

Supporting Hospital Wards with Enhanced Habitual Artifacts

FEDERICO CABITZA - MARCO LOREGIAN - MARCELLO SARINI

Università degli Studi di Milano Bicocca

Aim of the SWIRLS¹ project is to give support to practitioners working in hospital wards [1]. In particular the focus is on how practitioners can be supported by technology in coordinating their activities without disrupting their habitual practices. We chose to focus on hospital wards because they represent a paradigmatic case of work setting where actors are heterogeneous in role and experience, distributed in various locations and continuously moving from place to place. Supporting coordination work in hospital settings has always been one of the most challenging endeavors in the deployment of IT applications in real-life settings. Several researchers have tried to understand why this endeavor has generally been frustrated by the refractoriness of practitioners in adopting supporting applications that propose a more or less accentuated dismissal of paper and traditional artifacts [2]. As a matter of fact the level of digitalization in hospitals is still quite low. These considerations led us to shift our attention towards applications that could introduce in such an environment the clear advantages of digitalization without disrupting their consolidated work practices; hence we decided to concentrate our efforts on devices that users might interact with more friendly, in the sense that although they resemble quite closely habitual artifacts, however they are enhanced by computation (e.g. for the promotion of awareness about status of the work and to support communication).

For this reasons, our first research effort was oriented on the identification and analysis of artifacts used daily by practitioners as a support to their coordination. As a result, we detected that paper-based forms and wall-mounted whiteboards are among the most useful artifacts [3]. In the former case, actors make notes on pre-printed paper forms all along their daily work and this action plays a twofold role: it allows both the "accumulation" of information about patients as the work proceeds and the coordination of the activities as they are performed [4]. In the whiteboard case, information about planned activities and role as-

signment is often displayed on wall-mounted boards and hence shared by all practitioners. As a consequence, paper-forms represent a highly flexible, convenient and mobile support to reporting activities; while whiteboards provide actors with a highly interactive and timely support to assign activities and to be informed about their progress. Taking into account the above considerations, we chose technologies that make adoption of these artifacts possible, as well as their digital augmentation in connection with a computational infrastructure. In so doing, we do not disrupt usual work practices providing practitioners with the advantages of digitalization. In particular, we adopted Anoto² digital pens which allow a natural way of interaction with paper-forms. In fact, Anoto technology is based upon an unintrusive pattern that is printed on common paper sheets. The pattern enables pen strokes recognition and interpretation in terms of what is written and where on paper; in this way the usual paper sheet may be used both as a data entry tool that allows data relating to care and patients be fed into the Hospital Data System and as a command interface giving access to some system functionalities. For what concerns whiteboards, they are touch-sensitive large screens manufactured by Smart Technologies³, that may capture the richness of interactions taking place among practitioners.

Here again the system may be accessed, instead of sitting in front of a computer screen, through an intuitive, adaptive and customizable interface.

The interface is intuitive in the sense that the visual presentation of the whiteboard application may exactly resemble well-established practices. It is adaptive in the sense that it may facilitate the different activities each person performs all along the day. It is customizable in the sense that different users, with different tasks and responsibilities, have different views on the system and the whiteboard layout - and information there represented - is consequently adapted.

In designing the SWIRLS architecture we conceive of

Correspondence: Federico Cabitza - Marco Loregian - Marcello Sarini
Università degli Studi di Milano Bicocca
{cabitza,loregian,sarini}@disco.unimib.it

¹ Supporting Wards with Interactive Resources and Logic-based Systems

² Anoto Group® - <http://www.anoto.com>

³ Smart Technologies Inc.® - <http://www.smarttech.com>

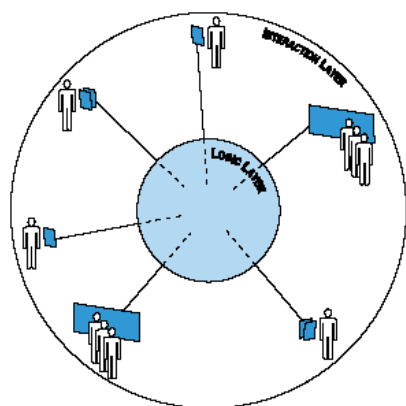


Figure 1: The SWIRLS web of artifacts

paper forms and whiteboards as influencing each other at some extent and hence they have not to be seen as separated artifacts. This strong but somehow implicit correlation among them may be expressed by the sharing of the same underlying logical core. Each SWIRLS augmented artifact may then be seen as the combination of an interactional side (with all its physical affordances and features) and a computational \back-end" where inference on current context is accomplished (see Fig. 1). The former side - what we called Interaction Layer - is spread in the environment: whiteboards are placed where coordination needs are stronger whereas paper-forms are lightweight and mobile supports that follow the practitioners in their rounds. The latter side - the Logic Layer - is a Rule-Based System (RBS), an inferential engine where the information coming from the physical interfaces (i.e. performed actions and entered data) is elaborated according to the context of work so to promote its awareness in a coherent way. After having tackled the architecture details of our application (see Fig. 2), we implemented a first demonstrator of the SWIRLS system for a preliminary feasibility assessment. As a next step we consider indispensable to reach a thorough knowledge of which coordination techniques are taught to the professionals of the field (especially to ward nurses); this will be accomplished with specific interviews with teachers and students of selected nursing schools. After drawing some basic hypothesis

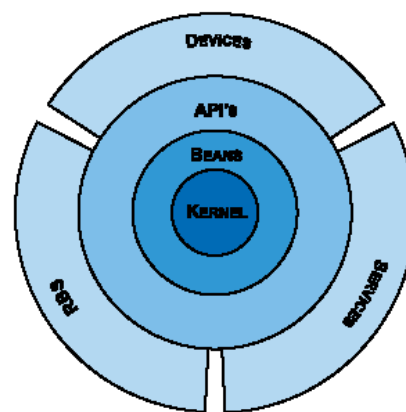


Figure 2: The SWIRLS high-level architecture. Gaps between the outer layers mean that information flows and communication between devices, services and the Rule-Based System (RBS) is implemented through a middleware kernel. Devices and Services are represented by JavaBeans, and through proper Application Programming Interfaces (API's) these objects are mapped in explicit facts on which logical inference can be carried out.

from this theoretical expertise, we will start an observational field studies session where we shall examine cognition and coordination of the ward; for this latter aim we are currently looking for the most suitable hospital settings where to tackle this task; the third goal of ours is to accomplish a participatory design of paper forms and whiteboards interfaces with their intended users. The deployment of the application is foreseen for the next year in a controlled test environment where a first analysis of the outcomes will be tackled in collaboration with selected practitioners. The prototype will be then officially presented to ward professionals and, in case of positive feedback, tested on the field.

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