

Developing a PDA to Assist Nurses on Hospice Home Visits

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Abstract

Wen Technologies and Pace University are working with Phelps Hospital to develop a Telemedicine system that enables a Personal Digital Assistant (PDA) to facilitate and enhance the procedures currently used by Phelps Hospital nurses on hospice home visits. The system being developed includes the hardware mentioned above, plus PDA client software and server software designed in standard client/server architecture. The hardware for this project was supplied by Wen Technologies and the software systems, both client and server, were developed by Pace University. The requirements and user scenarios were obtained through interaction with Phelps Hospice Center personnel. The Phelps Hospital server maintains a database of active nurses and of current patients including their medical history records. The client side of the system consists of PDA software that facilitates collection of patient clinical data. This paper focuses on the design and development of the client/server software system, including the initial testing and usability considerations.

Introduction

MIND PAL (Medical Information Nurse Direct Personal Assistant Link) Telemedicine System project is under development with the goal to discover/implement a design that facilitates Phelps Hospital nurses' access to hospice records at point-of-care. A prototype of the system is under construction in two

different paths in parallel. Firstly, the PDA Interface that is designed for easy use and customized to the needs of Phelps Hospital nurses. And secondly, the Web-based Server Interface that provides the same features and functions for the nurses. The web-based server interface is Graphical User Interface (GUI) based and permits the nurses to admit new patients, update existing records, load needed data to and from the PDA. The server interface also keeps an active list of nurses who perform home visits.

Relevance in the context of other work

As the nursing shortage continues, nurses are using technology as a tool to improve the efficiency and productivity of the existing nursing resources. This has led to the increased use of mobile devices in the nursing profession [3,13]. And according to the September 26, 2003 Forester Research "IT at Work: Doctors, Nurses, Pharmacists and Vets", 559,800 nurses were using PDAs in 2003 as cited in Yvonne Stolworthy's article "RNs are Mobilizing" [25]. Those nurses already using mobile devices for clinical documentation have cited the advantages of using the electronic forms, the time reduction and the elimination of duplicate documentation as the key benefits. [2]

Mobile device based systems, similar to our prototype, are being developed, tested and used throughout the healthcare industry. Studies in hospitals and ambulatory care

settings show that nursing documentation systems using mobile devices are being developed, successfully used and studied in the United States (US) [10, 7, 8, 20], Europe [5, 4, 2] and Asia[11, 14].

Research studies and prototype development of mobile devices for use in the home care setting are only beginning. A sample from the literature shows pilot studies of PDA based data collection by health agents in rural Brazil[21], paramedical health workers in rural India [1] and home care workers in the US [23, 22, 15]. The use of PDAs for home hospice care nursing use web accessed medicine reference materials and clinical documentation, is unique.

Sorensen et al. [24] surveyed homecare workers in Norway to determine their need for mobile data and devices. The results show that “being able to record and update patient information” was rated as ‘the most important’. Being able to access patient medical information, send messages, access professional information were also rated as important.

The use of mobile devices by individual health professionals working alone outside of the hospital and ambulatory setting gives rise to an even greater need for the use of mobile technology. In the past home care nurses had to carry copies of all previous clinical history and documentation about the patient, directions to the patient’s home, all drug and reference materials, and write paper-based clinical notes. Then upon returning to the office they needed to do duplicate enter the clinical documentation into the computer system to update the patient record. This process is very labor intensive, time consuming with redundant data entry, and difficult for the staff to carry all the paper reference materials.

The MIND PAL system provides all the necessary information, access and communications tools in a PDA; including directions to the patients home, photographing the patient condition for consult, obtaining clinical reference materials via wireless web access for better quality care, sending email to colleagues for a physician consult or supervisor recommendations, and recording the clinical documentation at the time of the patient visit is an excellent use of technology to facilitate nursing care.

We believe that the advantage of building our own system is the low cost and the ability to customize functionality to meet the needs of Phelps Hospital nurses. Since this system is being built from scratch this will allow the university to do further enhancements in upcoming years and will also allow the university to add and delete functionality, as needed, later on.

Methodology

We decided to split the design of the project into two parts –a client side and a server side–to allow each member of the team to focus on a certain component of the project. The client side interface to the database allows the nurses to do the following tasks:

- Add, delete and update patients and nurses enrollment information.
- With new configuration upgrade we now support up to 100 patients to be displayed on one PDA. With the patients name and identification number displayed on every screen of the PDA.

Allow the PDA to upload the recent visit result to the database upon return to the hospital and the server is connected for synchronization.

For the PDA interface, it is built using VB.NET to do the following tasks:

- Most importantly, the system allows nurses to record medical findings and clinical measurements into the PDA using a user friendly interface.
- The PDA allows the nurse to have wireless connection to the Internet to be able to send e-mails.

System Requirements

Hardware Supplied by Wen Technologies

- HP iPAQ Pocket PC h5100 series
- IBM Compatible server.

Software Supplied by Pace University/MSNAA

Development packages:

- Visual Studio .Net Framework [17].

An overview of the system is presented in Fig. 1.

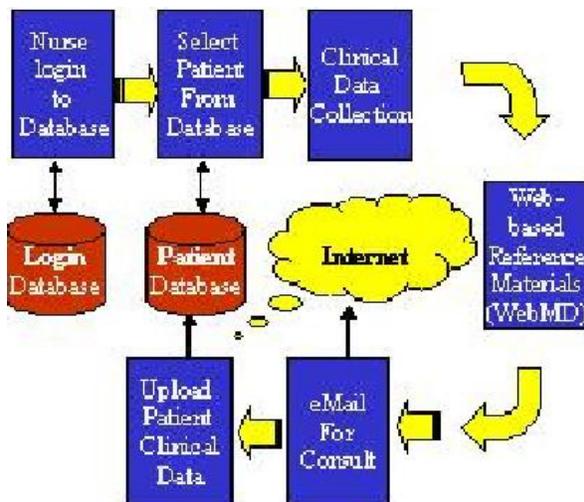


Figure1. System Overview.

A MYSQL (version 4.1) database was implemented on a Pace University server.

The database consists of six tables:

- Patient information table
- Nurse information table

- Home visits information
- Users table (for the login procedure)
- Medication table
- Log Table (to monitor user activities)

A directory has also been implemented on the server for the application JSP pages to facilitate the administration of the visits and the maintenance of the active list of nurses and doctors involved in this project. Also the team created a VB.NET application for the PDA to facilitate medical measurements taking and recording to the system.



Figure 2. Login Screen.

A macro was created that has simplified the synchronization process. On the workstation after the user has downloaded the MindPal compressed file, the user can simply press the “Hot Keys” Ctrl-D “for download”. This starts an uncompress process to move to the uncompressed PDA files to it’s destination folder and automatically synchronize with the PDA after process is complete. Then automatically removes the zip file from the computer to avoid duplicate zip files that may confuse the user. After turning on the PDA, start the MIND PAL Telemedicine

System. The first screen that will come up is the “Login” screen shown in Fig.2. Here the user will have to enter their user name and password and hit “OK” to enter the system or “Cancel” to exit the system
 After entering the system, the next screen to appear is the “Main Screen” shown in Fig.3.



Figure 3. Main Screen with Patient Detail.

The main screen has four fields containing the following data elements: ID, Name, Address, and Map. At the bottom of the main screen is the menu selection for functions as follows: Patient, Web, eMail, and Calendar.

When you select a patient by clicking the ID field of a patient, the medical examination screen appears (Fig.4).

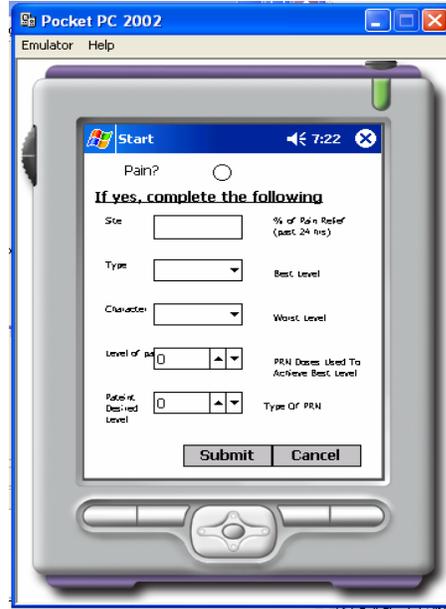


Figure 4. Medical Examination.

If the patient has pain, the appropriate user checks the “pain” field, and enters the data and clicks “Submit”. If the patient does not have pain then just click “Submit”.



Figure 6. eMail Screen.

If the user selects the “eMail” tab from the menu, the email screen is displayed (Fig.6).

After entering the “TO”, “cc”, and “Subject” fields if required, enter the text for the “Mail” part and then hit submit to send the email. If the user hits cancel, the system exits from the email application without sending an email.

When the user hits Web tab, Web Screen is shown (Fig.7).



Figure 7. Web Screen.

This screen provides information about certain medications for different patients. Just click on the desired website and browse for the information needed.

To exit the system, just click on the upper right hand corner “X” to close the complete system.

Storyboard

The following is a storyboard that we used to clarify the process of the system use:

- Nurse Wanda Orton comes to Phelps Hospital on Monday morning, goes to her desktop computer and logs into the server

interface using her unique username and password.

- She goes to the download/upload page.
- She selects a patient Sameh Eshak, from the available patient list and clicks download record to PDA.
- At this time her PDA system is connected to the server. The record gets downloaded and she gets a confirmation message.
- Wanda goes to her car with the PDA. Uses her password on the PDA to login. She succeeds and gets access to the PDA interface..
- Once in the patient’s house she clicks on **Medical Record** and starts recording her medical findings.
- She also realizes that she needs to look up Prozac side effects before increasing the doze for Sameh. She clicks on WebMD link and gets access to the medication side effects.
- Next she evaluates Sameh and completes the ‘Medical Examination’ data entry. After that she decides that it’s time for her to leave. She clicks on the logout tab and the system confirms that she is logged out.
- She returns to the hospital and would like to upload the visit to Sameh Eshak medical history onto the server.
- She performs the login with her unique username and password. Then connects the PDA device and uploads the data from the PDA to the server.

Discussion and Conclusions

During development, the design was under revision continuously since we expected to come across technical complexities as we proceeded [6]. As a matter of fact we did come across a few of them like setting up the correct account for the database on one of the test servers, also deciding which software to use for building the PDA. However, we are able to come up with a prototype for the two

components separately. We realize that there is a lot of development, testing and searching that need to be done specifically in the area of usability. It is the team intentions to deliver the system to Phelps Hospital, have the nurses use the system and get the user feedback from them to be able to incorporate the feedback requested changes into the system. We anticipate that a working and well tested version of the system will be produced.

Future Work

Our goal is the acceptance and productive use of the MIND PAL system by Phelps Hospital nurses performing home hospice care visits. We realize that usability is an essential quality for the operational use and acceptance of a mobile device in the workplace. One of the key reasons that persons do not use mobile data collection devices is their perceived lack of usability, primarily because of the small screen size, limited data entry capabilities and user interface design. Building on the usability studies and lessons learned from mobile devices used in healthcare settings by Koop[12], Scandurra [22], Mercado [16] and Coble [9], we plan our future work. The use of the MIND PAL system in a hospice home care setting will provide base-line usability measurements for the nurses. We would also like to update the MindPal web interface to integrate with Crystal Reports, and have graphical statistics on patients visit progression. A future expansion of the project will be to modify the MIND PAL application based on usability criteria to be developed specifically for mobile devices. The enhanced MIND PAL system will be re-tested with the same usability measurements to test the validity of the mobile usability model criteria.

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