

## A dietary menu-generating system to promote healthy life

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**Abstract:** In Japan, it has been pointed out that the number of patients afflicted with lifestyle diseases such as hypertension, diabetes and hyperlipemia is rapidly growing. These lifestyle diseases are caused from Habitual excessive drinking/eating, biased nutrition, little physical activity, sleep deprivation or stress. It is well-known that bad lifestyle habit provokes lifestyle diseases. In other words, improvement of lifestyle habit prevents these diseases from progressing. To improve eating habits (alimentary therapy), knowledge of medicine and nutrition is required because it is very important to keep a daily calorie count and to get a balanced meal. There are many studies which are focused on health care, however, none of them developed functions to assist planning balanced healthy meals.

This paper describes a designing and implementation of alimentary therapy assist system. The system can record users' individual data, such as gender, age, height, weight and so on. Also, this system has a function to accumulate clinical history. And this system calculates the moderate number of calories based on the individual information and medical information. Furthermore, this system has a function to accumulate user's meal history and market information, and provide the user with healthy menu based on the meal history, individual information and market information.

**Keywords:** Integrated Health Care System, Alimentary Therapy, Lifestyle Diseases, UML

### 1. INTRODUCTION

In recent Japan, the number of patients who are affected by lifestyle diseases is rapidly growing. It is well-known that negative lifestyle habits bring serious diseases such as high blood pressure, hyperlipemia, diabetes and corpulence and so forth. It is hard for most of patients who are affected by the lifestyle diseases to notice symptoms at the initial phase of diseases. Also patients do not learn the severity of such diseases because those lifestyle diseases progress over several years. Therefore it is very important to control unhealthy tendency and dietary habit. In this few years, healthy diet has been getting widespread domestic attention. Because it is well-known that healthy diet is very important to improve health condition. Also, the Cabinet Office, Government of Japan implemented the basic law on nutritional education on 2005. The basic law promotes nutritional education comprehensively for all Japanese citizens to be mentally and physically sound. In order to keep/improve health condition, dieticians advise their patients to improve dietary life. Dietary cure needs to be well-thought-out to the individual because each of patients has their own case history, allergies, individual taste, etc. Moreover, all of people can not be given dietary advice by dietitian and food information is required to take the best care of the health.

Many studies on health care and life support have been proposed with the progress of rapid aging of society. Many of these studies focus on sensing elders' health condition or behavioural information in a house[1]-[5]. None of them try to develop functions improve dietary habit or functions to assist to plan healthy meals, even if the significance of dietary habit is indicated. Previously, we proposed a health care system [6]-[9]. We consider

that it is important for the health care system to provide comprehensive support for patients. Based on the concept, we have proposed an integrated health care system which has a function to detect patient's health condition, a function to detect non-habitual behavior in a house and a function to support physicians to decide medical diagnosis. All of these functions are effective in sudden changes of patient's health condition, however, it is known that a long-term alimentary therapy helps people with lifestyle diseases. Therefore designing and implement the alimentary therapy support system is highly meaningful study.

In this paper, a design of information support system that provides list of menu based on patients' individual information such as taste, case history and market price of cooking ingredient is proposed. At first, uses input their basic individual information such as gender, age, tastes and case history. Then market price of food is given to the system. This system gives some candidates and total amount of calories of menu to users, and user can select one of the candidates. At last the system accumulates the menu which user selected to system memory. The system provides other menu based on menu history next time. This system is designed using UML and implemented by Java.

### 2. INTEGRATED HEALTH SUPPORT SYSTEM

We consider that it is important for the life support system to provide comprehensive support for a patient. QOL(Quality Of Life) is improved by not only sensing vital signs or behavioral information also keeping healthy condition and prevention from diseases. Figure 1 shows the proposed integrated life support system based on our concept. In this figure, arrowed lines show flow

of information/message between modules and a physician/dietician.

## 2.1 Detecting module

To detect changes of patient's health condition, two detection modules have been proposed. One of them is a detecting module which catches signs of cancer by blood test. It is well-known that early detection is the key in curing cancer. It is easy to have a blood test, because Japanese companies are obligated to let their workers have annual health checkup. Also retinarian can have medical checks in hospital or health care center. We try to develop this module using protein analysis data in the blood. In the near future, the experimental results and efficiency of this module will be reported.

Another detect module works to find irregular behavior different from habitual life behavior. In our daily life, we use many kinds of electric appliances. This implies that a person's action corresponds to an use of the household electric appliances. From this point of view, human behavior at home can be represented using turning on/off electric appliances. This module monitors states of electric appliances and detect the irregularity of human behavior.

An emergency message is transmitted from detecting modules to a send message module when these modules detect subtle changes of patient's life behavior or results of a blood test. Then, send message module send messages to someone, for example, patient, patient's families or physician.

## 2.2 Medical diagnosis support module

The medical diagnosis support module helps a physician to make medical decision based on signs, symptoms, clinical laboratory data such as blood and biochemical check up data. In the clinical field, the importance of this support module to medical decision has been pointed out for improvement objectivity and for early detection of disease. This support module uses medical check up data. and diagnosis algorithm is discussed for general internal medicine based upon blood check, bio-chemical check and main complaint from patient.

## 2.3 Alimentary therapy support module

All of the modules are effective in sudden changes of patient's health condition, however, it is known that a long-term alimentary therapy helps people with lifestyle-related diseases. Therefore designing and implement the alimentary therapy support system is highly meaningful study. In next section, an algorithm to generates list of meal to improve lifestyle dietary meal is proposed.

## 3. CHOOSING MEAL AND INFORMATION

When we decide what to cook for meal, they use some informations what are history, favorite food, price of cooking ingredient and/or diseases. First human calls to mind what I want to eat. At this time, they consider what I ate last night, what is lower price, what is suitable

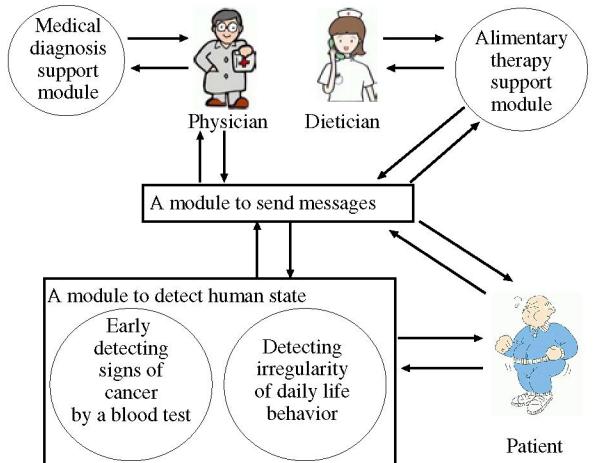


Fig. 1 A diagram of proposed integrated support system

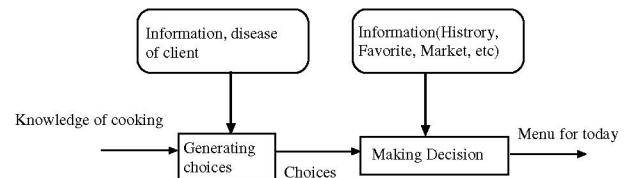


Fig. 2 Organizing one's menu

to my diseases and so on. Then some menu is thought of. Finally they chose one of menu. This flow can be regarded as general way. Since it is hard to formulate described human method. Heuristic algorithm is adopted to develop the software system at this project. First step, name of diseases is taken to generate choices. Second step to reduce choices, price of cooking ingredient, favorite and/or history are taken. See Fig. 2.

## 4. IMPLEMENTATION

In this section, software design and its implementation are described.

### 4.1 Software structure of alimentary therapy module

Figure 3 shows the software structure of the alimentary therapy module. This module has four categorized database, resources as market price of cooking materials, knowledge as synopses and cooking, and individual information as name of diseases, favorite food, taste and so on. A manager of supermarket of this module can register/update information on materials e.g. market price of food, a list of cut-price bargains, information on seasonal food. Also, patients can register their own information, e.g. tall, body weight, age, gender, case history. The module generates list of menu by using above mentioned information. Processing method is very simple. First, the module withdraw proper menu list for individual diseases. Second, these menu list are abstracted by using history and market information. Then patients can select the menu for breakfast, lunch or dinner. This module accumulates menus which patients selected, and propose other menu on the next.

### Information System to improve dietary habit

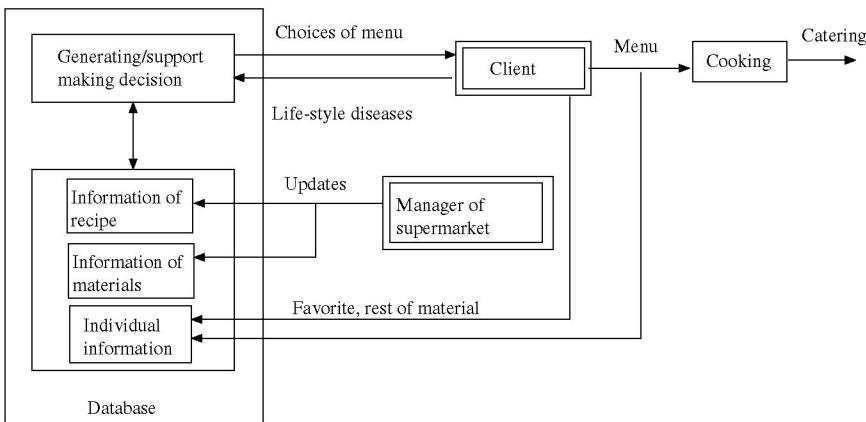


Fig. 3 Software structure of the alimentary therapy module

#### 4.2 System design and user interface

To implement functions described above, UML is applied for the design of the alimentary therapy modules. Figure 4 shows a diagram of use-case of the alimentary therapy system. In this figure, human-figured symbols, which is called “Actor”, represent users of this module. Also, elliptic marks, which are called use-case, represent functions that is provided by the module. This module is implemented using Java on Linux. Databases are constructed using PostgreSQL.

#### 4.3 User interface

Several user interfaces are provided for users as described follows.

##### 1. Main window

Figure 5 shows the main window of this module. On this windows, the module shows total calorie of a meal, main dish accompaniment, etc. Also, market prices of foodstuff are shown.

##### 2. Recipe window

Figure 6 shows a list of materials, cost of materials, information on nutrition value of the dish. Also recipe is shown in this window.

##### 3. User information window

Users can register their own information, e.g. body height and weight, gender, lifestyle diseases using a window shown in Fig 7. Furthermore users can register their favorites, least favorites, resources. The alimentary therapy module provide dietary formula to user with taking the user’s individual information.

##### 4. Materials window

This window (Fig. 8) shows a list of materials which is registered in database. User can modify, add/delete information on materials.

Several windows other than the windows previously mentioned are provided be the alimentary therapy module e.g. to register recipes and menus.

## 5. CONCLUSION

In this paper, we propose design concept of information support system that assist planning balanced healthy

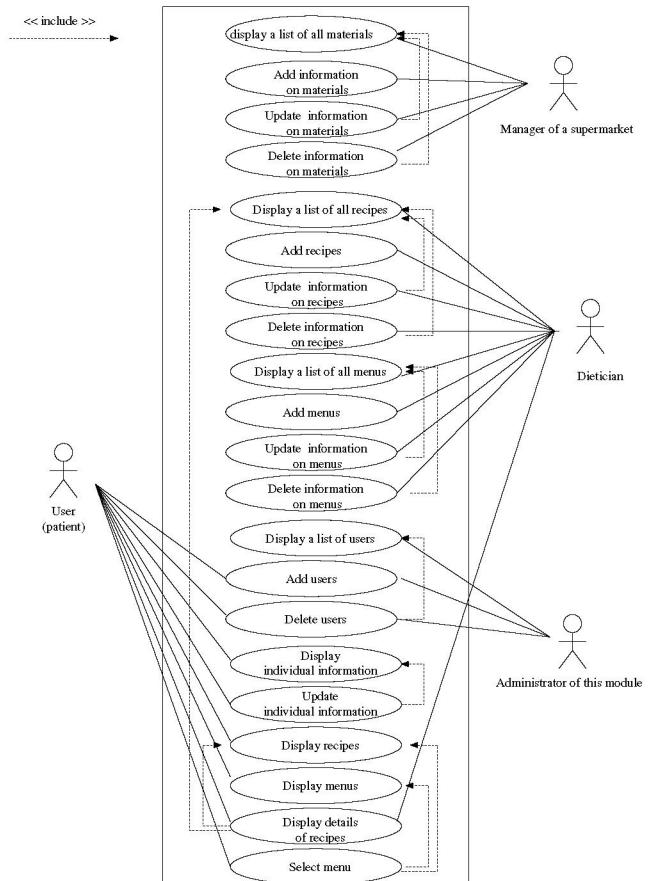


Fig. 4 A diagram of use-case of the alimentary therapy system

meal to improve patients’ health condition. Features of this system is taking adaptive method, that is; taste, history of diet is considered, also market price of cooking ingredient is used to generate the list for providing budget menu. This system still is on the laboratory level.

As future works, we have to develop functions to recognize what patients’ actually eat, to manage the rest of cooking materials. In order to put market price of materials into the database, enterprise such as supermarket,

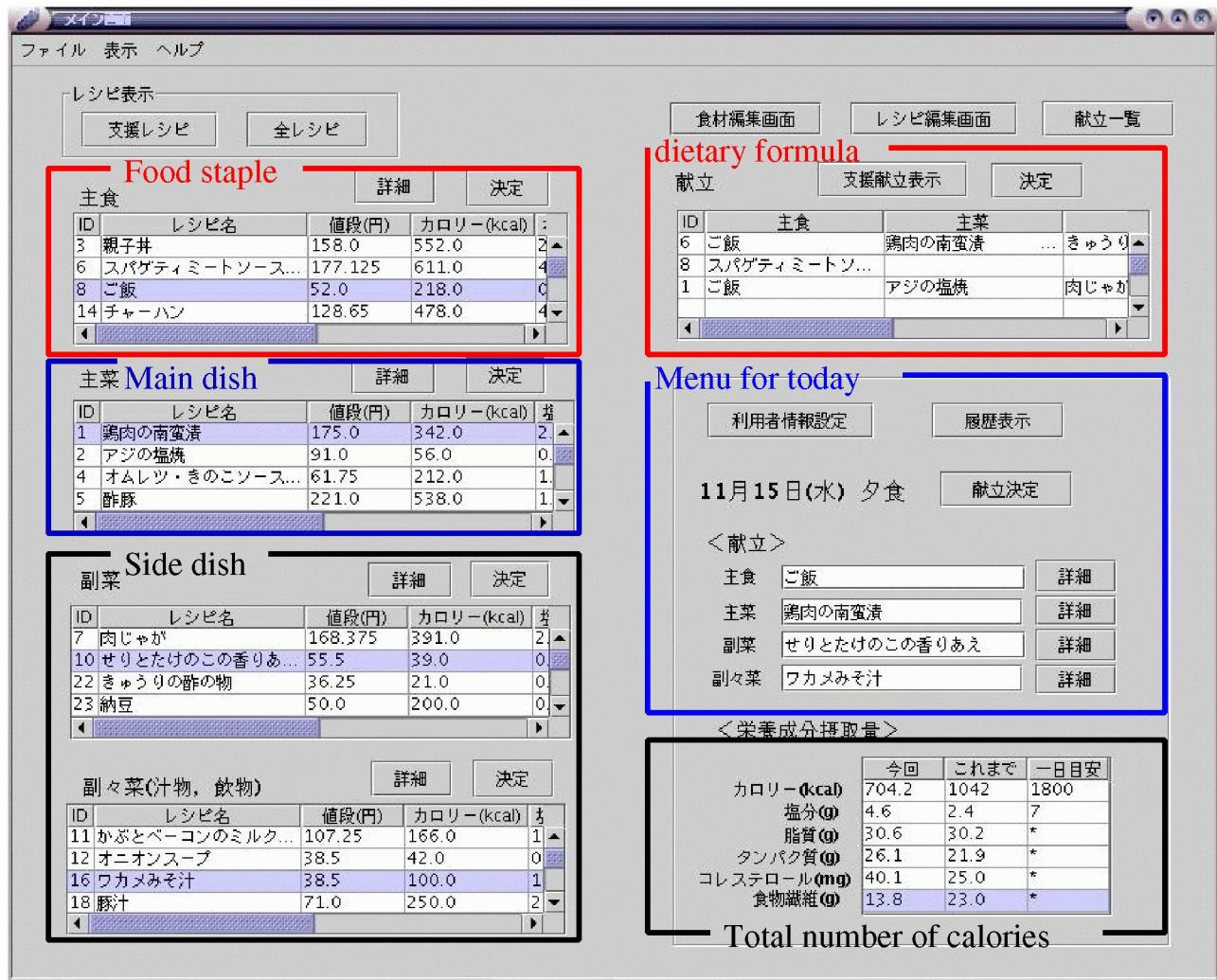


Fig. 5 Main window of the implemented module

ID	レシピ名	カロリー(kcal)	塩分(g)	脂質(g)	タンパク質(g)	コレステロール(mg)
1	鶏肉の南蛮漬	342.0	2.1	22.8	15.9	30.0
2	アヒの塩焼	56.0	0.5	1.2	7.5	0.0
3	親子丼	552.0	2.4	12.9	20.8	50.0
4	オムレツ・きのこソース	212.0	1.4	15.4	11.6	0.0
5	酢豚	611.0	4.3	20.7	21.3	0.0
6	スパゲティミートソース	587.0	1.8	34.9	13.1	0.0
7	肉じゃが	391.0	2.7	0.0	0.0	0.0
8	ご飯	218.0	0.0	0.0	8.3	0.0
9	牛丼のコチュジャン炒め	183.0	1.2	0.0	18.3	0.0
10	セリとたけのこの香りあえ	39.0	0.7	0.0	2.0	0.0
11	かぶとベーコンのミルク	166.0	1.1	0.0	5.4	0.0
12	オニオングラウンド	42.0	0.8	0.0	0.0	0.0
13	クリームシチュー	587.0	2.4	0.0	0.0	0.0
14	チャーハン	478.0	4.8	0.0	0.0	0.0

Fig. 6 Recipe window of the implemented module

User's name: 松田将一	Body height: 172.0 cm	Body weight: 53.0 kg
gender: 男	身長: 172.0 cm	体重: 53.0 kg
Lifestyle diseases: 高血圧症	生活習慣病: 高血圧症	
好きな食材: たまねぎ ...	嫌いな食材: あじ ...	食材の残り: にんじん ...
Favorite	Least favorite	Rest of materials
updating		cancelling

Fig. 7 User information window of the implemented module

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grocery store should be involved with this project. The user interface is not simple for elderly people to use easily. Therefore we will consider a design of user interface of this system. Also we will develop this module to implement on personal hand phone.

ID	食材名	単価(円)	単位	お買い得品
1	たまねぎ	8	g	お買い得
2	じゃがいも	5	g	お買い得
3	こんじん	8	g	お買い得
4	ピーマン	0	個	お買い得
5	牛肉	0	g	
6	卵	0.0	個	お買い得
7	大根	4	g	
8	鶏肉	8	g	
9	片栗粉	5	g	(適宜)
10	南蛮漬の酢	8	ml	
11	あじ	0.0	尾	
12	塩	0	g	(適宜)
13	ざいこん	0	g	
14	醤油	1	g	(適宜)
15	長ねぎ	0.0	本	
16	椎茸	0	枚	
17	カツオだし	0	ml	
18	水	0	ml	
19	酒	5	ml	
20	りんご	5	ml	

Fig. 8 Material window of the implemented module

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