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Research of legacy software systems using ontologies

The brief overview of the ontological approach to the research of legacy systems is given. There were described the benefits of such approach, the kinds of ontologies and techniques and ontological frameworks that can be used for researching legacy systems.

Introduction

Ontologies are a formal representation of a set of concepts within a domain and the relationships between those concepts. They provide a way to model and represent the knowledge about the domain of the legacy system, and can be used to support a variety of tasks such as understanding, analysis, and reengineering of the system.

In the context of legacy systems [1], ontologies can be used to capture the knowledge about the system, including its structure, behavior, and functionality. This can help to improve the understanding of the system and to identify potential areas for improvement or reengineering. For example, an ontology can be used to represent the relationships between the different components of the legacy system, and to identify areas of redundancy or inefficiency.

A brief overview of ontological techniques and tools for researching legacy systems

Ontologies can also be used to support the migration or integration of legacy systems with other systems. By modeling the domain knowledge of both systems using a common ontology, it becomes easier to identify areas of overlap or incompatibility between the systems, and to develop solutions for integrating or migrating the systems.

Overall, the use of ontologies can be a powerful tool for researching and analyzing legacy systems, and can help to support a variety of tasks related to the reengineering or improvement of these systems.

Some potential benefits of using ontologies for researching legacy systems include:

– Improved understanding of the system: By using an ontology to model the structure and behavior of a legacy system, researchers can gain a deeper understanding of how the system works, and how its various components and processes are related to one another;

– Enhanced analysis and diagnosis: With a well-designed ontology, researchers can apply reasoning and inference techniques to identify potential issues or areas for improvement within the system. This can help to guide decisions about how to reengineer or improve the system;

– Increased interoperability: By modeling the domain knowledge of a legacy system using an ontology, it may be possible to more easily integrate the system with other software or systems that use similar ontologies. This can help to reduce the costs and complexities of system integration;

– Improved documentation: An ontology can serve as a formal and structured representation of the knowledge and concepts within a legacy system. This can help to improve documentation and knowledge management practices, making it easier for stakeholders to understand and work with the system.

Some specific techniques and tools that can be used for researching legacy systems using ontologies include:

– Ontology-based reverse engineering: This involves using ontologies to model the structure and behavior of a legacy system, and then using automated tools to extract and analyze the relevant information from the system.

– Ontology-based analysis: This involves using ontologies to model the domain knowledge of the system, and then using reasoning and inference techniques to identify potential areas for improvement or reengineering.

– Ontology-based integration: This involves using ontologies to model the domain knowledge of multiple systems, and then using reasoning and inference techniques to identify areas of overlap or incompatibility between the systems, and to develop solutions for integrating or migrating the systems

– Ontology-based visualization: This involves using ontologies to model the structure and behavior of the system, and then using visualization tools to create graphical representations of the system that can aid in understanding and analysis.

In addition to these techniques, there are also a number of existing ontologies and ontological frameworks that can be used for researching legacy systems. These include:

– Unified Foundational Ontology (UFO): This is a general-purpose ontology that provides a framework for modeling the concepts and relationships within a domain

– Ontology for Software Engineering (OSE): This is an ontology specifically designed for modeling software engineering concepts and relationships.

– Software Ontology (SWO): This is an ontology that provides a framework for modeling the concepts and relationships within the domain of software.

Validation of the ontologies

The study of legacy software using an ontological approach boils down to the fact that the built ontological model needs to be checked for validity. Validation of an ontology built on the basis of problem models consists in the validation of a set of ontological models that are the basis of the ontology. The well-known requirements for a valid ontology are the quality requirements of the ontology, i.e.:

– completeness;
– correctness;
– lack of redundancy [2].

The quality of the ontology has several aspects. In particular, structural, functional and user-oriented aspects of quality are defined in [3]. Structural aspects of quality monitor, for example, the correctness of the construction of the taxonomy of ontology entities. Functional ones reflect the suitability of the ontology for solving a set of problems (functions) of the ontology, and user ones - the convenience of the end user's work. Verification of some aspects of quality, for example, structural, can be carried out by machine. On the other hand, the verification of functional aspects is most often carried out by an expert - the author of the ontology [3]. It is advisable to divide ontology quality assessment into verification (checking the formal, structural integrity of the ontology) and validation (checking the functional aspects of the ontology). In the case of a complex, general ontology with a vaguely defined set of applications, it is difficult to validate the ontology and prove its completeness and correctness, because there are no objective criteria of relevance and correctness. In practice, the created ontology is validated by its author, defining a set of concepts and relations of the subject area relevant in his opinion, which must be included in the ontology.

Definition 1. An ontology is completed if all aspects of the domain relevant to its competence are reflected.

Definition 2. An ontology is correct if the knowledge defined in it is correct for the defined subject area and relevant to the competence of the ontology.

Definition 3. An ontology is not redundant if the elimination of an arbitrary element of it makes it impossible to correctly solve problems in the system.

By analogy with these definitions, we consider an ontological model to be complete if it contains all the entities, relations, restrictions, and operations necessary to solve the given problem.

We consider a model that solves the given task according to the given efficiency criteria to be correct.

The model does not contain redundant elements, if all its elements are used to solve the problem and removing at least one of them will make it impossible to solve the problem correctly.

An ontology is correct if it is built on the basis of correct models.

Conclusions

Overall, the use of ontologies can help to make the process of researching legacy systems more efficient, effective, and structured. However, it is important to note that designing and implementing an ontology for a legacy system can be a complex and challenging task, requiring expertise in both software engineering and ontology modeling. Additionally, the success of an ontology-based approach will depend heavily on the quality and completeness of the data and information available about the legacy system.

References

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