



## INTELLIGENT-BASED JOB APPLICANTS' ASSESSMENT AND RECRUITMENT SYSTEM

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**ABSTRACT:** *In recent years, companies faced the challenge of sorting resumes from job applicants, assessing, recruiting, and notifying applicants manually. This study is centered on creating a system that will automate this process and resolve the problems associated with manual recruitment processes. The waterfall model was employed in the analysis and design of the system in this study due to its simplicity and sequential nature. The system was built using PHP programming language and the database was designed using MySQL. In this study, an intelligent-based job applicants' assessment and recruitment system was developed using artificial intelligence techniques. It brings phenomenal success to Human Resource Management in a very short time. The recruitment process, in general, would experience a foremost modification, delivering rapid, efficient, and cost-effective methods of discovering prospective workers. Numerous opportunities were identified when utilizing this technology in recruitment, which include speeding up the staffing procedure, computerization of responsibilities, and rising detachment. Results obtained during the evaluation display that this method enhances the correctness of toning the right applicants with the right jobs. However, this system is still open to upgrading in the future for any researcher who finds this to be of interest.*

**KEYWORDS:** Intelligent, Expert system, Job assessment, Recruitment, System, Human resource management, Artificial intelligence.



## INTRODUCTION

An intelligent-based job applicants' assessment and recruitment system is an expert system that collects and processes applicants' applications and then selects eligible candidates for employment for a particular position. Recruitment of employees is a very important function of human resource management amongst others. Recruitment is quite essential for every establishment as it selects and brings in suitable human resources based on objective criteria, for the overall improvement of the organization and to gain an advantage over any competition. Before the process of recruitment, companies execute proper staff planning and check for the number of employees needed, depending on the budget of the organization and goals, whether short-term or long-term goals of the establishment. The duty of the Human Resource Management (HRM), formerly referred to as personnel managers in the 1970's, among so many other duties, according to the authors in [1], involves anything and everything associated with the employment of staff in a particular establishment.

According to the authors in [2], Artificial Intelligence is the development of intelligent machines capable of performing the same kinds of functions characterizing human thoughts. It is a concept, dating from ancient times and applied to computer programs that are capable of performing complex tasks. The application of artificial intelligence for job applicants' assessment and recruitment would ease off a lot of stress and ensure faster, accurate, and unbiased processing of applicants' details and employment of qualified candidates.

The development in communication technology has brought about an overall change in all aspects of life, changes in our way of communication, gathering, and dissemination of information. It has also brought about a change in the old traditional process of recruitment using job boards and occupational vocation web pages [3]. An intelligent-based system is different from regular computer systems in such a way that it simulates human reasoning about a problem domain; it also performs reasoning, rather than mere data retrieval or numerical calculations. It offers so many advantages in human resource management as it supports activities like keeping records of employees, identifying potential employees, creating forums for developing employees' skills, and a host of other activities. The application of artificial intelligence in the area of recruitment would ensure that, even in the absence of a human expert, the job would still be carried out.

### Problem Statement

The following problems initiated this study:

- i. The unavailability of intelligent-based assessment and recruitment systems in many organizations hinder the employment of qualified personnel, therefore leading to low productivity;
- ii. Many organizations still make use of the traditional manual system of retrieving, processing candidates' details, shortlisting, and notifying successful employees. This method is very expensive, time-consuming, and inaccurate;
- iii. Jobseekers wander daily in pursuit of jobs, and so many would require waiting so long after applying for results that might not even be in their favour. They waste lots of time just submitting applications. Moreover, the manual method of selection might be unfair and biased due to the human nature of wanting to assist families and close relatives; and



- iv. After getting the job, employees do not get notified in time for them to resume or some get notified through email; there are cases where the applicants may not have access to the internet at the moment.

### **Objectives of the Study**

The study aims to develop an intelligent-based job applicants' assessment and recruitment system that will help in resolving the problems identified in Section 2. The objectives of this research include:

- i) To develop an intelligent-based recruitment system that will select, retrieve and process applicants' details automatically;
- ii) To provide a system that will serve as a database of job applications;
- iii) To provide a system that will provide information concerning registered job applicants if need be and accurately select qualified candidates for various job positions; and
- iv) To integrate an SMS alert component into the intelligent-based recruitment system that will alert successful candidates of their employment status.

### **Intelligent Systems**

An intelligent system is a system that integrates intelligence into applications being controlled by machines and performs hunt and optimization with learning competencies, according to the authors in [2]. The term, intelligent, is defined according to the authors in [4] as "the ability to comprehend; to understand and profit from experience; the ability to acquire and retain knowledge; mental ability and the ability to quickly and successfully respond to a new situation."

Intelligent systems generate reliable and dependable outcomes by utilizing a systematic and uniform method to offer solutions to complicated problems. According to the authors in [2], "an intelligent system emulates some aspects of intelligence exhibited by nature. These include learning, adaptability, robustness across problem domains, improving efficiency (over time and space), information compression, and extrapolated reasoning".

### **Characteristics of Intelligent Systems**

According to the author in [5], the following are the characteristics of intelligent systems:

- i) Ability to pull out and warehouse information;
- ii) Human-like cognitive procedure;
- iii) Knowledge from involvement or preparation; and
- iv) determining answers via procedures comparable to natural evolution.



The current tendency in intelligent systems includes extra refined communication with the user via natural language understanding, speech recognition and synthesis, and image analysis. There are several applications and types of intelligent systems, from handling enormous data sets to managing automatons and hums. The notions and perceptions are derived from the fields of artificial intelligence, machine learning, and a range of disciplines, forming many interdisciplinary relationships.

### **Job Assessment and Recruitment System**

A job assessment and recruitment system is designed to manage job assessment, selection, and recruitment processes, according to the authors in [6]. Recruiting is competitive, especially for those with a high demand for technical skills. This system is developed to enhance the effectiveness of recruiters as well as jobseekers and also reduce the cost of having to do these processes through the traditional file system.

Hiring the right person for a job involves finding the right talent, getting them to show interest in your organization, creating and managing the application process, screening candidates, scheduling interviews, collecting feedback, and eventually making a decision. According to the authors in [7], this process is cumbersome, expensive, and requires a lot of coordination; the ability to quickly take applicants through the various stages of the recruitment process is critical for the growth of any organization and hence the introduction of online recruitment systems.

This system is intended to make the hiring workflow efficient and faster. The system is convenient and efficient; it helps in migrating from the old file system processes into the digital world seamlessly. Information about candidates is gathered in one place; interviews are conducted faster using digital technology; organizations can be able to move and act fast when looking for talent. Intelligent assessment and recruitment system will cut down the time it takes to hire the right candidate for a job position.

### **Application of Artificial Intelligence (AI) in Job Assessment and Recruitment System**

Artificial intelligence (AI) is interrupting each business, and the employment marketplace is not excluded. It reduces or even removes the time-consuming activity of manually screening resumes, and provides inexpensive, quicker, and more effective methods to link persons to jobs [8]. Application of learning and problem solving to the recruitment system is designed to computerize recurring facets of the recruitment procedure, for instance, resume and application appraisal, and also help establishments identify top candidates from large candidates' pools.

Resume assessment is conventionally accomplished manually employing principles that cannot be consistent for each resume and this generates intrinsic prejudice, utilizing typical parameters to create the conditions for a flawless candidate, as AI systems can speedily detect the desired features via pattern recognition.

Recruiting and assessing novel personnel is an expensive procedure that requires special consideration, as workers are the most vital assets, and breakdown of staffing rationally results in enormous expenses [9].



According to the author in [10], employment as a business must alter enormously since the commencement of the 1970s, as the business first appeared. Nowadays, staffing is progressively thought-provoking and rivalry for decent personnel has deepened.

The usage of AI in recruitment has enticed attention agreeing to a Nationwide Employment review piloted by the author in [11], where 18% of defendants responded that the increase of AI in recruitment is the greatest tendency in employment in the year 2017. By way of general usage, AI likewise has its associated advantages and dangers [11]. It is foretold that AI will enhance human capabilities in several methods in the upcoming. Currently, retention, thoughtfulness, identifying designs, making a decision, acclimatizing to modification, and knowledge from perception are capabilities of AI. Through the backing of AI, types of machinery have turned out to be cleverer and have generated a method to advance important benefits. The risks can be attained as soon as AI starts to develop pieces of machinery that are more intelligent than human beings [12].

Artificial intelligent methods can be used in worker enlisting employing data extraction methods that computerize the procedure of resume recognition and extraction of pertinent data [13]. AI can translate a candidate's character and capabilities for the desired job through the application epistle. It is unsurprisingly potential to request approximately one's personalities directly, nonetheless, according to the authors in [13], they foresee that experiential character from manuscript and discussion will outdo models of self-assessed disposition. According to the authors in [14], personality extracting can likewise create the disposition and feelings by employing linguistic analysis to text.

As the number of tendered CVs and job applications can be irresistible, automatic applicant ranking systems have been suggested to accelerate the employment procedure. Applicant ranking prototypes can be constructed with the aid of AI and candidate ranking using AI algorithms that have studied the scoring function grounded on preparation data delivered by human recruiters [14]. Computer reinforced job matching can be effected in numerous methods, for instance, by employing learning-based procedures and genetic processes [15].

## **REVIEW OF RELATED WORK**

The authors in [16] observed that the drawback of mechanically toning candidate profiles is not fresh and has been reviewed in many science fictions; since the type of setback is fairly complicated, solutions could not extend to a high grade of achievement. Quite a few works have presented incomplete resolutions to honestly ease several glitches concerning the recruitment of personnel [17]; nevertheless, few significant confrontations must be tackled. Over the past couple of centuries, intense research on new recruitment techniques has been in place. This is because of the desire for computer-based smart procedures for employing workers in an extremely competitive universal marketplace that is meaningfully full-grown throughout the previous epochs.

Several studies have found the necessity for magnificent employment schemes that is more dependable and reliable. Many types of research reach agreement with this study indicating that unequivocal information will eliminate the challenges of effective recruitment. Instances of some of these works are stated below:



The authors in [18] proposed a system called **EXPERT** that comprises three stages in assessing applicants for employment. In the first stage, the scheme gathers applicant profiles and builds an ontology manuscript from the topographies of the applicant. Job prerequisites are offered as ontology in the second stage and in the third stage, the system maps the job prerequisite ontology into the applicant ontology manuscript and reclaims the qualified applicants. This system could not automatically alert applicants of their status through SMS.

The authors in [19] described the application of a fuzzy expert system for choosing eligible job candidates to minimize the pressure related to the applicant selection procedure. The innovation of this method comprises managing the fuzziness that is related to the glitch of personnel employment.

The authors in [20] proposed a scheme where the information about the recruitment domain has been exemplified utilizing ontology. This ontology is utilized to guide the blueprint of the presentation and to deliver the system with semantic competencies. The ontological constituents further permit describing an ontology-guided exploration engine that delivers additional intellectual tallies amid job proposals and candidate profiles.

The authors in [21] present Case-based Profiling for Electronic Recruitment (CASPER), a virtual recruitment search engine that tries to improve the usability of the Job finder website search engine by prolonging conventional search methods with a personalization method that can take control of user favorites by categorizing retrieved outcomes as pertinent or immaterial.

The authors in [22] present the Intelligent Sales Employment and Benchmarking Scheme (ISRBS), which is a means for signifying the answers and results grounded on field works and arbitrary reviews of vendors, and also the expansion of representations for determining autonomous and contingent variables associated with vending behaviour.

The authors in [23] expended cooperative filtering to match up candidates to a given job and then combine the cooperative filtering with content-based resemblance to suggest an applicant.

The authors in [24] used the relevance model to harmonize resumes and works. Also, the authors in [25] measured the efficiency of virtual contextual assessment. It was revealed that online assessment is operational; however, it gives several problems. There was a need for the development of an integrated online background screening approach and national online databases to comprehensively screen data over the internet.

The authors in [26] presented an SMS-based suggestion system for college grounds employment in China that enables the college appointment workplace to tally the establishments and scholars with upper exactness and lesser cost. The system focused on profile toning and preference list-based two-sided toning for additional suggestions. This is not obtainable in Nigeria.

The authors in [27] suggested a scheme for the selection of applicants for employment. The scheme gathers resumes and mine outstanding features of applicant profile like abilities, knowledge, skills, and position the applicants for a given job. The system cannot interview shortlisted candidates.



The authors in [28] exploited individual data accessible on networking websites like Facebook to appraise the candidates and on assortment choice making.

The authors in [29] investigated and suggested the reviewed resume arrangement that comprises applicant personality appraisal information for refining the efficacy of applicant vetting and assortment.

Many other E-recruitment systems have been suggested to reduce costs, speediness, and upsurge the efficacy of the employment procedure. To determine the appropriate applicants for job ranks, these systems use diverse methods such as relevance feedback [24], semantic matching [30], machine learning [14], and natural processing [31].

This study aims at applying Artificial Intelligence techniques in job assessment and recruitment processes. In spite of numerous surveyed works, there is no analysis proffering a general opinion about the benefits of Artificial Intelligence (AI) as developing, constructing, and using innovative systems for automatic recruitment procedures.

## **METHODOLOGY**

The Water Fall Model was adopted to analyze and design the system for this study. This is because the model offers numerous advantages for the application system developers.

Some of these advantages include the following:

- i) The model is straightforward, stress-free to comprehend, and easy to use;
- ii) Due to the inflexibility of the model, it is easy to manage, as each stage has precise deliverables and a reviewed procedure;
- iii) The use of the waterfall model will enable the project to preserve thorough scope and design edifice, because of forthright preparation and certification stages;
- iv) The waterfall model influences the development to be extremely controlled in its design and organization; and
- v) In this model, stages are handled and accomplished one at a time. Phases do not overlap.

### **Analysis of the Existing System**

When a position in an office is vacant and needs to be filled by a qualified candidate by the Human Resource Management, a vacancy is published on traditional forms of media which include newspapers, radio, and television broadcasts. Interested job seekers read and listen to these sources of media and when they happen to come across the news of the vacant position in that office put in their applications for the job position.



This usually involves writing an application letter containing credentials of their educational qualifications and their work experience and mailing the letter to the indicated address of the office of the employers. After the deadline for application submission is passed, the office personnel management staff then sort the submitted applications and come up with a shortlist of applicants to fill the vacant position.

The short-listed candidates are then contacted and interviewed and the best performing applicant in the interview is notified of his/her new appointment, either through publication in newspapers or on the notice boards in the establishment. This process is tedious, time-consuming, and error-prone.

### **Merits and Demerits of the Existing System**

The following are the merits of the existing system:

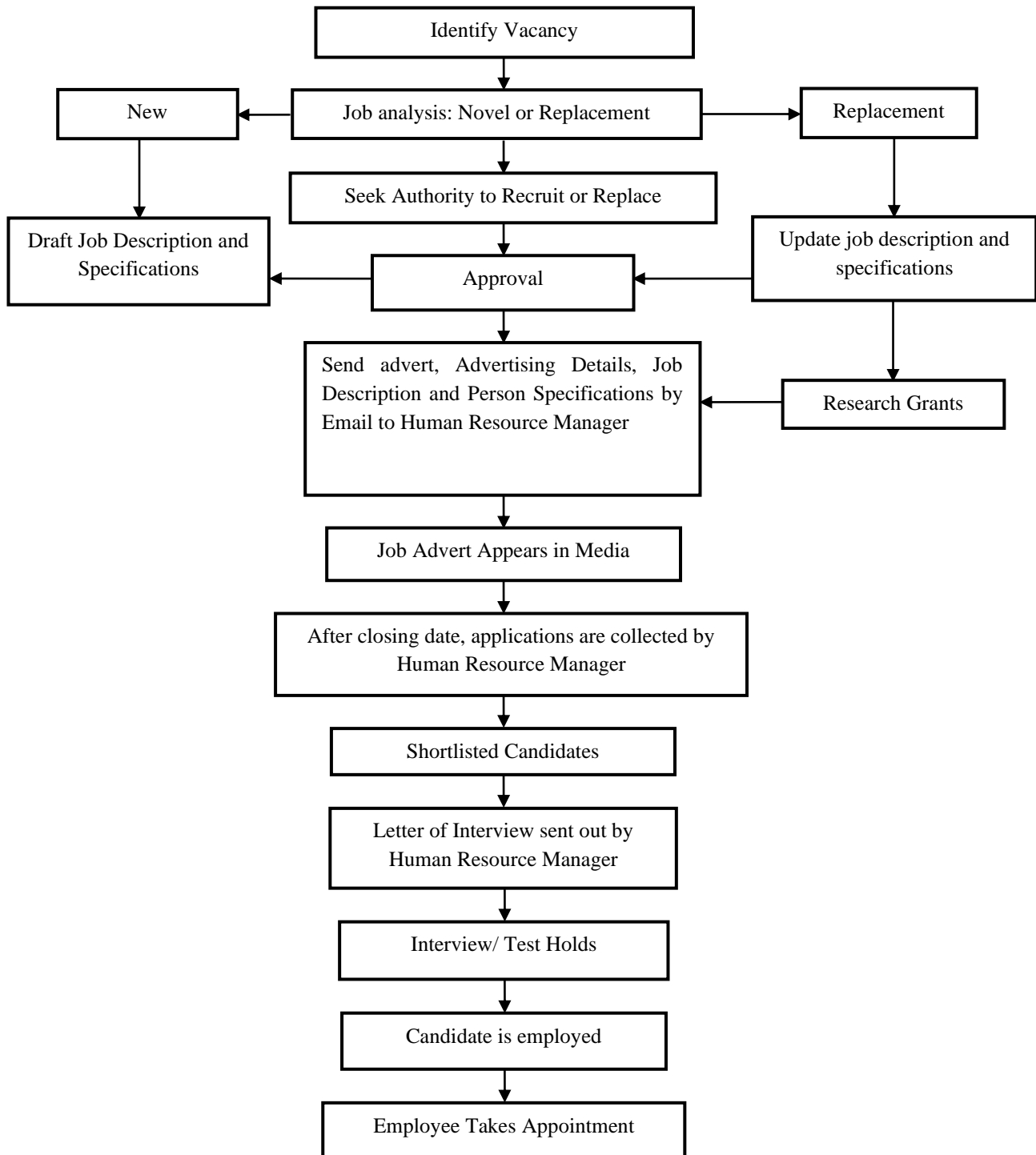
- i) This method continues to be a viable option for specific positions and requirements in many industries.
- ii) Traditional methods of getting information to a great number of candidates, which includes print media advertising are quite effective, especially in given geographic and demographic areas.

The demerits of the existing system are listed below:

- i) It is expensive for employers to advertise through traditional forms or media;
- ii) Processing applications can be very time consuming and prone to errors;
- iii) Delays can prevent the application of job seekers from being delivered before the submission deadline; and
- iv) Successful applicants do not get notified of their employment status in time.



**Block Diagram of the Existing System**



**Figure 1 is a block diagram of the existing system showing its functionality.**



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### **Analysis of the Proposed System**

The system will be designed to be used primarily by the prospective applicants searching for jobs and the employers who post vacant jobs. The employers will have an admin portion attached to the website platform which will only be accessible through the provision of accurate username and password authentication details.

The applicants can look for jobs and apply for them via the website. The screening and selection processes would be performed on the platform. Shortlisted candidates are contacted and interviewed and the successful candidates are notified of their appointments via SMS alerts.

### **Merits and Demerits of the Proposed System**

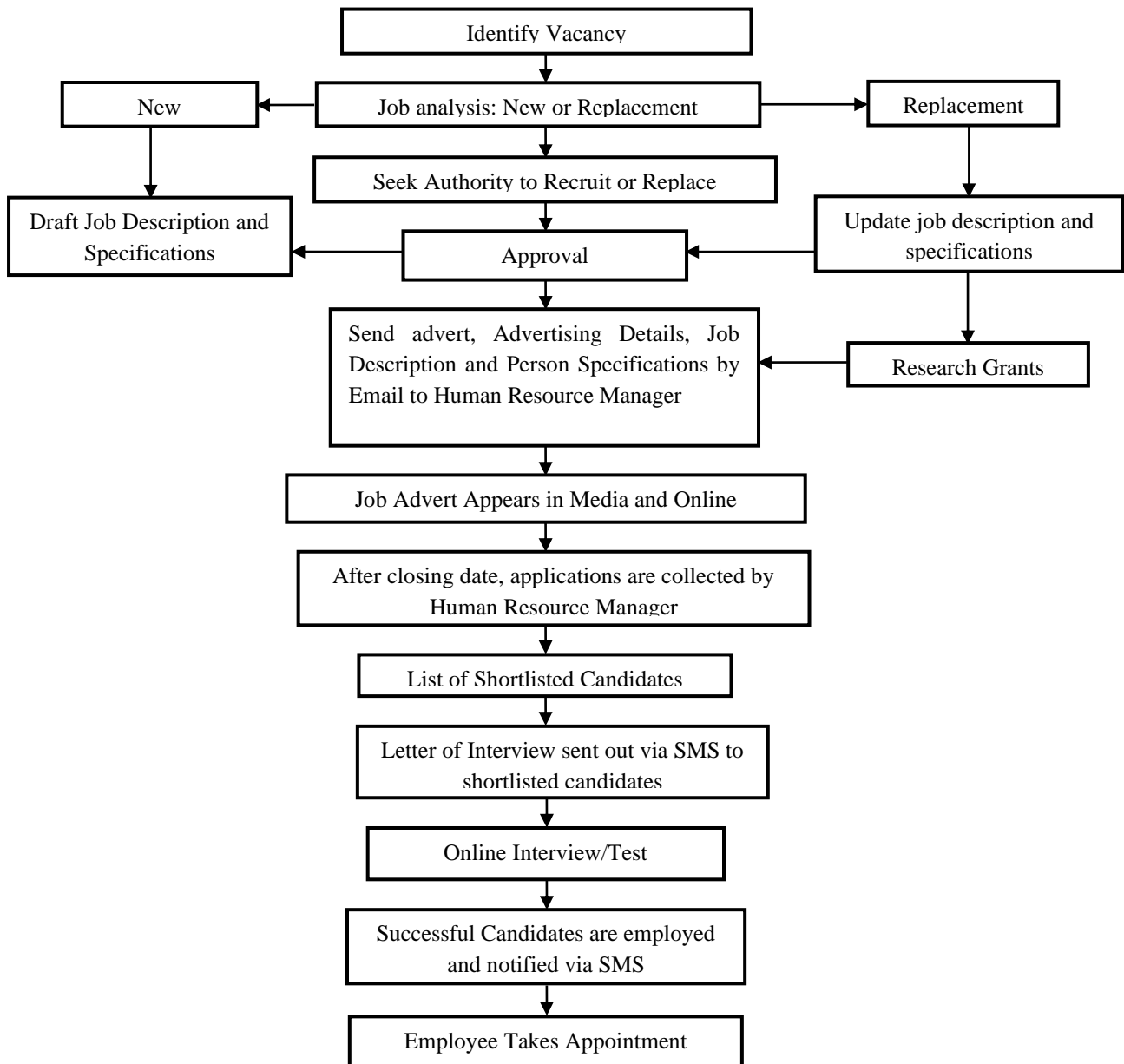
The merits of the proposed system include:

- i) The proposed system would help speed up the process of recruitment and employment;
- ii) The system would eliminate bias, which is associated with the traditional recruitment system;
- iii) The proposed system provides an easier way to sort records of applicants for shortlisting; and
- iv) Applicants can look for jobs and apply for them without stress, on this system.

The demerit of the proposed system is that:

- i) The proposed system uses the internet, thus consuming data.

**Block Diagram of the Proposed System**



**Figure 2: Block diagram of the proposed system**

### High-level Model of the Proposed System

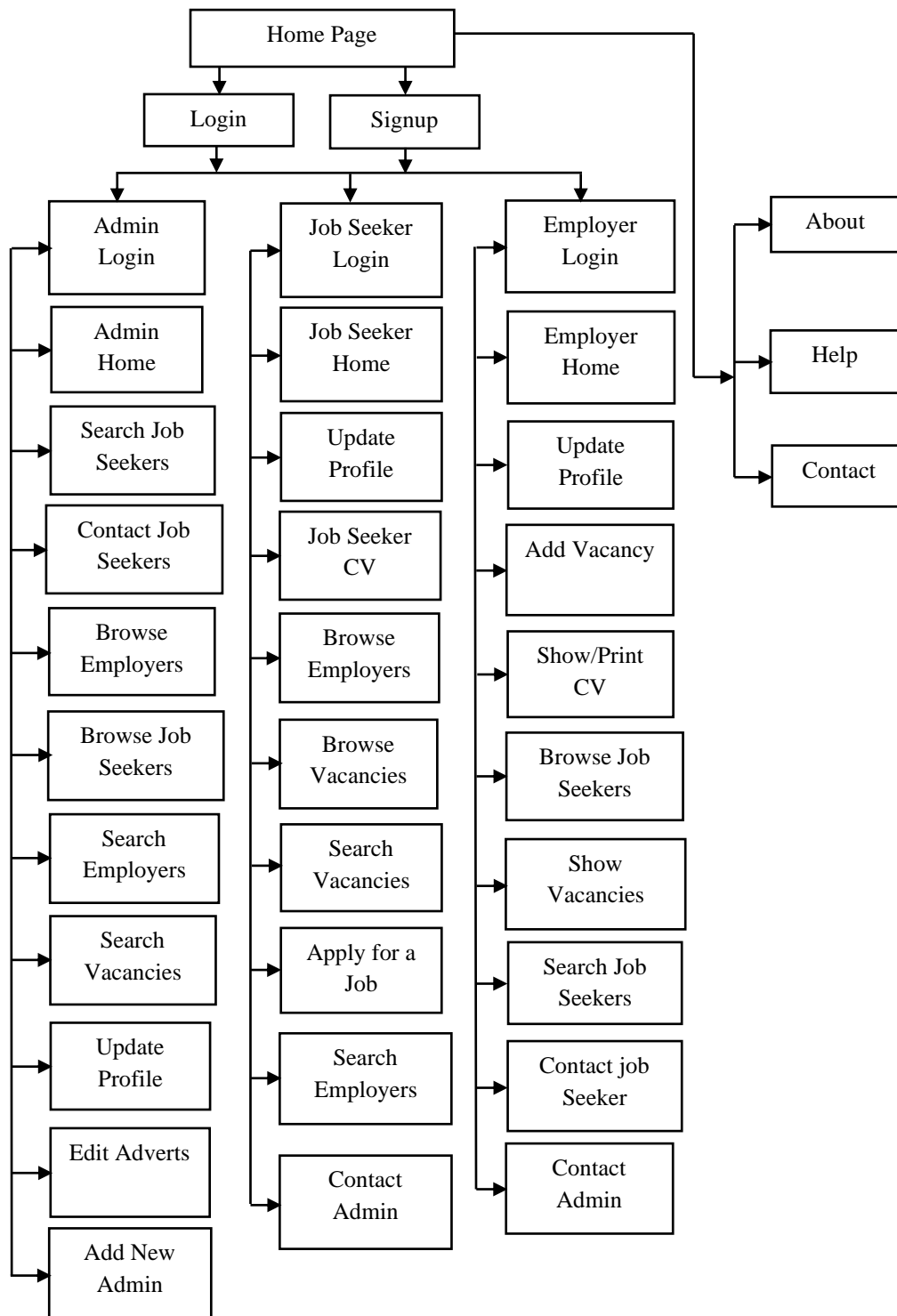


Figure 3: High-level model of the proposed system



The user logs into the system and is introduced to the home page, with options to log in as an existing user or sign up as a new user. Sign up would require that the user registers. Once the user registers, as an admin, jobseeker, or employer, he/she would be taken back to the home page to log in. Admins are taken to the admin home, jobseekers to a different home page, and the employers as well to theirs. Each login, that is, either as an admin, jobseeker or employer exposes the user to certain privileges. As can be seen in the high-level model in Figure 3, the admin, job seeker and employer each have different privileges.

**About:** This component provides the users with all possible information about the system.

**Help:** This feature assists with any possible issues encountered while executing the system.

**Contact:** This component comprises contact addresses, phone numbers of the admin in charge of the platform, and other information.

### Main Menu Design

Figure 4 shows the main menu interface of the proposed system.



**Figure 4: Main Menu Interface**

### System Flowchart of the Proposed System

Figure 5 depicts the flowchart of the proposed system.

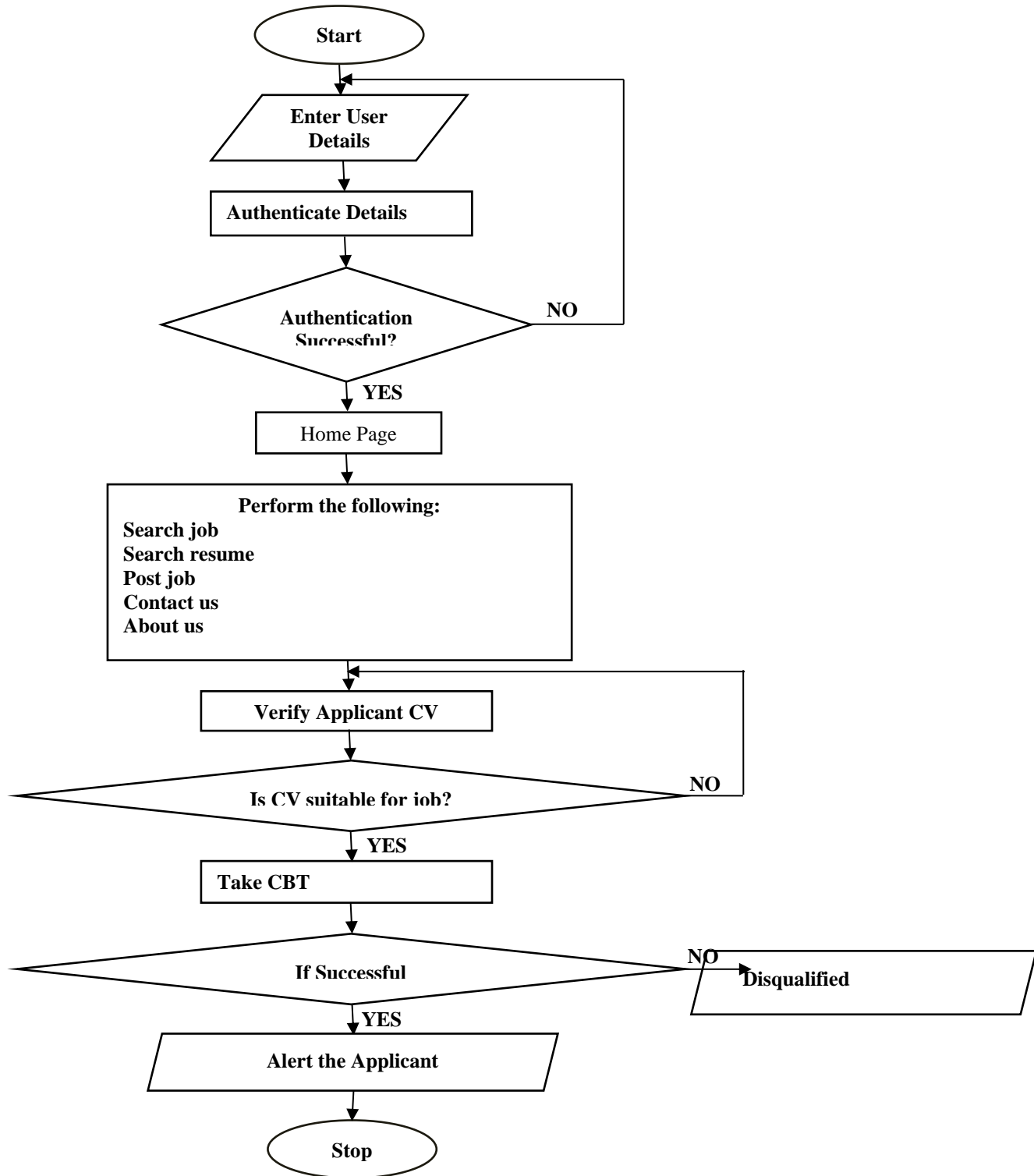


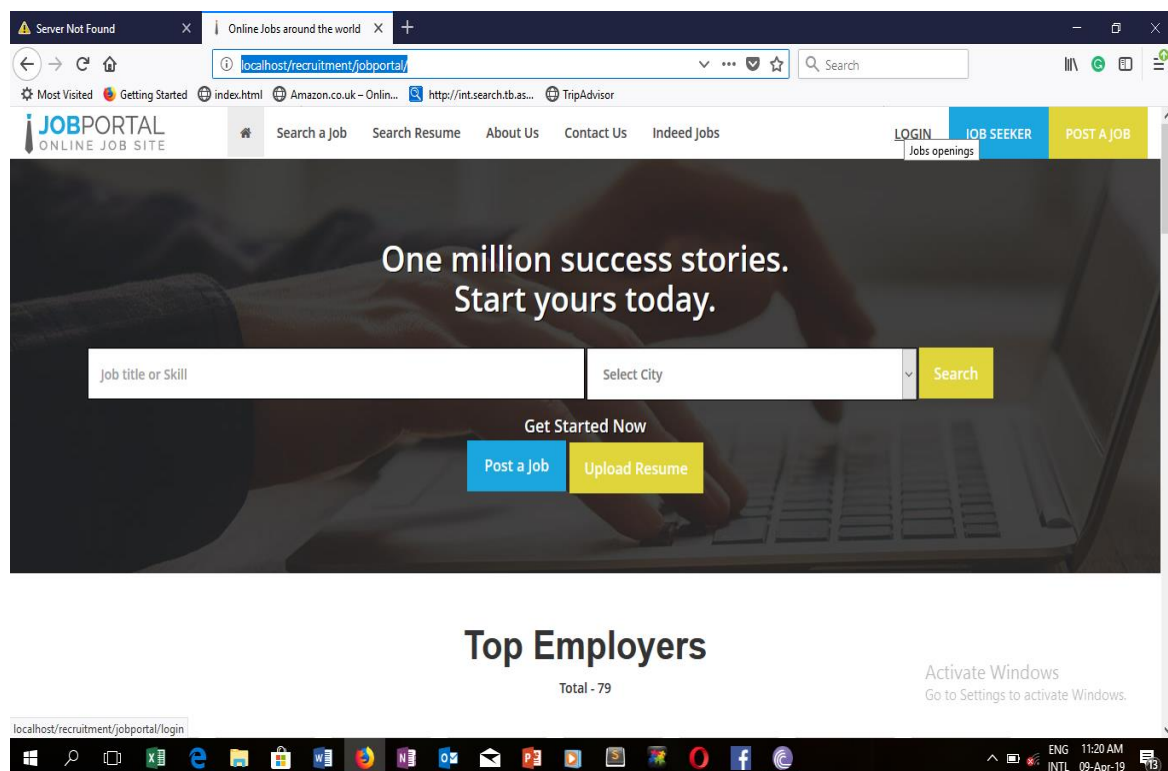
Figure 5: System flowchart of the new system

## RESULTS AND DISCUSSIONS

An intelligent-based job applicants' assessment and recruitment system was developed in this study using artificial intelligence techniques and comprises the following components.

### Home Page

The home page is the main menu interface of the proposed system that consists of other sub-components, as shown in Figure 6.



**Figure 6: Home page of the proposed system**

### Available Jobs Interface

This interface displays the available jobs on the developed platform and online for job seekers to search and apply for any job of their choice, as shown in Figure 7.

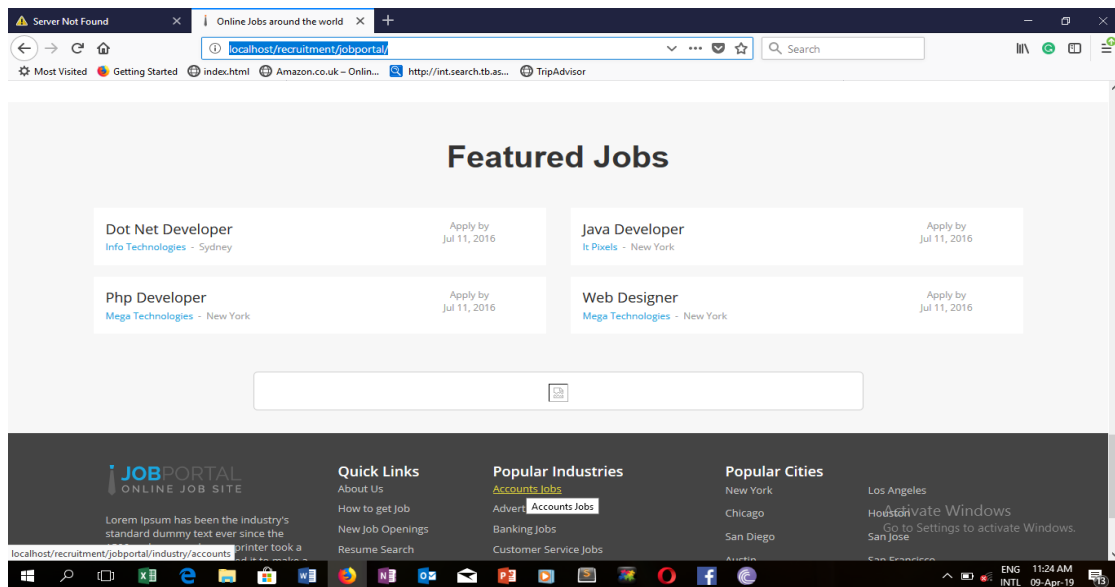


Figure 7: The available jobs interface

### The Search Job and Upload Resume Interface

This page enables job seekers to search for jobs online and upload their resumes, as depicted in Figure 8.

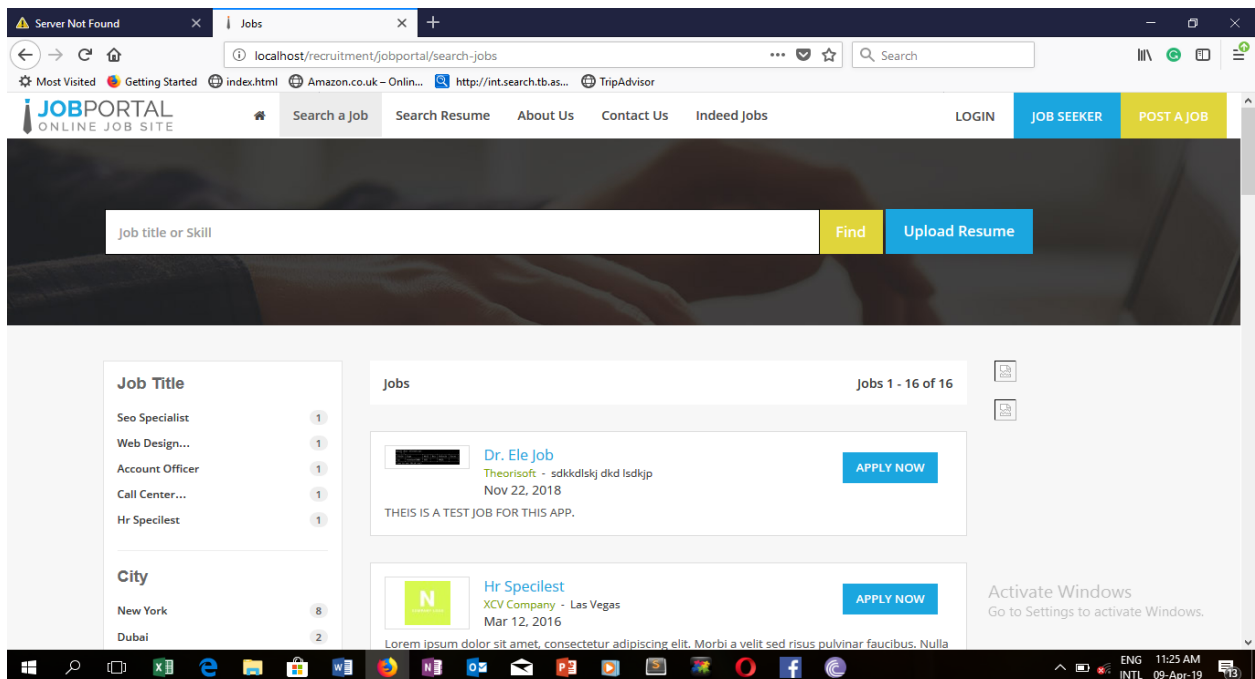


Figure 8: The search job and upload resume interface



## The Contact Us and Job Portal Support Form Page

This page enables job seekers to contact employers of labour and complete the job portal support form, as shown in Figure 9.

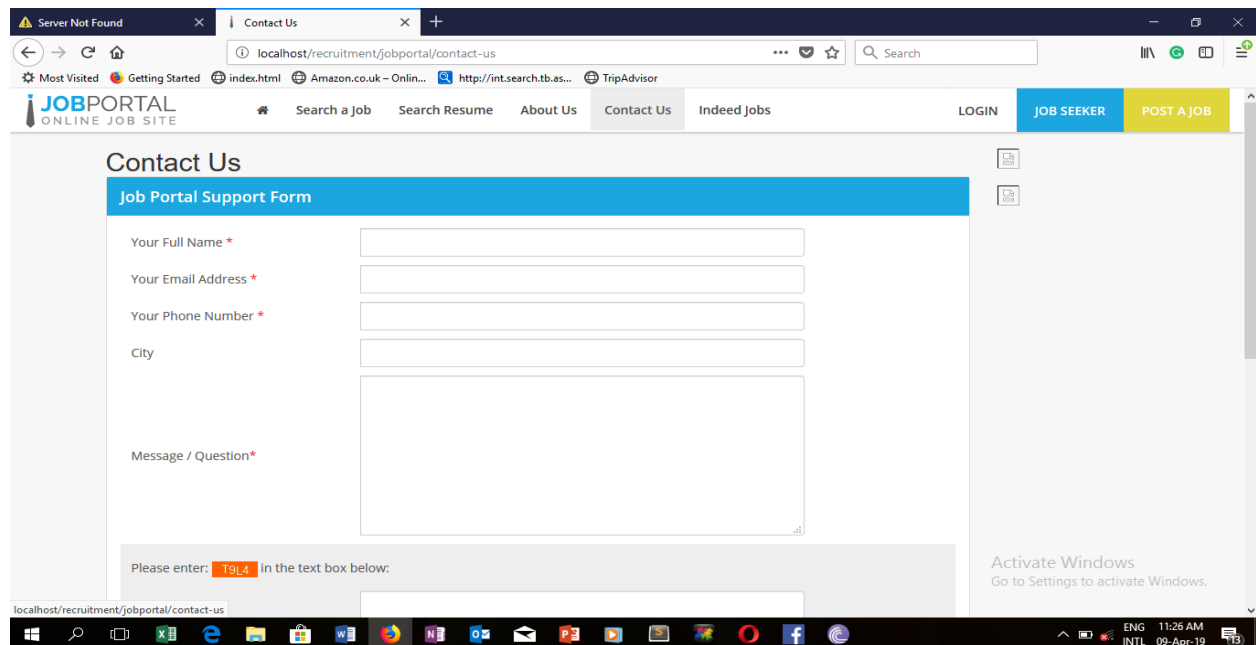


Figure 9: The contact us and job portal support form page

## Login and Sign Up Interface

This interface enables job seekers and employers to log in as existing users and sign up as new users, as depicted in Figure 10.

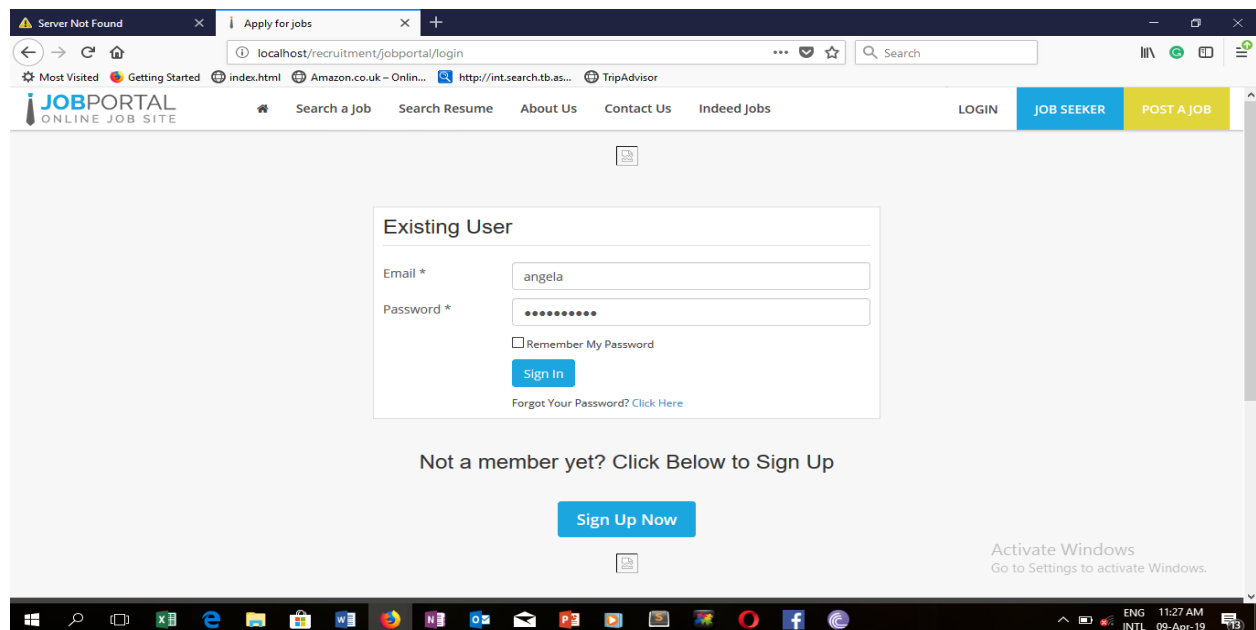


Figure 10: Login and sign up interface

## The Account Creation Interface

This page helps job seekers and employers to create a new account for job searching by job seekers and post jobs by employers, as shown in Figure 11.

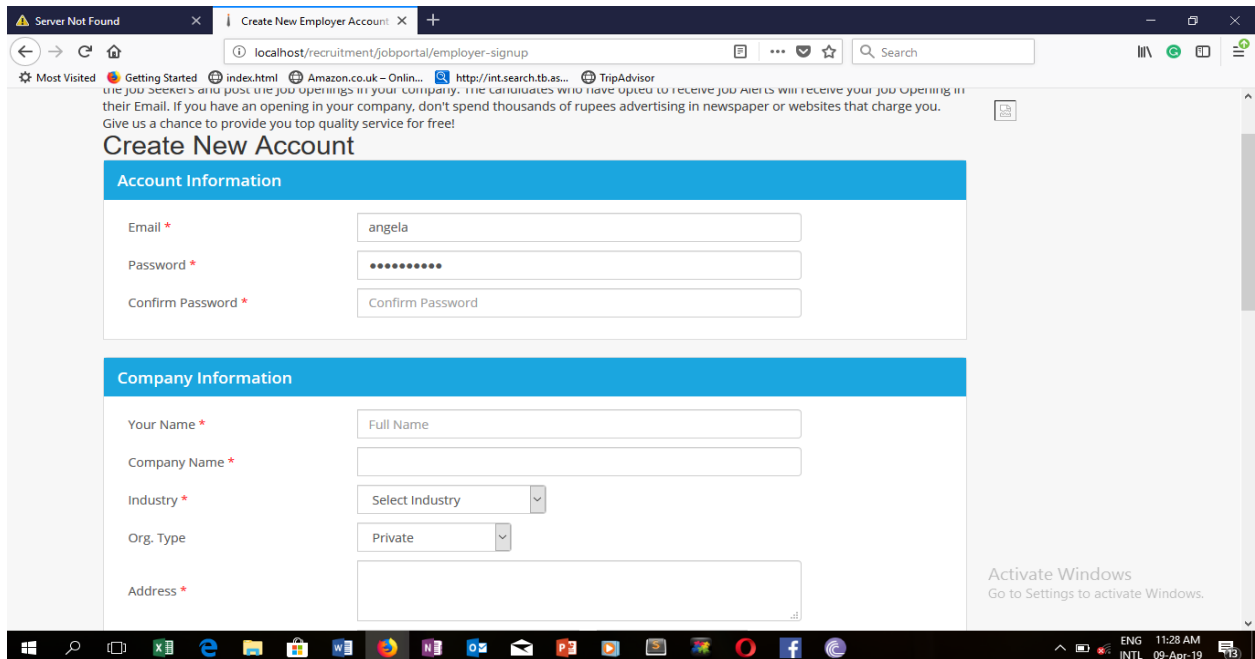


Figure 11: The account creation interface

## The Job Portal Dashboard

This is the interface that displays all the features of the available jobs, employers, qualifications, content management, and others, as depicted in Figure 12.

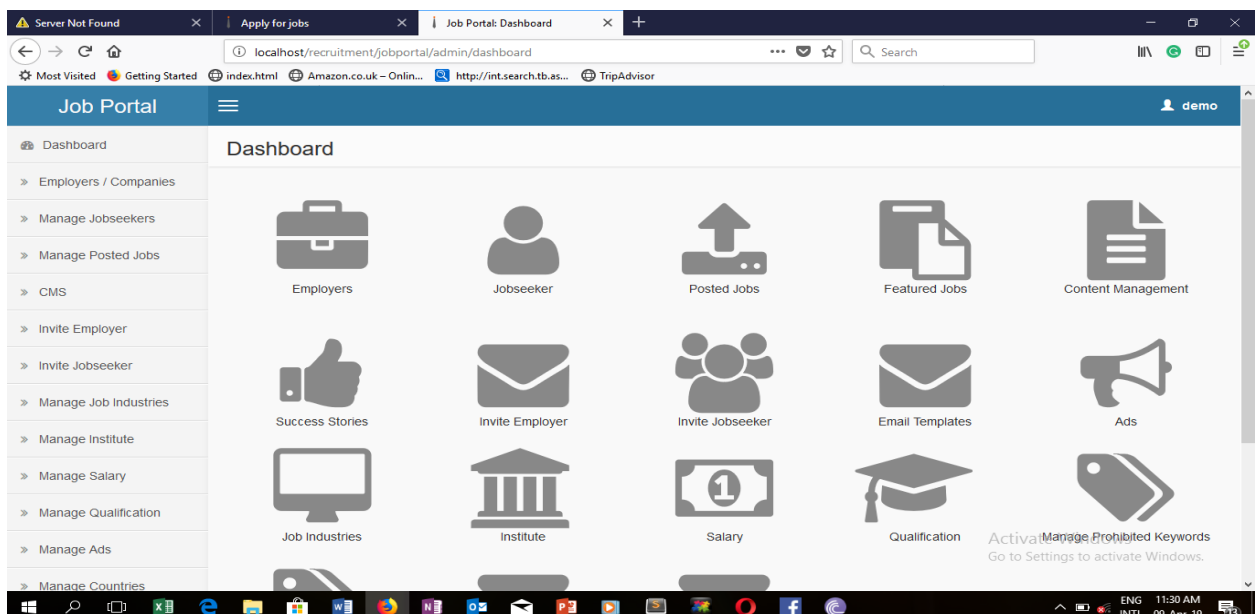


Figure 12: The job portal dashboard



## The E-interview Interface

This page interview shortlisted applicants electronically, as shown in Figure 13.

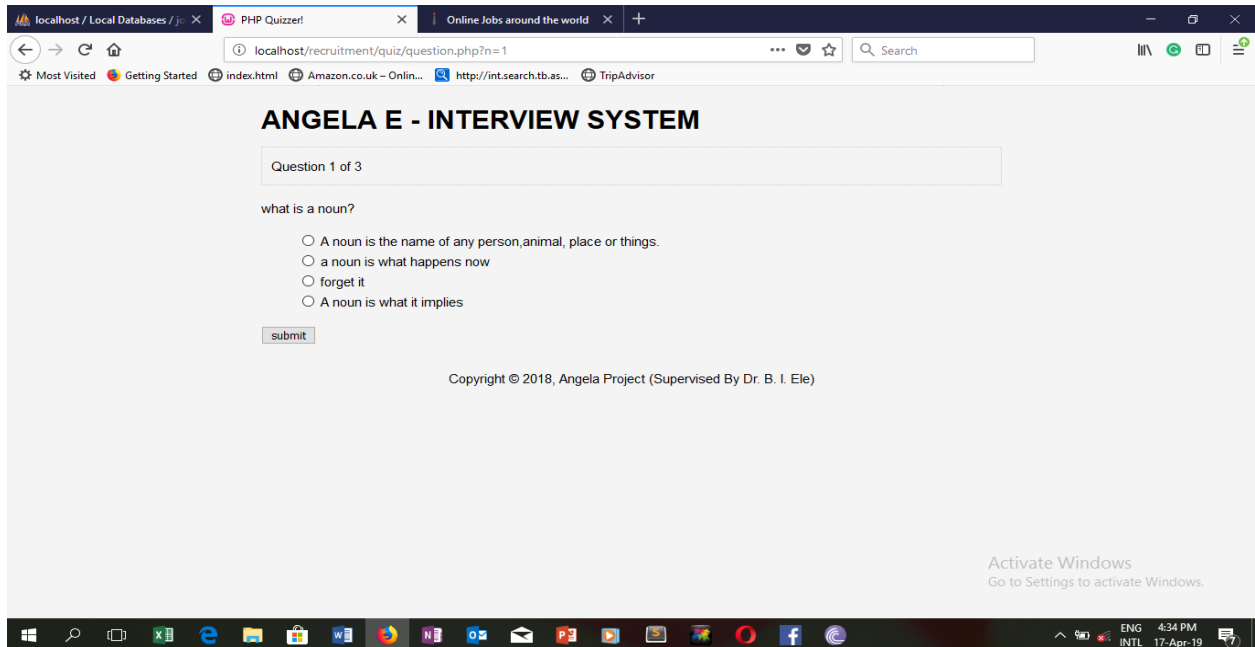


Figure 13: The E-interview interface

## Job Application Received Interface

This interface shows the available job applications received, as depicted in Figure 14.

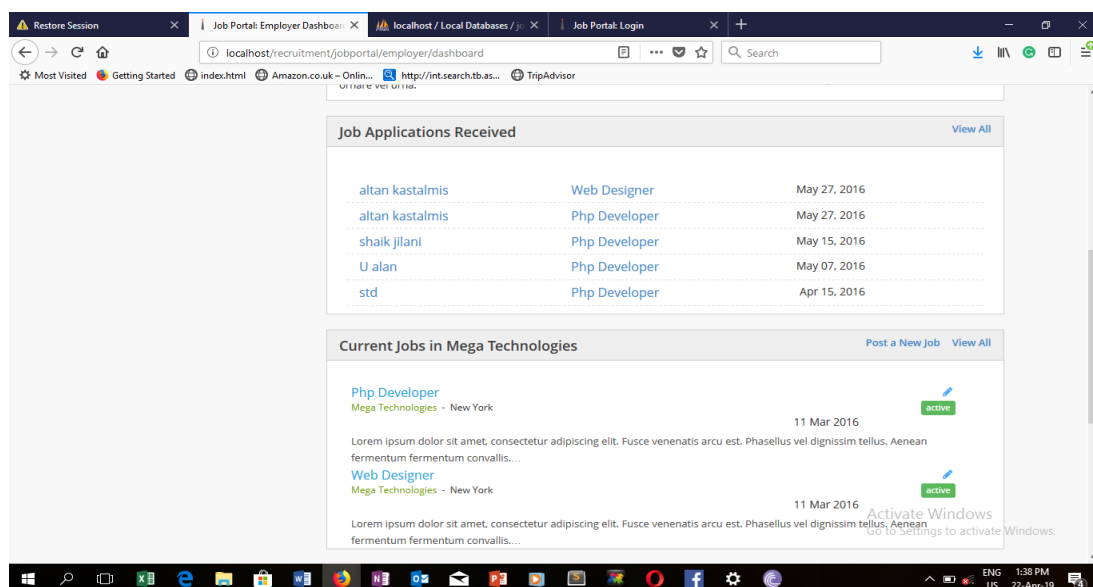
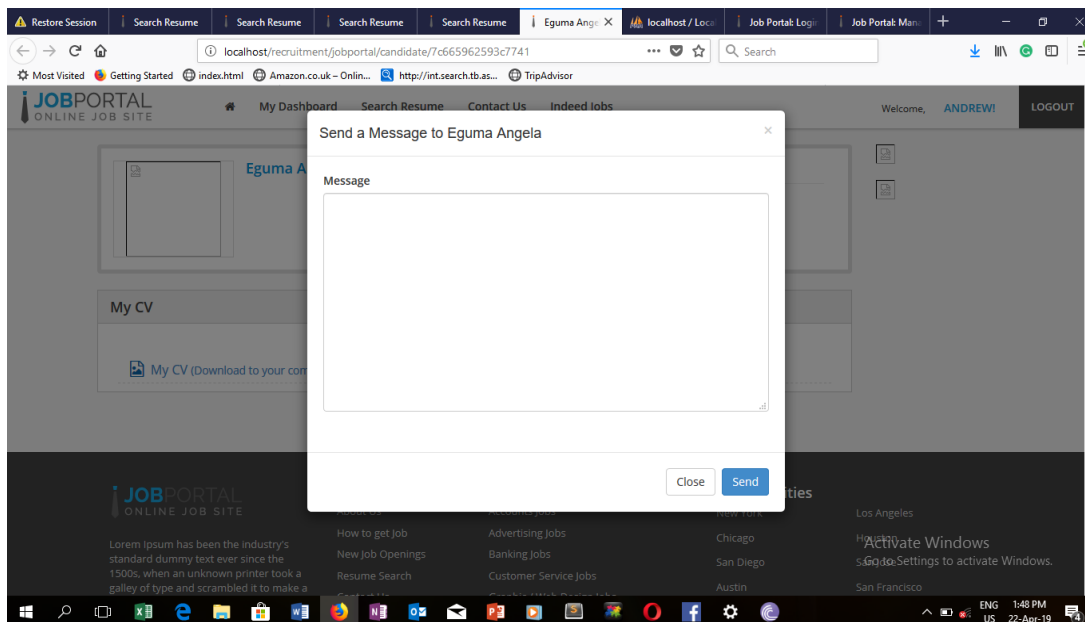


Figure 14: Job application received interface

## The Message Notification Interface

This page serves as a notification component that sends SMS messages to successful candidates that passed the e-interview and are subsequently considered for the job, as depicted in Figure 15.



**Figure 15: Message notification interface**

## CONCLUSION AND FUTURE WORK

An intelligent-based job applicants' assessment and recruitment system was developed in this study. Staffing and selection form a vital portion of the central operations underlying Human Resources Management (HRM). Recruiting the most suitable candidate for a position and stress-free search for dream jobs has been a serious challenge for both employers and job-seekers. There is a need for a platform that can bring these two parties together and reduce the burden of long processes involved in searching for a job, as well as searching for a suitable candidate for a job. This research was focused on the development of a platform, where job-seekers, as well as recruiters, will be able to benefit from, applying for a job and recruiting, and selecting the best candidate for a job. Even though there is an old system, it is limited in its services.

This proposed system has advantages over the old system. The system was able to accomplish the following:

- i) To retrieve and process applicants' details.
- ii) The system will serve as a database of job applications.
- iii) The system will provide information concerning registered job applicants if need be and accurately select qualified candidates for various job positions.
- iv) The system will alert successful candidates of their employment status via SMS alert.



The proposed system was designed to help job-seekers apply for available jobs without leaving the comfort of their homes. It would reduce the stress of roaming in search of the desired job. The system would also assist human resource management as it plays a very important role in ensuring that recruitment within work organizations is more effective, unbiased, and efficient.

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