Mobile Blood-glucose Monitoring of an Integrated Health Information Management System

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Abstract—Our design utilizes a portable Bluetooth blood glucose measuring device for timed measurements of the blood glucose, a remote site server equipped with appropriate software and an input inquisition device.

I. INTRODUCTION

Diabetes is a major, complex chronic metabolic disease, for which the health care is supposed to be a satisfactory daily diet and practicing regular habits, in addition to proper medication and qualified doctors. There are many papers that prevent, manage and control diabetes through diet therapy, for which the key is proper food and nutrition [1, 2].

Apart from the formal treatment through the medical care system, prevention and control of diabetes also need to rely on preventive medicine. In other words, an improved lifestyle, good diet and exercise habits, as well as continuous monitoring of blood sugar are all important for a diabetes patient in order to maintain his health. Improper diet will cause either excessively high or low blood sugar. The volume of the food intake can be used to control and maintain the blood sugar [3]. To help the patient achieve these goals, many systems have been developed in the past [4]. However, the deficiency of each of these systems and other factors make it hard to promote these goals moreover, these systems and can’t provide the patient with a set of standard guidelines.

Our study aims to develop a complete information and diet management system for diabetes patients by applying the fast, convenient and accurate characteristics of remote medical care without time and space limitations, in order to provide paramedics of remote nursing stations with mobile care services. The system reminds patients of disease control events and provides information with respect to a patient’s diet record, exercise and medication as well as both a suitable analysis and delivery. A diet plan is employed to provide a suitable disease control direction and strategy and finally to build a sound diabetes health-care system.

II. SYSTEM OVERVIEW

The system established in this paper which develops server software for providing diet plan, re-engineering and statistical analysis of the database, is shown in Fig. 1. The main software engine rules are also based on this server software. Its architecture can collect and manage data. When the software engine rules need to be modified, the system administrator can simply change the server rules to achieve the purpose without updating and maintaining software. For the user the system provides a set of user interfaces (UI) convenient which are inputting both personal parameters and diet plans and for inquiring about relevant statements. The system, as a channel for common storage and data exchange, is a server with an installed SQL Server which establishes a nutrition database, personal information, personal physiological parameters, and the database of diet plans. This system also provides a remote and a local system for data enquiry, establishment, update and maintenance. The last part of the system is a mobile blood sugar measurement device with both a wired and wireless transmission function which regularly reminds patients of their measurements. This device synchronizes the data with the entire system by way of online transmission to improve the accuracy and reliability of the data.

A. Hardware architecture of the mobile blood sugar measurement device

The digital control hardware architecture of the mobile blood sugar measurement device in Fig. 2 contains the control unit with a microprocessor as the core and uses static random access memory, built-in flash ROM and external removable programmable read-only memory for system computation and parameter storage of the program. The analog-to-digital converter of 16 channels, which is built into the system, provides both 10-12 bits of resolution and a channel DMA transmission. The microprocessor accomplishes the multiplexing operation of internal time-division via software and stores the quantified signals of each channel to the memory to increase the work performance.
B. Software design at user end

The user software is mainly designed for the user to input individual physiological parameters and personal daily diets and to update the information through the Internet to a remote database at any time by means of remote transmission technology, as well as to send a special command requesting the server software to make statistics and computation and to output a diet plan based on the updated information. In addition, the software at the user-end can query the historical record, print reports and depict long-term statistical charts based on the recorded information.

The three parts of the user software achieve its function: user end, server end and database end, as shown in Fig. 1, where the database end and server end could be a part of the same system. Data communication between the three consists of utilizing message packets through the Internet. The applied technology is popular point-to-point transmission technology which can use any node in the network. The software block diagram is shown in Fig. 3.

![Fig. 3 User-end software block diagram](image)

C. Operating procedure of the user software

The operating procedure of the user software is shown in Fig. 4. The entire system will require the user’s account and password for the login process. If the login is correct, the system enters the function menu of the main system. Otherwise the system will inform the user that the ID or password is incorrect.

![Fig. 4 Operating procedures of the user software](image)

III. IMPLEMENTATION RESULTS

Our design provides better service, as shown in Table I.

<table>
<thead>
<tr>
<th>Individual physiological parameters</th>
<th>Our Design</th>
<th>Reference1</th>
<th>Reference2</th>
<th>Reference3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Transmission and record</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Statistical and analysis</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Diet plan</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

References 1, 2, 3 are not real-time monitoring of blood glucose and the lack of two-way analysis for a diet plan. Instead, our design can help diabetics control their diet.

IV. CONCLUSIONS AND FUTURE WORK

The system test results show that this design creates a management system that can help the diabetic’s patient control his diet. The development of the remote server end, the local user software end and the biochemical blood sugar tester incorporated with wireless technology in the entire system are in line with the original feature settings, and through repeated execution tests the fluency of the entire system has verified its feasibility and the possibilities of future commercialization. The PFC method and the average distribution of diet shares assist the patient in achieving a balanced diet and can be applied to different users with different calorie intakes. The biochemical measurement method provides accurate and rapid blood sugar measurement and facilitates the information exchange for the user via wireless transmission.

V. REFERENCE