Derivation of Effective Guidance for Specification Constructions from CDFD-based Knowledge Representations

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Abstract—A completeness and accurateness of a specification is depend on how appropriateness and relevancy of the questions during a process of developing the specification. The process of providing an effective question requires several stages and need more discussions between system analyst and knowledge engineer. In this paper, we present on the structure of the questions in which are based on Context Data Flow Diagram (CDFD). In order to describe on how this method can be applied to derive an effective guidance, we use a case study of a brain tumor treatment system to assist and guide system analyst to construct the specification. Our aim is to develop a knowledge-based supporting tool to help system analyst in constructing formal specification.

Keywords-sofl, formal engineering method, cdfd, knowledge representation, brain tumor treatment system

I. INTRODUCTION

In general, system analyst (SA) is facing two main challenging issues when developing a requirements specification; (i) no specific guidance for the SA to write a specification and (ii) the SA must have a skill in certain formal language for representing the specification. To develop a new specification in a new domain, usually SA will produce unsatisfactory result. One possible solution is, he/she will requires more time to learn a new language of presenting a specification which is costly and more time consumption. Alternative solution, which will reduce cost and time, is by guiding him/her on how to constructing a requirement specification. This guidance will lead SA to achieve a complete and accurate specification. This will require on developing an intelligent tool with knowledge support. This knowledge is comprised into domain, dynamic and method knowledge and is organized as a hierarchical structure [1]. This structure is represented in a CDFD-based representation so that an effective guidance can be derived easily. This paper concentrates on this approach.

The Structured Object-Oriented Formal Language (SOFL) for developing specification for software systems has been developed and applied in information systems over the last eighteen years [2] [3] [4]. In particular, to construct a complete specification using SOFL, three steps are required: informal, semi-formal, and formal. While the informal step is to gather all the required functions, data resources, and constraints into one specification in natural language, the semi-formal step is to group and transform the expression into SOFL language except logical expressions (i.e. type invariants, pre- and post-condition). In the formal specification step, all informal expression of type invariants and process specifications in the semi-formal specification are formalized properly.

In this paper, we present a CDFD-based representation for deriving an effective guidance. Aimed at supporting the requirements analysis process and providing guidance, this approach needs two steps: informal and semi-formal. To enable the guidance, we organized and viewed the knowledge in CDFD in which the domain and dynamic knowledge represented as a module/processes in CDFD, while a method knowledge is represented by a directed graph (input and output link). In order to describe this approach, we use a small case study of a brain tumor treatment system.

The remainder of the paper is organized as follows. Section 2 gives a brief introduction to the SOFL approach. Section 3 describes the concept of CDFD as a knowledge representation. Section 4 presents how the CDFD is used to guide the process of developing a specification. Our presentation will be assisted by using a small case study of the brain tumor treatment system. Section 5 describes our experience and lesson learned from this project. A brief overview of related work is given in Section 6. Finally, in Section 7 we conclude the paper and provide several suggestions for future research.

II. OVERVIEW OF SOFL

SOFL is a formal engineering method that offers a systematic way to develop software systems using an intuitive but formal notation. The notation results from an effective integration of VDM-SL [5], Petri nets [6], and Data Flow Diagrams [7]. To facilitate the process of achieving such a formal specification, SOFL offers a three-step specification approach, which consists of informal specification, semi-formal specification, and formal specification. Each stage of the specification has its own goal and task. The goal for informal specification is to enable the developer to fully understand and produce complete requirements of the domain problem through communication with the client. During this