Managing Stakeholder Concerns in Large-Scale Multi-Agent Information Systems

Tagelsir Mohamed Gasmelseid, Department of Information Systems, King Faisal University, Al Ahsaa, Saudi Arabia

ABSTRACT

Software agents’ technology provides a variety of decision support tools for the improvement of emergency response processes. It improves information availability, automates tasks and enhances information accessibility and sharing. However, due to the heterogeneity of emergency response data and the diversity of stakeholders (and accordingly their objectives), the identification and management of cross cutting concerns is looming very big. Over time, some software agent engineering methodologies are being used for the crystallization of cross cutting concerns and information requirements. This paper examines the limitations of such methodologies and proposes the use of system innovation concepts for the management of stakeholder concerns in the emergency response management system in Al Ahsaa area.

Keywords: Cross Cutting Concerns, Emergency Response, Framework, Modularity, Software Agents, Stakeholders, System Innovation

1. INTRODUCTION

The use of software agents for in large scale systems (such as healthcare and emergency response systems) is gaining paramount importance due to the potential of such technologies in improving system performance, user involvement and the optimization of their utility matrix. While such systems are experiencing continuous complexities as a result of internal transformations and external shifts, software agents’ technology is also showing a trend of outstanding developments in terms of hardware capabilities, software functionalities and communication bandwidth and possibilities.

Over years, the development of agent-based continued to be guided by several agent oriented software engineering (AOSE) methodologies that dictate the way such systems are deployed. However, because of the growing focus on the involvement of stakeholders and the enhancement of the applicability of such systems to resolving and representing problem domains in complex systems such as healthcare and emergency response, the question of modularity and the representation of stakeholder concerns is looming very big. The importance of identifying, mainstreaming and representing the concerns of the stakeholders in a multi-agent environment is essential because:

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1. Stakeholders’ concerns constitute the backbone for the identification of the expectations of those stakeholders, their roles, objective functions and preferences. Therefore, in a multi-agent environment, stakeholder concerns significantly affect the articulation of the types of software agents to be incorporated in a particular multi-agent structure together with their individual and shared functionalities.

2. The dynamics of stakeholder concerns are reflected in the behavior of the overall multi-agent organization and the way corporate functionality is being monitored and balanced.

This paper focuses on relaxing the complexities associated with the identification and balancing of stakeholder concerns in multi-agent complex environments. Section two of this paper introduces the materials and methods used for conducting the study. Section three is devoted for introducing the research problem and its consequences in the domain of emergency response management in Al Ahsaa area. Section four addresses the context of emergency response management information and the main limitations associated with conceptualizing it as a base for the articulation of stakeholder (individual and cross cutting) concerns and accordingly, the development and deployment of multi-agent systems for the improvement of information availability and accessibility. In section five, the issues of stakeholder concerns in multi-agent complex systems (such as emergency response management systems) are presented. Section six was devoted for discussing the limitations and challenges associated with the characterization of stakeholder concerns using current and conventional agent oriented software agent engineering methodologies. Section seven and eight of this paper addresses and presents a proposed system innovation framework for the improvement of the representation of cross-cutting concerns in multi-agent systems with emphasis on emergency response management. Section nine provides a discussion for the work done with emphasis on the potential role to be played by the proposed system innovation based framework for the improvement of the processes used for the management of stakeholder concerns in complex systems. The conclusions of this work are provided in section ten.

2. MATERIALS AND METHODS

The paper uses the same methods adopted by Tagelsir (2014) as an extension of his work on the enhancement of emergency response procedures in Al Ahsaa area but by focusing on the identification and management of stakeholder concerns in multi-agent systems. The paper adopted Anthony’s taxonomy of decision-making and decision making problems. According to this taxonomy, decision making problems are categorized as structured, semi-structured or un-structured based on the availability of “decision making information” and “decision making models and procedures”. Bearing on the adoption of organizational structuring approaches for the design of agent organization, this study also adopts the classification of decisions in terms of “strategic”, “managerial” and “operational”. It also made use of the concepts of “information modeling” and “The Healthcare Operational Conditions Readiness Model (HOPCON)”, Hazard Vulnerability Assessment (HVA) and the Operational Risk Paradigm (ORP). Concepts related to intelligent agents and other information engineering frameworks are used to represent “process-centered” and “resource-oriented” dimensions of the emergency response management problem. The use of the organizational structuring approach in this paper is based on functional dimensions where agents are characterized in accordance with their capacity (i.e., superior and subordinate”.

The discussions included in this paper benefited also from the outcomes of previous government funded projects as shown in (Gasmelseid, 2013) in which TROPOS was used as an agent oriented software engineering methodology.
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