ERCIM "Alain Bensoussan" Fellowship Scientific Report

Fellow:	Srihathai Prammanee
Visited Location :	VTT Technical Research Centre of Finland, Espoo, Finland
Duration of Visit:	01/10/2008 – 30/06/2009

I - Scientific activity

The ERCIM fellowship was accomplished with the Computer Simulation Technology team, at VTT Technical Research Centre of Finland. The fellowship was mainly involved in the Nomadic Use of Plant Model (Nose) project. Primarily, Nose has conducted an industrially driven applied research to study and analyse the methods and tools that support an augmented reality (AR) data access for the mobile maintenance, field operation, and training tasks in an industrial environment. The tasks assigned during the fellowship program covered the requirement analysis and functional testing of mobile plant model environment, developed under the Nose project. In addition, the responsibility of writing the technical reports and publications was held.

Nose simplifies the manufacturing performances in a process plant. It implements Simantics Mobile tool, providing the efficient methodology and application integration platform for accessing the plant-related information ubiquitously and pervasively. Simantics Mobile makes an innovation contribution to a corporate information management. It is founded on the idea of sharing and integrating the overwhelming information thoroughly used over a process plant lifecycle. A hybrid concept of AR interaction and special content creation is envisioned; the requests and presentations of complex data over different stages of the lifecycle are carried out under a uniform interfacing model. Simantics Mobile promises the best access to industrial materials, presenting the *right* information in accordance with the personnel's' roles and duties at the *right* time and in the *right* place. Strategically, it realises the relationship matrix of contexts, each of which has a unique perspective on knowledge. A triple-dimensional contextual knowledge of time, content, and location is exploited to describe the fundamental distinctions of context acquisitions and show the spatial knowledge representations that must be taken into consideration during the design and implementation. More specifically, the time dimension refers to an *immediate response* at the *right* time. Using an augmented reality (AR) technology, Simantics Mobile offers an enriched user interface, enhancing an input ability. The knowledge of equipment appearances is promptly extracted from the factory environment. Next, the content dimension gives *ease of access* to the *right* information. The semantic plant model is defined. Literally, it is ontology-orientated, providing the comprehensive and unambiguous descriptions of technological and methodical knowledge, such as the measurement, historian and diagnostic data. Finally, the location dimension capitalises on the position knowledge to interact with the personnel *proactively* in the *right* place. A geographically positioning configuration is taken as the spatial knowledge bases to maintain the concept of the space and relative locations between plant equipments and personnel.

The feasibility of Nose, including the practicality of Simantics Mobile, was analysed within the scope of papermaking process. It was carried out under a practical test-run at Stora Enso Kvarnsveden, the paper mill in Sweden, During the test-run, the environmental risk factors and

certain atmospheric conditions that could affect the quality of services were thoroughly investigated.

II- Publication(s) during your fellowship

Conference

Srihathai Prammanee, Marko Luukkainen, Timo Seuranen and Tommi Karhela. *A Marker-based Mobile Learning Environment for a Process Plant*. In Proceeding of IADIS International Conference Mobile Learning 2009.

Abstract
The Nomadic Use of a Plant Model (Nose) project defines an open framework specification for nomadic plant usages. The project implements a tool, called Simantics Mobile, which incorporates the functionality supporting a marker-based mobile learning system in a manufacturing and factory platform. In theory, Simantics Mobile extends the provision beyond the classic mobility and ubiquity (i.e. anytime and anywhere service). Its primary intention is rather to retrieve the right information at the right time and in the right place. The learning contents, including the plant-related information, are semantically described by a set of ontologies and systematically maintained in physical storages distributed across a process plant. The heterogeneous ontology domains are coherently interconnected, exchanging their knowledge by means of the protocols defined in the Simantics architecture. Based on an augmented reality (AR) technology, a marker-based recognition is exploited, invigorating an intuitive user interaction. A marker adds the certain contextual information to the equipments in a plant. They are visually detected by a mobile camera, and the learning content is subsequently displayed on a mobile screen, accordingly. This paper documents the works in the Nose project and discusses the feasibility of the marker-based m-learning provided by the Simantics Mobile. At the end of the paper, the pilot study carried out at Stora Enso Kvarnsveden, a paper mill in Sweden, is demonstrated, and the practicality of the first prototypical implementation of Simantics Mobile is also exhibited.

Book Chapter

Srihathai Prammanee, Pekka Siltanen, and Tommi Karhela. *Augmented Reality System for Mobile Maintenance, Field Operation, and Training Tasks in Industrial Environment*. (To be printed in Handbook of Research on Mobile Software Engineering: Design, Implementation and Emergent Applications. Paulo Alencar and Donald Cowan (Eds)).

Abstract
Simantics Mobile is a toolset for nomadic use of industrial facilities' information. It supports the interoperability between mobile services and user interactions to facilitate an augmented reality data access for mobile field service operations taking place throughout a process plant lifecycle. The provision beyond the classic mobility and ubiquity (i.e. anytime and anywhere service) is extended. Realising a relationship matrix of contexts, each of which has a unique perspective on knowledge, Simantics Mobile retrieves the right information at the right time and in the right place. Its underlying technological infrastructure encompasses the collaborative functionalities of augmented reality (AR), semantics plant model, and location-based service (LBS). This chapter documents the works in the Simantics Mobile. It also discusses its strategies beyond the implementations. At the end of the chapter, the use case, carried out at Stora Enso Kvarnsveden – a paper mill in Sweden, is demonstrated.

III -Attended Seminars, Workshops, and Conferences

The IADIS International Conference Mobile Learning 2009 Barcelona, Spain. 26 – 28 February 2009.