A New Behavior Management Architecture for Language Faculty of an Agent for Task Delegation

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ABSTRACT

In this paper, the authors describe a new architecture for the language faculty of an agent that fulfills the interaction requirements of task delegation. The architecture of the language faculty is based on a conceptualization of the language faculty of an agent and a definition of its internal state paradigm. The new architecture is behavior-management based and possesses self-management properties. This architecture is compared with existing abstract self-management architectures, which examines how the new architecture solves unresolved issues of older models. The architecture description is followed by a case study - Multilingual Natural Language Agent Interface for Mail Service, which illustrates its application.

Keywords: Behavior Autonomy, Behavior Management Agent Architecture, Behavior Management Autonomy, Self-Management Agent Architecture, Language Faculty, Language Faculty Architecture

1. INTRODUCTION

Software Agents differ from other software by their ability to work on delegation. The interaction requirements of task delegation necessitate that an agent is able to work on abstract task specifications given by users and ask for and receive advice in human terms during task execution (Bradshaw, 1997). Hence, from an interaction perspective of delegation, an agent is required to support natural language interaction. The natural language interaction should also be collaborative in order that an agent is able to suggest alternatives or ask for advice during task execution.

To cater to the language requirements of global users, the collaborative natural language interaction should be supported in at least a subset of languages available. The agent should be able to dynamically configure its language of interaction according to the user’s choice or preference. Only then, an agent’s service could be made available across language barriers.
Therefore, collaborative natural language interaction (CNLI) with dynamic multilingualism (DM) have been identified as the two functions required to be attributed to an agent for fulfilling the interaction aspects of task delegation. Also, these two functions should be able to exhibit the required agent properties. In the existing agents with natural language capabilities, a comprehensive architecture for the language ability of an agent that accommodates both CNLI and DM along with the required agent properties have not received the required focus.

The objective of this paper is to define the architecture of the language ability of an agent. This language ability component interacts with the functional component of the agent in order to accomplish the goal of the agent. The newly defined architecture derives its base from earlier works (Chithralekha & Kuppuswami, 2008) which are:

- Conceptualization of Language Faculty
- Definition of New Internal State Paradigm for Language Faculty

The need for a new architecture for the language faculty was necessitated because of the paradigm shift brought about in the fundamental conceptualization of an agent described in the above two works. The shift is that the language autonomy of agent is diversified into the management and behavior dimensions, in contrast to the existing agents which possess only a single dimension of autonomy.

The definition of the architecture is described in the abstract, macro and micro levels of abstractions. In the micro level, the architecture for realizing the management dimension of autonomy has been focused in detail. This is performed by considering the properties required for an agent to self-manage it and attributing them in the architecture. For the behavior dimension, the existing behavior-based architectures (Brooks, 1986; Rao & Georgeff, 1991; Muller et al., 1995; Wooldridge, 1999) could be used. Hence, this behavior dimension has not been explored into.

After the architecture has been designed, it is compared with the existing generic self-management architecture (Kramer & Magee, 2007) to explicate how certain unresolved issues in it have been addressed in the newly defined architecture. The added advantage of the architecture is that it is not only suitable for the language ability of an agent but also generic in nature. Hence, it is suitable for realizing a functional ability of an agent also if self-management properties are to be attributed in it.

The case study illustrates the use of this architecture in developing a Multilingual natural language Agent Interface (MULLAI) for mail server.

The remainder of this paper is organized as follows. Section 2 provides an overview of the background of this work and emphasizes the need for the new architecture by explaining how the existing behavior-based architecture falls short in contributing for architecture of the language faculty. Section 3, 4 and 5 describe the architecture of the language faculty at the abstract, macro and micro levels correspondingly. Comparison of the defined architecture with the existing generic self-management architecture is given in Section 6. Section 7 describes the application of the architecture using a case study. The conclusion is given in Section 8.

2. BACKGROUND

This section describes about the two research works which form the basis of the newly defined architecture. In addition, it also proceeds to discuss the need for the new architecture which is triggered because of these two research works.

The definition of architecture is a continuation of our research work which focuses on attributing language ability to an agent for fulfilling the interaction requirements of task delegation. The following are the two signifi-
Using ZigBee in Ambient Intelligence Learning Scenarios
Óscar García, Ricardo S. Alonso, Dante I. Tapia and Juan M. Corchado (2012).
*International Journal of Ambient Computing and Intelligence* (pp. 33-45).
www.igi-global.com/article/using-zigbee-ambient-intelligence-learning/68843?camid=4v1a

Knowledge Representation: A Semantic Network Approach
Atta ur Rahman (2016). *Handbook of Research on Computational Intelligence Applications in Bioinformatics* (pp. 55-74).
www.igi-global.com/chapter/knowledge-representation-a-semantic-network-approach/157481?camid=4v1a