

RTXPS (Real Time Expert System) & its Applications

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Abstract—In present time we need to perform any type of work with fast speed. Then in current time we have very fast and advance technology to do any specific operation. The term RTXPS (Real Time Expert System) is a type of expert system that is the part of the artificial intelligence technology. It is used to operate the procedure where we need very small time to execute any operation like in milli second or micro second. [5]

It is designed for on line dynamic decision support, mission critical command, control and communication task such as emergency management for technical and environmental hazard, including early warning for events such as floods, toxic or oil spills, tsunamis, land slides etc. and complex control and assessment task, including coordination of first response, recovery, restoration and clean - up operation, related teaching and training program. [4]

RTXPS (Real Time Expert System) can be configured to implement any checklist, questionnaire or operating manual based procedure or protocol. It offers context sensitive support function based on artificial intelligence technology that can handle the most demanding dynamic situation in distributed client server environment, with several parallel action threads. RTXPS provides extensive support and [1]

To the operator and keeps complete real time logs for quality control. In this paper i focused on architecture of the real time expert system and all its operation and application.[3]

Keywords: Artificial intelligence, expert system, real time system, real time expert system, time aware forward chaining inference engine. [1]

1. INTRODUCTION

The nineteenth century saw the rise of artificial intelligence (AI) in literacy, with books like Hoffman's the Sandman or Marry Shelley's Frankenstein. Today reality is still catching with the help of modern computers. [8]

As soon as 1938, while developing his Z1 computer, Konrad Zuse recognized that the technology will eventually become an artificial brain. The real time expert system is used the technology of the artificial intelligence. The artificial intelligence is the branch of the computer science. It is the science and engineering of making the intelligent machines, especially intelligent computer programs.

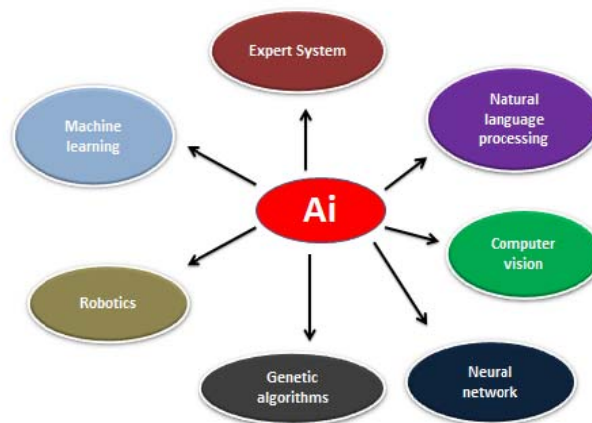


Fig. 1: Branches of AI

2. EXPERT SYSTEM

Expert system is a computer system that emulates the decision making ability of a human expert. That is it acts in all respects like a human expert. It uses human knowledge to solve problems that would require human intelligence. The expert system represents expertise knowledge as data or rules within the computer. These rules and data can be called upon when needed to solve problems. Expert systems have been developed in such diverse areas as science, engineering, business, and medicine. In these areas, they have increased the quality, efficiency, and competitive leverage of the organizations employing the technology. The scientists and engineers have used this technology to search for oil, diagnose medical problems, and explore space.

The traditional definition of a computer program is usually, [10][5]

Algorithms+ data structure = program

But in an expert system the definition change to

Inference engine + knowledge= expert system

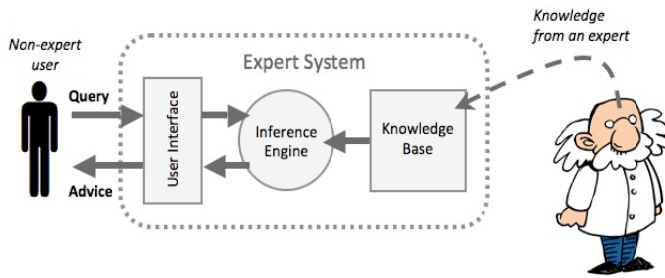


Fig. 2: Block diagram of expert system

3. EXPERT SYSTEM DEVELOPMENT PROCESS:

In case of development process of the expert system it contains the 4 steps.

1. Analysis
2. Specification
3. Development
4. Deployment

3.1. Analysis

The purpose of the analysis is to identify a potential application. Possible applications include diagnostics, a controller, etc.

3.2 Specification

The specification step is where the developer defines what the expert system will do. Here the developer must also work the expert to learn enough about the task to plan system development.

3.3. Development

The development must contain learn how the expert perform the task in a variety cases. There are three kinds of cases the developer should discuss with the expert: current, historical, and hypothetical .The current cases can be covered by watching the expert perform a task. Historical cases can be discussed by discussing with the expert a task that was performed in the past. And hypothetical cases can be covered by having the expert describe how a task should be performed in a hypothetical situation.[5]

3.4. Deployment

In the deployment phase the developer installs the system for routine use. He also fixes bugs, updates, and enhances the expert system

4. REAL TIME SYSTEM

There are many interpretation of the term “real time system” and it often only refers to high performance system. The literature helps gives different definition. These are

“A real- time system is any information processing activity or system which has to respond to externally input stimuli within a finite and specified period”.[4]

A real – time system is a system that is required to react to stimuli from the environment within time interval dictated by the environment.

The correctness of the real time system depends not only on the logical result of the computation, but also on the time at which the result are produced. [3]

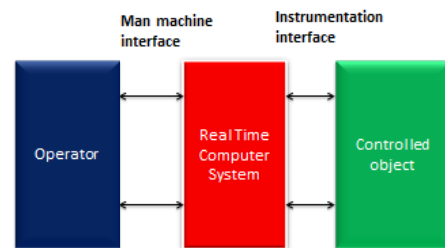


Fig. 3: block diagram of real time system

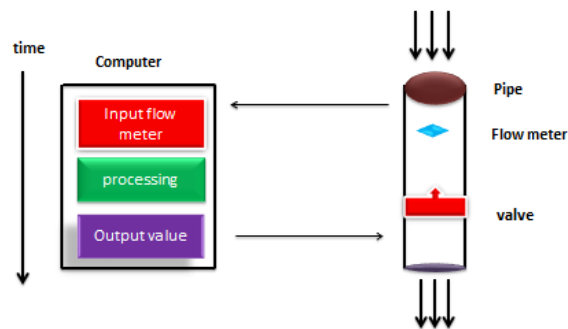


Fig. 4: example of real time system

This is flow control system

Now that we know more about real- time system, there are two types of expert system first is soft real time system and second is the hard real time system. In soft real time system missing the deadline that has been set does not result in a critical failure, instead the system degrade the quality of the service. This typically seen in a video player where each frame has to be shown within a deadline that could be 1 milisecond. Past that deadline the next frame should be shown and this one no longer does makes sense. Hard real- time system fails when a deadline is missed. Usually they lose their purpose if they don’t respond within the deadlines. The example above is typically hard real time since failure to respond within the deadline could cause damages to the equipment.

Another characteristic of real-time system is that they are inherently concurrent. [2]

4.1. Specific issues of real time system

Hard real time systems introduce some issues that need to be controlled in order to ensure the system will meet its deadlines. These issues can't not be controlled if the system is not predictable, that is does not behave in way that can be predicted mathematically. Memory is an issue as well. [5]

5. REAL TIME EXPERT SYSTEM

The real time expert system is used the technology of the artificial intelligence. It is based on the time aware forward chaining inference engine. ACTIONS are communicated to the operator in hypertext format, and can automatically trigger a wide range of function including data entry and display, an embedded backward chaining expert system, and complex simulation and optimization modeling GIS application. RTXPS uses a simple near-natural language syntax for its Rules, ACTIONS and Descriptors, the variables that the Rules operate on. An intuitive SCRIPT language supports the efficient development of the Knowledge Base for a new application. [7][9]

RTXPS can also link to on-line monitoring and acquisition system that can provide real-time intelligence and feedback from the field; this can be used not only to update the problem context dynamically, but also for the re-calibration of dynamic forecasting models. RTXPS uses a simple near-natural language syntax for its rules, ACTIONS and descriptors, the variables that the rules operate on. An intuitive SCRIPT language supports the efficient development of the knowledge base for a new application.

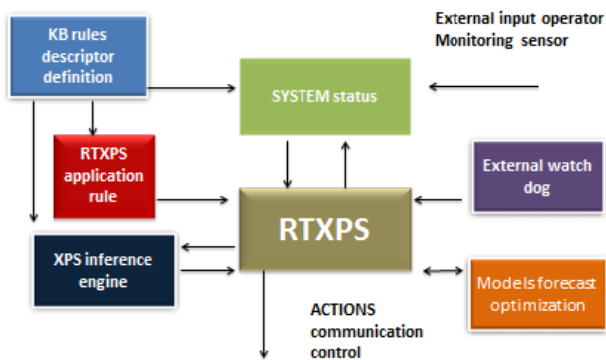


Fig. 5: Block diagram of rule based expert system

5.1. Time aware forward chaining inference engine

The expert system has the important part called the inference engine. It is the important tool of the artificial intelligence. The first inference engines were components of expert systems. The typically expert system consisted of knowledge base and an inference engine. The knowledge base stored facts about the world. The inference engine applied logical rules to

the knowledge base and deduced new knowledge. This process would iterate as each new fact in knowledge. [8]

The logic that an inference engine uses is typically represented as IF-THEN rules. The general format of such rules is IF<logical expression> THEN <logical expression> prior to the development of expert system and inference engine.

Inference engine contain two type of the chaining first is forward chaining and backward chaining. Forward chaining starts with the known facts and asserts new facts. Backward chaining starts with goal, and works backward to determine what fact must be Asserts so that the goals can achieve. [4][2]

The forward chaining starts with data available and it uses the inference rules for concluding more data until we reach a desired goal. An inference engine that uses forward chaining searches for the inference engine rules until useless it find one in which if 'if' clauses is know to be true. After that is concludes the 'then' clause and adds this information to its data. It continues to do this until the goal is reached .Because the data which is available determines which inference rules are to be used, this method is also known as data driven.

6. APPLICATION OF REAL TIME EXPERT SYSTEM

There are some applications of the real time expert system.

Real time optical expert system

1. Real time expert system for monitoring and maintenance of digital exchange
2. Expert system for process control
3. Real time expert system Environment for on-line operational control and decision support application
4. Real time expert system for mission control

6.1. Real time optical expert system

Optical has several advantages for overcoming the limitations that arises when applying existing electronic technologies to a real-time parallel computation. Particularly, the spatial light modulator allows simultaneous storage, multiplication, & complex interconnection. A simple expert also uses an SLM crossbar switch in order to prove a flexible and fast implementation of a combinatorial logic. [5]

6.2. Real time expert system for monitoring and maintenance of digital exchange

Knowledge based expert system methodology is required. The UFMS12 and UFMAXE are two expert system to perform the automatic corrective maintenance for large digital exchange: Ericsson's AXE and Alcatel's S12. This expert system have capability to repair automatically a fault that is dialoguing with the affected exchange or even they can guide the operator with manual interventions. All these development produce a shell, known as SIGMA i.e.

6.3. Expert system for process control

We can characterize the process control system as one or more of the following forms

6.3.1. Discrete

Like found in many manufacturing, motion and packaging application. Robotics assembly, such that found in automatic production. Most discrete manufacturing involves the production of discrete pieces of product, such as metal stamping. [1][3]

6.3.2. Batch

Some application requires that specific quantities of war materials be combined in specific ways for particular duration to produce an intermediate or end result. One example is the production of adhesive and glues, which normally require the mixing of raw materials in a heated vessel for a period of a time to from a quantity of end product. [5]

6.4. Real time expert system environment for on line operational control and decision support application

RTXPS a real time expert system environment that is designed for theon-line operational control and dynamic decision support, some mission critical command, control and even the communication tasks such as. The emergency management for the technological & environmental hazards, which includes early for events such as floods, toxic, tsunamis, land slides, etc.

7. REAL TIME EXPERT SYSTEM FOR MISSION CONTROL

The ONAV (Onboard Navigation) Expert system is being developed as a real time console assistant to the ONAV flight controller for use a real time control center at Johnson space center. Currently, Oct.1991 the entry and ascent system have been certified for use on console as support tools, and were used for STS-48. The rendezvous system is in verification with the goal to have the system certified for STS-49, Intelsat retrieval. [3]

8. CHARACTERISTIC OF REAL TIME EXPERT SYSTEM

There is the following characteristic of real time expert system

High performance: The response at a level of competency equal to or better than an expert

Adequate response time: Perform in a responsible time, comparable to or better than HE(Human Expert) time.

Good reliability: Must be reliable and not prone to crashes or else it will not be used.

Understandable: It has an explanation capability

- a. Sanity check
- b. Accuracy validation of the knowledge

Flexibility: Important to have an efficient mechanism for adding, changing and deleting knowledge.

9. ADVANTAGES OF REAL TIME EXPERT SYSTEM

Thereis some advantage of the real time expert system.

- **Multiple expertise:**The knowledge of multiple expert can be made available to work simultaneously & continuously on a problem at any time of day or night. The level of expertise may exceed that of a single human expert.
- **Increased reliability:**increase confidence by providing a 2nd opinion. When HE is tried or under stress she will make mistake.
- **Explanation:**Can explain in detail the reasoning that lead to conclusion. A human may be too tried, unwilling, or unable to do this all the time.
- **Fast response:**May response faster and be more available than HE. Fast response in emergency situations.
- **Steady, unemotional, and complete response at all times:**May be very important in real time and emergency situations. HE may not operate at peak efficiency because of stress or fatigue.
- **Intelligent tutor:**Letting the student run sample program & explaining the system's reasoning.
- **Intelligent database:**Can be used to access in an intelligent manner example- data mining.
- **Indirect benefit:**knowledge is exactly known instead of being implicit in the expert's mind.

10. LIMITATION OF REAL TIME EXPERT SYSTEM

It contain following limitations. [5]

- Not easy to do rule induction (system creates rules from data) especially when the knowledge has never been explored and inconsistencies, ambiguities, duplication etc.
- HE(Human expert) should know the extent of their knowledge & quality their advice as the problem reaches their 'limits of ignorance'.
- Lack of causal knowledge
- Complex approach
- If small portion of time not exact then system can failure.
- Expert system expertise is limited to the knowledge domain contained in the system.
- Expert system can't generalize their knowledge by using analogy to reason about new situations way people can.

11. FUTURE WORK

Research is being going on to developing such areal time expert system, who can understand emotions of people, can create new innovations itself and can judge intelligence of person. And system that must be able to understand from

environment and to make such an expert system those are able to maintain itself and able to update itself. Today's real time expert systems deal with domains of narrow specialization. For expert systems to perform competently over a broad range of tasks, they will have to be given very much more knowledge. The next generation of expert systems will require large knowledge bases. And research is being going on it.

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