

TPA-EXPERT: A Hybrid Legal Knowledge based System for Indian Legal domain

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ABSTRACT

Most legal expert systems attempt to implement complex models of legal reasoning. But the utility of a legal expert system lies not in the extent to which it simulates a lawyer's approach to a legal problem, but in the quality of its predictions and of its arguments. A useful legal expert system should be capable of producing advice similar to that which one might get from a lawyer, so it should operate at the same pragmatic level of abstraction as does a lawyer. The aim of this paper is to develop a legal expert system called TPA-EXPERT for transfer of property act of Indian legal domain. TPA-EXPERT has a simple representation structure which combine time tested rule based and case based approach. The authors have used VisiRule for development of rule based and Java Net beans for case based approach.

General Terms

Artificial Intelligence, Knowledge based systems

Keywords

Transfer of property act (TPA), Expert System, Rule Based System, and VisiRule

1. INTRODUCTION

1.1 Expert System

A knowledge-intensive task normally performed by knowledgeable human problem solvers, the researcher attempts to model the domain knowledge and problem solving techniques of the human problem solver, and uses this model to implement a KBS capable of performing the knowledge-intensive task. However it should be clear that data, information and knowledge are not static things in themselves but stages in the process of using data and transforming it into knowledge. The Knowledge based systems in principle replaces the human problem solver capable of performing the task by him, either completely or more commonly by allowing less skilled workers to perform the same task assisted by the KBS. A KBS is typically intended to take boring routine tasks out of the hands of scarce experts so that they can spend more time on the hard problems. Scarcity of expertise seems inescapable in the legal field in the foreseeable future, any increase in efficiency of the legal system will presumably immediately be cancelled by increasing demand. If the fielded KBS is cheaper than the people it replaces it is therefore reasonable to expect that the use of KBS increases the quality of jobs in the legal field, while making the legal solutions more accessible. Expert systems in the domain of law have not only been used as prototypes, but they are an important venture in testing theories and in the assistance they can give to legal decision-making. [13].

2. BACKGROUND

2.1 Building Legal Reality within the Expert System

The focus of Artificial Intelligence (AI) is to capture the idea of intelligent reasoning in computers and on making

“intelligent” computer programs. The AI research, in the early days recognized that intelligent performance of both humans and computers requires a great deal of factual knowledge. This means that the development of systems which demonstrate a general artificial intelligence is practically impossible, because it presupposes the development of enormous knowledge bases. Thus it was thus recognized that AI research should aim at developing more specific systems, confined to knowledge domains with restricted zone. The limitation of a domain reduces the amount of knowledge to be incorporated in the system and makes it possible to aim for systems which can make expert-like decisions in that domain. The ‘Expert systems’ are computer programs which pertain to knowledge domains of restricted size [12].

2.2 Research in legal rule based Expert Systems

The advances in AI were also expected to produce results in the field of law (Buchanan and Headrick, 1970). The early works in the field expert systems such as MYCIN (Buchanan and Shortliffe, 1984) and PROSPECTOR (Hayes-Roth, 1987) justified the idea. It was thought that the formal nature of many legal domains was very suitable for representation in expert systems. The possibilities of computer programs which could perform tasks only related to legal experts. The researchers focused on capturing legal reasoning in computer systems and on finding suitable ways of representing legal knowledge. This research into legal expert systems led to several prototype systems. Some well-known examples are:

- i) The rule-based model of the British Nationality Act (Sergot, 1988),
- ii) TAXMAN (McCarty, 1980) and
- iii) LEGOL (Stamper, 1980). The expert systems were in the initial place research systems, however, and not yet full-grown commercial applications. As a progeny of these experiments, a next generation of legal expert systems was developed. Some of better-known projects of this second generation are:
 - i) The Alvey Demonstrator Project (Bench-Capon, 1991),
 - ii) JURICAS (De Mulder, 1984; van Noortwijk and Stubbe, 1986),
 - iii) PROLEX (van den Berg et al., 1987) and
 - iv) TESSEC Nieuwenhuis, 1989) [2,3].

3. TRANSFER OF PROPERTY ACT: DEFINED

In India, the personal laws governed the transfer of property assisted by orders of Courts under civil procedure code before the transfer of property act, 1882 came into existence. Transfer of movable goods was regulated to an extent by the Indian contract act, 1872. For transfer of immovable property, the Anglo-Indian courts often turned to principles of justice, equity and good conscience as it prevailed in England at the time. This rarely did any good due to the vast differences in customs and society of the two countries. The rapidly growing

commerce and infrastructure in the late nineteenth century lead to more conflicts even in business. Thus, an immediate need was felt for a clear and pragmatic law regarding property and transfers suited to India and its peculiar problems as well as to take care of the potential economic problems. The task of drafting such legislation fell upon the First Law Commission and was later referred to the Second Law Commission [4].

3.1 The Act

A Bill finally presented to the legislative council, became a law on the 17th of February 1882 and came into force from 1st July of the same year. The transfer of property act, 1882 mainly deals with transfer of immovable property. It does not apply to transfers by the operation of law such as transfer of immovable property necessitated by order of court for insolvency or forfeiture among others. The 137 sections contained within have been divided into 8 chapters [4].

4. RESEARCH METHODOLOGY:

4.1 Research in integrating CBR with RBR

The reasoning methodologies to be successfully integrated with CBR were rule-based reasoning. The most basic CBR/RBR systems were built for statutory legal domains, where statutes naturally correspond to rules and legal precedents naturally correspond to cases. The expert system called CABARET used a rule-based agenda mechanism to integrate past cases with legal regulations in the domain of United States tax law (Rissland & Skalak, 1991). This system pioneered a domain-independent architecture in which there are independent CBR and RBR co-reasoners, each of which monitors and communicates its own processing and results. The examples early legal system are

i) GREBE, integrated CBR and RBR to determine and justify legal conclusions for cases in the area of Texas employment law (Branting, 1991)

ii) IKBALS operated in the domains of Australian worker disability law and lending by financial institutions (Zeleznikow et al., 1994) [5,6,7].

4.2 Approach adopted

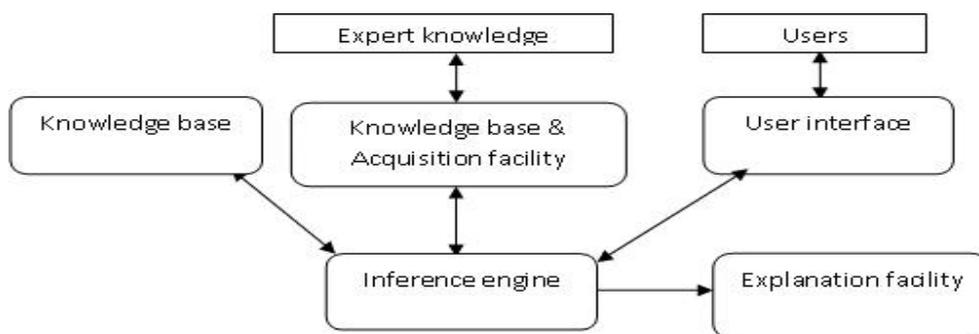


Fig. 1.0 Structure of a Rule based expert system

4.4 Case-based reasoning

Case-based reasoning is a problem solving pattern that in many respects is primarily different from other major AI approaches. CBR is able to make use of the precise knowledge of previously experienced, tangible problem situations (cases). A new problem is solved by finding a similar past case, and reusing it in the new problem situation.

This research work consists of development of HYBRID knowledge based systems where the authors have combined the rule based reasoning and case based reasoning. The details of the methodologies which are used are explained as below. In order to explicate our approach, we proceed as follows. Firstly, we introduce some definitions. Secondly, we describe the implementation of the hybrid expert system using RBR and CBR reasoning methodologies. Finally we analyse the results [14].

4.3 Rule-based expert systems.

The rule-based approach uses IF-THEN type rules and it is the method currently used in constructing expert systems. IF-THEN rules take the following form:

Typical Rule in VisiRule:

relation 'qTax paid receipts'(Conclusion) if the answer to 'Tax paid receipts' is _ and check('Tax paid receipts', =, 'Yes') and Conclusion = 'Property Can Be Purchased' The knowledge-based system may rely on knowledge commonly available. A true 'expert' system will be based on unwritten expertise, acquired from a human expert. In the circumstances where no algorithm is available to solve a particular problem, a logical solution is the best we can expect from an expert (system or human). The expert system will deduce a solution from the facts provided by the user and the rules in the knowledge base. Therefore, it should be able to explain the reasoning employed to achieve the solution. The rule-based expert systems, provide a explanation facility which is an important feature since it provides a mechanism for a human to follow and check the correctness of the solution achieved by the expert system [5,8,9]. The Components of the rule-based expert system are: User interface, Explanation facility, Working memory, Inference engine, Agenda and optionally knowledge acquisition facility. The structure of a rule-based expert system is shown in Fig. 1.0.

Another important difference is that CBR also is an approach to incremental, continued learning, since a new experience is retained each time a problem has been solved, making it immediately available for future problems. A legal advisor working on a complex case, before taking decision uses previous cases, which he has been involved and tries to

correlate them to the current one, so that he can have proper basis for his argument in the court of law.

The Case-based Reasoning Process and its illustration are as under:

- i) Uses past experiences
- ii) Based on the premise that human beings use analogical reasoning or experiential reasoning to learn and solve complex problems
- iii) Particularly evident in precedence-based reasoning
- iv) Useful when little evidence is available or information is incomplete

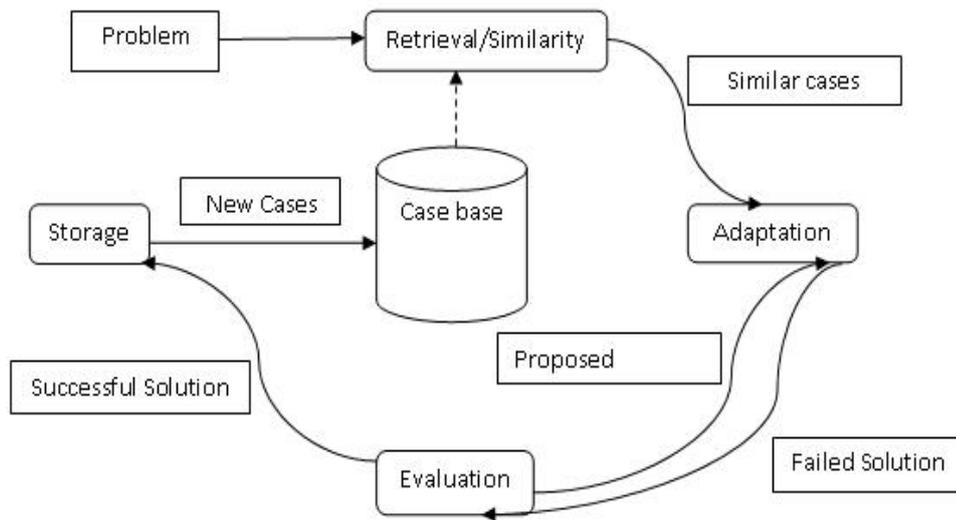


Fig. 2.0 the CBR Cycle

5. TECHNOLOGY USED FOR IMPLEMENTATION.

The authors of this paper have studied most popular expert systems shells available such as Clips and Jess. These shells were used by the authors for prototype development in the transfer of property act [9,10,11]. The researchers also studied other rule engine options such as Drool, Eclipse, Sweet Rules and VisiRule. The authors selected VisiRule, for the development of expert system. One of the major drawbacks of conventional expert systems is that they are largely text based and require some technical skills in using their often proprietary rule syntax. Logic Programming Associates, England the developers of WINPROLOG of which the VisiRule is the part, offers the Flex expert system toolkit which is a versatile, extendible development tool based in logic and with access to the underlying Prolog programming language. However, even with its highly readable English-like knowledge specifications language, Flex still requires domain experts to read and write rules as individual items of text using a specialized syntax and remember the connections between them. VisiRule overcomes these issues by presenting a graphical environment where rules are simply defined by a combination of graphical shapes and pieces of text. The potentially intricate structuring of the application logic is presented as a diagram which can be editing as one. By adopting and enhancing the well established metaphor of the flow chart, VisiRule allows experts to concentrate on exploring and establishing the structure of the logic rather than worry about how to encode the logic correctly using their chosen tool. The resulting diagram is readily available to

domain experts, i.e. legal practitioners, without having to involve technical experts, namely programmers. This opens up the discussion to a much wider audience, and actively encourages participation by more interested parties. As the adage states, a picture is worth a thousand words. It also helps avoid some of the errors which can come into play when trying to code logic in a text based rule language.

5.1 Implementation using VisiRule

The authors of this study carried out the development of the prototype as mentioned earlier in Clips and Jess [8,9]. The development of the prototype was done and proper verification and validation by the legal experts was carried out. The extensive developmental study of the modules was conceived and the VisiRule software was selected for the development purpose [1]. The authors have developed 10 modules covering all aspects of transfer of property act in Indian legal domain. The modules consist of 90 rules in total at present. More rules can be added to the system whenever any amendments are made to the act. As space is constrained, the authors have considered including only one module in this paper.

In this module the authors have presented one module called free-consent. In this part the authors check by asking the user 07 question which have been indicated in the yellow box. The red box indicates the conclusion (i.e. either the property can be transferred or not) drawn after series of inferences. The white boxes indicate options to be selected by the questions inform of 'yes' or 'no'. The chart below is the representation of the module which modular in nature and gives the exact nature of the flow of questions [11].

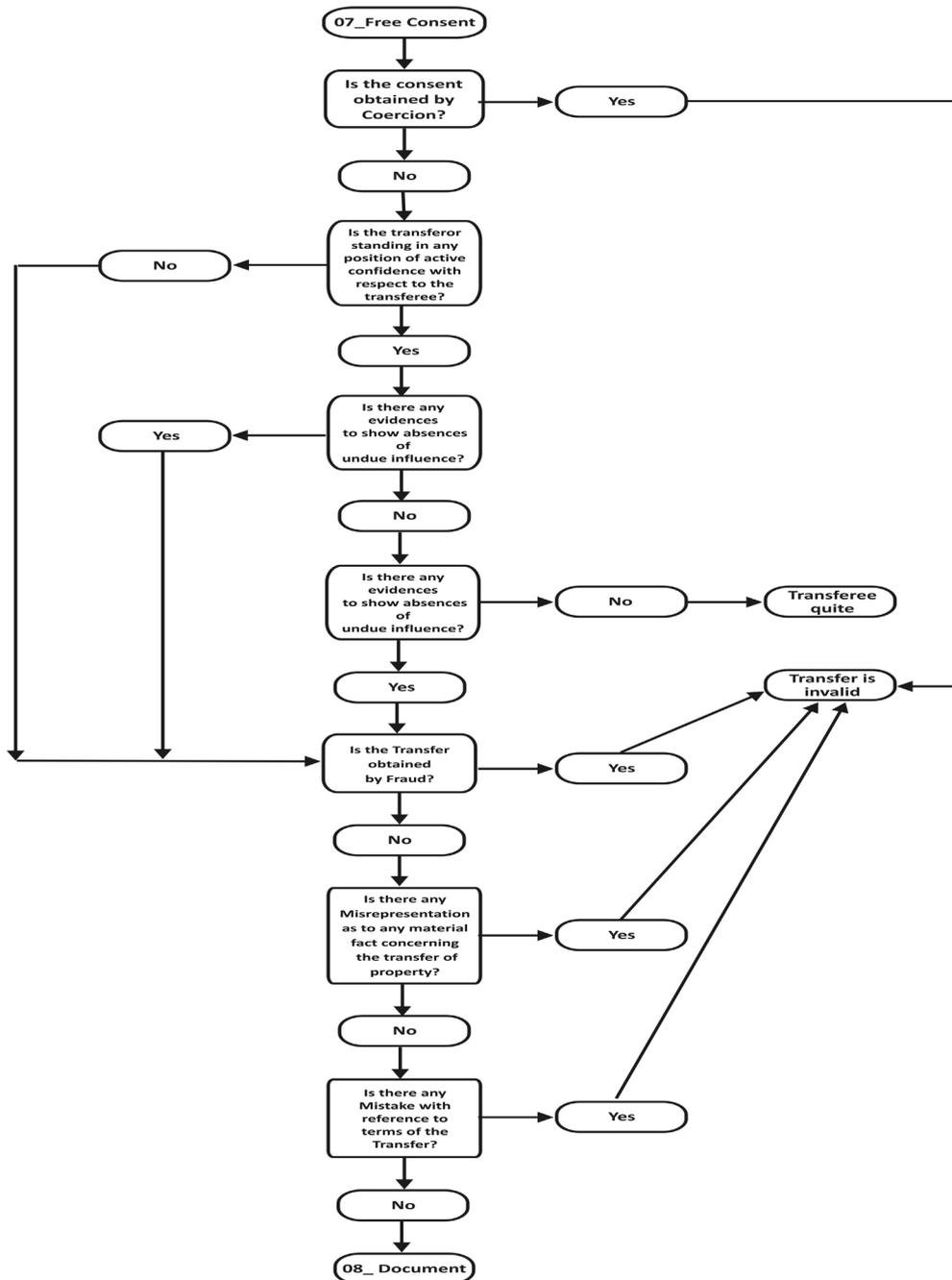


Fig 3.0 : VisiRule Implementation Module-1

5.2 Case based reasoning Implementation

The development of the case based reasoning module is in done in java net-beans. In this module the related cases can be searched which are stored in Microsoft access database. Proper verification and validation of this module was done by the legal experts. The cases related to Transfer of property act were collected from different legal databases and compiled. The necessary keywords were framed, which were used in searching for the related cases.

6. COMPARATIVE STUDY

The community has argued that decision trees and decision tables do offer a more realistic way of representing knowledge than text-based rules where the amount of text can

obscure the structure and interrelationships inherent in the rules. The decision tables can prove very compact and familiar structures to work with. Using a graphical paradigm one can hope to retain and re-use the structuring information required to appreciate, steer, and preserve complex rule bases. We consider that the systems having flexible architectures that can support large domains are needed and are more useful than the systems which are domain specific. In this system we have tried to induce that flexibility by giving equal importance to CBR and RBR technique and making sure that rule-base is as per the law books. We also believe that our approach would be useful for the non-law literate and also to expert in domain.

7. CONCLUSION.

The goal of the research work is to develop an integrated knowledge based system which incorporates the rule based and case based reasoning for transfer of property act of Indian legal domain using VisiRule and Java. VisiRule provides a graphical decision charting logic for representing rules, which makes application development easy. The authors have already developed the prototype of this expert system, which has been tested and validated by the legal experts. The authors have taken up the development of comprehensive legal expert system, and have built 10 modules which cover all the aspects of transfer of property act. The authors have also developed the module for case based reasoning related to cases of transfer of property act which a user can refer to. This work can be of great help to both the non-law-literates and also for experts in the field of law for productive and fast decision making.

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