DiabeSys

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Abstract: DiabeSys is a Personal Health Management System designed specifically for diabetes patients. This system is based from the previous study that was presented in last year's Research Congress entitled Personal Health Management System for Diabetics: A proposal. The study aims to help people that are suffering from diabetics to monitor their health status through their mobile phone and web application by formulating an ICT-solution (Garcia, Santiago, Sy, Tamina, & Tangkeko, 2014). Based from the study, the proponents have identified different problems and created different modules for the problems to be solved.

The four main modules of the system, which are eJournal, eRecord, eReports and Mobile Application, were retained. The proponents made changes in the development of the system. The proponents constantly seek recommendations of the patients and the doctors regarding the system so that it will really solve the problems identified. Aside from the feedbacks of the patients and doctors, comments of the people involved in last year's Research Congress were considered. Some changes include, user interface of the system, this time, the proponents considered the usability of the system. Also, the proponents added features to the system so that it will be more beneficial to the users. Feature such as OCR, or Optical Character Recognition, is one of it. OCR is the automatic conversion of scanned documents into text by the use of camera of mobile phones. Another feature that was added is the chat wherein the patient and doctor can leave messages to each other so that it will be easier for them to have a conversation.

After the system was created, a User Acceptance Test was conducted which involved several patients and doctors. This was done to ensure that the system works according to its intended use, the processes were correctly followed, and the problems were addressed. Based from the results and feedbacks of the users, the proponents were able to make the necessary adjustments to further suit the needs of the intended users. After that, the system is certainly ready for implementation. DiabeSys is capable of addressing the different problems that were identified by the proponents that contribute to the difficulty in monitoring health information of a diabetic patient.

Key Words: Diabetes; eHealth; Health Manager; Personal Informatics; Mobile Application

1. SECTION

According to World Health Organization, health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. Information and Communication and Technology helps in improving the health and health care of people by coming up with eHealth. Some examples of it are tracking diseases and monitoring public health, educating the health

workforce, and conducting research. It is an electronic means to transfer health resources and health care. The three main areas that it encompasses are first, through the use of Internet and telecommunications, health information are being delivered to health professionals and health consumers. Second is improving public health services by the use of IT and e-commerce through the different training and providing knowledge to health workers. And third is practicing health systems management through the use of e-commerce and e-business. (WHO, n.d)

The PHR is a portable tool that an individual can use to store, keep track and share current and previous medical health records through the utilization of web application and mobile devices. With this definition, the group wants to incorporate more useful modules into it rather than just merely recording the health record of the patient and sharing it to the doctor. Some of which are the ability of patients to record his personal health information outside the doctor's care, which the doctor could use in diagnosing or giving recommendations to the patient. Moreover, this PHR will be able to produce graphical and summary of the health records that were stored in the PHR. Another difference that the group will be making is that it will focus more on the needs of a diabetes mellitus patient in order to store what needs to be stored and make it more customized for diabetes patients, making it a customized PHR for Diabetes patients.

This Management System will hopefully solve the different problems that the group identified. These problems are the following: cannot remind the patient of when to take medicines, time-consuming way of backtracking previous health records, tedious way of summarizing personal health records for personal assessment, personal health records are not accessible at all times, and papers containing the health records are prone to lost or damaged.

2. METHODOLOGY

The group conducted several visits and interviews of different doctors that specialize in diabetes, Endocrinologist, also the doctors that specialize in kidney and heart problem. Aside from the doctors that are knowledgeable with the disease, the group also interviewed different patients of different types of diabetes to further understand the disease.

The group benchmarked 7 different mobile applications with a corresponding web application that helps people in recording their personal health information. Two of these 7 mobile applications are specific to recording and maintaining diabetes. The group patterned some of its modules and features from these different applications.

Rapid application development (RAD) is a user-oriented method that allows its users to be involved in every step of the way that's why it's somewhat similar to the entire SDLC model. Rapid application development speeds up the development of an information system while producing a functional information system through a team-based technique. To shorten the development time and cost while involving users in every stage of the development of the system is the main objective of all the rapid application development approaches.

The reason why the group chose this methodology is because it relies heavily on prototype and user involvement that's why the group needs to come up with a prototype so the group members would know if the requirements of the user are met or not. Also, this type of methodology increases speed of the development process while ensuring the quality of work is met since it involves the users. There are four phases and activities that consist of the rapid application development model. These are the requirements planning, user design, construction, and cutover. (Shelly, G., & Rosenblatt, H., 2012)

To make sure that the system works perfectly fine, the processes were correct, and the problems were being addressed, user acceptance testing was made. This is when the actual system was presented to the different doctors and the diabetic patients. The intended users were able to go through the system and give comments and suggestions. In this way, the group was able to know the strengths and weaknesses of the system.

3. RESULTS AND DISCUSSION

This is the graphical representation of the different modules and features of the system.
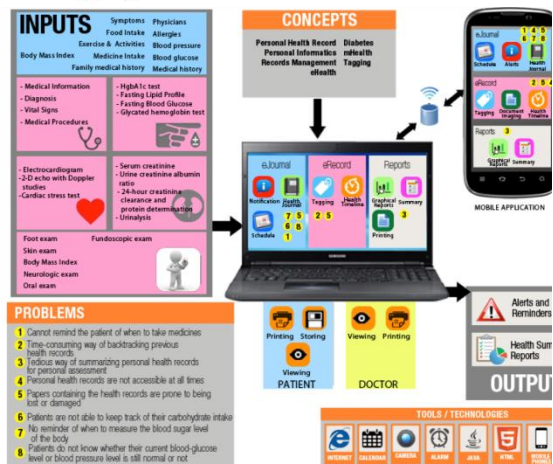
Figure 1. Conceptual Framework

3.1 eJournal Module

This module contains the following functions: notification, schedule, and health journal. In the health journal function, this is where information such as personal information which contains the name, birthday, type of diabetes, medical history, and allergies, food intake, blood glucose, blood pressure, weight and height, medicine intake, doctor appointment, physical activities, and symptoms will be recorded. Basically, it is like a diary wherein you will input or record the said information by filling up the form in the mobile application. One of the features of the module is scheduling which has the function of adding the schedule of when to take medicine, when to inject insulin and appointment to the doctor. For the appointment to the doctor, it would have a calendar view of the appointments.

3.2 eRecord Module

This module contains the following functions: health timeline, and tagging. In the health timeline function, it is the summary of your profile in the mobile application; you can see there the results of different laboratory examinations, history of blood pressure, and history of blood sugar, diet plan, exercise, medication you take, and insulin intake if ever. It is the compilation of all the information related to health of the diabetic patient. When the patient is adding information to the mobile application, the patient needs to put tags to that information so that it would be easier to search.

3.3 eReports Module

This module produces several reports from the inputs, which consist of the diagnosis from the doctor, the vital signs, laboratory results, and food intake. The reports that it would generate are the summary of the data recorded and it will be presented through graphs, and tables. For example, blood pressure report that will show the difference of your blood pressure daily and if it's increasing or decreasing or if it's normal.

3.4 Mobile Application Module

This module includes the following function: eJournal, eRecord, and Reports Generation. In the eJournal, it would be the same as the web application, the difference is that it would have an alert feature which will notify the user if ever he/she needs to go to the doctor already or if the blood sugar that the patient inputted is higher than the normal range. For the eRecord, it would include the document imaging which will allow the patients to take a picture of the laboratory results and such. And for the Reports Generation, the patients will be able to view it in the mobile application.

3.4 Sharing and Storage

Since there will be two platforms of the system which is the web based application and the mobile application The group have a centralized database between the two platforms. Using an Internet connection, the inputs of the web-based application will be reflected on the mobile application and vice versa. There are just some differences between the two platforms. The group benchmarks the different mobile applications on how their respective desktop version works. The difference between the mobile application and the web-based application is that the alerts will only be done by the mobile application. Also, the capturing of images of documents will only be done by the mobile application through the mobile phone. An OCR or Optical Character Recognition feature is also added in the system. For the desktop version, this will include the printing of reports and the doctor's account.

The group includes the doctor's as users of the system. They have access on both the mobile and desktop version. The patient will have to add the doctor to be able to share information, and the doctor has a choice to accept the patient. From this, the doctor can choose a patient and will now be able to view the medical information of this patient. The

group thinks that if the doctor is able to view all that is happening with the patient then the doctor will have a better treatment for the patient. The information that the doctor/s can view are the following: health journal, health timeline, graphical reports, and health summary. The health journal contains the symptoms, food intake exercise activities, medicine intake, family medical history, physicians, allergies, blood pressure, blood glucose, and medical history. The health timeline is the summary of all the records that the patient has inputted based from the health journal plus the medical information, diagnosis, vital signs, medical procedures, results of different tests like HgA1c test, fasting lipid profile, fasting blood glucose, and glycated hemoglobin test. Also part of the information that are shown in health timeline are results of test that are related to the heart which are electrocardiogram, 2-D echo with Doppler studies, and cardiac stress test. The results of the test that are related to kidney such as serum creatinine, urine creatinine albumin ratio, 24-hour creatinine clearance, protein determination, and urinalysis will be included. And lastly, the results of the foot exam, skin exam, body mass index, neurologic exam, oral exam, and fundoscopic exam. The graphical reports would be based from the inputs of the patient, one example of it is the blood sugar report of a patient, which will show the progress of the blood sugar of the patient if it is increasing or decreasing or normal in a specific time. The doctor can also chat the patient if ever he/she needs to. It is one of the features that the group added to the system.
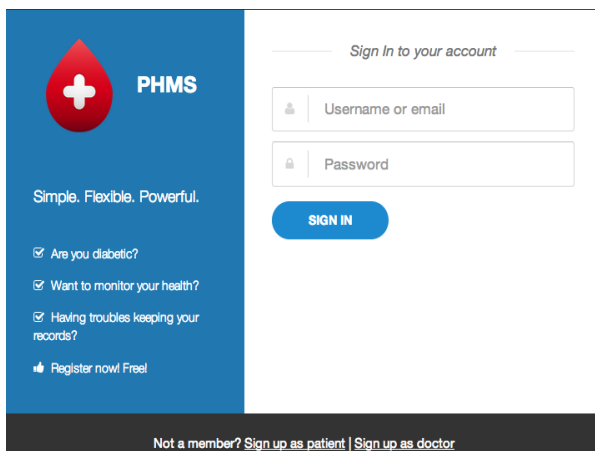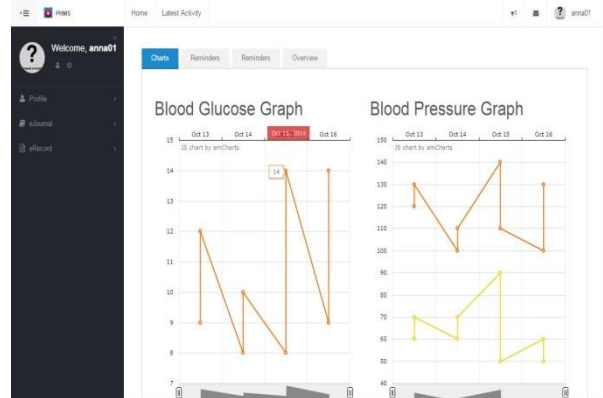
3.5 Screenshots

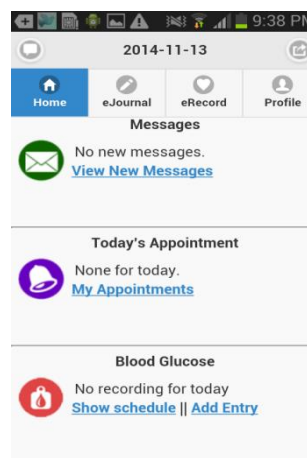Figure 2. Log in page

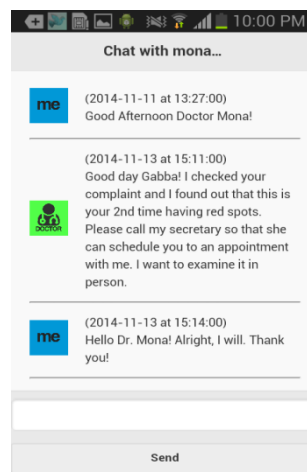Figure 3. Homepage

Figure 4. Mobile version

Figure 5. Chatbox

4. CONCLUSIONS

As a result of the study conducted by the group through analyzing the information gathered through interviews and other existing documentations such as forms, laboratory results, and existing reports, several problems and opportunities were identified in the domain. With the eight problems that the group was able to identify which are the following: personal health records are not accessible at all times, time consuming way of backtracking previous health records, tedious way of summarizing personal health records for personal assessment, cannot remind the patient of when to take medicines, papers containing the health records are prone to being lost or damaged, patients cannot keep track of their carbohydrate intake, no reminder of when to measure blood glucose and patients are not alerted if their blood pressure and blood glucose levels are not within the normal range, reviews were conducted regarding different information systems that would help both the patients and the doctors in handling their daily transactions. The features of these systems together with the requirements that was suggested by the doctors and patients that the group interviewed and based from the observation were combined and from these, the proponents were able to propose and information system such as the Personal Health Management System (PHMS) that was made specifically to diabetic patients. The group concludes that the proposed Personal Health Management System is capable of addressing the different problems that were identified by the group that contribute to the difficulty in accessing health information.

The Personal Health Management System is capable of monitoring the daily activities of the patients. For diabetics, it is very important to control everything that will go to their bodies. The patients should be able to balance out everything, from the medications he/she takes, the food that he/she eats, and the amount of exercise. If these daily activities are not monitored or controlled, a lot of problems may arise and it can lead to worsening of situation. In the PHMS that the group made, the patients would be able to keep track of everything that he/she needs. From what she ate for the whole day, to how much water she drank, to how many minutes he/she spent exercising, to his/her blood glucose result for the day and his/her blood pressure. This will all be stored in the database as so if he/she needs to see the record for a specific date, it will be easy to find.

Diabetic patients should be transparent to his/her doctors about his/her daily activities and laboratory results. As for that, the patients should be able to share this information to his/her doctor. In the PHMS, the diabetic patient will easily share his/her information to the doctor. It also has an added feature that reminds the doctor if ever there's an abnormality in the daily activities of the patient, abnormality in the result of the patient's blood glucose and blood pressure, and complaints that the patient added. Also, the doctor will notify if the patient already got the laboratory examination and the results of it. The interaction of the doctor and the patient is very important so as for them to relay information easily. For that, the PHMS has a chat feature wherein the patient and doctor can leave messages to each other so that it will be easier to have a conversation.

The PHMS is also capable of generating different types of reports that would help both the doctor and the patient in their decision-making. Since the data of the different transactions made by the diabetic patients were already stored in database, reports can easily be produced. This frees the doctor and the patient from manually collecting information stored in the notebook, or envelopes, or clear books and manually creating the reports. Since with the PHMS, the information were already in the database, less errors can be produced unlike in the manual report generation.

5. ACKNOWLEDGMENTS

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