A Pervasive System for Communicating Urgency Cues to Health Care Workers

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Abstract. The introduction of mobile communication devices in hospitals has led to an increased amount of interruptions. Studies indicate that interruptions can have a negative effect on both patient safety and care. This paper proposes a pervasive system that incorporates a number of interruption management techniques in order to reduce the harmfulness of interruptions in hospitals.

Keywords. Health care, pervasive technology, interruptions, communication

1. Introduction

Communication within hospitals is an important aspect to consider when aiming to deliver high quality care [1]. Due to the highly mobile nature of health workers within hospitals [2], this has led to a recent trend of providing these with wireless communication devices. Although this enables high availability among the health care workers, it also implies that they are more exposed to technology-mediated interruptions. This has been reported in [3], where the authors conclude that wireless communication devices, especially mobile phones, introduces further interruptions to an already interrupt-driven environment.

This can have a serious impact on patient safety. Studies indicate that interruptions are one of the main reasons why medication errors occur [4]. In [5], the authors also reveal that fewer interruptions could have a positive effect on patient care.

At the St. Olav's hospital in Norway, a collateral nurse call system has been introduced, which enables the delivery of nurse calls directly to the nurses' personal wireless phone. In this case, and in the context of this paper, a nurse call is an alarm initiated by a patient seeking the assistance of a nurse. This system exists in conjunction with artifacts from the old system, which provides awareness through the use of public displays. It has been identified that the new wireless system causes unwanted interrupts. For example are nurse calls delivered while talking on the phone or in a meeting [6].

The hospital environment has been singled out as a perfect fit for pervasive and context-aware technology. So far, not much of this type of technology has been deployed and evaluated in hospitals [7].

In [8], the authors argue that by distributing context cues through the use of technology, nurses and physicians can become socially aware of persons that are not in the same location. The proposed iHospital concept incorporates both public and private devices for communication. Within this concept, they present a wireless phone that
provides context information about the persons listed in the phone’s address book. Through the extended social awareness, it is assumed that the caller selects not to interrupt in an inappropriate situation.

The work in [9] tries to solve the issue of inefficient communication in hospitals through the use of a context-aware system. They propose that calls are to be routed through a system that decides whom to forward the call to and if the time is appropriate. The system makes the decisions based on location and availability of the callee, as well as on predefined rules.

Our aim is to reduce the harmfulness of interruptions by providing health care workers with urgency and awareness cues through the use of pervasive technology. Along with some relevant work, the concept of such a system will be presented before the contributions of this paper are discussed.

2. Communication of urgency and awareness cues

In accordance with previous research, we believe that communication systems in hospitals can be improved through the use of pervasive technology. Here we present a pragmatic solution to the problem of interruptions by providing nurses with a system that communicates awareness and urgency cues to both the caller and callee.

In contrast to the context-aware systems presented in [9] and [7], we acknowledge the problematic issues of building a context-aware system [10]. We define a context-aware system in a similar manner as in [7], namely a system that responds or acts with influence of available context information. Our proposed system does not try to act in a similar “intelligent” way. Rather it combines the interruption management techniques; interruption dissuasion, notification modification, and interruption preview, discussed in [11], to manage interruptions. It leaves the decision to the caller to decide if it is appropriate to make the call, similar as in [8], and to the callee to decide on whether or not the call should get through. The system should adopt the characteristics of a pervasive system by supporting the work, while not adding extra workload in form of configurations or requiring extra manual input of data. The nurses are often busy with other more important tasks, so new technology should make work run smoother rather than make it more cumbersome.

The idea is to provide awareness and urgency cues to a nurse even when the nurse is busy doing something else. However, these cues are to be signaled to the nurse using a less intrusive notification, such as a vibration or a blinking led, if the nurse has set the status to ‘busy’. The status functionality could be implemented through some sort of presence mechanism.

People also use technology to communicate context. For example, calling twice can indicate that the matter is urgent [10]. This system could support this by allowing the caller to set the urgency of the call. This information would then be displayed to the one being called. Further context cues could be sensed automatically, such as the patient id and the location from where the call originates.

The system incorporates a heterogeneous set of devices (Figure 1), including smartphones, smart watches, and fixed screens placed at strategic locations. When a nurse is located close to one of these devices, e.g. a fixed screen in the medication room or in a phone booth, the system senses the presence of the nurse and allows information about incoming requests to appear on the most appropriate device.
3. Discussion

We consider hospital environments being too complex and the possible costs too high for leaving the decision of whether a matter is urgent or not to an automated decision system. Rather we aim to build a solution that mediates urgency and awareness cues to the caller and callee. The concept of the system has been presented here. Future work includes design, implementation and evaluation of the proposed system.

Figure 1. The health care worker can interact with different devices.

References