

# Mobile Support of Electronic Whiteboards

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*“This study will investigate and evaluate the uses of a mobile application that supports electronic whiteboards, where the effect driven approach is central to the adoption and further development of the application. This is investigated through the development and integration of a general software layer for evaluation based on the experience sampling method as well as data gathering for the Imatis system and its applications in its entirety.”*

## Overview

The development of mobile applications in extension to the existing shared care initiative manifested by the Electronic Whiteboards has a great potential. Both internally at the hospitals (sekundær sektor) to help in the transfer of patients between wards, as well as assisting the dissemination of shared care to include the clinics and other related institutions outside the hospitals (primær sektor). By extending the overview provided by the electronic whiteboards to mobile devices, it is possible to deliver information right where it is needed.

One such situation is the Outreach project. It has been suggested that the development of a mobile application in the context of Imatis' electronic whiteboards has the potential to improve on existing practice regarding the ICU (intensive care unit) service *Outreach* (Østergaard 2013). Imatis A/S has already taken steps in the development of a mobile version of the Imatis Visi named *Imatis Mobi* and the further development of this mobile version has been rated as the fourth most important improvement to the users (Imatis A/S 2013). The development and integration between a mobile solution to support Outreach and the Imatis system has however not been investigated yet.

Secondly there is an opportunity to gather specific data about the use of and attitude towards the software not possible in the current paper-version regarding the Outreach service. By integrating a layer of effect driven evaluation across the Imatis software system, an 'on-the-go' system evaluation based on the *Experience Sampling Method*, would be possible. Furthermore the scenario is opportune to make the evaluation event-based (rather than time-based) thereby taking advantage of the latest developments in context-aware principles and focusing the evaluation.

The general potential in mobile applications as well as the evaluation system opens up doors to other projects. The "Flaskehalse og belastningsbarometer"-project, the "Patientoverførsel og kompetenceopbygning i effektdrevet optimering"-project as well as the "Hospital Porters"-project (Arnvør á Torkilsheyggi) are all projects that could benefit from the opportunities in mobile support. Also the ongoing projects in SINFTEF and their collaboration with Imatis is relevant for exchange in experiences with mobile supported patient care.

One question is however, whether it is possible to rely on earlier findings regarding the implementation of the Imatis Visi - specifically the results from (Rasmussen 2010). In the case of the electronic whiteboards, the implementation relied on an existing work practice based on dry-erase whiteboards, and the electronic version based its initial design on the same metaphor. This was done to adhere to the principles of tradition and transcendence. In the case of putting a mobile application to use that supports the careful patient

transfer between hospital wards; there is no analogue version of the system to mimic other than the existing paper-versions. On what metaphor should the mobile version of Outreach be based and how should the implementation of Outreach co-evolve and melt together with the existing Imatis solution(s)? The Outreach project circumscribes this problem in an exemplary way.

It is assumed that in such a case it is necessary for developers and users to cooperate on the arrangement and lay-out of the application from the beginning in close contact with the development of the actual medical service i.e. Outreach. Specifically the fact that Outreach is not yet fully standardised leaves a window of opportunity for the development process of both service and application. Outreach as a service could benefit from the built-in evaluation *and* the implementation and adoption process of the mobile application could benefit from the close participation between users and developers from the beginning.

The configuration of a mobile application, such as Imatis Mobi, to support and extend the existing electronic whiteboards would yield learnings relevant to other similar practices and their adoption of the electronic whiteboards.

Secondly the added software layer (an "Imatis evaluation module") for evaluating *the use* of the Imatis system as well as the system *itself* is relevant throughout the use of the Imatis systems. It is intended that any application of Imatis should have the opportunity to configure and apply the evaluation module – optimally to support an effect driven approach. As previously mentioned the generality in this module opens up to collaboration with other projects that seeks to gather and treat data from the electronic whiteboards and their mobile kindred.

## Relevant areas

The following represent possible areas of inspiration to the overall project.

- *Experience Sampling Method (ESM)*  
ESM is a means to make "real-world environment, repeated assessments of experiences or behaviour over time" (Atz 2013) and seeks to evaluate the users experience of an activity. It is originally invented by behavioural psychologist M. Csikszentmihalyi (Hektner, Schmidt og Csikszentmihalyi 2007) and said to be a derivation of the Ecological Momentary Assessment (EMA) (Shiffman, Stone og Hufford 2008) originating from the medical disciplines. In this case ESM seems relevant to evaluate the use of and attitude towards a mobile application as well as the specific practice that the application supports i.e. the Outreach service.
- *Context-aware software*  
It is evident that the Imatis devices (e-boards as well as mobile devices) to some extent are context aware, understood as the software's ability to sense and react on the current situation, but the mobile application might benefit further from the opportunities in context-awareness (Kjeldskov og Skov 2007).
- *Pilot-implementation*

This project seeks to take a software application from its development environment out into the field of use. That is to extend prototyping from the laboratory and is called *pilot-implementation*. The purpose is to let “users to experience a system design under realistic conditions and developers to get feedback from realistic use while the design is still malleable” (Hertzum, Bansler, et al. 2012)

- *Effect-driven development*

The study is an example of a more general approach to software development and dissemination called *effect-driven development* in which the main purpose is to close the gap between development and implementation. The approach is characterised by an iterative strategy that 1) focus on the desired effects of the system 2) that the effects are realised and 3) *measuring* the effects during use of the system. (Hertzum og Simonsen, Effects-Driven IT Development - Specifying, realising and assessing usage effect 2011)

- *Responsive (web) design and Digital Signage*

As previously mentioned the electronic whiteboard is relevant on a variety of different devices of different screen size such as large screens as well as tablet and smartphones. I find it interesting to investigate to what extent the principles of responsive web design (Marcotte 2010) adheres to the case.

Studies in the area of digital signage might give insights to the possibilities as well as the limitations in the design of the graphical layout of the software applications (Müller, et al. 2009).

## Research question

The path of investigation is twofold. Firstly the study seeks to evaluate the use of mobile applications through a pilot implementation process.

This could be said to happen in a vertical manner as it needs to take place in one or more specific context. Also it must happen from initial prototype through pilot-tests and finally evaluation of the test.

Secondly it is intended to develop a general evaluation module for use across the Imatis system for general support of effect driven strategies that needs precise measurements as a foundation for decision making. This could be conceptualized as being horizontal to the general software application environment anchored in the Imatis system.

The research questions are as follows:

- How can mobile applications support and extend the use of electronic whiteboards?
- How can the Experience Sampling Method assist an in-situ evaluation on mobile devices to support effect-driven development?

The study will be carried out in four phases

1. *Pre-investigation evaluation-module development*  
Survey made on the status of the existing method and practice regarding the use of electronic whiteboards and other IT-systems. At the same time an evaluation-module based on the ESM is built into the Imatis system portfolio.
2. *Prototype configuration and live-testing*  
Based on the pre-investigation, a mobile software application is put to use and monitored.
3. *Pilot implementation and prototype evaluation*  
An evaluation of the system is carried out.
4. *Re-intervention*  
Based on the evaluation of the prototype a coherent design vision is put together based on the findings in the pre-investigation, prototype development and –evaluation, for the purpose of further development.

## Method

The collective investigation would benefit from following the four phases of MUST at two levels: 1) at a micro-level concerned about the first phase (Pre-investigation) and at a macro-level concerning the overall investigation. In this way, the first phase will serve as an enclosed study based on the four phases of MUST itself, providing substantiated rationales for the further investigations for the rest of the overall study which in turn follows the four phases (initiation, in-line analyses, in-depth analysis and innovation).

## Schedule

1. May. '14 – 31. Oct. '14	<ul style="list-style-type: none"> <li>• Pre-investigation: The domain is investigated and initial requirements established and possibilities analyzed.</li> <li>• Isolated technical development setup established.</li> <li>• Literature study on <i>context-aware mobile software applications</i> and studies on <i>event-based Experience Sampling Method</i>.</li> <li>• Evaluation-module in development.</li> </ul>
1. Nov. '14 – 30. Apr. '15	<ul style="list-style-type: none"> <li>• Intervention: Period of monitoring the system in action</li> </ul>
1. May. '15 – 31. Oct. '15	<ul style="list-style-type: none"> <li>• Data-analysis and re-iteration in the development of the evaluation module.</li> </ul>
1. Nov. '15 – 30. Apr. '16	<ul style="list-style-type: none"> <li>• Follow-up.</li> </ul>
1. May. '16 – 30. Nov. '16	<ul style="list-style-type: none"> <li>• Post-intervention and final evaluation.</li> </ul>
1. Dec. '16 – 30. Apr. '17.	<ul style="list-style-type: none"> <li>• Assembling and finalizing the written works to a thesis.</li> </ul>

## Plans of Publishing

There will be an ongoing publishing in acknowledged, peer-reviewed, international journals, conferences and scientific books/anthologies. All publications will be encompassed by the BFI authority list (BFI autoritetslisten). General methodology oriented papers can be published in journals such as Design Issues and Scandinavian Journal of Information Systems. Papers with a focus on the specific health care domain can be published in journals such as International Journal of Medical Informatics and Health Informatics

Journal. Relevant conferences for the publications of the project are the Participatory Design Conference (PDC), Information Systems Research Seminar in Scandinavia (IRIS), European Conference on Information Systems (ECIS), Medical Informatics Europe (MIE) and Scandinavian Conference on Health Informatics (SHI).

Furthermore the results of the project will be conveyed to relevant actors at NFS and in RS through seminars and workshops.

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