

E-recruitment systems: A theoretical model

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Abstract

The rapid development of modern Information and Communications Technology (ICT) has resulted in an increasing number of job-seekers turning to the Web for information. This has motivated the use of electronic recruitment (e-recruitment) systems, also known as online recruitment which is one of the emerging worldwide trends in electronic human resource management (E-HRM) functions. E-HRM is a way of implementing HRM strategies, policies and practices in an organization through a directed support of Web technology based channels. The Internet can facilitate the selection of employees and other HR functions related to recruitment, especially where long distances are involved. This has dramatically changed the way business is conducted and this use of technology is clearly demonstrated by the number of organizations and individuals who utilize the Internet and electronic media. In terms of HR management, the Internet has changed the recruitment perspective for both organizations and job seekers.

Key words: Information and Communications Technology, e-recruitment systems, online recruitment, human resources, Internet, E-HRM, electronic media.

Introduction

Recruitment includes practices and activities carried out by an organization with the primary purpose of identifying and attracting potential employees. With the development of new technology, recruitment has shifted from traditional methods to evolving online methods. The first decade of the twenty-first century saw rapid growth in the use of online recruitment and the transformation of electronic recruitment into one of the fastest growing recruitment techniques (Holm, 2010). Online recruitment systems provide an avenue for centralized storage, management and distribution of recruitment information. Given the physical geography of Papua New Guinea (PNG) such a system should prove very attractive. This will not only target the ever increasing human resource talent, but also introduce an accountability mechanism for tracking and transparency purposes. This is further emphasized in PNG's Vision 2050, which asserts that "We will be a smart, wise, fair and happy society by 2050" (National Strategic Plan Taskforce, 2009).

This paper proposes a theoretical model that could be used by any recruitment agency for recruiting and selecting human resources online. This, therefore,

would create a functional channel for recruitment agencies to communicate between job seekers and employers. It seeks to contribute to scholarly discussion on designing global recruiting services and systems, since sourcing new staff is increasingly carried out on a global basis. Further, discussions include a view to creating effective service delivery systems to support human capital development through the use of technology and information systems. This theoretical innovation would enable access to a large base of potential employees. Ultimately, it should provide employers with the ability to recruit even where great distances are involved.

Literature review

According to Fuertmueller (2012), e-recruitment is a diverse topic fed by various disciplines including Human Resources Management, Organizational Behaviour, Management, Information Technology and Computer Science fields. Because of this diversity, a comprehensive search for relevant journal articles in human resource management and information systems was required.

In recent years, there has been a large number of publications on e-recruitment and the increasing diversity of publications on e-recruiting research calls for a synthesis (Wolswinkel, et al., 2010). The notion of an online recruitment system is derived from literature surrounding the basis of e-HRM and functions of a web-based channel for e-recruitment. This review integrates the various e-recruitment findings and the possibility of developing a functional system that runs online recruitment.

Effectiveness of the theoretical system design

According to Gopalia (2012), the effectiveness of e-HRM and selection processes can be measured by several advantages. It saves time to hire which can usually be prolonged if using other news media. E-recruitment and selection procedures save costs of recruitment and administration, thereby reducing recruitment and administration cost. Furthermore, e-recruitment and selection provides a competitive edge to organizations by developing a market image and helps in terms of gaining advantage on the basis of speedy applicant data collection. Finally, it allows access to a large verifiable talent pool of candidates, and focuses on expanding individual employment options as well as improving recruitment processes for businesses.

Theoretical e-recruitment system

The proposed recruitment agency will function as a third party; it will form the link between job seekers and employers. It will provide the interface by which employers can perform functions such as registering as a partner to the agency, viewing website contents, and uploading information about job vacancies and application forms.

Job seekers will be able to use the Web interface to register and login to view the site, upload curriculum vitae (CV) and supporting documents for respective

job vacancies, and receive notifications of job vacancies when they become available.

Network design

The main objective of this paper is to provide an overview of the requirements for the effective performance of the network. Designing a network helps to discover and establish a means of communication between two different branches of an organization or a global connectivity mechanism via a Wide Area Network (WAN).

Product context

The aim is to design a WAN which will enable the system to interconnect and share resources across large geographical distances. The finished product is most likely to be a subsystem of other systems. It cannot be said to be independent or self-contained because, with the use of Virtual Private Networks (VPN), the system is contained within a broader public network. A larger system can be built on this using two internal networks connected together via an external interface such as the Internet.

User characteristics

The types and characteristics of the users who may come into contact with the system have been described in terms of certain general categories: power (advanced) users, who are job seekers as well, may be able to identify flaws in the system design; average users who are just applicants in search of jobs; recent graduates who may have ample knowledge in this field of study may be able to criticize the product (Dhamija (2012).

Assumptions

Because having a design is most often based on anticipation of what is expected, there are three main assumptions about the theoretical system. The first is that the network design can only be feasible for Windows Operating Systems. Secondly, the network documentation may be subjected to change when WAN media specified changes, or technologies used are upgraded. Finally, the WAN, operating over a VPN, is assumed to be able to handle requests on a global scale.

Constraints

According to Lammler (2011), some items that might constrain a proposed design include parallel operation with an old system; access, management and security; criticality of the hosted application; system resource constraints such as limits on disk space or other hardware limitations, and other design constraints including design or other standards, such as programming language or framework.

Dependencies

Dependency requirements are the factors that the system depends on in order to function. In this case, several protocols are required since the WAN will be incorporating a VPN. Point-to-Point Tunnelling Protocol (PPTP) will be used to facilitate encapsulation and encryption of data to be sent over a public network. It allows for data to be securely transferred from a remote to a corporate network. Secondly, Layer 2 Tunnelling Protocol (L2TP) will be used to enable a device to use a dial-up connection to create a secure connection to a corporate network. It also incorporates the functions of PPTP. Moreover, Internet Protocol Security (IPSec), an industry-wide standard framework of protocols, is needed to allow for secure data transmission over an IP-based network.

Transmission Control Protocol / Internet Protocol (TCP/IP) takes large blocks of information from an application and breaks them into segments, it sequences each segment to enable reassembly. Then, using a routing table, it decides on a best route for the packet to take to its destination. Assuming the system runs on a Web platform, Hyper Text Transfer Protocol (HTTP) will be used to manage communications between web browsers and web servers and open the right resource when a link is being clicked, wherever that resource may actually reside. Finally, File Transfer Protocol (FTP) is needed to enable the system to transfer files. Users are still subject to an authentication login using passwords and usernames implemented by system administrators.

Security measures for the system

Security measures are factors that will protect the system from malicious or accidental access, modification, disclosure, destruction or misuse. Some measures to be incorporated include encryption, activity logging, historical data sets, data integrity checks, and data encapsulation.

Logical network designs

The system is designed to receive Internet connectivity through a leased line from an Internet Service Provider (ISP), which connects to the respective company's Local Area Network (LAN) via a Channel Service Unit / Data Service Unit (CSU/DSU) device (Figure 1).

For security, there will be two firewall routers: one on the external interface which will screen packets - objects transmitted on a network are divided into parts called packets, which are given logical addresses so that they can be routed through an internetwork - coming through from the Internet, and one on the internal interface which will screen packets that are being routed from the internal network.

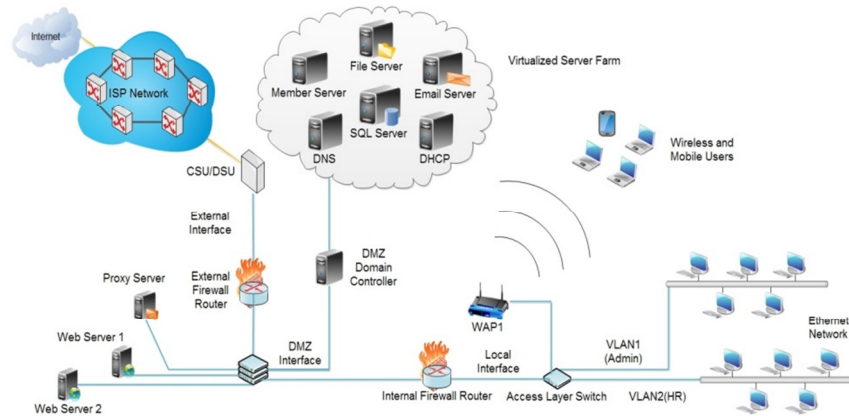


Figure 1 Logical design of an in-house network that hosts the theoretical e-recruitment system.

On the demilitarized zone (DMZ) interface, there will be the virtualized server farm, a group of virtual servers consolidated to operate on a single physical server, which will be accessible to both external and internal users. Because the network will be used to host a Web application that is expected to be available 24/7, the suggestion here is to have two Web servers.

Just after the external firewall router will be the distribution layer pool of switches: one provides switching to access layer switches while the other provides load balancing between servers. There will also be an internal firewall router which connects to the access layer switch (Figure 1). To provide security, Virtual Local Area Networks (VLANs) can be used for the internal network. Each VLAN provides connectivity and switching for respective organizational departments. There will be wireless access points (WAP) connected to the access layer switch, to provide network access to wireless and mobile users.

Database design

An essential requirement for designing a database is to identify the different end-user requirements. Database requirements analysis seeks to gather information needed to design a database that meets the informational requirements of a user or an organization. This includes the type of data that is to be stored in the database and the conditions under which that data needs to be accessed. Database requirements analysis is often concerned with the nature and use of data. It involves the identification of the data elements which are needed to support the data processing system of an organization, the placing of these elements into logical groups and the definition of the relationships between the groups. This theoretical model provides designs for a database that would capture information about candidates who have applied for advertised positions, employers who have advertised, and the available vacancies. This phase requires data, processing and management from the organization that

uses it. In this paper, simulated data will be used to illustrate a theoretical standard design.

Purpose and need

The Recruitment Management Database would create a storage system for jobs and applicants who apply via a web portal. This storage system is designed to keep records of job vacancies, the entities who advertise those jobs and the candidates who have applied for vacancies. This would enable the establishment of logical relationships between entities of the database and capture it in the actual implementation.

List of current data sets

Table 1 A list of required entities and their respective attributes for the design of a database.

Candidates	Job Vacancies	Employers
Candidate ID	JobID	Employer ID
First name	Position	Company name
Surname	Description	City
Gender	Location	State
Data of birth	Salary package	Country
Age	Benefits	Industry
Marital status	Qualification	Postal address
Address	Experience requirements	Email
Email	Applications closing date	
Phone number		
City		
State		
Country		

The entity relationship model (Figure 2) illustrates how these data sets will be captured and how the database will be structured.

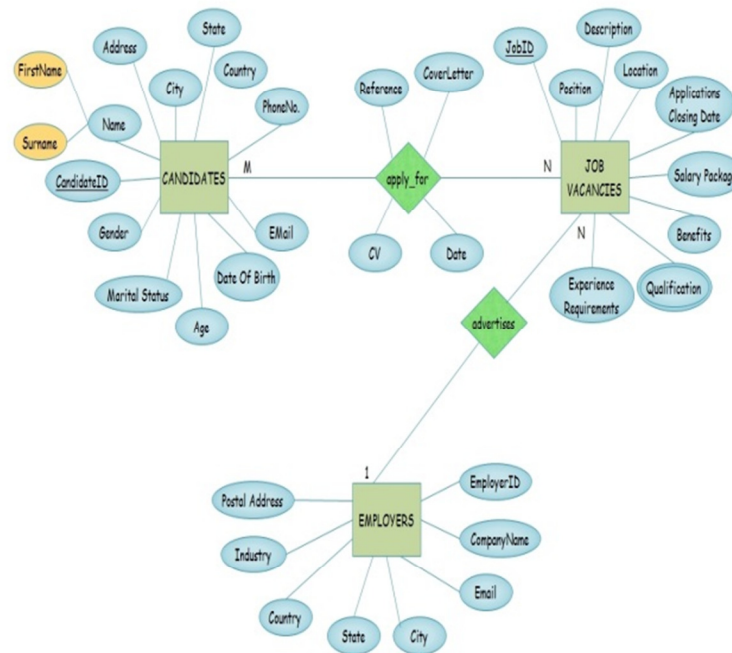


Figure 2 Entity relationship diagram illustrating the existence of entities and attributes in the database, and the relationships that exist between these entities. Rectangles represent the entities, which will be implemented as tables in the database; ovals represent attributes, which are fields in the database; diamonds represent logical relationships between the entities involved; and ovals with double borders represent multi-valued attributes.

According to the data requirements of the organization, the database presumes there is a many-to-many relationship between candidates and job vacancies. This means that one candidate can apply for many jobs, and many candidates can apply for the same (one) job. Further, there is a one-to-many relationship between employers and job vacancies. At any one time, only one employer can advertise a particular job. No two employers can advertise the same job.

A many-to-many relationship in a relational database exists when one record in table A can be referenced by one or more records in table B and one record in table B can be referenced by one or more records in table A. This concept can be captured by using a junction table to relate theoretical tables A and B when physically implementing the database.



Figure 3 The relational schema which transforms the entity relationship diagram into an implementation model, thus indicating primary to foreign key relationships that would exist in the physical tables when implemented.

A relational schema transforms the high-level entity relationship model into an implementation model and shows how the database will be physically implemented. It states primary to foreign key relations and maps data models. Figure 3 shows the relational schema with arrows pointing from the foreign keys to their primary keys.

Entities and data types

A list of entities, their respective fields and data types (Tables 2 to 6) are provided for the physical database implementation. Note that because the web application allows for files to be uploaded (CV and references, etc.), there is a separate directory storage for these files because some files might be too big to be stored in Microsoft Access (which is the application used to simulate the existence of a database system).

Table 2 Candidates

Field	Data Type
Candidate ID	Text
First name	Text
Surname	Text
Gender	Text
Date of birth	Text
Age	Text
Marital status	Text
Address	Text
Email	Text
Phone number	Text
City	Text
State	Text
Country	Text

Table 5 Employers

Field	Data Type
Employer ID	Text
Company name	Text
City	Text
State	Text
Country	Text
Industry	Text
Postal address	Text
Email	Text

Application development

The application component of the system uses the three-tier client-server architecture (Figure 4). In this model, the client accesses the system via a graphical user interface (GUI) which is the website, the middle tier is the application or web server which processes requests and responses, and the third tier is the database management system (DBMS) for storage purposes.

Table 3 Applications

Field	Data Type
Candidate ID	Text
Job ID	Text
Submission Date	Text

Table 4 Job Vacancies

Field	Data Type
Job ID	Text
Position	Text
Description	Text
Location	Text
Salary package	Text
Benefits	Text
Qualification	Text
Experience requirements	Text
Applications closing date	Text

Table 6 Qualifications

Field	Data Type
Job ID	Text
Qualification	Text
Candidate ID	Text

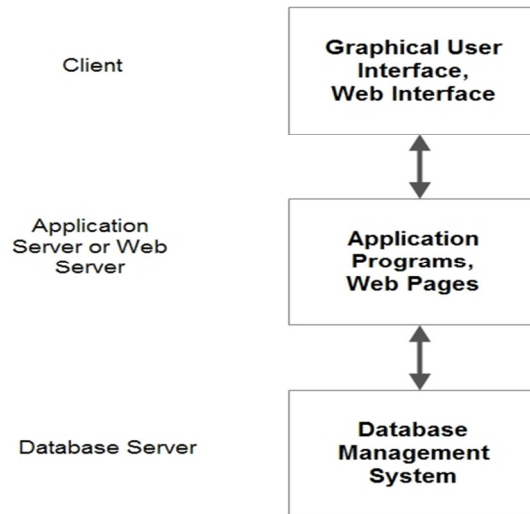


Figure 4 Three-tier-client-server-model representing the system architecture

A typical Web request is sent to the Web server, which executes any ASP code and translate them to HTML. If external data is required, a database request (SQL) is sent to the database server, which executes the SQL request and sends the data back to the Web server. The Web server collates and sends to the Web response to the client in HTML (Figure 5).

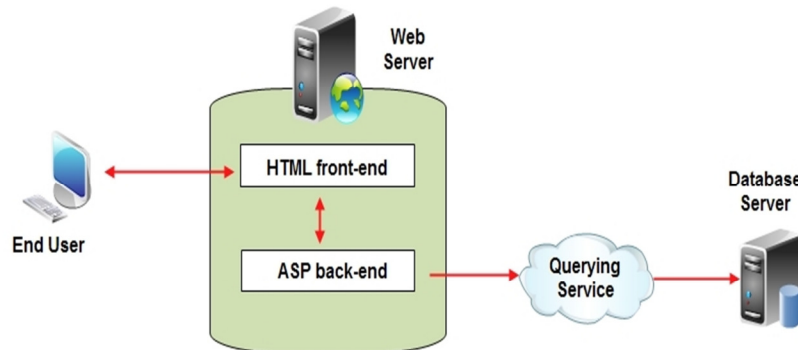


Figure 5 Path taken by a typical web request and response

Functionalities

The web application aims to achieve three main functions. These include, registering an applicant and an employer to log in to the site using their allocated username and password and post jobs on the site, which are updated in the database, thus, allowing applicants to apply for jobs and upload related documents to be saved in a directory on the site.

The system is developed in such a way that, when viewing the database, one can identify which employers posted which jobs, and how many jobs altogether were posted by which employer. Furthermore, it indicates which candidate applied for a job, using what qualification, and on what date so that recruitment officers know that they have not passed the applications closing date.

Because some information on the web site is private and confidential, ASP session objects can be used to ensure that only registered members are able to log in and view the page content. Unregistered users would not be able to view certain pages and will be redirected to the login page. To be able to login, you must first register. Hence, this measure limits access to registered users only.

Conclusion

This paper has discussed the design of a theoretical model for an online recruitment system, which would be hosted on a proposed network design and using a simulated database system. It would enhance global recruitment activities. E-recruitment is a phenomenon that has led to the appearance of a new market in which there is an unprecedented level of interaction between employers and potential employees. A vast volume of literature continues to become available from the perspective of Human Resources Management (HRM), Information Technology (IT) and other disciplines.

The implementation of an e-recruitment system with full functionality depends entirely on the organizational and informational needs of those concerned. One such system is the theoretical online recruitment model which this paper has discussed. This model enhances flexibility of recruitment by ensuring a mechanism is provided for accountability, tracking and transparency. Valuable information can, therefore, be centrally stored and distributed so as to avoid data redundancy and duplication. Limits of physical mobility, which may have prevented online recruitment in the past, are removed by 'cyber-mobility'. Regardless of where they live, individuals as much as organizations can have a global presence, working in virtual teams anywhere in the world.

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Glossary

ASP	Active Server Pages	IPSec	Internet Protocol Security
CSU/ DSU	Channel Service Unit / Data Service Unit	ISP	Internet Service Provider
CV	Curriculum Vitae	L2TP	Layer 2 Tunnelling Protocol
DBMS	Database Management System	LAN	Local Area Network
DHCP	Dynamic Host Control Protocol	MS	Microsoft
DMZ	Demilitarized Zone	PNG	Papua New Guinea
DNS	Domain Name System	PPTP	Point-to-Point Tunnelling Protocol
E-HRM	Electronic Human Resource Management	SQL	Structured Query Language
ER	Entity Relationship	TCP/ IP	Transmission Control Protocol / Internet Protocol
FTP	File Transfer Protocol	VLAN	Virtual Local Area Network
GUI	Graphical User Interface	VOIP	Voice Over Internet Protocol
HR	Human Resources	VPN	Virtual Private Networking
HTML	Hyper Text Mark-up Language	WAN	Wide Area Network
HTTP	Hyper Text Transfer Protocol	WAP	Wireless Access Points
ICT	Information and Communications Technology		