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An Expert System for Management of Poultry Diseases

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Abstract. Expert system could keep knowledge in its knowledge base as the system knowledge resources and manipulate that knowledge. So it could prepare the high level decision tool to the user that is called inference engine as the brain of the system. On the other hand, expert system could help people in many cases in order to get decision in solving a problem. This work aimed at developing an expert system for diagnosing poultry diseases which could also be used both by the farmer and the experts to train their students. The knowledge was elicited from the experts through interview and literature review. The knowledge was represented in the system using a rule based approach. The unified modeling language was used to describe the design of the system. Visual prolog 7.3 was used to develop the expert system. The system was tested using Design Criterion and Knowledge Base Expert System for Stratified Root.

Keywords: Poultry, Expert system, Inference engine, Knowledge base and Prolog.

1. Introduction

Poultry constitute by far the largest group of livestock and are estimated to number about 14,000 million, consisting mainly of chickens, ducks and turkeys. Throughout the developing world, many living in rural areas keep small flocks of scavenging poultry. These birds are usually chickens and have an important role to play in poverty alleviation and food security. The flocks are small but important - providing meat and eggs for family consumption, for sale to provide additional income, or for social obligations. Rural poultry also provide manure and are active in pest control. But for long time, poultry diseases have been one of the main problems to influent our poultry industry development; have become the bottleneck limiting the development of our poultry industry. To fit the basic strategy of "prevention is first, prevention is more important than cure", we try to solve the logic reasoning of poultry disease diagnosis through the computer, and taking this chance, discuss the problems of realizing the poultry disease diagnosis. The designing is that we come to the basic rule through the comparison of data and come to the preliminary diagnosis. An Expert System is an intelligent computer program that uses knowledge and inference procedures to solve problems difficult enough to require significant human expertise to solve [1].

1.1. Justification of the Study

The subject of economic analysis of poultry production has received considerable attention in the literature [2, 3, 4, 5, 6, and 7]. [8] claimed that poultry production in Nigeria as well as in other warm climate countries has a high priority rating compared with other types of livestock because poultry has better energy and protein conversion ratio and that net return on investment are relatively high. Poultry was chosen because its importance should not be compromised. But the fact is that many farmers in this region do not know how to effectively treat poultry diseases. Another factor is insufficient poultry extension agents to give explanation to poultry farmers. The agent was limited by time, chance and any other limitation that could be solved by expert system. While we know that expert system have many advantages that could help people

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solve the human limitation. The aim of this study is to develop an expert system for diagnosing poultry pest and diseases.

There is a lot of related expert system in the literature on diagnoses problems. A web based expert system for management of pests and diseases of cassava [9] refers to Expert System also called knowledge based system or decision support system as a computer program that contains some of the subject specific knowledge of one or more human experts. An information technology enabled Poultry Expert System was presented in [10] while poultry disease diagnostic Computer Simulation Research was in [11]. PDDSS simplify the attribute and rules with the rough set theory anthology; it can make a conclusion of diagnosis and measure of cure quickly. Other diagnoses systems are presented in [12, 13, 14, 15, and 16]

1.2. Problem Formulation

The problem formulations are how to develop an expert system to assist the extension agent of agriculture and also farmer, especially in the case of diagnosed poultry diseases and its solution. The developed Expert System could be used to boost poultry production.

2. Architecture of Expert System

Expert System Knowledge represents a concept, non in form of numerical; information in expert system does not too complete and up-to-date, that's why expert system should improve self-learning, expert system solution possibility to a problem differ, depend on expert thinking and program design, there is no guarantee that expert system load 100% needed expertise in system, expert system have to be trusted, easy to modified as according to science and technological growth. In developing an expert system the three components of an expert system that should be available are; User Interface, Inference Engine, and Knowledge Base.

2.1. Knowledge Elicitation

Knowledge elicitation is the process of collecting data from the consultation with domain experts which are the most important individuals in an expert system design process. In this work, knowledge is acquired by consulting experts in poultry farming. This involves constant interaction with the expert and extraction of relevant information including the signs, symptoms, diseases, pests, economic importance and control measures. The knowledge acquired from the domain expert and a summary of knowledge acquired on Poultry diseases are presented below:

Disease	**Causes**
Abnormal Egg Shells	Improper Nutrition disease, Physical Condition of Hen.
Air Sac Disease	Egg transmitted Contact with Infected Birds.
Ammonia Burns	Ammonia Gases Crested in damp Litter
Anatipestifier Disease, New Duck Syndrome	Faecal Contamination of feed water or the Environment where survival of the infectious agent may be prolonged.
Chronic Respiratory Disease	It is caused by egg transmitted disease.
Lice	Ducks geese if housed with Chickens
Swollen Head Syndrome	Contact with infected birds or indirectly by Exposure to infectious material.
Infections Bursal Disease or "Gumboro"	Contact with Leaches of infected birds and contaminated equipments.
Leg Problems	Accident inadequate nutrition. Lack of Vitamins and Slippery Surface.
Newcastle Disease	Contaminated Equipment Shoes, Clothing Contact with infected birds.
Paratyphoid	Egg Shell penetration, Eating or Contact with droppings of infected Carriers.

The knowledge acquired is represented using a set of IF-THEN rules and stored in the knowledge base. Visual prolog was used to write the code in design phase, prolog is a high level, programming language that is specifically designed for applications in AI such as ES. It is based on predicate calculus [9]. Prolog

differs from traditional programming languages in that it tells the computer what to do (a technique called declarative programming) while programs in other language tell the computer how to do it (procedural programming). Prolog does this by making deductions and derivations from facts (assertions), rules (inference) and questions.

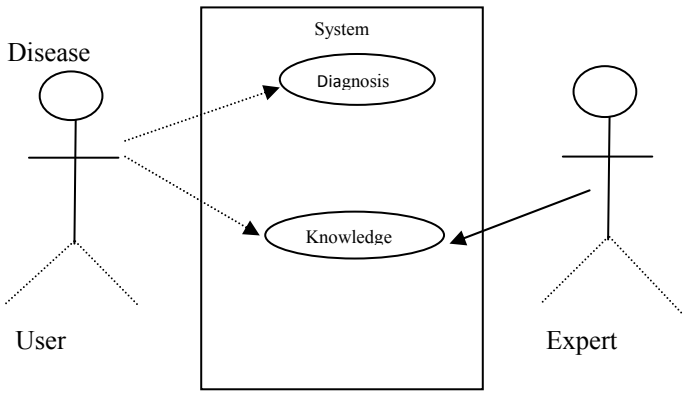

Fig 1: Use Case Diagram

2.2. The System Rule Base

The knowledge elicited from the domain experts are used to produce the rule base for the system. The rule base structure help to determine the specific disease of the poultry using the *If……Then* statement. For example, *If* bird has Gray eye and enlarged feather follicles ***and*** there is paralysis of wings, legs **and** neck, *Then* the disease is Marek's disease which is caused by Virus.

2.3. System Design Using Unified Modeling Language (UML)

The UML is an object oriented programming (OOP) tool for modeling objects and relationships between objects and classes in the design phase of a program. It is a powerful tool for representing the structure of programs. We make use of two UML type diagrams namely: the Use case and sequence diagrams.

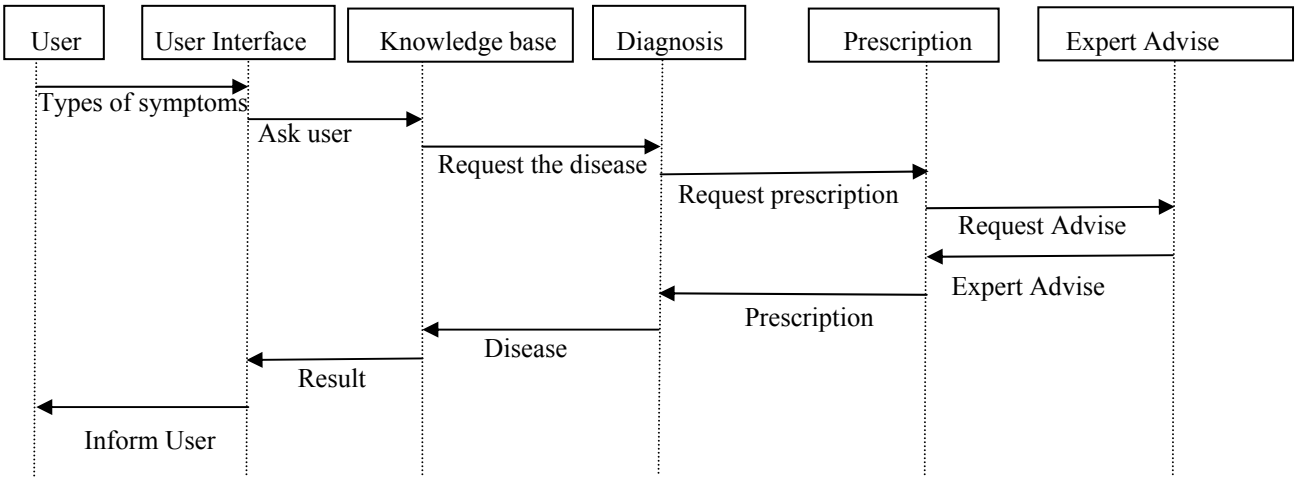

Fig 2: System Sequence Diagram

The UML type used in this work is the UML 2.0. The use of case diagram in the description of the system's behaviour is from the user's viewpoint. This diagram is a valuable aid during analysis as it helps to understand the requirements. The use of case diagram is shown in figure 1. The actors are the user and the expert as they are the individuals that interact with the system. The resources are identified as the diagnoses medium and the knowledge base. The expert and the user can both call the knowledge base as a resource, while the user can call the diagnosis medium resource to be used within the program structure.

The sequence diagram describes how the objects in the system interact; the objects identified in this system are the specific user, specific user, specific diagnosis, specific control measure, particular portion of

the knowledge base, specific user interface and the diagnostic advisory subsystem. They interact in the sequence shown in figure 2 by passing messages across the timelines (presented by the dotted lines). These messages are the actions carried out by the objects in the system in a chronological order.

2.4. User Interface Design

The system is designed in such a way that it could accommodate various problems that can occur at present and those that may occur in the nearest future, concerning the diagnosis of poultry diseases using Expert Systems. Details of the diseases are in Figure 3. Diagnose consultation session is as presented in Figure 4.

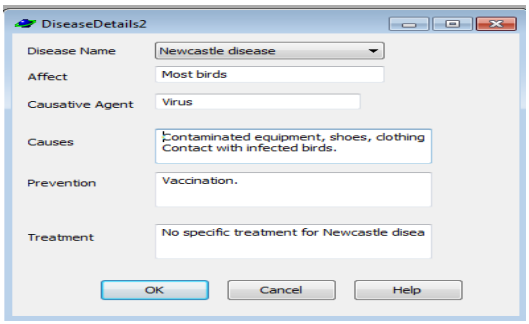

Fig 3:Disease detail form

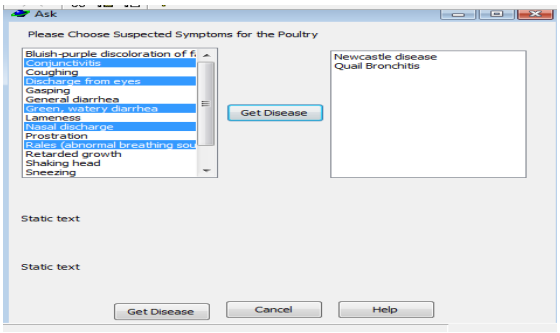

Fig 4: Diagnoses file

3. Testing

Testing is the last step in developing expert system design to diagnose pest and disease of poultry. Testing was held to really check the field, if the system developed matches with the expert criteria. There are several steps which should be followed to meet the criteria, from goal identification, testing itself and analysis of testing result.

3.1 Analysis of Testing Result: The analysis of testing was done using the formula [17].

$$C\ Nilai = \frac{\sum_{i=1}^{n} Bobot\ I \times Nilai\ i}{\sum_{i=1}^{n} Bobot\ i}$$

With C Nilai category as follow:

Table 1. Result Category of Testing Analysis

C Nilai	Category	Successful Degree
8.00 – 10.00	Exactly	Good
6.00 – 7.99	Less exactly	Less Good
3.00 – 5.99	Less exactly	Less Good
0.00 – 2.99	Not exactly	Not Good

After the testing done, we have the following result:

Table 2. Expert System Testing analysis Result of Diagnose pest and disease of Poultry

Skor	Credit	C Nilai
1786	208	
423	56	
2209	264	8,367

Based on the testing analysis result above, we got C Nilai 8.37 that shows on the table. This indicate that problem solving analysis to diagnose pest and disease with expert system as alternative solution is correct and this expert system application has a good opportunity to success in usage.

4. Conclusion

In this study, Knowledge based System for poultry disease diagnosis has been designed and presented. The usefulness of an Expert System in diagnosing poultry disease is really required in the field of poultry and all other aspects of life. The study will actually assist poultry farmers and as well enhance foreign

exchange earnings for the country of adoption. Furthermore, adding feature system besides diagnoses of pest and disease could make expert system complete and more powerful.

Expert system design to diagnose pest and disease of poultry could be codified for elementary up to high school so it could be a local content to study computer and local application where applicable.

5. References

[1] E. A. Feigenbaum. "Knowledge Engineering for the 1980's". *Heuristic Programming* Project, Computer Science Department. Stanford University, Stanford, California, USA, 1982.

[2] R.M. Sani, I. Tahir, and S. Kushwaha. *Economics of Poultry Production in Bauchi State:* A Case Study of Bauchi Local Government Area. Nig. J. Anim. Prod. 2000, 27: 109-113.

[3] G.N. Umeh, and B.I. Odo. *Profitability of Poultry Production Among School Leavers* in Anaocha Local Government Area (LGA) of Anambra State, Nigeria. Nig. J. Anim. Prod. 2002, 29: 76-80.

[4] L.O. Olarinde, and F.A. Kuponiyi. *Resource Productivity Among Poultry Farmers in Oyo State, Nigeria*: Implications For Agricultural Development. J. Sustainable Development. 2004, 1: 20-26.

[5] O.O. Adebayo, and R.G. Adeola. *Socio-Economic Factors Affecting Poultry Farmers* in Ejigbo Local Government Area of Osun State. J. Hum. Ecol. 2005, 18: 39-41.

[6] T.T. Amos. Analysis of Backyard Poultry Production in Ondo State, Nigeria. *Int. J. Poult. Sci*. 2006, 5: 247-250.

[7] R.M. Okafor, M.A. Odii, C.A. Emeyonu, and U. Obih. *Profitability Analysis of Poultry Production Imo State, Nigeria*. In Adepoju, S.O., and P.B.Okunneye (eds). 2006. Proceedings of the 20th Annual National Conference of Technology and Agricultural Development in Nigeria. 18th-21st Sept. 2006. Forestry Research Institute of Nigeria, Federal College of Forestry, Jos, Nigeria. 2006, pp 392-397.

[8] J.A. Oluyemi, and F.A. Roberts. Poultry Production in Warm Climatic *Macmillan Press Ltd, London*. 1979, pp 197.

[9] L.A. Akanbi, O.A. Odejobi, J.T. Opabode, and A.A. Adeyemo. "A *web based expert system for management of pests and diseases of cassava".* Proceedings of an international conference AICCTRA, held at Obafemi Awolowo University, Ile-Ife. 2009, pp 1-8.

[10] D.Thammi Raju, B. Sudhakar Rao, S.T.Viroji Rao, and M. Srinivasa Reddy. *"Perceptions of stakeholders on the applicability of Information Technology enabled Poultry Expert System- a comparative Analysis*" An International Journal of Education and Development using Information and Communication Technology, 2006.

[11] LIU Meng-qiang, and MA Jin-su. "Poultry disease diagnostic Computer Simulation Research" Project fund: 2008, *Henan Province Department of Education, high yield and efficiency of animal husbandry computer applications – Animal Nutrition Optimization System*", 2008.

[12] D. Deschamps, and A. M. Fernandes. An expert system to diagnosis periodontal disease. *Proceedings of Sixth Internet World Congress for Biomedical Sciences in Ciudad Real, Spain*. 2000.

[13] H. A. Guvenir, and N. Emeksiz. An expert system for the different diagnosis of erythemato-seuamous disease. *Expert system with Applications*. 2000, 18; 43-49.

[14] Q. M. Huang, X. Li, X. Jiang, and Y.R. Qian. A fault diagnosis expert system based on fault tree analysis for lubricating deqaxing process. *Computers and Applied Chemistry*. 2001, 18; 129-133.

[15] H. J. Cho, and J. K. Park. An expert system for fault section diagnosis of power system using fuzzy relations. *IEEE Transactions on Power Systems*. 1997, 12; 342-348.

[16] K. M. Wiig. Knowledge management, the central management focus for intelligent-acting organization. Arlington: *Schema Press*, 1994.

[17] Lou JunLu, and A Rock. Bold Design Criterion and Knowledge Base Expert System for Stratified Root, *Virginia Polytechnic Institute and State University*. 1999, 133 – 137.