

# Expert System

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# Expert System

An expert System is a software that manipulates encoded knowledge to solve problems in a specialized domain that usually require human expertise. An expert system's knowledge is obtained from expert sources and is coded in a form suitable for the system to use in its interference or reasoning processes.

# Expert System...

Experts systems usually share certain characteristics. These are listed below.

- The solution process of an expert system exploits knowledge, rather than data.
- The knowledge is encoded and maintained as an entity which is separate from the control program.
- They are capable of explaining how a particular conclusion was reached, why the requested information is needed during a conclusion process.
- Expert systems use symbolic representation for knowledge(rules, networks, or frames) and obtain their inference through symbolic manipulation that closely resemble manipulations of natural languages.
- Expert systems often reason with meta knowledge, i.e., they reason with knowledge about themselves, their own knowledge limits, and capacities.

# Expert System...

Some of the well known expert systems are

- DENDRAL (1960, Stanford University)- Used to analyze and explore chemical compounds from mass spectrographic data.
- MYCIN(1980's, MIT)- Used for the diagnosis of infectious blood diseases.
- PROSPECTOR- Used to assist geologists in the discovery of mineral deposits.
- Many others.....

Most expert systems follow a general structure that consists of modules.

# Expert System...

## **Explanation module**

This module keeps track of the reasoning process during a consultation process. As and when required, this module provides explanation regarding how a particular conclusion was reached, or, why the requested information is needed during a consultation process.

## **I/O Interface**

Provides interface to the user for interaction with the system.

# Expert System...

## Editor

Local editor for the system provides an environment to create and modify documents specially required by the system.

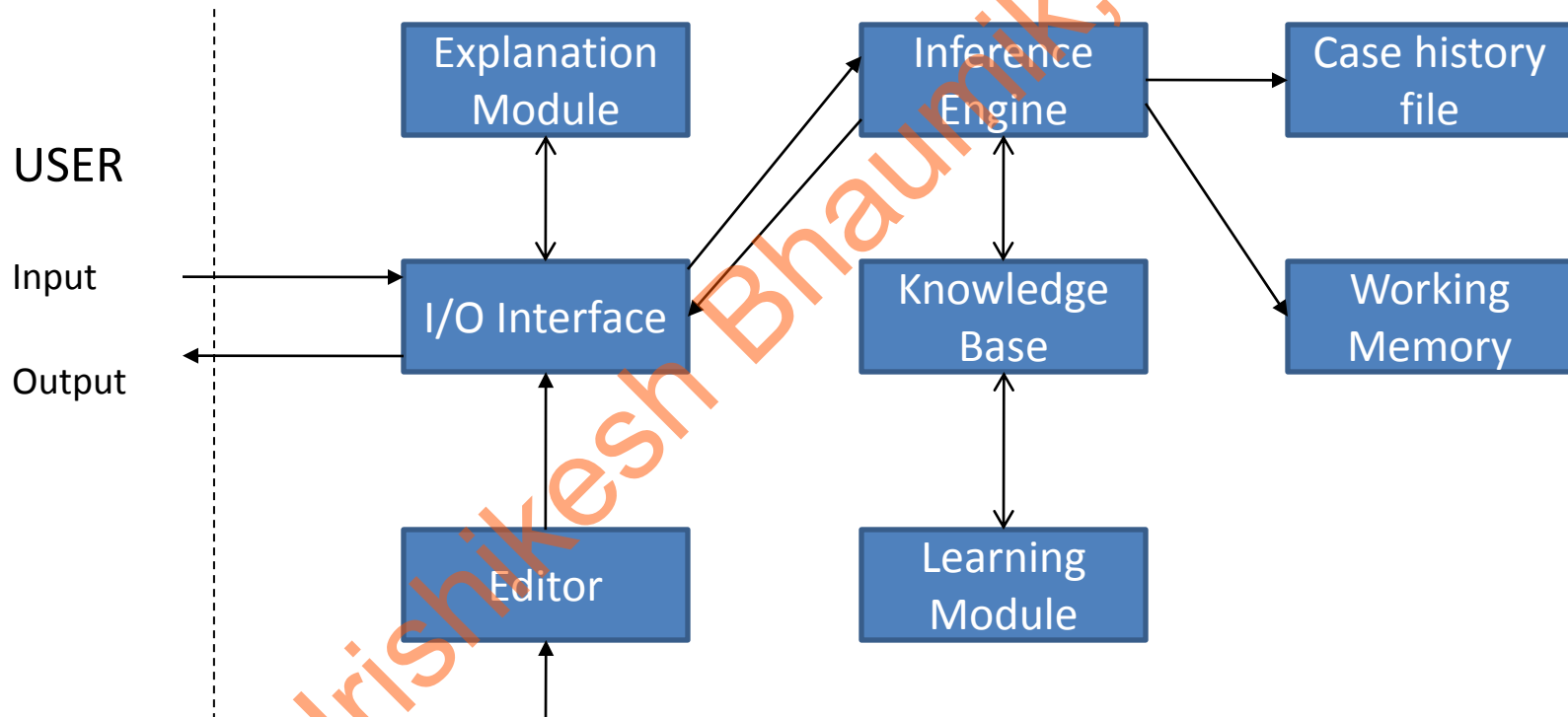


Fig : Structure of a typical Expert System

# Expert System...

## **Inference Engine**

Inference engine contains the inference procedures and control structures for the consultation process. It utilizes the knowledge base to analyze the current problem and directs the inferential process in the proper direction.

## **Knowledge Base**

The knowledge base stores the system's total, permanent knowledge relating to its application domain. Creation of the knowledge base is a major concern of the knowledge engineer. The main issues are, deciding the knowledge representation technique which is most appropriate for this application, consultation with the domain experts, provisions for discarding obsolete knowledge and inclusion of new knowledge, etc.

# Expert System...

## **Learning Module**

This module provides facility to learn new facts either directly from the user, or through experience.

## **Case History File**

This is a database of important cases dealt with.

## **Working Memory**

Working memory contains all information regarding the current session. The inference engine consults the knowledge base as well as the working memory during a session.

(For related topics, see **Knowledge Engineering, Knowledge Acquisition, Facts, Expert System Shells, Goal Oriented Reasoning, Forward Chaining , Backward Chaining**)



# Expert System Shell

Most expert systems have certain common features, e.g.,

- Knowledge representation technique (irrespective of the domain specific knowledge)
- Rule interpreter that works on the knowledge base to arrive at conclusions/advice.

An expert system shell is a system that could be used to construct new expert systems by adding new knowledge corresponding to the new problem domain. Example of an expert system shell is EMYCIN (i.e., Empty MYCIN, 1984). There are several commercially available shells now a days. They typically support rules, frames, and a variety of other reasoning mechanisms.

# Expert System Shell...

Capabilities of expert system shells are

- Mechanism for knowledge representation
- Mechanism for reasoning
- Mechanism for explanation
- Mechanism for knowledge acquisition
- Mechanism for providing the easy-to-use interface between the expert system and a larger, conventional, programming environment. This is required because expert systems are often embedded within a larger application program.