Web based Expert system for the prevention, diagnosis and treatment of Malaria using two Ethiopian local languages (Amharic & Afan Oromo)

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ABSTRACT

It is estimated that a child is killed every 30 seconds and there is an annual report of 500 million Malaria cases in Africa [1]. To get the best of care, the patient may need the advice of several specialists over the course of time and with their own languages. Although major medical centers can and do provide such an adequate spectrum of services, those economically disadvantaged or remotely located cannot or do not receive such an intensive concentration of assistance. This problem is especially acute in underdeveloped countries, where even the supply of physicians, nurses and technicians is very limited [2].

The main focus of this research project is to develop and use Malaria expert system to provide support in the Prevention, prediction and diagnosis of malaria using the two widely spoken languages in Ethiopia (Amharic and Afan Oromo). There are still some problems in creating such systems as most people in rural areas of Ethiopia are illiterate and computer literacy cannot be expected from them. We are convinced as such systems are needed to be developed in regional languages. Such systems are required to make available to village area through blocks or village administration units. In addition to this the possibility to communicate with the system by text, pictures and sounds will provide extra advantages. Adding speech interface to such systems may be proved to more beneficial to the people of remote areas. Even illiterate people can interact with speech interface based expert systems and get benefits.

Key Words:- Malaria, Expert system, prevention, prediction, diagnosis

1. RESEARCH PROBLEM

The ever increasing population rate of Ethiopia requires a need of more health personnel. There is also a shortage of hospitals, dispensaries, maternity and child health centers. The problem is even worse in rural areas where there are very less number of health centers. The health personnel to population ratio in Ethiopia have improved over the past two decades. But majority of these health personnel are available in urban areas. The rural areas have still very low health professionals to population ratio [2]. This shows that many people are still living without general health facilities (like essential drugs, safe water etc.). Medical expert systems designed using local languages can play here a major role by providing support in common clinical problems like prediction of diseases, prevention of diseases, diagnosis of diseases, counseling of the patients etc. Such programs would be very handful in rural areas where there is a shortage of health personnel. To achieve positive results in the fight against Malaria dissemination in Ethiopia, the application of Artificial Intelligence (AI) should be taken on board.

2. OBJECTIVES

The main Objective of developing Malaria Expert system with embedded Amharic and Oromifa languages are:- To assist medical personnel in the diagnosis and treatment of malaria with their own language, To improve management of malaria patients in remote areas of the country with a shortage of Medical Personals using Amharic and Afan Oromo Languages, To formalize and document knowledge on malaria using the widely spoken local languages Amharic and Afan Oromo, To design and develop a user friendly web based Malaria expert system that will take into account practical considerations like cost, ease of usage and integration with its working environment using Amharic and Afan Oromo Languages.

3. METHODOLOGY

The knowledge acquisition and elicitation stages of the system were achieved using questionnaires and interview techniques, a visit to at least to 5 Malaria affected areas were made so as to gather sufficient information for this stage. The knowledge gathered from these processes were analyzed and represented in the form Knowledge base engine. Rapid prototyping, using a simple expert system shell, were used to develop the system due to its simplicity and fast learning nature.

Our System were implemented using backward chaining rule, as this enables the system to prove one particular hypothesis at a time before moving on to another hypothesis. The results from the initial analysis were discussed explicitly with the consultants and after further revisions, converted into decision tables which, in turn, made up the rule sets that will provide the decision support for the expert system strategy [3]. Questions supporting the action-oriented strategy will be asked in two formats, 1. The first question will be directed at the user of the system to enable him or her to observe the patient, 2. The second question will be directed at the patient to find out his/her condition.

During consultation with our system, a series of questions will be asked either in Amharic or Afan Oromo language in order to prove that the patient actually had a particular identified sign or symptom (An ICT expert will assist the patient to enter data to the system) . For example to prove that a patient had cough or diarrhea a set of 3 or 4 questions will be asked in different combinations depending on the patient's prevailing condition and age. Thus, questions will be asked that are relevant to a particular hypothesis. The system will also give explanations as to why a particular question is asked as well as how it arrived at the diagnosis of the disease and how certain it is regarding the diagnosis. The system will take into consideration cases where a particular sign might be caused as a result of medication or the patient's travel history. A typical consultation will be made where different questions will be asked in different combination to prove or disapprove a rule set. Depending on the patient and user's response to questions; the system will generate the next question. Hence, all approved rule-sets then combine differentially to reach a decision and order an appropriate Medicine for the disease. All these things will actually be processed by using the two local languages Amharic or Afan Oromo.

4. DESIGN PHASE

4.1 Model and sequence diagram of the Expert system

The model depicted below (Fig. 1.1) is selected to develop the web based malaria expert system with an embedded Amharic and Afan Oromo Languages

The Malaria Detection Expert Shell is used to consult a user to detect about the vulnerability to malaria infection. The shell prompts the user to submit information about personal details, symptoms and feelings, and medical treatment results to find out the chances of getting malaria infection. Submitted information is used only to be processed and give a clue about malaria infection; it will be temporarily deleted soon after conclusion/s is/are made. A template of inferring a conclusion is prepared referencing a medical procedure with the help of medical experts to diagnosis malaria infection based on asserted symptoms and medical results. The software inference engine is designed and developed considering well known symptoms and medical results about malaria infection. Controlled inputting mechanism is implemented to monitor in/valid inputs to enable the system to generate a range of valid outputs. The validity of the system output is ranged markedly by error tolerance factor, i.e. percent of accuracy combined with error tolerance factor will make up the output. Recommendation is one of the outputs that indicate what the user should do next to evaluation. The recommendation goes far to prescribing medical treatments. However, all output solely depends on the information the user submits.

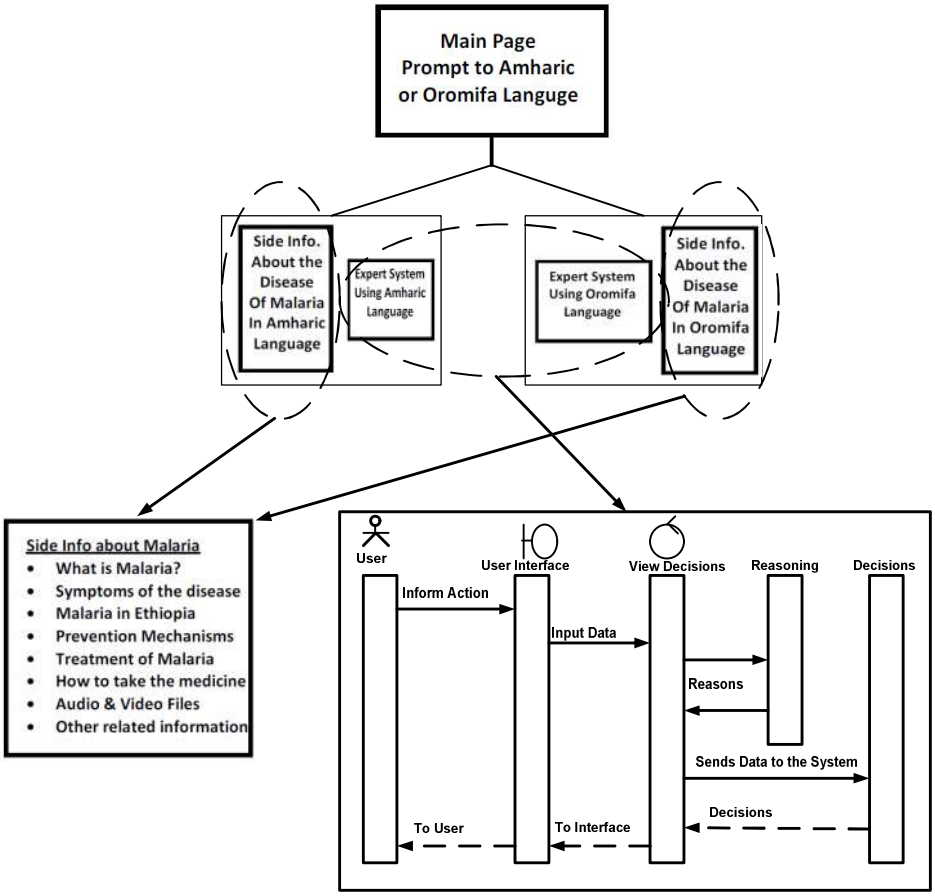

Fig. 1.1 Model and Sequence Diagram for the expert system shell

4.2 General Sequence diagram of the system

This General sequence diagram shows exclusively the interaction with the Shell, considering the User has already performed the Initialization steps.

4.2.1 Initial Step-By-Step Description

1. The Shell displays a window that prompts the User to response personal details
2. The User selects answers accordingly
3. The data is recoded in to the Knowledge base
4. The Shell displays a window that prompts the User to response about symptoms sequentially
5. The User selects answers accordingly
6. The data is recoded in to the Knowledge base
7. The Shell displays a window that prompts the User to response medical test results
8. The User selects answers accordingly
9. The data is recoded in to the Knowledge base
10. The Shell request data for inference
11. The Knowledge base returns the requested data.
12. The Shell display outputs
13. The Knowledge base delete recorded data
14. The Interface changes the content to show the first page.

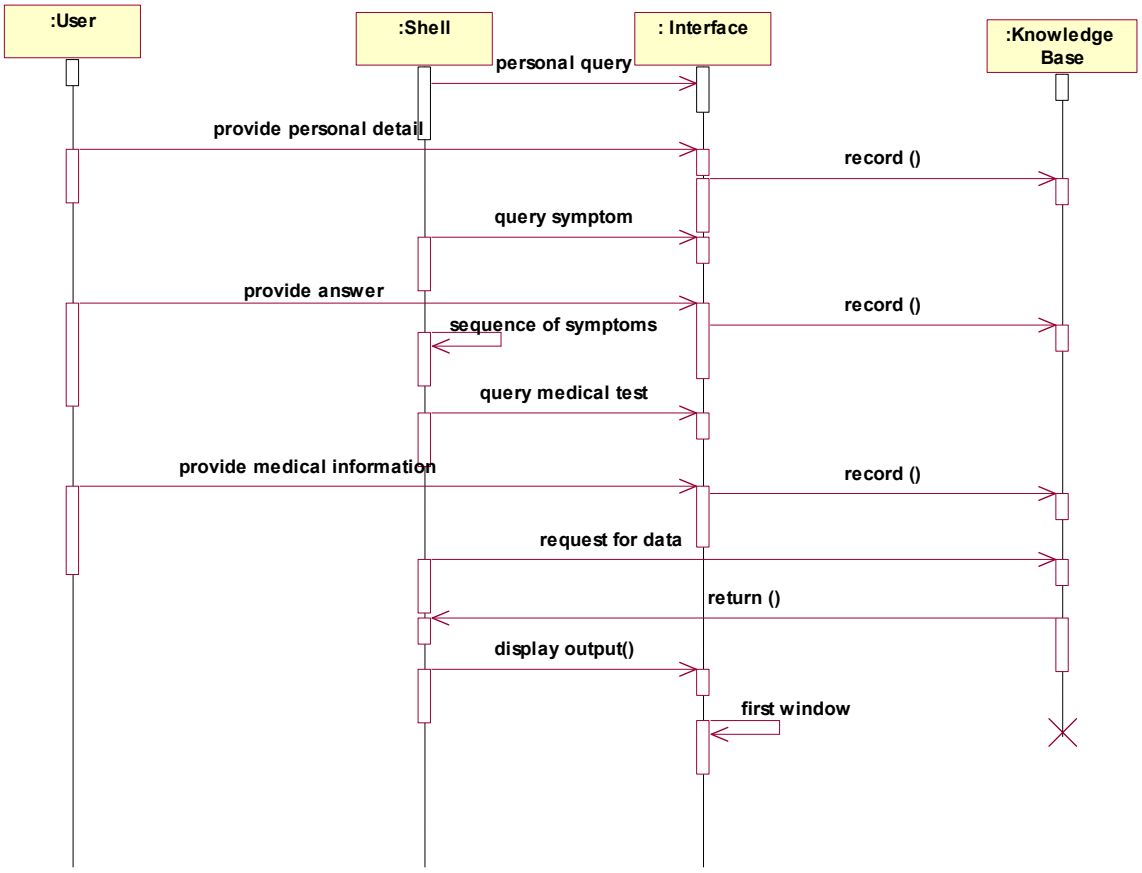

Fig. 1.2 View of General Sequence diagram

4.3 Sample User Interfaces

4.3.1 User Interface Specification

The anticipated users of the system are rural people with the help of a trained person. The training focuses on how to browse through the system with minimal effort

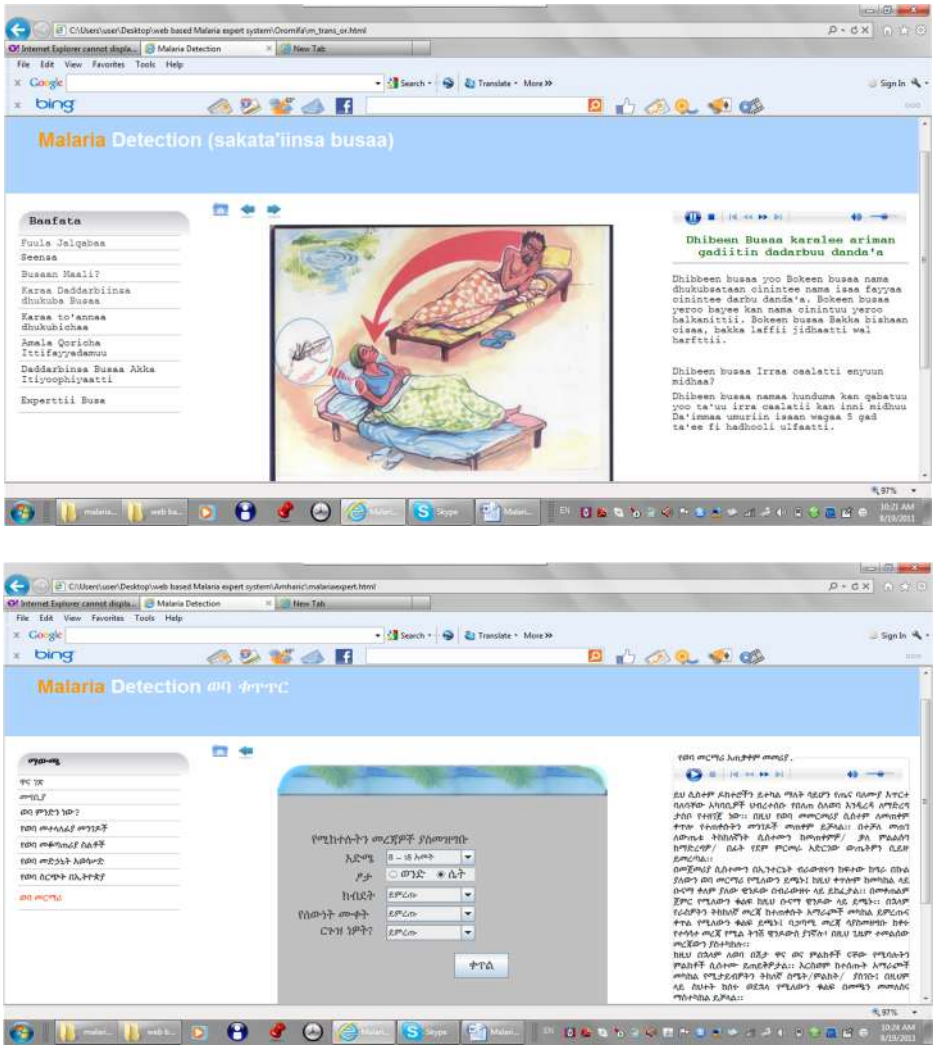

Fig. 1.3 Sample user interfaces

5. CONCLUSION AND RECOMMENDATIONS

In conclusion, the desired enhancement in preserving knowledge about the prevention, diagnosis and treatment of Malaria using two Ethiopian local languages (Amharic & Afan Oromo) is achieved. The system is working on a standalone system and it can be uploaded to the Internet so that it will easily be accessible to many health practitioners with ease at remote areas where there is an Internet facility. Government Internet extension programs should ensure that every health center has Internet accessibility as well as reducing costs for Internet connection for affordability. It should also devise means of reducing costs of computer related systems as a way of encouraging people to train and buy them.

The Ministry of Health should ensure that all people involved in malaria treatment have minimum knowledge about malaria treatment and basic computer skills. This helps them to give correct advice to patients and benefit from the system developed for them. The government should also look for ways of reducing acquisition costs of medical laboratory equipment as a way of encouraging the private sector to set up improved laboratories for efficient and reliable malaria diagnosis. The government should also extend electric power to the rural areas and where possible reduce on the costs for affordability of the rural in order to support such new projects. The government should also open and fund research centers to explore new information and given a chance to keep updating the developed scalable system with new facts.

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