ERCIM "Alain Bensoussan" Fellowship Scientific Report

Fellow: Olawande Daramola
Visited Location: Norwegian University of Science and Technology (NTNU), Norway
Duration of Visit: 01/10/2010 – 30/09/2011

I - Scientific activity

My 12 months stay at NTNU was spent on empirical research in requirements engineering for embedded systems development with specific focus on safety analysis under the supervision of Prof. Tor Stålhane. Although safety analysis is considered critical in the development of embedded systems, prominent safety analysis procedures such as HazOp and FMEA are generally regarded as repetitious, time consuming, costly, and require a lot of human involvement. Hence the need to reduce the amount of human effort needed for these safety analyses procedures through automation. Also, the automation needs to be provided at the early stages of development such as requirement engineering for optimum advantage. During my time at NTNU, I investigated the concept of reuse-oriented safety analysis, which seeks to provide automated tool support for hazard identification, and the reuse of experience in the conduct of safety analysis in order to reduce the amount of human effort required.

My research on reuse-oriented safety analysis involves the provision of a semantic framework based on the integration of ontology, natural language processing (NLP) and Case-Based Reasoning (CBR) to facilitate automated support for conducting HazOp and FMEA procedures. A prototype tool called - Knowledge Reuse-Oriented Safety Analysis (KROSA) tool was created and subsequently evaluated in an industrial setting.

I was specifically involved with the CESAR EU Project on cost-efficient methods and processes for safety relevant embedded systems. Within the context of CESAR, I was responsible for leading an investigation into suitability of the semantic framework for reuse-oriented safety analysis for safety analysis within the CESAR domain.

Other core activities I was engaged in include:
(a) Formulation of new boiler plates for semi-formal representation of requirements
(b) Recommendation of potential system hazards through requirements text analysis
(c) Semi-automatic creation of domain ontologies for ontology-based safety analysis
(d) Facilitation of reuse of experience in the documentation of HazOp reports
(e) Investigation on improving the level of trust in travel recommendations using Textual Case-Based Reasoning (TCBR) – An extension of my doctoral work.

II- Publication(s) during your fellowship

Please insert the title(s), author(s) and abstract(s) of the published paper(s). You may also mention the paper(s) which were prepared during your fellowship period and are under reviewing.

(1) Working papers

(a) Olawande Daramola, Tor Stålhane, Inah Omoronyia, Guttorm Sindre: Automated Tool Support for Requirements-based Hazard Identification and Knowledge Reuse-Oriented Safety Analysis. Extended abstract submitted to a scientific book: Managing Requirements Knowledge. Editor: Walid Maalej and Anil Kumar Thurimella, Publisher: Springer, 2012.

(b) Olawande Daramola, Thomas Moser, Guttorm Sindre, Stefan Biffl: A Semantic CBR Approach for Handling Implicit Requirements. Submitted to the 18th International Working Conference on Requirements Engineering: Foundation for Software Quality, 2012.

(c) Tor Stålhane, Stefan Farfeleder, Olawande Daramola: Safety analysis based on requirements, Submitted to, Nordic Nuclear Materials Forum for Generation IV Reactors, 31st October - 1st November 2011, Halden, Norway

(d) Olawande Daramola, Tor Stålhane, Stefan Farfeleder, Towards Semi-automatic Creation of Safety-Relevant Domain Ontologies from Text (In Process)

(2) Refereed conferences and workshops

(a) Olawande Daramola, Tor Stålhane, Thomas Moser, Stefan Biffl : A Conceptual Framework for Semantic Case-based Safety Analysis, Proceedings of the 16th IEEE International Conference on Emerging Technologies and Factory Automation, Toulouse France, September 5th - 9th, 2011.

(b) Olawande Daramola, Tor Stålhane, Inah Omoronyia, Guttom Sindre, Enabling Hazard Identification from Requirements and Reuse-Oriented HAZOP Analysis, Proceedings of the 4th IEEE International Workshop on Managing Requirements Knowledge (MARK), Trento, Italy, August 30th, 2011.

(c) Olawande Daramola, Gleb Sizov, Pinar Ozturk, Improving Trust in Travel Recommendations Using a Conversational Textual CBR Framework, Proceedings of the 1st International India-Norway Workshop on Web Concepts and Technologies, Trondheim, Norway, October, 2011.

III -Attended Seminars, Workshops, and Conferences

Please identify the name(s), date(s) and place(s) of the events in which you participated during your fellowship period.

1. 4th IEEE International Workshop on Managing Requirements Knowledge (MARK), Trento, Italy, August 30th, 2011.
2. 16th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA), Toulouse France, September 5th - 9th 2011.

IV – Research Exchange Programme (12 month scheme)

Please identify the name(s), date(s) and place(s) of your Research Exchanges during your fellowship period and detail them .

(1) **Exchange visit** 14/03/2011 – 18/03/2011
Christian Doppler Laboratory for Software Engineering Integration for
Flexible Automation Systems
Vienna University of Technology, Austria
Core responsibilities:
(a) Understanding semantic integration in hybrid industrial engineering projects.
(b) Transition from Implicit to explicit requirements in industrial automation domain.
Advisor: Prof. Stefan Biffl

(2) **Exchange visit** 27/06/2011 – 01/07/2011
Department of Embedded Systems Development
Fraunhofer Institute for Experimental Software Engineering (IESE)
Fraunhofer Platz 1, Kaiserslautern, Germany
Core responsibilities:
(a) Investigate Safety Analysis for Product lines
(b) Knowledge-based Product line variability modelling
(c) Variant analysis of Product lines using ontologies
Advisor: Dr. Martin Becker