on the healthcare system App is used for sending data to Apache server through HTTP Protocol, and the php, written by JsonParser, gets the data from SQLite and fills in the data at the right columns and rows. The user can just type in the name and birthdate to retrieve the old data.
4.3 Introduction to Healthcare System Function

The user interface of healthcare system is mainly designed for smart phones, because of the limitation of screen size that every unit just fits to a finger width. Both input and output will be shown on the screen, and some problems need to be overcome such as font size, icon and layout. The following are the operation process, as in Table 1, Table 2, Table 3 and Table 4.

(1) Personal Data Module:
As shown in Figure 6, when a user turns on the App for the first time, it will check on and certificate with the back-end server to insure whether the user has ever logged in. If there is no record, it will offer a list for the user to fill up and send back to back-end server for backup. People who have not used this App before would be required personal data such as, name, gender, age and weight, which are converted into BMI value. The healthcare list will come out with a health value according to the first height and weight and then send the data to the sport module and the diet module for the amount of calories that need to be taken.
Table 1: Personal Data

<table>
<thead>
<tr>
<th>No</th>
<th>Procedure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Start App</td>
<td>Turn on Healthcare System App</td>
</tr>
<tr>
<td>2</td>
<td>Type in personal information</td>
<td>Type in name, age to certify with the back-end server</td>
</tr>
<tr>
<td>3</td>
<td>Back-end server certification</td>
<td>Search the relevant data or edit a new client in the server for synchronization.</td>
</tr>
<tr>
<td>4</td>
<td>First use this App, edit new client information</td>
<td>Offer the blank to fill in name, gender, age, height and weight, and then choose the modes of gaining, loosing, or maintaining weight.</td>
</tr>
<tr>
<td>5</td>
<td>Make sure the data are correct and build a new file</td>
<td>Confirm personal data and follow procedure 3 to edit or synchronize.</td>
</tr>
<tr>
<td>No</td>
<td>Procedure</td>
<td>Description</td>
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<tr>
<td>----</td>
<td>------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>6</td>
<td>Enter the home page of Healthcare system</td>
<td>Log in the first page to continue</td>
</tr>
</tbody>
</table>

(2) **Diet Module:**

Diet module receives the data from personal data module, and the sport module then does the background monitoring; after that, the data are sent to diet suggestions and basic records. Shown in Figure 7, the diet suggestion module analyzes recent diet conditions and basal metabolic rate to offer the diet suggestion and exercise time. It also allows the users choosing the meal of breakfast, lunch or dinner and then gives some advice about food. The basic record is responsible for recording a user’s eating time, such as breakfast, lunch, and dinner, and the name of food calories and nutrition. Recording after all these procedures, the data will be synchronized and analyzed with those in the sport module. After the multi data evaluation of diet module and sport module, if the result is lack of calories or large amount of exercise, the diet module will receive the update from
the multi data evaluation module. Diet suggestion receives the update then analyzes and evaluates it again; the last step is to give a new suggestion to users.

![Diagram of Diet Module](image.png)

Figure 7. Diet Module

<table>
<thead>
<tr>
<th>No</th>
<th>Procedure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Click on diet</td>
<td>Click on the diet button in Healthcare System.</td>
</tr>
<tr>
<td>2</td>
<td>Enter the diet module</td>
<td>Enter the homepage of diet module, appear the calories that have been taken, and offer diet suggestion and diet record function.</td>
</tr>
<tr>
<td>3</td>
<td>Select diet suggestion</td>
<td>Click on single diet suggestion, choose diet suggestion or daily diet suggestion</td>
</tr>
<tr>
<td>4</td>
<td>Single diet suggestion</td>
<td>Choose the meal time and list the food</td>
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</tr>
<tr>
<td></td>
<td>for user’s selection, which are organized by calories and shown by standard unit Kcal/100g.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Suggestion food list</td>
<td>Five different calories sections or common food to be chosen.</td>
</tr>
<tr>
<td>6</td>
<td>Food selection</td>
<td>Pick one food and go on, or just finish ordering. The system will record all the ordering food and list them as user’s usual food for future selection.</td>
</tr>
<tr>
<td>7</td>
<td>Daily diet suggestion</td>
<td>Offer five different calories sections for selection.</td>
</tr>
<tr>
<td>8</td>
<td>Recommend food</td>
<td>List out breakfast, lunch and dinner.</td>
</tr>
<tr>
<td>9</td>
<td>Click on basic record</td>
<td>Click on selection list mode or manual input mode</td>
</tr>
<tr>
<td>10</td>
<td>Menu mode</td>
<td>The menu mode offers six categories of food, usual eating food, and searches function.</td>
</tr>
<tr>
<td>11</td>
<td>Six categories of food</td>
<td>The list offers total six categories of food, including grains, meats and beans, vegetables, milk and olein.</td>
</tr>
<tr>
<td>12</td>
<td>Select food</td>
<td>After the chosen food being taken, one can keep ordering, and the system will record and evaluate the result and add the data as usual food for future selection.</td>
</tr>
<tr>
<td>13</td>
<td>Usual food</td>
<td>A user can put the food which they usually eat into the usual food list to make it easier &amp; more convenient.</td>
</tr>
<tr>
<td>14</td>
<td>Search mode</td>
<td>Log-in the search bar to find the food database.</td>
</tr>
<tr>
<td>15</td>
<td>Manual input</td>
<td>After selecting the manual input mode, a user can fill in food name, calories (Kcal/100g), and food category, confirm it as a common food or not, and then record them on the list.</td>
</tr>
</tbody>
</table>
(3) Sport Module:

The sport module collects data from personal and diet modules, and the procedure is shown in Figure 8. The suggestion module will analyze a user’s age, height and weight to offer the users’ basic daily exercise distance and then check the calories consumption record to suggest and adjust the new distance. If the calories are under the basal metabolic rate, the system will suggest the users to cut the exercise distance to deal with unbalance. If the situation is the calorie consumption being higher than the basal metabolic rate, the system will suggest extending sport distance for the user. The basic module offers a user to set up the regular distance and duration. The suggestion module and the basic module will record the exercise distance, duration & route and supply for user reference. All the data will be transferred to mobile phone database SQLite as the storage and integrated the evaluation data together with the diet module. Comparing the diet module and the sport module, if the metabolic rate consumption is higher or less, the sport module will be revised or updated. The user will receive the new suggestion exercise distance after relative data input evaluation.
Table 3 Sport Module Procedure

<table>
<thead>
<tr>
<th>No</th>
<th>Procedure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Click on sport</td>
<td>Click on sport on Healthcare System.</td>
</tr>
<tr>
<td>2</td>
<td>Enter sport module</td>
<td>Enter the home page of sport module, which shows the require calories and daily calories consumption and offers suggestion module and basic module for selection.</td>
</tr>
<tr>
<td>No</td>
<td>Procedure</td>
<td>Description</td>
</tr>
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<td>----</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Basic module and suggestion module</td>
<td>Offer users to choose duration module, distance module and fat-burning module and then set up parameters. Suggestion module will auto-analyze the user’s daily fat consumption and offer new suggestion of exercise distance.</td>
</tr>
<tr>
<td>4</td>
<td>Sport UI (data)</td>
<td>Show the current time, exercise duration, consuming calories and exercise distance.</td>
</tr>
<tr>
<td>5</td>
<td>Sport UI (map)</td>
<td>Users can check the exercise routes.</td>
</tr>
</tbody>
</table>

![Image of Health Care System](image1.png)

![Image of Health Care System](image2.png)

<table>
<thead>
<tr>
<th>Note 3-1</th>
<th>Note 3-2</th>
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<tbody>
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</tbody>
</table>
(4) Multi Data Evaluation Module: Multi data evaluation module monitors the data from both diet module and sport module under the background data and analyses simultaneously, then feedback the suggestion data instantly. Based on different age, height, and weight in personal data module, those data are evaluated and come out with suggestion data. When the evaluation launches, it collects the data from the diet module and the sport module simultaneously and keeps modifying the suggestion data and feedback those modules to keep a user’s body balance. There are four conditions in the multi data evaluation module. 1. Diet calories under suggestion calories, it suggests users to have more calories and halt the exercise until the calories get balanced. 2. Diet calories over suggestion calories, it updates the suggestion data and exercise module to consume more calories. 3. Exercise distances under suggestion distance, it keeps the diet calories and suggests users to maintain the current exercise distances. 4. Exercise distances higher than suggestion distances, it updates the diet suggestion to get more calories and halts the sport module until it gets balanced.

(5) Record module and health information
Record data from the multi-data evaluation module and store those data in the smart phone App database. In the future, if a user needs to review the history of diet module and sport module, they will be shown by graphs. The record module is logged in the diet
record and the sport record in SQL format and stored a copy on the SQLite database in smart phone and through the Internet to be stored in Apache server by JsonParser. Health information offers users the basic healthy data for comparing with their current status from this function support (See Table 4).

Table 4. Record Module and Health Information

<table>
<thead>
<tr>
<th>No</th>
<th>Procedure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Click on record</td>
<td>Click on the record on Healthcare System</td>
</tr>
<tr>
<td>2</td>
<td>Enter record module</td>
<td>Enter the home page of record module to show the rate of daily diet and exercise condition as well as offer weekly average calories and monthly average calories.</td>
</tr>
<tr>
<td>3</td>
<td>Weekly average calories</td>
<td>Offer a user to review the weekly average calories by broken line graph.</td>
</tr>
<tr>
<td>4</td>
<td>Monthly average calories</td>
<td>Offer a user to review the monthly average calories by broken line graph.</td>
</tr>
<tr>
<td>5</td>
<td>Health information module</td>
<td>Click on health information</td>
</tr>
<tr>
<td>6</td>
<td>Health information</td>
<td>Offer the standard healthy index to compare with a user’s.</td>
</tr>
</tbody>
</table>
V. RESULT

In order to know whether the system has influence in students or not, we randomly invite 80 students from engineering college to conduct this experiment. There are 47 boys whose average age of 21.3 years old, weight 71.2 kg, height 172.8 cm, and BMI is 24.6. There are 33 girls whose average age of 21.6 years old, weight 62.5 kg, height 162.4 cm, and BMI is 23.7. Comparing with the standard published by Ministry of Health and Welfare, the BMI of boys and girls, who go under this experiment, is higher than the ordinary people. Therefore, they have to change their dietary habits; simultaneously, they also need some technology tools to assist them and improve the method they record on the paper.

Table 5. Characteristics of University Students using the Healthcare system App.

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>BOYS MEAN</th>
<th>SD</th>
<th>GIRLS MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>21.3</td>
<td>0.6</td>
<td>21.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>71.2</td>
<td>24</td>
<td>62.5</td>
<td>21</td>
</tr>
<tr>
<td>Height, cm</td>
<td>172.8</td>
<td>8.2</td>
<td>162.4</td>
<td>8.5</td>
</tr>
<tr>
<td>BODY MASS INDEX</td>
<td>23.8</td>
<td>4.5</td>
<td>23.7</td>
<td>7.5</td>
</tr>
</tbody>
</table>

This experiment is separated into two phrases. For the previous four weeks, we invite 80 students to record the diet on the paper. Each student has to record at least three days in a week. The record should include two weekdays and on weekend. We can calculate the whole nutrition they eat in a week. During the paper record phrase, none of these 80 students can fulfill the record.

At the second phrase, we also record for four weeks while we require students to record on the application. 60 students can fulfill the record of breakfast, which is 75 percent; 72 students can fulfill the record of lunch, which is 90 percent; 74 students can fulfill the record of dinner, which is 92.4 percent; as for the other snacks, 56 students can fulfill it, which is 70 percent; 72 students can fulfill the record of exercise, which is 90 percent.

Table 6. Evaluation of the dietary intake records provided through Healthcare system App.

<table>
<thead>
<tr>
<th>Eating event (n =80)</th>
<th>Breakfast</th>
<th>Lunch (90%)</th>
<th>Dinner (92.5%)</th>
<th>Other (70%)</th>
<th>Sport (90%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>60 (75%)</td>
<td>72</td>
<td>74</td>
<td>56</td>
<td>72</td>
</tr>
</tbody>
</table>
VI. DISCUSSION

There are a lot of treatises about diet domestically and overseas, but they seem still not complete enough. A good diet habit could prevent from chronic diseases and postpone bad illness conditions. However, the studied objects are mostly patients or people who are overweight. The targets are focused on eat-out persons, and their diet records are kept in a server for medical consult and also the users’ review. These data used to only be stored in client-end or hospitals for medical treatment. There was no such self-survey system being able to keep personal diet records all the time. Besides, previous systems always reduced the user’s willingness in the process of ordering meals because of complicated procedures.

This research is mainly for eat-out persons. The full functions of a smart ordering system with sport system contain personal data module, diet module, sport module, integrating evaluation module, and health module. Besides, it also completes the nutrition factor analysis database and the calculation of out-eaters setting their meals and exercise in Taiwan. For different groups of people, different sets of breakfast, lunch and dinner are also designed for their selection.

This research completes the Personal Smart Healthcare System and allows out-eaters tracking their daily diet situation and the amount of exercise to balance their diet. It not only prevents from illnesses, but also saves the insurance cost. The smart meal ordering system can simplify the user interface and process to be a study tool for clinic medicine and research. Through Personal Smart Healthcare System, the long-term recording data can be a medical research material to control diseases (over-weight, under-weight), and the use of red, yellow and green signals can help users understand food ingredients. Diet and exercise are two major factors in health to control user’s weight and cardio-pulmonary functions through index management and to keep notifying their body conditions.

In the experiment, the previous four weeks which record on the paper, none of the students taking the test can fulfill the record because they might lose the paper and forget about bringing and recording. Nonetheless, the later four weeks when they record on the application, more students can complete the record. Not only can the students avoid to bring it, but it can provide an abundant nutrition information as well. Students can soon know the nutrients and decide the food they eat or even choose other substitute food. They can record the dietary content rapidly and record the calories they spend on exercising conveniently. Through record on the application, 83.5% of students can complete the record.

Additionally, the record rate of breakfast is lower because students rush to the class.
Only 60 students, which is 75 percent, can fulfill four dietary records. Therefore, the system should add a function for students to re-register which intent not to interfere students’ ordinary life and also cater to the demand on the rush morning. In this research, we observe the achieved rate of lunch and breakfast is more than 70 percent. Through the application, college students can fulfill their dietary record on time which shows an outstanding situation and willingness of improving.

VII. CONCLUSION

This research focuses on the development and design of the smart Healthcare System. It is discovered that similar systems domestically or overseas are all about diet, but few about ordering and sport system. If those systems can be combined with this research, it would become more complete. In the design process, some experts and users are interviewed for their opinions to simplify the operating interface and processes. Nonetheless, some insufficient and hidden problems can still be improved to make it better & more acceptable.

Besides, as time passes by, people start eating healthily rather than fully and well; and, diet and exercise help better sleep, emotion management, and brain degeneration. It should be the critical developing tendency in future.
REFERENCE


