

Improvement in Quality of Care by Mobile Access to Always-up-to-Date Clinical Guidelines and Documentation of the Decision Process

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Abstract

All staff members and residents at the department of Cardiology are provided with a Palm Tungsten-T Personal Digital Assistant (PDA). All departmental clinical guidelines, which are based on international (ESC) and national guidelines, are available on the PDA. The guidelines are created with Frontpage and iSiloX, and are stored in iSilo format. In addition to the guidelines, medical calculators and medication subscription software are available on the PDA. Primary risk-prediction software, developed earlier in our department, is also available. To make sure that information on the PDA is always up-to-date, the devices can be synchronized wirelessly via Bluetooth LAN Access Points.

The ability to have up-to-date clinical information on an easy to use PDA directly at the point-of-care allows consistent diagnosis and treatment of all cardiology patients according to the latest guidelines, thereby vastly improving the quality of care.

1. Introduction

Until recently cardiologists were depending on clinical guidelines in printed form to assist them in the medical decision process. Not only is it cumbersome to identify the appropriate action by browsing through printed guidelines, but the guidelines change regularly under influence of the results of new research trials.

Today, much of the clinical information is available in digital format, which makes it easy to have up-to-date information on a desktop PC. Still, this is not a very practical solution for guidance of treatment at the patient bedside. For data entry of clinical information at the Coronary Care Unit, we employ Tablet-PC's [1]. For clinical guidelines and other documentation a pocket-sized Personal Digital Assistant (PDA), such as the Palm or Pocket PC seemed more appropriate.

2. Methods

2.1. PDA selection

The main division amongst PDA's is between those using the Palm operating system and those using Microsoft's Pocket PC operating system.

Palm system devices:

- Offer excellent basic functionality as personal information managers
- Have a long battery life
- Have a larger installed base and enjoy more third-party software
- Are typically lighter and more compact
- More medical software is being developed for Palm OS versus the Pocket PC.

Pocket PC devices:

- Provide closer integration with Microsoft Office programs, including the ability to create formatted Word documents
- Are gaining market share
- Are faster and can run programs which are more memory-demanding

We have chosen to provide all staff members and residents at the department of Cardiology with a Palm Tungsten-T Personal Digital Assistant (PDA) (see Figure 1).



Figure 1. Palm Tungsten T, as used in our department

The Palm Tungsten T was chosen because of its high resolution screen (320x320), small size and light weight, built-in Bluetooth connectivity and the possibility for additional memory cards. However, the project is set up and the software is chosen in such a way that also Pocket PC devices can be used (some cardiologists already owned a Pocket PC device).

2.2. Content

The main focus for the content of the PDA's in our project is:

- Clinical guidelines
- Medical calculators
- PIM information
- Phone lists, etc.

All clinical guidelines that are in use in our department are or will be available on the PDA in a format using flowcharts with hyperlinks. National and international (ESC) guidelines are converted into Palm format. Some of the ACC/AHA guidelines are already available in iSilo format. However, the Dutch Cardiology Society (and thus also our department) has chosen to use only the European (ESC) and national guidelines. The guidelines are created (in html format) with Microsoft Frontpage and then converted into iSilo format with iSiloX. iSilo is a webbrowser application that runs on the Palm. There is also a version available for the Pocket PC.

2.3. Synchronization

Normally, users synchronize the content of the PDA with the information on their desktop PC. In our case, the documents that are meant for every staff member to use on their PDA are available on a central network server. To make sure that all staff members can always have the most up-to-date information and latest version of the applications on the PDA, Bluetooth Access Points (PICO Connect) (see Figure 2) are placed at various places through the department, allowing the Palm Tungsten-T to connect wirelessly to the network. Dedicated software (XTND Connect) is used for central synchronization and administration.



Figure 2: PicoBlue Bluetooth LAN Access Point

2.4. Wireless synchronization: Bluetooth versus Wi-Fi

Bluetooth

Bluetooth technology was developed to create a short-range wireless voice and data link between a broad range of devices such as PCs, notebook computers, handhelds and PDAs (hereafter referred to as PDAs), Smart Phones, mobile phones and digital cameras. Consistent with its aim of operating in even the smallest battery-powered devices, the Bluetooth specification calls for a small form factor, low power consumption and low cost. The range and speed of the technology were kept intentionally low so as to ensure maximum battery life and minimum incremental cost for devices incorporating the technology.

Wi-Fi (IEEE 802.11b)

The IEEE 802.11b standard was designed to be the best solution for a single specific application: wireless Ethernet. It is implemented in PCs, laptops, PDAs and network access points and is meant to offer comparable performance to 10baseT Ethernet LANs. Wi-Fi offers benefits to users that wish to gain LAN or Internet access while moving about an office or traveling and to small to mid-sized organizations seeking a rapid LAN deployment. At its heart, Wi-Fi is about enabling wireless LAN access for computer and other portable device users.

Why we chose Bluetooth

For our goal, synchronization of the user data on his/her PDA, the PDA needs to be in contact with the network only for a short time. Bluetooth is a perfect solution for that. Most important benefit of Bluetooth, as mentioned above, is the low power demand and small form factor.

Bluetooth and Wi-Fi together

Bluetooth and Wi-Fi share the same frequency band (2.4 GHz). Therefore, when both network technologies are employed in the same environment, they can interfere with each other [2]. For instance, the Tablet-PC's that we use on the Coronary Care Unit use Wi-Fi to connect to the network. However, rigorous tests that we have performed have shown that this problem can be circumvented by placing the Wi-Fi and Bluetooth LAN Access Points at a distance of at least 1 meter of each other. Another possibility is the LAN Access Point that has been recently developed by PICO and that contains both a Wi-Fi and a Bluetooth module. By smart switching, both technologies can be employed simultaneously.

3. Results: content

3.1. Clinical guidelines

The following guidelines have already been made available on the PDA:

- Treatment of adult patients with congenital heart disease (ESC guideline) (see figure 3).
- Hypertrophic cardiomyopathy (HOCM)
- Endocarditis prophylaxis
- Acute myocardial infarction

All present guidelines are created in iSilo format by the members of our project team.

A table structure makes it easy for the user to identify important items in the guideline (see figure 4). The iSilo guidelines can also contain hyperlinks (see figure 3) or images (see figure 5).

3.3. Other medical applications

Other medical applications that are available on the PDA's of the staff members are:

- Coronary heart disease risk prediction software (developed earlier in our department [3])
- Medcalc: a general purpose medical calculator
- Medication prescription software

3.4. General applications

The most important general application is the synchronization with the information that is present on the Outlook Exchange server: Calendar, E-mail, Tasks, etc. The XTND Connect server software (see above) performs this synchronization, with many configuration possibilities. The XTND Connect software also has the possibility for context-aware document distribution: documents that are only of interest for cardiologist (or for IT people), will be uploaded only to that specific group of staff members.

Other software that has been purchased and made available on the PDA:

- LauncherX: Application and file management software on the Palm
- BackupMan: Software which can automatically make a daily backup of all data on the Palm to a memory expansion card



Figure 3. Example of the guidelines menu layout as created in iSilo.

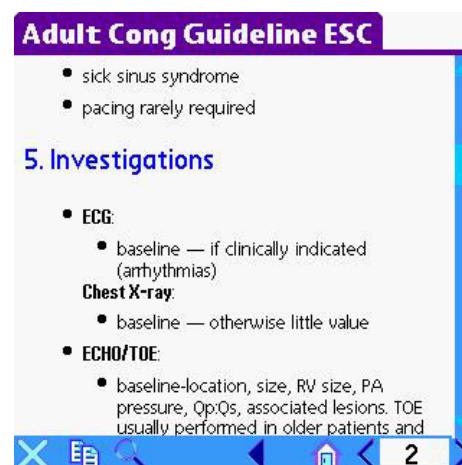


Figure 4. Example of the table structure in the iSilo guidelines.

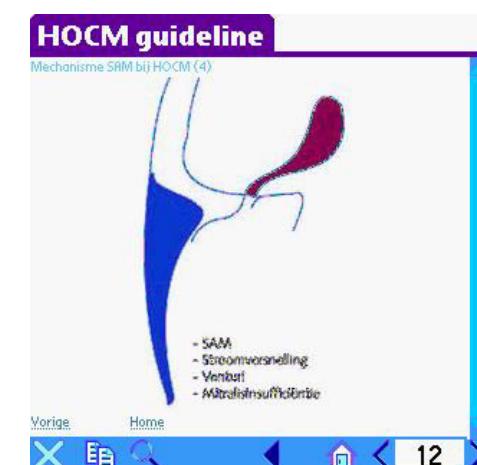


Figure 5. Example of the guidelines graphical possibilities.

4. Discussion

The availability on a pocket-sized device of clinical guidelines and other for the cardiologist essential information has proven to be of great value in our department. Instead of having to carry many different booklets, a Palm Tungsten T device is all they need. In addition, they have all their appointments, e-mail and notes at hand.

Presently, we are also developing Palm applications which will allow documentation of the decision process. The cardiologist will be able to enter critical information (such as time of onset of chest-pain, extent of ST-segment elevation, hemodynamic status). Afterwards, when the user synchronizes his PDA with the network, the data that has been entered in the PDA will be imported in our Cardiology Information System (CARIS) for documentation of the decision process.

5. Conclusion

The ability to have up-to-date clinical information on an easy to use PDA directly at the point-of-care allows consistent diagnosis and treatment of all cardiology patients according to the latest guidelines, thereby vastly improving the quality of care.

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