

Design and Implementation of an Expert Recruitment System

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Abstract: Recruitment is not as simple as it sounds. Every failed recruitment is a set back to the employers as this may result to a catastrophic loss. It is therefore empirical to look beyond the manual recruitment process to automated process and the field of expert system (ES) has offered us a hand shake towards this transition. The act of merging of technologies in the Internet and the field of expert systems has offered new ways of integration of processes and knowledge distribution. This has not left the field of recruitment with a vacuum. The researcher will develop a web-based expert recruitment system that will assist human skills in recruitment selection procedures. However, there has been a general lack of research in the area of web-based expert recruitment systems (ERS). The researcher addresses the issues associated with the design, development, and use of web-based ERS from a standpoint of the Job seeker, the System administrator and the organizations (Employers). The original theory and concepts in conventional ES were reviewed and a knowledge engineering framework for developing them was revisited. The study considered the design of an ERS which is used to select candidates for a most suitable job with accuracy of about 98%.

Keyword: Expert System (ES), Artificial Intelligence (AI), Expert Recruitment System (ERS), Web-Based Testing (WBT),

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I. Introduction

Different methods of recruitment abound as used by various companies and establishments. One may even want to inquire the reason behind companies engaging with careful recruitment process. Recruitment is vital public relation force; the truth is that the quality of any workforce will ultimately impact on the society and the company both in bottom line profit and public relations image [1]. Most companies accept resumes and job application through recruitment websites in line with various job posting or advertisement [2]. In this case personnel and recruitment officers will require doing manual screening of each application which is no doubt a rigorous and cumbersome process. This kind of process is overtly identified to be time taking as well will require more numeric staff strength to handle and most of the times will involve cross checking due to factor of human accuracy limitation. One can also say in summary that human factor is a major source of inaccuracy and inconsistency in results. There are many approaches and techniques for automating the recruitment such as collaborative filtering to match the candidate for the given job [3]. Certain recruitment and selection patterns impose social barriers for disabled people [2] but quality recruitment process which is as a result of Expert screening procedure or simply put Expert Recruitment System (ERS) is key and the solution to the flaws of most of this limitation in recruitment selection. Truly, the mentality of searching and selecting of applicants for employment based on performance on their certificate is another challenge of most employers today. This work is therefore geared towards overcoming the inherent challenges of social and manual recruitment exercise [4] thereby avoiding the selection of less reliable, less competent and less suitable applicants and also recommending the best fit for employment interview.

This work is designed to create a solution that will facilitate the speed in recruitment process and improve on the quality of candidates recruited. This design will achieve this by applying some sort of fuzzy theory concept in statistical analysis of information for each candidate, which is an Expert system. We will develop an Expert Recruitment System that can establish links with other employment websites. We can agree that the advent of internet has created a progressive development of most process from manual to automation, and recruitment exercise is not left behind. Web based recruitment has emerged and is taking the lead in human resource exercise. Hence, we have identified the challenges facing some recruitment agents and processes and these challenges have also been addressed likewise in this work. We have identified the present challenges facing the recruitment system in Nigeria and they are manual recruitment processes and the non-expert web-based recruitment system.

The research aims at creating a functional expert recruitment system that can address the existing issues with the following objectives:

1. To select and hire appropriate candidates suitable for the specified Job

2. To eliminate human errors and inconsistencies due to manual selection process, therefore increasing the processing capacity and speed with higher level of accuracy using Expert System.
3. To identify and improve employers' recruitment needs and liaise more with them in improving on their selection standards.
4. To develop a system that will help to recommend the most suitable candidate for the job.

This work will provide a solution to the hire and sack syndrome facing most establishments due to incompetent hiring of staff and will be significant to the Public and Private sector. Also, this work will be relevant and beneficial to the present and future work of Expert System. One can also see how beneficial it will be to individuals because the System is customer centric because individuals/ user's satisfaction is ultimately designed. There is room for people who are wrongly placed or referred to a job to give a feedback for reassignment of choice. One can see that this work will both develop our establishment's workforce and prepare candidates mentally for employment, thereby improving the society and economy.

II. Related Works

It has been gathered that human resources are long acknowledged by various scholars and researchers to be a major player to the overall success of an organizational structure. Recruitment is one function of the human resource management. Recruitment is one those practices and activities carried out by an organization with the aim of selecting desired potential employee [5]. The major essence of recruitment is to hire and retain staff that will meet the needs of the advertised positions in an organization with the utmost view and goal of reducing cost of the process. Selection procedure is a very essential part of recruitment process. Selection is a method used to identify the rank of suitable and adequately qualified applicants in any advertised positions with respect to knowledge, skills and abilities [6]. From our reviews so far, it is important to note that any recruitment process is interceded by some sort of organizational, legislative, social and political requirement. For instance, after any selection is done, you must also ascertain the employment eligibility and qualification of your new employee. In most nations, for instance, the immigration reform and control act require the employment of citizens and aliens authorized to work in the country. So, eligibility of employment based on this should be verified from relevant quarter and authorities. An expert recruitment system is expected to perform some of this task seamlessly.

In evaluating the recruitment and hiring process, the ERS is required to perform this task via the use of statistical information analysis for the recruitment and hiring functions. This process is evaluated in order to ensure cost effectiveness, timeliness and competency. Any gathered information may not be of consequential importance in further recruitment without the input of other additional information. There is record in studies carried out in the past which claims that fifty-two million American uses the internet for their job searches and even more than 4 million do so typically everyday [7].

It is gathered that almost all the nations of the world are copying the Americans. Our study further shows that every hiring procedure when automated will substitute drastically reduce paper and manual approach thereby streamlining with view to improving recruitment and selection processes.

It is not disputable that online recruitment is one of the most active e-commerce websites [8]. From further study, a total of 91.3% of the job seekers have also opined that the internet was somewhat helpful for their Job search.

E recruitment utilizes the web and its assets for the execution of task requirement of finding, attracting, testing, assembling and hiring new employees.

There are many job recruitment portals that are available on the internet today. The growth of Internet-based testing opens a window of opportunities for researchers. Even though answers to questions that are related some theories are provided such as in organizational justice theory. We need to examine the views on some experts' mind. By a short review of some work shows on the cost benefits as one dividends of internet-based testing. Up to date, many experts believe beyond reasonable doubt on the promising aids of Internet based recruitment. In the same way, there is more collaborative thoughts that shows that Internet testing invariably enjoys more advantages over the manual pen and paper format, thereby adapting many forms of computer-based testing at large. Making us not to leave behind evidences as showcased by researchers alike. This explosion presents the significances of a case study of an organization which used the Internet for screening out applicants in early selection stages [9]. This was done by comparing the testing process before and after the introduction of the Internet-based system on an amount of proportions. By the help of Internet-based selection, it was easy to reduce the screening time per hire and was measurably decreased by 73.67% as such drastically reducing the event in shorter days. Rendering to another studies, exhaustive importance on Internet recruitment prototypes can be used to by companies to achieve reduction of hiring sequence time by 60%. A major setback of these postulation, is that the evaluation of the combined impact of Internet-based recruitment with selection, making it difficult to understand the exclusive effect of Internet testing. More doubts, still showcases the growth

relationship of expert internet-based testing over “orthodox” computerized testing within the organization. In other words, we are looking at the optimal risk and value-added aspect of having applicants partake of their testing using specialized test centers versus doing the tests in the organization building? The answer could be obvious and simple. There is increase in changes for both the employer and the candidate, also don't forget the associated travel and logistics costs are reduced. Light is gradually emerging at the tunnel. Technology is about advancement helping to make life more reliable and measurable. [10] Web based testing (WBT) provides an interactive screening experience for candidates with user identification and test security tips. In this light, upcoming work should be able to investigate the efficacy of various web-based testing applications and methods. To this end, numerous key performance factors can be used such as time and cost savings and accessibility. Another important factor that stems from other reviews about Internet selection processes relates to expert's concern area, trying to find out if the use of this tool will contribute to the social and cultural work ethics to employees in particular. More work is yet emerging on selection tools. It is also important that we pay attention to the various dimensions towards possible technological failures of web-based testing.

A WBT is an assessment tool which is normally written in the "language" of the web, HTML, XML etc. The test is made up of one or more HTML files located on the server computer which is downloaded used for testing on the candidate's computer, the client. Downloading continues as long as the test is still ongoing occurring at once or item by item. There is a client server relationship.

The client computer makes use of web-browser software to present the downloaded data form in HTML. Normally the Candidate taking the test responds to items through a client computer and transmits responses back as a form data. The WBT is of different kinds. One depends on the programmer's budget, skills, and the availability of computer equipment to the candidates to be examined. In this WBT, the server only holds the test or the item pool while the selection of the next test item is done by means of a script located in client side. Test partakers' responses are either scored on client side or sent to the tester's email box and stored for later downloading [10]. This kind of approach is preferable since not so much requirement of test data is expected.

There is the high-tech WBT which requires a heavy use of server interaction, both activities require the services of program testers. This method is sufficiently better for high volume of data and supports internet testing [11].

Expert system can be defined as computer software that uses artificial intelligence (AI) techniques to perform or control guide a given task which a human expert can do. The emphasis has been shifted from techniques and formalism to the knowledge that an expert system contains [12]. The expert knowledge is very necessary and sufficient for developing an expert system. The study of expert system has shown the clarity that acquisition of this knowledge is a technique and can also be called an art and is relevant area in the field of knowledge engineering process.

Every other Author of articles on expert system and knowledge acquisition favorably quotes Hayes-Roth. In expert systems the power base is the knowledge that it possesses [13]. Most of the emphasis in expert system development is expected to go to the knowledge acquisition center [14]. The building process is described as the process of knowledge acquisition.

Now in building expert system, we have identified some documented stage involved namely identification, conceptualization, formalization, implementation and testing stage. Given that most literature has identified the theoretical need of expert system is recruitment, the gap is identified in siting an automated system that filters its search with skills in recruitment selection.

III. System Analysis and Implementation

Systems analysis is a process by which data accuracy is observed in data collection. In this stage, we have tried to understand the processes, identify the inherent challenges required to suggesting and improving the system functionality. This process involved studying the recruitment processes, gathering required data required fix the new system.

Most Job Portal serves as a common repository for collection and search of CVs. A detailed review and analysis of some selected existing web-based recruitment system such as Hot Nigerian Jobs (hotnigerianjobs.com), My Job Mag (Myjobmag.com.), Jobber Man (Jobberman.com), Ng Careers, Dice.com and Glassdoor.com all shows that they may be well articulated but not expert in operation. Most of them will eventually post jobs to the subscribers but does not have the ability to do selection test and eventually complete the recruitment with much interference of human expert.

3.1 Method of Analysis

Recall that in our literature review we talked about observational studies as one of our technique for knowledge acquisition in expert system. The assessment was carried out using observational studies of users which are mainly job seekers. The success of this study as a result of subscribing many users as Job seekers to

different job portal for the various jobs/vacancies available per time. This was done between May 2018 to March 2019.

The present procedure of recruitment systems lacks expert in it. We have observed that people just come and post CVs without follow up. The present system does not revisit application data ones treated in case of future eligibility to new openings.

3.2 Design Consideration

3.2.1 Analysis of the Proposed System

The following subsections present the system analysis of the proposed system which includes: requirements definitions, data modeling and detailed system designed.

The scope will entail designing a system that will be able to accept and gather CVs from individuals as well as gathering of company profiles and adverts, match adverts to applicants and subsequently do the selection procedure. After any selection is done, you must also ascertain the employment eligibility and qualification of your new employee. In performing the recruitment and hiring process, the ERS is required to perform this task using the statistical information analysis for the recruitment and hiring functions. This process is evaluated in order to ensure cost effectiveness, timeliness and competency. Requirement analysis involves ability for the system to the deduction of requirements from the various the stakeholder such as organization and applicants. We have done direct observation and interviews to ascertain the modalities of these activities. Also, because this is much of the management that will be concern with the data analysis, much of the reasoning will be from the management and owners of the company.

Data modeling is the process of taking the software requirement and converting them into hard diagrams. We will be using text and symbols to represent the way data flow. In traditional system development, Entity Relational Models (ERM) were normally deployed using the Entity Relational Diagrams (ERD). However, in big data and data warehouse design, the entity diagrams are not necessary desirable.

The model of analysis approached as adopted by this research work is object-oriented analysis and design method (OOADM). OOADM will structure a research into smaller and well-defined activities and also defines the sequence and object interactions.

As in use by [15], Unified Modeling language (UML) was engaged. As identified even in the use modelling there is some associated risk in automation [16].

The system describes a use case diagram showcasing the functional unit as provided by the system. This shows the visual requirement of the relationship with the actors that is human beings who will interact with the system.

Administrator, the job seekers and Organizations, Administrator: Verify Organizations, Job seeker: Fill CV, search for jobs, submit CV to jobs, update CV, Organizations: Post Jobs, search for potential employees, send invitation

In this design we have employed a unique object classification shown below in the diagram.

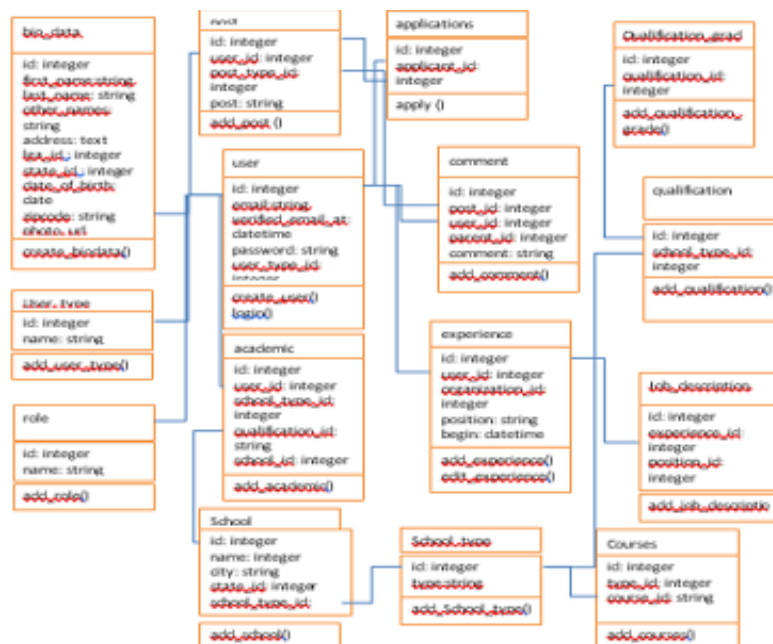


Fig 3.1 The System class Diagram

Also, the database design of the proposed is achieved with MSQl, which is a relational database that stores data in a separate table rather than keeping all the data in a single warehouse. Few of the tables are shown.

Table 3.1Users table: This table contains the login details for all users in the system

Field	Data Type	Size	Null	Description	Action	Extra
Id	integer		NO	Unique	Primary Key	Auto-increment
Email	varchar	50	NO	Valid email	unique	
Password	Varchar	50	NO	Not less than six characters	encrypted	
Email_verified_at	datetime		Yes	Date and time of email verificaton	datetime	

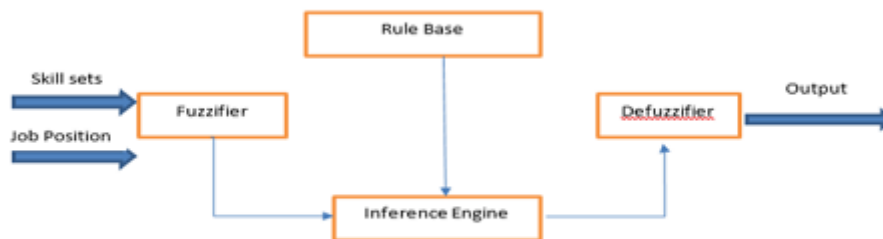
Table 3.2Experience table: this table holds details about a users’ work experience

Field	Datatype	Size	Null	Description	Action	Extra
Id	integer		NO		Primary key	Auto-increment
User_id	integer		NO		Foreign Key	

Table 3.3Skillsetstable: this tables contains various skills acquired by users and how long they have been exposed to such skills.

Field	Datatype	Size	Null	Description	Action	Extra
Id	integer		NO		Primary key	Auto-increment
User_id	integer		NO		Foreign key	
Name	Varchar	100	NO			
Years of experience	integer		NO			
Details	Varchar	200	NO	Further information if needed		

Fig 3.2 Activity diagram of ERS



3.3 Implementation Requirements

In ERS we use Java and MySQL. The glossaries of Job specification, applicant’s details and remarks with respect to their experience scores is stored in the database.

PHP: for the interaction between user and the system, the system and the database. And the system and Elastic search. Java: Interaction between Elastic Search and the database. The Java also is responsible for the fuzzification and defuzzification of the system.

The system accepts a skill at a time, then checks for candidates who have the skill or closely related (in spelling) to the skill. If found then other skills are checked as well. The more skills match for a job, the greater the degree of membership.

For all candidates who have at least one skill match, the system goes through their CV for a job-position match. If there is a job position match, then the candidate is fully a member of the set.

The system returns a list of the candidates and their years of experience with degree of membership.

3.4 Algorithm: A summarized algorithm of this process includes

- Step 1:
- Post job
- State skills requirement
- State job title

Step 2:

Foreach user in the system

2.1 Foreach skills in job skills

2.2 if skills look like user skills then

2.2.1 Save user as potential candidate

2.2.1 Check Experience

Step 3: Output

IV. Result and Discussion

There is a need to understand what the ERS does. The system within seconds goes through the Curriculum Vitae (CV) in the database as well the job postings available and recommends candidates who should be invited for interview. The degree of accuracy increases when the potential employer uses more related tags that are likely to appear in CV. In further studies one may be looking at developing an interface for automatically switch to invite candidates for interview and generation of system adaptive model for creating online testing by first of all giving the candidates link for their testing with date schedule.

The system output generated eliminates the hurdles of manually going through CVs to select those who are needed for interview. It also eliminates the manual computation of years of experience in a particular role as this can be inferred by the new system from the CV.

This method greatly reduces the time taken to recruit a new staff. It also increases the organization reach as all the potential candidates in the system are reached. It is relatively cheaper for the organization as there is no need for them to place adverts in any other marketing medium.

Here are the input and output snap shots

Input Snapshot loading

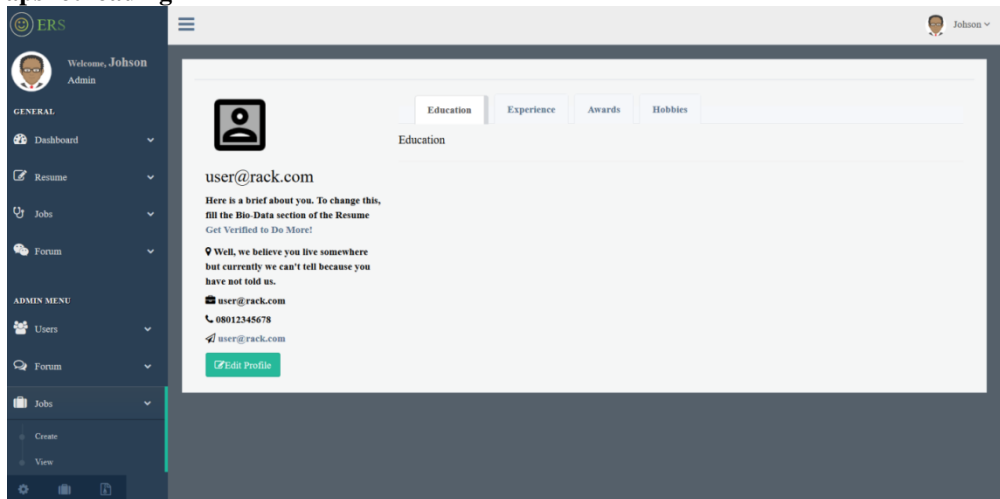


Fig 4.1 Admin Landing page Menu

Output Snapshot loading

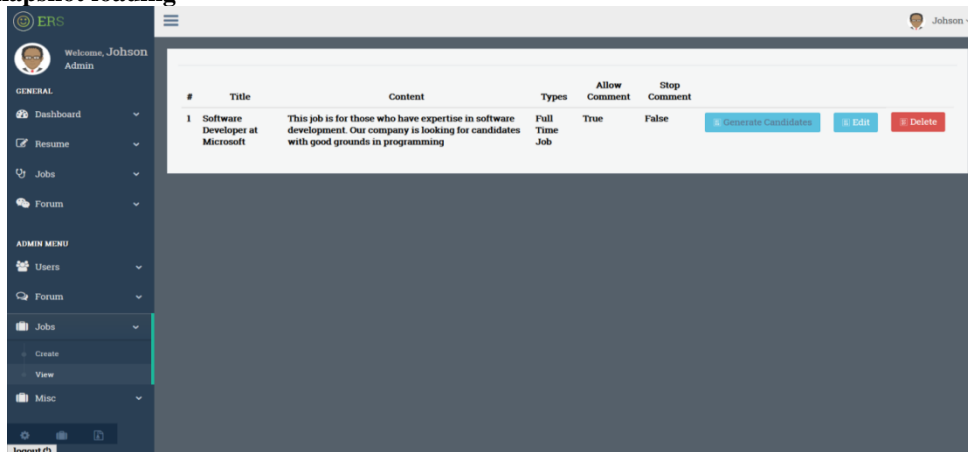


Fig 4.2 Candidate Selection Menu

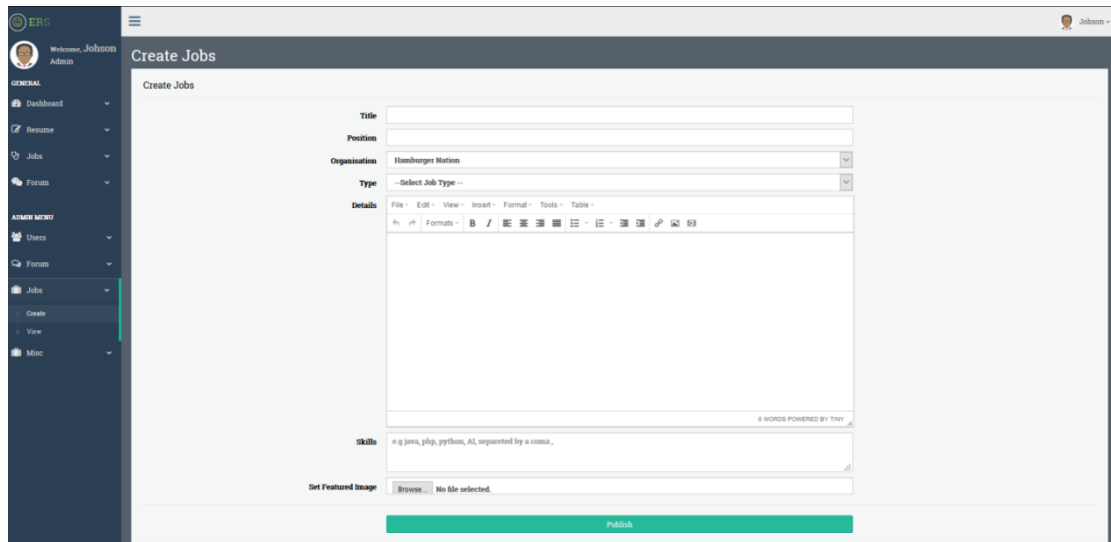


Fig 4.3 Job Phishing Menu

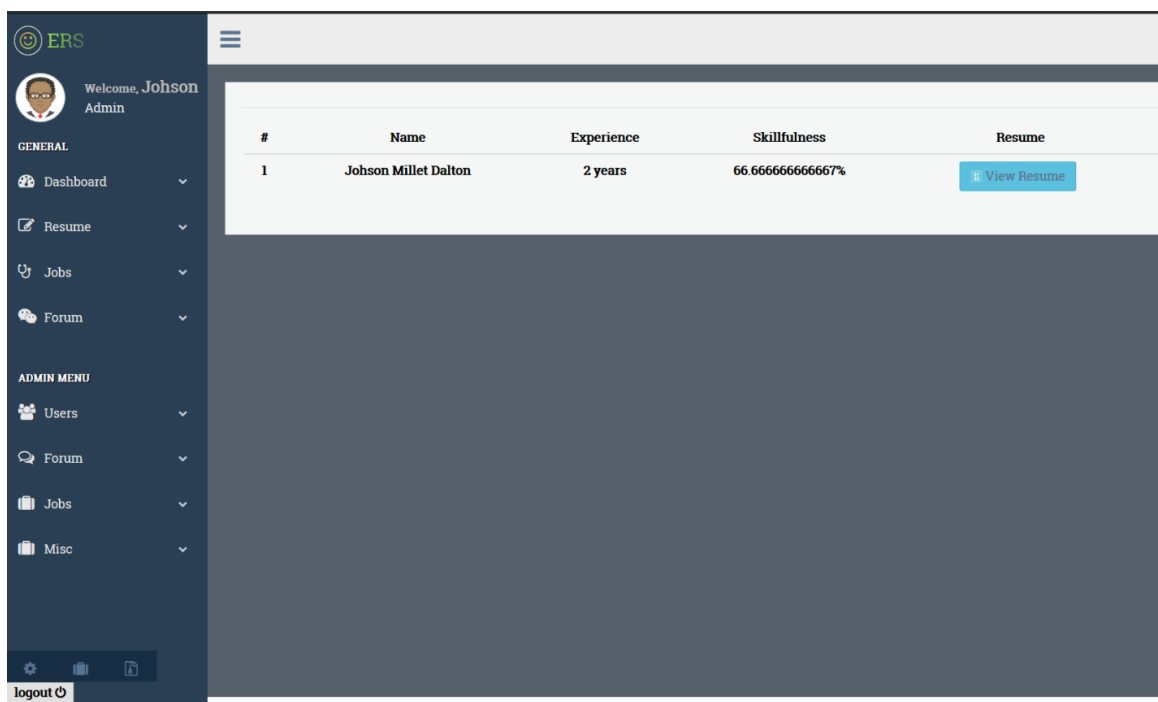


Fig 4.4 Fuzzy search Menu

The search for the right candidates is endless until we began to think towards the line of an expert recruitment will select and hire appropriate candidates suitable for the specified Job and eliminate human errors and inconsistencies due to manual selection process, therefore increasing the processing capacity and speed with higher level of accuracy. We can now see that this will identify and improve employers' recruitment needs and also bridge gap around afore mentioned human resource needs. There is no doubt that a system that will recommend the best mapped candidate will sale in the market of today.

V. Conclusion:

There is no better way to end this work other than accepting the fact that the research has succeeded in opening our eyes to the limitlessness and endlessness to the capacity of any research. Who could have imagined in precision the evolvment in the computer world as we have today? We are therefore faced with an enormous need to improve on this research work by developing different aspects of this work, in order to make it succeed beyond this level. We understood in the course of this work that a recommender system can be further developed to handle the cases of applicants whose CV stayed over time with match to any job by recommending to them short certificates courses that will make them more marketable and employable. This also can be done

by the intelligent system having studied over time the qualifications and attributes of candidates who have succeeded over time in their applications. We also observed that this system can be improved to organize aptitude test and direct interviews with candidates without human interference and this can be achieved by presenting a full knowledge base repository of different areas of career endeavors.

We therefore speculate that this work will definitely be of great relevance to future advancement in this field of research.

5.2 Recommendation

Going by the result of the work, we recommend that every employer of labor should engage the use of ERS. This system will help to automate selection of candidates without bias because most employers are guilty of compromise [17].

5.3 Suggestion for Future Work

In further work we recommend that development should be geared towards having a design to handle an automatic switch invitation of candidates for interview and also generate a multi-system that will be able to adapt to any kind of online testing for diverse fields of study, be it medical, engineering, arts etc. The method that system will use to handle the task depends on the researcher.

Reference

- [1]. Reddi, C.V. Narasimha, (2019), "Effective Public Relations and Media Strategy", Third Edition.
- [2]. Scholz Frederike, (2017), "Disability inequality and the recruitment process: responding to legal and technological developments". PhD thesis, University of Leeds.
- [3]. Laumer S, Eckhardt A, (2009), "Help to find the needle in a haystack: integrating recommender systems in an IT supported staff recruitment system", SIGMIS CPR '09: Proceedings of the special interest group on management information systems' 47th annual conference on Computer personnel research, May 2009 Pages 7–12 <https://doi.org/10.1145/1542130.1542133>
- [4]. Adisa T, Osabutey E, Gbadamosi G and Mordi C, (2017), "The challenges of employee resourcing: the perceptions of managers in Nigeria", Career Development International, Vol. 22 No. 6, pp. 703-723.
- [5]. Ployhart, R.E, Schmitt N and Tippins, N.T (2017), "Solving the Supreme Problem: 100 years of selection and recruitment" Journal of Applied Psychology. Journal of Applied Psychology, 102(3), 291–304
- [6]. Pratyush Banerjee, Ritu Gupta, (2019), "Talent Attraction through Online Recruitment Websites: Application of Web 2.0 Technologies" Australasian Journal of Information Systems, 2019, Vol 23, Research on the Role of Tech in Workforce Mgt
- [7]. Aaron Smith, (2012), "46% of American adults are smartphone owners" Pew research Internet and Research March 1, 2012, Pew Research Center's Internet & American Life Project
- [8]. 1615 L St., NW – Suite 700 [Online] Retrieved 20 December 2018, <https://www.pewinternet.org/wp-content/uploads/sites/9/media/Files/Reports/2012/Smartphone-ownership-2012.pdf>.
- [9]. Eunmi Chang, Hyun Chin, (2017), "Signaling or experiencing: Commitment HRM effects on recruitment and employees' online ratings" Journal of Business Research Volume 84, March 2018, Pages 175-185
- [10]. Baiq Sri Handayani, A.D. Corebima, 2017, "Model brain-based learning (BBL) and whole brain teaching (WBT) in learning" International Journal of Science and Applied Science: Conference Series, Int. J. Sci. Appl. Sci.: Conf. Ser. Vol. 1 No. 2 (2017) 153-161
- [11]. Tuncay Bayraka, Bahadır Akcam, (2015), "Exploring Benefits of a Web Based Testing and Training Tool" World Conference on Technology, Innovation and Entrepreneurship, Procedia - Social and Behavioral Sciences 195 (2015) 1032 – 1041, Available online at www.sciencedirect.com.
- [12]. Winfred A, Nathanael L K and Dennis D, (2018), "An Information-Processing-Based Conceptual Framework of the Effects of Unproctored Internet-Based Testing Devices on Scores on Employment-Related Assessments and Tests" Journal Human Performance Volume 31, 2018- Issue 1
- [13]. D S Maylawati, W Darmalaksana and M ARamdhani, (2018), "Systematic Design of Expert System Using Unified Modelling Language" The 2nd Annual Applied Science and Engineering Conference (AASEC 2017), IOP Conf. Series: Materials Science and Engineering 288 012047 doi:10.1088/1757-899X/288/1/012047
- [14]. SLaumer, F Gubler, C Maier, and T Weitzel, (2018), "Job Seekers' Acceptance of Job Recommender Systems: Results of an Empirical Study" Proceedings of the 51st Hawaii International Conference on System Sciences, Hawaii International Sciences (HICSS), <https://scholarspace.manoa.hawaii.edu/bitstream/10125/50379/paper0492.pdf>
- [15]. Monkman Helen, (2018), "Consumer medication information: memory, perceptions, preferences, and information needs, university of Victoria Library, faculty of graduate studies, ETD (Electronic Theses and Dissertations), <https://dspace.library.uvic.ca/handle/1828/10431>
- [16]. Moses O. Onyesolu, Amara C. Okpala, (2017), "Improving Security Using a Three-Tier Authentication for Automated Teller Machine (ATM)", International Journal of Computer Network and Information Security (IJCNIS), Vol.9, No.10, pp.50-56, 2017. DOI: 10.5815/ijcnis.2017.10.06
- [17]. Ljubica Nedelkoska, Glenda Quintini, (2018), "Automation, skills use and training" OECD Social, Employment and Migration Working Papers. https://www.oecd-ilibrary.org/employment/automation-skills-use-and-training_2e2f4eea-en
- [18]. Li, M Liu, X Liu, (2016) "Why do employees resist knowledge management systems? An empirical study from the status quo bias and inertia perspectives" Computers in Human Behavior Volume 65, December 2016, Pages 189-200. <https://doi.org/10.1016/j.chb.2016.08.028>

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