Dynamic Knowledge Acquisition Process of online Fuzzy Disease Diagnosis Expert System for Home Pets

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Abstract- This Paper reports a design and development of web based Fuzzy Expert System in specific domain. In Fuzzy Inferencing technique Most Probable and Least Probable Symptoms is considered to drawing the conclusion. Euclidean Distance method is used to calculate accurate result and reliability for the diagnosis result. This Expert System contains two types of database; Static Database and Dynamic Database. Static Knowledge Base will contain all the information of symptoms and disease of Home pets like Dog, Cat etc. Static database contains the data and heuristic knowledge about the specific domain, which gathers the data about the domain, was accomplished by Knowledge Engineer, these data is encoded in to Knowledge Base and Expert System is developed in a particular domain. The drawback of this system is, once knowledge base is developed it is become difficult to update the knowledge base without intervention of programmer. To deal this difficulty Dynamic Acquisition module will be facilitated to up to date Knowledge Base. Knowledge Base contains the textual as well as pictorial information of disease and symptoms, which can help to better understanding about the System. Using these techniques Fuzzy Expert System is implemented in Veterinary Domain.

Keywords *- Fuzzy Logic, Expert System, Euclidean distance, Knowledge Acquisition, Veterinary Domai*

I. INTRODUCTION

An Expert System is defined as "A computer Program designed to model the problem solving ability of human Expert" [1]. It is an intelligent computer program that uses knowledge and inference procedure to solve the problem [2]. Expert System is very much applicable in Veterinary domain. At present, in the course animal disease diagnosis, Veterinaries generally analyze and judging the result of pathology result and reach at diagnose result at the state of animal disease [3]. However traditional Expert System is restricted to these subjective factors. In this system user simply select the symptoms from the list of diseases and system draws the conclusion with the reliability factor, Introduction of that disease along with the control measures of that disease.

II. FUZZY EXPERT SYSTEM

A Fuzzy Expert System is simply an Expert System that uses a collection of Fuzzy membership function and rules, instead of Boolean logic to reason about data. They are oriented towards numerical processing and handle uncertain or imprecise information [4]. A typical process in developing the fuzzy expert system incorporates the following steps:

a) Identify the problem and characterize linguistic variables.

b) Determine Fuzzy Sets

c) Obtain and create Fuzzy rules

d) Encode the Fuzzy sets, Fuzzy Rules and procedure to perform Fuzzy Inference to the Expert System.

e) Evaluate and tune the System [5]

III. ARCHITECTURE OF DEVELOPED SYSTEM

The Developed Expert System is Fuzzy based Expert System for Home pets disease is web based dynamic and interactive software system addresses of data collection, transmission ,retrieval, analysis of critical reporting of disease event as and when they occur and useful for field veterinarians ,administration, technocrats research personnel, farmer, veterinary college and students. This paper deals with the technique which is used to determine the disease name, Reliability factor, and provide Control measures of that disease using the

knowledge base of particular domain. In this system user select the symptoms from the list of symptoms and based on that symptoms appropriate control measure will be provided to the user. Each symptoms has own weight factor and user assigns the membership value to the linguistic variable. According to this system arrive at a certain conclusion with the reliability factor of that disease and display the Introduction of that particular disease and treatment measures of conclude disease.

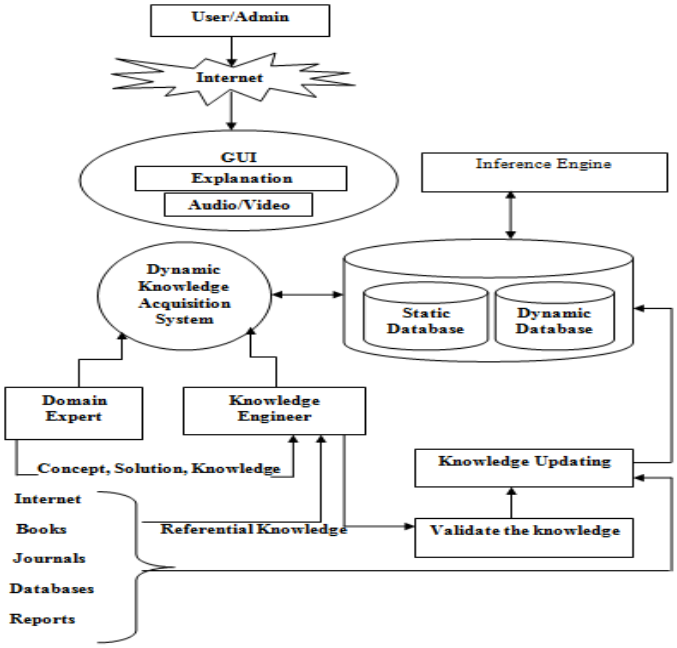

Figure1. Architecture of Developed System

The Developed Architecture has five modules which are as follows:

A.) User/Admin

B.) Explanation System

C.) Inference Engine

D.) Knowledge Base

E.) Dynamic Knowledge Acquisition System

A.) User/Admin-User/Admin can login the System and access the service from the system. User can be Veterinary doctor, pet's owner or domain Expert or Knowledge Engineer.

B.) Explanation System- Using this module system can give the reasoning of particular disease. Expert system allows a user or decision maker to understand how the system arrived at certain conclusion and result.

C.) Inference Engine- inference engine was designed and implemented to make use of proper reasoning mechanism for searching the disease diagnosis and treatment knowledge base. In Developed system use Fuzzy reasoning method is used means both most probable and least probable symptoms is used to deduce the result.

D.) Knowledge Base- A knowledge base is an information repository that provides a means for information to be collected, organized, shared, searched and utilized. In a Developed Expert System contains the textual information as well as pictorial information which will be beneficial for selection of symptoms. In this Developed framework two types of database will be use one is static database and another is Dynamic Database. In Static Database contains the information about disease and symptoms and cure details of disease. Dynamic database contains the up to date information.

IV. ALGORITHM OF DEVELOPED EXPERT SYSTEM.

Step 1-Begin

Step 2-Select the Symptoms from the list of disease by observing the activities of animals.

$$Po=X(X_1, X_2, X_3 \ldots X_j, Y_1, Y_2, Y_3 \ldots\ldots Y_k),$$

Step 3-Calculate the membership degree for selected Symptoms.

$$F(X_j) = Times((X_i)/T)$$

Xi=no of symptoms

T= Total no of symptoms in one disease

Step 4-The weight set of selected symptoms

$$W = (W_1, W_2, W_3 \ldots W_n, W_1, W_2, W_3 \ldots W_m)$$

The weight factor which are assigned by the domain Expert get automatically attached to the symptoms when user select them

Step 5- The Euclidean distance is given as-

$$d(Po, Qo) = \sqrt{\sum_{j=1}^{n} Wi\left(1 - P(Xj)\right)^2} + \sqrt{\sum_{j=1}^{m} Wj\left(0 - P(Yj)\right)^2}$$

Step6 - The comparative Euclidean distance is given as

$$\tau(Po, Qo) = \frac{d(Po, Qo)}{\sqrt{\sum_{j=1}^{n} (Wi + Wj)}}$$

Step 7- The similarity degree-

$$C(Po, Qo) = (1 - \tau(Po, Qo))$$

This represents the result in terms of Reliability **R** for the diagnosis Disease.

V. IMPLEMENTATION WORK OF EXPERT SYSTEM

The online Fuzzy Disease Diagnosis Expert System is implemented using PHP. MySQL is used for creating database. The Graphical User Interface made is very simple so user can interact with the system easily. Below the some snapshots of the user-interfaces designed for Expert System.

E) Dynamic Knowledge Acquisition System- Traditionally Knowledge acquisition method is used where Knowledge Engineer gather the information from various resources like Domain Expert, Books, Journals, Internet and encoded to create Knowledge base. In this developed Fuzzy Expert System, Dynamic Knowledge Base Acquisition Module is introduced. This Technique is very helpful to change the Knowledge base as per requirement without intervention of Programmer. Once system is developed expert can change the Knowledge Base. In Developed Expert System Expert (Computer Operator/ Data Entry operators /Programmer/ authorized person) has authority to change the Knowledge base. Experts can change the database directly from the front end, without using the database of the system. To update the knowledge base Expert can simply use the Expert login and then fill all the fields of Update form of the system and then click the Submit button. System automatically updates the knowledge Base and according the knowledge Symptoms will be incorporated in Symptoms Table. According to the symptoms system makes all possible rules to diagnose the disease of pets.

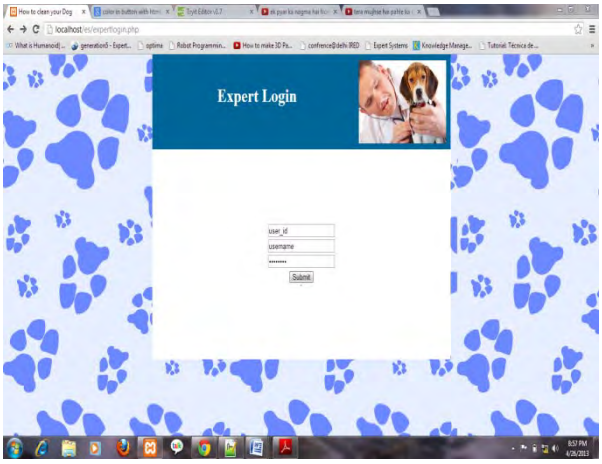

Figure2. Expert Login Page

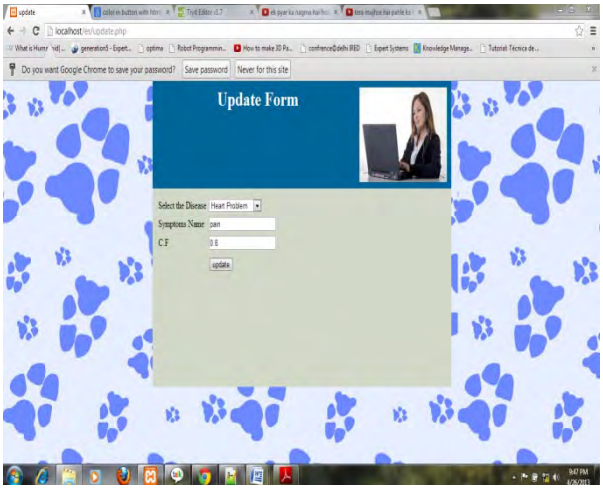

Figure3. Update Form

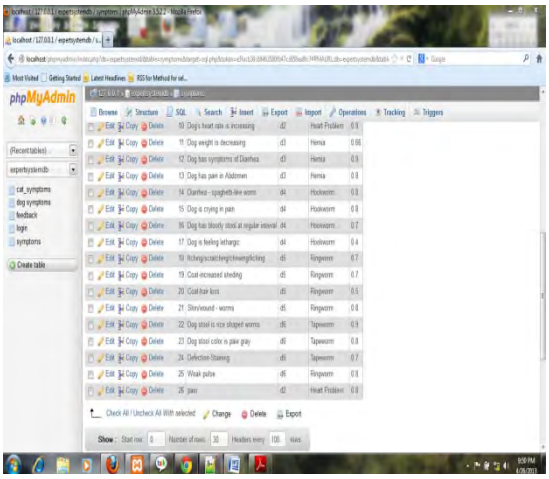

Figure4. Updated Database table

Figure 2 shows the page of Expert Login, Expert can login using his user_id, some authorized person can login the system it may be Expert (Computer Operator/ Data Entry operators /Programmer/ authorized person).

Figure 3 shows the Update form, Expert enter the symptoms from that disease. Second are symptoms name means Expert wants to update that symptom in the knowledge base. Third is CF means weight factor of that symptoms in particular disease.

Figure 4 displays the updated database Updated Knowledge Base table shows the updated information in Knowledge base.

VI. WORKING OF DEVELOPED EXPERT SYSTEM

The workings of developed Expert System are discussed by snapshots which are as follows:

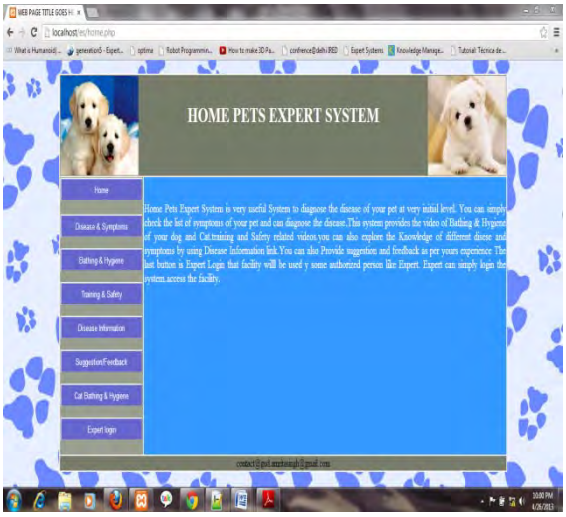

Figure5. Home Page of Home Pets Expert System

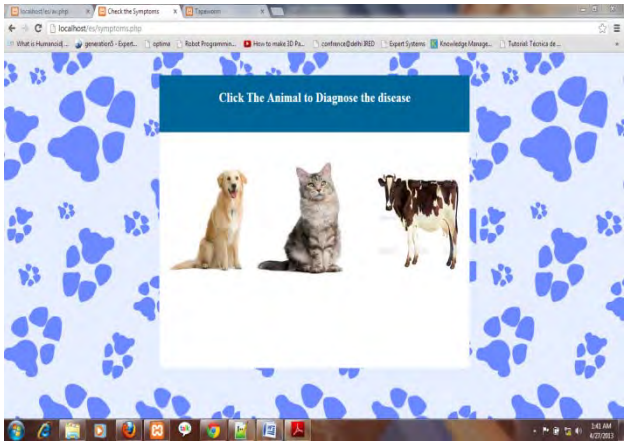

Figure6. click the Animal to diagnose the Disease

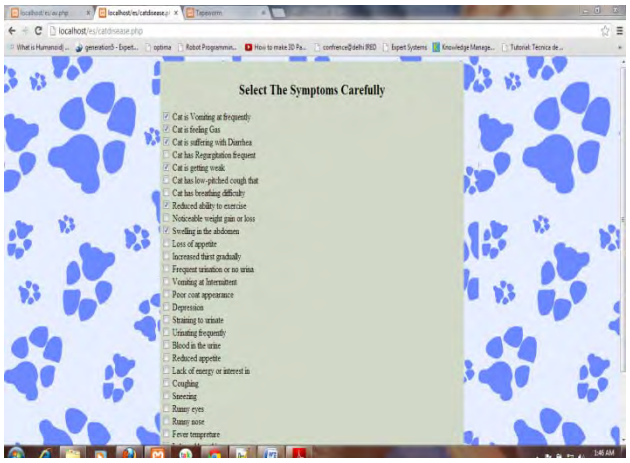

Figure7. Symptoms

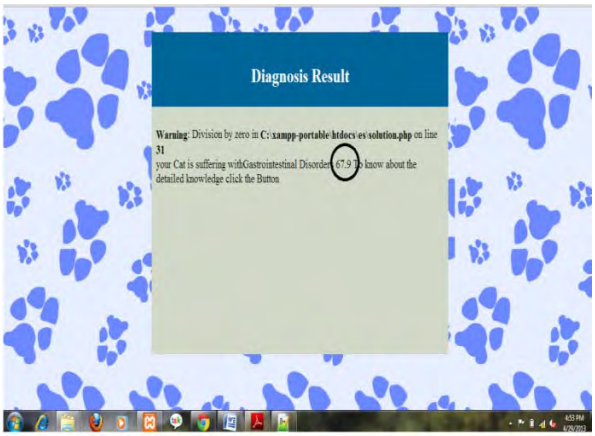

Figure8. Diagnosis Result

Figure9. Detailed Information of Disease

VII. RESULT ANALYSIS: A CASE STUDY OF CAT DISEASE

Table [1] Symptoms & Reliability

S.No	SelectedSymptoms	Reliability
I	1	20
Ii	2	40
Iii	3	60
Iv	4	80
V	5	100
Vi	6	98.44
Vii	7	95.96
Viii	8	93.55
Ix	9	90.52
X	10	87.31

In table [1]shows the selected symptoms for a disease with result in terms of Reliability. Symptoms from S.No (i)-(v) represents the specific disease symptoms and S.No (vi-x) repesents different disease. So S.No (i-v) represent positive symptoms, and S.No (vi-x) represent the negative symptoms. Reliability vary from (20-100) % according to selected symptoms whether it is positive and negative symptom.

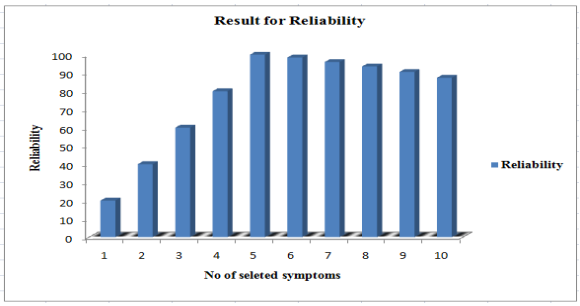

Figure10. Reliability Graph

In Figure [38] this graph shows the relationship between the selected symptoms of disease and Reliability of that disease. In this graph X axis represents the no of selected symptoms and Axis Y represents the reliability of the disease. As graph shows the results that when the positive Symptoms (supporting the occurrence of that disease) symptoms no (i-v) has checked the reliability of that Disease increased, and when the Negative symptoms (Denying of that disease) symptoms no (vi-x) has checked, the reliability starts decreasing gradually

Table [2] Reliability & no of query Fired

No of Query Fired	Selected Symptoms	Reliability
1	2	40
2	4	80
3	6	82.83
4	8	70.87
5	10	68.51
6	12	66.54
7	14	64.2
8	16	62.76
9	18	60.12
10	20	58.66

In table [2] Three columns are there first column is no of query fired and second column is no of selected symptoms by user. Third column is Reliability. Based on these parameter reliablity is calculate and present in the tabular form.

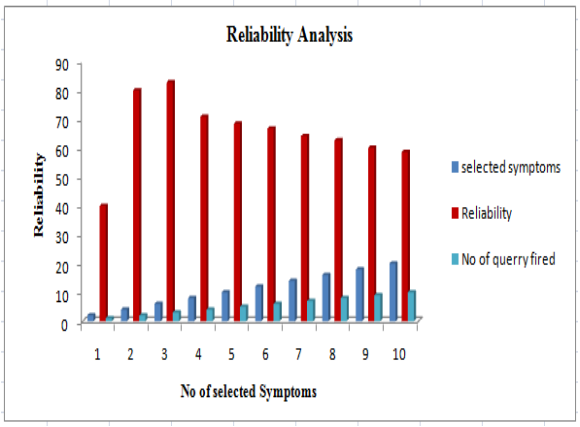

Figure11. Reliability Analysis

In figure [11] the graph represents the Reliability graph of disease that is depends on the selected symptoms and no of query fired. Graph represents that when the Positive symptoms of one disease has checked that disease has maximum reliability of occurring and when the no of negative Symptoms increases in each query the reliability decreases gradually.

Table [3] Reliability table for Cat Flu

S. No	Selected Symptoms	Weighted Euclidean distance	Relative Euclidean Distance	Reliability	Disease Name
i	1	0.83	16.66	17%	Cat Flu
ii	2	0.66	33.33	33%	Cat Flu
iii	3	0.5	50	50%	Cat Flu
Iv	4	0.33	66.66	67%	Cat Flu
V	5	0.16	83.33	83%	Cat Flu
Vi	6	0	100	100%	Cat Flu
Vii	7	0.015	98.48	98%	Cat Flu
viii	8	0.039	96.0	96%	Cat Flu
Ix	9	0.069	93.73	94%	Cat Flu
X	10	0.0926	90.73	91%	Cat Flu

In Table [4] there are six columns. One column is S.No of symptoms. Second column is no of selected symptoms. Third column represents the Weighted Euclidean Distance. Fourth column is Relative Euclidean Distance; fifth column is Reliability of that Disease. Six Columns is Disease name that diagnose named as Cat flu.

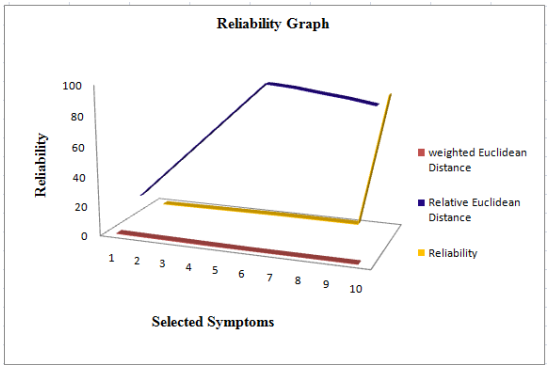

Figure12. Reliability Graph for Disease Cat Flu

In Figure [12] shows three parameter that is weighted Euclidean Distance, Relative Euclidean Distance and Reliability for Disease Cat Flu. As the Positive symptoms increases for one disease the Reliability goes up and when the negative symptoms increases. Reliability goes down for a particular disease.

VIII. CONCLUSION AND FUTURE WORK

This paper developed a Fuzzy Expert System for diagnoses the disease of Home pets. The main emphasis of this paper is to design a System with well designed interface for health giving related suggestions and diagnose result for Home pet's disease. In Designing of this Expert System some features are focused that improves the potential of Expert System are as (i) Knowledge Base of the developed Expert System can be enter, store and structure the domain specific knowledge using front end. (ii) Check boxes are dynamically reflected on front end when symptoms are added to the database.(iii) Symptoms are automatically converted in to the rules (iv) System displays the diagnosis result in percentage form that is better understandable by Lay men also. (v) Making the attractive interface that user can easily use. (vi) Textual as well as Pictorial information of Disease and Symptoms for better understanding of System. (vii) The user feedback facility serves as an effective and efficient mechanism to collect the user problems and suggestions. (viii) Providing User guidance for training and health information of their Animals. Domain expert at Veterinary Hospital examined and verified the result which varied from 16% to 100% in terms of Reliability. The result is found satisfactory and acceptable to the Domain expert.

Presently, the Expert System contains Knowledge base of two animals Dog and Cat. The System can be extended for all type of Home Pets like Buffalo, Goat, and Birds and so on in future. The interface of current developed Expert System is functional in English language. Taking various regional diversity into consideration, the System needs to develop the system in regional language so that the laymen and less computer knowledge could get more flexible GUI for interaction.

IX. REFERENCES

[1] "The evolution of Expert System",(2001), Griffith University School of computation and Information technology,.

[2] K S R Anjaneyulu, (March 1998) "An article on Expert Systems: An Introduction.

[3] The Basics of Expert (Knowledge Based) Systems, Dictionary of Computing, (1986), New York: Oxford University Press. •Bishop, Peter. Fifth Generation Computers Concepts.

[4] M.S.Josephine, 2V.Jeyabalaraja" Expert System and Knowledge Management for Software Developer in Software Companies "Volume 2 No. 3, (March 2012) ISSN 2223-4985 International Journal of Information and Communication Technology Research.

[5] Zadeh, "L.A. Fuzzy Sets"." Information and Control",(October 1965), pp 338–353.

X. CERTIFICATE

28th April, 2013

To WHOMESOEVER IT MAY CONERN

This is certified that **Amrita Singh**, Enrolment No. 11/PIT/010, M.Tech (ICT) Specialization-IS&R Final year student of Gautam Buddha University, Greater Noida, Uttar Pradesh has completed the **Dissertation Work, "Dynamic Knowledge Acquisition Technique for Online Fuzzy Disease Diagnosis Expert System"**. The Veterinary Domain work is satisfactory. The result shown by her research work is good and acceptable.

(Dr. Dharmendra Katheria)
Veterinary officer
Bareilly (U.P)

Figure13.Certificate