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OOExpert: Distributed Expert System for Automatic Object-Oriented Software Design

OOExpert:

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Abstract: Researchers and software designers come to a conclusion that identifying objects including associations, attributes is an ill-defined task and there is no unified methodology for object-oriented software design. In this research, we suggest an approach to solve the difficulties of object-oriented design by developing a distributed expert system that contains formulated design patterns and rules that aims at automating object-oriented design process in an interactive way. A novel point is using an interactive user interface to enable software designer and the system communicate with each other in order to determine the best design, without disturbing the creativity of the designer. Thus, making it possible for distributed expert system, to overcome the data sharing and the interoperability problems in a groupware. In this paper we present the system architecture and the research outlines.

1 Introduction

The four challenges of object-oriented design are to identify the objects and classes needed to implement the software, describe the relationships between the identified objects and classes, define the behavior of the objects by describing the function implementations of each class, and refine and organize classes by using inheritance to share common structure [Rumbaugh *et al.*, 1991] [Holland *et al.*, 1996]. These are very complicated challenges because of there dependence on heuristic [Kato, 1998].

On the other hand, changes of social and technology's field result in the change of software development framework, from command system into cooperation system in groupware using network technology as media [Drucker, 1988]. This brings an urgent need of a new Computer Aided Software Engineering (CASE) tool, which can handle data sharing, interoperability, compatibility and portability problems.

Researchers and software designers come to a conclusion that identifying objects including associations, attributes is an ill-defined task, regarding of the difficulties of heuristic [Kato, 1998] [Holland *et al.*, 1996] and there is no unified methodology for object-oriented software design. This is mainly due to lack of formalism for object-oriented software design.

In this research, we formulate design patterns and rules, and store them in the distributed knowledge

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bases of the OOExpert system. The system can overcome certain difficulties in the object-oriented design, difficulties in the very large knowledge base system, and it can fulfill the need of a new CASE tool for groupware.

2 System Architecture

Figure 1 shows an overview of the OOExpert's architecture. This system is composed of User Interface, Communication Engine, Reasoning Engine, Distributed Knowledge Base, and Documentation Engine. Each engine with a running autonomous task is called an *expert unit*.

2.1 User Interface

There are four functions that are managed by the user interface unit, they are object-oriented design editor, reasoning engine process (result) viewer, Java source code viewer and documentation function. Using this user interface unit, software designer and expert system can communicate with each other in order to determine the best design.

2.2 Communication Engine

The communication engine is mainly responsible for maintaining connection between user interface unit and another expert units besides of message management. We are implementing the communication engine by using CORBA (Common Object Request Broker
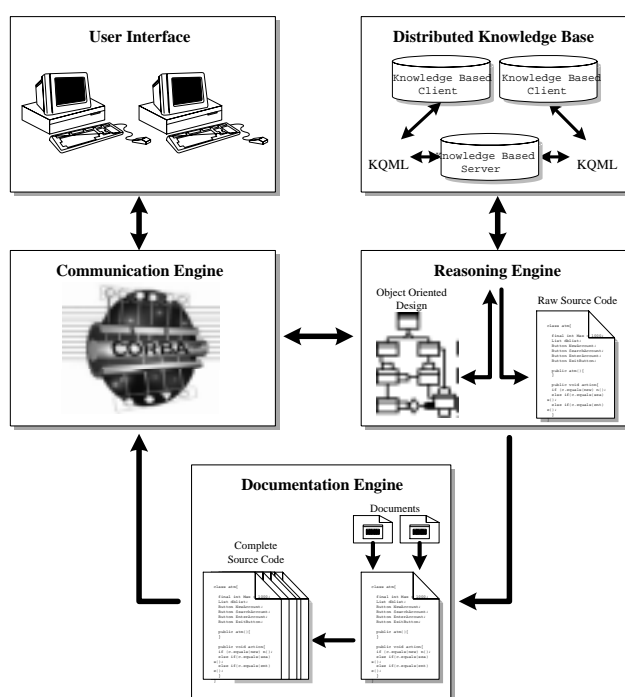
Figure 1: System Architecture of the OOExpert

Architecture) distributed object, because it can handle data sharing, interoperability, compatibility and portability problems on complex application.

2.3 Reasoning Engine

The reasoning engine plays an important role in reasoning about the design requests coming from the user and the design rules or patterns that are stored in the knowledge base. Actually, reasoning engine is composed of the object-oriented reasoning module and the source code reasoning (generation) module. These two, address two kinds of design rules in distributed knowledge base.

2.4 Distributed Knowledge Base

Distributed knowledge base is composed of some knowledge bases, using KQML (Knowledge Query and Manipulation Language) as communication language. In this research we intend to capture and reason with the sort of knowledge that software design experts use in design. Software design knowledge includes design product knowledge and design process knowledge.

The design product knowledge relies on the perspective that the design system is viewed. It includes domain-specific concepts, constraints and qualitative or quantitative models of the system. And the design process knowledge is viewed as a progression toward a goal by applying detailing patterns. The design process knowledge involves design rules acquired from human design, and tacit knowledge to make such pattern operational. Actually, design rules have two kinds of rules, the rules for object-oriented design and the rules for source code generation.

2.5 Documentation Engine

Documentation engine plays the role of reasoning engine's assistant. The documentation engine performs three main tasks : documenting all tasks that are produced by reasoning engine, preparing and reformatting the above mentioned data for to be transferred to the user interface units, and assisting user or software designer to create good software documents.

3 Conclusion

In this paper, we presented the outlines of an ongoing research project to build a distributed expert system for supporting object-oriented software design (OOExpert). The interactive user interface, reasoning engine, documentation and communication engines are already developed. The knowledge base which contains rules for automating design process is under development.

Using this system, software designers and expert system can communicate with each other in order to determine the best design, without disturbing the creativity of the designer.

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