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Expert System for Poultry Management

Dr. Oye, N. D.*, Jemimah, N.
Department of Computer Science, School of Physical Sciences (SPS), Modibbo Adama University Technology (MAUTECH), P.M. B. 2076, Yola, Nigeria

ABSTRACT

This research is aimed at developing a Software Framework for poultry management with the objectives: To provide poultry farmers with expert knowledge from the comfort of their homes. The system is developed using generic iterative waterfall model as methodology, HTML, CSS, JavaScript and Bootstrap for graphical user interface. PHP is used as programming language and MySQL as DBMS and normalization technique. The system is hosted locally for validation and testing on Xampp local host. The researchers recommended Poultry farmers to adopt and use the software framework because it can give knowledge on how to manage poultry expert system of different categories in poultry farming.

Keywords : Expert, System, Poultry, Management, Generic.

I. INTRODUCTION

Background of the Study

Globally, the demand for the poultry source food has been growing exponentially, particularly in developing countries due to urbanization, income and population growth (Meng-Qiang 2009). However, despite the growing demand for poultry products, poultry farmers worldwide face numerous problems. In Nigeria and Ghana, for example, poultry farmers have suffered setbacks in poultry production due to lack of sources for farmers to access information from experts about farm inputs management and because of that mysterious disease have wiped out the farmer's birds. The high costs of inputs and the mysterious diseases have significantly reduced the returns of the poultry farmers businesses (Olarinde & Kuponiyi, 2010). In Uganda, the relative importance of poultry industry, particularly the art of keeping traditional birds cannot be under-rated in terms of the provision of the livelihoods of the low income families in the rural and semi-urban areas. This is because local poultry meat, especially chicken meat, has increasingly dominated the diets of many Ugandan rich families (Olarinde & Kuponiyi, 2010). However, the consumption of chicken in poor rural families has been declining due to increasingly high prices. Thus, 80% of the total poultry meat in the markets is consumed by effluent urban and semi-urban dwellers due to their income growth and high purchasing power (Mugga 2009). However, in low-income rural family's poultry products consumption has declined to approximately 7% only of the country's total consumption of poultry's products.

Poultry production and farming system has been evolving into a complex business system requiring the accumulation and integration of knowledge and information from many diverse sources. In order to remain competitive, the modern farmer often relies on poultry specialists and advisors to get information for decision making. Unfortunately, assistance of the poultry expert is not always available when the farmer needs it. In order to alleviate this problem, expert systems were identified as a powerful tool with

extensive potential in agriculture (Yelapure & Kulkarni, 2012). Expert system for poultry management is a web based system that will offer a technology based solution that will allow farmers keep up rapidly with information on poultry production records and weigh their income and expenses been made on the farm. Management is the process of working with and through others to archive organizational objectives in a changing environment, is the set of principles relating to the function of planning, organizing, directing, and controlling and the application of these principles in in harnessing informational resources efficiently. Central to this process is the effective and efficient use of limited resources (Kreitner, 2010).

Poultry management is concerned with how can the individual farmer so organize the factors of production land, labour and capital on his poultry farm, so adapt practice to his particular environment and so dispose of his product, as to yield him the largest net return, while still maintaining the integrity of his land and equipment (Butterfield , 2009). Information and Communication Technologies (ICTs) are bringing significant changes to India, as elsewhere. Such ICTs can be exploited to design cost effective systems to provide expert advice particularly to rural communities, helping increase productivity and livelihoods (Adeyemo, 2013). 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 (Balakrishnan, 2013). Expert Systems provide a framework for presenting the latest scientific knowledge and decision making tools. Although Expert Systems have been developed in many agricultural science disciplines, such systems do not always adequately address the end user. The issues and challenges in the development of such systems include involving the user in development, building consensus between developer and user on the definition of usefulness, delivering computer based technologies and the challenges of implementing the system rather than its parts (Halimat & Amosa, 2012).

Poultry Expert System (PES) attempts to address these issues and was developed using hypertext markup language (Html), cascading style sheet (Css), and JavaScript on four dimensions of poultry farming i.e. diseases, biosecurity, summer management and drugs used. The present study was carried out to test its applicability among end users' veterinarians and veterinary students.

An Expert System (ES), also called a Knowledge Based System (KBS), is a computer program designed to simulate the problem-solving behavior of an expert in a narrow do main or discipline. The expert system could be developed for decision-making and location specific technology dissemination process. An expert system is software that attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence. Expert systems help in selection of crop or variety, diagnosis or identification of pests, diseases and disorders and taking valuable decisions on its management. The expert system which developed earlier were more of text based and could be utilized only by the extension officials and scientists.

Keeping the importance of ICT enabled interventions in agriculture and providing timely expert advice to farmers, the expert system on agriculture and animal husbandry was proposed and obtained as network project from Indian Council of Agricultural Research.

Statement of the Problem

The recent ban on importation of poultry and its products by federal government has really encouraged local production and high return on investment by poultry farmers. In other words, this has led many crop farmers, civil servants and other people in other ventures, to incorporate poultry farming into their

businesses. However, the vital role of poultry production to both farmers and the nation in general cannot be achieved, if there is no effective knowledge to the farmers and other stakeholders through expert system (Adeyomo, 2013).

Poultry farmers however, often depend excessively on the interpersonal sources such as friends, fellow poultry farmers, middlemen, feed sellers and health care providers as their major sources of poultry farm knowledge about poultry production, despite the availability of the needed knowledge through expert system. Consequently, very little of the needed knowledge reach rural communities and Nigeria is clustered within urban areas where more of the farmers live and the actual poultry farming takes place. Small-scale poultry farming which is new to many farmers in Nigeria unlike crop production; it is a knowledge dependent agricultural venture, which involves a lot of risk, thereby leading to loss or low profit, which discourages incoming poultry farmers, breakthrough of diseases in poultry farms and inflation in poultry products. This study sought to ascertain the impact of expert system in poultry farming and develop a framework of knowledge base poultry expert system to solve the above stated problems.

This study will help in a good number of ways that include reduced cost in running poultry farms which will make farming more efficient and profitable and encourage poultry farming, prevent epidemic in poultry farms, reduced cost of poultry product to customers, to enhance performance of Agricultural extension personnel and farmer, and to reduce the time required in solving the problems.

The scope of this research work is to be able to design and develop a software framework for knowledge base of poultry based expert system that runs on a Personal Computer (PC). This research will not cover aspect of software that runs on an Internet-based or on a network. Therefore, it is restricted to those operations that involve an off-line mode.

II. LITERATURE REVIEW

Expert system is a computer program that contains expert knowledge about a particular problem domain, often in the form of online or we-based application is able to solve the problems at a level equivalent to or greater than human expert. Knowledge Engineer collects knowledge from domain expert and transfers it into production rules and creates Knowledge base. Inference engine then apply different knowledge acquisition techniques and catch the knowledge and deliver it in the form of advice to solve problem. Because of its explanation facility, it can be used as training tool to agricultural persons.

High yield is aim of a poultry product is achieved by acquiring expert knowledge, so that depending on that knowledge, Farmer can take decision related to different factors like the type disease affecting poultry, the cure for the disease and the and the necessary measures to take to prevent future occurrence of such disease.

Expert system can be used to make decision at different levels in poultry farming, i.e. at operational and planning level. On operation level, the extension workers in the villages, districts and /or government can use the system to support him in making his decision in giving appropriate advice to growers. On the planning level, the decision makers can use expert system who establishes need of water, vaccines and feeds of the poultry. (Rafea, 2009).

Oluby & yerulu (2018) Expert system is one of the tools of AI that could be used to solve various types of real life problems. In expert system ES, the knowledge of expert in a particular domain is transferred to computer machine using the appropriate computer code for the machine to apply the knowledge to solve

problems in such domain in human-like manner. The machine therefore follows the footstep of the expert to arrive at reasonable solutions. Based on the acquired knowledge, the system is capable of explaining the reason or reasons for arriving at a particular solution. Therefore inane attempt to develop an expert system, a domain expert in a specific field has to be interrogated and the acquired knowledge is stored in a suitable form for solving specific problem using simple reasoning. Poultry refers to bird that people keep for human consumption. It generally includes chicken, turkey, duck, goose, quail, pleasant, pigeon, guinea fowl, peafowl, ostrich, emu and rhea.

Thammi & Sudhakar (2011) presented a research work titled "An Information Technology Enabled Poultry Expert System: Perception of Veterinarian and Veterinary Students, University, India". The major aim of the work was not to carry out diagnosis but rather to collect relevant information from students and veterinarians of the institution on the effectiveness of using expert system for diagnosis and management of poultry diseases.

"*Animal knowledge based system"* was developed by Maryam and Alaa (2013). The article present different methodologies of developing knowledge base system and developed an animal knowledge base system in Egypt. The system was not particular about poultry diseases.

Andino and Mahmud (2012) developed poultry disease warning system using Dumpster-Shafer theory and web mapping. Obviously, the method used is more of Statistics and Geographical Information System. The principle adopted looks different from that of Expert System. It was built to visualize map so as to identify the existence of poultry disease in a region by the district, regencies or municipalities.

Andino and Hassan (2012) present a research work titled "Avian Influenza Expert System using Demeter-Shafer. The system was able to identify Avian Influenza disease and display the result of identification process. The system only made use of basic probability assignments of symptoms and not Expert System approach to build the knowledge base. The system was also restricted to Avian Influenza as the only type of disease and other common poultry diseases were not considered Going by the literature, it can be observed that each of the existing system have one weakness or the other. This research work is expected to come up with a better system that works on the principle of AI (Artificial Intelligence). Again, Most of the existing systems were not evaluated. In the very few ones that were evaluated, experts in the field were not directly involved. The new system will come up with better evaluation method that that will involve expert from the field.

Expert system combines a lot of knowledge of so many experts at one point. By helping people to consider all of the relevant information and by assimilating this information into an understandable format, Expert system assists people in making of environmentally sound and economically viable for farm management decision (Robinson, 2018).

A poultry Management Information System is a system for ''collecting, processing, storing and disseminating of data in the form of information needed to carry out the operations functions of the farm'' (Salami, Ahmadi, 2010). Poultry Management Information System tools helps poultry farmers to identify areas of their operation that needs improvements and guidance on how to address the issues focusing on the potential risk areas and opportunities for improvement, the specific modules include poultry farm (husbandry). The Poultry Management System approach is designed to help poultry farmers better plan their management process, access management performance and effectiveness of management practices, identify for opportunities for improvement and efficiencies. The Poultry

Management System is a step by step approach; through the implementation of a poultry management system, farmers can improve competitiveness by highlighting where efficiencies can be made and maintaining procedures that streamline management and record keeping. The accountability of poultry management system process helps a poultry farmer to document and demonstrate how the property of farming activities are being managed to minimize impacts on the environment and to optimize efficiency of natural resource use.

Poultry Farm Management System provides a process enabling targeted investment to improve practices for better business, using a systematic approach to agricultural business management; farmers can identify and manage risks and opportunities arising from their farming activity. Management attention is focused on implementing recommended practices to address identified risks, and then reviewing progress made against plans and desired outcomes. Poultry management deals with the organization and operation of a farm with the objective of making a livelihood whilst dealing with global trade, traceability and consumer requirements, agricultural policies, environmental requirements, and the multi-functionality of agricultural enterprise as a whole. These functions include strategic, tactical and operational planning, implementation, and documentation, assessment and optimization of the performed work on the fields or on the poultry farms. To improve the execution of these functions, various management systems, database network structures and software architecture have been proposed to serve these purposes.

The Use of Information Technology (IT) in Poultry Management Information System

Information Technology is the application of computers and telecommunication equipment to store, retrieve, transmit and manipulate data. Between 1920 and 1970, the total inputs used in agriculture increased 20%, while total output increased 179%. (Duncan, Harshbarger, 2009) A few decades ago it was already noted that the output increase was clearly not just an increase in the amount of inputs used but rather the technology knowhow for efficient agricultural inputs utilization which poultry production is of a large percentage. Recently, it was concluded in their research that the use of information from poultry experts, biological innovations, harvesting and hashing machines, and mechanical technology used in poultry farming mainly caused the increase in productivity per poultry worker three folds between 1970 and the 2000s. Over the past 15 years however, poultry farmers started using computers and software systems to organize their financial data and keep track of their transactions with third parties (Batte, 2011) and also monitor their sales more effectively. In the Internet era, where information plays a key role in people's lives, poultry farming is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (e.g. sensors, farming machinery, meteorological sensors, etc.) in order to become more efficient in production and communicating appropriate information (Csótó, 2010). These efforts deal with a number of factors such as ecological footprint, product safety, labour welfare, nutritional responsibility, plants' and animals' health and welfare, economic responsibility and local market presence. The efforts cover almost all steps in the production chain concerning the daily agricultural tasks, the transactional activities for all involved stakeholders and the support of information transparency in the food chain. Information brought to farmers originates from systems installed by third parties such as meteorological stations or specialized infrastructure, e.g. sensors for measuring temperature, humidity and soil moisture. Farmers need to combine all these data effortlessly and take precise decisions to produce qualitative products, improve their income

and adhere to governmental regulations and principles. All this information should also be combined with the "farmer's internal system of practical knowing and learning", building thus a real cognitive system (McCown, 2012). Nowadays, a number of proprietary solutions have been developed to help poultry farmers manage their farms in an effective way. More sophisticated systems track geographical areas, weather patterns and perform numerous advanced predictions on whether it will be conducive for a kind of breed to be ground in a particular geographical location and most of the latter mentioned systems, known as Poultry Farm Management Information Systems (Lewis, 2009), focus on specific tasks and use their own specifications to implement the functionality provided. Currently, these systems are slowly moving into the Internet era and are starting to use some of the well-established networking solutions to improve what they offer to the end users. However, it is widely accepted that the Internet faces a number of shortcomings, especially in handling vast numbers of networked devices (i.e., Internet of Things) or stakeholders. Moreover, there is still no standardized solution to enable a simple and cohesive interoperability among services and stakeholders. The Future Internet (FI) infrastructures are expected to handle these shortcomings.

The aim is to propose a functional architecture of a poultry expert system (PES) utilizing Future Internet capabilities. Our goal was not to build a complete management system but rather to focus on those functionalities that can be improved with the use of the innovative FI's capabilities. Using these capabilities the farmer should be able to perform a number of tasks that are not possible today (e.g., advertise his poultry products effortlessly, discover trustable stakeholders, information and services, combine functionalities from different management systems and services, cope automatically with unstable data network links, etc.).

Poultry Expert System for Diagnosis of Broilers

Broilers are defined as chickens of meat-type strains raised specifically for meat production. Based on data production from the Ministry of the Republic of Indonesia raised 3.76% from 2015 – 2016. But in reality the price of chicken is expensive, because the amount of market demand is more than the amount of production. Harvest failure due to chicken disease is on the increase because of the lack of information for the poultry farmers to manage and cultivate their poultry to mature for sale. Detecting diseases at early stage can enable to overcome and treat them appropriately. Identifying the treatment accurately depends on the method that is used in diagnosing the diseases. A Diagnosis expert system (DE) can help a great deal in identifying those diseases and describing methods of treatment to be carried out taking into account the user capability in order to deal and interact with expert system easily and clearly. This system has 25 symptoms and 6 diseases using certainty factor method to solve the problem of uncertainty. The result of the research is that Broiler Expert System has been successfully identifying diseases that can solve the problem with 90% accuracy (Setyohadi, 2018).

Concept of Poultry Production and Expert System

Poultry production as an aspect of livestock production is important to the economic and social development and biological needs of the people of any nation because it assists in alleviating food security, creates employment opportunities for the people who are engaged and creates incomes to the people who are engaged in the projects. It is a process that involves rearing of chicks from day one to the time they mature by using some farm inputs, capital, labour and entrepreneurial talent (Oladeebo 2010). Al-Hassan (2008) points out that, inefficiency in poultry production can result from socio-economic, demographic or environmental factors. However, some of the environmental/exogenous factors such as

weather, government policies among others are outside the scope or the control of the farmers, and hence their impacts cannot be considered as the causes of the farmers‟ inefficiency. In view of this, Oladeebo (2010) note that farm specific efficiency can be influenced by farmers‟ characteristics (Socioeconomic-factors) which impact on the managerial skills of the farmer. Such socioeconomic characteristics include: the age of the farmer, his/her level of education, number of years of poultry farming experience, access to credit and extension services, contacts and networks, farm size, gender, and engagement in other income generating activities other than farming activities.

Coelli & Battese (2011) identified age and schooling (level of education) as factors influencing efficiency in poultry farming. The result of their study indicated that the younger farmers were found to be more efficient than their older counterparts. The situation was made worse by the devaluation of the currency combined with very poor government policy. Nhemachama & Hassan (2010) who also found out that farming experience enhanced a farmer's knowledge and information and high skills in farming techniques and management, which improve the technical efficiency of the 16 farmer. Farming experience also enables a farmer to adapt to climatic change, new agricultural practices and ability to spread risk. Kaur, Sakhon, & Kingra (2010) conducted their study on technical efficiency of poultry production in Punjab state, India. They used stochastic frontier production to estimate the technical efficiency of poultry production and they found that the mean technical efficiency of poultry production as 87 per cent, 94 per cent, 86 per cent and 87 per cent in semi-hilly, central, south-western and Punjab state as a whole, respectively. The result of their model showed that the technical efficiencies are positively and significantly related to age, education and experience of a farmer.

Kaur, sakhon (2010) found that age and the level of education were significant and positively related to productivity of the farmer. Younger and more educated farmers attained high levels of TE, AE and EE than their older and less educated counterparts. Ongundari & Ojo (2009) conducted a study on Economic Efficiency of Small Scale Food Crop Production in Nigeria using the stochastic frontier approach. The study revealed that farm size was one of the contributing factors of the economic inefficiency of the farmers. Small-sized farms exhibited high levels of technical inefficiency due to diseconomies of scale they experienced. The mean total cost of production was Naira 48,712.95 per hectare with a standard deviation of 43,358.81 Naira. The large variability in the standard deviation implied that the farmers included in the sample operated at different levels of farm sizes, which tended to affect their cost levels. According to Oji & Chukwuma (2012) carried a study on technical efficiency of small scale poultry egg production in Imo State of Nigeria and found out that farm size has a significant 17 positive effects on efficiency. They noted that farmers who were not operating at full capacity and would increase output by increasing the number of birds reared. The two researchers also noted that extension contacts and the farmers‟ level of education do have positive impacts on the farmer‟s efficiency. Furthermore, a farmer‟s access to credit also increases his efficiency's ability. They noted that farmers who had access to credit were found to be more efficient than those who did not access credit. This could be due to the fact that those who accessed credit were able to increase their level of production and benefit from cost advantage that are associated with economies of large scale production. Availability of Market and poultry production Galeboem, Isaac & Mmattio (2009) notes that availability of markets and market information encourages farmers to produce goods that are demanded and hence their confidence that there exists a ready market. A market that is deficient in information and exhibits inconsistency is likely to be

attractive to the investors. Like any other business, poultry farmers also prefer to invest in poultry farming where there is adequate information exist.

Makhura & Delgado (2012) found that distance to the market negatively influences both the decision to participate in markets and the proportion of output sold. Thus, the variable transport costs per unit of distance increases with the potential marketable load size. For farmers in very remote rural areas, geographic isolation through distance creates a wedge between farm gate and market prices. This leads to a shift from production of profitable but highly perishable commodities such as fruits and vegetables to relatively storable low-value cereals (Stifel & Minten, 2008) points out that poultry farmer also wish to invest in markets which are not faced with unfair and un-regulated competition and also in an environment of free trade barriers that have been implemented in other countries. For example, Kolare (2012) points out that in Botswana poultry marketing is highly disorganized. Despite the fact that the buying price of the major poultry input product, corn, is mainly determined by the poultry farmers where they pay low prices, the Botswana poultry industry has not experienced growth over time. This is because word of mouth is the most relied upon method of marketing of the 60% the poultry products. And buyers are the ones who dictate the price to pay for such products. This due to the imperfection of the market as a result of the Ugandan government not focused in establishing a system that can ensure a smooth flow of products from the source to the end-user, thus guaranteeing smooth utilization and higher profit margins for the poultry farming business.

Kariuki (2010) In Kenya, points out that the poultry industry also suffers from poor organization and marketing due to little effort on the side of the Kenya government focus on the provision of information in order to facilitate the smooth flow of the poultry products from farmers to the consumers. Another problem that is experienced by poultry farmers in Kenya is the issue of low prices of poultry products in Uganda. This has caused poultry product buyers to illegally cross the border to Uganda to buy cheaper poultry products and then come and resell in Kenya, thus earn better returns. This has affected poultry farming in Kenya due to lack of market.

Expert system for Decision Making

The conventional decision support has predefined set of input data, after that they begin analysis. They precede the data, step by step as directed by algorithm, to reach conclusion. Here the algorithm plays important role since knowledge is represented in the form of Algorithm. If knowledge of problem got changed then Algorithms need to be changed or rebuilt. Also solving new problem in same domain needs to develop new system. Against this, human expert tends to follow cognitive approach rather than algorithm. They rely on extensive knowledge base (in their mind) which may contain facts, assertions, past mistakes, trial – by – error method. The machine equivalent human experts are expert systems. The expert system works with cognitive approach and stress the knowledge in knowledge base which is separate component. So that changes in knowledge do not change whole structure of expert system. Another advantage is reasoning capability. They can explain reasons for arriving at particular decision.

Importance of Poultry Expert System

The complexity of problems faced by poultry farmers are lack of information for in poultry farming, disease and parasite of the poultry products, feeds of the poultry products, location and water related problems, drug related problem of the poultry farm product. All the above listed poultry problem can be solved with the use of an expert system. Expert System are computer program that are different from conventional computer programs as they solve

problems by mimicking human reasoning process, relying on logic, belief, rules of thumb opinion and experience. In agriculture Expert System are capable of integrating the perspectives of individual disciplines such as plant pathology, entomology, horticulture and agricultural meteorology into a framework that best address the type of ad hoc decision making required of modern farmers. Expert system can be one of the most useful tools for accomplishing the task of providing growers with day to day integrated decision support needed to grow their crops.The studies reviewed under this section clearly indicates that, various software were used by the researchers to develop computer-based Expert System and used as an effective tool in various fields of agriculture. The above observations suggest the need to develop a user friendly computer based Expert System considering the flexibility, simplicity, nature of problem and familiarity of the software to the student researcher.

Experiences in Using Poultry Expert System for Agricultural Development

Rafea , (2014), stated that the application of Expert System generally falls under three classes, namely, Expert System proper, intelligent front-ends, and hybrid systems. An Expert System proper is a purely rule based system, relying on a sizable knowledge base. It is based on a qualitative, causal understanding of how things work. Such a system is more suitable under situation wherein not quantitative data are used. It is essentially conceptual and heuristic rule-based system. An intelligent front-end is a user-friendly interface to a software package, enables the user to interact with the computer using his/her terminology. It minimizes or avoids misuse of complex models by less experienced users. A hybrid system represents the integration of algorithmic techniques with Expert System concepts. Thammi & Rao (2009), Developed a microcomputer-based, graphics-oriented Expert System for use in the design of parallel terrace systems. It divides the design process into manageable activities: digitization of a contour map, input of field and machinery characteristics, definition of "watersheds" to be terraced, definition of the outlet system and waterway divides placement of conventional terraces and placement of parallel terraces based upon a key terrace. The system is able to make design suggestions based on accepted practices and the programmed knowledge of recognized terrace system design experts. Barnabas (2013) observed that an expert's knowledge is the central and key component of developing an Expert System. Furthermore, it is more difficult component. At the end the knowledge acquisition must be. Regarded as much as an art as a methodical and scientific procedure. One approach, however, that often seems to be ignored is the collection, integration and use of research results, while an expert should clearly build research results into their expertise, it is also possible to bypass the expert and use the published results in formulating rules in cases where the research provides a complete and logical answer.

Ikenna, (2012), revealed that Expert Systems methodology has shown considerable promise as an information technology. However, limited knowledge of how current information technologies relate to the decision process impedes the adoption of Expert Systems. The significance of developing an economic theory of Expert Systems is substantiated with an empirical application investigating a soybean pest management decision process (SMARTSOY) based on experience with four insect pests causing damage to soya beans in the southeastern USA. SMARTSOY is combined with SOYGRO (soya bean crop growth simulation model). In Poultry Expert system, diseases such as Newcastle Disease or Ranikhet Disease, Mareks Disease, Infectious Bursal Disease, Infectious Bronchitis, Avian Influenza, Colibacillosis, Infectious Coryza, Fowl pox, Ascariasis, Coccidiosis, Gout are included in the key visual symptoms of the Health Adviser component.

III. METHODOLOGY

Research methodology simply involves the procedures for collecting and analyzing information or data, necessary to define or solve the problem for which the research is embarked upon. The system design phase considers the methods of designing the new system and the actual steps involved, system requirement and flowcharts and programs that implement software. This chapter also focuses on the method of collecting data, the steps in the new system, design, user documentation, the tools used and possibly the file organization of the system.

Fact Finding Methods Used

The data used in the study were collected from two sources; primary and secondary sources.

- **Primary source:** This involves the oral interviews conducted from various poultry farmers at their respective poultry farms. The difficulties they undergo in getting knowledge about their poultry farms are revealed.
- **Secondary sources:** This includes the use of textbooks, dictionary, journals, newspapers and the internet for downloads of necessary materials required to aid in data collection.

The Existing System

Poultry farmers seeking for knowledge of species, new breeds, or knowledge of poultry diseases, their preventive measures, i.e. how they spread, how to immunize and provide medication, have to seek for experts who are not readily available in the rural community to teach them, and as a result, many poultry farms collapse which will lead to scarcity in poultry products. The proposed system will provide cost effective expert knowledge to both the rural and urban poultry farmers which will help them to overcome most of their challenges such as (high cost of obtaining knowledge, breakthrough of diseases etc.)

Software Development Life Cycle (SDLC)

The process of building computer software and information systems has been always dictated by different development methodologies. A software development methodology refers to the framework that is used to plan, manage, and control the process of developing an information system. A software development methodology is known as software development life cycle (SDLC). It is used in several engineering and industrial fields such as systems engineering, software engineering, mechanical engineering, computer science, computational sciences, and applied engineering Richard & Barry study as cited in (Bassil, 2012).

IV. RESULTS AND DISCUSSION

Implementation

The prototype of software framework for developing knowledge base of agro based expert system is implemented using HTML for markup with CSS and bootstrap framework to make the design welcoming and responsive. The system is design with star UML and MySQL is custom to implement the design to store and retrieve records while PHP is used as programming language to connect to database, forward data and retrieve. XAMPP localhost server is used to test the framework software and NetBeans IDE is used in writing source codes.

The computer system used is installed with windows 10 operating system.

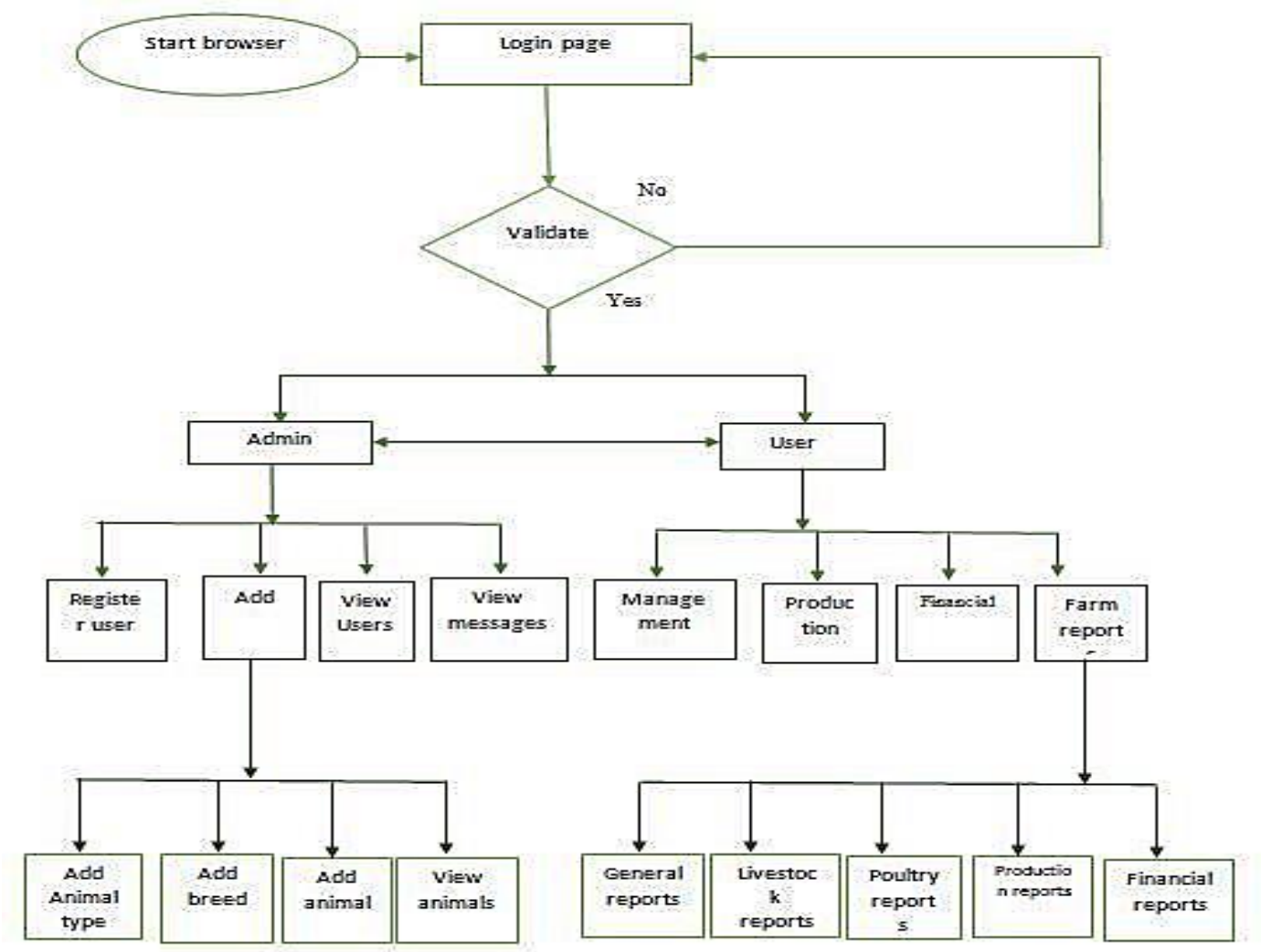

Figure 1 : workflow chart of expert system for poultry management

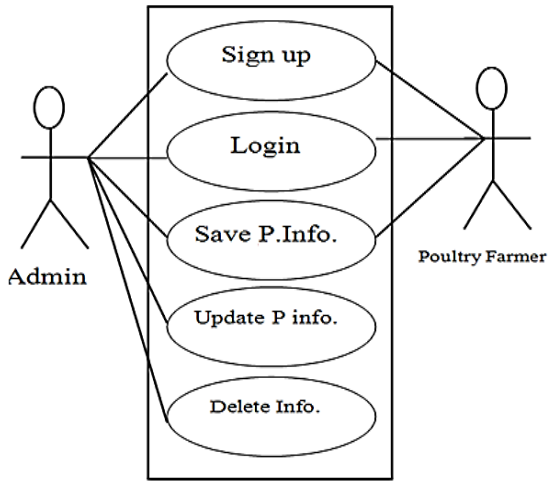

Figure 2 : Use Case Diagram for Poultry Expert System

System Interface

The page bellow is the homepage interface with links in form of click-buttons to other pages which enables a visitor to access information.

Figure 3: poultry Expert System Interface

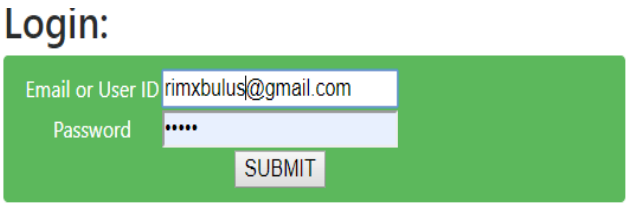

Figure 4 : login Interface for Poultry Expert System

V. CONCLUSION

The research was carried out to develop a software framework for knowledge base of agro based expert system easier and more effective. The framework and prototype has been developed using PHP, MySQL, CSS and JavaScript, Bootstrap framework in windows environment hosted on XAMPP local host. The following conclusion can be made about the framework: it's efficient, fast, secure, user friendly, approachable, responsive, cost effective and web-based. The researchers recommended Poultry farmers to adopt and use the software framework because it can give knowledge on how to manage poultry expert system of different categories in poultry farming.

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