MedTrad+: An Expert System for Traditional Medicine

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Abstract - In this paper, we propose an expert system generator which is based on the use of icons rather than textual content to represent facts. It has been designed, implemented and used to create an expert system in the African traditional medicine where actors are often illiterate. Thanks to its iconic interface which is suitable for traditional medicine practice knowledge, this system will enable users to be totally independent, they don't necessarily need intermediaries in the management and usage process of their own knowledge base.

Keywords: Knowledge base, Knowledge-Based system, traditional medicine, medicinal plants, iconic interface.

1 Introduction

Traditional medicine holds a prominent position in developing countries’ health policy, and mainly those countries in Africa. According to WHO’s 2007 report [1], up 80% of the African populations use traditional medicine to satisfy their health needs. However, this ancestral knowledge that its practitioners jealously transmit orally to other generations is passing away with the disappearance of these practitioners. Knowledge-Based Systems (KBS) have then been conceived in order to preserve them. [8] [7] [4]. The cognisor is the exclusive manipulator of the system in these KBS. The KBS interface is badly hooked to traditional medicine, whose users are not computer science specialists. In fact, most traditional medicine practitioners are reluctant to use the informatics tool at best because they are illiterate and worse because they refuse to share their knowledge and know-how with other persons. To remedy this problem and make the practitioners trust the informatics tool, we have proposed an expert system that we have called MedTrad'. The new system is based on the use of icons which are more suitable to the traditional medicine practitioner’s culture. The system will allow practitioners to get rid of intermediaries, in order not only to feed their own KBS, but to update it, and submit it requests.

We will present existing works on it in chapter2, and the description of MedTrad'' in chapter3. Chapter4 displays the usage procedure of MedTrad'', and the conclusion makes the point of the work which has been conducted.

2 Material and methods

2.1 Existing works

The traditional medicine issue has been tackled in the process of conducting the following works:

The SEIGOGA expert system [8] allows the identification of plants in an iconic way and the tracking of their curative virtues. Another system allows the capture of a patient’s symptoms interactively, and the arrival to diagnosis, followed by some recommendations in terms of curing with plants. Knowledge on diseases is represented with rules. This system is based on a geographic exploitation, which requires some competence from the user (i.e. dividing the screen into several zones and choosing functions and comparison operators...).

MEDTRA system [7] is a traditional medicine Knowledge Base (KB) creation tool, which will move towards a multi-expert system that deals with plants. Although it generally concerns African natural medication substances it is particular to Cameroonian ones. This system is not meant for herbalists mainly, but rather for experts who are involved in its conception (i.e. computer scientists, botanists, biochemists, chemists, pharmacologists, and agronomists).

The MedTrad [2] [3] system is based on the exploitation of a concept base on medicinal plants. Its objectives are on the one hand to capitalize the African ancestral knowledge on physiotherapy which present rational aspects and convincing results as felt by numerous African researchers [1], [10] and [12]. On the other hand it brings support to traditional healers in their diagnosis process and their attempt to propose rigorous therapy. This system is a Web application which includes a database but does not allow any inferences.

2.2 GExpert+ architecture

GExpert is an expert system generator ranks 0+ that the IUT of Bayonne (France) developed then the students of INP-HB of Yamoussoukro (Côte d’Ivoire) improved [9] by adding to it an iconic graphic interface (GExpert+). The KB contains all the information which is specific to the field in terms of facts and rules.
MI is a program which knows how to use the KB to solve a problem. It models the expert’s reasoning within the system. It uses two modes of reasoning: front chaining and back chaining. The iconic interfaces facilitate communication between the system and the user or the expert.

Knowledge acquisition module is a tool that helps the expert to structure the domain knowledge, to identify and formalize the domain concepts. Work Memory or Fact Base contains the proper facts which relate to a problem that requires a solution. The Tracker enables the explanation of the WM reasoning system by providing a hint which is made of applied rules in order to check a given hypothesis (Table 1).

2.2.1 Icons in GExpert

The particularity of GExpert is its use of icons to represent facts instead of their textual content. This benefits the creation of expert systems which are accessible to illiterate informatics users. Their use permits to set a universal communication system between system users, depending neither on the language that we speak (French, English, etc.) nor on our origins (ethnic language), nor on our tradition [5] [6]. They can be created in conjunction with other icons as displayed in table 2.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Diseases</th>
<th>Plants</th>
<th>Medications</th>
<th>Dosages</th>
<th>Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge acquisition module</td>
<td>Knowledge Base (KB)</td>
<td>Traker</td>
<td>Inference Engine (IE)</td>
<td>Work Memory (WM)</td>
<td></td>
</tr>
</tbody>
</table>

This malaria representation displays an image of insect over a patient. This means that the insect dominates the patient or it causes the disease.

2.2.2 Rules representation

KB includes all the information which relate to traditional medicine. It involves four kinds of rules:

- **Diagnosis rules**: Their hypothesis contain the symptoms and their conclusion the diseases. Example: IF fever AND headaches AND bile vomits THEN malaria.

Table 3: Malaria diagnosis.

- **Therapeutic rules**: Their hypotheses contain the diseases and their conclusion the plants. Example: IF malaria THEN Azadirachta indica or IF malaria THEN papaya root.

Azadirachta indica is the scientific name of neem

Table 4: Healing prescription.

- **Medication preparation rules**: The rules show how medication recipes are prepared. Medication1: Grind a male papaya root and mix it with lukewarm water.

Table 5: Preparation of medication.

- **Taking rules of medication**: They show how to take the medication and the way to take it. Example: Medication1 is taken twice a day in compliance with a purgative method

Table 6: Taking procedure of medication1.

2.2.3 Iconic language grammar

A formal grammar has been designed with regard to herbalists’ language in GExpert+. This ensures that adding a rule to KB remains a coherent process; this also means that the added rule is consonant with the syntactic rule (diagnosis, therapeutic rules, etc...). For instance, the conclusion to a diagnosis rule must simply relate to a disease. Here are below
the main rules of this grammar. Their edition has been based upon this grammar.

3 Results

3.1 MedTrad\+ architecture

A web interface helps the traditional medicine practitioners to manage and use his KBS (Table 8). The inference engine has been developed as a CGI (Common Gateway Interface) program in third part architecture as shown in table 7.

Table 8: MedTrad\+ Web interface.

![](image1.png)

Table 7: MedTrad\+ Architecture

1. The client submits a query request containing the data of the problem and the hypothesis to be tested in the Application server.
2. The Application server sends the facts and the rules to the KB or sends the data of the problem and the hypothesis to be tested to the inference engine (CGI program) that runs it and returns the response.
3. The CGI program returns the result of the execution of the request to the Web server.
4. The Web server returns the response to the client.

3.2 Use of MedTrad\+

The first step consists in creating a KB. Table 9 shows the fact base and Table 10 display the creation of a relating rule by catching the bases upon which they rest, with their subsequent conclusion.

Table 9: MedTrad\+.fact base

![](image2.png)

Table 10: Devising rules with MedTrad\+.

*<diagnosis> \rightarrow \quad \text{if <symptom> then <disease>}
<symptom> \rightarrow \quad \{ <sign> \}
<sign> \rightarrow \quad \text{fever | general pain | ... | headaches}
<disease> \rightarrow \quad \text{fever | malaria | ... | coughs}
<curing> \rightarrow \quad <medication> \quad <disease> \quad \text{if <disease> then}
<medication> \rightarrow \quad <dose> \quad <taking procedure>
<dose> \rightarrow \quad <part of plant> <preparation>
<taking procedure> \rightarrow \quad \text{two purgatives a day | ... | three glasses a day}
<part of plant> \rightarrow \quad <stem>|<flower>|<root>|<bark>|<leave>
<preparation> \rightarrow \quad \text{grind | boil}
<stem> \rightarrow \quad \text{Acacia stem | ... | neem stem}
<flower> \rightarrow \quad \text{Acacia flower | ... | neem flower}
<root> \rightarrow \quad \text{Acacia root | ... | neem root}
<bark> \rightarrow \quad \text{Acacia bark | ... | neem bark}
<leave> \rightarrow \quad \text{Acacia leave | ... | neem leave}
The second step of the process is concerned with the effective use of the system. Table 12 displays the deduction of Malaria together with the plant that cures it after grasping its symptoms which are included the rule below (table 11).

### Table 11: Facts in working memory.

![Image](image1.png)

**Table 12: Detecting disease with MedTrad.**

![Image](image2.png)

## 4 Discussion and conclusion

### 4.1 Discussion

The analysis of the results shows that all traditional medicine practitioners can use the system MedTrad+ to build its knowledge base with very little help. This assistance is limited to scan the images and icons to install on his machine. traditional medicine practitioners may grant rights to query other users. MedTrad+ certainly can not replace a traditional medicine practitioners, but it can be used to: provide medical assistance to patients, learning herbalism, learning traditional medicine.

Traditional medicine practitioners that wins with this system? MedTrad+ can allow it to sustain its knowledge, bring awareness for this on the web, increase productivity, increase its customers easier and cooperation with other healers.

### 4.2 Conclusion

Our goal was to conceive an expert system for traditional medicine. First of all, the work required that a GExpert+ be conceived. This conceived tool is a generator of an expert system, the main purpose of which is to use icons to represent facts. GExpert+ has then allowed the realization of the MedTrad expert system that traditional medicine practitioners are able to use more easily. Traditional healers from Yamoussoukro region are working toward its validation, and it includes 134 facts and 66 rules. This is also followed by an attempt to conceive a MedTrad iconic language interpreter, which will permit a non-recurring KB to remain in a coherent state of use.

## References


