Knowledge Based Database Systems

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Knowledge based database (KBDB) systems are a class of database systems that use database concepts and models to store and retrieve knowledge. Knowledge based database systems help in what is called Knowledge Management (KM). Most often, the knowledge refers to a particular domain. Different teams of designers of knowledge based database systems use particular terms and concepts in order to build the frameworks for the information representation. Different databases can use the same terms but with different meanings. Alternatively, the same meaning can be expressed via different terms.

Knowledge based database systems typically can help link and integrate all available knowledge sources, including explicit knowledge (various kinds of databases stored in existing information systems) and inexplicit knowledge (practical experience, skills, thought and thinking method in the brain of the experts / people) to form knowledge databases of various kinds. Through further refining, the systems provide a platform to let people to find out the knowledge they need from disordered information. In other words, the objective of a knowledge based database system is to make available the most optimal knowledge to the most optimal people in the most optimal time to enable them to make the most appropriate decision-making. This can lead to effective improvement of innovative capacity, response capacity, production efficiency and technical skills of people. In many situations, these databases can help solve complicated problems with relative ease. On the flip side, a knowledge based database should not be expected to be an exhaustive source of knowledge capable of offering help in solving any problem.

Knowledge based database systems are centred on the notion of rules. Broadly speaking, two types of rules can be distinguished: production or forward-chaining rules (also known as IF-THEN or condition-action rules), and deductive or backward-chaining rules. KBDB systems utilizing the former are typically referred as expert database systems (indicating the relationship to AI expert systems), and those based on the latter are often known as deductive database systems. However, these are by no means exclusive.

Knowledge based database systems are used in many areas. Examples are medical diagnosis systems, engineering systems, quality management systems, Geographical Information Systems (GIS), expert systems in various domain areas, Client Service Software (also called Incident Management System) and even artwork documentation. An example of a system which uses a knowledge based database system is SoilVision. It has been developed by Air Dispersion Modeling Inc., which is a Division of Scientific Software Group located at Utah, USA. It is a knowledge-based database software system for the estimation and management of soil properties. Popular solutions range from a single-user soil database system to a multi-user corporate database solution capable of managing borehole, and geo-environmental information. The database is designed to provide a central data warehouse for soils data and allow data to be presented in multiple formats including borehole logs, GIS, finite element models, and laboratory test reports. SoilVision automates the entire process from the laboratory to the final reports. The knowledge-based component can provide input for analysis of unsaturated soils. SoilVision provides over 20 journal published algorithms for the estimation of soil properties required for unsaturated seepage modeling. A soils

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database including laboratory data on over 6000 soils is also included. SoilVision can assist the modeler in estimating suitable input for the modeling of unsaturated soil processes independent of extensive laboratory testing programs.

Today, knowledge based database systems are being increasingly made available over the web through what are termed as knowledge portals. This is because they provide a flexible knowledge environment to a potentially large number of users in a very cost effective manner. Wikipedia which is now the largest storehouse of knowledge (it is another matter that a significant proportion of this knowledge is not verified) is a knowledge portal.

Systems which use knowledge-based databases are designed using the following steps:

- The first step involves creating an initial representation of the application domain (known as the problem domain model) and subsequent refinement of this model.
- The second step involves the creation of an analysis model, and subjecting this model with analysis and refinement rules to generate a conceptual schema for the database in question.

In general, there are four types of design inconsistencies (errors) that should be detected and resolved in designing the knowledge based database of such systems. The errors are as follows:

- Semantic inconsistencies.
- Inconsistent concepts.
- Redundant properties and relationships.
- Redundant elements.

A knowledge based database system should be simple to maintain. Maintenance costs money and time, and high maintenance systems are typically poorly designed systems. For knowledge based database systems in particular, however, a second thought should come to mind: those systems must be simple to use. The typical user of such a system is confused, possibly inexperienced, frustrated, or both, as this person suffers from a problem (the one that he or she hopes the knowledge database can solve). In order to assist this user, rather than add to confusion and frustration, ease-of-use should be a primary design goal in developing knowledge based database systems.

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