

## Assignment No. 6

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Subject -

### Problem Statement -

Implement any of the following Expert System

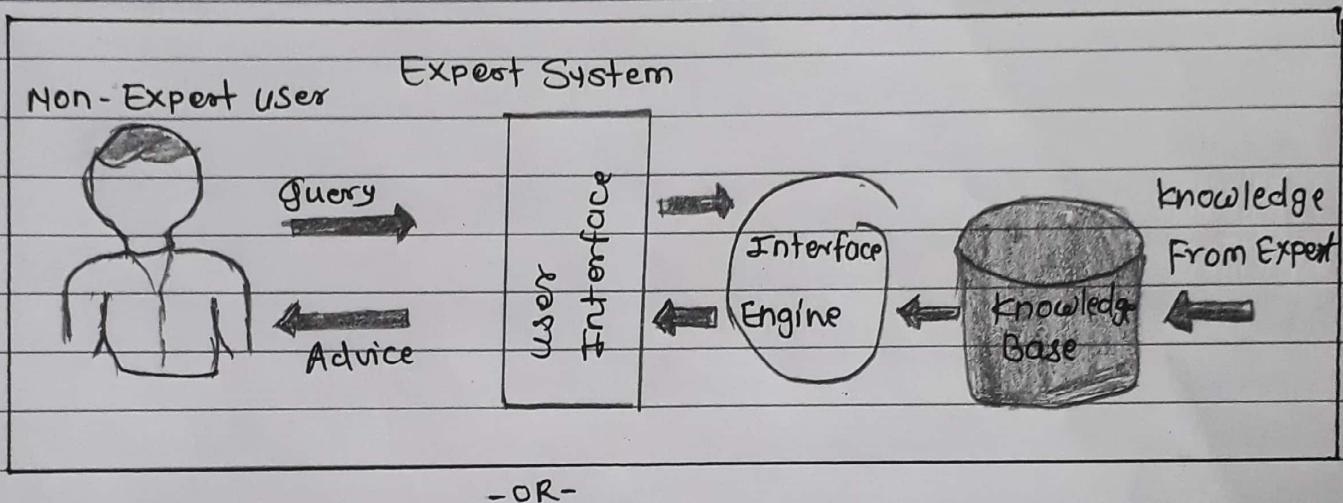
1. Information Management
2. Hospitals & medical facilities.
3. Help desks management.
4. Employee performance evaluation.
5. Stock market trading.
6. Airline scheduling and cargo schedules.

### Theory -

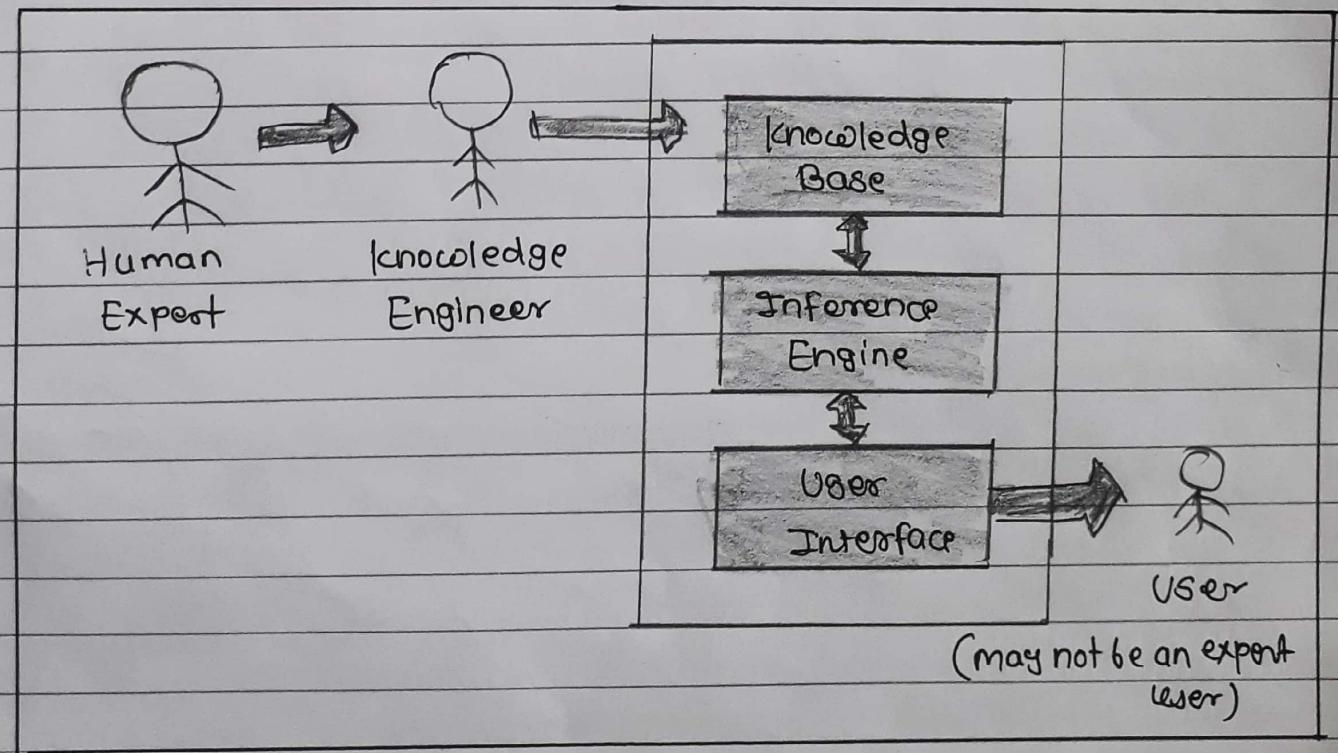
#### \* Expert System in Artificial Intelligence -

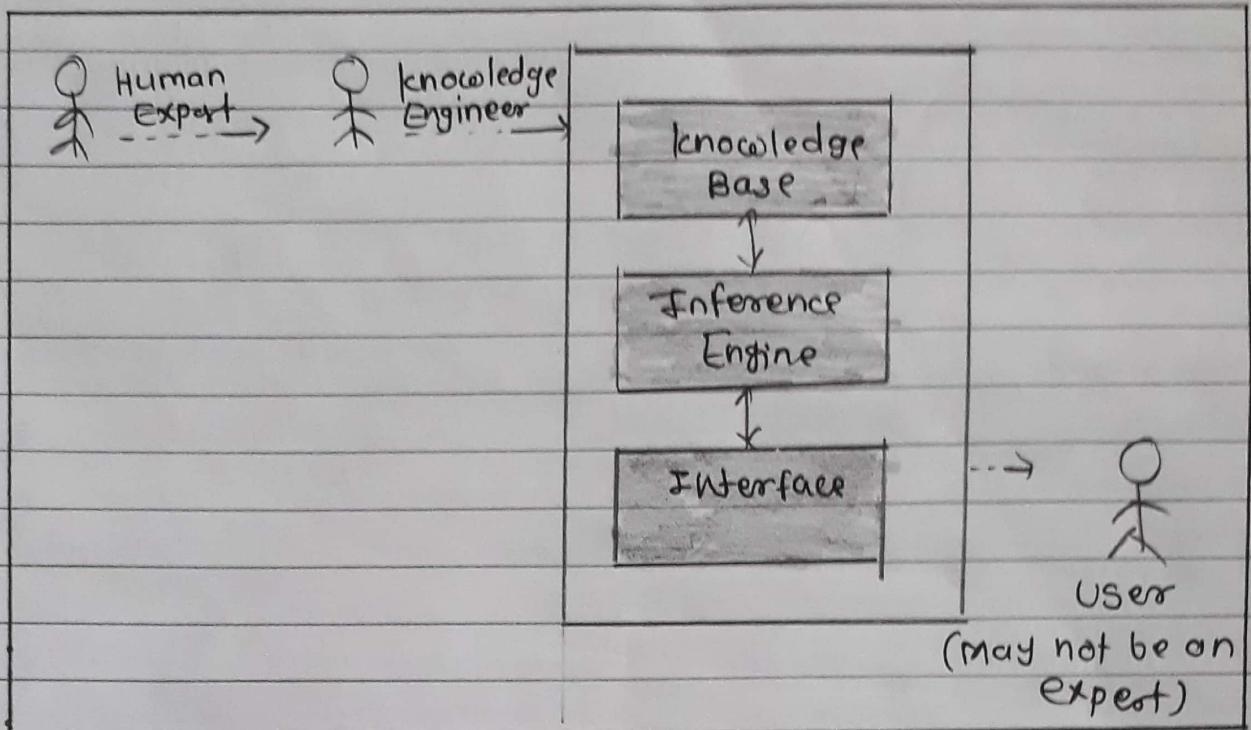
Artificial Intelligence is a piece of software that simulates the behaviour & judgement of a human or an organization that has experts in a particular domain is known as an expert system. It does this by acquiring relevant knowledge from its knowledge base and interpreting it according to the user's problem. The data in the knowledge base is added by humans that are expert in a particular domain & this software is used by a non-expert user to acquire some information. It is widely used in many areas such as medical diagnosis, accounting, coding, games, etc. An expert system is AI software that uses knowledge stored in a knowledge base to solve problems that could usually require a human expert thus preserving a human expert's knowledge in its knowledge base. They can advise users as well as provide explanations to them about how they reached a particular conclusion or advice. Knowledge Engineering is the term used to

define the process of building an Expert System & its practitioners are called knowledge Engineers. The primary role of a knowledge engineer is to make sure that the computer possesses all the knowledge required to solve a problem. The knowledge engineer must choose one or more forms in which to represent the required knowledge as a symbolic pattern in the memory of the computer.



-OR-





#### \* Why Expert System?

- ① No emotion
- ② High Efficiency
- ③ Expertise in a domain
- ④ No memory limitation
- ⑤ Regular updates improve the performance
- ⑥ High security
- ⑦ Consider all facts.

#### \* Characteristics of Expert System:

- ① They have high performance levels.
- ② They are easy to understand.
- ③ They are completely reliable.
- ④ They are highly responsive.
- ⑤ Human experts are perishable but an expert system is permanent.
- ⑥ It helps to distribute the expertise of a human.
- ⑦ One expert system may contain knowledge from more than one human experts thus making the solutions are efficient.

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- ⑩ It decreases the cost of consulting an expert for various domains such as medical diagnosis.
- ⑪ They use a knowledge base and inference engine.
- ⑫ Expert systems can solve complex problems by deducing new facts through existing facts of knowledge, represented mostly as if-then rules rather than through conventional procedural code.
- ⑬ Expert systems were among the first truly successful forms of artificial intelligence (AI) software.

#### \* Capabilities of Expert System

The expert systems are capable of a number of actions including -

- ① Advising
- ② Assistance in human decision making
- ③ Demonstrations & instructions.
- ④ Deriving Solutions.
- ⑤ Diagnosis
- ⑥ Interpreting inputs & providing relative outputs.
- ⑦ Predicting results.
- ⑧ Justification of conclusions
- ⑨ Suggestions for alternative solutions to a problem

#### \* Components / Architecture of Expert System -

- 1) Knowledge Base - The knowledge base is an expert system represents facts & rules. It contains knowledge in specific domains along with rules in order to solve problems & form procedures that are relevant to the domain.
- 2) Inference engine - The most basic function of the inference engine is to acquire relevant data from the knowledge base, interpret it and to find a solution as per the user's problem. Inference engines also have explanation & debugging abilities.

- 3) knowledge acquisition & learning module - This component functions to allow the expert systems to acquire more data from various sources & store it in the knowledge base.
- 4) User interface - This component is essential for a non-expert user to interact with the expert system & find solutions.
- 5) Explanation module - As the name suggests this module helps in providing the user with an explanation of the achieved conclusion.

#### \* Types of Expert System Technology -

ES technologies come in various levels, they are :

##### Expert System Development Environment

The ES development environment contains a set of hardware tools (workstations, mini computers, mainframes), high level symbolic programming languages [List programming (LISP) & programmation en Logique (PROLOG)], as well as large data base.

##### Tools

Tools as an ES technology assists in reducing the effort & cost involved in developing an expert system to large extent.

##### Shells

A shell or expert system that functions without a knowledge base. It provides developers with knowledge acquisition, inference engine, user interface & explanation facility. For example - Java Expert System Shell (JESS), Vidwan, etc.

#### \* Advantages of Expert System -

- ① Low accessibility cost.
- ② Fast response.
- ③ Not affected by emotions unlike humans.
- ④ Low error rate.

- ⑤ Capable of explaining how they reached a solution.
- ⑥ It improves the decision quality.
- ⑦ Cuts the expense of consulting experts for problem-solving.
- ⑧ It provides fast & efficient solutions to problems in a narrow area of specialization.
- ⑨ It can gather scarce expertise & used it efficiently.
- ⑩ Offers consistent answers for the repetitive problem.
- ⑪ Maintains a significant level of information.
- ⑫ Helps you to get fast & accurate answers.
- ⑬ A proper explanation of decision making.
- ⑭ Ability to solve complex & challenging issues.
- ⑮ Artificial Intelligence Expert Systems can steadily work without getting emotional, tensed or fatigued.

#### \* Disadvantages of Expert System

- ① The expert system has no emotions.
- ② Common sense is the main issue of the expert system.
- ③ It is developed for a specific domain.
- ④ It needs to be updated manually. It does not learn itself.
- ⑤ Not capable to explain the logic behind the decision.

#### \* Limitations of Expert System

- ① Difficult knowledge acquisition
- ② Maintenance costs
- ③ Development Costs
- ④ Adheres only to specific domains
- ⑤ Do not have human-like decision-making power
- ⑥ Cannot possess human capabilities.
- ⑦ cannot produce correct result from less amount of knowledge.
- ⑧ Requires excessive training.
- ⑨ Requires constant manual updates it cannot learn by itself.
- ⑩ It is incapable of providing logic behind the decisions.

- ⑪ Unable to make a creative response in an extraordinary situation.
- ⑫ Errors in the knowledge base can lead to wrong decision.
- ⑬ The maintenance cost of an expert system is too expensive.
- ⑭ Each problem is different therefore the solution from a human expert can also be different & more creative.

### Applications -

- ① Different types of medical diagnosis like internal medicine, blood diseases & etc.
- ② Diagnosis of the complex electronic & electromechanical system.
- ③ Diagnosis of a software development project.
- ④ Planning experiment in biology, chemistry & molecular genetics.
- ⑤ Forecasting crop damage.
- ⑥ Diagnosis of the diesel-electric locomotive system.
- ⑦ Identification of chemical compound structure.
- ⑧ Scheduling of customer order, computer resources & various manufacturing task.
- ⑨ Assessment of geologic structure from dip meter logs.
- ⑩ Assessment of space structure through satellite & robot.
- ⑪ The design of VLSI system.
- ⑫ Teaching students specialize task.
- ⑬ Assessment of log including civil case evaluation, product liability, etc.
- ⑭ Information management.
- ⑮ Hospitals & medical facilities.
- ⑯ Help desks management.
- ⑰ Employee performance evaluation.
- ⑱ Loan analysis.
- ⑲ Virus detection.
- ⑳ Useful for repair & maintenance projects.

- ⑪ warehouse optimization
- ⑫ Planning & Scheduling
- ⑬ The configuration of manufactured objects.
- ⑭ Financial decision making | knowledge publishing.
- ⑮ Process monitoring & control
- ⑯ Supervise the operation of the plant controllers.
- ⑰ Stock market trading
- ⑱ Airline scheduling & cargo schedules.

### \*Expert Systems Example -

There are numerous examples of expert system. Some of them are:

MYCIN - This was one of the earliest expert systems that was based on backward chaining. It has the ability to identify various bacteria that cause severe infections. It is also capable of recommending drugs based on a person's weight.

DENDRAL - This was an AI based expert system used essentially for chemical analysis. It uses a substance's spectrographic data in order to predict its molecular structure.

R1/XCON - This ES had the ability to select specific software to generate a computer system as per user preference.

PXPES - This system could easily determine the type & the degree of lung cancer in patients based on limited data.

Cadet - This is a clinical support system that identifies cancer in early stages.

DXplain - This is also a clinical support system that is capable of suggesting a variety of diseases based on just the findings of the doctor.

## \* Conventional System Vs Expert System

	Conventional System	Expert System
①	knowledge & processing are combined in one unit.	knowledge database & the processing mechanism are two separate Components.
②	The programme does not make errors (unless error in programming).	The Expert system may make a mistake
③	The system is operational only when fully developed.	the expert system is optimized on an ongoing basis & can be launched with a small number of rules.
④	Step by step execution according to fixed algorithms is required.	Execution is done logically & heuristically.
⑤	It needs full information.	It can be functional with sufficient or insufficient information.

## \* Human Expert vs. Expert System

	Human Expert	Artificial Expertise
①	Perishable	permanent
②	Difficult to Transfer	Transferable
③	Difficult to Document	Easy to Document
④	Unpredictable	consistent
⑤	Expensive	cost effective system.

Conclusion -