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Data Management System and Knowledge Analyzing via KADS Approach

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Abstract: With a greater complexity of the distribution of energy, making it more difficult for system operators to manage their network. Distribution Management System (DMS) system helps operators to operate efficiently and control the distribution system through better decisions in near real time. Generally, many functions can be included in DMS as required by public service. This paper presents an alternative approach to overcome these design problems. This approach uses expert knowledge regarding the requirement of DMS such as functionality, architecture and customization. Using Common KADS part, this expertise can be captured on a systemic and system-based knowledge can then be developed this paper, the knowledge of members of the electricity the panel Metropolitan Authority (MEA) will be captured and presented as a case study. The results of this Research will show that the knowledge exists to design DMS. In addition, by developing the knowledge system based approach can help engineers to design another DMS effective.

Key words: System Distribution Management (DMS) · Expert knowledge · Knowledge analysis and structuring of data (KADS) system based on knowledge

INTRODUCTION

Today, many utilities market liberalization increase their performance by applying digital control to reduce the overall cost [1].

Supervisory Control and Data Acquisition system for distribution management (SCADA / DMS) or DMS with many functional tools, as shown in Figure 1, will help their system operators control the efficient distribution system. The features allow simplified management for large distribution systems with frequent changes and operations update. Utility will focus on system reliability, power quality, system losses, client communications and customer billing. The functions of DMS [2] can be grouped into:

SCADA: Data acquisition, data processing and control monitoring

Substation Automation: Control device in the substation, such as food service, control of the bus voltage, in parallel with the control transformer, automatic reset etc.

Feeder Automation: Control device on the charger, such as fault location, fault isolation, service restoration, reconfiguration of power etc.

Analysis of the Distribution System: Base flow and distribution of electricity to advance features such as emergency load transfer, load and voltage profile, and distribution losses, etc.

Interface with Other Computer System: As customer information system (CIS), Geographic Information System (GIS), Energy Management System (EMS) through, *Middleware,* a software layer that provides a level interconnection.

Standard hardware architecture can be centralized or distributed (multi-center), redundancy workstation (UNIX or Linux vendor) or personal computer (window or Linux). The software can be proprietary or open. Communication in the metropolitan area is mostly fiber. Specific protocols or open and error detection philosophies are used to transfer data efficiently and optimally [3].

This paper proposes an approach to knowledge engineering to develop the knowledge based system for the design of DMS is organized into six sections that make up the introduction in section I, the problems in the design of DMS in Section II, systems thinking for the design of DMS in Section III, engineering knowledge for the design of DMS in Section IV, a case study in Section V and conclusion in Section VI.

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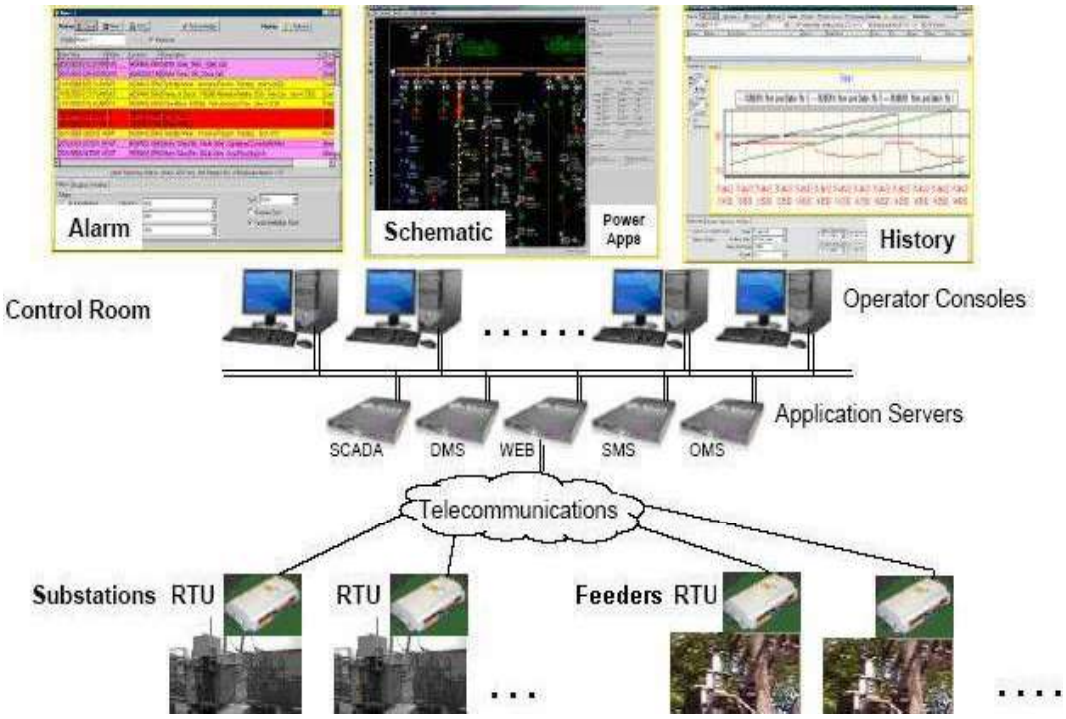

Fig. 1: Typical SCADA / DMS [4]

II. Design Problems DMS: According to a distribution system of individual utility, DMS design can vary from system to system. The design process that interacts between the designer and the user is generalized as follows:

- Acquire knowledge DMS
- Capture requirement DMS
- Needs Analysis
- DMS offer design
- The proposed design to verify the prescription
- Revise design

In fact, the requirement of users is always dynamic and there is a knowledge gap between the user and the designer can cause the problem in the design of DMS. Therefore, three types of problems in the design of DMS are discussed in this document.

One problem is that key knowledge is not transmitted from generation to generation. New engineer have no idea about the old primary distribution equipment as a key expert knowledge is not transferred from time to time. Utility of an expert individual knowledge, skills and experience related to the action, solve problems and opportunities for decision making. This knowledge is called *tacit knowledge,* which is a dynamic process of justifying personal belief with regard to their truth and specialization. Tacit knowledge is valuable, but difficult to express in a formal language. It is impossible to get all the experts 'tacit knowledge, which is massive, but it is necessary to transfer the key experts' tacit knowledge to know what is done or changed, how do or change, why the system is made ??or modified, and especially who is or has changed.

Another problem is the diversification of knowledge throughout the organization. This is illustrated in Figure 2. Individual tacit knowledge between primary equipment, protection, information technology and communications people in the department such as functional planning, design, construction, operation and maintenance make this diversification knowledge within the organization for their internal use of language is full of jargon. Moreover, their demand heuristic individual is different and dynamic. This will allow them not of their unit. He will place difficulties in the acquisition and designer DMS knowledge map and actual requirement.

The last problem is a little knowledge of DMS within the organization. Moreover, the capacity varies from one system to DMS DMS in particular developing countries. Before obtaining the system, technical problems may arise when buying DMS systems to the study of price alone. Many suppliers and different techniques with many different parts make a difficult situation when big small suppliers no longer exist.

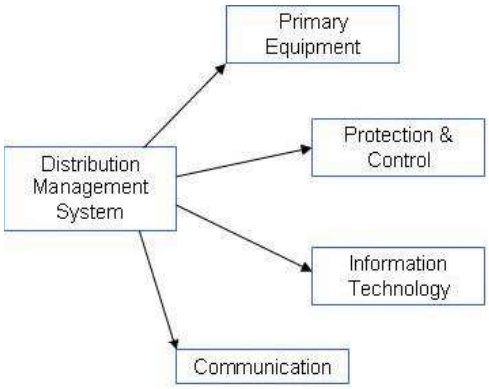

Fig. 2: Diversification Knowledge

In the DMS product life cycle, utilities must learn to maximize the system than enough for their distribution and organization. They use the DMS as a tool to control and monitor their distribution network to increase their effective performance and reduce operating costs and maintenance. However, utility personnel still need to acquire some knowledge of the new system and to develop skills in action. DMS organizational learning process is extensively developed for system planning, design, installation, commissioning, operation and maintenance period [5].

To overcome this problem, this paper introduces systems thinking and methodology of knowledge engineering for the design of DMS in the next section.

Think Design System Dms: This section presents a learning organization and to introduce a technical system of thought to help in the design of DMS.

Purpose of organizational learning is to convert individual knowledge into organizational knowledge, collaborate to share intellectual materials, and to collect material intellectual as a person, documents, information, etc. There are five basic ingredients for a learning organization [6]:

Team Learning: Working together to achieve the vision

Vision Share: Form a plan everyone can agree on

Mental model: Put aside their old ways of thinking

Personal Control: Learning to be open with other

System Thinking: To understand how the business really works

Systems thinking is in search of cause and effect in a systematic way. Unlike reductionist, a good system thinker is someone who sees the events, system, modes of behavior and mental model of operation simultaneously. For example, we can try to improve the protection of primary power, not only by looking in detail at individual relay setting for primary power but also the components of the diet, the type of feeder, the location of the shipper, customer type, the lateral position on the charger, fuse and disconnect feature, the fault indicator, the position of the arrester, the minimum requirement of fault, the charge state of overload, operation and procedure given the interactions between them.

Technical system of thought as *"Storytelling"* is used for the elicitation of knowledge in this paper. It can help the organization to collaborate with individual knowledge by watching the story rather the image of the entire system. This method can generate useful solution aligning main objective organization, reducing conflict and maintaining its individual idea. When using *"storytelling"* technique to determine the causes and effects of the life cycle for DMS, distribution planning for decommissioning, the entire image management system of distribution can be captured.

In the next section, knowledge engineering technique provide a useful model to capture and analyze requirements.

Knowledge Engineering for the Design DMS: This section, method, knowledge engineering-logy is applied to capture, analyze and model the knowledge of the design process of DMS. Because the key success factor for integration DMS software features and implementation is an enterprise level architecture describing how information is shared, the technology should not only consider the information and communication but *also knowledge.* [7.8] Knowledge engineering can help to maintain and systematic use of knowledge that would otherwise be lost. In other words, it provides heuristic approach to capture, analyze, model and use the knowledge of key experts in the organization.

Moreover, technology-oriented knowledge is concerned in which people acquire, create, store and use knowledge within the organization. Knowledge engineering provide tools and techniques to manage knowledge of the design organization DMS.

Knowledge engineering approach such as analysis of knowledge and data structure (KADS) and knowledge-based system (KBS) can be shown in more detail in the next paragraph.

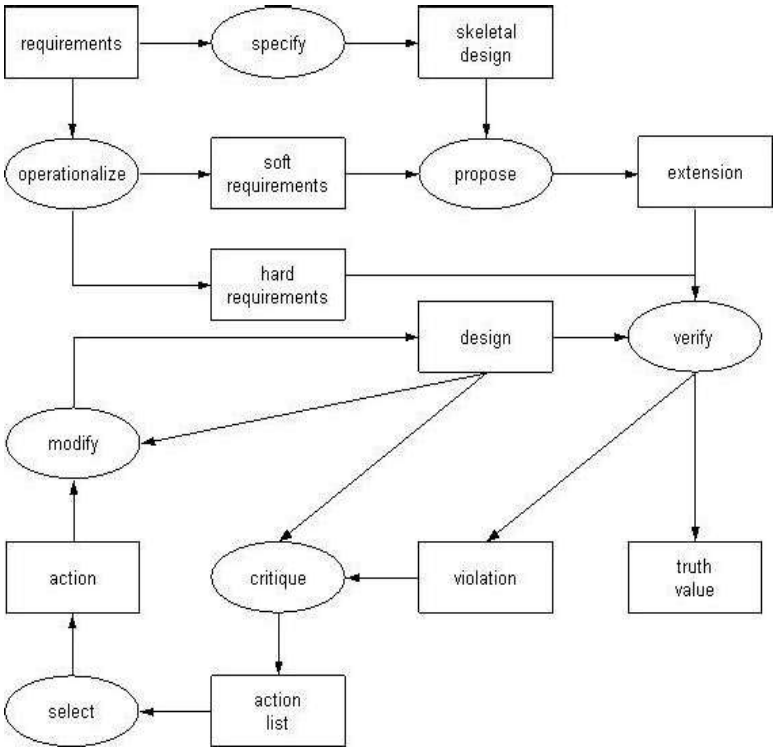

Fig. 3: *'Submit and Review'* Inference Model [7]

Knowledge Analysis and Data Structure (KADS)

KADS: knowledge analysis and structuring of data is a knowledge engineering methodology supporting the development of knowledge systems. In principle, a knowledge model KADS has three types of knowledge [6]:

Working Knowledge: "Book" contains knowledge of how basic inference can be combined to achieve a certain goal. It can commit to a particular purpose. Tasks are strategies for achieving the fixed objectives of solving problems.

Knowledge Inference: "chapter" Knowledge controls we abstract from the field theory and describe the conclusion that we want to make the reason for this theory.

Domain knowledge "theory" represents the conceptualization of a domain for a particular application in the form of a theory of the field. It can be seen as a declarative theory of the field. In fact, the addition of a simple deductive ability in theory allow a system to solve all problems solvable by the theory.

Common KADS methodology, the EU de facto standard to support the design and implementation of knowledge systems. KADS and Common KADS (previous version of Common KADS) has been widely applied in food companies, for instances, knowledge management for the planning, operation, maintenance, price negotiation, asset management and regulatory issues.

It provides a standard model for inference of knowledge to the design configuration to support the process model of knowledge which can often be reused for the construction of the system feasible. It assumes that all components of the artifact are predefined as the construction of a boat from a set of Lego blocks.

This document uses this type of task of synthesis for the design of DMS is called *"propose and revise"* as a standard for collecting knowledge of design and the requirements of DMS. This is illustrated in Figure 3, so that the knowledge heuristics MEA distribution equipment, operation, control and protection, and demands on the DMS can be transcribed, analyzed and used systematically.

Knowledge-Based System (KBS): Knowledge based system has four major components which are [9]:

Dialog: UI

Engine Inference: Structure system control.

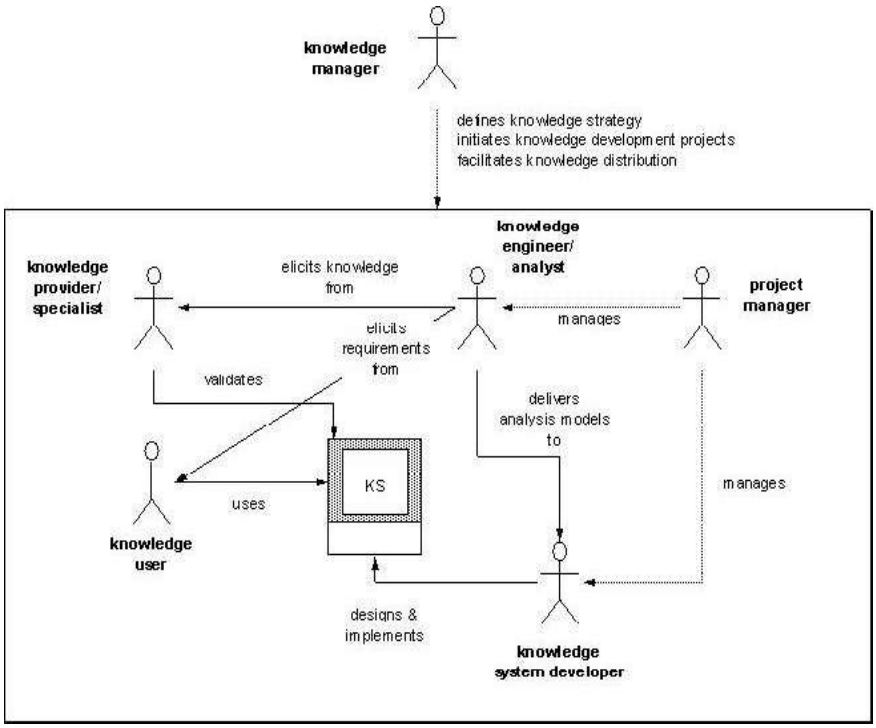

Fig. 4: System Knowledge Base [7].

Knowledge Base: contains facts and basic rules in a given field.

Facilities Explanation: Allow the user to ask how and why.

Even though tacit knowledge of experts does not exist in explicit form, the most common way to deal with tacit knowledge is yellow pages that refer to the owner of the tacit knowledge. There are six roles in the process of knowledge engineering and management that relate to [7]:

Provider of Knowledge: an "expert" in the field of application.

- *Knowledge users* can use direct or indirect system of knowledge based
- *Knowledge engineer "analyst"* creates expert knowledge and demands of users
- *Developer knowledge system:* is responsible for system design based on knowledge and the implementation
- *Project Manager:* is responsible for knowledge of the system development project based
- *Knowledge Manager:* determines the strategy of knowledge

This is illustrated in Figure 4. *And* to *propose* a model based *Revise* paragraph prior knowledge, which contains the facts and the basic rules in the design of DMS can be developed and modified the amount of specific problems DMS existing knowledge within the organization. [10]

In summary, the organization and learning methodology of knowledge engineering is used to help design the configuration of the DMS hardware and software in the following processes:

Elicitation of Knowledge: Knowledge capture and the requirement is both this heuristic and tacit

Analysis of Knowledge and the Creation Of: Determining the function of the DMS architecture and requirement

The Use of Knowledge: Using Common KADS *"Propose and Revise"* standard and guidelines to customize and get an appropriate design for the design of the skeleton.

Validation of the Design: To approve and evaluate the design

The next section will present case studies MEA.

V. Case Study: Metropolitan Electricity Authority (MEA) of the DMS design is used as a case study to demonstrate the applicability and advantage of using systems thinking and Common KADS to capture the knowledge and requirements in a systematic way. The methodology and technique as described in previous sections are used to capture the knowledge and the requirement for Metropolitan Electricity Authority (MEA)

General Description of the MEA DMS: MEA is responsible for distributing energy to customers in Bangkok metropolitan area, Nontaburi, and Samutprakan provinces, has 18 service centers in the district with an area of 3192 km^2 of distribution feeders and the CCT-13471 km. Primary feeders are turned to 12 or 24 kV. For overhead primary power configuration is radial or loop. For groundwater, the primary power configuration is radial, loop, selective primary, or special line replacement. MEA plans to get DMS to improve their quality of service in the near future. For this reason, the MEA team of experts is set to work with the consulting firm specialized in implementing an effective DMS.

Research Methodology: An exercise in knowledge engineering methodology and that used the above technique was carried out on the expert team of MEAs. The elicitation of knowledge was made from the MEA expert in Engineering, Design and commissioning, and operation control department and district service department using both unstructured interviews with *"Storytelling"* and the structured interview Common KADS on *"Propose and Revise"* model.

Knowledge elicitation, analysis and creation for the design of DMS is shown in this paper prove useful knowledge in the organization for the design of DMS. In addition, the use of knowledge and validation will be in the future.

Results and Future Work: This document uses the system's technical standards and thought Common KADS template heuristics to capture the MEA and the demands of their distribution system such as distribution equipment, operation, control and protection.

First, the technique of *"Storytelling"* is used to identify heuristics AME in their distribution system.

Although this knowledge is tacit and circulates it within the organization, the concept of thinking of the system can be used to collaborate and collect reasonable knowledge organization. However, information technology and communication knowledge and requirements will be captured in future work.

Second, Common KADS *"Propose and Revise"* model can help knowledge engineer to capture their cliché reasonable knowledge domain organization and the requirement to build and field diagrams for the system of knowledge for the basic design of DMS.

Nevertheless, it is shown that the MEA has enough useful knowledge and requirements in the organization and is ready for the design of DMS.

Finally, this initial knowledge-based system can help knowledge transfer MEA, integrate knowledge organization, a compromise to the conflict and to bridge the gap for the design and implementation of DMS. Moreover, this specific knowledge can be reused for modification, future expansion and migration.

CONCLUSION

Knowledge engineering is another effective approach to capture specific knowledge of cost-efficient distribution system, building the community of practice and motivate the organization to achieve their learning performance with effective cost reduction. Knowledge based system can be used as collaborative tools for organizing DMS design of learning to know, do and review process. It will benefit to all public services, consultancy and manufacturer of storing, transfer, update, and reuse knowledge and needs so they can all DMS design effectively.

With staff knowledge organization, DMS will be smart tools to manage their distribution system and obtain customer satisfaction in the market liberalization.

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