

Use of an Improved Online Job Recommendation System to Search Job Roles and Vacancies

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Abstract— Finding the perfect job is the main purpose of Higher Education for young individuals. For this purpose, nowadays, there are a lots of job portals available in Sri Lanka, where job seekers discover work opportunities and vacancies according to their preferred job titles. Yet for this, the seeker has to have a clear idea about at least several job titles or roles in a company. Not every person who uses these portals has knowledge of jobs and job positions, and most might know only a few job positions, while they might not have ever heard of some. With the outbreak of the COVID-19 pandemic situation, the whole world has been suffering for almost 2 years now. Changes have happened in every sector in continuing with daily processing during the pandemic. Many researchers have already proposed matching approaches by developing ontologies as a reference to mediate matching accuracy approximately. However, these approaches do not prove how closely matched applicants are in relation to their core skills. This research paper proposes a method that uses a proper approach for improved keyword searching, by influencing the comparability between concepts in the judgment, which represents the core skills and qualifications needed for a job to decide how closely matched an applicant is during the job searching process, mainly focusing on two recommendation processes; job role recommendation and job vacancy recommendation.

Keywords: *job portal, job search engine, online jobs, job role recommendation, job vacancy recommendation*

I. INTRODUCTION

The Internet has become the primordial medium for everything by now. The same situation applies for recruitment and employment processes as well. There are plenty of global job

portals available and they also have included Sri Lankan Job opportunities as well. This indicates an upward ambition in existing job portals being a top player in modern-day job recruitment process.

Most elegant search mechanisms are adopted by online job recruitment portals which rely heavily on subordination of keywords in free text before search results are shown. These mechanisms were there even before the pandemic but mostly used during the COVID-19 pandemic. This may produce a collection of results from the submitted keyword or phrase but most of those results may not be relevant to user's need. Also, all the job portals that can be found related to Sri Lankan job industry follows the same concepts and most of them are contained with similar functionalities. All of those job portals are designed by targeting the job vacancies of various companies. As a result of that those job portals are targeted to fulfil the needs of the audience who are available for what they supply. This research paper focuses on how the online job portals have helped people and how useful these online platforms are in seeking jobs in any industry. With the COVID-19 outbreak most people had to change their industrial statuses and companies as well. Further the implications of curfew for a long-time durations and travel restrictions have made most companies in a difficult situation and the companies that was unable to adapt to the situation has been closed by now. Due to these reasons more people are unemployed and searching for jobs with higher demands and stable future statements. There are many people who still depend on old job searching methods like Newspapers and articles. But technology can make it easier than ever, if it is used properly and effectively. There are various job recommendation systems in Sri Lanka and each job portal has common features and qualities. People are used to choose the platforms which are more likely comfortable for

them to use. The next factor that effects these job portals is the technology and search mechanisms that is used. With the improvement of the technology there has been changes also in these common web applications too. As an example, most web-based applications are now turning in to Semantic web application as it gives better search results rather than the traditional web applications. By considering all the above facts through this research, it focuses on the pros and cons of the existing job recommendation systems and how the proposed method can affect the job seekers in an efficient way than existing job recommendation systems.

II. LITERATURE REVIEW

There are several research papers published related to online job portals already using various technologies in semantic and web technologies. But none of them explains how these systems are useful in pandemic situations. Therefore, it is essential to gather information through a survey regarding the situation to combine the existing job recommender system technologies with the selected problem domain.

Amity university researcher named Seema Wadhawan has gathered information on factors influencing young job seekers' perceptions towards job portals. According to them with the development of the modern technologies, youngest job seekers are interested in online job portals. Most of the top-rated companies in India use online job portals for hunting the best talents. They further conclude that handing out the information to job seekers about the relevant open vacancies is not only one of the factors to build the perception towards the job portal. Numerous other factors like usefulness, ease of use, widespread services, potential career opportunities, quality of the system, and trustworthiness that conduct the determinations are discovered (Wadhwan, 2018)

According to Uma Pavan Kumar's research paper on Concept-based Dynamic Ontology construction for job recommendation system ontology is a polite detailed classification of shared inspiration that provides common semantics for agent communication. They strongly believe that their system will give the best outcome in case of suitable job recommendations for both employers and job seekers without spending much time. To attain that first, they have gathered the data from

various web pages and stored the collected data into .csv files. In the second level, the stored input files are used by the common numerator measurements and ontology creation module by generating the equivalent Web Ontology Language (owl) file. The third stage is creating the ontology with the generated. owl by using the dependent tool. Finally, the created ontology shows available jobs related to the given skills. Further, they generate reports considering relationships and attributes. (Kumar, 2016)

Joachim HASEBROOK and Ankit SAHA ISNM International School of New Media at the University of Luebeck Germany has observed about Job hunting and how students look for jobs online. Their survey results certify significant strengths and weaknesses of various aspects of online tools and services used in the job surfing process. They further locate that student from some regulations are more accomplished than others at the effective use of online tools and services. Even though the majority of participants have identified themselves as heavy Internet users, there seemed to be a lack of awareness of some developing web technologies too. Younger people below 30 years old mostly use online tools effectively than their earlier generation does (HASEBROOK, 2007).

According to the Global Job Seeker Survey held in 2016 and sponsored by 'madgex-Job Board Doctor' conducted in the U.S, The U.K and German to identify and evaluate job opportunities, they found out that there were many similarities between job seekers in the U.S., U.K., and Germany – but also some significant differences. There were also comparatives in behavior – perhaps not doubtfully – when responses were analyses by ages. None of the respondents in all three countries found it useful to upload a video CV/resume and according to them the most critical factor in choosing a job search tool for all three countries was “Jobs in my location & Jobs in my industry/sector”. The top job seekers in all three countries, locate jobs, and apply on the employer's site, research jobs, and identify employers. Employers that include salary with their job postings are much likely to collect responses from job seekers (Dickey-Chasins, 2016).

The research on Integration of Job Portals through Meta-search by Jürgen Dorn and Tabbasum Naz Vienna University of Technology, Institute of Information Systems, List down the

trends towards an online exchange of information about human resources with examples. They have developed a prototype for affiliating information on different job portals into one meta-search engine. They have investigated existing job portals and uninspired XML schemes from those job portals. Then, translation rules for translating each schema to a centralized HR-XML-conform schema were stated. They conclude that the main difference between their work and existing works were that they used HR-XML for schema unification and the research paper s doesn't explain how to symbolize XML Schema substitutes for HTML elements, i.e. text boxes, text areas, radio buttons, checkboxes, select lists, and generation of XML Schema for HTML search UI/UX (Naz, 2014)

Shalini Lihitkar, Department of Library and Information Science, Rashtrasant Tukdoji Maharaj Nagpur University in India has routed a survey and published a research paper on LIS (Library Information System) job portals and it says that "The study revealed that 1433 educational & research institutes have posted job opportunities in the LIS jobs.com, GSLIS Gateway, and Info librarian.com. Originating out of 635 jobs advertised for the academic libraries in three LIS job portals 412 jobs for university library followed by 174 jobs for college library and 134 jobs for the school library and most of the institutes has recommended to look their website for further information & other institutions (439) are not posting their information of websites" (Lihitkar, 2009).

Another research has led by four talented authors of Atharva College of Engineering, University of Mumbai. Mumbai, India on Job Portal using Data Mining Techniques for dynamic Analysis in 2016 and analyzed that the data mining techniques were used to list out the company details. That also helped the companies tied up with the job portals to shortlist the users to fill the job vacancies and the requirements of the users were managed through data mining techniques. They have further informed that their system more importantly solves the problem on both ends with certain clarity to protect user privacy. Also, it is to be noted that their system doesn't prove a job to any user as it depends on set of skills and vacancies of jobs of the applicant (Patil, 2016).

In 2012 P. Niaphruek Department of Computer Science, Faculty of Science, Rajamangala

University of Technology Thanyaburi has published a research paper on A Job Recruitment System Using Semantic Web Technology and that paper presents A Job Recruitment System Using Semantic Web Technology and it has introduced an information model to represent a CV (curriculum vitae) by creating the CV Ontology based on exiting well-known standards such as Europortfolio Europass CV, Description of a Career, FOAF and VIVO. The survey results express that this proposed system is better than others, especially in supporting RDF, supporting ontologies and vocabularies, supporting SPARQL, and enabling linked data by SPARQL endpoint. Their study has designed only an information model of CV for an applicant. (Niaphruek, 2012)

According to the paper under the topic, Ontological User Profiling in Recommender Systems done by STUART E. MIDDLETON, NIGEL R. SHADBOLT AND DAVID C. DE ROURE Intelligence, Agents, Multimedia Group, the University of Southampton in 2015 they explore a fresh ontological approach to user classification within several recommender systems, while working on the issues of recommending online academic research papers. The research paper is categorized using ontological classes and interactive recommendation algorithms used to recommend papers seen by similar users on their current titles of interests. They list down the advantages and disadvantages of their ontological recommendation system at the end (STUART E. MIDDLETON, 2009).

Sudiana, Computer Science Graduate Program, Bina Nusantara University, Jakarta, Indonesia in 2014 brings a discussion on Users' Interest Assessment on Job Portal and they conclude those job portals allow users to search for employment to move forward with their careers, or to market themselves in the industry without much effort. They gather out some complaints regarding features of job portals that are unable to fulfill the users' needs and those complaints have caused in declining the number of users. They say their research summarized that there were four factors like context, content, community, and commerce that affected users' interests toward online job portals (Sudiana, 2014).

III. METHODOLOGY

This paper proposes a proper approach for an improved job recommendation system that allows the users to get knowledge about the job posts and job roles. There are already plenty of job portals in Sri Lanka, but all those portals provide job vacancies based on keywords. This paper is based on a survey to identify the engagement of the youngsters with the job portals and the features that need to be changed in existing job portals in Sri Lanka. Mostly the final year undergraduates are the people who seek jobs and internships during this period, as a result, majority who participated in this survey are final year undergraduates and unemployed people during this pandemic situation.

The methodology of this research consists of four major steps. They are Problem identification, Conducting a survey, Result analysis, and Result evaluation. Parallely the implementation of an improved job recommendation web application is done as the final year project. The survey results with descriptive discussions and conclusion of this research paper will affect in developing that job recommendation system. As the first stage of this research is identifying the problem domain. The problem domain discussed here is how online job portals affect people's lives during this COVID-19 pandemic situation. Then as the second stage of the methodology, referring existing research papers about the problem domain and job portals to find the solutions to the problem domain. Also in this stage, the survey is created and distributed. As the problem discussing here is a timely topic the best way to come to conclusions is by conducting a survey and analysis of the survey results. For that, the questionnaire must be symmetrically divided into all the criteria that needed to be addressed. The third step has to be the questionnaire. This paper is based on a survey to identify the engagement of the youngsters with the job portals and the features that need to be changed in existing job portals in Sri Lanka.

As the fourth step, the gathered data and information from the questionnaire have analysed and find the solutions to the problem domain. The last step is the outcome or the final decision or conclusion of the discussed results.

The Semantic Web is an outstanding extension of the existing web, in which information is given a figurative explanation and is machine operatable. Ontologies have become crucial element of semantic web technologies introduced before.

The source of the term ontology is in philosophy, where it is mainly focused on the study of the behaviour of existence. As mentioned before a survey was created to get enough responses covering the area of existing job portals and the engagement of the unemployed and employed youngsters with those job recommendation systems in Sri Lanka. The contribution of this study is to review the engagement, identify the mistakes, challenges when surfing a job using the existing job portals, and to get the audience suggestions related to Job recommendation system. With all those gathered information the implementation has done. According to the situations discussed here the best solution that can be included is developing a job portal which has the ability to search for the eligible job roles by entering qualifications and interests of the user and at the same time including the facility to search for the job vacancies with proper description and detailed information to have a better understanding. Descriptive search results will help the job seeker to take the best decisions on behalf of himself. When talking about the implementation process it is important to pay more attention to the user interface and the content of the web page. Otherwise, it will not be much useful because the most common disadvantage most of the job portals are the poor user interfaces. For the recommendation, purpose an algorithm has used and for the filtering purpose content based filtering and collaborative filtering has used,

IV. RESULTS AND DISCUSSION

The questionnaire is conducted to gather and analyse information about existing job recommendation systems in Sri Lanka and encapsulate the most useful and effective features for an online job recommendation system. The questionnaire contains complete nine questions and under question number eight there are five more rating questions for the audience for a better understanding. The questionnaire was distributed among 130 people and had received more than 100 responses within three days targeting students Undergraduates and postgraduates.

When discussing the survey results majority who have responded are women and the percentage is 70.5%. As this survey is focused on youngsters like undergraduates and postgraduates the unemployed percentage is in a higher stage. That

means among the responders 83% are unemployed, 8.5% are working under part-time employment, 7.5% are working under full-time employment and 1% are contract employers. In a world that is filled with so many online job opportunities, it is sad to believe that more than 80% of the undergraduates and postgraduates are unemployed.

Another thing to consider is the knowledge about job searching. Above mentioned pie chart shows the percentages. According to this survey, 24.5% say that their knowledge about job portals is in a poor stage and 7.5% say it is very poor. There are only five people out of 106 responders who say they have excellent experience on job portals. This leads us to the reason for the responses to the previous question.

3. How would you rate your job search experience?
106 responses

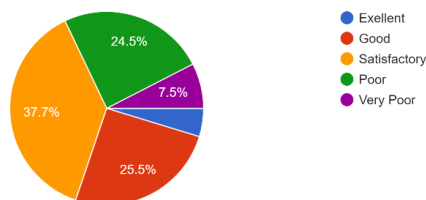


Figure 1: Rating of job search experience

In the questionnaire, there is a question that asks about the top 10 existing job portals in Sri Lanka and the responses are unexpected as 23.6% of the responses say that they haven't even visited any of those job portals. Topjobs.lk, Xpressjobs.lk, IkmanJobs.lk, Jobpal.lk, Observerjobs.lk, CV.lk, Myjobs.lk, Dreamjobs.lk, and Jobenvoy.com are the top 10 job portals in Sri Lanka. Topjobs.lk is the most popular site out of those 10 job portals and that percentage is 52.8%. The second most popular job portal is Ikmanjobs (32.1%) and third place goes to Myjobs that has 31% responses. The rest of the results gained by other job portals are mentioned below in the graph.

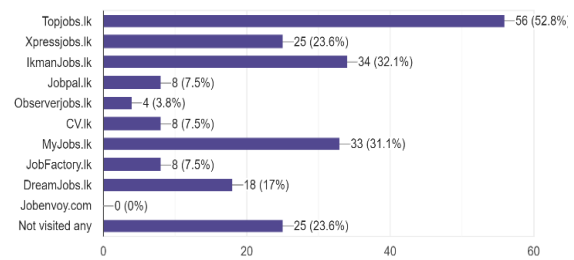


Figure 2: Existing Job Portals

When talking about the existing job recommendation systems there are both pros and cons of those job portals. Some of the pros and cons of those existing job portals which was found within this research is listed as bellow.

Table 1: Pros and Cons of Existing Job Portals

Job Portal	Pros	Cons
Topjobs.lk	<ul style="list-style-type: none"> Ability to check job application status (applied, shortlisted, and Offered with the Job / Not Successful). Special offers and organizational benefits for registrations. Ability to submit the job application to employers directly. 	<ul style="list-style-type: none"> Search option needs to be improved. UI is not user-friendly.
Xpressjobs.lk	<ul style="list-style-type: none"> Offering career guidance for job seekers. Providing unique and convenient price packages for the recruiters. Easy and convenient search options. 	<ul style="list-style-type: none"> Job seekers cannot directly send the CV to the because of the privacy and filtering purpose of the companies.
IkmanJobs.lk	<ul style="list-style-type: none"> Offer app facilities Support multilingual languages (English, Tamil, Sinhala) Job seekers can reach employers directly without signing up. 	<ul style="list-style-type: none"> Do not provide sufficient job descriptions on the feed.
JobPal.lk	<ul style="list-style-type: none"> Providing valuable resources of Human Resource Management Job seekers can reach employers directly Instant job alerts via SMS or Email 	<ul style="list-style-type: none"> Needs multilingual languages implementation.
CV.lk	<ul style="list-style-type: none"> Having a wide variety of job categories in local and overseas. Offers candidates for a wide range of firms and job vacancies. Make the whole recruitment process effective and less time-consuming. 	<ul style="list-style-type: none"> Search option needs to be improved. multilingual Languages implementation is needed. Poor UI design.

There are many things that people focus on the most when searching for jobs. In the survey there are some of those factors are listed. Role or the job title, Salary, Work-life balance, Workplace, and company culture and colleagues are those listed factors. According to the survey responses analysed by the google form most of the people are focusing on salary (65%) as the first thing and then there comes the role or the job title (62%) and work-life balance (52.8%) and colleagues (12.3%) at the last. Also, the questionnaire results say that when searching for jobs majority use Job search engines mentioned earlier and that percentage is 59.4%. 51% also are familiar with searching for jobs on social media like Linked-in, Facebook, Twitter, and Instagram. Further, the survey results prove that LinkedIn is mostly (59%) used social media in job searching and the second-most used social media platform is Facebook (29%). A small number of votes has gone to social networks like Instagram (4.7%), Twitter (2.8%), Google, company websites, and friends.

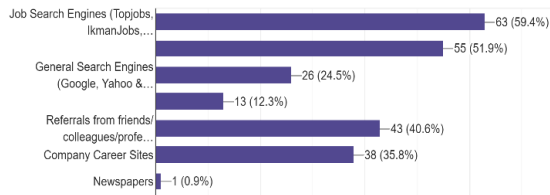


Figure 3: Job searching methods

In the questionnaire, there are five features mentioned in order to get the ideas of the responders. First feature is the ability to make the resume anonymous could be useful, and for that feature majority (62) agrees then the strongly disagree (2) responses. In the second feature, it is mentioned as the ability to filter job titles according to the existing qualifications makes the searching process easier. That is the main function which will be implemented at the end of this project. Almost all the users agree with that and the strongly agree response rate is also at a higher level than the other four features. according to the responses of the third feature most of the users expect more details about the suggested job roles from any job portal. Also, the user expects to upload the CV easily into the system and there must have a method for the receivers to filter and analyse the responses (CV) for their vacancies. And the final feature of the job portal related questionnaire is about expert support and guidance. Most of the users ask for expert support and guidance in choosing jobs through job portals. As the final question of the questionnaire, the responders are allowed to provide their suggestions and feedbacks regarding online job portals. Among those suggestions, there are some interesting suggestions too. A responder says "It would be easy if we can open and select jobs in a new tab or put selected jobs into a cart and after selecting all the jobs can apply those jobs which we put into the cart one by one" This comment is a suggestion that none of the job portals have.

When implementing the system, it is important to consider almost all the things discussed earlier. As mentioned before there are two recommendation processes in the portal and they are Job Role recommendation and Job vacancy recommendation. Further for the other sub filtering purposes it is needed to use collaborative filtering and content-based filtering. Also detailed information is needed to display every time in the search results because

most of the users use job portals for the research purposes and decision making and as a result of that information is much more important here. The following attachment shows how the detailed descriptions are added in the implementing system.

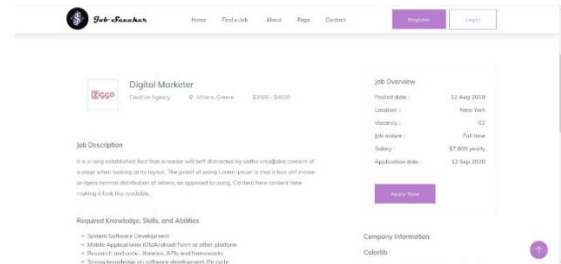


Figure 4: UI Job vacancy search results page

The idea can be improved and for job portals, the developers can add "into cart" option as well. Another good suggestion which came within the responses is that ability to apply for online jobs separately and include the details and guidance details about online jobs in the job portal. If a system comes with job applying feature, will be a good platform for anyone who is having difficulties when finding for jobs. This also proves that the idea of an improved job recommendation system for Sri Lanka well come idea.

V. CONCLUSION

After detailed analysing the data contained in many ontology-based research papers and the conducted survey, could decide that most of the undergraduates are unemployed and when searching for jobs most of them are willing to use various job portals and social media platforms. This research proved that the Mostly known job portal was Topjobs.lk and the most used social media platform is LinkedIn. The majority had a little amount of knowledge on online job portals and that has to be changed. Because using a job portal makes so many opportunities than other job-seeking methods as it practically allows access to the platform anytime anywhere for anyone even without any human connections. All the applicants or the seeker need is the ability and the true qualifications. Also, through the survey, it proved that Salary, job title, and work-life balance are the basic things people mostly focus on when seeking jobs. As it is mentioned before the main purpose of this research is to find about the engagement of the youngsters with online job portals and to know what do they think about the existing job portals in Sri Lanka to

design and implement an improved job recommendation system.

As mentioned, before it is more appropriate to use social media platforms and online job portals in searching jobs under the current situation all around the world. It also gives the users many advantages like they can search for what they like within milliseconds and that doesn't waste any money. The ability to apply for any job role preferred by the user is also an advantage and no additional cost is applied. With the current situation COVID-19 pandemic the job seekers can filter their preferences like whether they need a physically attending job or a work from home job and after deciding, apply. Further most of the companies conduct their interviews using social media platforms and meeting applications like Zoom, Google Meet, Microsoft Teams and Skype. As a result of that it is safer in using these modern technologies rather than following the traditional methods. There are also few new job portals are rising in the society Rooster Jobs is an example for such platforms and people are more in to online stuff mostly the youngsters and the main reason for that is the COVID-19 situation.

The research statistics are based on google form diagnostics and the same survey can be done using more complex analytical tools like SPSS, Minitab in the future to get highly discriminating data that can be depended on for further productive results.

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ACKNOWLEDGEMENT

I have taken efforts in this project-based research paper. I am highly indebted to Mrs. Dinu Gunasekara, Dr. Niroscha Weerasinghe, Mr. Ashen Wanniarachchi, Mrs. Dushyanthi Vidanagama and Mr. Pathum Kathriarachchi for their guidance and constant supervision as well as for providing necessary information regarding the research & also for their support in completing this research paper. My thanks and appreciations also go to my colleagues in providing details and participating in the survey who have willingly helped me out with their abilities.

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KHNK Kumarasinghe is a 4th year undergraduate student of the Information Technology department at General Sir John Kotelawala Defence University. She was

actively involved in creating the survey based on the topic and focused on the results and discussion in this paper. She also covered all the areas of this research paper

including the Abstract, Introduction, Methodology and Conclusion.