Intelligent Control

Expert System (2a)

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Chapter Description

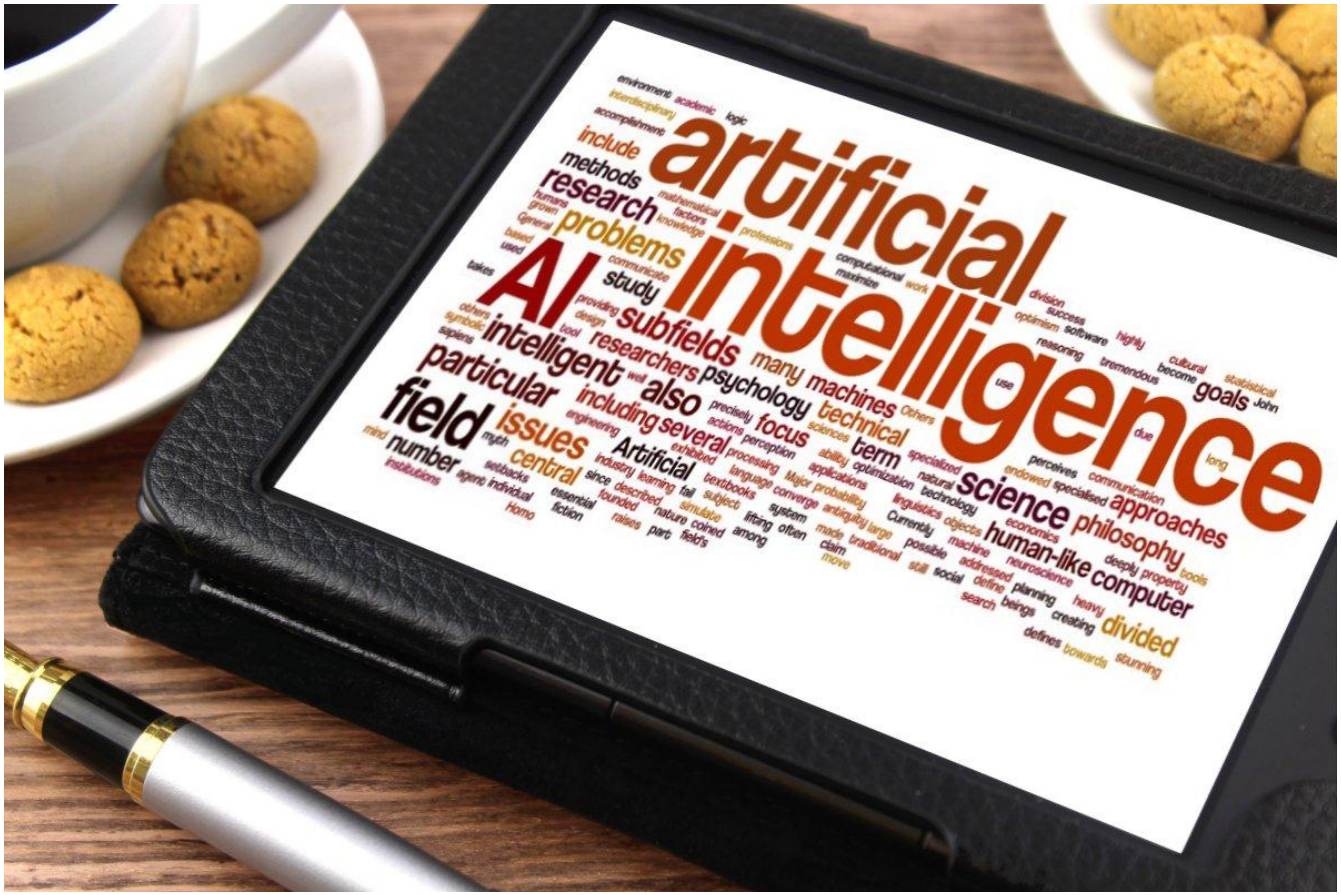
At the end of this topic , student should be able to:-

- Understand the concept of expert system.

Contents

Knowledge representation technique

2.1



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EXPERT SYSTEM:

WHAT IS IT ALL ABOUT?

What is Knowledge?

Theoretical or practical understanding of a subject.

Anyone considered an expert if has deep knowledge (facts and rules) and strong practical experience in certain area.

In general, an expert is a skilful person who can do things other people cannot.

Sum of what is currently known and who possess knowledge are called experts.

Expert system development team

2.2

BRIEF HISTORY
Famous Expert System

DENDRAL
Stanford Univ.
(1965)

- Analysis of chemical compounds.
- Rule-based system.

CADACEUS
Univ. of
Pittsburgh
(1970)

- Diagnosis of human internal diseases

MYCYSMA MIT
(1971)

- Symbolic mathematical analysis

Expert System Definition

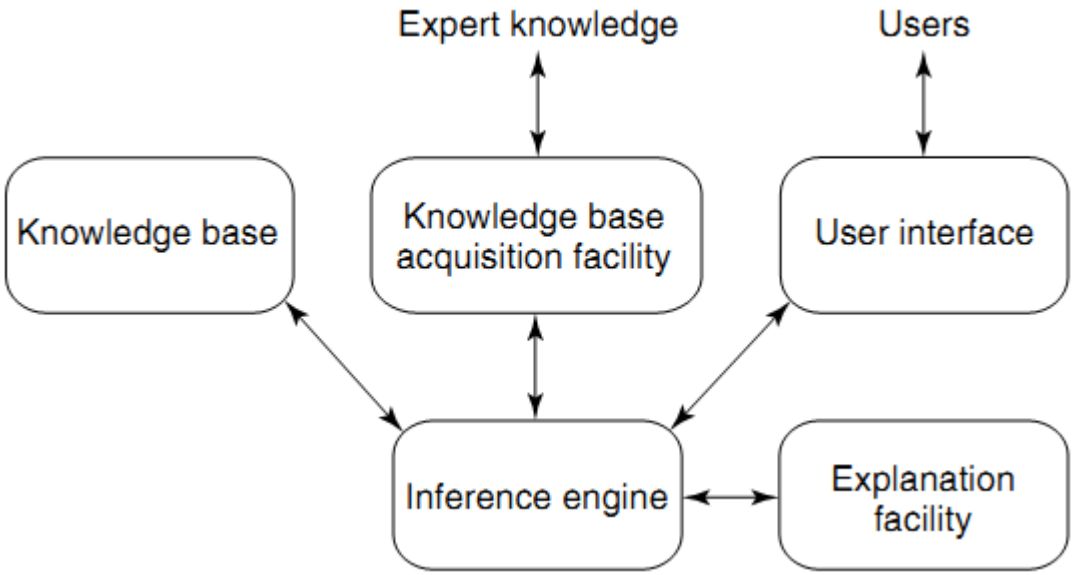
ES is computer-based system (mainly software) that uses knowledge and facts.

Apply appropriate reasoning technique (inferencing).

Solve complex problems which cannot be done by human expert.

ES is a computer system which emulates the decision-making ability of a human expert.-*Giarratono*

Simple Expert system architecture



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Rule-based expert system structure

2.3

Rules as a knowledge

Rule

- IF-THEN structure.
- provides description.
- easy to understand and create.
- relates given information or facts in the IF part ; ***antecedent*** (***premise*** or ***condition***).
- action in the THEN part; ***consequent*** (***conclusion*** or ***action***)..

Rules Cont'd

IF	the 'traffic light' is yellow
THEN	the action is be ready
IF	the DC motor is broken
THEN	the action is replace new motor

Rules Cont'd

Relation

- IF the stomach is empty
- THEN the person will feel hungry

Recommendation

- IF the season is Winter AND the forecast is Snowing
- THEN the advice is 'Do not drive on the road'

Directive

- IF the stomach is empty AND the person feels hungry
- THEN the action is 'Go find food'.

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Rules Cont'd

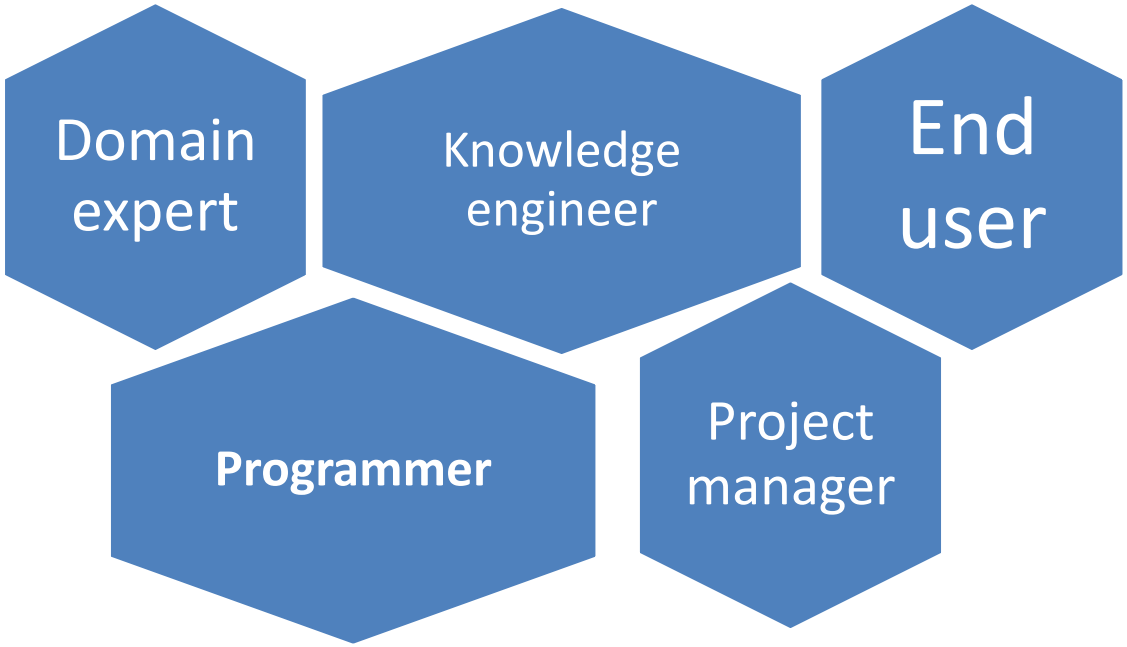
Strategy

- IF the lamp is off
- THEN the action is 'check the bulb';
  - step1 is complete
- IF step1 is complete
- AND the 'lamp' is still off
- THEN the action is 'check the wire connection';
  - step2 is complete

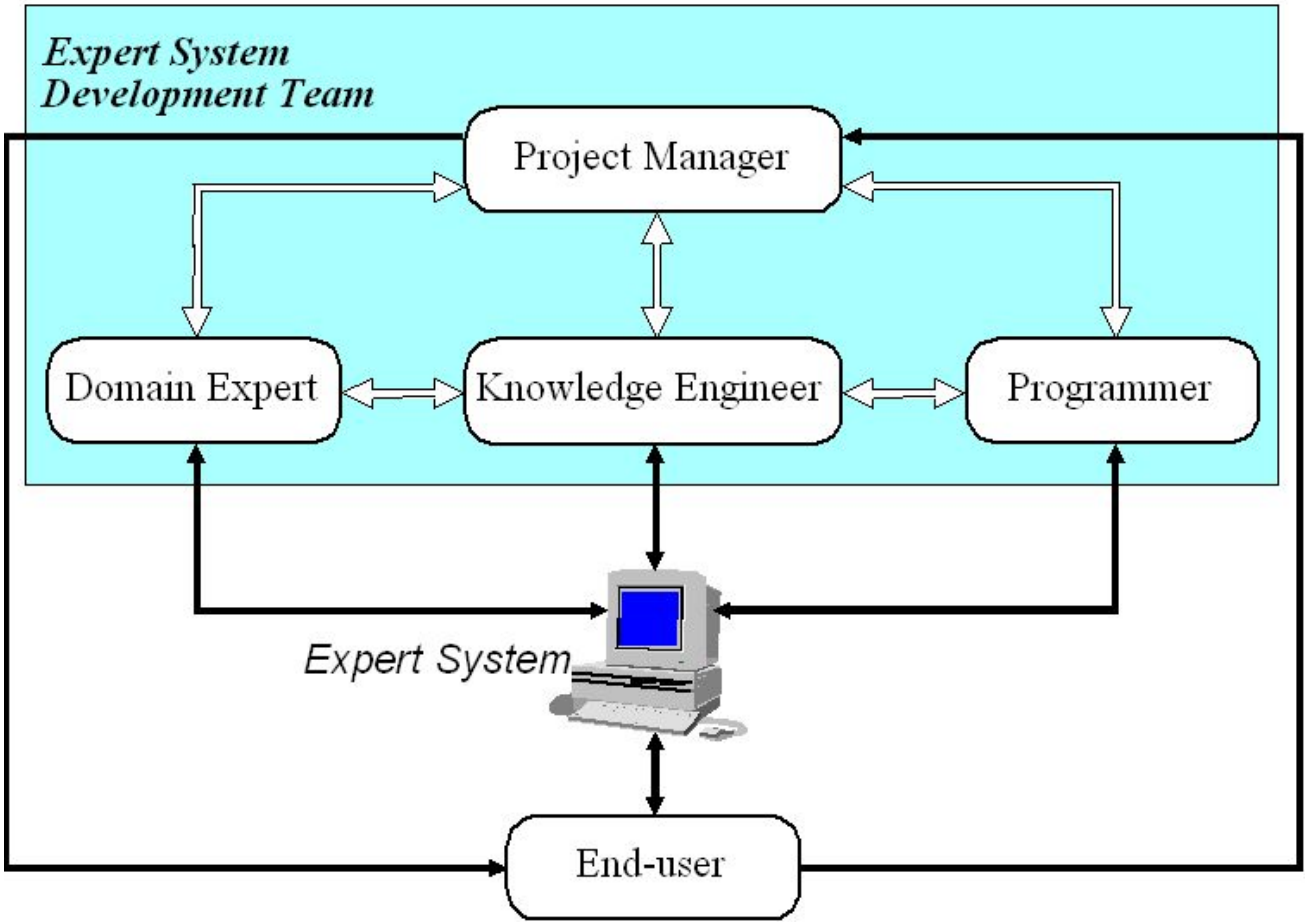
Heuristic

- IF the pH of the water is >7
- AND the water does not smell sour
- THEN the water is alkali

Five main players in development team



Five main players in development team Cont'd



Source: https://www.slideshare.net

Five main players in development team

Knowledge engineer

- designing, building and testing an expert system.
- chooses some development software

Programmer

- have skills in symbolic programming
- know standard programming like C, Pascal, FORTRAN and Basic.

End user

- uses the ES once developed.
- confident in the expert system performance.
- important for the project's success.

Five main players in development team

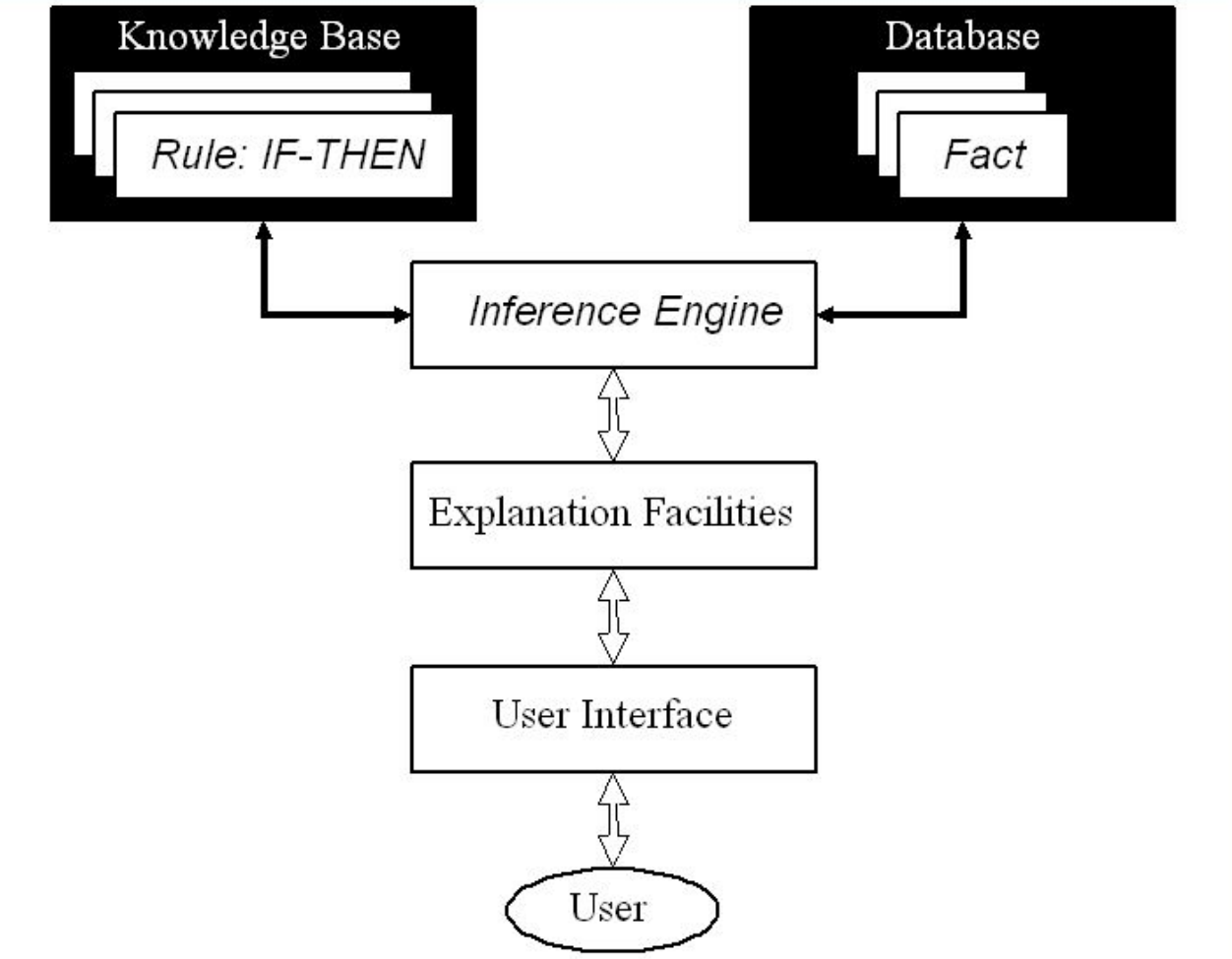
Domain expert

- Knowledgeable, skilled person can solve problems in a specific area or ***domain***.
- greatest expertise in a given domain.

Project Manager

- leader ; responsible to keep project success in given time.
- Assure all milestones are met, interacts with the programmer, end-user, expert and engineer.

Basic structure of a rule-based expert system



https://booleanaljabar.wordpress.com

Knowledge base

- Rule Set representation.
- IF (condition) THEN (action) structure.
- Once the condition part is satisfied, ***fire*** and action part is executed.

Database

- facts to match the IF (condition) parts in the knowledge base.

Inference engine

- Reasoning executed once solution achieved.
- Links the rules stored in the database.

Explanation facilities

- To answer ***how*** and ***why*** a particular conclusion is reached a specific fact is needed respectively.
- Can explain its reasoning and justify, analyze or conclude.

User interface

- User and ES communication to find the problem solution.

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