Bank Products Recommender

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--**ABSTRACT**---
Customer service personnel in banks play many roles including prescribing and propagating bank products to current and prospective customers in a precise and consistent manner. These personnel are overstretched in reaching large number of contacts who may also be geographically dispersed, and merely placing product information on websites is not satisfactory. This research attempts to develop a web-based expert application to fill this gap. A number of customer service personnel were interviewed for expect knowledge, and related systems were examined in order to incorporating learnt ideas. The Prototype, horizontal and throwaway versions, software development life cycle model was adopted. Software development environment include WampServer, Adobe Dreamweaver, Hypertext Markup Language, Cascading Style Sheets, and Hypertext Preprocessor. The proposed application and idea would improve bank product prescription and propagation.
Keywords: Bank, Products, Recommendation, Application, Propagation, Selling
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I. INTRODUCTION

An expert system is a special computer-based business information system that emulates the decision-making capabilities of a human expert (Jackson, 1998; Stair & Reynolds, 2007). The computer application program, being the determining factor, makes sensible defining an expert system as a computer program that simulates the judgment and behaviour of a human or an organization, in terms of expert knowledge and experience in a particular field (Rouse, 2014). Expert system, which mainly uses if-then rules rather than conventional procedural codes, is a form of artificial intelligence (AI). The application is usually divided into three parts: Knowledge base (the facts and rules of the system), User interface (through which the user interacts with the system), and Inference engine (a computer program that tries to derive answers from a knowledge base (Stair & Reynolds, 2007). Knowledge engineers gather, largely through interviews, the expert knowledge and the heuristics from human experts in the field for which the computer based system is being designed to support decisions fields such as medicine, engineering, and geology, among others (Ayesha, 2014).

Customer service is the act of providing services by a customer service agent to customers before, during and after a purchase (Buchanan, 2011). Bank products refer to instruments that help bank customers save, invest, get insurance or get a mortgage, among others. Customer service personnel in banks play many roles including intimating, prescribing and propagating bank products to current and prospective customers in a precise and consistent manner. These personnel are stretched in reaching large number of contacts who may also be geographically dispersed, and merely placing product information on websites is not satisfactory. Reliable customer service personnel are in short supply. It is also true that humans should engage in more profitable ventures than those that could be assigned to machines. It is, therefore, important to pay attention to creating an expert system that recommends bank products and be available everywhere every time, which this work is focused upon.

The aim of this research is to create a web-based application that would grant expert advice on bank products to current and prospective customers. The specific bank products addressed include traveller's cheque, internet banking, smart kid savers, and mortgages. It will take queries from current and prospective clients, as the expert financial adviser would do, and mimick the expert in returning expert advice to the clients.

Extensive literature review was done. The design and creation research strategy (Oates, 2009) was adopted. The data collection method was existing documents and structured interviews. The data collected was analyzed qualitatively. A number of related expert systems, and how bank currently propagate product information were examined with the intention of incorporating what is learnt. The Prototype, horizontal and throwaway versions, software development life cycle model was adopted in order to ensure proper and efficient development and production of suitable software. This model is ideal for this project as it generally helps to identify the requirements of a system that interacts a lot with the user, just like the intended expert system. The horizontal prototyping, which requires the displays of the user interface for the product and help give a broader view of the entire system without concentrating on internal functions, was utilized in conjunction with throwaway type of prototyping, which uses very little efforts with minimum requirement analysis to build a prototype. This procedure leads to the development of the proposed system with essential requirements ultimately met.

Software development environment include WampServer, Adobe Dreamweaver, Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), and PHP (Hypertext Preprocessor). The scripting language best suited for the development and actualization of the project is PHP as it provides a suitable way to produce a web based expert system. It works with JavaScript for browser scripting, and HTML and CSS for the user interface. It also works efficiently with the chosen Database Management System (DBMS), MySQL. MySQL was used to store and manage data, in relation to time and session, among others, contained in the systems knowledge base. Artificial intelligence focused programming languages such as LISP and Prolog were not readily available.

Debugging and testing, including verification and validation, reliability estimation and correctness, were performed heavily to find out design defects. This was done to ensure that the application performs the right behaviour and does what is expected at every stage. Black-box testing, White-box testing, Integration testing, Top Down and Big Bang were performed. System testing was conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. The interface testing phase was done to ensure that customers have a positive feel of the application. The Graphic User Interface of the homepage makes it possible for every user to use it effectively.

Method of evaluation of user experience is very important; in order to get adequate feedback to know which aspect of the software is to be improved. Questionnaires are inexpensive, quick and easy to analyze, and also easy to administer over the web when the user is done with the sites function (Mellenbergh 2008). The application was designed to give every user a simple questionnaire to complete after the user is done with the system. The completed questionnaires are sent to the administrators for analysis towards continuous improvement of the application website.

The proposed expert bank products recommendation system would be a tool, in the Banking sector, to support customer service personnel or fill their place when they are not available, in bank products prescription and knowledge propagation. This would improve precise and timely circulation of expert disposition within the sector even to people that cannot be physically present to meet an expert face to face. The expert system will serve as "virtual" consultant to support financial advisors and their clients, empower appropriate staff with knowledge about many complex product lines, ensure that consistent advice is always provided, increase the ability for cross-selling products, provide for better customer service and support in freeing personnel, help attract and qualify prospects in an intelligent and cost effective manner, ensure that compliance guidelines are being met, shorten training time for financial advisors, enhance operational productivity and cut maintenance costs, enterprise-wide.

II.   OUTCOMES

2.1 System Analysis

Functional requirements describe required behaviour in terms of necessary activities, such as reactions to inputs, and the state of each entity before and after an activity occurs. The proposed system will be web based expert system and it will provide its users with advice on bank products, ranging from the account types to open to various other packages offered by the banks. The users will be required to enter into interview from which the system will recommend appropriate product and provide an explanation for the product. The user will also be able to search for terms used by the expert system and also ask the search engine a question.

The experts will also have a role in the running of the system. The expert will provide the knowledge in the system and will also have an account where answers to user questions could be provided. The system will also have a knowledge engineer to update the knowledge base from the knowledge provided by the expert. Lastly, the administrator manages all the users, database and knowledge base.

The system specification includes the following:
i.   The system should provide authentication for logging into the system with username and password
ii.   The system should provide a questioner for the user regarding product interest
iii.   The system should provide an advice once the user completes the interview
iv.   The system should provide a term explanation whenever the search engine is queried
v.   The system should enable the expert to view user questions and provide answer
vi.   The system should enable the expert update the knowledge base
vii.   The systems should enable the knowledge engineer update the knowledge base

Figure 1 shows the user Use Case Diagram.
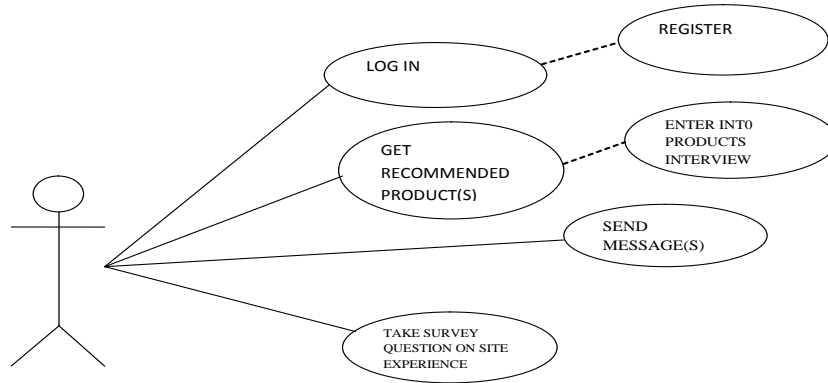
Figure 1 – User Use Case

2.2 System Design
The Bank Product Recommendation application will have the components of a standard expert system as depicted in Figure 2. Human experts, which in this case are customer service personnel, solve problems by using a combination of factual knowledge and reasoning ability. In an expert system, these two essentials are contained in two separate but related components: a knowledge-base and an inference engine. The knowledge-base provides specific facts and rules about the subject, and the inference engine provides the reasoning ability that enables the intelligent system to form conclusions.
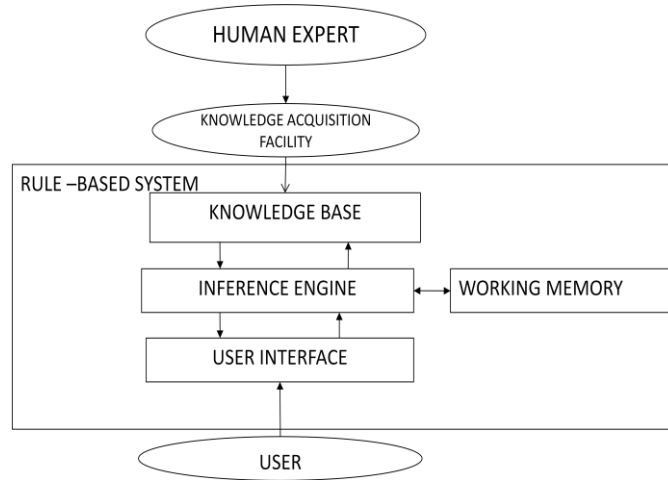
Figure 2 - Main Components of an Expert System (Stair & Reynolds, 2007)

The proposed web based expert system will have a user interface that receives user input and displays desired output. The user interface consists of different web pages. The homepage of the application will have different links that every user type can navigate through

i. The Database

Data Entity is a generalized class of objects for which data is collected, stored, and manipulated (Stair & Reynolds, 2007). They are, for the proposed system, Customers, Experts, User's History, Messages, Options, Products, Questions, Survey, and Terms. The database for this application, therefore, consists of nine (9) main tables. They are Customers, Experts, User's History, Messages, Options, Products, Questions, Survey, and Terms, holding the customers personal information, the experts personal information, the user's history content, the messages sent by the users to the experts, the option available to the users during their interviews, the information on the products the expert system can recommend, the information on the questions and their option id, the information on the survey results on the system, and the terms available in the database, respectively. Figure 3 shows the entity relation diagram. Figure 4 shows the application database table contents on phpMyAdmin.
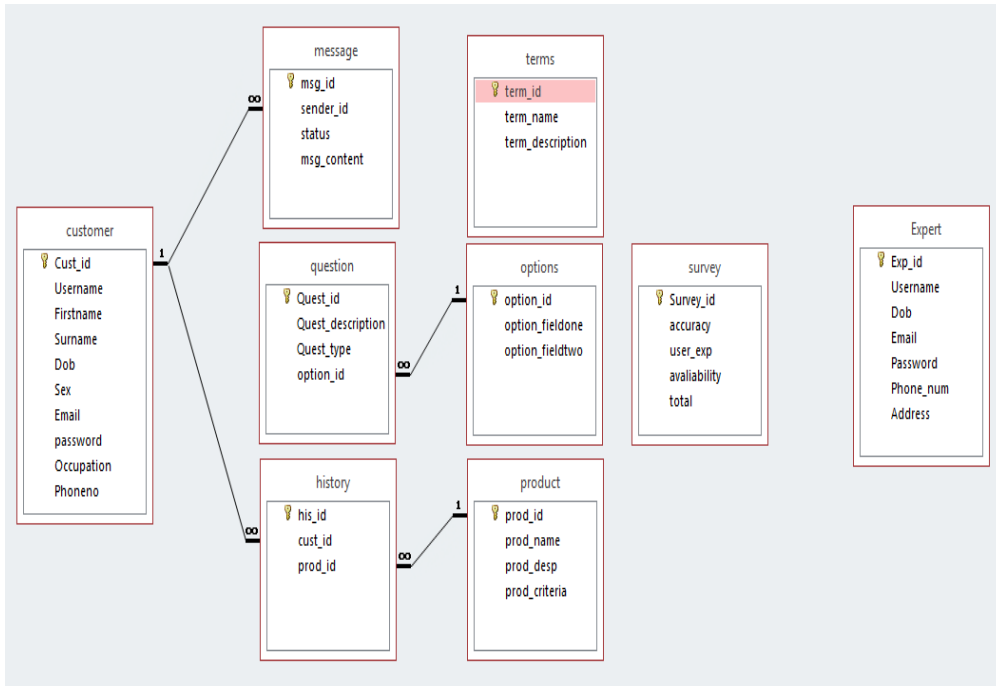
Figure 3 - Entity Relationship Diagram
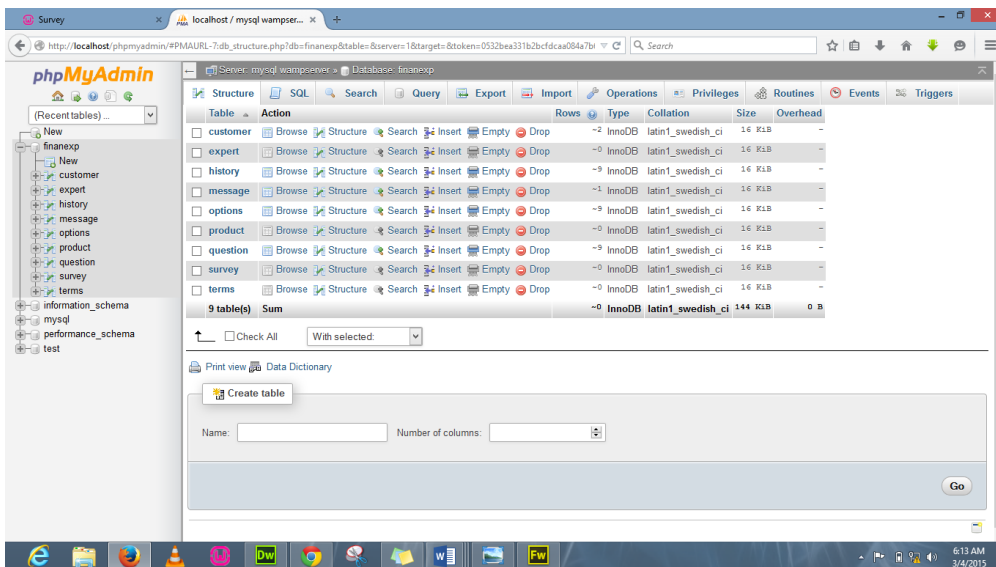
Figure 4 - The Application Database Table Contents

Figure 5 shows the Customers' table holding customer personal information. Figure 6 shows the Expert's table holding experts' personal information. The Product table (Figure 7) contains the information on the products the expert system can recommend. The Questions table (Figure 8) holds information on the questions and their option identifiers.
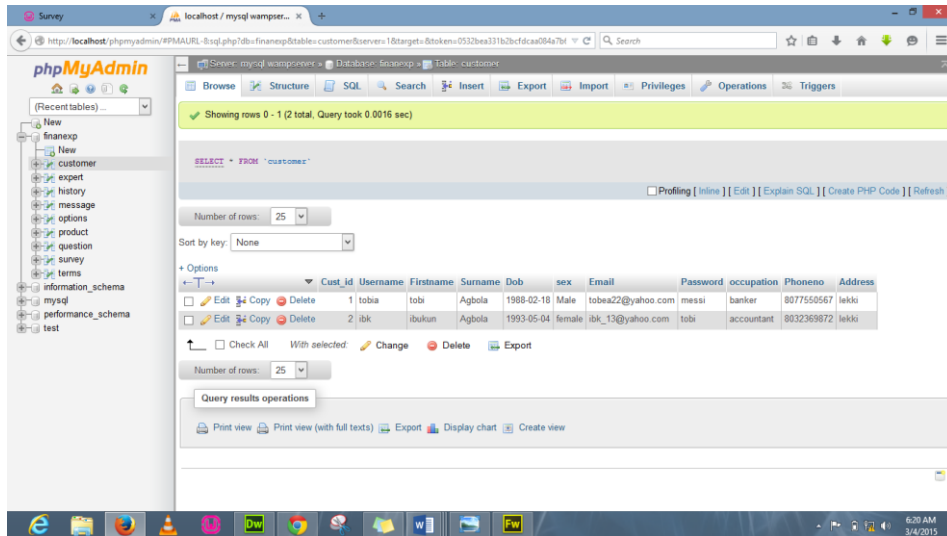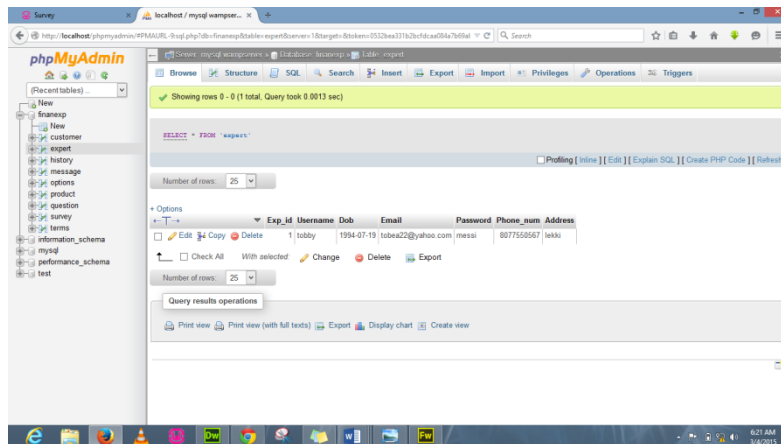

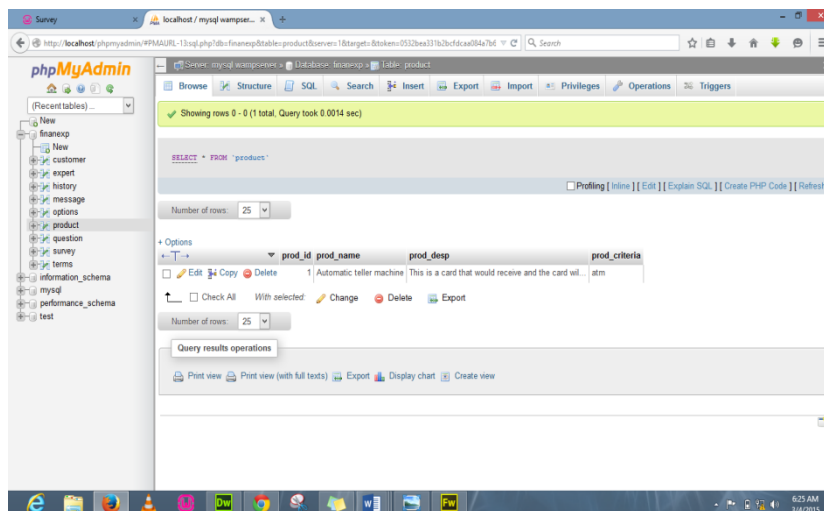Figure 5 - Customers Table

Figure 6 - Expert Table

Figure 7 - Product Table

Figure 8 - Questions Table

b. System Testing

The whole system was tested to ensure that every part was well integrated and functional (black-box and white-box testing). In process testing, it was ensured that every feature works satisfactorily. In testing the database, it was ensured that the database captured the specified fields according to their respective attributes, and that the storage and retrieval functions of the database functioned properly. The application interface was properly tested to ensure that it queried the database as required and fetched required information for any particular page.

c. The Application

This section presents the application. It states what some pages contain as well as what they enable. Starting with the homepage (Figure 9), various links are displayed. New users can click on the "Register with us" link to fill a form and register with the application. Registered users can click on the "Login" link to log into the system. Users who want to log into the system are expected to supply their username and password. If a user enters an invalid username and/or password, the system does not grant access and prompts the user to enter valid username and password. Logged in users are able to enter interview with the expert system, check their history, send messages to the expert, and view their own profile. The homepage also provides links to Contact Us and About Us pages.

Figure 9 – Homepage

Figure 10 shows the Registration page where users fill their details and register. This page gives the organisation certain useful information about prospective customers.
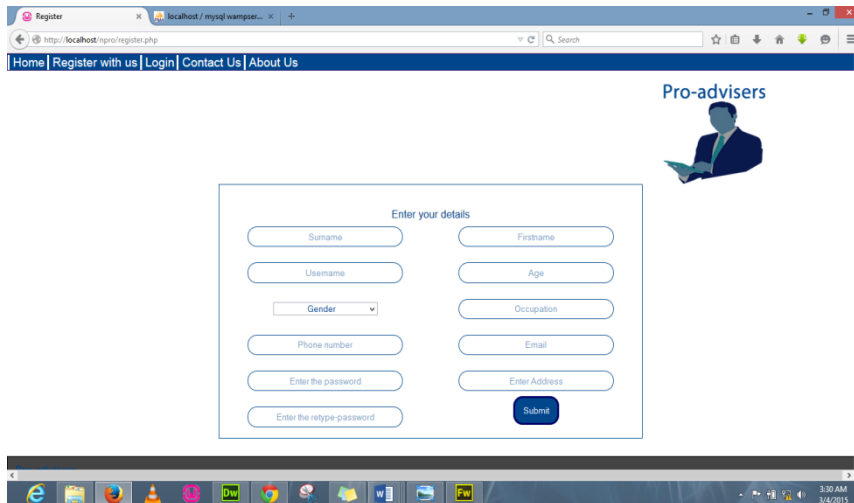
Figure 10 - Registration Page

Figure 11 presents login form for customers, prospective customers and the experts to gain access into the web application, through the process of authentication.
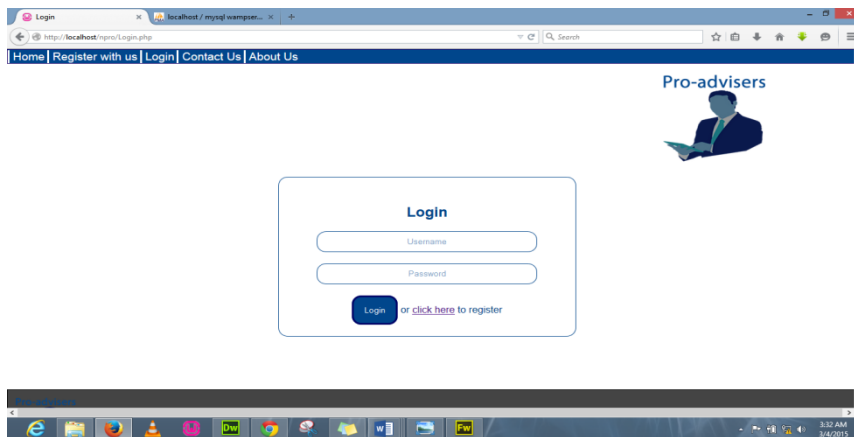

Figure 11 - Login Page

Figure 12 shows prospective or current customer home page where searches for more information on terms may be conducted or where an interview with the expert may be initiated.
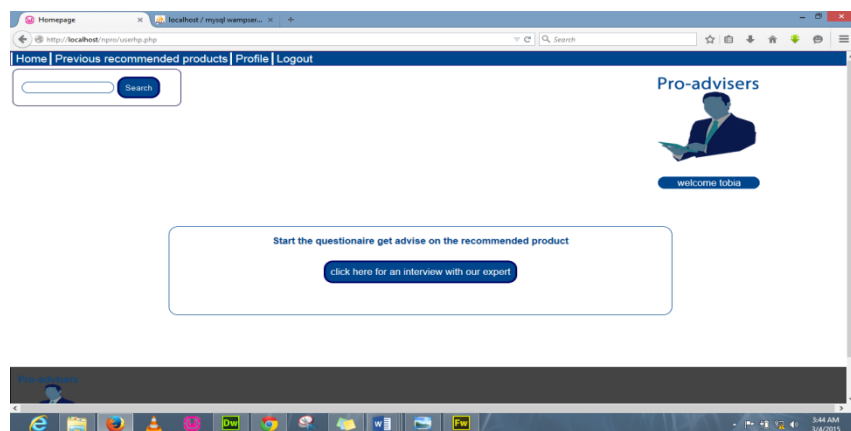

Figure 12 - Users Homepage

Figure 13 shows interview initial page where the expert system asks the user questions that it would consider in the making of the inferences and arriving at a decision.
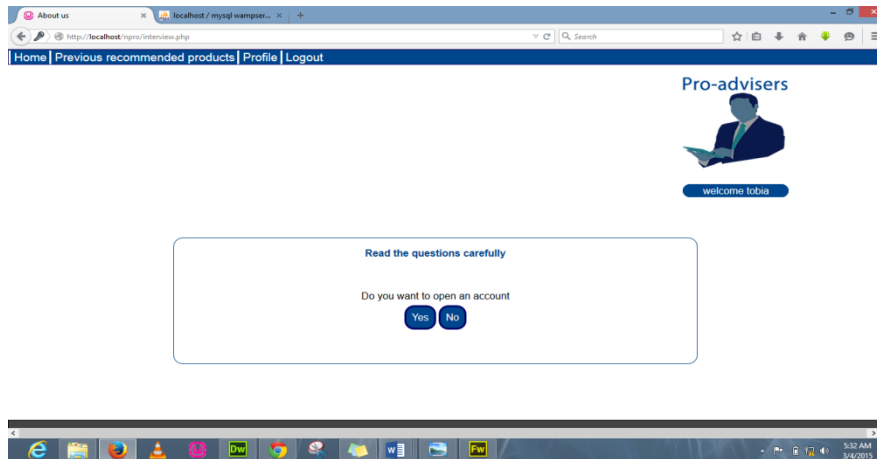
Figure 13 - Interview Initial Page

Figure 14 shows the home form for the expert and it contains the users' information and links to messages that individual users sent.
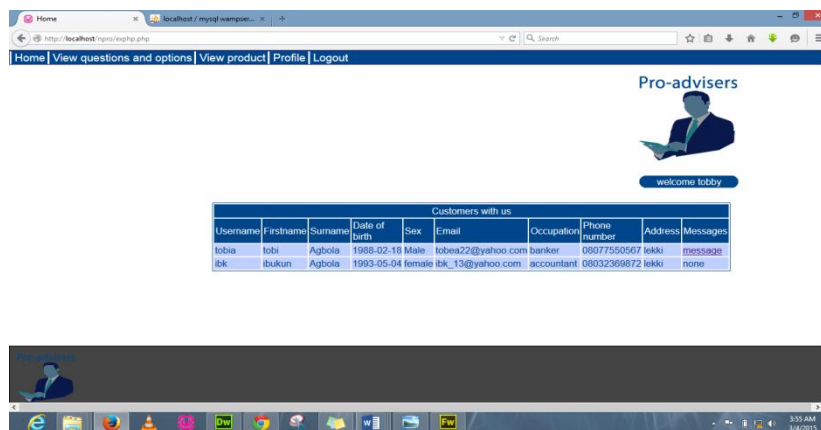

Figure 14 - Expert Homepage

Figure 15 shows the Expert's View of Questions and Options page where the human customer service personnel look at the questions in the expert system knowledge base and what the expert system will ask the user during the interview. The page also enables the expert to add new questions and option and to edit the existing ones.

Figure 15 - Expert's View of Questions and Options

The Products View page (Figure 16) contains the products that the expert can advise the user to make use of. It also enables the expert to add new products and to edit the information on existing products.

Figure 16 - Products View Page

The Add Questions page (Figure 17) enables the expert add more appropriate questions to the database for the expert system to use in inference to users' responses.
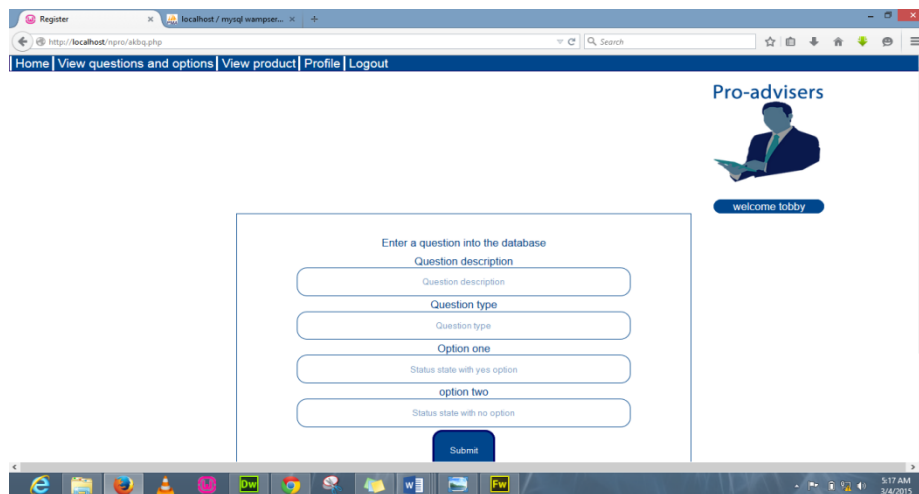

Figure 17 - Add Questions Page

Figure 18 shows the Add Product page that enables the expert add new bank products to the database.
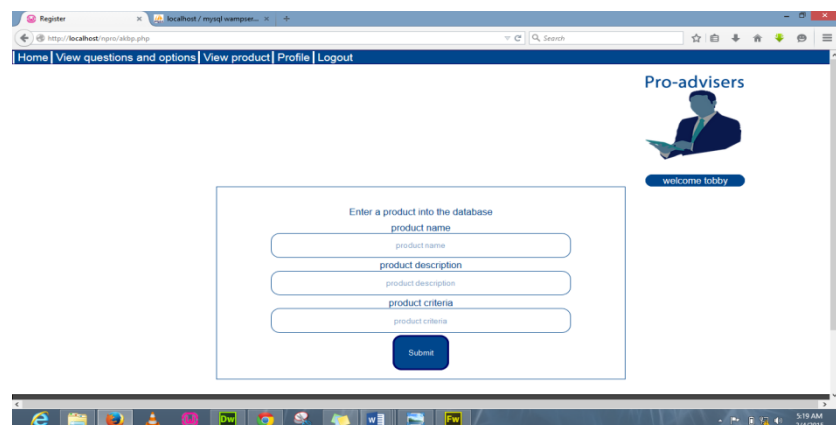
Figure 18 - Add Product Page

Figure 19 shows the Edit Products page that expert uses to update products information in the database.

Figure 19 - Edit Products Page

Figure 20 shows the Product Recommendation page that displays the recommended product to prospective or current customers interacting with the system.

Figure 20 - Product Recommendation Page

The Survey Page (Figure 21) gives every user a chance to rate the site. The result of the survey will enable the expert rate the quality of their site towards continual improvement.

Figure 21 - The Survey Page

d.   Application Platform
A platform is particular hardware configuration and systems software upon which an application will run (Stair & Reynolds, 2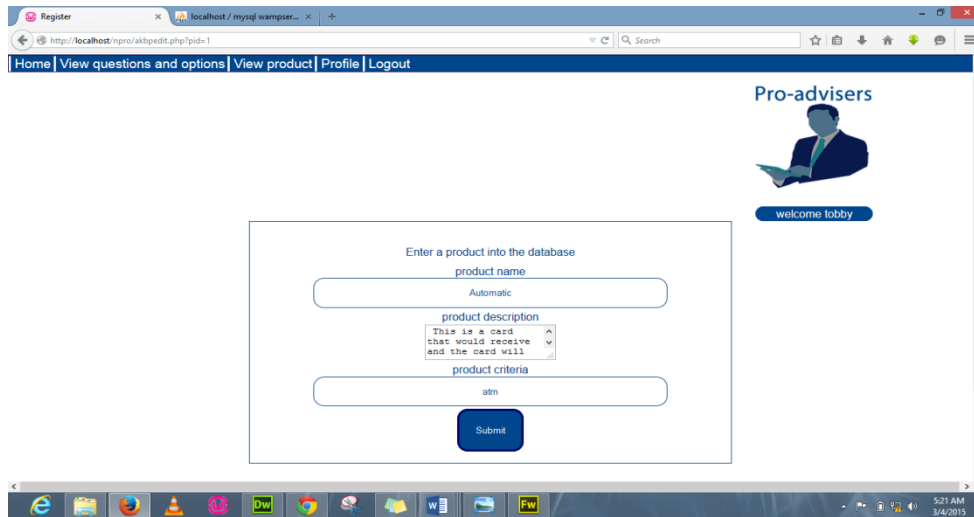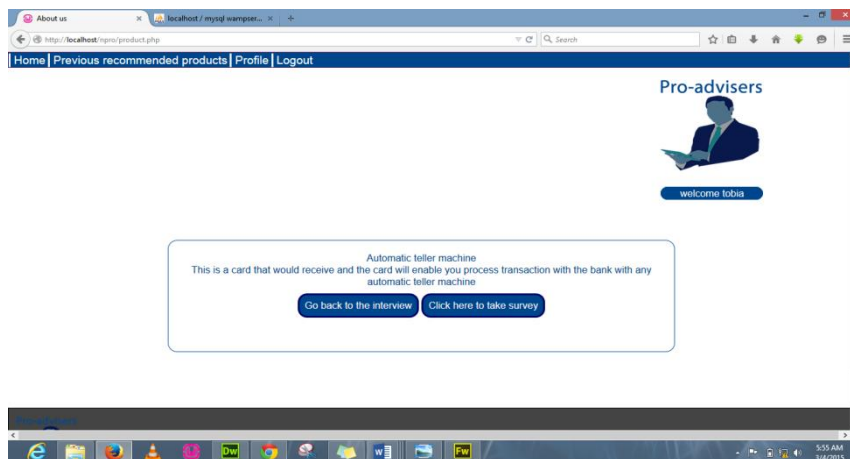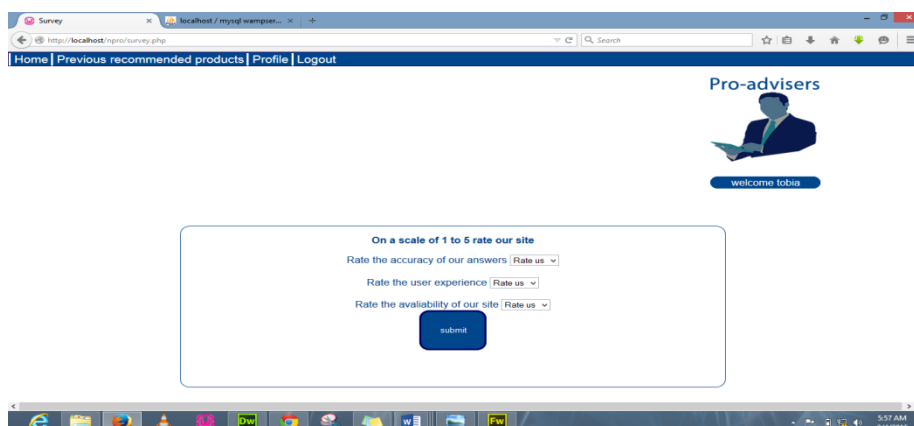007). Minimum hardware and software resources for the Bank Product Recommendation application to be deployed for use are as follows: Intel Pentium 1.0 GHz and higher, 80GB hard disk space, 1GB MB RAM or more, 1024 x 768 resolution screen and Network Interface Card on motherboard, Operating System (Microsoft Windows (XP, NT, Vista 7), Linux, or Mac OS), Web Server (Wamp Server 2.0, XAMPP version 1.7.1), and Browser (Internet Explorer 9.0, Safari, Mozilla Firefox 11.0, or Google Chrome).

III.   RELATED WORKS

Expert system is a branch of applied artificial intelligence (AI) that came to light in the mid 1960s. The basic idea of an expert system is to transfer the expertise of a human domain expert to a computing system, which makes inferences and arrives at specific conclusion (Nammuni et al., 2004), as would the human expert. Expert systems are basically used as assistants to help the experts and not to replace those (Nedović & Devedžić, 2002).

Important advantages in using an expert system are the uniformity of knowledge and a possibility of its improvement over time. If any new parameter is important for a company, then it is added to the knowledge base and is taken into consideration during the decision-making process (Nedović & Devedžić, 2002). In the 1980s, expert systems proliferated. Universities offered expert system courses and two thirds of the Fortune 1000 companies applied the technology in daily business activities (Leondes, 2002).

Up until a certain point, the primary development environment for expert systems had been high end Lisp machines from Xerox, Symbolics and Texas Instruments. With the rise of the personal computer (PC) and client server computing, vendors such as Intellicorp and Inference Corporation shifted their priorities to developing PC based tools. In addition new vendors often financed by Venture Capital started appearing regularly. These new vendors included Aion Corporation, Neuron Data, Exsys, and many others (Hurwitz, 2011). Rule engines are no longer simply for defining the rules an expert would use but for any type of complex, volatile, and critical business logic. They often go hand in hand with business process automation and integration environments (Leith, 2010).

Fineva is an expert system for financial analysis of firms (Matsatsinis, Doumpos & Zopounidis, 1997). It is a multi-criteria knowledge-based decision support system for the assessment of corporate performance and viability. The system was developed using the M4 expert system shell. The knowledge from the international literature was used and further knowledge acquisition was conducted through a series of interviews with financial experts. Decision tables were used to elicit the knowledge from the experts in the most efficient way, while a decision tree provides a graphical representation of the acquired knowledge. The representation through production rules was used to implement the acquired heuristics in a knowledge base. The output that Fineva produces is a specific ranking of the firms considered, according to a class of risk. Fineva's inference engine that draws conclusions about the performance of the examined companies employs both the forward- and the backward-chaining method. This inference strategy closely reflects human-expert logic and decision making in the domain (Nedović & Devedžić, 2002).

The FAME system is a knowledge-based advisory for financial marketing that has been developed long ago (Apte et al., 1989), but still represents a good example of financial expert systems. Financial marketing is the activity that determines the most beneficial offer to a customer within an agreed set of financial parameters. There are usually no well-defined criteria for determining the best solution for a customer's problem. FAME helps in the preparation of comprehensive financial marketing recommendations for the mainframe computer business. It runs on Lisp workstations, and extensively utilizes the advanced Input / Output features that are commonly available on these workstations. The system operates as an interactive assistant (the user remains in complete control during a problem solving session). The FAME system consists of well over 2000 complex objects connected in a K-rep network of multiple inheritance links (Nedović & Devedžić, 2002).

Advisory systems are designed to support decision making in more unstructured situations which have no single correct answer. In unstructured situations cooperative advisory systems that provide reasonable answers to a wide range of problems are more valuable and desirable than expert systems that produce correct answers to a very limited number of questions (Sasha, 2014).

Advantages of expert systems include expert advice availability extension, knowledge of expert staff capture, and use as training aid. It also provides rational decisions without any emotional overhead, without tiredness, efficiently, and in a friendly manner (Sasha, 2014). The major challenge in creating an expert system is the knowledge acquisition problem; getting adequate commitment of domain experts because the experts were by definition highly valued and in constant demand by the organization. As a result of this problem a great deal of research effort in the later years of expert systems was focused on tools for knowledge acquisition, to help automate the process of designing, debugging, and maintaining rules defined by experts. However, when

looking at the life-cycle of expert systems in actual use, other problems, essentially as with any other large system (integration, access to large databases, and performance), seem at least as critical as knowledge acquisition (Kendal & Creen, 2007). Limitations of the Expert Systems include narrow range of the codified domain, not responding well to situations outside their range of the expertise, human self – awareness is lacking and no introspection is possible, lack of causal knowledge (deep knowledge) cannot generalize through analogy to reason about new situations in the way people can, and Knowledge acquisition is the bottleneck of building an expert system (a time-consuming and labour intensive task) (Singh, 2013).

First Bank, Guaranty Trust, Diamond and Wema Bank of Nigeria, UBS Switzerland, Barclays and Chase Bank were examined regarding products and service prescription and propagation to current and prospective customers. Information about their products and services were mainly provided through simple links from their web homepages. All intended users were left to read and decisive what would be appropriate for them; no interactive nor tailoring to particular client's needs session. FBN provided the information through Banking Services, Personal, Business and Corporate buttons on its Homepage. Wema Bank provided its information through Individual, Corporate, SME or E-Banking buttons on Homepage. GTB, Barclays, Diamond and Chase through Products and Services tabs on Homepage. UBS Switzerland provided specific product and services details through Switzerland dropdown tab on through client types. The proposed application recommends products based upon interaction with current and prospective clients.

Konga, OLX and EBay e-commerce sites were also examined. Products and services were presented through categorization, classification and sub-classifications to specific product details. Customers were expected to browse to find what they desire. This may serve a good purpose considering what advert may do in convincing individuals to buy what they never intended in the first place. Nevertheless, this could still be complimented with an application similar to the proposed.

IV. CONCLUSION

The bank product recommendation application is an example of how customer can be led through a complex financial consultation process, without losing their bearings in the rather complicated domain. The best way to sell a product and encourage a recommendation from the buying customer to a prospective one is to first know what the customer wants and then meet and exceed the customer's expectations (Denny, 2012). The proposed application attempts to elicit customer's desire and recommend appropriate product to meet the customer's needs. The application recommends ideal product to each customer on the basis of the information provided. In addition, the application development process is available. The proposed idea and application could also be improved and polished to serve better.

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