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Improving communication among nurses and patients

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ABSTRACT

Patients use nurse call systems to signal nurses for medical help. Traditional push button-flashing lamp call systems are not integrated with other hospital automation systems. Therefore, nurse response time becomes a matter of personal discretion. The improvement obtained by integrating a pager system into the nurse call systems does not increase care efficiency, because unnecessary visits are still not eliminated. To obtain an immediate response and a purposeful visit by a nurse; regardless of the location of nurse in hospital, traditional systems have to be improved by intelligent telephone system integration. The results of the developed Nurse Call System Software (NCSS), the Wireless Phone System Software (WPSS), the Location System Software (LSS) and the communication protocol are provided, together with detailed XML message structures. The benefits of the proposed system are also discussed and the direction of future work is presented.

1. Introduction

In hospitals, nurses must be easily reachable and must respond to the calling patient, as quickly as possible. In short, nurse availability affects the quality of a hospital's patient care. Most hospitals use push buttons, flashing lamps and paging systems to provide notification to nurses, in an ad hoc manner. However, when a paging call is received, present activity has to be stopped and an available phone has to be found. The prolonged delay until a response is given, degrades the quality of care and operational efficiency. In today's large hospitals, the need for the nurses to be at locations besides the nurse station, aggravates the availability problem. The nurses point to the need of carrying a wireless device during the mobile or "away" times [1], because such a device can:

- Show the room number, bed number, call priority, and the patient name who pressed the call button, Have an available call back feature that allows responding a patient for calls that come when the nurse is outside the nurse station.

The need for a mobile wireless device has been declared because the most important ramification of a nurse call system is effective communication with the patient, to decide the urgency for a visit. Most nurse call systems are arranged as wired communication systems, where a patient pushes a red button located next or above the bed. The action triggers an alarm by flashing a light outside the room, as well as creating an audible tone. The red buttons are connected to a central monitoring panel, located at the nurse station. When the call occurs, the priority of the call, the originating bed number and some other limited information are displayed. The alerts are

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expected to catch the immediate attention of the nurses. The light is turned off when the nurse visits the caller. If there is a delay to answer the call of the patient, then the frequency of flashing the light and the audible tone are increased, which are configurable through software. Nurses can also opt to pick up the phone and start a voice communication to help the patient remotely, while at the nurse station.

Participants of a work on patient–nurse interaction, described the nurse call system as a means to start an interaction and get the needed help, as quickly as possible [2]. Work [2] suggested that regular visits to patients would decrease resorting to nurse call systems. However, random visits done by doctors or nurses unavoidably increase the number of redundant patient visits, which is inevitably unaffordable in large hospitals. The shortcomings of the traditional nurse call systems can be overcome by investigating new technologies like the home Digital Enhanced Cordless Technology (DECT) phones. DECT telephone features are continually upgraded to catch up with the characteristics of mobile phones, due to the competition between the Global System for Mobile Communications (GSM) and cable phone operators. DECT phones can be utilized, not only for receiving (similar to pocket pagers) and sending text messages, but also for providing full-duplex voice communication. Some proposals have indeed been made to integrate DECT phones into nurse call systems, in an effort to improve the nurse-patient communication and the functionality of the existing systems [3–5]. After all, DECT phone integration opens the way to calls to a specific nurse, in charge of a particular patient or bed [3]. A call to a DECT phone is accompanied by the calling patient's room number, bed number and the priority of the call on the state of the art phone display (liquid crystal or thin film transistor). However, the disadvantage of the unscreened call system in Ref. [3] is the possibility of calling a nurse who is already giving care to another patient. Another drawback of the system presented in Ref. [3] is that the patient name is missing on the phone display. But, replying a patient with his/her name would increase the satisfaction level toward the nurse.

In other work, the wireless nurse call system helps bedridden patients to communicate with the nurses, in the absence of their caretakers [4]. But, the nurse calls are generated automatically when the physiological parameters of the patient such as ECG, pulse rate, or respiration rate exceeds certain thresholds. However, the disadvantage of that system surfaces when the physiological parameters drop below the threshold in the presence of a caretaker. In this system, the patient has to depend on the caretaker, instead of a nurse. The nurse call system in Ref. [5] is adaptive and assesses the priority of the call, based on certain pre-defined conditions and delivers a call to the most appropriate nurse. The disadvantage of the system is the decision time taken until the right nurse is chosen, one of the causes of the delay in traditional nurse call systems. Various surveys completed by doctors and nurses in work [6] indicate that the participants are dissatisfied with one-way paging devices. And, the use of wireless phones has resulted in significantly reduced patient interruptions, longer patient visits and reduced waiting times for returned calls. Finally, the work of Ref. [1] shows the challenges faced by the wireless phone based systems, but proposes only partial solutions. As observed, the various works surveyed have limited success in increasing the effectiveness of nurse-patient communication and still fail to meet certain challenges such as

- Transferring a call to the secondary nurse, if the primary is on the phone with another patient,
- Transferring the call to the secondary nurse, if the primary is currently on a visit in a patient's room,
- Transferring the call to the secondary nurse, if the primary is outside the ward,
- The communication protocol between the nurse and the patient is defined in detail.

For many years, nurse call systems were stand-alone and required the integration of pocket pagers to support the mobile nurses. Even though it was possible to transmit nurse calls through pocket pagers, the patient - nurse communication was still one-way. The one-way set-up required the nurses to make too many redundant visits [6]. In summary, an intelligent solution is needed to meet the above challenges by creating a nurse call system with wireless phones.

2. The wireless phone interface software solution for nurse call systems

2.1. *Motivation*

The present work is an attempt to eliminate the redundant visits and prolonged call returns, by making the nurse–patient communication a two-way and intelligent system. In the literature, the details of the proposed two-way communication are not clear. This work deliberately presents details of the proposed communication protocol, in order to make it repeatable for interested researchers. The overall solution is summarized in a name that consists of the first letters of the modules, Nurse Wireless Location System (NWLS). Each module is described in detail in Section 3.

2.2. *Assumptions*

Nurse call systems can be inspired by the facilities available in mobile phones. To meet the expectations, today's overall nurse call applications need to make more intelligent decisions, based on additional information from the location and ADT (admit, discharge and transfer) systems. As a pre-requisite, all helpful information should be displayed not only on pagers or phones, but also on the desktop computers of nurse stations, administration and clinical engineering offices. This work assumes that such hardware (computers, network, DECT phones, switch boards, etc.) are already available at today's hospitals.

2.3. *Our contribution*

The proposed NWLS provides the following advantages to the patients and the nurses:

The patient can reach a nurse equipped with a DECT phone, quicker,