Ubiquitous mobile access to real-time patient monitoring data

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Abstract:
An application "Pocket WinView" was developed for a Pocket PC personal digital assistant device, which allows remote access to near real-time physiological information from a patient monitor on a commercial handheld device (iPAQ, Pocket PC). The application provides continuous display of up to six monitored physiological waveforms and parameter values. Wireless communication can be established using Wireless LAN and general packet radio service (GPRS). Data is protected with hybrid public key encryption. User authentication is required every time the application is started. Patient data can also be stored on Compact Flash memory cards for data collection purposes. Additional integration with Web-based applications on the hospital intranet make it possible to combine the near realtime signals with previously recorded 12-lead ECGs, laboratory test results, and charting information.

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SECTION 1.
Introduction

With the recent advances of Internet and wireless technology it becomes possible for physicians and care givers to remotely access patient data from anywhere and anytime. Wireless access to the patients' vital parameters and signals could greatly benefit the daily routine of caregivers, thus providing around the clock continuous intensive care (ICU) patient management in those regions where expert cardiologists/intensivists are scarce.

In the in-hospital situation, wireless access to vital signals can be particularly useful in medium care or telemetry wards, where patients may be ambulatory. Display of real-time signals is often limited to a remote screen at the nurse desk, and is not continuously available at point of care in alarm situations. In these instances, a wireless personal digital assistant (PDA) in combination with a paging system may be very useful.

SECTION 2.
System overview

We developed a viewing application ‘Pocket WinView’ for a commercially available Pocket PC PDA (Compaq, iPAQ) giving wireless access to information from the in-hospital patient monitors and telemetry transmitters. Our research set up consisted of a PDA running Pocket PC 2002/Windows CE with a 206 MHz ARM processor, 32Mb RAM and a screen resolution of 320 by 240 pixels with 4096 colors. Pocket WinView can be installed next to the existing applications and it does not restrict the PDA for personal information management such as appointments, address books, memos and other uses, including databases, e-books and calculators.

2.1. Wireless access methods

The system was designed for both in-hospital use and for off-site consultancy by physicians. Connectivity within the hospital was set up using Wireless LAN (WLAN) technology (IEEE 802.11b), which provides network speeds up to 11 Mbit/s for a limited distance (100 meters). We used several types of WLAN network cards from commercial vendors, including CompactFlash (CF) and PCMCIA cards.

For wireless connectivity outside of the hospital, a commercial cellular phone network (GSM) had to be used to ensure local coverage. However, the GSM data speed of

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