Mobile Mental Health Care: Using Handheld Computers to Extend Information Systems to Mental Health Care Workers at the Location of Service (August 2003)

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Abstract – **Many providers of mental health services to children require access to centralized clinical computer systems, yet need to provide service where children need it, primarily at schools. Childrens Hospital of Los Angeles' Mental Health Services Division (CHLA), and Exym Corporation, an information technology consulting firm, are implementing a pilot program to track service activity and case notes using handheld computers. This paper discusses how Childrens Hospital is extending their systems with handheld computers.**

***Index Terms*—Mobile Computing, Medical Information Systems, Handheld Devices, Billing Systems**

I. Introduction

Mental health care providers at Childrens Hospital Los Angeles (CHLA) need to provide mental health and medical services at sites other than the hospital, such as schools, yet still have access to patient data. This presents the challenge of how to make data accessible in locations that are not directly connected to the hospital information systems. In addition, most of these locations still have limited Internet connectivity, making traditional off-site solutions, such as a virtual private network (VPN), impractical. Finally, limited budgets necessitate a solution that is inexpensive (under US$600/ €500).

The specific data required by CHLA clinicians and nurses consists of patient therapy notes, records of medication and allergies, and the ability to record billable activities. At the hospital, they have in place a system to record this information using Windows-based PCs connected to a SQL Server database application.

II. Proposed Solutions

The initial solution proposed was to enable access to patient data via a web site. This would require building a browser-based interface to the SQL Server data and providing secured access to it via the internet. In addition to the need for a secured connection to the web site, a lack of a consistent internet connection at the point of service presented a further challenge. In order to use a web-based application, clinical staff would have to access the application after hours, using an internet connection from home or other location. While certain record-keeping tasks, such as billing, can be completed after seeing the patient, access to current medical records and therapy history is required at the time of service.

These requirements necessitated a portable data solution (under 500 grams). Handheld devices with the ability to synchronize data with hospital systems were proposed [1]. This would enable clinicians to download current patient records and access this data when seeing patients. Since the data used by the application requires updating at approximately weekly intervals, the need for real-time access to data was negligible.

To implement such a solution involves addressing two major requirements: Designing the application on the handheld device, and synchronizing the data from the handheld device to the central database.

III. Handheld Application

There are three sets of data which clinicians need to access via the handheld application: The first part consists of patient medical history and allergy information. The second part consists of a history of therapeutic notes, and the third part is an interface to billing records.

To implement these parts on the centralized system CHLA's technology consultants, Exym Corporation (Exym), implemented a SQL Server database and a front-end application based on Visual Basic.

To implement the corresponding elements in a portable format a handheld computer running the Microsoft PocketPC operating system was chosen. Factors involved in the choice of this platform included the ability to synchronize with the centralized SQL Server database, the availability of software development tools for the platform, and the larger screen size relative to Palm operating system devices and mobile phones.

Based on the specifications provided by CHLA, Exym developed a custom software application using the Pocket Access database on the handheld computer which synchronizes with the central database when the handheld device is connected to a PC on the hospital network. Visual Basic and SQL were used to implement a relational database

and display data in master-detail data entry forms on the handheld device.

IV. USABILTY

The Environmental Systems Research Institute defines usability as "a combination of factors that effect the user's experience with [a] product". The factors include usefulness, learnability, effectiveness, efficiency and satisfaction [2]. For our purposes, usefulness and satisfaction were the most important criteria of success. Satisfaction was important to encourage adoption of the technology. It had been the experience of CHLA on past projects that if users found a system interface difficult to use they would find a way not to use it.

The initial challenge was to present data in a compact format. Clinicians need to be able to input several paragraphs of notes in a screen 1/6 the size of a PC monitor. The solution was to develop forms that displayed data via a tabbed interface. The standard note format in use by CHLA consists of six separate multiple-line notes that comprise a single document. Using a tab to represent each of the six notes, clinicians could view enough text on a single screen to write the note, then click a tab to move to any of the other six parts of the document.

The second challenge was presenting both summary and detail information in a compact format. For example, the users of the system needed the ability to browse through a list of past sessions with the patient, yet also see the details of a single session [3]. Again, a tabbed interface was used in which each successive tab presented a more detailed view of the data element selected in the previous tab (Fig. 1).

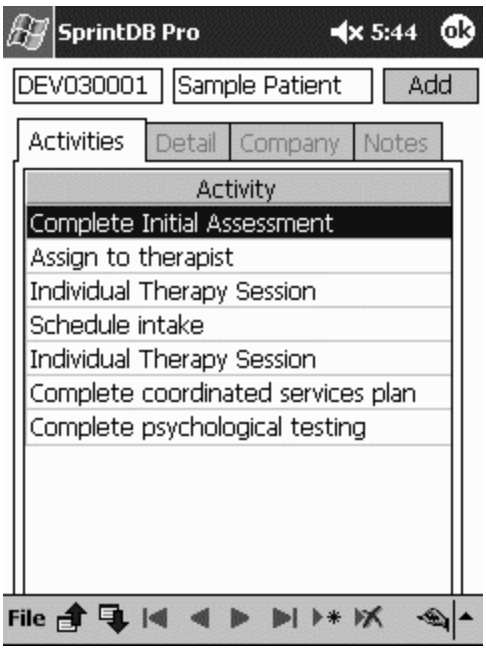

Fig. 1 A screen shot of the handheld application showing the activities scheduled for a given patient. Selecting an activity then selecting the "Detail" tab reveals the dates, time and other pertinent information for a given activity.

The final challenge was to enable users of the handheld system to input data at a reasonable pace [4]. This was important not only for productivity reasons, but also to ensure acceptance of the application by its users. While users will accept certain trade-offs in speed for the convenience of a portable device, the minimum data entry rate deemed acceptable on the handheld device was determined to be 75% of the speed of the PC application. This was accomplished with the use of a compact, portable keyboard connected to the handheld device. The combination of handheld computer and keyboard weighs approximately 400 grams.

Usability was measured via a series of informal interviews with users. They were asked for their general impressions of the technology and suggestions for improvement. The majority of users reported that the application was easy to learn and contained relevant information. The tabbed navigation structure made it easy to find information quickly. A significant minority also reported that the application lacked features found in the Windows version of the application. Our interviews revealed that users expectations of the handheld application were formed by their prior experience with the PC version of it.

Despite these expectations, a majority of users reported the benefit of having access to critical data while off-site far outweighed the inconveniences of a restricted user interface.

V. DATA SYNCHRONIZATION

While handheld computing devices have proliferated, technology to synchronize disconnected devices with centralized databases has not progressed as quickly. Microsoft ActiveSync technology was chosen for this application due to the ability to synchronize between the Pocket Access database running on the handheld device, and a SQL Server database on a server, using a PC as the conduit between the two data stores.

VI. FUTURE CONSIDERATIONS

The most significant limitation of the solution implemented is that it requires providers to synchronize with clinical systems periodically by connecting to a PC physically attached to the central hospital systems. While the nature of the data used does not require real-time access to the central system, periodic trips to the hospital for data synchronization is somewhat inconvenient. Therefore a wireless connection to hospital systems is highly desirable. The ubiquity of mobile phones, and their increasing processing power, suggests that future applications could be provided on these devices. In order to accomplish this, mobile phones with larger screens than are commonly available, and the ability to access centralized databases is required. The emerging SyncML standard for data exchange between wireless devices offers a

promising possible solution in the future [5]. Data is not accessed in real-time but updates can occur frequently and off-site.

Other alternatives include real-time access to systems via mobile phones equipped with the Pocket PC operating system and next generation wireless data technologies. Samsung and Siemens offer such devices that can be used on data networks in the United States at speeds of approximately 56 Kbps. A thin-client application running on a mobile phone would be practical at this speed.

Finally, wireless networks using the 2.4 GHz spectrum, so called Wi-Fi networks, offer connectivity to mobile devices at LAN speeds. While such access in the United States is currently limited to coffee shops, airports and selected business centers, three different organizations are rapidly deploying Wi-Fi networks: Deutche Telekom's T-Mobile, Boingo Wireless, and a consortium lead by IBM and AT&T [6]. In addition Intel is spending several hundred million dollars to promote its new Wi-Fi chipset [7].

VII. Conclusions

It is not yet possible to provide the functionality of applications found on PCs with handheld devices, yet significant problems can be solved. Critical information that would otherwise not be available can be provided to health care workers effectively via handheld applications. The trend is clear. In the next three years, Wi-Fi will become more ubiquitous. The next generation of applications will likely be web-based applications accessed in real-time via a portable device over a Wi-Fi network, offering users the same functionality currently provided by PCs on wired LANs.

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