LEGAL EXPERT SYSTEM · LES-2

H. Yoshino, S. Kagayama, S. Ohta, M. Kitahara,
H. Kondoh, M. Nakakawaji, K. Ishimaru, and S. Takao

Legal Expert System Association
Meiji Gakuin University,
1-2-37 Shirokane-Dai, Minato-Ku, Tokyo, (108) Japan

1. INTRODUCTION

This paper presents the second version of the Legal Expert System (hereafter LES-2), which the Legal Expert System Association (LESA president Prof. H. Yoshino, Meiji Gakuin University, Tokyo) developed in cooperation with NEC Corporation in 1986.

In December 1985 LES-1 was developed. It was the 1st version of this system and it was developed as a reasoning system for substantial law(Japanese civil law). LES-2 was developed in June 1986, the structure of which is meant to augment LES-1 simple natural language transmission, Q&A system and a new reasoning system for civil procedural law. LES-2 employs PROLOG-KABA and WING on an NEC PC9801 computer.

A legal expert system is a computer system containing specified legal knowledge, with which one can perform legal problem-solving. Progress in the expert system in the field of law has, comparatively speaking, made less headway than in other fields. A developing program with PROLOG has, however, recently served to promote several systems. For instance, we can see new impact on research description dealing with the time in law.

To build up a general legal expert system, one needs to have cooperation between information scientists and legal professionals(experts). In this very sense, it can be argued that this system has resulted from such cooperation.

In building up a legal expert system, it is necessary to analyze the structure of legal knowledge, and subsequently create a system suitable for that structure. The features of legal knowledge are: (i)it is expressed in natural language, and (ii)it is an OPEN-ENDED universe of discourse. This study examines LES-2 from these two perspectives.

2. THE FUNDAMENTAL STRUCTURE OF LAW AND LEGAL REASONING AND ITS FORMALIZATION

The process of judgement made by a jurist to solve legal problems, that is, the process of the legal judgement, is referred to as legal reasoning." A legal expert system must be first and foremost a legal reasoning system.

The most typical form of legal reasoning is the reasoning of law application. That is, the process of reasoning the conclusion to be gotten by applying a law to a certain case. This legal reasoning is composed of the reasoning for justification of legal conclusions from the given premises and heuristic reasoning for the premises themselves. As the reasoning for justification of legal conclusion is looked upon as the fundamental source of legal reasoning, the system of the reasoning of legal justification should be created first.

The reasoning of legal justification is based on logical proof, but not legal syllogisms in a simple form which are composed only of legal rules and facts. While legal rules(the "articles") are abstractly prescribed, each fact is concrete. It is necessary, therefore, for legal rules to be interpreted as the "concretization" of the meaning of the rules so that a bridge might be built between an abstract legal rule and concrete facts. These articles are not independent of each other, but are related logically to each other to form the legal system. There are legal principles which logically relate each legal article. The structure of the reasoning for the justification, as well as those principles formulated by PROLOG, can be

expressed in the following modified legal syllogism:

Fig. 1.

```
Rule 1 (legal norm sentence):
1a. legal_principle: legal_effect_0(X):-
            legal_effect_1(X), legal_effect_2(X).
1.  legal rule:      legal_effect_1(X):-
            legal_requirement_1(X), legal_requirement_2(X).
1b. interpretation:  legal_requirement_1(X):-
            legal_requirement_11(X), legal_requirement_12(X).
1c. judgement·supplementary interpretation:
                     legal_requirement_11(X):-
            legal_requirement_111(X).
Rule 2 (subsumption judgement dictionary)
2.  subsumption:     legal_requirement_111(X):-
            fact_1(X).
Fact:
3.  Fact:            fact_1(a).
-------------------
Logical deduction:
4.  Legal decision:  legal_effect_0(a).
```

(Legal rule 2, legal requirement 2, and legal requirement 12 need an appropriate legal rule, interpretation, and facts, but they are abbreviated here.)

As shown in Fig. 1 above, the fundamental unit of legal knowledge, a legal norm sentence, has a logical structure based on the conditional sentence of legal requirement and legal effect. Moreover the legal system has a hierarchical logical connective structure reaching from the abstract to the concrete level. It should be noted that in the above PROLOG formulas the connection of each legal requirement on the right side, that is, of each literal in the body represents not just the logical operation AND in logic, but also it prescribes the procedural order to decide the truth or falsity of each sentence, and thus the legal world resembles the PROLOG world in that both assume a closed world where each sentence must be false if it fails to be proved to be true. It could be said that it corresponds to the reality of legal reasoning.

Supposing the rightness of the rules system, (the rightness of) the legal decision of a case can be proved as a logical deduction from this rules and the given facts. To construct a reasoning system of legal justification, the system has to be provided with a rule base of rule 1 and a dictionary base of rule 2. Then inputting the FACTS of the case the legal decision can be deduced by the backtracking reasoning process of PROLOG.

In legal reasoning, there are valid meta rules which control priority in applying rules. For example, "A special law is prior to a general law," "An upper law is prior to a lower law," "A new law is prior to an old law" and so on. When it is possible to apply multiple legal rules to a case, it is necessary to control the reasoning by means of the meta rules. And it is necessary to build up an inference engine to control the priority. (The precise way is to be stated in section 4 below.)

The object being sought in legal reasoning is usually the affirmation of the existence of a legal relation, that is, the affirmation of the existence of a "right-obligation" relationship. In formalizing legal knowledge, therefore, regarding the relationship as a top-goal, the expression form is to be considered in which one can call into the variable domain the concrete data of the aspects of the legal relation according to the particularity of the case. In the world of legal knowledge as shown in Figure 1, each legal requirement and legal effect shares a reciprocal and systematic relationship with other legal requirements and legal effects. To express this relation properly, it is desirable to formalize each legal requirement as a unit. It is to be noted in the formalizing that in the legal practice each factor describes the various social relations ruled by law in natural language. The formalized unit must exactly describe such a variety. And the ex-

pression in natural language must always correspond to the description of the logical formalization with a high degree of regularity.

In order to realize the formalization easily and exactly, a formula of compound predicate logic by PROLOG was devised. The legal effect of a legal norm sentence(head of PROLOG), for example, would appear as in (1) of Fig. 2.

Fig. 2.
(1) Compound Predicate Logic Formula by PROLOG:

```
become_effective(ID1,T0,legal_act(ID2,M12,
contract(ID3,M2,M3,M4,Sale),
content(ID4,Have(ID5,T1,M5,M6 (ID7,T2,P1,M7,M8,H1,purchase-
price(ID8,M10,K3,Thing))))))).
```

(2) Predicate Logic Formula:

```
∀ID1, ∀ID2, ∀ID3, ∀ID4, ∀ID5, ∀ID6, ∀ID7, ∀ID8, ∀T0, ∀T1, ∀T2,
∀P1, ∀M1, ∀M2, ∀M3, ∀M4, ∀M5, ∀M6, ∀M7, ∀M8, ∀M10, ∀K3, ∀H1(
become_effective(ID1,T0,ID2)&
legal_act(ID2,M1,ID3,ID4)&
contract(ID3,M2,M3,M4,Sale)&
content(ID4,ID5)&
have(ID5,T1,M5,M6,ID6)&
duty(ID6,ID7)&
pay(ID7,T2,P1,M7,M8,H1,ID8,)&
purchase-price(ID8,M10,K3,Thing))
```

(1') Compound Predicate Logic Formula by PROLOG:

```
become_effective(id1,1986-5-1,legal_act(id2,fuji_corporation_and
mishima_yoko,contract(id3,fuji_corporation,mishima_
yoko,M4,sale),content(id4,have(id5,
1986_6_1,mishima_yoko,fuji_corporation,duty(id6,pay(id7,1986-6-10,
office(id6_1,fuji_corporation),mishima_yoko,fuji_corporation,
without_delay,purchase_price(id9,M10,¥370,000,english_conversation_
teaching_materials(id10,with(id11,advantage(id12,content(id13,can
(14,M11,go(id15,T3,P2,M12,M13,cheaply,overseas_travel))))))))))))).
```

(3) Simple Natural Language Expression:
"On May 1 1986(Fuji Corporation and Mishima Yoko establish((On June 1 1986 to Fuji Corporation Mishima Yoko(On May 10 1986 at the office of Fuji Corporation to Fuji Corporation Mishima Yoko Without delay(to Fuji Corporation ¥370,000(purchase-price of English conversation teaching materials with advantage of the content to go overseas travel cheaply)pay)duty)have)content (of sale between Mishima Yoko and Fuji Corporation)of contract)of legal act)effect has come into existence."
(4) Daily Parlance:
"On June 10 1986, at the office of Fuji Corporation, between Mishima Yoko and Fuji Corporation established contract of sale that Mishima Yoko pays to Fuji Corporation the purchase-price of English conversation teaching materials with advantage to go overseas travel cheaply."

In Figure 2, compound predicate logic formula(1) is the expressing form of predicate logic formula(2) by PROLOG. The formula(1') was obtained as the result of a unification of case. And it also corresponds to (simple)natural language expression(3). It can be put into a daily parlance(4) and has the specified logical structure of the legal meaning.

As shown in the correspondence of (1) and (2), the formula of compound predicate logic by PROLOG expresses the legal effect and legal requirement factors --- that compose legal norm sentences --- in the whole form as a compound sentence, logical conjunction of the component proposition, by dealing with slot of frame or case grammar as argument of logic. This style enables us to reconstruct the systematic relevance of legal rules with logical precision. We are able to analyze and express precisely the inner structure of each legal requirement factor of the legal rules. And by allocating a certain postpositional particles(as Japanese is a

postpositional language rather than a prepositional language, which is to say the particles are placed after nouns rather than before) for each argument, it is possible to put PROLOG sentences automatically into simple natural languages or conversely to put simple natural language(written according to the manual) into sentences understood by PROLOG automatically.

When we express the world of legal knowledge in the system, we do so in order to formalize natural linguistic expression of legal rules as it is. We have taken great pains to do so. It would be desirable to translate legal norm sentences into the language on the system within the structure of the natural language, and to change them according to logical inference rules and then in the same way retranslate the results into natural language as output. Thus, it is possible to prove a given legal conclusion as the output for the legal deduction from the given prepositions. As legal reasoning is logical proof, the legal judgement as the conclusion must be something indicated as a logical consequence following from the propositions, which are held to be currently valid. From the point of view of the mission of a legal expert system, it is important to show the conclusion to be valid, and the process to be valid as well.

3. THE CHARACTERISTICS OF LEGAL KNOWLEDGE

3.1 Open-Ended World Knowledge

Knowledge in the legal world is essentially open-ended. That is, in the world it is impossible to regard a particular knowledge- set as being always valid. This is so because of various factors, for example the increase or decrease in legal knowledge, as follows:

1) law : laws(legal norms) are constantly being established or abolished.
2) theory : valid knowledge is different according to theory.
3) contract : a contract is defined such that a law can be established as being valid only between the contracting parties(that is, "Prinzip der Privatautonomie").

This means that the knowledge-set particular only to the parties is added to the common knowledge-set.

Since a knowledge-set increases or decreases according to various factors, one should regard as the unit of knowledge an article of law which is considered a unit of increase or decrease of legal knowledge. However, such knowledge is closely interrelated, so it is necessary to set up a knowledge structure which is minimally influenced by the increase or decrease of knowledge.

3.2 The Characteristics of Legal Rules

When the knowledge, which is regarded as a unit by lawyers, is formalized into logical formulae, the legal rules will not always take a form of set of logical formulas. This can be explained as follows:

a) Enumeration and Exemplification

Enumeration and exemplification are included in legal rules. Suppose the formulas below represent:

$A \rightarrow P \quad B \rightarrow P$

When these rules are in enumeration, the logical meaning is:

A or $B \leftrightarrow P$ and

$\neg P$ can be deduced from $\neg A$ and $\neg B$

On the other hand, in exemplification, the logical meaning is:

A or $B \rightarrow P$

b) Priority of Legal Rules

In application of law, one rule is prior to the other, there being several legal rules applicable. In this case the prior rule is applied with priority. This is called, "Priority of Rule" in the legal terminology, but there coexist some priorities which should be logically separated from each other. In this paper, "Priority of Application" and "Priority of Ground" are separated.

4. KNOWLEDGE STRUCTURE OF THE SYSTEM

The knowledge structure is called a rule system which is defined in order to represent the characteristics of legal knowledge described in the previous section. The rule system itself is a general knowledge structure and independent of law.

4.1 Rule System

The rule system is expressed in the form : $(R, >_{ap}, >_{b})$. "R" is a set of rules, "$>_{ap}$" and "$>_{b}$" are binary relations defined on "R", which correspond respectively to priority of application and that of ground.

A rule is expressed in the form of <application condition, rule type, rule body>. The rule body is a Horn clause.

4.2 Rule Type

There are four kinds of rule types: Combination of Positive(P-type)/ Negative(N-type) and Exclusive(E-type)/ Inclusive(I-type).

When the rule body has the form $(P \rightarrow Q)$ and the rule exists by itself, each rule type means: PE-type: if and only if P, then Q; PI-type: if P, then Q; NE-type: if and only if P, then not Q; NI-type: if P, then not Q.

	P-type	N-type
E-type	PE-type	NE-type
I-type	PI-type	NI-type

4.3 Application Condition and Priority of Application

To formalize the priority of application, it is necessary to provide each rule with application condition. The application condition describes in what case a rule can be applied. Priority of application is a binary relation between rules. When a rule of E-type has priority, the rule excludes non-prior rules, and when a rule of I-type has priority, the rule is added to the non-prior rules.

Here we give the following example:

Rule A : Declaration of intention becomes effective at the time of its arrival.
Rule B : Declaration of intention to accept becomes effective at the time of the dispatch.

In this case, the application conditions are as follows:
The application condition of rule A : effectiveness of declaration of intention.
The application condition of rule B : effectiveness of declaration of intention to accept.
Rule A and rule B have a form of PE-type, and rule B $>_{ap}$ rule A.
Thus, in determining the time when the declaration of intention to accept becomes effective, it is possible to apply rule A and rule B. However, only rule B can be applied in this case because rule B is an E-type rule, and hence prior to rule A.

4.4 Priority of Ground

Priority of ground is also a kind of priority of rule. It is a binary relation between positive and negative rules, and it plays a role in deciding which conclusion of rules is prior when the proof of both rules is successful and the conclusions are inconsistent. The following's an example:

Rule A : Birds fly. Rule B : Penguins do not fly.

Both rules are applicable to a penguin but the conclusions are inconsistent. In this case, the conclusion that "penguins do not fly" is prior because rule B is prior to rule A.

4.5 The Semantics of the Rule System

The Semantics of rule system$(R, >_{ap}, >_{b})$ is expressed by way of determining the truth value of a given proposition G.

1) Selection of applicable rules: A rule set R_1 in which rules are applicable(i.e. when application conditions are satisfied) to the given proposition G is selected from rule set R.
2) Exclusion of rules by priority of application: a)when R_1 involves a rule of PE-

type, the maximum rule(MaxPE) of application is selected from all the PE-type rules in R_1. Let R_2 be a set of rules which excludes all the rules(P-type, N-type) posterior to MaxPE from R_1. If R_1 includes no PE-type rules, $R_2 = R_1$.
b)when R_2 involves a rule of NE-type, the maximum rule(MaxNE) of application is selected from all the rules of NE-type in R_2. Let R_3 be a set of rules which excludes all the negative rules(N-type) posterior from MaxNE in R_2. If R_2 involves no NE-type rules, $R_3 = R_2$.
3) Decision Making Procedure: Rule set(R_3) is divided into a set of positive rules(R^P) and negative rules(R^N). Let R_P be a rule set in R^P which can prove the proposition G, and likewise R_N in R^N.
a) If $R_P \neq \phi$, $R_N = \phi$, then G→true.
b) If $R_P = \phi$, $R_N = \phi$, then, if R^P involves PE-type rules, G →false, regarding rules of R^P as enumeration; if R^P involves no PE-type rules, G → indeterminate, regarding rules of R^P as exemplification.
c) If $R_P = \phi$, $R_N \neq \phi$, then G→false.
d) If $R_P \neq \phi$, $R_N \neq \phi$,
If $\exists r_P \in R_P \quad \forall r_N \in R_N \quad r_P >_b r_N$, then G→ true;
If $\exists r_N \in R_P \quad \forall r_P \in R_P \quad r_N >_b r_P$, then G→ true.
In the other cases the knowledge structure is not well-defined.

4.6 Rule System and the Characteristics of Legal Knowledge

We explain the correspondence of rule system to the characteristics of legal knowledge.

1)Since a rule system consists of a rule set and binary relations defined on rule set, increasing or decreasing rules means an increase or decrease in the relevant binary relations and thus affects nothing else.

2)To separate enumeration from exemplification it is assumed that in the former the main rules are E-type and the rest are I-type. In the latter, all the rules are I-type. This separation is made so that in adding exemplifying rules it is not necessary to know whether existing rules are in enumeration or in exemplification.

3)Priority of rules means priority of application and that of ground.

4.7 Method to Introduce Priority of Rules

In introducing a binary relation of priority of application or of ground into a rule set, it is not practical to enumerate binary relation between rules. In the legal field, the following method is used. Priority of application and ground are commonly introduced as priority of rules.

a)Direct Explicit Method

An article of law provides the priority to the other articles in itself: "when····, ·····, in spite of the provision of the article."

b)Comparative Method of the Character of Rules

For example, "An enforceable law is prior to an adoptive law," "A special law is prior to a general law." In the former, the priority is decided according to whether the rule is enforceable or adoptive. In the latter, according to whether the rule is special or general.

c)Comparative Method of Rule Set

For example, "A written law is prior to an unwritten law." The priority of a rule depends on the priority of the rule set to which the rule belongs.

d)Method to Give a Character to the Rule Itself

For example, "·····except as otherwise provided by other laws." In this case, the rule itself shows that it has the least priority.

5. FUNCTION OF LES-2 SYSTEM

5.1 Architecture of the System

The architecture of this system is shown in Figure 3. The system is provided with a knowledge base of legal rules, inference engines of the substantial and the procedural laws, an explanation module, and a suit game module.

5.2 Knowledge Base

This system has substantial and procedural rules as legal knowledge.

5.2.1 Substantial Law Rules

Substantial law rules are expressed in the clause below:

rule(ID,source,theory,priority_data,rule_type,application_condition,rule_body).

The argument of rule has the following meaning.

1)ID is an identifier of the rule.

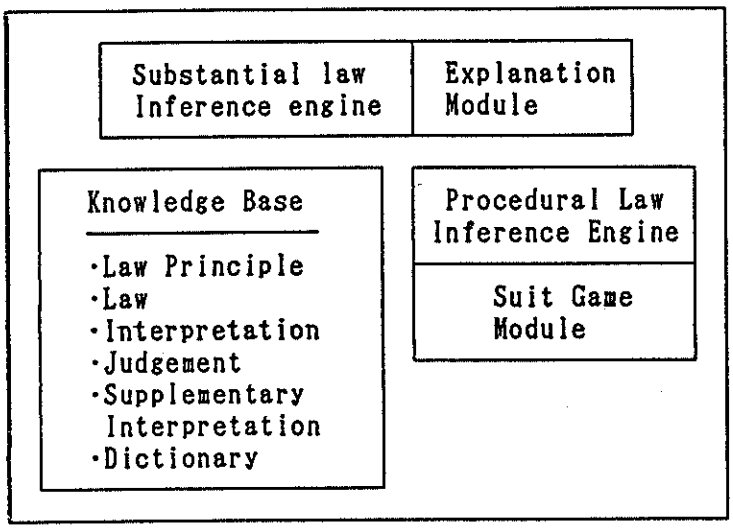
2)Source means the name of law from which the rule is derived.

3)Theory is the person's name who asserts the rule.

4)Priority data, which is used to decide priority between rules, involves other infomation, such as the name of the law.

5)Rule type and application condition are the same as described in section 4.

Fig. 3.



6)The rule body means the legal rule itself. The rule body is expressed as follows.

"A contract is established when the offer and the acceptance both become effective, except in those cases where the offer has become ineffective."

rule(id,_,_,p(civil_law,···),PE-TYPE,
established(···,contract),
established(···,contract)←
become_effective(···,offer),become_effective(···,acceptance),not(become_ineffective(···,offer))).

A "not" used in the rule body means not only logical negation but also expresses the distribution of responsibility of assertion in inference of procedural law. Thus, if the rule body is expressed in the formula: G: ¯A,B,not(C)., it is expressed in the logical formula: A & B & ¯C → G, in inferring in substantial law and the
responsibilities of assertion and proof are distributed in the formula: {A,B} and {C}, in inferring in procedural law.

5.2.2 Procedural Law Rule

Procedural law rules are ones used for deciding the truth values of the propositions in procedural law, that is, the asserted propositions of procedural law and fact, and are high order rules. The example is as follows(the first argument is a procedural rule body, and the second is the explanatory sentence):

```
procedural_rule((judicial_confession(P):-
      main_fact(P),subsumption(P),assertion(plaintiff,P),
      assertion(defendant,P)),the_accordance_of_the
asserted_propositions_of_both_parties_becomes_judicial_confession).
     procedural_rule(
     (base_of_suit(P):-
     judicial_confession(P)),the_confessed_pro_
```

positions_comes_the_ground_of_judgement_
as_the_truth_of_suit).

5.3 Substantial Law Inference Engine and Explanation Module

Substantial law inference engine provides the given case with a conclusion for the legal judgement(or truth value of suit of the proposition), and realizes the subset of the inference described in section "4.5 The semantics of the Rule System."

The inference is backward reasoning with priority control added. Given the goal G, it resolves the goal by the following procedure;

1)It extracts the rule set R_3 used to resolve the goal G according to the procedure of "1) extraction of applicable rules" and "2) exclusion of the other rules by priority of application" in section 4.5. In this procedure, "A special law is prior to a general law" and "An enforceable law is prior to an adoptive law" appear as legal knowledge in deciding the priority of application of rules.

2)It divides the rule set R_3 into a positive rule set R^P and a negative one R^N.

3)It resolves the goal G by the positive rule set R^P and gets the solution G_i. The rule used to get G_i is R_i ($R_I \in R^N$).

4)It determines whether the goal can be resolved by the negative rule set R^N or not. Comparing the priority of ground of the all rules ($R_I \in R^P$) resolving G_i with that of rules R_i or R_j which derived G_i, if R_i is prior to all the R_js which belong to R^N, and it resolves G_i, then G_i is the solution for the goal G.

An explanation module is the one to explain this inference process, and it enables a user to traverse the "proof tree" of inference.

5.4 Procedural Law Inference Engine

Procedural law inference aims to infer a conclusion(judgement) of procedural law, putting in the argument or evidence of the parties and gives truth value to the procedural law propositions. A higher order rule is used for expressing the truth value. The distribution of responsibility of assertion and proof is processed and determined by an inference engine according to an expression form of substantial law rules. Moreover, the process structure of suit and the flow are also built into the inference engine.

5.5 Suit Game Module

A suit game module can simulate a legal case. Using a procedural law inference engine, it infers the condition of suit action(here, assertion and plea) of litigants(plaintiff, defendant) and the weight of evidence in civil action. Furthermore, it models the interlocutory judgement according to the proceeding of the suit and finally the conclusion of the definitive judgement.

6. The DEMONSTRATION OF THE LES-2 SYSTEM

6.1 The Demonstration of Inference of Substantial Law

In the inference of substantial law, a case is, first, put into the system from the file(it is made with the editor using simple natural language). As the second step, the goal, the goal of the legal judgement, is put in using simple natural language. Then, the system starts to run for the goal, being implemented with necessary data by Q & A between the user and the machine.

In Figure 4 below, this Q & A is described.

a)[5]: As it is short of the data of "Offer's become effective" to reach the goal, the system questions the user.

b)[6]: The system questions the time of the arrival of the offer, as the rule of "Declaration of intention's become effective"(Art.97I, Civil Law) is applied to solve "Offer's become effective".

c)[7]: The goal has been solved. Here, the system does not question the time of the arrival of the acceptance to solve the goal, while acceptance is also declaration of intention. This is because the system applies the special rule(Art.526I, Civil Law) according to the meta rule that a special law is prior to a general law.

That is, the system performs the priority control of application of the rules, so that it reasoned by applying the same article.

6.2 The Demonstration of Simulation on the Civil Procedural Law

To simulate the suit in inference on the civil procedural law, first of all the user puts in the object of the claim:"The defendant should pay the money ...to the plaintiff," and the cause of the claim. Then the plaintiff and the defendant can put in their assertions. The user may output the interim conclusion on the point of civil procedural law with the comment thereof, by putting in the judge command at a certain point.

Figure 5 shows the dialog between the user and the computer. Input is done using the "simple natural language translation method"(see [1]). This method can automatically translate natural language which is input with parenthese "( )"and space according to the manual into PROLOG sentences. From the demonstration step[2], it is expressed in ordinary natural language.

a) [1]: Input of the object and the cause of the claim in the complaint.
b) [2]: Input of the pleadings
   [3]: Input of the fact freely asserted
c) [4]: Example of judge report of judge command.
   The object of the claim and pleading, the
   cause of the claim, the plea, and the conclusion
   of the system are described in order. Here only the last one is shown.

Fig. 4.

[The content of the input data is enclosed in quotation marks, i.e. " "]

Example of question & answer in inference on the substantial law.

[1]Input of case file:

"On May 10 1986, Fuji Corporation sent to Mishima Yoko a letter stating that they wanted to sell her English conversation teaching materials and in return for her buying said materials Fuji would provide certain travel discount for her. On June 1 1986, Mishima Yoko mailed the notice stating that she wanted to buy the English conversation teaching materials. The notice reached the letter box of Fuji Corporation."

[2]Setting up of the goal to be solved:

"(contract) has been established"

[3]Start of inference:

[4]Q(uestion) and A(nswer):

[5]Q: Is there the fact that the intention of offer of the sale with Mishima Yoko reached at the time of X ?

A: "y"

[6]Q: Put in the content of X.

A: "May 13 1986"

[7]Conclusion of inference:

From the present case has been proved: the legal act of the contract of sale has become effective;
on June 1 1986, to Mishima Yoko, Fuji Corporation has a duty to transfer the right of property of English conversation teaching material with advantage to go overseas travel cheaply, and to Fuji Corporation, Mishima Yoko has duty to pay the purchase-price of ¥370,000.

Fig. 5.

[1]Put in the content of the complaint:

Name of the party:

plaintiff: "Fuji_Corporation"; defendant: "Mishima_Yoko" Object of the claim:

"Mishima_Yoko should_pay purchase-price_of_¥370,000 to_Fuji_Corporation"

Cause of the claim:

"(contract of(sale of(content of(on_June_1_1986 to_go_mishima_yoko fuji_corporation(has(duty to(transfer(property of(english_conversation_teaching_material))))),

to_fuji_corporation mishima_yoko(has(duty to(pay(purchase_price ¥370,000)))))))has_become_effective"
[2]Put in the content of the pleadings:
1. Approve or not approve the assertion of the plaintiff:
The assertion of the plaintiff 1 [·····] : "argue"
The assertion of the plaintiff 2 [·····] : "approve"
2. Put in the new assertion of the defendant:
"declaration and intention in_declaration_of_intention were_inconsistent"(abbreviated)
[3]Assertion mode: Put in the additional assertion:
"·····(abbreviated)"
[4]Example of judgement report.
The conclusion of the judgement from the object of the plaintiff and the plea of the defendant:
From the argument and the examination of evidence, the first cause of claim of the plaintiff and the first plea of the defendant are approved, and the plaintiff will win the suit.

7. CONCLUSION

The central feature of this research is that the project was completed by combined work of experts, such as jurists and knowledge and information scientists. Through this cooperation, we did not always make ourselves understood because we work in different research areas. However, the cooperation provided the prime result that the jurists' analytical skills were converted to information, and scientists converted that into a technological system fpr analyzing legal decisions.

In constructing the system, we developed knowledge processing equal to the structure of law and legal reasoning, for example, the priority control of application of rules. There are many problems remaining. We could indicate the restricted number of the rules above all, at most 150 or so, which are selected from the general provisions and claim(contract) of civil law and a part of civil procedural law. However, our efforts brought into focus the realization that a system may be applicable to all laws in private law area. Of course, it is necessary to analyze and systematize legal rules more deeply and increase the number of rules for the system as a legal expert system to work in the field of law. As for the interface, we used simple natural language translation to input and output the data, but have much expectation for the study of natural language processing in the near future.

This system has been developed with an eye towards legal artificial intelligence, and therefore there must be further research done in order to realize a system for practical use. However, we think that the system could show a base for legal artificial intelligence. Moreover, the system is provided with the system structure which works as legal education developing system or a practical system in other areas. Based on the result and problems obtained in the LES-2 system, we are determined to seek ways of solving the remaining problems.

ACKNOWLEDGMENT

This study resulted from integrating research of various problems. The researches could not be realized without many supporters. This study was greatly supported financiallyby Grants in Aid for Scientific Research of 1985 and 1986, Ministry of Education, Culture and Science, Japan as well as by Grants in Commission Research of 1985, ICOT. For having made this study possible, for having provided the information on which it is based, we are greatly indebted to Dr. Koichi Furukawa(Chief, Second Research Laboratory, Research Center,ICOT)as well as the researchers of ICOT, Mr. Masahiro Yamamoto(Manager, Computer System Research Laboratory, C&C Systems Research Laboratories, NEC Corporation), Mr. Takuji Ikeda(Manager, Police and Justice Sales Department, EDP National Government Systems Division, NEC Corporation), fellows of Meiji Gakuin University and the members of

LESA.

REFERENCES

Cory H T, Hammond P, Kowalski R A, Kriwaczek F and Sergot M J(1985) The British Nationality Act as a Logic Program. Depart. of Computing, Imperial College, Univ. of London

Ikeda J (1984) Interpretation and Application of Law by Artificial Intelligence Language. Nikkei Computer 1984.7.9: 197-209; 1984. 7.23: 179-190

Ikeda M, Tanaka H (1985) Expert System of Copy-right Law. Proceedings of Japan Society for Software Science and Technology, pp.1ff

McCarty L T (1980) The TAXMAN Project: Towards a Cognitive Theory of Legal Argument. in: Niblett T B (ed.) Computer Science Logic and Legal Language, Cambridge University Press, Cambridge, 23-43

McCarty L T (1980) Some Notes on the MAP Formalism of TAXMAN II, With Applications to Eisner V. Macomber. Technical Report LRP-TR-6, Laboratory for Computer Science Research, Rutgers University.

Nitta K, et al.(1985)Problem Solving Function of Expert System of Industrial Property Law. Proceedings of the Logic Programming Conference'85

Nitta K (1985) A Knowledge Representation and Inference System for Procedural Law KRIP/L. Proceedings of Japan Society for Software Science and Technology, pp. 65ff

Ohta S (1983) The Base of Proof Theory in Civil Action. Kohbundo, Tokyo

Yoshino H (1981) Die Logische Struktur der Argumentation bei der Juristischen Entscheidung. in: Arnio A,u.a.(Hrsg.), Methodologie und Erkenntnistheorie der juristischen Argumentation, Rechtstheorie Beif. 2, S. 233ff

Yoshino H (1984) An application of Computers to Reasoning in the Judicial Process. Law and Computers No.3; pp. 77ff.

Yoshino H (1986) A Possibility of Legal Expert System. ICOT Commission Research Report'86

Yoshino H (1986) Legal Expert System as A Legal Reasoning. 86-IS-11 Proceedings of Japan Society for Software Science and Technology Vol.86, No.43