

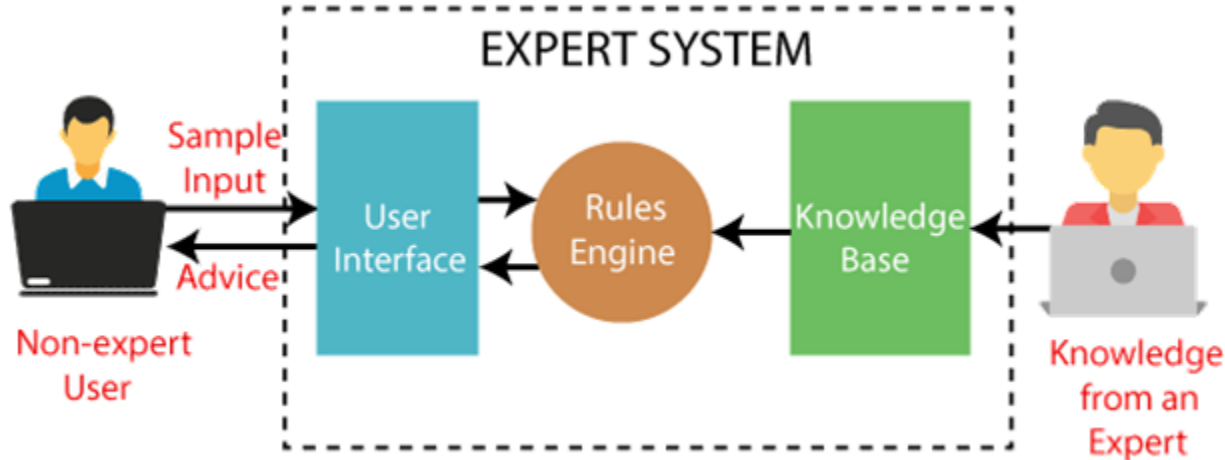
Expert System

Expert System

- An expert system is a computer program that is designed to solve complex problems and to provide decision-making ability like a human expert.
- It performs this by extracting knowledge from its knowledge base using the reasoning and inference rules according to the user queries.
- It solves the most complex issue as an expert by extracting the knowledge stored in its knowledge base.
- The system helps in decision making for complex problems using **both facts and heuristics like a human expert**. It is called so because it contains the expert knowledge of a specific domain and can solve any complex problem of that particular domain.
- These systems are designed for a specific domain, such as **medicine, science, etc.**

Expert System

- The performance of an expert system is based on the expert's knowledge stored in its knowledge base. The more knowledge stored in the KB, the more that system improves its performance. One of the common examples of an ES is a suggestion of spelling errors while typing in the Google search box.



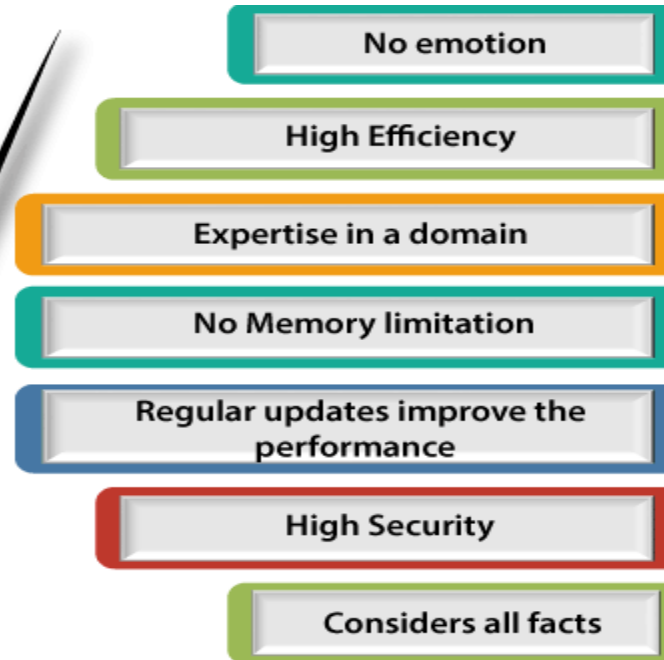
Expert System

- Expert system is not used to replace the human experts; instead, it is used to assist the human in making a complex decision.
- These systems do not have human capabilities of thinking and work on the basis of the knowledge base of the particular domain.
- **Some popular examples of the Expert System:**
 - **DENDRAL:** It was an artificial intelligence project that was made as a chemical analysis expert system. It was used in organic chemistry to detect unknown organic molecules with the help of their mass spectra and knowledge base of chemistry.
 - **MYCIN:** It was one of the earliest backward chaining expert systems that was designed to find the bacteria causing infections like bacteraemia and meningitis. It was also used for the recommendation of antibiotics and the diagnosis of blood clotting diseases.

Why Expert System

- Although we have human experts in every field, then what is the need to develop a computer-based system. So below are the points that are describing the need of the ES:

Why Expert
System



Why Expert System

- **Not affected by emotions:** These systems are not affected by human emotions such as fatigue, anger, depression, anxiety, etc.. Hence the performance remains constant.
- **High Efficiency:** If the knowledge base is updated with the correct knowledge, then it provides a highly efficient output, which may not be possible for a human.
- **Expertise in a domain:** There are lots of human experts in each domain, and they all have different skills, different experiences, and different skills, so it is not easy to get a final output for the query. But if we put the knowledge gained from human experts into the expert system, then it provides an efficient output by mixing all the facts and knowledge

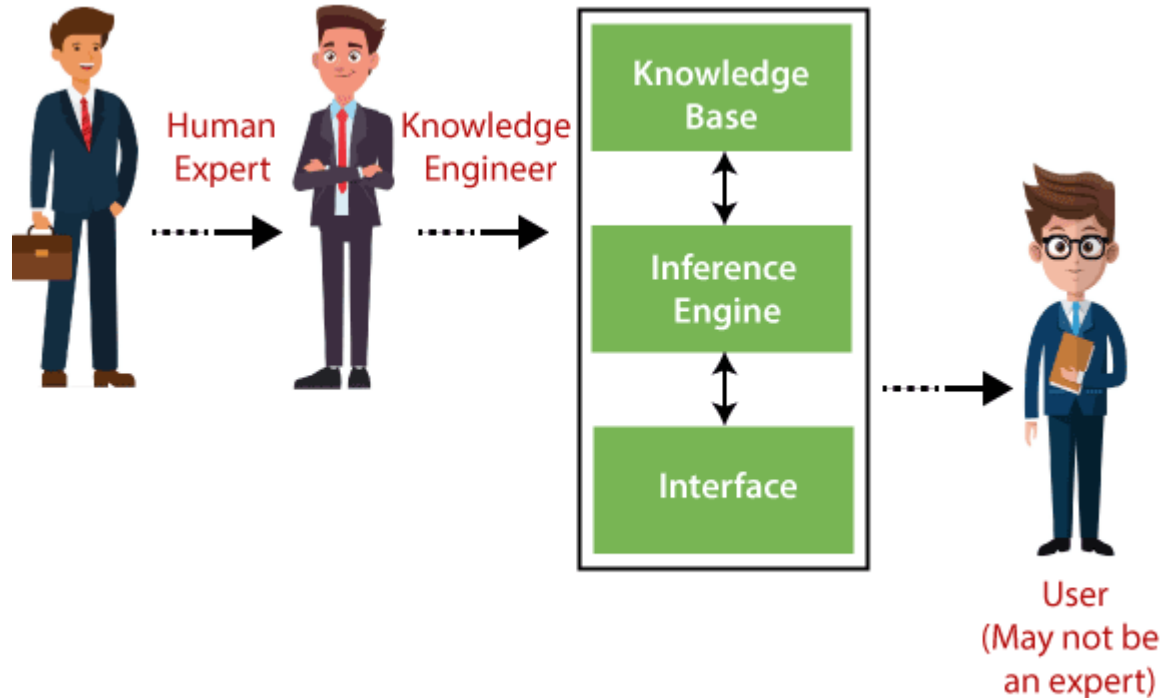
Why Expert System

- **No memory Limitations:** It can store as much data as required and can memorize it at the time of its application. But for human experts, there are some limitations to memorize all things at every time.
- **Regular updates improve the performance:** If there is an issue in the result provided by the expert systems, we can improve the performance of the system by updating the knowledge base.
- **High security:** These systems provide high security to resolve any query.
- **Considers all the facts:** To respond to any query, it checks and considers all the available facts and provides the result accordingly. But it is possible that a human expert may not consider some facts due to any reason.

Components of Expert System

- An expert system mainly consists of three components:

- **User Interface**
- **Inference Engine**
- **Knowledge Base**



Components of Expert System

- **User Interface**

- With the help of a user interface, the expert system interacts with the user, takes queries as an input in a readable format, and passes it to the inference engine.
- After getting the response from the inference engine, it displays the output to the user.
- **It is an interface that helps a non-expert user to communicate with the expert system to find a solution.**

Components of Expert System

- **Inference Engine(Rules of Engine)**
 - The inference engine applies inference rules to the knowledge base to derive a conclusion or deduce new information. It helps in deriving an error-free solution of queries asked by the user.
 - With the help of an inference engine, the system extracts the knowledge from the knowledge base.
- There are two types of inference engine:
 - **Deterministic Inference engine:** The conclusions drawn from this type of inference engine are assumed to be true. It is based on **facts** and **rules**.
 - **Probabilistic Inference engine:** This type of inference engine contains uncertainty in conclusions, and based on the probability.

Components of Expert System

- **Knowledge Base**

- The knowledge base is a type of storage that stores knowledge acquired from the different experts of the particular domain.
- It is considered as big storage of knowledge. The more the knowledge base, the more precise will be the Expert System.
- It is similar to a database that contains information and rules of a particular domain or subject.
- **Knowledge Representation:** It is used to formalize the knowledge stored in the knowledge base using the If-else rules.
- **Knowledge Acquisitions:** It is the process of extracting, organizing, and structuring the domain knowledge, specifying the rules to acquire the knowledge from various experts, and store that knowledge into the knowledge base.

Participants in the development of Expert System

- **Expert:** The success of an ES much depends on the knowledge provided by human experts. These experts are those persons who are specialized in that specific domain.
- **Knowledge Engineer:** Knowledge engineer is the person who gathers the knowledge from the domain experts and then codifies that knowledge to the system according to the formalism.
- **End-User:** This is a particular person or a group of people who may not be experts, and working on the expert system needs the solution or advice for his queries, which are complex.

Development of Expert System

- Example of **MYCIN** ES
 - Firstly, ES should be fed with expert knowledge. In the case of MYCIN, human experts provide information about the causes, symptoms, and other knowledge in that domain.
- The KB of the MYCIN is updated successfully. The problem is to identify the presence of the bacteria by inputting the details of a patient, including the symptoms, current condition, and medical history.
- The ES will need a questionnaire to be filled by the patient to know the general information about the patient, such as gender, age, etc.
- Now the system has collected all the information, so it will find the solution for the problem by applying if-then rules using the inference engine and using the facts stored within the KB.
- In the end, it will provide a response to the patient by using the user interface.

Applications of Expert Systems

- Hospitals and medical facilities
- Help desks management
- Employee performance evaluation
- Loan analysis
- Virus detection
- Useful for repair and maintenance projects
- Financial decision making Knowledge publishing
- Process monitoring and control
- Supervise the operation of the plant and controller
- Stock market trading
- Airline scheduling & cargo schedules

Thank you.