

# Designing Mobile Tracking Solution in Monitoring Patients

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## Abstract

Smart phones have recently overtaken PCs as the primary consumer computing device in terms of annual unit shipments. Given this rapid market growth, it is important that mobile system designers and computer architects analyse the characteristics of the interactive applications users have come to expect on these platforms. In fact, healthcare professionals spend much of their time wandering between patients and offices, while the supportive technology stays stationary. Therefore, the need for mobile applications in healthcare and processes is at an all time high. Healthcare providers, physicians, clinicians and nurses need real-time access to patient information, patient state, patient state history and other practice related information to provide best patient care. This paper aims to propose and design a handheld solution that could support hospitals in tracking patients progress. Thus, will help physicians and nurses to track the patients conditions more efficiently and easily.

**Keywords** - Mobile, design, healthcare, tracking, patient progress

## 1 INTRODUCTION

These days with massive usage for technology, the mobile device uses in many fields such as agriculture, medical and learning. Mobile phones have become widely used technology and for many people a daily companion. The main function is to enable communication and information access anywhere and anytime [1]. During the last three decades, development of medical technology has been the main engine that has driven the spectacular advances in our ability to diagnose and treat many human ailments. This has reduced mortality and morbidity for thousands. Medical costs paid by the governments grow so rapidly that it will be necessary to reduce other areas of country spending to the "bare bones" levels [2]. Information technology plays a major role in every field of modern development and is an essential tool in healthcare. Mobile technology has offered an opportunity to provide a new generation of people with the means to interact with activities irrespective of location. With the speedy development of mobile communication and wireless technologies, business activities will break away from the limitation of the region and time step by step, which bring the continuing influences on organizations [3]. Mobile computing applications allow anytime, anywhere access to the internet and corporate intranets.

The physicians at various hospitals face many problems with tracking the patients status, where in natural case physician still relies on paper to record and track the patients status progress, in the other words tracking has been done manually. This can cause damages, misplaced and loss of some papers relating to information of the patients. In addition, nurses and physicians have to check the patient status daily and report on the progress of the patient.

However such manual case forced the physicians to track all the patients and read their reports. Tracking manually is considered inefficient and time consuming. Thus some patients status is provided by the reports without the need for the physicians checking. Some orders can be given to nurses to achieve the task and some cases cannot wait for the physicians checking round. Additionally, patients are not regularly given written information about their care and treatment, making it difficult for physicians/doctors and nurses to remember and manage their care effectively. This paper aimed to design a handheld solution that could support hospitals in tracking patients progress and overcomes these challenging.

## 2 RELATED WORKS

Physicians have to examine and to apply a variety of treatments to patients. Without improving their equipment and technology, they will face a big challenge. Therefore, health care administrators are always looking for the latest technologies that will improve the output. In hospital system, one complicated issue will slow down the workplace, in trying to keep track of what is occurring throughout the health care system with every patient. Their orders, lab, radiology, and other pertinent results, and even general information such as nurses assigned to them on a particular shift are necessary to keep the flow of care. Delaying this flow can consume time of the overall process of their care. In order to face the time consumption, software companies are always looking for new and improved ways to assist health care providers in better managing personnel and time constraints.

In this section, we provide some background information on the Mobile Application, Personal Digital Assistances (PDAs), Mobile Application in HealthCare industry, Mobility in HealthCare and Electronic Patients Tracking System (EPTS).

### 2.1 Mobile Application

Nowadays, with the increasing growth in technologies, mobile devices being used in many fields such as agriculture, medical, tracking and learning. Mobile devices have become widely used technology. The main aim is to enable communication and information access anywhere and anytime [4]. Portable device is accompanying users most of the time. Thus, makes it an interesting platform for building convenient applications that can display output any part in the world [5]. Mobile devices are used commonly in daily life to communicate, coordinate and to access information.

### 2.2 Personal Digital Assistances (PDAs)

Personal Digital Assistants (PDAs), encompassing Palm and Pocket PC devices, have found increasing acceptance, and hence proliferation in recent years, owing to the perception of their convenience when compared to traditional PCs and laptops [6]. Offering the ability to connect to applications such as email, instant messaging, RSS feeds, discussion boards and blogs, and to download courseware and Web pages.

Interestingly, research has demonstrated that the features and functionality of PDAs remain underutilized [7]. They observed that the devices are still primarily used for Personal Information Management (PIM) functions, such as calendaring and for storing contact information. To realize the PDA's full potential, designers and developers are entreated to address their reported difficulty of use, and disconnect between the functionality users require in context, and what is delivered to them.

### 2.3 Mobile Application In Healthcare Industry

For the majority of mobile device strategy for developing health care, mobile device companies have to design and provide a system which is helpful and easy access the information in health care databases. Moreover, in the fact the cell phones started using computers (applications such as PDA) to facilitate mutual feedback on the health care environment effectiveness such as clinical skills evaluation, support continuous quality improvement initiative, provide treatment and monitoring services. According to [8] pharmacist is arguing to use computers and mobile applications with transactions through the internet. The patients put pressure on health care providers such as contacted through phone or via the internet. Fig.1 shows the new generation of Personal Digital Assistants (PDAs).



Fig.1. The New Generation of Personal Digital Assistants (PDAs)

## 2.4 Handhelds In Healthcare

Smart phones have proved to be popular in healthcare industry, because it able to store a vast amounts of information in the pocket [9]. A mobile allows remote access to reference material, patient information, patient history, clinical lab data and patient health states. [10] Have indicated a study among the staff at a Swedish county hospital where doctors and nurses had high expectations of mobile information support systems. The study is conducted of interviews which showed that physicians need a mobile tool for accessing such information about patients, a knowledge database and functions to ease and standardize everyday tasks. It also, is being able to understand the patient's case and to decide quickly for a patient's condition. Thus, there is needed for mobile access to the information. The study also showed that the nurses are concerned about not interfering with the interaction between the staff and patient. The tool should be easy to use so that the treating staff focus can remain on the patient and not to the Personal Digital Assistance (PDA). The physicians/doctors and nurses state that access to test results and reference values has the highest priority when looking in patient information.

In [8] it is stated that the main resources to improve medical work would be mobile accessible. Particularly, in the treatment information databases, tracking patient health, cost of tracking and prescription of pharmaceuticals. [9, 11] has both conducted research programs to produce review articles on handheld computing used in medical environments up until 2004. The main source for both articles is Medline and other medical reference libraries. The studies do not discuss gains in mobility or collaboration to the extent that would be found in Human Computer Interaction (HCI), Computer Supported Collaborative Work (CSCW) or mobile informatics research fields. The articles reviewed were mainly focused on the practical use of mobile medical applications. Mobility and communication are mentioned the benefits of the retrieval and use of patient and medical information are the main theme. Accessing to medical information where and when needed is the common denominator which would make handheld devices a valuable contribution to medical work.

## 2.5 Mobility In Healthcare

Mobility in health care industry improves patient care and allows hospital professionals to spend more time with patients [9]. The handheld device gives the physician to plan and spend their time. The spatial restrictions imposed by stationary information support system forces the user into a pattern where a "home base" needs to be visited at intervals to gather information for current and further work activities. A mobile solution aids the user by providing up to date information on any location, and also allowing a more fluent time schedule where important events can be noticed and acted upon. [12] Have found that participants in studies of various settings rely on their own mobility and the mobility of artefacts to be able to coordinate activities with others. In their study of the introduction of computer based records into the medical consultation they explored how the technology has undermined collaboration. Traditional paper records support collaboration between both clinicians and other professionals, and between patient and the clinician. Luff and Heath expressed that paper records serve as an important resource for communication and collaboration and are, even with the introduction of computerized systems, an important resource in professional medical practice. The paper becomes important because of its portability; it can be passed around, be carried around, and be moved between different parts of a location. It is said that when

developing mobile technologies to support collaboration between users, developers need to explore in more detail how objects are used in interactions where mobility is crucial.

[13] Stressed the importance of artefacts in an environment where written paper has a value itself. A paper act as a token and the bookshelf acts as a measure of the workload. Actions such as moving a document from one table to another, face-to-face discussions and the use of boards for scheduling influences different kind of interdependence in medical work. In another article [14] concludes that translating the coordinating role of paper documents and other linked artefacts to computer systems is a challenge because artefacts are part of a shared infrastructure and needs to be better understood. They explained that system designers need to understand the complex coordination of work in an organization in order to support coordination. An attitude towards artefacts must be considered when presenting information on a handheld device instead of the binders used today. The effect of using handheld devices in medical work rather than stationary computers would be high, because one of the normal modes of operating in a hospital environment is by wandering between different locations of work [15] Adding frequent detours to this workflow for visiting a stationary computer would be to minimize the effect, especially if a question cannot be answered while being with a patient and the clinician needs to leave to find the answers for that question.

## 2.6 Electronic Patients Tracking System (EPTS)

Electronic patients tracking system uses a web-enabled database, laptops and wireless mobile devices (PDAs) to collect, centralize and transmit patient information fast, facilitating data-sharing between on-scene responders, transporters, command centers and hospitals, while maintaining patient privacy [16]. Figure 2 shows an information technology solution that facilitates triage, treatment, and transport of victims.



Fig.2. The Electronic Patient Tracking System

The Electronic Patient Tracking System has three primary components: *Electronic Patient Tracking System field units*, *central server*, and *web pages*. The Electronic Patient Tracking System fields units collect the patient information at the scene of the incident and transmit it back to the central database. Dedicated and redundant servers host a database where the incident and patient data reside. The servers also provide the web content available to trusted users over the Internet. The Electronic Patient Tracking System provides patient and resource-tracking information via web pages accessible to trusted users by any HTML browser capable computer on the Internet [16].

## 3 PROPOSED SYSTEM DESIGN

Mobile Tracking on Patient Progress (m-TOPP) has designed to check the feasibility of the proposed mobile technology in healthcare that has been planned and to check the efficiency of introducing mobility to patient tracking. The proposed mobile tracking on patient progress system designed to support two types of users, Doctor and Nurse.

The functionality of a system as **Doctor Actor**, after login as a Doctor, requires entering the patient ID to *View Patient Information*, *Manage Patient Progress*, *View Patient State*, *Enter Patient State*

and *View Patient History*. While as **Nurse Actor**, after login as a Nurse, requires entering the patient ID to *View Patient Information* and *View Patient State*. Fig. 3 shows the functionality of both actors.

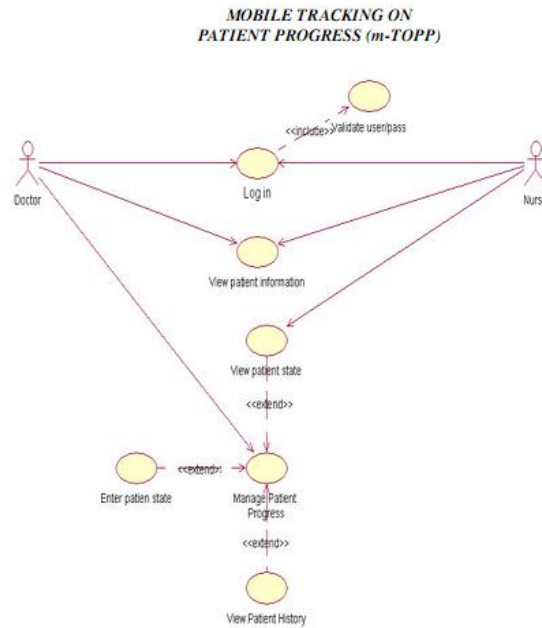


Fig.3. Mobile Tracking on Patient Progress Use Case

The following snapshots explain the system design.



Fig.4. Main Page

The main page displays the title of the system and two types of logging (Login for doctor and login for nurse).

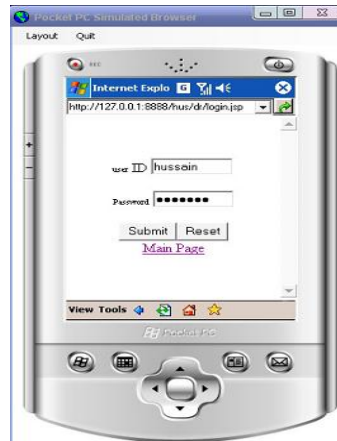


Fig.5. Login Page

After pressing the doctor button in the main page, the prototype displays a page to enter a user ID and password



Fig.6. Patient ID Page

Entering Patient ID by the doctor to view patient information and manage patient progress.



Fig.7. Patient Profile

Fig.7 shows that the doctor can see the patient profile such as name, age, gender, check in, room number and patient ID.

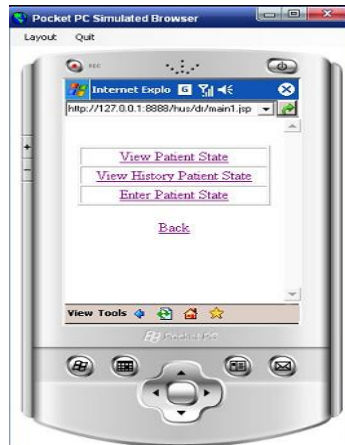


Fig.8. Managing Patient Progress Page

For managing patient progress page, it contains three buttons: view patient state, view history patient state and enter patient state.

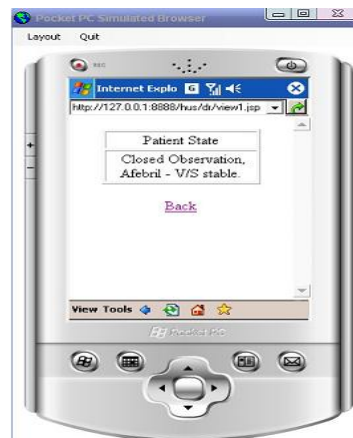


Fig.9. View Patient State

View patient state enables the doctor to see the latest patient condition (state) that recorded in the patient file.

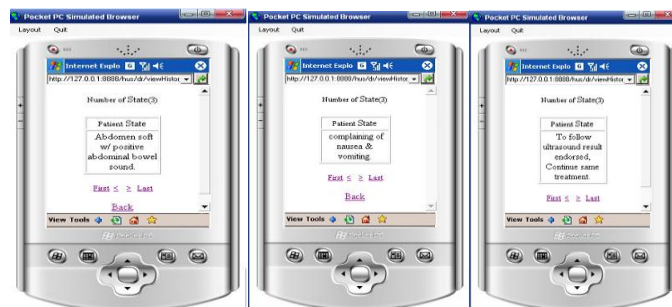


Fig.10. View Patient History

View history patient state enables the doctor to see all patient conditions (state) that recorded in the patient file. It shows the three patient states, the doctor can check these entered states using first and last buttons.



## 4 RECOMMENDATION AND FUTURE WORK

It is advisable that the application requirements should be treated and maintained in a consistent way. It is strongly recommended that the interface of mobile tracking on patient progress works constantly and also should do training for doctors and nurses how to use mobile application.

Designing Mobile Tracking Solution in Monitoring Patients is simply a first step in systems development. Looking ahead, for developing mobile tracking solution in monitoring patients.

## 5 CONCLUSION

In recent years, emphasis on improving the quality of care provided by the hospitals has increased significantly and continues to gain momentum. Because doctors and nurses are integral to hospitalized tracking patient's progress and pivotal in hospital efforts to improve quality. Therefore, the demand now is creating new needs to help and make better choices as using the mobile application on tracking patients progress. Therefore, proposed mobile tracking on the patient progress design is presented in this paper. By using technology of mobile tracking on patient progress system the doctor can follow up the case of the patient from outside the hospitals to enter the system and noted the amount of change based on reports stored. It also, allows doctors and nurses to track the state of patient more efficiently. Using this prototype it's easy for the doctors and nurses share information about state of patients. Currently we are in the process of designing and modifying a technology acceptance model for investigating the acceptance of the proposed mobile solution in monitoring patients.

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## 7 REFERENCES

- [1] B. J. Fogg, : Persuasive technologies. Communications of the ACM 42(5), 1999, pp. 27-29.
- [2] J. Gover, and P.G. Huray. "The engineer's role in averting the pending health care cost crisis". Albuquerque, NM, 2000, pp. 687-691.
- [3] C. Y. Lihua. "Mobile business applications adoption model based on the concepts of task/technology fit". Services Systems and Services Management, 2005. Proceedings of ICSSSM '05. 2005 International Conference . Vol 2, 2005, pp 1346-1350.
- [4] B. J. Fogg. Persuasive Technologies. Communications of the ACM. 42 (5), 1999. pp. 27-29.
- [5] F. Ichikawa, J. Chipchase and R. Grignani. Where's the Phone? A Study of Mobile Phone Location in Public Spaces. In Proc. IEEE Mobility Conference 2005 in Guangzhou, China, 2005, pp. 797 – 804.
- [6] T. Cochrane. Mobilising learning: A primer for utilising wireless palm devices to facilitate a collaborative learning environment. Proceedings of ASCILITE 2005. Retrieved January 12, 2006, from <http://www.ascilite.org.au/conferences/brisbane05/proceedings.shtml>.
- [7] G. Singh, L. Denoue and A. Das. Collaborative Note Taking. Proceedings of the 2nd IEEE Workshop on Wireless and Mobile Technologies in Education (WMTE '04) JungLi, Taiwan: IEEE Computer Society. 2004, pp. 163-167.
- [8] R. Suomi. "Establishing a contact centre for public health care." Proceedings of the 36th Hawaii International Conference on System Sciences . 2003. Pp. 10.



- [9] Y. C. Lu, Y. Xiao, A. Sears, and J. A. Jacko. A review and a framework of handheld computer adoption in healthcare. *International Journal of Medical Informatics*, 76, 2005, pp. 409-422.
- [10] M. Berglund, C. Nilsson, P. Révay, G. Petersson, and G. Nilsson, Nurses' and nurse students' demands of functions and usability in a PDA. *International Journal of Medical Informatics* 76 , 2007. pp.530-537.
- [11] S. Fischer, T. E. Stewart, S. Mehta, R. Wax, and S. E. Lapinsky, Handheld Computing in Medicine. *Journal of American Medical Informatics Association*, 10 (2). 2003.
- [12] P. Luff, and C. Heath. Singh. Mobility in collaboration. *Proceedings of the 1998 ACM conference on Computer supported cooperative work*, 1998. pp.305-314.
- [13] N. Lundberg, and T. Sandahl. What do Artifacts Mean to us in Work? *Proceedings of the 22th IRIS*, 1999, pp.363-372.
- [14] N. Lundberg, and H. Tellioglu. Understanding complex coordination processes in health care. *Scandinavian Journal of Information Prototypes*, 11(2). 1999, pp. 157-181.
- [15] S. Kristoffersent, and F. Ljungberg. Representing Modalities in Mobile Computing. In *Proceeding of Interactive Applications of Mobile Computing, (IMC'98)*. 1998.
- [16] Raytheon. JPS to market electronic patient tracking prototype (EPTS). 5(3), 2008, Retrieved from [http:// www.jps.com/subscribe](http://www.jps.com/subscribe).