Expert System (ES)

An Expert System (ES) is a knowledge based information system that uses its knowledge about a specific, complex application area to act as an expert consultant to end users.

Expert system provides answers to questions in a very specific problem area by making humanlike interfaces about knowledge contained in a specialized knowledge base. They must also be able to explain their reasoning process and conclusions to a user. So expert system can provide decision support to end users in the form of advice from an expert consultant in a specific problem area.

A related term is wizard. A wizard is an interactive computer program that helps a user solves a problem. Originally the term wizard was used for programs that construct a database search query based on criteria supplied by the user. However some rule-based expert systems are also called wizards. Other "Wizards" are a sequence of online forms that guide users through a series of choices, such as the ones which manage the installation of new software on computers, and these are not Expert Systems.

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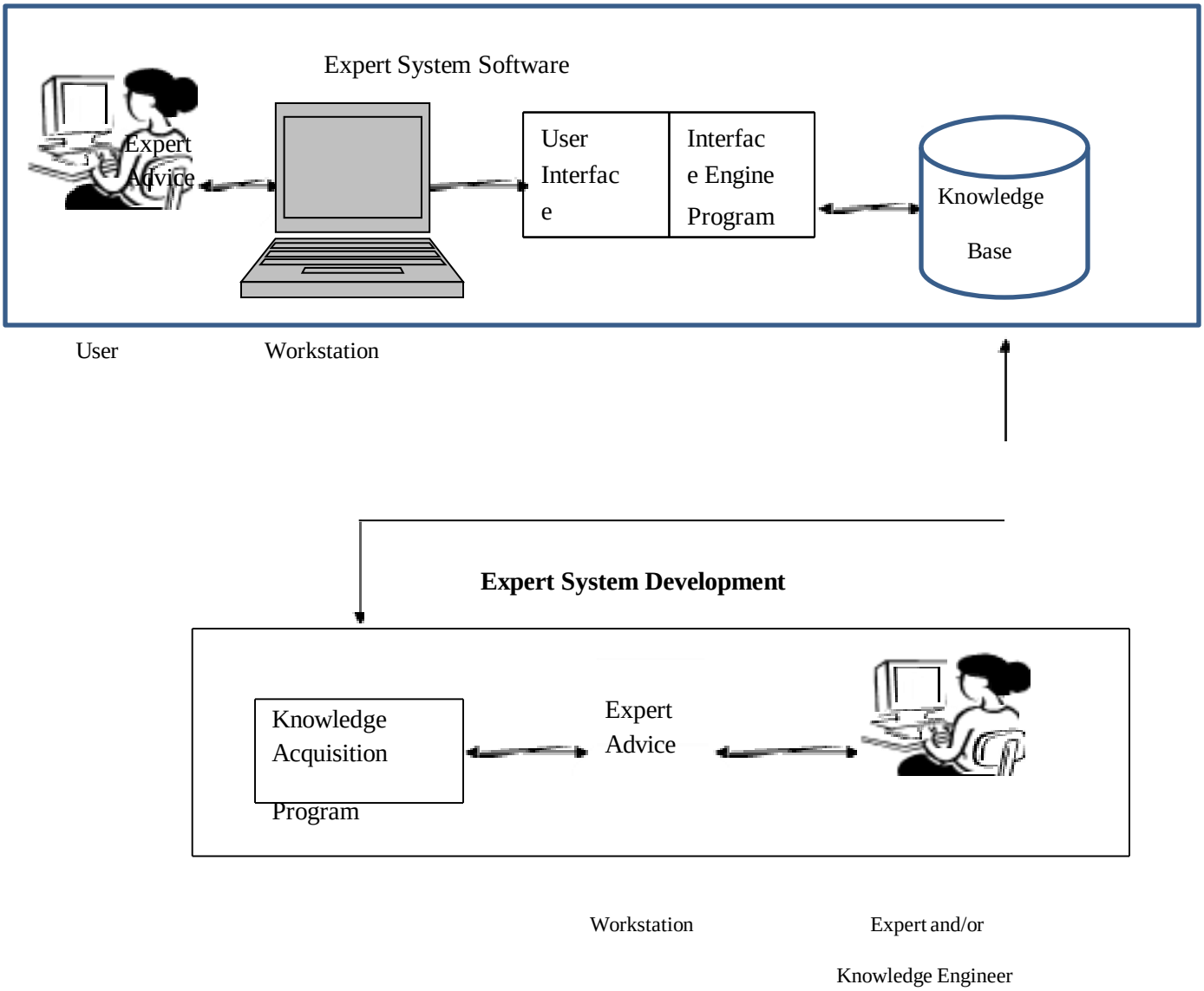
The Expert System



Components of an Expert System:-

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The components of an expert system include a knowledge base and software modules that perform inferences on the knowledge in the knowledge base and communicate answers to a user's questions.

Below are the following components:

1. **Knowledge Base:**

The knowledge base of an expert system contains (1) facts about a specific subject area (for example, Ramesh is an analyst) and (2) heuristics (rules of thumb) *that express the reasoning procedures of an expert on the subject (for example, IF* Ramesh is an analyst THEN he needs a workstation) . There are many ways that such *knowledge is represented in expert systems. Examples are rule-based, frame-based,* object-based and case-based methods of knowledge representation.

Rule-Based Knowledge:

Representing knowledge in an expert system's knowledge base in the form cases, that is example of past performances, occurrences, and experiences.

Frame-Based Knowledge:

Knowledge represented in the form of a hierarchy or network of frames. A frame is a collection of knowledge about an entity consisting of a complex package of data values describing its attributes.

Object-Based Knowledge:

Knowledge represented as a network of objects. An object is a data element that includes both data and the methods or processes that act on those data.

Rule-Based Knowledge:

Knowledge represented in the form of rules and statements of fact. Rules are statements that typically take the form of a premise and conclusion such as: If (condition), Then (conclusion).

2. Software Resources:

An expert system software package contains an inference engine and others programs for refining knowledge (such as rules and facts) related to a specific problem. It then makes associations and inferences resulting in recommended courses of action for a user. User interface programs for communicating with end users are also needed, including an explanation program to explain the reasoning process to a user if requested. Knowledge acquisition program are not part of an expert system but are software tools for knowledge base development, as are expert system shells, which are used for developing expert systems.

Applications:

Using an expert system involves an interactive computer based session in which the solution to a problem is explored, with the expert system acting as a consultant to an end user. The expert system asks questions of the user, searches its knowledge base for facts and rules or other knowledge, explains its reasoning process when asked, and gives expert advice to the user in the user in the subject area being explored.

Expert systems are being used for many different types of applications, and the variety of applications is expected to continue to increase. However, you should realize that expert system typically accomplish one or more generic uses. Expert systems are being used in many different fields, including medicine, engineering, the physical sciences, and business. Expert system now help diagnose illnesses, search for minerals, analyze compounds, recommend repairs, and do financial planning. So from a strategic business standpoint, expert systems can and are being used to improve every step of the product cycle of a business, from finding customers to shipping products to providing customer service.

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Application Categories of Expert Systems:

- **Decision Management:**

System that appraise situation or consider alternatives and make recommendations based on criteria supplied during the discovery process:

  - Loan portfolio analysis
  - Employee performance evaluation
  - Insurance underwriting
  - Demographic Forecasts

- Diagnostic/Troubleshooting :

Systems that infer underlying causes from reported symptoms and history:

  - Equipment calibration
  - Help desk operations
  - Software debugging
  - Medical Diagnosis

- **Design/Configuration:**

Systems that help configure equipment a component, given existing constrains:

  - Computer option installation
  - Manufacturability studies
  - Communications networks
  - Optimum assembly plan

- **Selection/Classification:**

Systems that help users choose products or processes, often from among large or complex sets of alternatives:

  - Material selection
  - Delinquent account identification
  - Information classification
  - Suspect identification

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- **Process monitoring/Control:**

Systems that monitor and control procedures or processes:

- Machine control (including robotics)
- Inventory Control
- Production monitoring
- Chemical testing

Advantages:

- Provide consistent answers for repetitive decisions, processes and tasks
- Hold and maintain significant levels of information
- Reduces creating entry barriers to competitors
- Review transactions that human experts may overlook
- Expert systems are faster and more consistent, can have the knowledge of several experts, and do not get tired or distracted by overwork or stress.
- Expert systems also help preserve and reproduce the knowledge of experts.

Disadvantages:

- Limited Focus.
- Inability to learn.
- Maintenance problem.
- Developmental cost.
- The lack of human common sense needed in some decision makings
- The creative responses human experts can respond to in unusual circumstances
- Domain experts not always being able to explain their logic and reasoning
- The lack of flexibility and ability to adapt to changing environments as questions are standard and cannot be changed
- Not being able to recognize when no answer is available
- Failure at subjective managerial decision making.

Developing Expert System:

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The easiest way to develop an expert system is to use an expert system shell as a development tool. An expert system shell is a software package consisting of an expert system without its kernel, that is, its knowledge base. This levels a shell of software (the interface engine and user interface programs) with generic inferencing and user interface capabilities. Other development tools (such as rule editors and user interface generators) are added in making the shell a powerful expert system development tool.

Expert system shells are now available as relatively low-cost software packages that help users develop their own expert systems on microcomputers. They allow trained users to develop the knowledge base for a specific expert system application.

Suitability Criteria for Expert System:

Domain:

The domain, or subject area, of the problem is relatively small and limited to a well-defined problem area.

Expertise:

Solutions to the problem require the efforts of an expert. That is, a body of knowledge, techniques, and intuition is needed that only a few people possess.

Complexity:

Solution of the problem is a complex task that requires logical inference processing, which would not be handled as well by conventional information processing.

Structure:

The solution process must be able to cope with ill-structured, uncontained, missing, and conflicting data and a problem situation that change with the passage of time.

Availability:

An expert exists who is articulate and cooperative, and who has the support of the management and end users involved in the development of the proposed system.

Knowledge Engineering:

A knowledge engineer is a professional who works with experts to capture the knowledge (facts and rules of thumb) they possess in order to develop a knowledge base for expert systems and other knowledge based systems. The knowledge engineer then builds the knowledge base (and the rest of the expert system if necessary), using an iterative, prototyping process until the expert system is acceptable. Thus, knowledge engineers perform a role similar to that of systems analyst in conventional information systems development.

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