The Dynamic Database Model Supporting Greatly Varied Items for the Continuous Monitoring of Physical Fitness and Healthcare

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Abstract

We developed personal healthcare database of the personal physical fitness and healthcare records, which suits individual life styles, registrants input the obtained personal health information via network and compare with the previous data by themselves. For aged people, it is important the continuous measurements not only the standardized items but also the measurements which fit individual characteristics to compare the previous his own data. It is a dynamic database, which supports greatly varied items in the measurements for the continuous monitoring of physical fitness and healthcare. It converts diversified measurement items into the conventional database configuration and process them.

Keywords:
Dynamic database, physical fitness, elderly, new fitness test, web database

Introduction

In the current society, the amount of physical activity shows a downward tendency and this implies the consequent imbalance in physical harmonization, which results in a lifestyle-related disease. Therefore, it is necessary to raise the awareness of physical activity and exercise while creating the environments and methods for the purpose of promoting the physical exercise on a day-to-day basis[1) 2) 3)].

Concerning personal health databases (PHDB), in the past, we studied the integration of medical information and the multicenter collaboration in handling medical information [4) 5)]. This time, in order to broaden the applications of PHDB in addition to its application to medical treatment, we study the participatory personal healthcare monitoring for the purpose of developing the personal healthcare monitoring system which coordinates with the school health and physical education and the community programs, with the intention of creating the personal healthcare database of the personal physical fitness and healthcare records which suits individual life styles rather than the hospital-centered database of medical records.

To begin with, we carry out the physical fitness measurement and medical checkups on students, and the students themselves input the obtained personal health information via network. The prototype for the healthcare monitoring system, which creates self-administered data is developed, and the pilot test is carried out.

In the system developed this time, individuals register themselves with the system, and each registered individual can specify the items which he or she desires to measure every time, and can freely add and browse the data. The elderly do the physical exercise which suits themselves, such as the activities like standing up, walking, and stepping, as well as pedaling a bicycle[1) 2) 3) 6) 7)]. Their main focus is to compare their newly recorded numeric data with their old numeric data which were recorded before. Therefore, many measurement items are included in a set. In this way, measurement items are being diversified. However, conventional database systems have difficulties in handling such diversified measurement items. In order to solve this problem, we develop the dynamic database, which converts diversified measurement items into the conventional database configuration and process them.

Method

1. Selection of the items to be measured in the physical fitness monitoring

1-1. The measurement items in the physical fitness monitoring for school children, students, and the middle aged

The physical fitness measurement in those periods has the following two significant points: 1) The physical development condition and the deterioration in physical fitness can be compared with those of the age peers. 2) Personal changes due to aging can be studied. Concerning the former case, in order to compare with the age peers group, the items in the standardized physical fitness measurement need to be measured. From this aspect, we employ the measurement items in "Japan Fitness Test 1999", the new fitness test approved by the Ministry of Education, Culture, Sports, Science and Technology for statistic data collection.

The new fitness test is intended for the 4 demographic groups, such as the age 6-to-11 bracket, the age 12-to-19 bracket, the age 20-to-64 bracket, and the age 65-to-79 bracket. In our study, we employ the measurement

items in the new fitness test for those who are between the ages of six and sixty-four.

1-2 The measurement items in the physical fitness monitoring for the middle aged and elderly

When it comes to the elderly, some participate in full marathon, and others are not impaired but have difficulties in walking even for several meters. This implies that the personal physical capabilities of the elderly greatly vary, and the comparison with the standard in age peers means very little. Wide variances among individuals can be seen in the deterioration of their physical fitness and physical capability, which means the obtained data should be used to study the personal changes due to aging instead of conducting the cross-sectional analysis of the group. It is also necessary to establish the environments where the elderly do the physical exercise suitable for them and record the results as numerical data with the intention of comparing them with those recorded in the past for the purpose of grasping their current health and physical conditions and raising their awareness of future health.

Therefore, we create the database which covers the measurement items in the physical fitness measurements which are currently conducted (such measurement items include those which are already standardized, those which are popular but not standardized yet, and those which suit individual characteristics), and register as many measurement items as possible, including those which are already reported in literatures and are newly contrived by us, in order to provide the way for individuals to choose the measurement items which suit them.

2. Web-capable health information database

In order to input and browse the data without the place-wise and time-wise restrictions, a Web server side database is selected. As user IDs and passwords are automatically issued, an individual or a healthcare administrator can register, and input and browse the personal data via the Internet.

In the physical fitness measurements for school children, students, and the middle aged, the standardized measurement items are adopted, therefore, the information can be recorded and browsed using a conventional database. Based on the average of the age peers, the obtained personal results can be rated on a 1-to-7 scale, which is the cross-sectional evaluation of the data. In addition, the column for each individual to write his or her own personal evaluation after the measurement is prepared in order to accumulate the personal evaluations and remarks about the results in the database as a help for longitudinal study of the data. Concerning the measurement items in the physical fitness measurement for the middle aged and elderly, individuals are supposed to choose the measurement items which they think are suitable for them. Therefore, the number of measurement items grows too large for a conventional database system to handle, and the tabular lists themselves become extremely large, making it difficult to consolidate them.

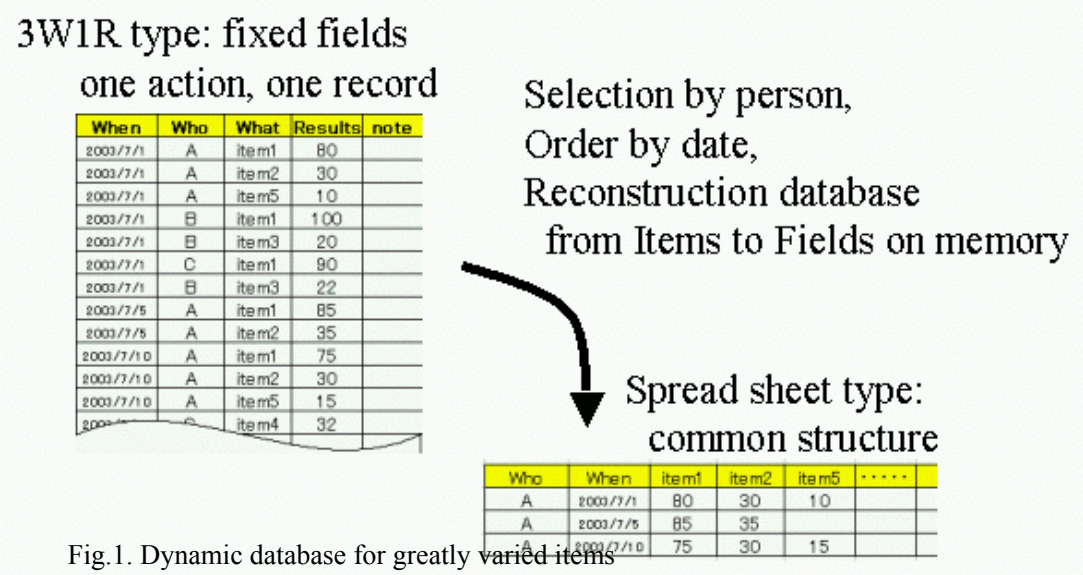

Fig.1. Dynamic database for greatly varied items

For this reason, we develop the new dynamic database system, which employs the 3W1R (When, Who, What, and Result) style to create and maintain the master database where one action is treated as one record, and extract it on memory into the conventional database configuration for use (Figure 1).

Results

1. 3W1R-style database

In a conventional spread sheet type database system, the definition of a field is designed at first, which causes difficulties in changing the field and adding a new field

later. Additionally, when the number of the classified fields grows big, the entire database system deteriorates its efficiency.

For this reason, we develop the database which adopts 3W1R style for data archives.

As shown in Figure 1, this database configuration is simply comprised of four fields (When, Who, What, and Result). When some one measures three items, the results are recorded as three different records, in which the fields of "When" and "Who" have the same information but the fields of "What" and "Result" have different information. Therefore, the number of the saved records correspond with the number of the items measured. At first glance, it gives the impression of being inefficient, however, it has the supreme and decisive advantage that records can be saved without changing the database configuration regardless of the number of fields For searching, the data pertinent to the person are extracted once to screen the items described in the field of "What", and then convert the database configuration into that of the conventional spread sheet type on memory in order to provide the way to accomplish various kinds of searching in accordance with SQL. Based on the intention of the continuous healthcare monitoring system, it is not assumed that an individual would measure physical fitness using numerous items, therefore, the system runs efficiently. Nevertheless, when the experiment is conducted based on the assumption that thirty items would be measured per person, the system runs without problems.

2. System installation

Windows 2000 Server is installed as the server operating system, and Microsoft Internet Information Server (IIS ver. 5.0) is installed as the Web server software. The database software installed is MS Access. For the program language, VBScript ASP (Active Server Programming) and the Dynamic HTML technology are employed.

Figure 2 shows the flow of the job processing we developed this time, and Figure 3 shows the developed input and output interfaces which a user sees on the WWW browser.

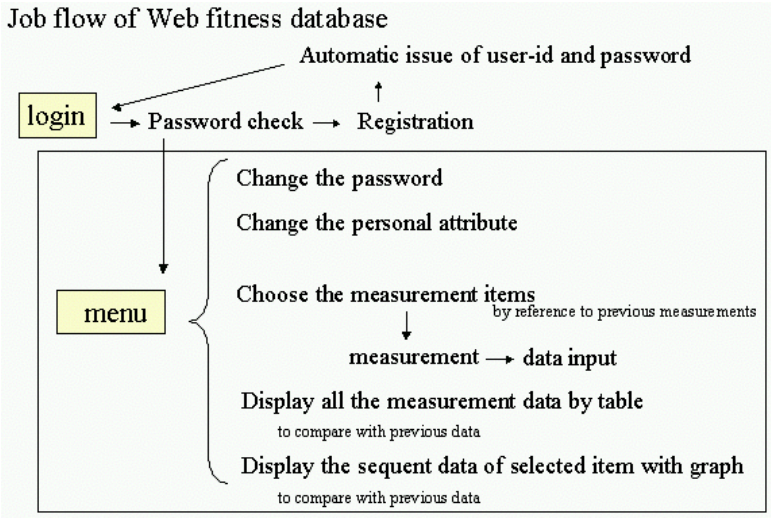

Fig. 2. Job flow of fitness database

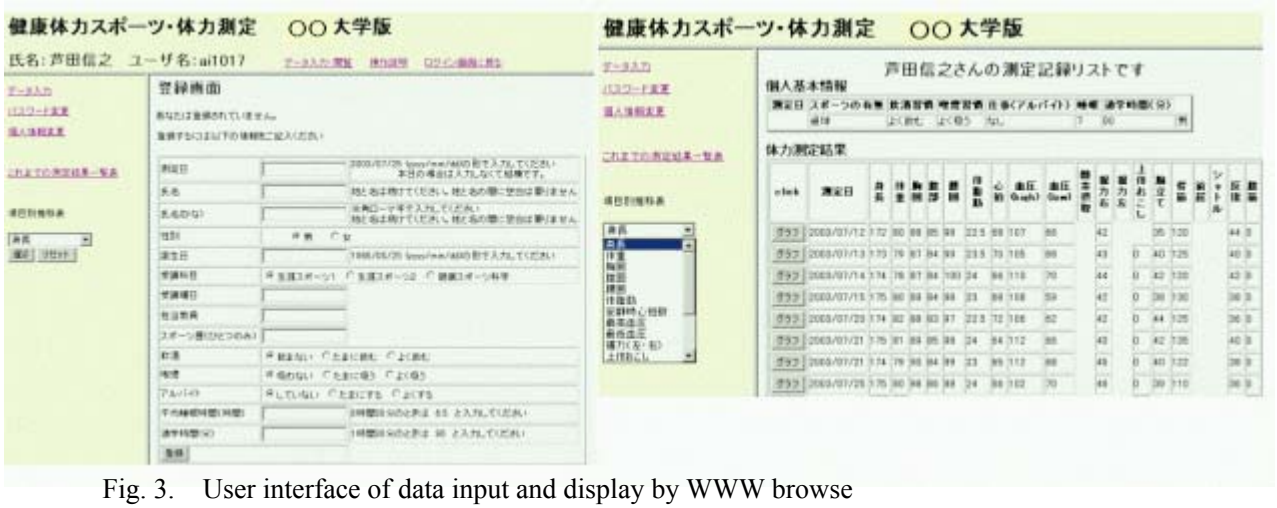

Fig. 3. User interface of data input and display by WWW browse

3. Test operation results

The pilot test is carried out using the data obtained in the physical fitness measurement conducted in 2001over the student public at Kinki University Healthcare Sports Education Center, which covers 2300 persons and 4352 data entries.

Discussion

The Japanese health care administration is not consistent, and various supports are extended to different demographic groups, such as the medical checkups for school children and students which are provided as a part of the school health services, the healthcare services for employees and workers which are provided under the Industrial Safety and Health Law, and the services for the elderly provided by the healthcare and welfare for the aged. Thus, personal health information is not integrated. For the young and the adults, the comparison with the age peers is necessary in order to indicate physical development and stability. However, the continuous changes due to aging in physical development also need to be recorded. In particular, concerning the elderly, the deterioration in physical fitness and physical capability greatly varies with individuals, which means the obtained data should be studied to grasp personal changes due to aging rather than conduct cross-sectional analysis of the group. In addition, the measurement items should reflect the activities of daily living instead of physical capability, and the measurement which fits individual characteristics becomes important.

In this study, the demographic groups are categorized for convenience into two groups, the group for those who are between the ages of six to sixty-four and the group for the elderly. In this system, even the young can choose the measurement items which suit their characteristics to keep track of personal changes due to aging, and even the elderly can select standard measurement items to compare their personal data with others.

Regardless of ages, when personal health information is consolidated for easy self-administration, the awareness of personal health will be deepened furthermore.

The target for this continuous monitoring which uses this system to record measurement results will be broadened, by soliciting participation by children, adults, and the elderly, through the collaboration with school physical education courses, companies, local communities, local governments, and associations for the elderly.

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