Expert System For Power System Dispatch Aid

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Abstract

Expert System has become an effective tool for storage of expertise in many fields. The task of operation, mentainance & design of power equipment using expert system has attracted a lot of attention. Power system control, during normal operation and at emergency conditions can be effectively governed by the aid of expert sysyem. In order to restore normal conditions a lot can be learned from expert systems specially by inexperienced operators. A litrature survey for status of the art is given. An expert system for Jordanian National Control Center is presented. It has been found that such a system can of great help for effective and efficient power dispatch experially in developing countries where highly specialized and experienced personal is rare and difficult to train.

1.Introduction:

Artificial Intelligence (AI) is the subfield of computer science that is concerned with symbolic reasoning and problem solving by knowledge manipulation rather than data. Non-intelligent computer program can not solve any problem that the programmer did not forsee when he wrote the program. Intelligent programs however is expected to do things that have not been explicitly programmed. Such programs may contain sets of rules which may be used to solve the problem and to reach the goal. The program has to use these rules with the available data to reach the aim of the problem .
 AI is divided into subfields: Expert System, Natural Languages, Speach Proccessing, Vision, Robotics and some others.
AI has its own well developed programming languages. The most widely used languges are LISP and PROLOG.

2. Expert Systems:

Expert systems are software designed to deliver the expertise of human expert or group of human experts to other people who need expert advise. Expert systems may substitute the human expert without suffering from usual human habits of becoming tired, sleeping, going for holiday or retitement. It may include the experise of several human experts who collected their expertise over very long period of time. Usual computer software makes a seperation between data and programming statements. Expert systems too makes such seperation but between rules and data. Rules are themselves stored as data as well. Hence for specific problem the data are processed using the set of rules towards the goal of the problem.
Expert systems hence consists of three main parts: User interface, Inference Engine and Knowledge base.

2.1Inference Engine:
Inference engine is a software that performs inference reasoning tasks for the expert system. This software uses the knowledge base information and any other information provided by the user to reach the new knowledge.

2.2Knowledge Base:
It is the data base where the knowledge in a particular topic is stored. Such knowledge may have been obtained from the human expert by the knowledge engineer.

2.3User interface:
It is the software necessary to make the user interaction with the system more friendly. It may provide graphic facilities, explanation facilities, justification etc. Expert system shell hence is a ready made software which provides the facilities for the user to build his own knowledge base and then utilise this knowledge to solve unlimitted number problems in the field of knowledge base.
Rules of the inference engine are usually in the form of:

Rule Label
IF   condition
THEN   conclusion
)   clauses(
)ELSE   conclusions
)   clauses((
)BECAUSE   "Text("

There are now in the market quite a number of expert system shells. Among them are EXSYS, VP-EXPERT, LEONARSO and others. VP-Expert was used in this paper since it provides some extra facilties which makes the interfacing easy.

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Control and operation of large power systems has been the subject of many attempts to introduce expert systems (33.(
Such systems should be able to cope with unforseen conditions Most of these systems solve wide range of power system problems e.g. control, operation, emergency tasks, stability & security problems (63,30,39,48.(
Economic dispath including control of real and reactive power has been the subject of many litrature (10,16,37,51,62,9,15,3,41,45). Such expert systems may be used with SCADA systems as well (37). Some expert systems were developed specifically for alarm emergency (11,14,32,42,43,44,59,46). Faults were analysed by some other expert systems (5,8,23,50,54,61). Such analysis were taken further to give a guide for steps to be taken for load distribution networks and substation operation (55,64,24,49,53,60,4). Power systems for space vehicles were supplied by on-line expert systems (17,21,22,28). Nclear power plant has been supplied with expert systems too (26,27,29,52,56). While other plants has necieved also a good attention in the field (65-75). Power Industry in general had been arsted by some expert systems such as those in litrature 35,36,40,57 and 38.

Expet System for Jordan Power Control Center
For a small power system like the Jordanian, tasks to be controlld by the operators are quite limited. It has been found that the tasks could be classified into 3 categories: Genenating units shut down, Transmision lines trips and Transformens trips.
If the total load at the event instant is known, then the source of the power and its path is to be managed by the expert system.
The required information were supplied to the expert system. Such information were either to be taken form experienced operators or from manuals and system specifications.
More than 200 rules were deduced and included in the expert system both for normal operation and emergencies.

Discussions of Conclusions
With the shortage of highlylughly experienced personal in developing countries, use of expert system has higher merit than industrial countries. Development of expert systems for power plants as well as other industrial enterprises should be highly enconraged. Such systems can be used for training and aid for less experienced

operators and may be introduced as ON-line at later stages. Knowledge engineers development hence is needed to help in developing such expert systems.

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