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An Intelligent Based Screening Agent for Job Recruitment

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Abstract
Presently, companies and organizations face a lot of stress and complications to acquire intelligent and qualified employees. A lot of expert system has been developed to elucidate the process but they are not intelligently based enough. In this paper, an intelligent based screening agent is proposed. The advertised positions and necessary requirements are posted by company or organization. The applicant logon the system and apply for an advertised position, filling necessary form to generate his/her attribute and submit. Knowledge base for the applicants and the requirements of the company or organizations are created using Microsoft Access and an inference engine then developed to assign an applicant to a proper job requirement and finally create qualified list and unqualified list for assigned and unassigned cases. The system was implemented using Visual Basic 6.0.
Keywords: Intelligent, Screening, Recruitment, Human Resource (HR) Personnel, Expert System, Knowledge Base.

1. Introduction

It is not uncommon to see thousands of job seekers trouping daily in search of jobs. Many job seekers who have applied for job would have to wait for a long time for the result that may not even favor them. They receive a lot of insults while waiting on the queue and a lot of time wasted just to submit application. Besides, the selection done by human may cause an unfair result. It will happen due to the nature of humanity, kindness, or biased. The Human Resource (HR) personnel may choose their friends, family members, or anyone who has supports from influential people, who are not qualified for the vacancies by many jobseekers. The manual process needs a lot of files and application forms. It may cause a bulky of files in the Registrar Office. This may drive into a problem of applications' lost, damage, tear or unseen.

Most companies and organizations had started to do their works and business using automated systems in order to facilitate good service qualities. Some of them have left the manual method of receiving and screening job applications for modern systems of doing that with less of human efforts. It is because such systems acts as a medium to help them solve the problem of much time taken to screen many job applications as case may be.

A HRMS (Human Resource Management System) or HRIS (Human Resource Information System) is a combination of systems and processes that connect human resource management and information technology through HR software. Many HR professionals are choosing a HRMS to handle all their HR activities electronically. Having a great HRMS has numerous benefits. In the end, productively levels tend to increase as a result of choosing the right HRMS.

This paper proposes an intelligent based screening agent for job recruitment. The screening will allow applicants to logon, view available job, choose and apply for any job of his or her choice and submit the job application form into the system and it will immediately screen the job application(s) base on the job positions posted by an employer and the associated requirements, before it will display screening results for the applicant to know whether he/she is qualified or unqualified for a job position applied for. The system will equally display the list of all applicants, qualified and unqualified candidates.

The aim of this study is to develop an efficient intelligent job application screening agent which would among others allow the following objectives:

1. Accurately select without bias qualified candidates for job positions advertised;
2. Quickly update the application's form;
3. Fast processing of qualified and unqualified applicant's results including the list of all applicants together;
4. Save the result of the processing for future purpose.
5. Reduce cost of recruiting applicants for job

2. Related Works

2.1 Applicant(s) Selection

Selection is the process of collecting and evaluating information about an individual in order to extend an offer of employment. Employee selection is part of the overall staffing process of the organization, which also includes human resource (HR) planning, recruitment, and retention activities. By doing human resource planning, the organization projects its likely demand for personnel with particular knowledge, skills, and abilities (KSAs), and compares that to the anticipated availability of such personnel in the internal or external labour markets. During the recruitment phase of staffing, the organization attempts to establish contact with potential job applicants by job postings within the organization, advertising to attract external applicants, employee referrals, and many other

methods, depending on the type of organization and the nature of the job in question. Employee selection begins when a pool of applicants is generated by the organization's recruitment efforts. During the employee selection process, a firm decides which of the recruited candidates will be offered a position (Gatewood and Field, 2001)

Effective employee selection is a critical component of a successful organization. How employees perform their jobs is a major factor in determining how successful an organization will be. Job performance is essentially determined by the ability of an individual to do a particular job and the effort the individual is willing to put forth in performing the job. Through effective selection, the organization can maximize the probability that its new employees will have the necessary KSAs to do the jobs they were hired to do. Thus, employee selection is one of the two major ways (along with orientation and training) to make sure that new employees have the abilities required to do their jobs. It also provides the base for other HR practices—such as effective job design, goal setting, and compensation—that motivate workers to exert the effort needed to do their jobs effectively(Gatewood and Field, 2001).

One of the most difficult tasks a business owner faces today is finding the right person for the job. Most follow a suggested interview guide and trust their instincts (Kevin, 1997). They hire the individual and hope that with proper training and motivation, the individual will succeed. The difficulty with this approach is that it is the human nature to hire people we like and that have similar personalities to our own (Kevin, 1997). If you are a doctor of chiropractic and want to hire an associate, then you probably have a 50% chance of hiring the right person for the job. However, if you are hiring for a position for which you have little experience, chances you have is 10% and the position will become a revolving door . With the average hiring mistake costing of company $17,000-$20,000; competitive pressures makes hiring right the first time a necessity. There is a better way; Kevin said that the key to productivity and profits is having the right people in the right jobs (Kevin, 1997). He opined you call people with the right skills, motivation and work ethic to do the job.

2.2 Expert System

An Expert System is a computer program that uses artificial intelligences to solve engineering or computer related problems within a specialized domain that ordinarily required human expertise (Rich and Knight, 1996), (Krishnamoorthy and Rajeev, 1996). The expert system uses contemporary computer technology to store and interpret the knowledge and experience of a human expert in a specific area of interest. By accessing the database of knowledge stored in a computer, a non-expert can get a benefit of expert advice in that area. In addition, an expert system can be referred to as an interactive computer based decision problems, based on knowledge acquired from an expert. This statement may give the impression that an expert system is most likely to be inferior to the individual whose expertise was use in developing it, or can the most be as good as that individual. However, this may not always be the case. For instance, there are chess playing systems that demonstrate a much higher proficiency in chess than the human who helped design them. This shows that is not fair to characterize a computer-based expert system as necessarily being inferior to a human expert. (Turban and Aronson, 1988) assert that “an expert system is a system that uses human knowledge captured in a computer to solve problems that ordinarily require human expert”.

Every expert system consists of two principal parts which include: Knowledge-based and Inference engine (reasoning)

2.2.1 Knowledge Base

The knowledge base contains the domain-specific knowledge required to solve the problem. The knowledge base is created by the knowledge engineer, who conducts a series of interviews with the expert and organizes the knowledge in a form that can be directly used by the system. It is not necessary that the knowledge engineer be proficient in the domain in which the expert system is being developed. But a general knowledge and familiarity with the key terms used in the domain is always desirable, since this will not only help in better understanding the domain knowledge but will also reduce the communication gap between the knowledge engineer and the expert. Before deciding on the structure of the knowledge base, the knowledge engineer should have a clear idea of different knowledge representation schemes and the suitability of each under different circumstances.

The knowledge that goes into problem solving in engineering can be broadly classified into three categories, viz., compiled knowledge, qualitative knowledge and quantitative knowledge. Knowledge resulting from the experience of experts in a domain, knowledge gathered from handbooks, old records, standard specifications etc., forms compiled knowledge. Qualitative knowledge consists of rules of thumb, approximate theories, causal models of processes and common sense. Quantitative knowledge deals with techniques based on mathematical theories, numerical techniques etc. Compiled as well as qualitative knowledge can be further classified into two broad categories, viz., declarative knowledge and procedural knowledge. Declarative knowledge deals with knowledge on physical properties of the problem domain, whereas procedural knowledge deals with problem-solving techniques.

The knowledge base contains the knowledge necessary for understanding, formulating and for solving problems. It is a warehouse of the domain specific knowledge captured from the human expert via the knowledge

acquisition module. To represent the knowledge production rules, frames, logic, semantic net etc. is used. The knowledge base of expert system contains both factual and heuristic knowledge. Factual knowledge is that knowledge of the task domain that is widely shared, typically found in textbooks or journals. Heuristic knowledge is the less rigorous, more experiential, more judgmental knowledge of largely individualistic. It is the knowledge of good practice, good judgment, and plausible reasoning in the field performance, rarely discussed, and is largely individualistic. It is the knowledge of good practice, good judgment, and plausible reasoning in the field (Tripathi, 2011)

2.2.3 Inference Engine

The inference engine is where a decision or solution of a problem is drawn. The expert system reasons or makes inferences in the same way that a human expert would infer the solution of a problem in the knowledge domain that it is known to the system (Ghani et al., 2009). The inference engine is the component that manipulates the knowledge found in the knowledge base as needed to arrive at a result or solution (Edward and Robert, 1993). Inference engine is the generic control mechanism that applies the axiomatic knowledge present in the knowledge base to the task-specific data to arrive at some conclusion (Jocelyn, 1996). This is the second key component of all expert systems. Having a knowledge base alone is not of much use if there are no facilities for navigating through and manipulating the knowledge to deduce something from it.

The inference engine is the heart of the expert system since this is the part of the program that builds the bridge between information and solutions. Two different approaches to problem solving are usually distinguished and inference engines are accordingly characterized in two different ways, as either backward chaining or forward chaining (Liao et al., 2004). Forward chaining is the process of data gets put into working memory. This triggers rules whose conditions match the new data. These rules then perform their actions. The actions may add new data to memory, thus triggering more rules and so on. This is also called data-directed inference, because inference is triggered by the arrival of new data in working memory. Meanwhile backward chaining is the process when the system needs to know the value of a piece of data. It searches for rules whose conclusions mention this data. Before it can use the rules, it must test their conditions. This may entail discovering the value of more pieces of data, and so on. This is also called goal-directed inference, or hypothesis driven, because inferences are not performed until the system is made to prove a particular goal (Jocelyn, 1996); (http://www.ukessays.com).

The inference engine is the program part of an expert system. It represents a problem solving model which uses the rules in the knowledge base and the situation-specific knowledge in the working memory (WM) to solve a problem. Given the contents of the working memory (WM), the inference engine determines the set of rules which should be considered. These are the rules for which the consequents match the current goal of the system. The set of rules which can be fired is called the conflict set. Out of the rules in the conflict set, the inference engine selects one rule based on some predefined criteria. This process is called conflict resolution. For example, a simple conflict resolution criterion could be to select the first rule in the conflict set. A rule can be fired if all its antecedents are satisfied. If the value of an antecedent is not known in the WM, the system checks if there are any other rules with that as a consequent; thus setting up a sub-goal. If there are no rules for that antecedent, the user is prompted for the value and the value is added to the WM.

If a new sub-goal has been set up, a new set of rules will be considered in the next cycle. This process is repeated till, in a given cycle, there are no sub-goals or alternatively, the goal of the problem-solving has been derived. This inference strategy is called backward chaining (since it reasons backward from the goal to be derived). There is another strategy, called forward chaining where the system works forward from the information it has in the working memory. In forward chaining, the conflict set will be created by rules which have all their antecedents true in a given cycle. As a knowledge base is usually very large, it is necessary to have an interference mechanism that searches through the data base and deduce results in an organized manner. An inference engine can be divided into two categories namely: deterministic and probabilistic.

Deterministic: It is a process that has some element of certainty associated with it.

Probabilistic: It is a process that does not have some element of certainty associated with it.

Inference mechanisms are control strategies or search techniques, which search through the knowledge base to arrive at decisions. The knowledge base is the state space and the inference mechanism is a search process. As expert systems predominantly process symbols, the inference process manipulates symbols by selection of rules, matching the symbols of facts and then firing the rules to establish new facts. This process is continued like a chain until a specified goal is arrived at. In an expert system, inference can be done in a number of ways. The two popular methods of inference are backward chaining and forward chaining. Backward chaining is a goal-driven process, whereas forward chaining is data driven. The knowledge base contains three rule bases, one for selection of a structural system, the second for arriving at span-to-depth ratios for beams and the third the meta rule base. The inference process for the first rule base is presented first for understanding the two methods, viz., backward chaining and forward chaining.

There are three ways of constructing an inference engine which includes: Forward chaining, Backward chaining, and Rule value

2.3 Forward Chaining

It is an inference engine that uses the data supplied by the user to move through a network of logical AND''S and OR''S until it reaches a terminal point which is the object. It is sometimes called Data Driven Inference Engine. If the inference does not find the object by using by using existing information, it requests for more. The path that leads to the solution is determined by the attributes of the object.

2.4 Structure of Expert System

The general structure of an Expert System is shown in Figure 1. A Knowledge based is an organized collection of facts about the system domain and an inference engine interprets and evaluates the facts in the knowledge based in order to provide an answer. Typical task of expert system involve classification, diagnoses monitoring design, scheduling and planning for specialized endeavours. In general, knowledge is acquired from human expert through interviews.

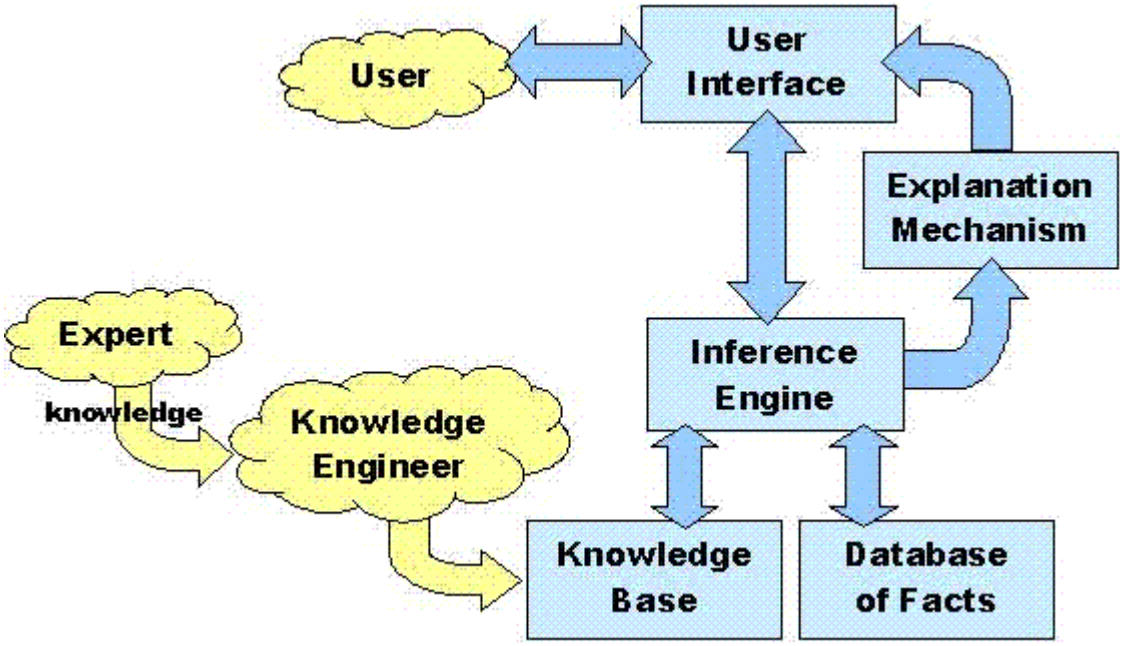

Figure 1: General Structure of an Expert System (http://hsc.csu.edu.au/ipt/dss/3294/expert_structure.htm)

2.5 E-recruitment Expert System

There are many e-recruitment systems that have been proposed with an objective to cut cost and to speed-up and increase the efficiency of the recruitment process. In order to find the suitable candidates for job positions, these systems use different approaches like relevance feedback (Kessler et al., 2007; Yi et al., 2007), semantic matching (Mochol et la., 2007), machine learning (Faliagka et al., 2012), natural language processing (Amdouni and Ben Abdessalem Karaa, 2010) and analytic hierarchy process (Faliagka et al., 2011) to automatically represent CVs in a standard format.

Major advantages cited as related to the rapid and successful adoption of e-recruiting methods include cost savings, efficiency and convenience for both recruiters and job seekers (Cappelli, 2001).

All these tools suffer from inadequate matching of candidates with job requirements (Bizer et al., 2005). Basic theory and mathematical tools are already available; however, the most complicated part in job matching process is the matching between the candidate's information and employers' requirement.

3. Analysis of the Proposed System

The proposed system is designed in three stages. Database for the organization or company's vacant positions and requirements are created. The applicants' database and attributes also created. The inference engine (screening agent) was then created to matches the applicants to corresponding positions as required.

3.1 Database Design

The company or organizations simply send the needed positions and requirements and the database of it are easily created. The database for the applicants and their attributes are created as he/she log into the system, select a position posted, filled a form already designed that on three keys to which will necessitate their selection using the proposed screening agent.

1) Educational Qualification

2) Skills, knowledge and working experience
3) Retention

Educational Qualification: The first thing is to know is whether the applicant have formal academic training. However, any individual without this qualification is of course not the right person for this job. It is based on the individuals' training that we can accept him/her for further consideration. Hence, form is designed acquired attributes relating his/her education qualification.

Skills, Knowledge, Experience: The second question to know whether the individual have the skill set to do the job. The form to be filled is also designed to acquire the skill and experience of the applicant. The bottom line is that what good does it do to hire someone who can't open Microsoft windows, add and subtract or compose a business letter? Make sure they have these basic skills before you hire (Kevin, 2004).

Retention: If an applicant is hired, who inside the organization is best to mentor him or her and jump start his or her productivity? So question of "who do you know you can work with in the company or organization" is necessary. Many times the "right" applicant, are hired and they perform excellently during the '' honeymoon''. Then after some times their productivity slowly fall into nonexistence. In a recent research, it was discovered that often if a new hire had the ''right trainer'' success is achieved. But if the new hire was then assigned to a supervisor or trainer with whom they were incompatible. The result was that after 120-180 days; the new hire became de-motivated, disheartened and left.

To get more attributes, the form is also designed for applicants to filled information that is bordered on **mission/sense of purpose, tenacity/ perseverance, time management, character and credit history**

3.2 Mathematical Model/ logic Design

The inference engine that mathematically maps the applicant's information in the applicant's database onto the company or organization's positions and requirement in the company or organization database is designed logically as given in figure 2.

Mathematically or logically, the system has the database for information for the applicants consisting of $A_{ij}\{i = 1,2,3, \dots, M \; and \; j = 1,2,3, \dots N\}$ where i = number of applicants and j = number of attributes that may be considered for the job positions. Note that all the fields for attributes may not necessary be filled by each applicant. Also in the system is the database for the company consisting of $C_{ij}\{i = 1,2,3, \dots, M \; and \; j = 1,2,3, \dots, N\}$ where i = number of vacant positions to be filled and j is the requirements for the positions. Note all jobs requirements may not be necessary the same.

The mapping then transforms A_{ij} into list of qualified candidates (Q_{kn}), and list of not qualified candidate (NQ_{ln}), in Microsoft Excel environment, where k is the number of qualified candidate, l number of not qualified candidates and n attributes of the candidates.

The database of applicants is stored from beginning to the end in order of time of login. This implies that if five candidates are required for a five similar job positions and six applicants attributes matched the job requirement, only the first five candidates will be considered qualified.

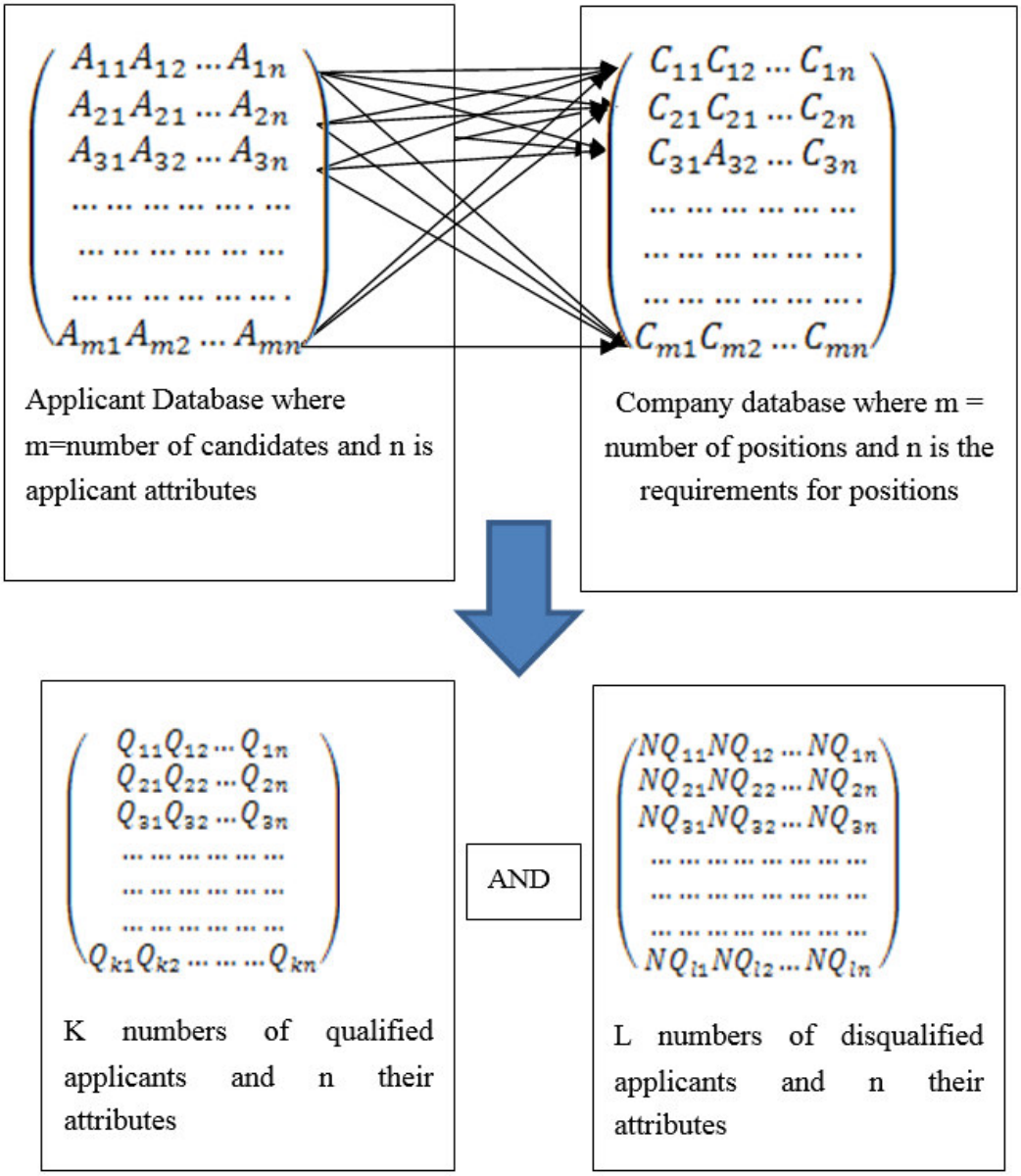

Figure 2. Mathematical Logic Design of the system

The architectural design of the system is as shown in figure 3.

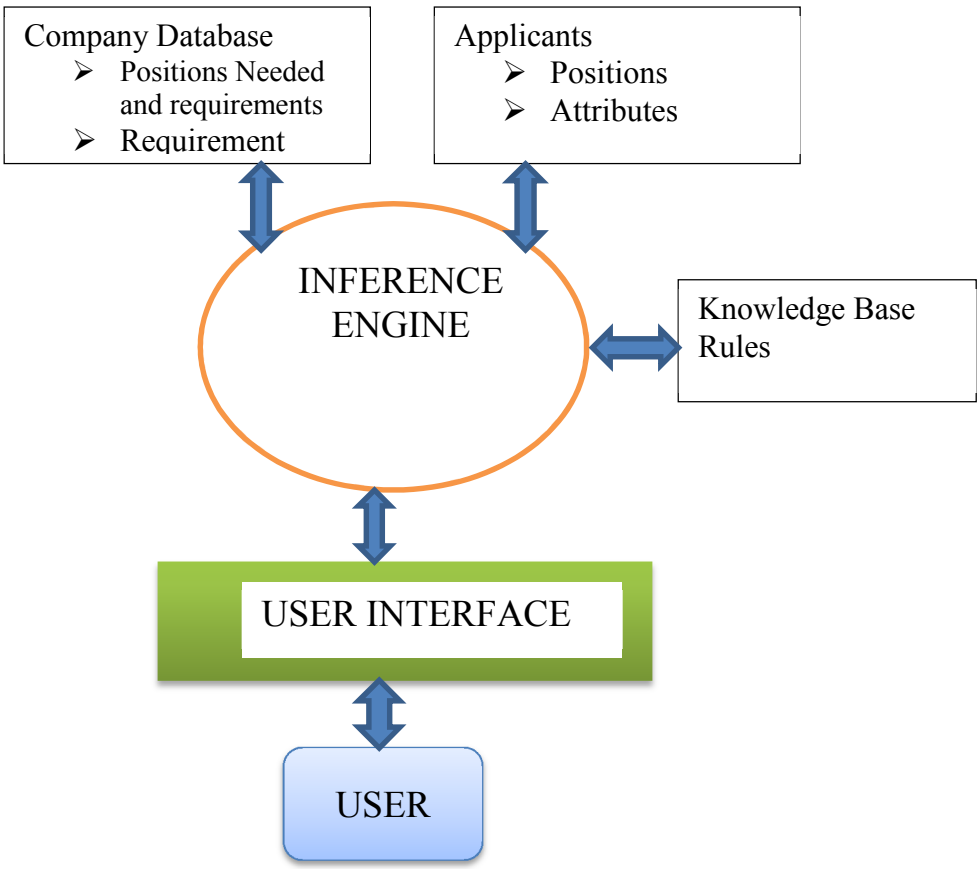

Figure 3. Architectural Design of the System

4. Results and Discussion

The developed system was implemented using a PC with the Microsoft Windows Operating System (windows XP or later) with Microsoft Office 2003 or later (with access included).

Microsoft Visual Basic 6.0 was used for the implementation as it makes it easy to obtain data from relational database and is object oriented; it also provides complete set of tools to simplify rapid application development. The program created with Visual Basic are event driven, events are signals generated within the computing environment that indicates something has happen to which the computer should respond to. It is interactive in nature and easy to debug, because of the inbuilt error reporting system.

Figure 4, Figure 5 and figure 6 show sample output from simulation of the system. Figure 4 shows the main menu for login, Figure 5 shows the application screen and figure 6 shows the admin screen where the screening has been done.

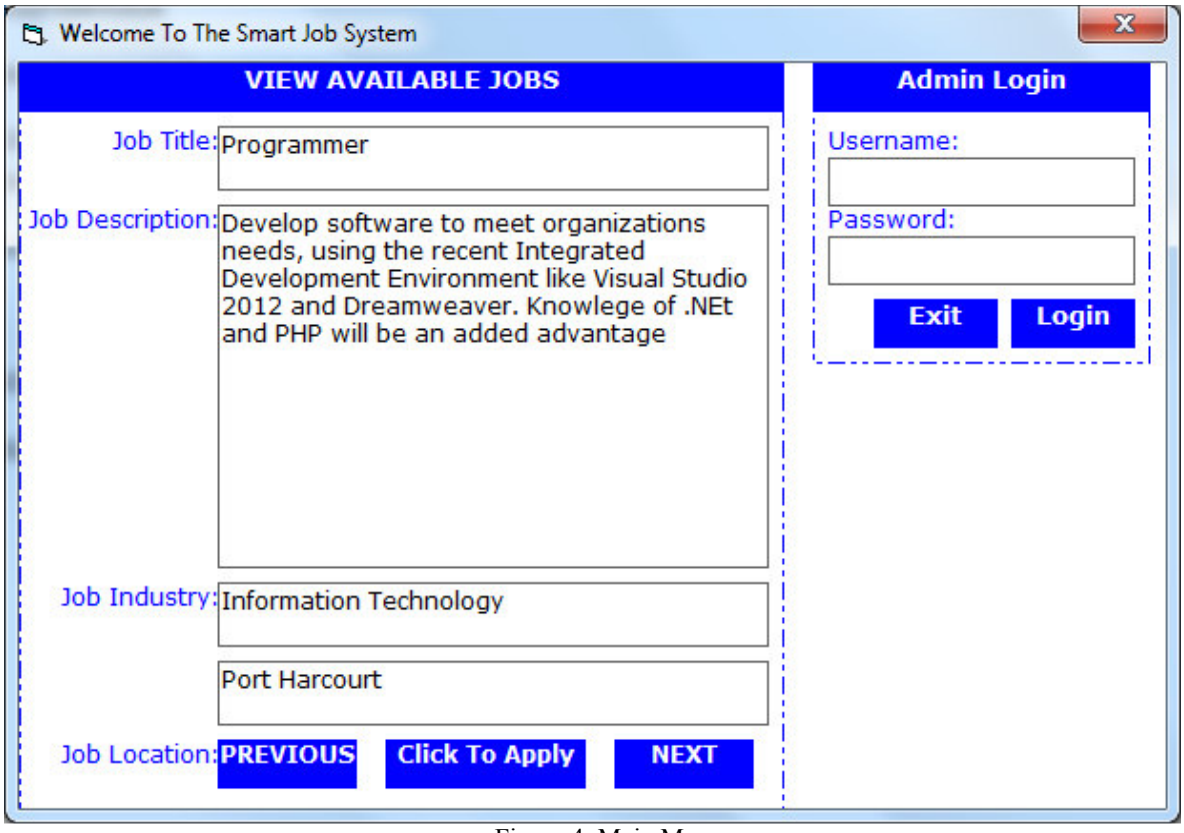

Figure 4. Main Menu

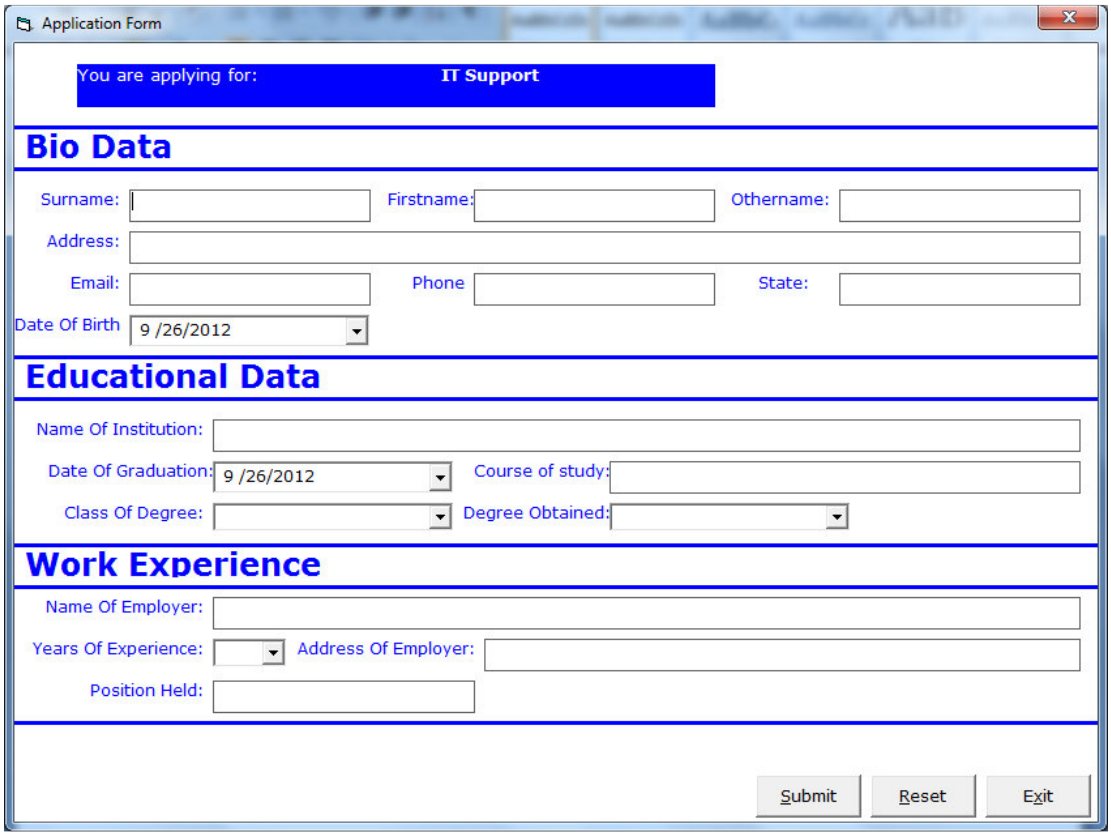

Figure 6. Application Screen

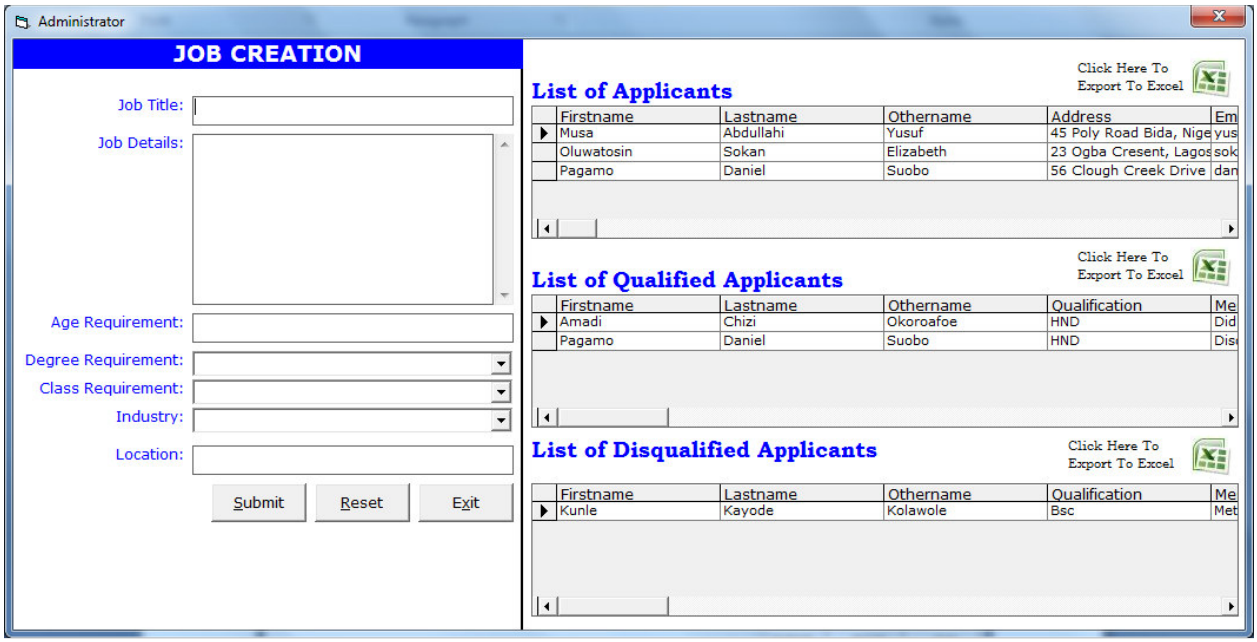

Figure 7. Admin Screen

5.0 Conclusion

The designed intelligent based screening agent for job recruitment has an aim to make an intelligent relationship between user or consultant and job provider companies. This present work represents an application of expert system in software development for job seekers and for companies and organizations wishing to hire the right person for the right position. From the simulation result and discussion, it is clearly concluded that the designed intelligent screening agent using visual basic and Microsoft Access is very user friendly, robust, less computational cost based system and easily useful for the consultant (Job seekers) and as well as job provider companies.

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