

PDA Prototype for Medical Application

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Abstract

The use of PDA technology for medical applications is opening a new field to research in recent years. This technology appears to be very useful for collecting data and data entry at point of care providing tools to enter data in an efficiency and consistent way to nurses and physicians.

This paper provides a short description of previous PDA applications, then provide a description of the prototype development for viewing the patient record, order entry and physician documentation and nurse documentation. After that, the usability user test and the results are described. Last section is dedicated for future work.

1. Introduction

Point of care data entry is an important part of a clinical information system. Unfortunately, most electronic patient record systems do not provide support for point of care data entry. The PDA technology is opening a new market for medical applications. PDA technology improves healthcare by providing facilities for rapid order entry, collecting clinical information and access the patient record via wireless communication at bedside. Some applications has been created and tested and the use of those applications has been shown that it has reduce the documentation time to nurses and physicians, make documents easy to understand, maintains the uniformity, reduces errors at order transcripts and reduces time of searching of patient information. Also give access to up to date information.

This paper present a new prototype application created for Pocket PC to provide the nurses and physicians the need tools to documentation and order entry at bedside.

2. Previous Work

There are many new PDA applications that are being developed to improve clinicians, residents, nurses and physicians' efficiency and productivity at point of care.

2.1 Mobile Nurse

Mobile Nurse is a PDA application to help nurses to management the patient information, check the medical order and recording the nursing care plan at point of care. This application provide the nurses functions like: automating vital signs graph, calculating amounts of intake and output fluids, tools for pain assessment and test results at bedside. [Choi00]

2.2 Ward in Hand

Ward in Hand is a project of DISEM University at Italy to computerize the patient clinical record by connecting it wirelessly to a central database. It application should collect clinical and relevant patient information like test and labs results at bedside. [Ancona00]

2.3 EMR

Hollings Cancer Center and the Division of Hematology/Oncology Medical University of South Carolina is developing a prototype PDA application (EMR) to help the nurses and physicians with the daily task. It application

should: display and update patient problems and treatments, medications, display last 6 month of notes, ordering and print the documents. Also provide the nurses enter vital signs and review vital signs. [Afrin02]

3. PDA Prototype Application

The objective is to state the importance of usability and human computer interaction in the development of PDA application to medical information systems to provide a graphical user interface easy to use and learn. It prototype is separate in 3 main areas, the interfaces for viewing the patient record, interface to physician ordering and documentation and interface for nurses documentation at bedside.

To understand the needs of those health professionals an analysis were realize. That analysis involved a task analysis where nurses were interviewing and paper forms were collected. To know the physicians' tasks and needs, paper forms were collected in different hospitals and task analysis were realize in past years for graduate students of the Mayaguez Campus at Puerto Rico University. [Angarita97, Acosta99, Rodriguez02]

3.1 Interface for Viewing the Patient Information

This interface was generated to provide at physicians the views of different forms that they usually study before and during they visit a patient. This interface is shown in figure 1 and shows the patient name and personal information at the top of the window. It provides the list of active medications, test and labs results, notes, vital signs, total of intake and output fluids by periods and list of visits summaries. When a tab is selected a list of specific information appears in the area below the tab, this area has the options of select an item of the list and view the related information. Using this prototype interface the physicians can obtain the up-to-date patient information at bedside.

Type	Description	Date	Hour
Lab	Blood -CBC, Sod.	01/03	1641
IV	1000 ml NS Cont.	01/03	1641
Med	Ibuprofen 400 m.	01/02	1759
Med	Guaifenesin 5-1.	01/02	1759
Lab	Pap Specimen (C.	01/02	1334
Lab	Blood -CBC, Sod.	01/02	0959
Med	Potassium Chlor.	01/02	0915
Med	Neutra-Phos 1Pk.	01/02	0915
Rad	CT Chest W/Cont.	01/02	0134
Con	Physical Therapy	01/02	0049

Figure 1. Interface for viewing the patient information

3.2 Physicians Documentation and Order Entry Interface

This interface shown in figure 2 join the physicians documentation tasks and the order entry task in one form to provide the physicians the usually tasks that they perform with the patients during a visit.

Diagnosis:

- Diabetes, Type II
- Coronary Artery Disease
- Cancer

Laboratories:

- Chemistry - Enzimas Cardiacas
- Chemistry - Complement C3
- Chemistry - Alkaline Phosphatase

Medication:

- Caltrate--250 mg

Figure 2. Interface for Physician documentations and order entry.

The prototype interface shows the patient name and personal information at the top. Several buttons are associated with this interface. The left group of buttons has the options for physicians' documentation like: notes (Nt) and diagnosis (Dx). The right group of buttons has the options for order entry, like: medications (Rx), laboratories (Lb), diagnostic studies (DS), consults (C) and Miscellaneous (Tx). When a button is activated a window for the particular function appears in the display to the user enter the appropriate information. After the window is closed the information that was entered is display in the area below the buttons.

3.3 Interface for Nursing Documentation

The interface has the options for nursing documentation. This interface has the patient name and personal information at the top. The options that are provide at nurses are: vitals signs entry and lookup (Vitals), intake and output entry and lookup amount totals (I/O), lookup and acknowledging pending orders, fill the initial assessment (I Assessm) and the daily assessment (Assessment). When a tab is selected the bottom area shows the related information of the tab. This prototype interface is shown in figure 3.

Day	Hour	T	B/P	HR	RR
01/03	2030	97.2F	122/74	68	18
01/03	1600		132/60	66	16
01/03	0915	91.3F	150/84	80	16
01/03	0300	97.3F	142/79	71	18
01/02	2000	98.2F	142/78	84	16
01/02	1600	97.5F	140/58	86	16
01/02	0800	97.2F	138/70	71	16
01/01	1920		138/64		
01/01	1840		142/60		
01/01	1800		125/70		

Figure 3. Interface for nursing documentation

4. Usability User Test and Results

After the prototype were development test were realize to compare the physicians and nurses interaction with a hand held devices and desktop graphical electronic patient record systems. The test were realize at Beth-Israel Deaconess Medical Center in Boston with 20 physicians and 18 nurses. The tasks tested were:

Physicians Tasks:

1. Indicate the age, and weight of the patient.
2. Look for the most recent vital signs.
3. Look for the result of a CHEST (PA & LAT) study and read it aloud.
4. Order the following:
 - a) Ibuprofen 400m PO Q8H:PRN
 - b) Heparin 5000 UNIT SC Q24H
5. Order the laboratory: Blood, To be collected on MORNING OF 1/17/03, process STAT: SMA 6, CBC
6. Enter a progress note.

Nurses Tasks:

1. Indicate the age, and weight of the patient.
2. Look for the most recent vital signs. Acknowledge when you find it.
3. Look for the result of a CHEST (PA & LAT) study and read it aloud.
4. Take a pending medication order
5. Enter set of vital signs
6. Enter an I/O.
7. Enter an assessment.
8. Enter a note.

After the test finish a statistical analysis was done. The analysis was done in the area of: tasks completion, time wasted in the task realization and the user satisfaction. The analysis shows: In terms of task completion the physicians could realize the most of the tasks, the areas that present design problems were the interface for ordering medications and laboratories in the PDA. The tasks in the desktop were realized without great problems, possible for the computer experience of the physicians. The nurses realize most of the tasks, a problem found

was the Assessment interface that caused very difficult at nurses in both systems (PDA, desktop). The rest of the tasks were realized without lot problems but the areas of enter vital signs need to be analyzed and redesigned providing a better input method in the PDA.

In terms of time wasted in the task completion the physicians get the less time in the task with the desktop compared with the time in the PDA, except in the task of look the most recent vital signs that the times were less in the PDA than in the Desktop. The nurses analysis was very different, the nurses waste less time in tasks like: look the most recent vital signs, acknowledge a pending order, enter the input and output data and enter an assessment information compared with the time wasted in the desktop. The user satisfaction reveals the preference for the desktop systems for nurses and physicians.

5. Future Work

Using the analysis of the usability user test and the design problems found in the test we planned to redesign the prototype interfaces to make better the user interaction with those applications. Then we work with the wireless connection to a central database to get and retrieve the patient information.

6. Conclusion

The PDA use for medical applications appears to be a good solution to cover the physicians and nurses needs at point of care, providing tools to nurses documentation, physicians documentations and order entry at point of care. Good applications can reduce time consumption, redundant paper work, facilitate the information to be read, reducing errors of translations or interpretations of the documents created.

Some researches need to be done to resolve the problems with the PDA applications like interaction types and input methods among others. This technology can provide a lot of useful tools to improve the efficiency of professionals in health and other areas.

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