

QUALTES: A Domain Specific Tool for Electric Power Stations

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Abstract

QUALTES is a domain specific tool for developing knowledge-based systems (KBSs) for electric power substations. The task of the KBSs is to support human operators to make and verify *Command Table Sheets* (CTSs). CTSs define operation procedures for stoppage sequences at a specific substation. This paper describes the principles of QUALTES behind the functions shown in the videotape demonstration.

Background of QUALTES

While executing maintenance tasks at an electric power substation, complex operations on the facilities or equipments are required. To prevent mistakes from occurring, prior to beginning the tasks, *Command Table Sheets* (CTSs) are reviewed. The CTSs have been first described by human operators and then verified by human experts, so far. There are about 70 substations in Chubu Electric Power Company to maintain through the use of the CTS method. The objective of the QUALTES project is to provide the utility personnel with a cost-effective way to develop specific knowledge-based systems (KBSs) to support the CTS method at each substation with different facilities and operational heuristic rules [Suzuki *et al.*, 1993].

Principle 1: Domain Specific Approach

There are two approaches to develop special purpose AI tools: the task specific one and the domain specific one [Terano, 1991]. The former is useful when the task level knowledge to solve a given problem requires complex inference mechanisms [Chandrasekaran *et al.*, 1992]. The latter is effective when the characteristics of target domain tasks are well specified and when there are needs to develop similar applications. The requirements on the QUALTES project meet the domain specific one.

Principle 2: Model-Based Approach

Similar to PLEXSYS [EPRI, 1989], QUALTES has plant component models, model building functions, model-based reasoning capability, and simulation functions. Generic Knowledge Base (GKB) of QUALTES contains class libraries on general substation facilities, declarative descriptions on power systems, and generic simulators.

In this sense, we adopt the model-based approach to develop QUALTES. However, unlike PLEXSYS, the task also requires empirical knowledge hardly represented only by the plant models. The simulator solves physical constraints problems with the empirical knowledge on operational regulations.

Principle 3: Graphic Oriented Interfaces

Sophisticated graphic interfaces are critical for KBS development by end users. QUALTES has (1) an intelligent graphical editor with functions for verifying the correctness of generated CTSs, (2) a mimic diagram board subsystem to represent the substation facilities on a display, and (3) integrated simulators and consultation functions to verify the CTSs.

Concluding Remarks

Using QUALTES, the complex task of implementing a specific knowledge-based system can become accomplished by the end users themselves at the substations. QUALTES has been highly accepted in field tests and in demonstration to human experts. Specific KBSs developed by QUALTES are now on field testing at two of the substations. After completing the evaluation phase, we have a plan to use QUALTES in company-wide scale.

References

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