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Online Expert System Based on Raga Chikitsa for Health Care

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ABSTRACT

Music is used to change mood in everyday life and to maintain physical and psychological health of human being. Number of research papers on Raga Chikitsa (Music Therapy) evaluated the evidence that music improves health and well-being of human being through the motivation and pleasure; stress and arousal; immunity and social affiliation. This paper presented an online Expert System based on Indian Classical Music therapy for health care. In this Expert System knowledge base has been contain information about the Indian classical Ragas and the symptoms of the disease which will be used to solve the query of the user. Then Expert System diagnosis the patient's disabilities and advice to listen tunes of appropriate Raga based songs, instrumental tunes with duration and specific time. The Forward chaining inference approach is used for the implementation of Expert System.

Keywords: *expert system, Indian classical music, health, Raga, music therapy.*

1. INTRODUCTION

1.1 Raga Chikitsa

India has been well known for its rich Classical Music. Indian classical music is an individualistic, subjective, and spiritual art, aiming not at symphonic elaborations but at personal harmony with one's own being [23]. Indian music therapy is based on long empirical traditions.

The Vedic chants were used by the people to please the presiding deities of different Vedic sacrifices to get benedictions of brilliance, power and wisdom to cure diseases [24]. The old age as well as new age literatures has been gives number of proof of Raga Chikitsa. The library at Thanjavur contains number of literatures on Raga Chikitsa (Indian classical Music

therapy) and contains evidence on Raga Chikitsa for example, Saint Thygaraja gave life to a dead person by Bilhari composition Nav Jivan Dhara, Muthuswamy Dikshitar's Navagriha kirti cure stomach ache by Raga Chikitsa, Tansen recovered queen's health by using Raga Chikitsa and so on. At present number of Indian Classical singers and Music Therapists has been work on Raga Chikitsa like Dr. M. Hari Haaren , Arun Apte, Prabha Atre etc. Significant improvements in depression were observed in [27] the music therapy group, by listening Indian classical instrumental music. In [31] observed that Indian classical instrumental music has been effective for decreasing tension.

Raga chikitsa found in an ancient manuscript, which dealt with the therapeutic effects of raga. The seven basic Swaras "Sa", "Re", "Ga" "Ma", "Pa", "Dha" and "Ni" (musical notes) of the musical octave with five intermediate notes "Komal Re" , "Komal Ga" ,"Komal Dha" , "Komal Ni" and "Tivra Ma" have a one-to-one correspondence with the chakras (nuclei of subtle energy)[32,33]. A Raga is a scientific, precise, subtle and aesthetic melodic form with ascending and descending movement consisting of only 5-7 notes [33]. According to an ancient Indian text, *Swara Sastra*, the seventy-two melakarta ragas (parent ragas) control the 72 important nerves in the body. R*aga lakshana* (norms) and sruti shuddhi, (pitch purity) the raga could affect the particular nerve in the body in a favorable manner [32, 33]. The listening time called Prahar is also important of the Raga. It is become more effective if that Raga is listen at that Raga's Prahar.

1.2 Expert system

The Expert system defined in various ways like:

1) An expert system is a computer program that simulates the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field.[3]
2) An expert system is a system that employs human knowledge captured in a computer to solve problems that ordinarily require human expertise [1].

Expert systems are a branch of Artificial Intelligence (AI) [2]. Artificial Intelligence (AI) is the area of computer science focusing on creating machines that can engage on behaviors that

humans consider intelligent [1]. Now a day number of medical services are available in the form of offline or online Computer application. These computer-based applications have been improved the efficiency and accuracy in medical services. The different research areas of Computer Science have been working on these systems like Artificial Intelligence, Image Processing etc. The information or knowledge about a particular service or task of human expert is surrounded by uncertainty and imprecision. The human expert cannot reasoning always inexact, certain, and in an appropriate manner. Also there are so many factors by which it is revealed that why Expert system is needed. Table1 shows the factors which are indicate the need of Expert system [3] [8]. Expert systems are always domain specific [3] and have limited scope. Expert system is just solving the target problem and reaches at a particular solution(s). Expert system asks relevant information from their human users and from available knowledge bases captured from human expertise makes recommendations.

Factor	Human Expert	Expert System
Time availability	Workday	Always
Geographic	Local	Anywhere availability
Safety	Irreplaceable	Replaceable
Consumable	Yes	No
Performance	Variable	Consistent
Speed	Variable	Consistent (usually faster)
Cost	High	Reasonable

Table 1: Comparison of various factors in between human expert and Expert system.

After giving the brief introduction about Indian classical Music therapy and Expert System in this Section1, Section2 presents Literature survey. The detailing of presented Expert system is given in Section 3, which includes architectural and implementation details. Result and analysis is discussed in Section 4. Section5 presents the conclusion.

2. LITERATURE SURVEY

The number of techniques and methods previously have been proposed and discussed for the development of Expert System. Mainly rule-based and knowledge-based technique has been used for the design of Expert System.

Naser et al. [1] presented the design of an expert system that diagnosis the some of the eye diseases by providing the patient background details. In paper [2] proposed rule-based expert system that aims to improve the method of selecting the best suitable faculty/major for student planning to be enrolled in Al-Azhar University. The expert model tested and measured the student capabilities like intelligence, understanding, comprehension, mathematical concepts and others suggested a list of faculties/majors that are most suitable with the student capabilities and abilities. The paper [4] proposed an Online Children Skin Diseases Diagnosis System. A rule based and forward chaining inference engine is used for the development of the system. They concluded that their system recognize children skin diseases via online system and provide useful suggestion to user. A web-based fuzzy expert system for diagnosing human diseases is described by [5]. The expert system presented in [6] developed using Artificial Neural Networks technique captured the knowledge of the experts and the data from the customer requirements, and then, process the collected data and form the appropriate rules for choosing product's colors and design. The framework for developing shell expert system with all the algorithms, for creating, indexing, and checking the availability of a rule and a case, is presented in [15]. The paper [14] focused on the construction of an online Expert System which suggests the students for the selection of their undergraduate courses after the completion of higher secondary school education. Similarly number of Expert system described for different services in [18] [20] [7] [9-12].

Research aspects of Expert Systems are discussed in [3]. A brief review on Expert Systems is discussed in [7] [19]. According to literature review of the last decade shows that no one expert system designed for diagnosis of disabilities of human being based on Indian classical Music therapy. This research paper is presented a design of online expert system based on Indian classical Music therapy.

3. EXPERT SYSTEM IMPLEMENTATION

In this paper, online expert system based on Raga Chikitsa is presented. The main objective of this expert system is to enable user to recognize disabilities faced by him and suggest him an appropriate music tunes with detail information how to use it. This system not only give the suggestion but also it enable to provide the appropriate information on Raga Chikitsa. This system is a rule-based system and it is using forward chaining technique to retrieve inferences from knowledge base [14]. Figure1 shows the architecture of designed Expert system consists of the user interface, the inference engine and the knowledge base.

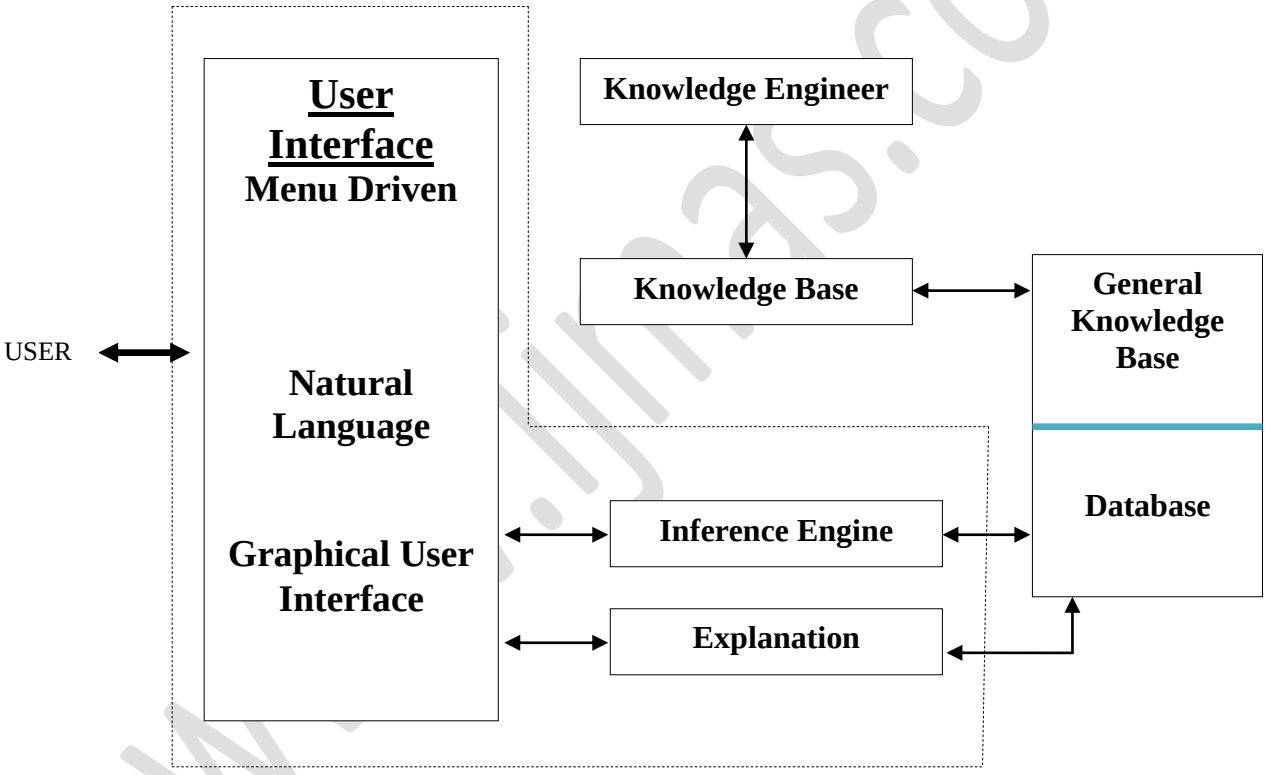


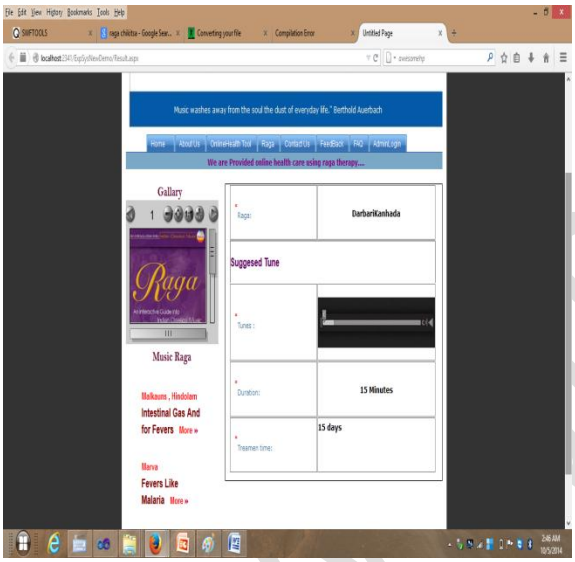
Figure 1: Architecture of Expert System.

3.1 User Interface

This is the system that allows a non-expert user to query the expert system, and provide an appropriate advice. For easy communication between the user and the system user interface is implemented in English language. The user interface is designed using graphical component

like menus, buttons, choice component etc. for example decision page is shown in Figure 2(a).

When home page is displayed on the screen it contains main menu with registration menu. Registration page required only basic information about user like name, email etc. After registration, user can enter its query by three ways as: 1) by choosing one of the diseases, 2) by selecting the symptoms or 3) by enter the query in text box about disability or disease. Finally, if user chooses the disease then appropriate tunes of appropriate Raga for that disease is displayed with download and listening facility, Listening Time (Raga Prahar), Duration, Volume Limit as shown in Figure 2(b).



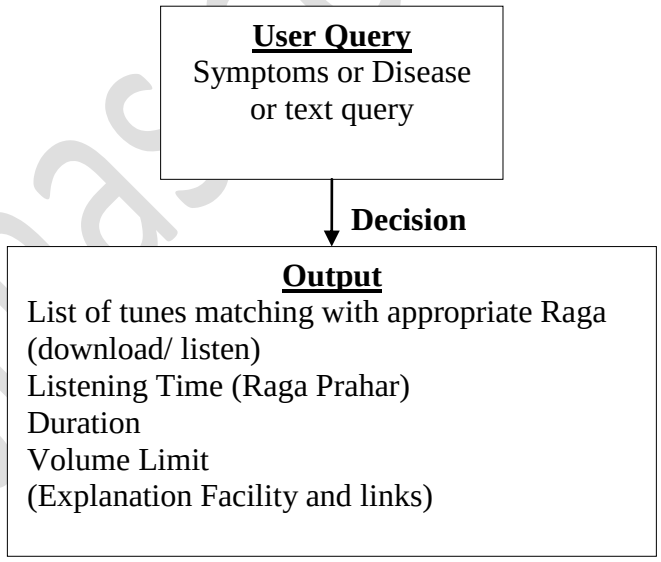


Figure 2: (a) Expert system Decision Page *(b) Workflow of user query to system decision*

3.2 Knowledge Base

Knowledge base consists of facts, heuristic methods, procedures, and relationships and is organized in such a manner that it can be used for inferences. The designed expert system is used Production rule system based on idea of condition-action pairs called productions. For this Expert system the three generalize production rules are presented in Table2.

Rule1presents the conclusion of i^{th} disease or j^{th} disability from number of n symptoms, Rule2 presents the conclusion of i^{th} disease or j^{th} disability for k^{th} query and Rule3presents the conclusion of k^{th} or l^{th} Raga tunes for i^{th} disease or j^{th} disability. For example,

(rule (Raga)

(if (trigger Acidity))

(then

(conclusion (DeepakRaga))))

Rule1:	**Rule2:**	**Rule3:**
(rule (Symptoms)	(rule (UserQuery)	(rule (Raga)
(if (trigger sysmpton$_1$)	(if (trigger query$_k$)	(if (trigger disability$_j$)
(trigger sysmpton$_2$)….	(then	(trigger desease$_i$))
(trigger sysmpton$_n$))	(conclusion disease$_i$)	(then
(then	(conclusion disability$_j$)	(conclusion raga$_k$ -tunes)
(conclusion disease$_i$)	)	(conclusion raga$_l$ -tunes)...
(conclusion disability$_j$)	)	)
)		)
)		

Table 2: Generalize production rules for the decision making.

3.3 Inference Engine

Inference engine examines the knowledge-base for information that matches the user's query. Forward Chain control strategy is used for performing inferences on rule base. Forward Chain is a control strategy used for Execution of Rules involves chaining of IF-THEN rules to form a line of reasoning. The chaining starts from a set of conditions and moves toward some conclusion [35]. The cycle of inference engine is shown in Figure3.

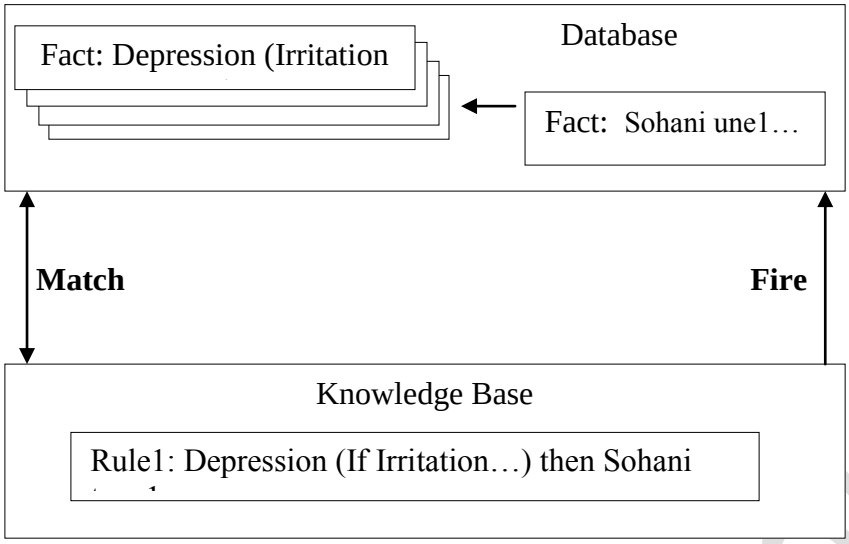


Figure 3: Inference engine cycle

These problem-solving methods are built into program modules called inference engines or inference procedures that manipulate and use knowledge in the knowledge base to form a line of reasoning. It processes the data base in order to extract rules, which complete the knowledge base [35]. The developed database with sample data is given in Table 3 to Table 6. Database storing the data rules and utilize for the training the system.

Raga Name	Listening Time (Raga Prahar)	Duration of Listening	Treatment Time	Disease/ Symptoms	Frequency Level
Todi	8-10am	15 Min	15 days	Symp2	45-75dB
Marava	4-6pm	20 Min	20 days	Symp8	55-65dB

Table 3: Raga Information [33,34].

Diseases	Symptoms
Typhoid (enteric fever)	Continuous temperature increase day by day
Malaria	Shivering, Severe headache, Temperature, Weakness, Body ache, vomitting
Depression	Irritation, Severe Headache ,Omitting
Migration	Irritation, Severe Headache

Table 4: List Diseases with their related symptoms

Raga Name	Tunes/ Songs
DarbariKanhada	DarKan_tune1(BastiBasti Parbat)… Basuri _Insturmental1 …. Guitar _Insturmental1 ….
Khammaj	Khm_tune1(Ayo Kahan Se)…. Basuri _Insturmental1 …. Guitar _Insturmental1 ….

Table 5: List of Raga with their available songs or instrumental tunes.

Disabilities of Health	Raga Name
Hysteria	Darbari Kanhada, Kamaj , Pooriya
Suffer From Hypertension	Ahirbhairav, Pooriya , Todi
Acidity	Deepak
Constipation	Gunkali , Jaunpuri
Intestinal Gas And for Fevers	Malkauns , Hindolam
Fevers Like Malaria	Marva

Table 6: Disabilities of Health with the list of Raga appropriate for that disability [34].

4. RESULT AND ANALYSIS

The performance of the expert system is evaluated by using three criteria. In the first criteria disease or disability is chosen by the user and the system predicted result 100% accurately.

The system advice Raga tunes in precise manner in some cases based on symptoms selection criteria. In some cases the disease or disability is not recognized. In such cases diseases or disabilities have most of the symptoms common. For example if patient is suffered by colic then it may be a normal colic because of improper digestion or kidney stone or appendix. In such cases if user not entered the other symptoms like for kidney stone the symptom is urine

problem or lumber pain then system is not able to recognize the proper disease or disability. Thus naturally system could not predict the proper Raga.

In the third criteria when user entered the query it should be entered in proper manner. For the valid query the system discriminate the symptoms and by recognizing disease or disability the system results precisely. If selected or entered query or entered query text is not valid or not related to any symptom or disease or disability then system not able to answer.

5. CONCLUSION

The presented online expert system on Raga Chikitsa performs the many functions. It wills diagnosis the disease or disability based on symptoms as well as query. The system concludes the appropriate Raga as per disease or disability. It is providing the facility with download or listen the related tunes for suggested Raga with explanation facility. It gives the awareness about the Raga Chikitsa. This system can provide decision support system for therapist to take a decision by using feedback tool as well as helpful to seek new invent in their research.

In future we are building the extended version of this expert system with Yoga Chikitsa and food diet. The extended model of this system will also support for Marathi and Hindi languages.

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