



UNIVERSITY OF NAIROBI
SCHOOL OF COMPUTING & INFORMATICS

**E-VERIFICATION – A CASE OF ACADEMIC
TESTIMONIALS**

By

MUTHONI, JOSEPH MATHENGE

(P53/65118/2013)

Supervisor

Dr A. M. KAHONGE

A project report submitted in partial fulfillment of the requirement for the award of Masters of Science in Distributed Computing Technology of the University of Nairobi.

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Declaration

This project is my original work and to the best of my knowledge this research work has not been submitted for any other award in any University

Signature

Date

Muthoni, Joseph Mathenge

(P53/65118/2013)

This project report has been submitted in partial fulfilment of the requirement of the Master of Science Degree in Distributed Computing Technology of the University of Nairobi with my approval as the University supervisor

Signature

Date

Dr A.M Kahonge

School of Computing & Informatics

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Abstract

Recruitment and selection is a core process for any organization as it serves to provide the organisation with the sufficient number of staff that has the appropriate qualities in terms of skills and experience. In such an activity the process of verifying academic capabilities must be employed. The process is manual and allows fake or unverified papers to pass on to other stages of recruitment. This is despite e-recruitment systems being used all over – leaving verification to be manual and tedious.

The study examined the current methods of verification as well as the score of fake certificates over genuine ones. Two hundred and thirty two respondents were examined to identify also the electronic methods used in the process and how their academic certificates were treated in the last job interview or school admission sessions. It was found that in both cases, there was little use of ICT in verification (< 5%) and the process took days and was not efficient at all.

In an attempt to curb the issues and improve efficiency, a technique for electronic verification was proposed and tested. This is a technique that employs the web and database programming, XML data sharing as well as message passing via a very simple web service to share academic data between employers and the schools. The prototype was continuously improved via the RITE (Rapid Iterative Testing and Evaluation) approach. In evaluating the technique further, twenty respondents were surveyed and academic info subjected to verification via a questionnaire. It was found that the average verification time was reduced from weeks to an average of 5 seconds. The technique is then poised to be the solution of fighting academic paper vices and enable employers select the best with little effort and resources.

Table of Contents

Declaration.....	ii
Acknowledgements	iii
Abstract.....	iv
List of Figures & Tables.....	viii
1.0 Introduction	1
1.1 Background.....	1
1.2 Statement of the problem.....	3
1.3 Project Objectives.....	3
1.4 Research questions.....	3
1.5 Justification and scope.....	4
1.6 Significance terms.....	4
2.0 Literature Review	5
2.1 E-Recruitment.....	5
2.1.1 E-recruitment Process.....	5
2.1.2 E-Recruitment Landscape.....	7
2.1.3 Categories of E-Recruitment Sources.....	8
2.1.4 Drivers of E-Recruitment	9
2.1.5 Challenges of E-recruitment.....	9
2.2 Verification	10
2.2.1 What is verification?.....	10
2.2.2 Manual verification process.....	10
2.2.3 Electronic Verification	10
2.2.3.1 E-Verify	10

2.2.3.2 Credit Reference Bureau (A case of Kenya)	11
2.3 Integrity and Legitimacy of Academic papers	11
2.3.1 Attempted Verification Methods	12
2.3.2 Technology and Verification Illusion	14
2.4 Conceptual Framework	15
3.0 Research Methodology	16
3.1 Research Design	16
3.2 Data Source and Target Population	16
3.3 Data Collection and Analysis	18
3.4 Limitations in Research methodology	19
3.5 Prototype Development and Testing	19
4.0 Results and Discussions	21
4.1 Questionnaire Overview and Response Rate	21
4.2 Reliability & validity of the Data Collected	22
4.3 Findings	23
4.3.1 Respondents nature of work and methods of hire	23
4.3.2 Organization’s Vs. Academic papers Verification methods	24
4.3.3 Verification in Past academic Enrolment	26
4.3.4 Availability of Fake academic papers	27
4.3.5 ICT Use in Documents Verification	28
4.3.6 Privacy Concerns	29
4.4 Co-Related Findings	30
4.5 Discussion	31
5.0 Prototype Development	32
5.1 Prototype Overview	32
5.2 Contextual representation	33

5.2.1 Implementation Variation one (Managed by a central authority)	33
5.2.2 Implementation Variation two (Managed by the institution)	34
5.3 System Functional Specifications	35
5.4 System Non-functional Requirements	35
5.5 Data Flow	36
5.6 XML Definitions structure	37
5.7 Prototype Architecture	38
5.8 Implementation Technologies	39
5.9 Input data	40
5.10 Output Data	40
5.11 System Privacy Considerations	41
5.12 Prototype Testing and Discussions.	42
5.12.1 Testing Overview	42
5.12.2 Test Findings Analysis and actions.	42
6.0 Conclusion & Recommendations	44
6.1 Conclusion	44
6.2 Recommendations	47
References	48
Appendices	51
E-Verification - A case of Academic Testimonials - Appendix i.....	i
E- Verification Prototype Evaluation Form - Appendix ii	i

List of Figures & Tables

Figure 1 E-Recruitment Process 6

Figure 2 E recruitment Landscape. (Adapted from IES) 7

Figure 3 Perceived Conceptual framework 15

Figure 4 Respondents Nature of Work 23

Figure 5 Preferred Methods of Hiring 23

Figure 6 Organization vs. Methods of Hiring 24

Figure 7 Methods of verification – General employees view 24

Figure 8 Employees’ account on certificate verification 25

Figure 9 Minimum Qualifications sought 26

Figure 10 Students account on Certificates Verification 26

Figure 11 Method used to verify certificates before enrolment. 27

Figure 12 Methods of Application 27

Figure 13 Chart on times encountered a fake certificate 27

Figure 14 Chart - know more than one person hired with fake documents 28

Figure 15 Contextual Diagram variation one 33

Figure 16 Contextual Diagram Variation two 34

Figure 17 Data Flow chart illustrating data flow on cron and during search 36

Figure 18 XML Definitions by example 37

Figure 19 System Architecture 38

Figure 20 Data Input Screenshot 40

Figure 21 Output Data Screenshot 40

Figure 22 Normal Distribution of Time taken to verify a certificate 43

1.0 Introduction

1.1 Background

Information and Communication Technology (ICT) has not only become vital, but have changed the way business is done. Every business that has to remain relevant and be profitable must employ ICT in their business models. E-recruitment or online recruitment which can be defined as a “*practise that uses technology and in particular Web-based resources for tasks involved with finding, attracting, assessing, interviewing and hiring new personnel*”, (Rouse, 2012) becomes one of the business models. This is an efficient method that not only saves time and monetary resources but also extends the reach to a diverse set of applicants. Being a vital process on business growth and continuity, then it must have the qualities of transparency and verifiability.

Academic testimonials are not only used to gain entry into employment but also guarantees an entry into other institutions of higher learning or leadership positions. The constitution of Kenya provides that aspirants for elective posts should be vetted. The elections act of 2011, of the constitution of Kenya provides that candidates for the elections of Senator or Member of the National Assembly to have a minimum post-secondary school qualification recognised in Kenya. On the other hand a candidate for election as President, Deputy President, County Governor or Deputy County Governor must be a holder of at least a degree from an institution recognised in Kenya. The Independent electoral and boundaries commission of Kenya is tasked with the mandate to vet the aspirants for the Kenya Elective posts, as like other electoral bodies of the world.

In every call-up of students to join a course or programme, mostly dubbed as ‘intake’ every institution sets some minimum qualifications that must be taken into considerations. Key to these are Minimum education requirements. The same institutions need to verify all certificates presented but also fall prey to fake or unverifiable lower level certificates submission.

New institutions and new courses are coming up every day creating a disparage situation that leaves an employer with the difficult task of weeding fake certificates from the original ones. This creates 'ripe venture(s)' for distribution of fake certificates especially when submissions are done via email or via various talent or recruitment portals. This is aggravated by the fact that verification is done manually by visiting the host institutions. The process consumes resources and most of the employers avoid it and trust the certificates provided.

The project aimed into finding the missing gaps in the e-recruitment exercise and provide a solution to aid in the verification of academic testimonials presented for any consideration, be they for elective posts as mandated by the law, education or college's enrolment or even for the recruitment purposes for any post. It is a project that will eliminate fake documents production by a larger margin and will save the country the millions of resources lost in hiring incompetent staff or court cases that arise from elections of candidates who provided fake or unverifiable documents as part of their nomination papers.

The project and study aims tiers up academic institutions, academic certification authorities, the government and employers in a web service tier architecture that will allow anyone to verify any academic papers at disposal automatically by querying the given interface. The host institutions will run their disparate systems but will publish and share certificates information that is later queried. A separate portal that brings all institutions together will also be a part of the final implementation. Some skills in web services and data sharing capabilities will be required for the successful implementation.

1.2 Statement of the problem

With the advancements of technology and increased internet usage e-recruitment has become the norm among State Corporation or private hires. The adoption of these e-recruitment procedures is more than Just technology. It is all about the recruitment system having the hooks and baits to attract and nab the right candidate, (Kerrin M, 2003) and must provide a method to track process and verify with a reason the authenticity of every process. The selection must be based on sound and credible criteria however most of the available tools or the email submission methods only serve as a tool to inform applicants and/or collect their resumes to build a resume data bank. They are deficient of an electronic method to verify the validity and authenticity of the submissions.

The resulting process of selecting a candidate from the unverified list allows fake certificates to pass on - and where extra manual verification is not done a recruit with fake certificates ends up being hired. This is a threat and a discouragement to qualified candidates and employers who gear to work only with the best available and who also spend a lot of resources to get the best.

1.3 Project Objectives

The main objectives of the project includes:

1. To find out the verification procedures, methods and shapes that organisations employ in the recruitment process and the issues encountered.
2. To find out the extent of use of technology in verification, in a recruitment exercise.
3. To build and test an electronic tool and a service to employers, academic institutions or state corporations with an easy, fast and verifiable process tool - that can provide real-time or semi-real time information on the validity on top of the e-recruitment systems.

1.4 Research questions

1. Has e-verification taken a stride in our country, in what sectors or phases of recruitment and what are the steps involved?
2. What are the limitations and missing gaps with the use of these e-verification procedures, if any?
3. What are the privacy issues associated with sharing of academic data, if any?
4. Are there fake certificates in circulation? If yes, what is being done to curb their circulation?

1.5 Justification and scope

The project will be instrumental to all the recruitment panellists, and will avail a fast tool that will verify and weed out any fake documents presented for consideration. This in turn will save the time and effort for any selection exercise. Additionally it will help constitute a transparent process that encourages the job seeking fraternity of the due consideration in the position they applied.

With the implementations in vetting of candidates for elective positions it will aid in proper governance as only the right candidates will pass the nomination stage for positions whose qualifications are entrenched in the constitution of the land.

1.6 Significance terms

E-verification – the electronic method or process of establishing the truth, accuracy, or validity of something. In the context of the project this means the electronic verification of the academic testimonials availed for the purposes of recruitment or hire.

E-recruitment - The *'practise that uses technology and in particular Web-based resources for tasks involved with finding, attracting, assessing, interviewing and hiring new personnel'*, (Rouse, 2012).

HR – Human resource – it is used to mean the entire human resources team. The staff responsible for recruiting staff in various disciplines of the organisation.

Certificates - These are used to refer to academic papers issued to a student after successful completion of a course. They form the contention in terms of validity.

E-verifyIT- The Slag name used to refer to the prototype built in this project.

2.0 Literature Review

2.1 E-Recruitment

E-recruitment has driven the today employer to employ web based recruitment systems in the hiring processes. The E-recruitment constitute web based frameworks that provide structures for key personnel processes, (Cullen, 2001). The methods have been employed in a wider scale with several companies forming a business or a living in this area and also helping the companies in hiring the ‘right’ staff based on information submitted. The terms online recruitment, internet recruitment and e-recruitment will be used interchangeably in the same context. The term recruitment will refer to all situations where academic papers are presented for hire and/or consideration be they for political nominations or even school enrolments.

The financial sector is arguably the most computerized sector in Kenya and have extensively used e-recruitment systems as a method of acquiring the right staff, (Chunguli, 2003). The sector has benefited widely and have led further to the growth of the sector. In a survey in state corporations in 2006, Lagat Catherine noted limiting factors that prohibited the effective use and adoption of e-recruitment among government institutions. The survey highlighted lack of skills and over dependency on the old norms as other limiting factors – these have however passed and e-recruitment is on the rise in all sectors of the economy.

2.1.1 E-recruitment Process

A recruitment process includes those practices and activities carried on by the organization with the primary purpose of identifying and attracting potential employees, (Barber, 1998). This process can be the traditional call up for interviews or the modern method that involves usage of electronic media. Thus, the process must provide an efficient pool of applicants and from them deduce the best of the best, (Nrip)

An electronic recruitment involves various actors and tools, (Recruit Advantage, 2012). Among these are the Job seekers, Talent seekers, job boards and assessment tools. The processes involved include research and match as well as applicant tracking.

The Talent seekers publishes a job advertisements in a job board or social media where prospective job seekers use the information to apply. An Application Tracking System (ATS) is a constituent

system that enables the process to move on traceably. It tracks and reports on all the stages involved and awards or conclusions obtained from each level. At any time reference can be deduced.



Figure 1 E-Recruitment Process

A general E-Recruitment process includes several activities, (Nrip).

- i. Determine the current need of employment, desired qualifications and job scope.
- ii. Posting the advertisement of job vacancy on job board (Online) or other media with reference to application procedures.
- iii. Managing the response i.e. Applicant database.
- iv. Short-listing of Applicant according to job specification.
- v. Arranging and conducting online interviews (By chatting, video conferencing or personal interviews etc.).
- vi. Decision making regarding further process
- vii. Hiring

2.1.2 E-Recruitment Landscape

In a typical recruitment system a candidate interacts with the system, he or she posts his/her resume. The line manager in consultation with the line manager selects a set of suitable resumes and subjects them to scrutiny. Where recruitment agents are involved they communicate with the Human resource department or specific line managers who in turn can communicate with the candidate. This all happens before any candidate is invited for an interview.

A decision is made based on the resume and other testimonials sent to the system. The system is error prone at this age as no formal verification is done. Most of the documents submitted are either attachments or self-description notes. These are however not fully verifiable. Otieno (2013) Warns “... So next time you hire someone be sure to screen their papers thoroughly, lest you earn yourself another fake friend, wearing a fake smile to impress you” in his story of Kenya the land of Fake goods, fake leaders and fake smiles.

The e-recruitment at this step have achieved the main goals of a cheap, fast and far reaching system but have not provided the full accuracy needed to enable the company hire the best available staff.

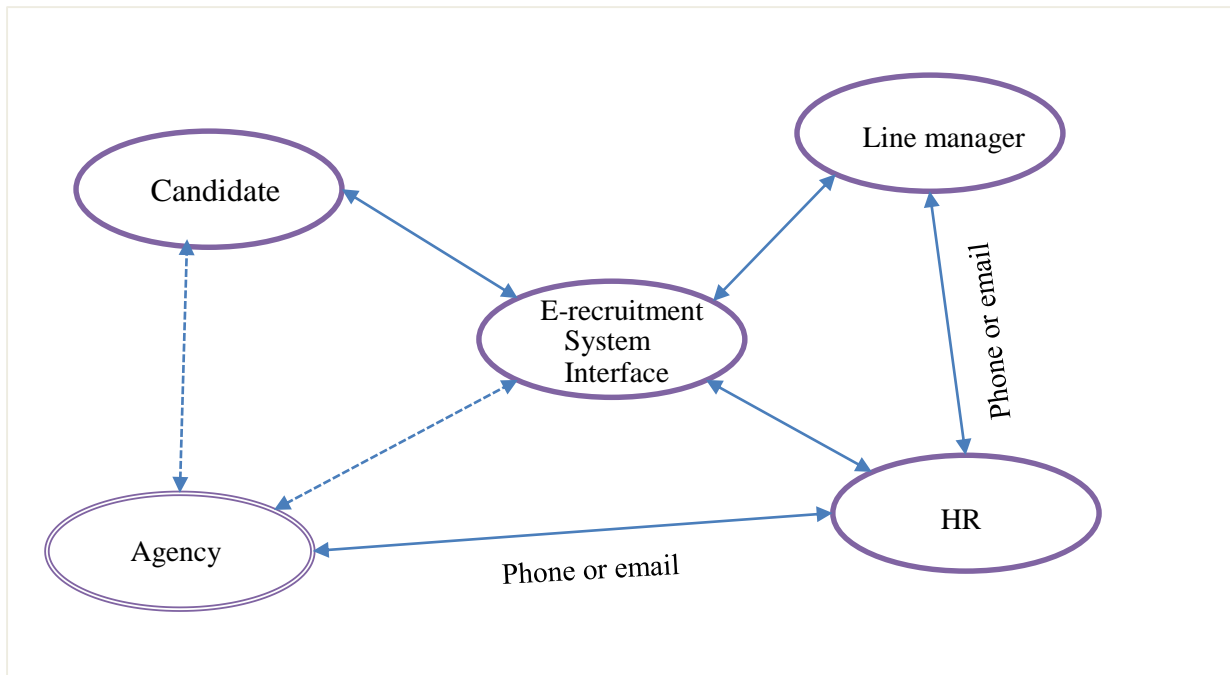


Figure 2 E recruitment Landscape. (Adapted from IES)

2.1.3 Categories of E-Recruitment Sources

Though there have been no formal categorisation of e-recruitment sources, Lee I., (2006) proposed six categories

- i. General purpose job boards – these provide recruiters and prospective clients with an interface where a recruiter can post his/her job with candidates applying for these. These have evolved to provide even custom postings and resumes databanks. These databanks are either free or provided at subscription services. A good example include brightermonday.co.ke and its sister sites.
- ii. Niche Job boards – these only specialise in specific areas of expertise. They avail job listings for the specific sectors and majors on areas that require specialized skills. Examples of these include marketing or IT Jobs Only. Manufacturers of customized inputs or machinery also reserve resumes for experienced staff in this area. These includes plant machinery operators who have been trained on specific set of skills.
- iii. E-recruitment Application Service Providers – These provides additional services to the employers by adding some value – they at most train applicants on usage or operation of some key installations before offering their resumes for recruitment to prospective employers.
- iv. Hybrid recruiting Service providers – these are contracted by employers and hire on behalf or even do job placements as per the instruction. They also conduct interviews on behalf and propose salary structures. At times they lease out their staff to work on other client companies with their uniforms and get their payments from the client as they also pay the staff.
- v. E-recruitment consortium – this is a cost effective alternative to the services provided by Job Boards. The consortium can be formed by a large company or by several small companies working together. These are common in placements for United Nations Jobs. The Jobs are posted together due to the similar structure of their operations.
- vi. Company Website – this constitutes a portal on a company website, the careers are posted here and either submission is done directly via filing a form or sending via email.

All the above sources, serve the same purpose of recruitment and uses web as the enabler framework. They however face the same challenges of information mistrust unless a manual verification is done. With the endless growth of technology and crime associated with technology, human resource professionals need to proactively embrace technology to the fullest, they should not only do electronic shortlisting but they should also do an automated verification of academic requirements.

The E-recruitment sources avail a large data set of information at once and thus creates a burden on the qualification and disqualification stages.

2.1.4 Drivers of E-Recruitment

In a comprehensive list by Lang, Laumer, Maier and Eckhardt (2011), several drivers and advantages of e-recruitment are identified. Some of these include cost and time saving, increased number of applicants, independence of place, race and time, simplified and effective process as well as target Group orientation – one is able to match hobbies and interests during advertisement. E-recruitment applications also allow easy update of applicant's data and as well simplify the application tracking process. Other benefits include expanding geographical scope of recruiting sources thus realizing a competitive advantage.

With the addition of a verification phase in the e-recruitment systems methodology other benefits will include an effective filtering of qualification to ensure the best pass the test of the day.

2.1.5 Challenges of E-recruitment

The major challenge of e-recruitment is the trade-off between quantity and quality of the candidates. The number of applicants increase as the number of unqualified ones increases, (Pearce & Tuten, 2001). This then creates an extra overhead in terms of cost of selection and time taken, though not comparable to the traditional methods.

E-verification modifies the social interactions and thus makes the job seeker not to effectively represent a number of personal qualifications for the job, (Stone, Stone-Romero, & K., 2006). Attentiveness and the look cannot be full represented via this method of recruitment. This method is further accused of '*lacking a human touch*' (Pin, Laorden M., & Sáenz-Diez I., 2001), and thus will likely to be acceptable by the set of population who prefer relationship-based interactions.

Pin, Laorden and Sáenz-Diez (2001), posits on the advantage of social interaction of e-recruitment sources, earlier mentioned as an advantage of e-recruitment sources. E-recruitment systems provides a broad access and thus makes matching to the job position a big issue. The consequence of this is '*having less qualified applicants with the cost of losing qualified ones*', Pin et al, explains. This then calls for a solution to filter the large pool of applicants and match them to the job position.

2.2 Verification

2.2.1 What is verification?

The dictionary.com defines verification as “*to ascertain the truth or correctness of, as by examination, research, or comparison*”. It further gives reference to “*prove the truth of, as by evidence or testimony; confirm; substantiate*”.

In a recruitment process, hiring is based on the information presented while presentation skills and other factors only play a minor role. It is therefore paramount for an organization to ascertain the truthfulness of the information presented in the recruitment process. Every certificate should be treated with the worth as presented but its contents must be verified to be true and valid.

2.2.2 Manual verification process

Most organisation recruiting personnel trust the certificates as they are presented. They normally look at the holograms and the clarity of the other images or writings on the certificate and either qualify or disqualify a certificate. Trust levels are further gained when a candidate presents a certificate that is well known.

The printed certificates could have all the required watermarks and other security features such as holograms or school seals but the candidate acquired it illegally either from the school or from other sources.

A number of employers carry out a background information that includes contacting the referees provided in a resume as a check to authenticate the worthiness of the information provided. Mukami (2014), a human resources manager notes that human resources manager uses background info to check on the provided documents. In a situation where an employee connives with his referee this becomes difficult. Others adds up years also as a check to confirm if their exists any disparities.

2.2.3 Electronic Verification

Electronic verification refers to the use of computer or computer related methods to verify the authenticity of any provided document. This has not been widely used although its take shapes in various sectors of the economy globally or locally.

2.2.3.1 E-Verify

United States E-verify program is an internet based program widely used by over 500,000 users and verifies the employment eligibility based on the statutory form I-9. The E-Verify is the only free, fast,

online service of its kind that verifies employees' data against millions of United states government records and provides results within as little as three to five seconds, according to the official website of united states department of homeland security. An employer fills in a form I-9 and submits it – the system checks the eligibility criteria of the candidate and replies with the eligibility status (US Department of Homeland Security, n.d.).

2.2.3.2 Credit Reference Bureau (A case of Kenya)

Credit reference bureaus complement the central bank of Kenya roles played by banks and other financial institutions in extending financial services within the Kenya's economy (Central Bank of Kenya, n.d.). The lending institutions share credit worthiness of a prospective loan applicant. This allows banks to make decisions on loans issuance at a fast pace.

Banks work independently but share the payment history and in consequence a credit worthiness record is computed. In a similar way schools and colleges (plus other certificate issuance bodies) hold vital education data of all students who have passed in their institutions. Sharing this information with employers then can be the only way to which fake certificates or credentials can be eliminated.

2.3 Integrity and Legitimacy of Academic papers

The global demand for higher education currently exceeds the worlds existing university capacity. Consequently a shortfall has been created, raising concerns on the frustrated number of students who choose to purchase fraudulent credentials from counterfeits or diploma mills (Gollin, 2009). The employer can in turn make reference to academic papers that were fraudulently acquired (counterfeits).

As per the Havoscope (2014) Crime report counterfeits are on the increase despite the heightened control measures to curb them. Though the report is inclusive of all kinds of fake goods, counterfeits on academic papers is further aggravated by the ever growing technology space. The latest version of CorelDraw and Adobe Creative¹ Suite includes tools to trace a scanned document and reproduce it with other details. The process is normally a success as most of the certificates have no formal verification parameters.

¹ Corel Draw and Adobe Creative Suite. These are Desktop publishing tools and pre-printing that allows unlimited edits to graphics and include trace capability tools to trace even the color and minor details of a document. More information on <http://www.coreldraw.com/us/product/graphic-design-software/> and <http://www.adobe.com/>

2.3.1 Attempted Verification Methods

a) Verified University Lists

These are lists that include all recognized institutions of higher learning or recognized by the respective ministries or governing bodies. An example list is published by UNESCO and is available at <http://www.unesco.org/new/en/education/resources/unesco-portal-to-recognized-higher-education-institutions>.

This method only verifies that the university or college one attended is verified or approved but fails to connect the authenticity of the purported owner of the document with the institution.

b) Verification Forms / Letters or Confidential Letters.

These methods attempt to get verification manually from the host institutions in regards to information sought in any application. An application for scholarship mostly uses this method. An application form normally has a section that is supposed to be filled from the school an applicant attended.

Another form of this method is when an applicant is supposed to disclose the referees or an institution where a confidential letter is sought.

This methods is normally manual and involves time and money. It is not the best in the information age.

c) Certified true Copies (CTC'e)

This method is commonly used where duplicate copies are required. An applicant duplicates his document normally via a photocopier and takes them to a certification authority that may include the document issuer or a commissioner of Oaths or a magistrate.

This method is still not the best as the law bindings only confirm - the copy is a copy of the original. If the original that was brought was not authentic the CTC will still hold. This then becomes a method with no 100% accuracy.

d) Security Holograms and Institution Seals

This is the most common method used in the paper documents. A hologram represents a security kind of a seal in the certificate body. Every university has its own seal mostly held under a key and lock. Its imprints are embodied in the certificate as a trust that the document is authentic.

Despite its widespread use it has a disadvantage in that the seals can be remade in the black market and its effective use is based on prior knowledge on how the imprint looks like.

2.3.2 Technology and Verification Illusion

2.3.2.1 The Illusion

Technology is poised to be a solution of a number of social or business problems, but can it be useful in document verification? Over the list discussed above, an additional approach to academic verification is possible in which the qualifications verification will be verified automatically via the same information security tools that are used in financial transactions and that permit a sharing logic over the internet.

The presence of a self and or automated verification process will wipe all academic qualification counterfeits. A lesson can be learnt from the money printing process though the problem is more than in money industry. Money is normally printed by a single institution and every country has its own standards. The issue with academic paper is that these are printed by different schools with new ones coming up every day to join a field with no certificates standards.

Technology avails the public key infrastructure and digital signatures as a preliminary solution to the certificate issue. This will however not work well as these will apply only to e-documents used, something not common with our institutions of higher learning. Our institutions provide hard copies of academic qualifications rendering technology impotent in the digital signatures sector, despite its widespread use in the e-commerce sector.

2.3.2.2 Web Services

The W3C definition states “a web service is a software system identified by a URI, whose public interfaces and bindings are defined and described using XML. Its definition can be discovered by other software systems. These systems interact in a manner described by its definition, (Zimmermann, Tomlinson, & Peuser, 2003).

Web services provide an integration aspect between two or more systems allowing them to share data despite their different structural composition. Unlike digital signatures that rely on electronic documents, the e-recruitment system have components that require data entry or captured from certificates submitted. This information can then be used to verify authenticity of the documents provided the host institutions share the data and all work in a tier architecture.

2.4 Conceptual Framework

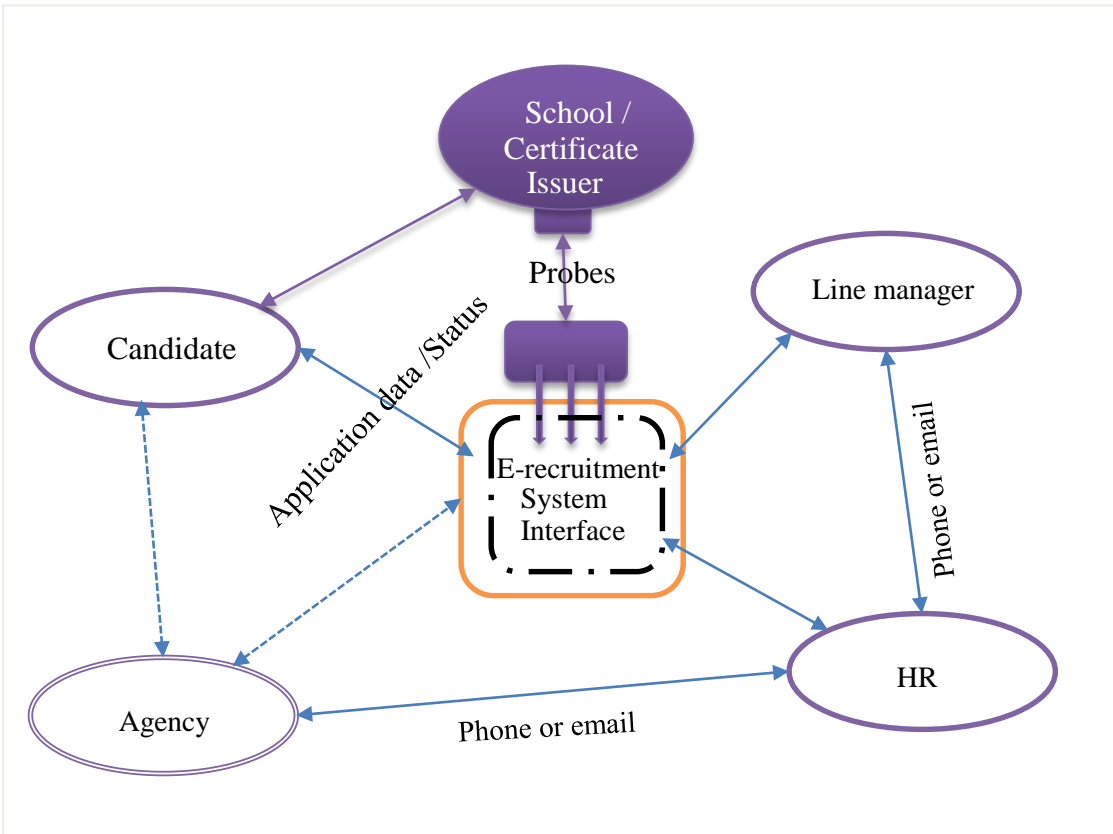


Figure 3 Perceived Conceptual framework

An E-recruitment system that does not have a verification system includes only the candidate and the recruiting panel, sometimes it includes the agents too. The HR team posts a job that is publicly viewed by a candidate in consultation with the line manager or expert in the field. The candidate then applies through the e-recruitment system or through his agent and the human resource team begins the process of selecting the most suited candidate based on the qualifications submitted.

This system lacks a verification system that bridges between the student and the employer who is in this diagram represented by the HR (Human Resources) team. An introduction of a verification system filters and connects to the school via a web service with probes to verify the validity of the data submitted by an applicant. The service can be integrated to the e-recruitment or used separately for the purposes of bulk verifications.

3.0 Research Methodology

3.1 Research Design

The research study was more of an explorative type though included a descriptive phase. The need to ‘explore and explain while providing additional information about’ (Virginia Tech), electronic verification necessitated the need for the inclusion of a descriptive phase in the research. The gaps from the descriptive research laid out the foundations for the explorative research. The theoretical idea was on the hypotheses that technology can be a solution to verification of academic papers.

The main purpose then become to find and explore how technology can be used to verify academic testimonials and whether the method will raise any issues such as of privacy or/add value to existing systems.

3.2 Data Source and Target Population

Gall and Borg (1989) defines target population as a set of all members of the real set of people, events or objects to which a research wishes to generalize the results of the study. The research targeted recruiters and prospective job applicants whose certificates or academic papers will be put into question. This provided an insight into the process they (recruiters) use in recruitment and methods used to qualify and disqualify an academic testimonial presented.

Also targeted were the schools that offer academic papers on completion of their studies. This was presented from a student is perspective angle. The students were examined to answer to whether the institution they are enrolled, did examine their academic papers before they were admitted.

In an entirety, a set of business owners or recruiters and employees were sampled to provide an insight on the methods used to recruit and how academic testimonials were verified upon presentation.

An accidental or convenience sampling method was used. This a technique that uses the sample at hand until it reaches a designated size, (Powell 1997).

The population of currently employed and prospective job seekers plus recruiters is fairly large and is otherwise ‘unknown’ for the purposes of the research. A representative population of 200 was considered to represent the unknown.

Other parameters considered was a confidence level of 95% and a confidence interval (CI or margin of error that assured a variant of plus or a minus, that the sample will pick the same result with the survey administered to them) of 5.

The sample of respondents was determined using the formula adopted from (Mugenda, O. M. & Mugenda, A. G., 1999) and also cited in (Njoroge, 2002). This is a Sample Size to Estimate a Population Proportion,

$$n = \frac{z^2 \times P(1 - P)}{e^2}$$

Where

Z = value from standard normal distribution corresponding to desired confidence level (Z=1.96 for 95% CI)

P is expected true proportion (in this case equals 0.5)

e is desired precision (half desired CI width also referred to as the Margin of ERROR equals confidence level /100 i.e. 5/100).

n is then sample size.

$$n = \frac{1.96^2 \times 0.5(1 - 0.5)}{0.05^2}$$

$$= 384.16$$

= **↑385 (Since these are humans under survey)**

(Mugenda, O. M. & Mugenda, A. G., 1999), recommend the formula:

$$nf = \frac{n}{1 + \frac{n}{N}}$$

to be used to calculate samples size.

Where

nf= desired sample size when the population is less than 10,000,

n= desired sample when the population is more than 10,000,

n= estimate of the population size (Which in this research was set as 200).

$$nf = \frac{384}{1 + \frac{384}{200}}$$

Sample size chosen (nf)=131.506

$$= \uparrow 132$$

3.3 Data Collection and Analysis

To get a comprehensive view of the situation, both printed and on-line questionnaires were used. Online Questionnaires were created in Google forms to take care of the ability to collect data at first hand and preserve data anonymity and at the same time enforce required fields as compulsory. These were chosen over other online tools since they are easy to access and free for all with no restrictions whatsoever. The forms also allowed custom scripts to handle varying changes and requirements in the survey. The data is also presented and stored in a spreadsheet for further analysis.

Printed questionnaires were later filled in the online questionnaire so as to aggregate the data and utilize the capabilities of Google forms in data analysis.

Other useful tools in data analysis were the powerful pivot tables and charts available in Microsoft Excel 2013. These drew varying conclusions from a number of fields.

3.4 Limitations in Research methodology

Though Google forms formed the precision instrument for research data collection and basic analysis, they did however go without issues. The Major issues was on the fact that when you preserve anonymity in this – a respondent may fill the form twice. This can be corrected by setting the form to be filled once by a user. This requires some kind of identification that will again breach the anonymity fact. Email identification could have played a role, but will still allow duplicates since a single user could be having more than one email. This was overruled, as control cannot be achieved whatsoever.

Another issue came when filling in text or text area inputs. Several fields and phrases that meant the same were used and without understanding the context wrong conclusion could have been drawn. This was more on areas where a questionnaire asked ‘what the respondent would like not shared by the institution. Depending on the institution some could refer to retakes as resits or otherwise while this meant areas of weaknesses. This had to be coded comparatively to mean the same despite the different dictionary wordings.

Another noted limitation was where respondents avoided questions that were not compulsory so as to complete and close out. This data was avoided unless where the whole section was filled in.

3.5 Prototype Development and Testing

To iteratively improve the accessibility and easiness of use two approaches were used in testing the prototype. The rapid iterative testing and evaluation (RITE) method was used in the development stage. This is a method that involved users at all stages of development and any issues raised were quickly added onto the design. An accidental sampling method was used in identifying the respondents. This helped the prototype to change from several pages to a single page for easy and fast access and well controlled by user actions.

Issues raised in the RITE process included:

1. The need to eliminate search by student identification number and instead use a serial number attached to the certificate which is not known to fellow students. This helped to beat the anticipated issue of the system assuming the functions of result checking.
2. Inclusion of user help to limit the number of questions users asked along the way of verifying a given certificate. This was implemented via tooltips on ‘mouse hover’ actions. The Pop-up

links in the prototype answered several questions of which would not have been answered where the prototype lacked such modern help.

3. Adoption of AJAX search mechanism to solve privacy violations that may arise from data caching when a user tries to verify a certificate on a public computer. This also helped to reduce the number of pages a user needed to visit to verify a certificate to one from three.
4. Inclusion of the country in the search form to allow the technique assume a global perspective.

After the RITE approach came the method to subject the users to a real accessibility and acceptance testing. A focus group was interviewed via a questionnaire (see appendices) to inform on the navigation capabilities, the intended purpose, ease of design and implementation, choice of platform and even the capability to fight and curb academic forgeries. The prototype was modified at this stage to watch and record on the time taken for any user to verify a given certificate. The time was measured via a time cookie from the time the user selected the country, all the way to the time the response was received.

Considering the prototype is a web application and web interfaces usability follows a normal distribution curve, a test sample size of 100 was considered for accessibility determination while a test sample size of 20 was chosen for analysis (NIELSEN, 2006). Due to technology enthusiasm few opted to test the prototype and not fill in the questionnaire. This choice of 20 from 100 typically offered a tight confidence level for the four quartiles of a normal distribution in representation. An infrastructure bias sampling technique was used. The influence of internet accessibility and availability informed the choice of the technique.

The prototype was also fed with dummy data for verification purposes. This data was also shared with the test respondents for the purposes of a perfect match verification.

4.0 Results and Discussions

4.1 Questionnaire Overview and Response Rate

There was over 80% completion of the questionnaire posted online with a slightly lower completion rate of printed questionnaires. A total of 132 (As defined in sample size calculations) respondents will be considered for data analysis. Incorrectly or incomplete filled in questionnaire was discarded.

The questionnaire had 4 sections as below.

Section 1: Worked around to collect data on the respondents past experience during recruitment and the type of organization he/she works for.

Section 2: Measured the respondent last enrolment to an institution of higher learning, the form collected the type of organization and how his or her academic papers were treated.

Section 3: Was a self-account on how the respondent felt on the general world of fake academic papers and whether he/she had an attempt in forging one.

Section 4: Was a general feedback review that checked on what a respondent would like not shared or shared with an employer if an employer digs into his or her past grades or worthiness of the papers presented.

4.2 Reliability & validity of the Data Collected

To ensure the data was in-tandem with the objectives of the study some reliability and validity tests were employed and considered. These helped to ensure that necessary measures were put into place to provide accurate and precise results from the study. These helped to operationalize the objectives into all phases of data collection.

4.2.1 Reliability considerations

Reliability is defined as ‘the degree to which an assessment tool produces stable and consistent resources’, (Phelan & Wren, 2005-06). This was a major consideration in the questionnaire development. This dictated to use the questionnaire to check all aspects in one assessment and helped to draw conclusions that spanned from school to places of work.

The assessment was mainly to find out the technology solutions, if any, that have been implemented to curb academic papers forgery if any. To make sure the survey was more on IT Savvy respondents, and thus deliver results with an IT edge an online questionnaire was considered on a larger extent.

4.2.2 Validity Considerations

Phelan & Wren (2005-06), defines validity as a ‘how well a test measures what it is purported to measure. The subject under measure in the study is how fraudulently acquired academic papers score and whether there is any use of technology as a method to fight the crime if any.

The results could have resulted into wrong analysis if the respondent is last job minimum requirements was experience level and not academic level. To provide an accurate percentage measure, a question was introduced in the questionnaire – it is the question of what was required in the last job interview or application.

4.3 Findings

4.3.1 Respondents nature of work and methods of hire

The largest percentage at 38% of 132 respondents were from the education sector. Others are represented by smaller proportions with business or profit making following closely. The questionnaire was designed to list the nature of organizations and in turn draw the comparison between these and methods used to verify academic papers.



Figure 4 Respondents Nature of Work

The preferred method of hiring is by both advertising and hiring and sometimes outsourcing for areas may be difficult or requires special skills during hiring. The academic sector rarely outsources but prefers to recruit exclusively. This is in contrast to Non-Governmental Organizations that have equal measures on the same.



Figure 5 Preferred Methods of Hiring

A closer look at the data comparatively revealed the preferences for each organization type. This is represented below.

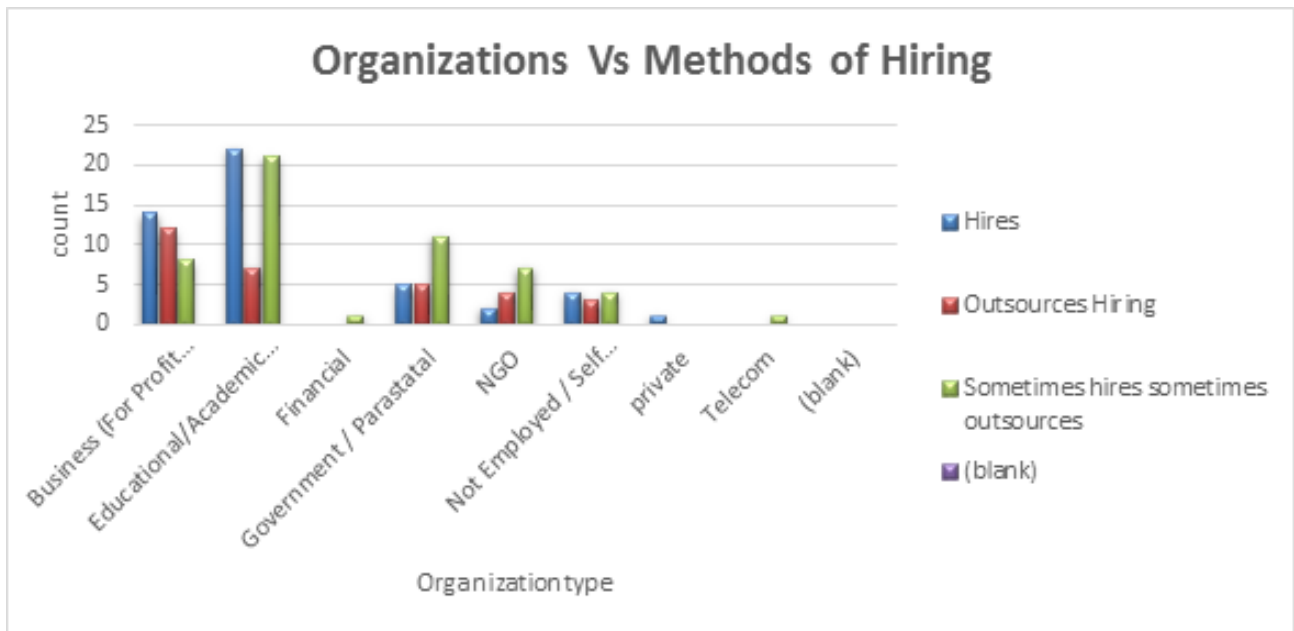


Figure 6 Organization vs. Methods of Hiring

4.3.2 Organization’s Vs. Academic papers Verification methods

One in every 3 academic papers is properly verified. The big question comes in the method used. 60% of all respondents judge a certificate by no concrete facts. This makes conclusions on validity based on how the certificate looks but do not attempt to verify it either by checking with the document issuer. This then raises a warning – despite being trusted as OK and valid the method may not withstand proof of test, thereby creating an element of doubt. Very few work to confirm that the institution exists and whether its academic papers are recognized.

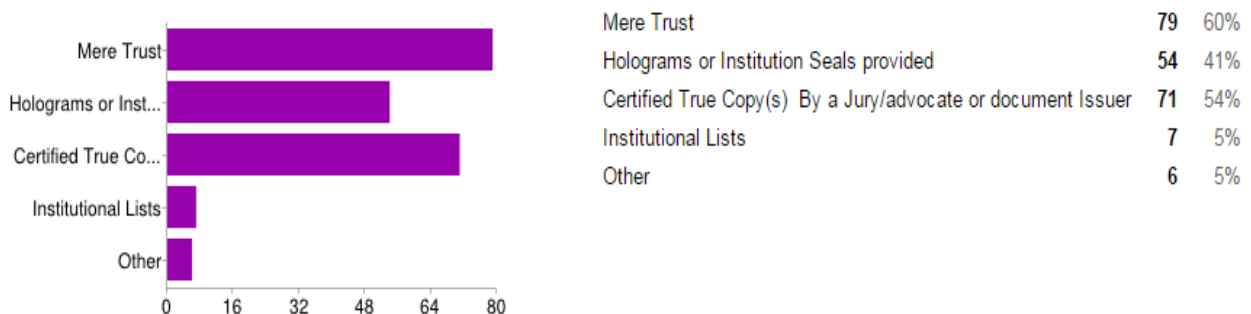


Figure 7 Methods of verification – General employees view

The combination of mere trust holograms or institutional seals available in certificates plus the certified true copy methods formed the top used methods. The questionnaire though having a field to specify any other method used, no any technology based method was listed. Other methods included certification by authorities in various segments.

In all sectors, employees feel that, before they were hired, the certificates were properly scrutinised. However though a worrying figure is more than half believe they were not and this could be as a result they doubt what they presented during recruitment. Considering the fact that these people are already on their jobs and these are successful cases, the worst may be found on trying to verify their papers.

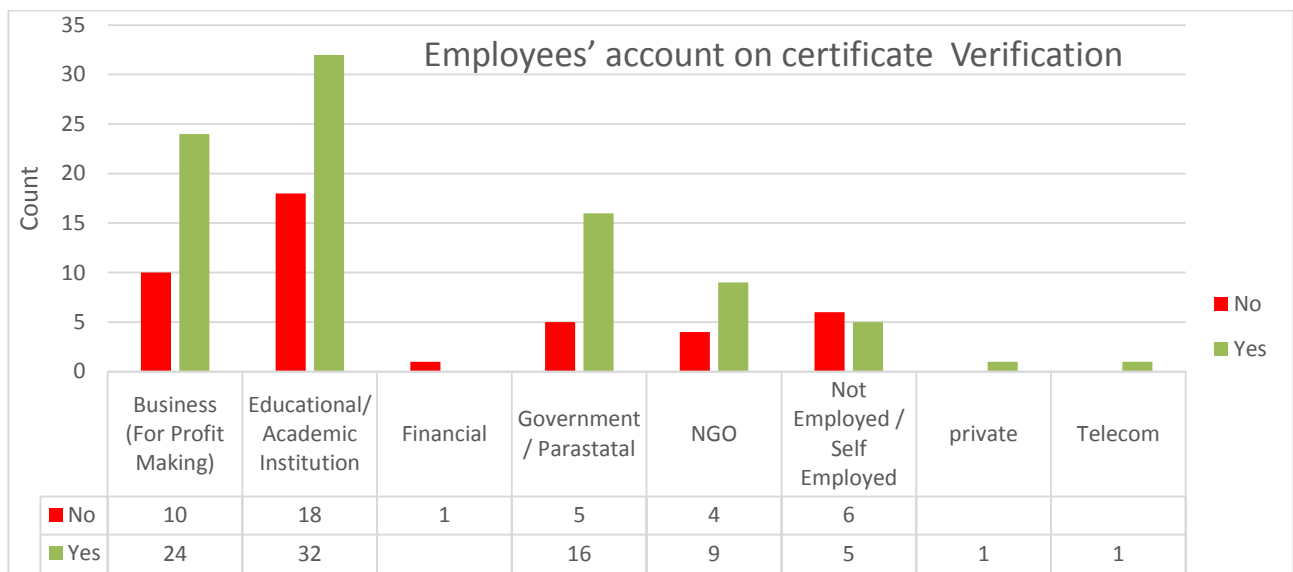


Figure 8 Employees' account on certificate verification

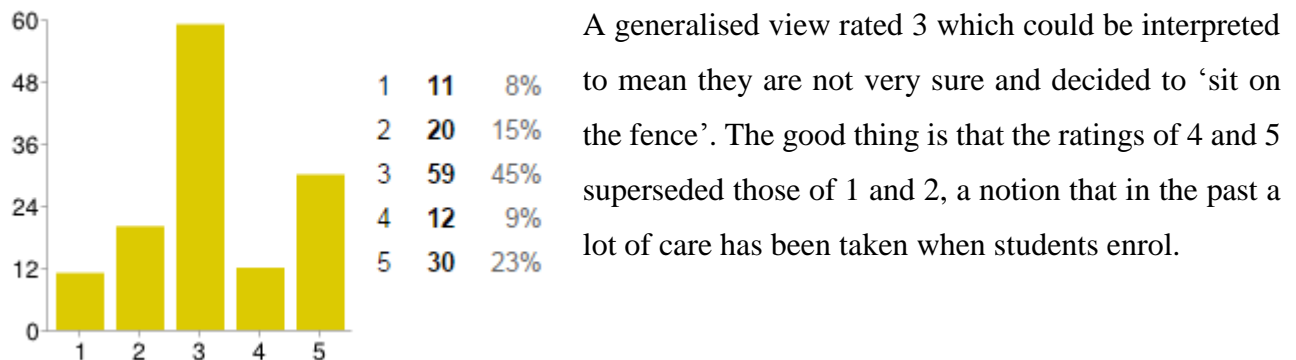
4.3.3 Verification in Past academic Enrolment

Section 2 of the questionnaire dealt with past academic experience. Although there were several minimum qualifications sought, only those who's academic past grade is the choice will be considered. This helps to generate a percentage of true representation. This forms 84% of all responses in this section.



Figure 9 Minimum Qualifications sought

Unlike in section one where respondents were presented with a yes or no answer on whether the certificates were properly checked, this section brought in a range in a scale of 1 to 5 where one meant little was done, and 5 meant much were done.



A generalised view rated 3 which could be interpreted to mean they are not very sure and decided to 'sit on the fence'. The good thing is that the ratings of 4 and 5 superseded those of 1 and 2, a notion that in the past a lot of care has been taken when students enrol.

Figure 10 Students account on Certificates Verification

Academic institutions seem to trust the method of certified true copies of the original, as the preferred method of certifying documents before enrolment. Like in the previous case no electronic method was mentioned to have been used. The figure below illustrates the situation.

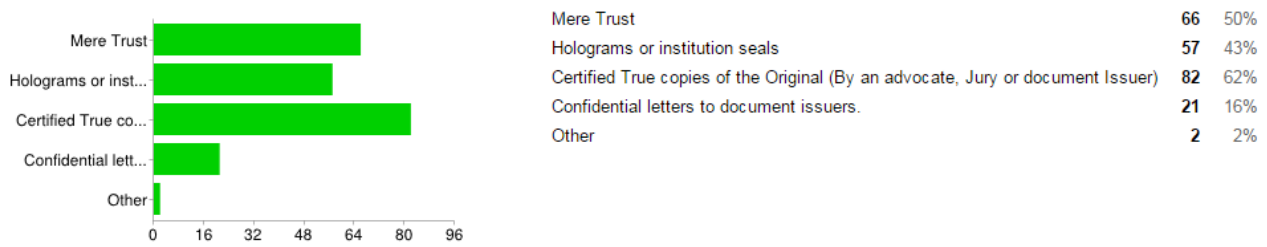


Figure 11 Method used to verify certificates before enrolment.

This section also was geared towards identifying the common methods of application. The online methods of application have taken shape and are in widespread use. These occupy over 50% with the option of online with testimonials attachment being in use. This justifies the need to have an electronic verification capability as an add-on to the existing online application methods.

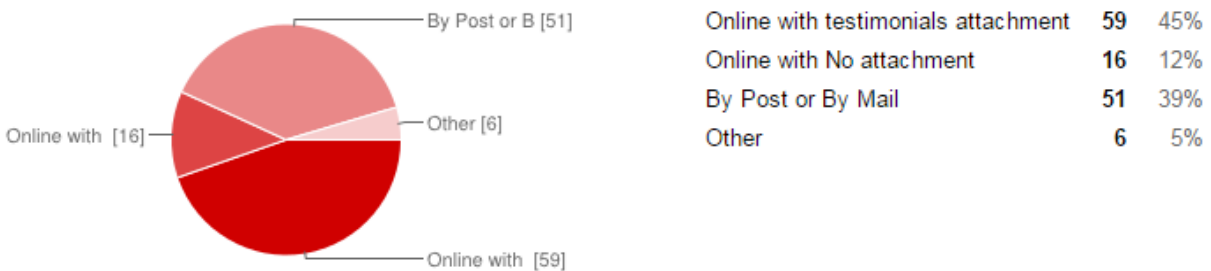


Figure 12 Methods of Application

4.3.4 Availability of Fake academic papers

Section 3 was on a self-account whereby we sought to get the respondents knowledge or even one's participation in forgeries. Five out of ten respondents claimed to have not come across a fake certificate. With the rest five having admitted to have come across either once or several times.

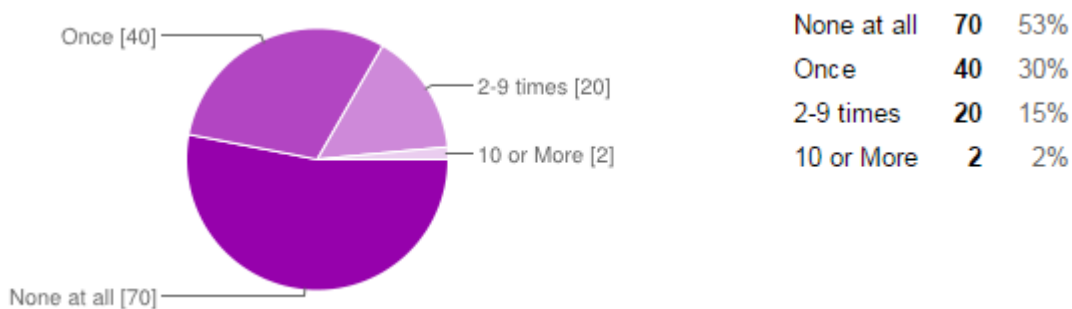


Figure 13 Chart on times encountered a fake certificate

Similar margins also indicate they know either someone or several people hired on fake papers. 35% claim to know one and a daring 16% know more than one. The comparison shows that fake testimonials are competing in equal measures with valid certificates.

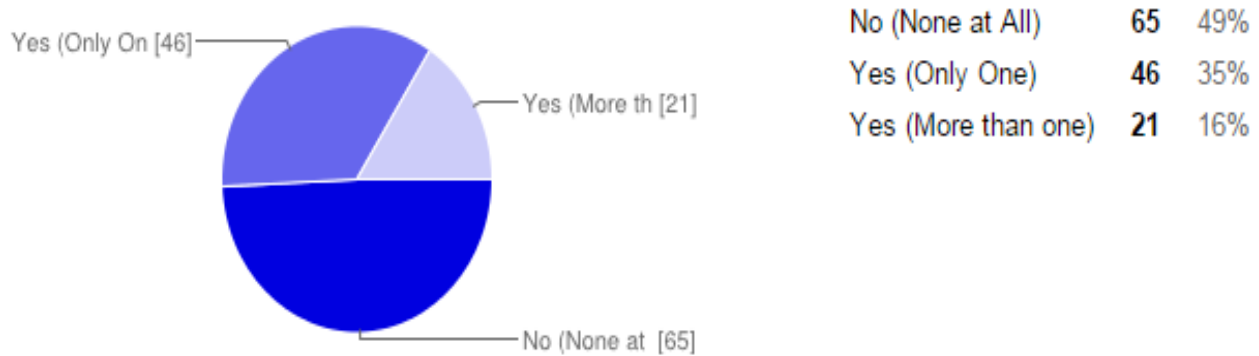


Figure 14 Chart - know more than one person hired with fake documents

The worrying figure is that one (27%) in every three people have tried to fake or use a fake document. The reason given include test cases as well as reasons related to having not collected their originals from the school for various reasons. Some claim to live by the proceeds of forging academic papers.

47% of all respondents claimed to know one or more tools that can generate a fake certificate. This represents a worrying trend as ICT – the enabler method for forgeries is penetrating deep. The figure is not growing smaller in the near future unless curbed.

4.3.5 ICT Use in Documents Verification

The use of ICT in documents verification was very little as per the findings of the survey. All the three sections that had an assessment on the methods used to verify academic papers reported no any method that is fully technology dependent.

Holograms on academic papers was however cited to be related to use of technology however its application was not a real time solution and still did not stand a proof that it was forgery proof.

Lack of ICT methods then raises a warning why this sector has been left behind and calls for a solution that is in tandem with the information age.

4.3.6 Privacy Concerns

The last section of the questionnaire was geared in identifying the privacy concerns that would infringe on their document owner rights. Almost all (over 99%) are positive about academic grades being shared – most were quick to note they have no issues with academic ability being shared.

Almost all respondents felt, it was not good to share their campus life, moral values and general conduct while undertaking their education. This includes everything considered personal in the private school life.

A few cases also noted that respondents did not feel was OK for presentation was the type of student, this is normally the type of enrolment where a student is enrolled as self-sponsored or government sponsored.

Respondents are comfortable when the school or the institution they passed through shares validity information any time to the prospective employers or general public for purposes of consideration though extra care should be taken when this is done.

4.4 Co-Related Findings

Though the main objective was to find grounds for an electronic verification method in curbing academic papers forgeries, some other co-related findings include.

- i. Verification of academic papers is a key element to every selection exercise. The Knowledge of this is widely acceptable and is normally done via methods some that have been fruitful in the past but are increasingly loosing track and are vulnerable with the advancements of technology. These methods include certified true copies by an advocate or a jury or a certification authority. Other methods used to ascertain validity include holograms attached to the paper documents issued or even institutional lists.
- ii. Technology use in verification of documents is less often used by all the respondents surveyed. This is in contrast with the modern world where automation is the order of the day. The need for an electronic verification method is thus not ill advised.
- iii. Most organisations do hire or contract other entities to hire on behalf. The process of verification in any these methods lacks the grip to fully verify and ascertain the genuine of the papers presented by the candidates.
- iv. Fake certificates or academic papers score well and are in widespread use and thus any attempt to curb the vice is welcome in the eyes of the document issuers and genuine certificate holders.
- v. Respondents feel it is prudent for the host institution to share information to the prospective employers and others in the public but not to all. It is only those who hold the certificates that can verify them. A method to keep off academic grades to others – general public- must be put in place

4.5 Discussion

From the results it is evident that electronic methods in recruitment have taken form and are being used alongside other traditional methods. The striking balance between the two is that the two must involve some certificates or academics papers at a stage in the recruitment process.

Most Job adverts defines a minimum level that applicants must meet for consideration. This creates an unchallenged situation that the validity of the papers presented must also be put into a validity test.

While a larger percentage have admitted to have come across a fake paper, the vice must be stopped. There are methods already available but they (the methods) are not technology 'fully' dependent and in real time. The solution then comes to employ a simple fast and efficient method that is traceable and can validate any academic paper at any time with even provisions to invalidate certificates earlier validated. This will serve in situations where the certifying authority can cancel even genuine papers fraudulently acquired.

The need for a tool to verify results electronically will be a major advancement and utilisation of technology in this important aspect of any business or an organization. The tool will then avail an efficient method or process to verify results that is readily available and should utilize a common known resource on the internet and web.

5.0 Prototype Development

5.1 Prototype Overview

This chapter describes the prototype design and the operation procedures. The chapter includes the system function and non-functional descriptions, use cases and contextual diagrams. The chapter also describes the data flow and also showcases some of the main screenshots to illustrate operation and proposed data formats. The choice for the method as well as other process is hugely informed by the survey.

In the prototype design some aspects that run across several servers and require huge resources will be only represented here in writing and will not exist in the prototype. The prototype will showcase the front-end operations that can be set with minimal resources.

The prototype being an addition to existing systems will not cover the entire system but only the insert into an assumed existing system.

Note: An insert here is used to mean it will be added as an application over existing systems. An example could be as a subdomain into an existing website.

The discussions in this chapter refers to the insert operations and components only. The system prototype involves two variations that will fit in their own circumstances, given the right inputs and consideration.

For the purposes of reference, the prototype is referred to as E-VerifyIT.

5.2 Contextual representation

5.2.1 Implementation Variation one (Managed by a central authority)

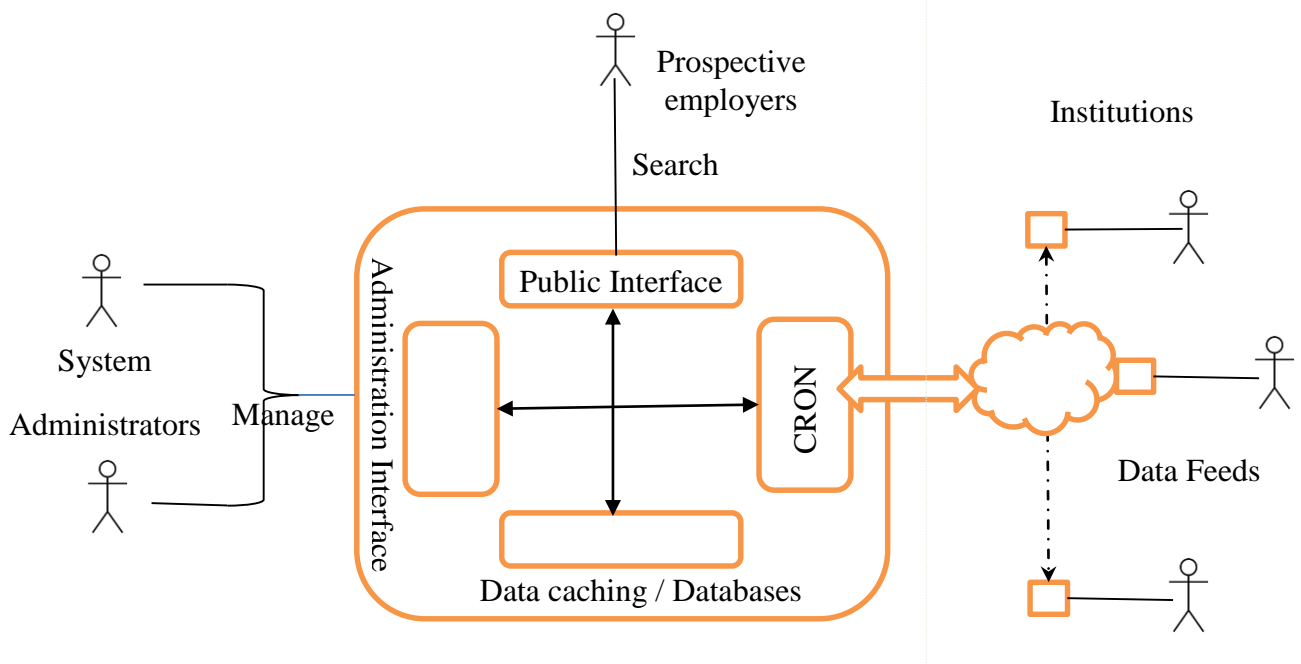


Figure 15 Contextual Diagram variation one

In variation one the system will run as a middle agent and will hold data or read data from host institutions and display it to the prospective employer once searched. The host institutions will share data through cloud and via published xml interfaces. The system will periodically via a CRON scheduler fetch xml data from host institution and cache the same in the system databases or file. This method is meant to improve response time.

The prospective employer who seeks to verify a certificate will visit the system via a browser front-end and supply required data. The system will in turn query its cache based on the input parameters and return the data to the user on validity. Bulk verification will be supported in the main system but not in the prototype.

5.2.2 Implementation Variation two (Managed by the institution)

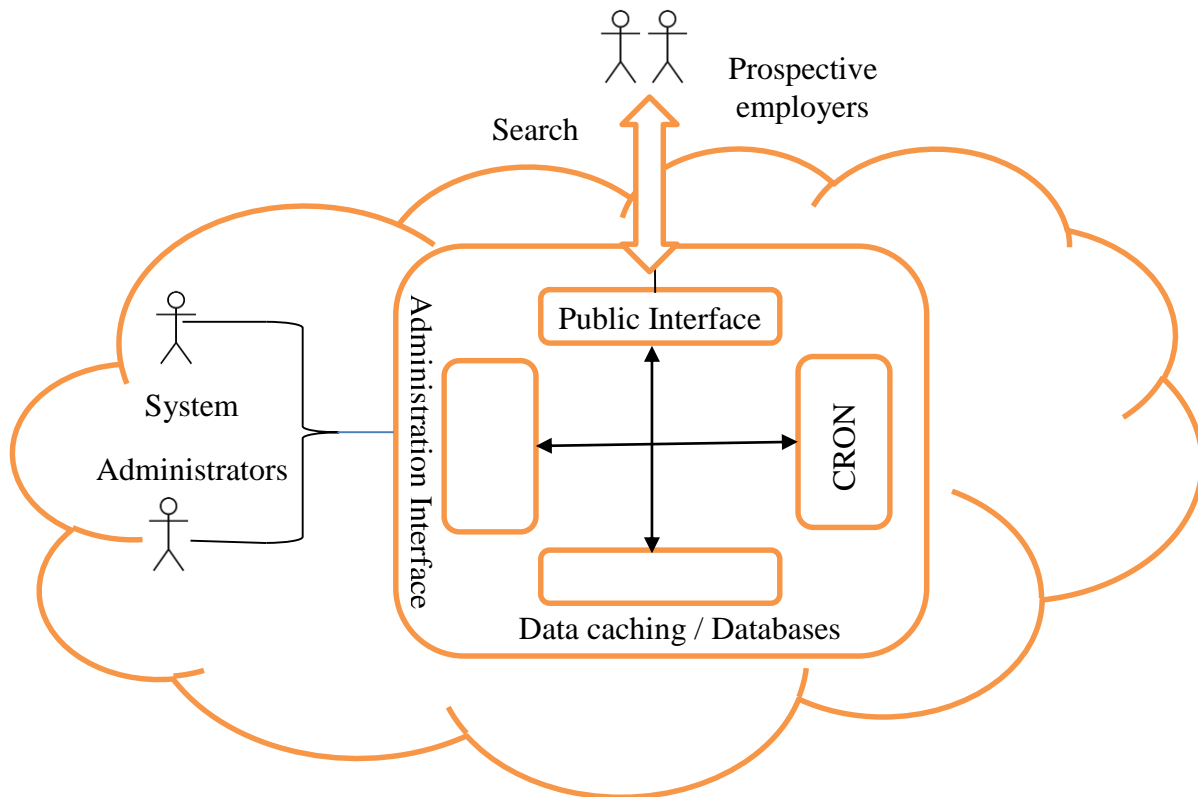


Figure 16 Contextual Diagram Variation two

In this variation the application is hosted by the institution. Most likely it resides in the university cloud or website and can be accessed directly by visiting the institution official website or a subdomain.

Like in above case the host institution avails a link for all certificates verification. The link allows a prospective employer to verify the certificate information by keying in some input data. This variation is important when there is no central authority or the university/institution is not willing to share its data to a central authority.

5.3 System Functional Specifications

Key functional units include the capabilities to

- Search certificate information – the capability will allow a user who holds a certificate or a copy of it to verify the particulars and compare with other documents presented.
- Collect statistics on the cases of genuine and not genuine certificates.

Other technical and functional specifications

- XML parser will allow data to be read from xml format and displayed in a readable format either during cache process or data fetch from the host institution.
- CRON Scheduler – this will continuously update and check from the host institution any changes and update its databases cache. (This will not be necessary in variation two where the insert resides directly in the institution. This can be reconstructed to provide an in-house cron to check data integrity)

5.4 System Non-functional Requirements

To enable first and seamlessly search capability the system will be required to meet some non-functional requirements.

These include:

- Reliability – this is the mean time between failures. The system will cache data during its every fetch and will run even if the host institutions xml interface is down.
- Efficiency – this is the resource consumption over load. The host web interface will meet modern page speeds, insights and parameters for faster access with minimum page loads.
- Audit control – for the purposes of accounting of system functioning the system will maintain an audit trail on whatever was searched and when any given data was fetched.
- Fault tolerance – the system will be designed to withstand any faults either from the framework and/or from the hosting limitations.
- Inter-operability – Will use and utilize xml interfaces to share data from host institutions. Any XML that will meet the defined xml structures will be fetched and cached for purpose of search.
- Accuracy and precision – considering the fact that certificates are document fetched over time with a lot of effort, the data returned will need to be accurate and represent the true position. Poor representation may cost the job seeker the opportunity.

5.5 Data Flow

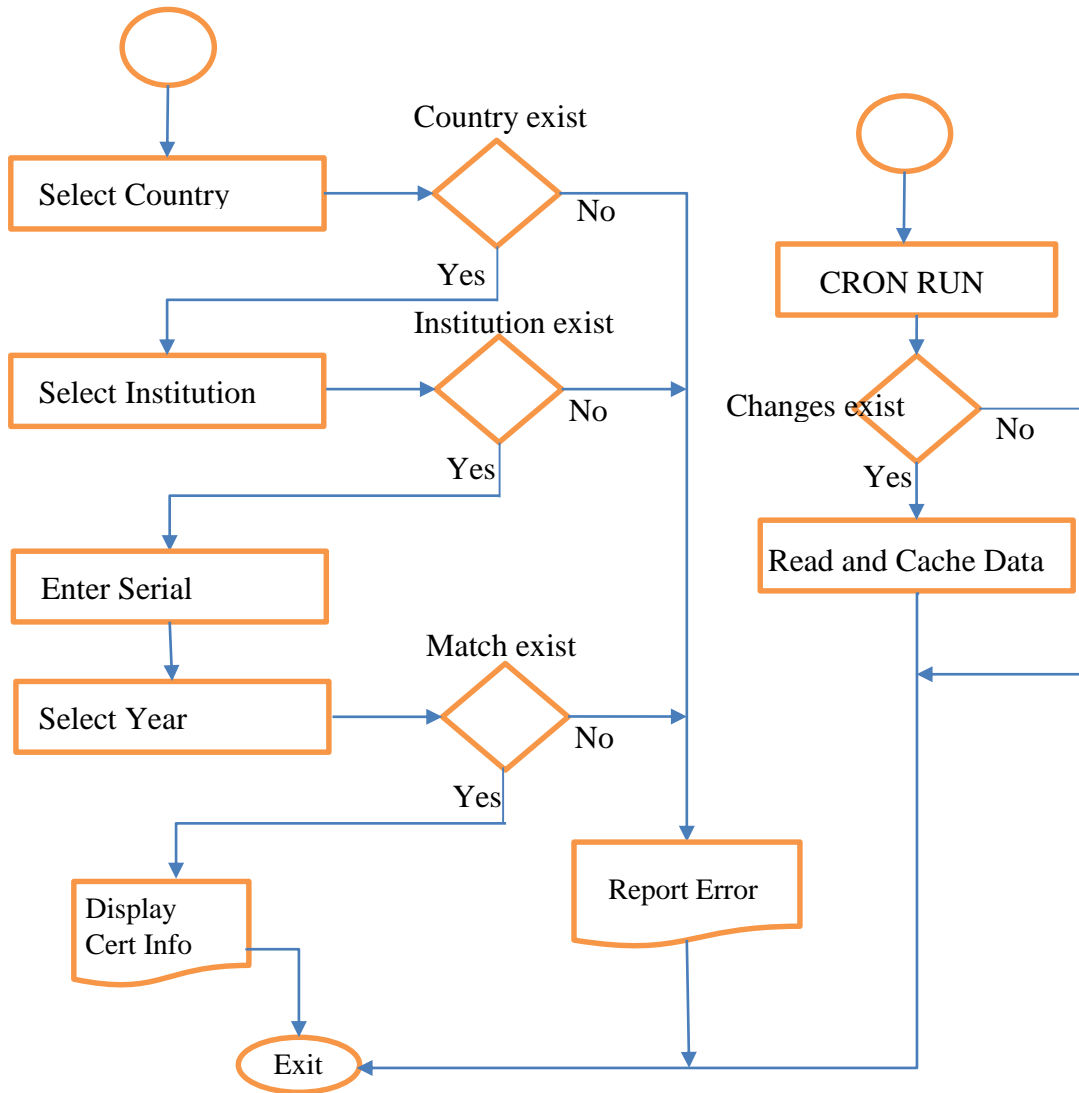


Figure 17 Data Flow chart illustrating data flow on cron and during search

5.6 XML Definitions structure

```
<?xml version="1.0" encoding="UTF-8"?>
<studList date="1926-03-10 07:32:12" institution="jkuat" lot="2014" modTime="2009-09-25 03:11:58">
  <gradList>
    <graduate type="Self-Sponsored">
      <name>Stout, Krish</name>
      <regNo>B1/Z8S8W5/B2</regNo>
      <enrollDate>1965-11-10</enrollDate>
      <award>Diploma</award>
      <faculty>Agriculture</faculty>
      <college>Arts</college>
      <department>Tempus.</department>
      <course>Condimentum auctor.</course>
      <certSerial>QUH-857308-03</certSerial>
      <gradDate>2007-04-27</gradDate>
      <finalScore>Fail</finalScore>
      <status>Ut.</status>
      <notes>Lobortis imperdiet, molestie nascetur sapien!</notes>
    </graduate>
  </gradList>
</studList>
```

Figure 18 XML Definitions by example

For any data to be fetched from the host institution, the host institution must publish its data in agreement with the structure above. Any time the xml is modified it is expected that the modTime attribute must be changed to the date of update. This applies only to variation one where we have the system being integrated by a central authority.

5.7 Prototype Architecture

The prototype runs on a client – server architecture, PHP will interface between xml and data caches stored into the database. The connection between the user and the server will be driven by user events but the interface between PHP and xml interfaces on the institution data will be via timed cron jobs.

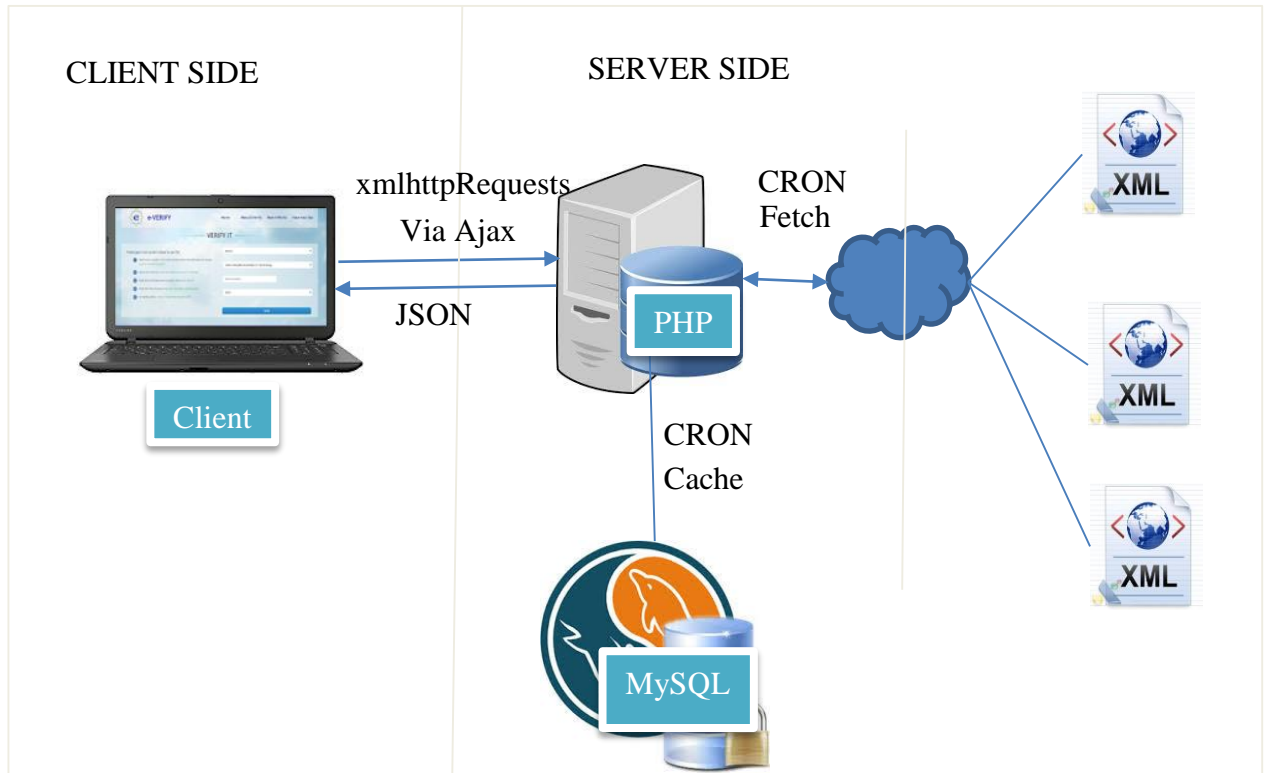


Figure 19 Prototype Architecture

This is an architecture of a system that is centrally managed. A system managed by the host institution will require Just a PHP /Database interface for data fetch. The XML may represent the graduation lot data.

5.8 Implementation Technologies

The prototype is implemented on the following technologies and presented to the user via a browser front-end.

PHP - this is a server side scripting language that is light weight and has the capabilities to communicate with databases and remote xml either via feeds or remote reads. This is a scripting language for the web and will run smooth across with no further extension support on the client side. For the purpose of extensibility, PHP is free and has a wide range of support with various frameworks ready to implement any extensive or simple function.

MySQL / MySQLi – this is an open source relational database management system that is easy, fast and high performing. Its light structure allows it to make the best to use for the web.

AJAX - Asynchronous JavaScript and XML. This is a group of interrelated web development techniques used on the client side to fetch data asynchronous over web. An application can fetch data via xmlhttpRequests. The use of it prevents several page loads and thus a single web page can be used to run several complicated queries. The data from this is returned in JSON (JavaScript Object Notation) format. The combination of this allows data to be fetched asynchronous saving the user the load time and effort.

5.9 Input data

To be able to draw an input, several input data is required. The country information is required. This enables an efficient filter of institutions. Also required is the year of graduation and the certificate serial number. The form will generate an error whenever any of these is not supplied.

The prototype input screenshot is shown in the figure below.

VERIFY IT

Prototype Instructions (how to verify)

- 1 Select your Country. This is the country where the certificate was issued. *Cannot Find the Country?*
- 2 Select the institution. *But the institution/School is Missing?*
- 3 Enter the Certificate serial Number. *Where do I find it?*
- 4 Enter the Year of award. *How do I Know the required year?*
- 4 Hit Verify button. *How do I Know the required year?*

Please Select your Country

Select An Institution

Serial Number

Year

Verify

Figure 20 Data Input Screenshot

5.10 Output Data

Certificate Details	
Name	Slout, Krish
Reg. Num	B1/Z8S8W5/B2
Enroll Date	1965-11-10
Enroll Type	Self-Sponsored
Faculty	Agriculture
College	Arts
Department	Tempus.
Award	Diploma
Course	Condimentum auctor.
Graduation Date	2007-04-27
Final Score	Fail
Status	Ut.

i NOTES: Lobortis imperdiet, molestie nascetur sapien!

Whenever a search is conducted two results are expected, one is when match is found in the database and the other one is when no match is found.

Whenever there is a match, the certificate info is returned as shown.

Whenever there is no match, an error is echoed – this signifies that the certificate does not exist or you fed the system with the wrong input data.

Figure 21 Output Data Screenshot

5.11 System Privacy Considerations

In the data collection phase, respondents had no objection in sharing of their academic performances, however it was clear that the system should not in any way be a result checking platform. Not everybody should be able to verify the certificate, if he or she does not have the certificate with him/her.

From the requirement above, the system prototype was designed to require four sets of input data. These include

- The Country (Where the institution resides)
- The Institution
- Year of Award
- The Certificate Serial Number

In the case of variation 2, the country and the institution will be pre-fed into the system

The combination of the above and moreover the inclusion of the certificate number makes this a non-result checking system. The Serial number must be entered for you to obtain a search result.

5.12 Prototype Testing and Discussions.

5.12.1 Testing Overview

Prototype testing refers to testing the prototype in its functional and non-functional requirements as well as the process.

The key objectives of testing were to

- Determine how effective the new technique will be before going into live usage.
- Identify the missing elements and the key changes that need to be done before making the system live.
- Reveal the user interactions, especially how users navigate the system.
- Understand and augment the design in making it simple and fully functional.

5.12.2 Test Findings Analysis and actions.

- **Accessibility:**
 - The focus and randomly selected group was selected to test the basic functionalities of the system. 99% of the respondents were able to access the temporary link, and many admitted to have seen such a web application. The choice of web was not a new concept and was the contributory factor into the larger percentage of accessibility.
- **Appearance:**
 - The search page was rated professional and pleasing by over 80% of the respondents with over 90% respondents acknowledging to have come across a similar form though not for verification process. This clearly showed that web is a good choice for such an application.
- **Time taken**
 - From a time cookie set to track the time taken since the use started his search showed a mere normal distribution as per the figure below. The majority of the respondents took between 4 and 7 seconds with very few taking over 10 seconds to search a given certificate.

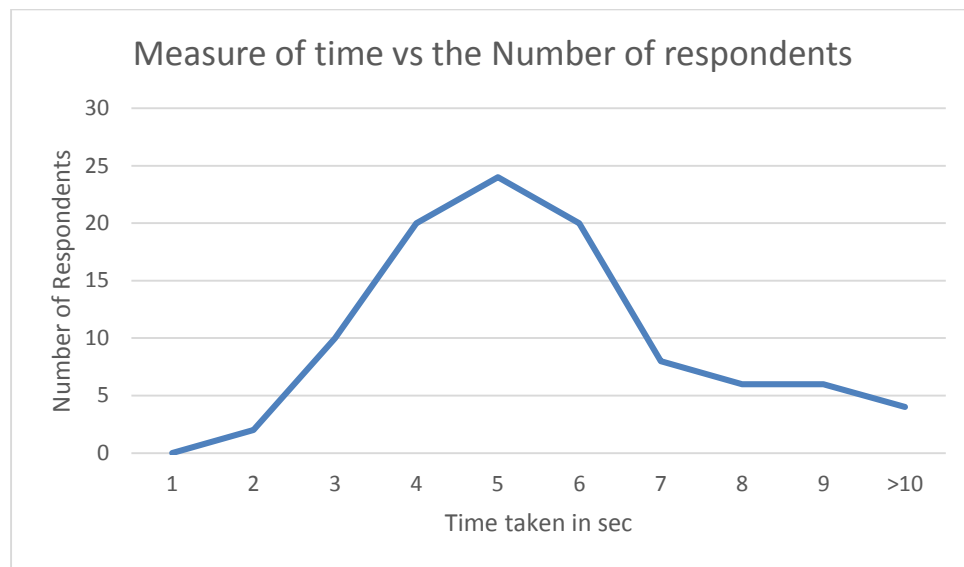


Figure 22 Normal Distribution of Time taken to verify a certificate

- **Missing Elements :**

- The real academic certificates missed the country of the award – yet the prototype offered an input for the country. To remedy this for the old and already issued certificates a standardization of certificates was recommended. All certificates need to include the country of award but for the already issued the country can be found from institutional lists as per the name of the university

- **Objections and Acceptability**

- No respondent objected to have their data shared but 95% objected in sharing the data if they owned the institutions. The percentage opted to have the system reside in their own official school websites and co-managed by their organisations. This was due to lack of a central body with such authority or powers or even credibility. This informed the decision to have variation two of the prototype where the proposed system is an application in their official website

- **Impact**

- In a linear scale of 0 to 5, where zero represents no impact and 5 very high impact, a score of four, showed that the prototype if implemented will have a great impact in solving the problem of fake academic papers.

6.0 Conclusion & Recommendations

6.1 Conclusion

With the advancements in technology and having e-recruitment as the convenient and preferred recruitment method, the next big thing is to sustain the process and continuously add value to it. E-verification will be the ultimate consideration at this time when information uptake and integration into all aspects and sectors of the economy is on the rise. Electronic recruitment procedures cannot withstand the validity test without an electronic verification method in use.

Fake or otherwise not genuine certificates are ‘scoring well in the society’ and they pose a threat to the school award system and must be discouraged and ‘fought’ well especially by use of available technology. The certificate ‘mills’ or otherwise the grades cleaning process will fail with e-verification project implementation. The school award system will have sanity and will earn the respect it deserves in the society.

Summary of Conclusions Addressing the Research Questions

1) Has e-verification taken a stride in our country, in what sectors or phases of recruitment and what are the steps involved?

Electronic verification has not taken shape into the verification of academic papers but have taken shape into other sectors. The Central Bank of Kenya and other lending institutions maintain a credit reference bureau from which the credit worthiness of a prospective customer can be found. The research indicates less than 5% use of ICT in any verification method.

This process of recruiting has been using ICT in call for applications but fails to use the same technology in verification of the applications. This gap then needs to be filled by the adoption of the e-verification technique and fully make the recruitment process fully dependent on ICT.

2) What are the limitations and missing gaps with the use of these e-verification procedures, if any?

E-verification of academic papers has not been in use. However, with the introduction of the proposed technique – the process will be met by challenges of the host institutions refusal to share their graduate’s information to a central body. The prototype at this phase will assume the variation shown in section 5.2.2, that allows host institutions to host and avail a verification link.

Most certificates offered locally do not have the country of award despite holding all other academic information required. This cannot be changed for older certificates but the country of origin country can be found from the document owners.

The uptake of the e-verification technique can also stand as a barrier when only few institutions take up the initiative. This will then allow the vice of academic papers to move away from one institution to the next that will not have subscribed to the service.

3) What are the privacy issues associated with sharing of academic data?

Sharing of academic data for verification does not violate any privacy when the data is published in the manner recommended. Violation of privacy will only arise when the university or the institution publishes data searchable by any person who does not hold the certificate and for other reasons. With privacy not a concern, the grounds for implementing the technique then becomes valid.

4) Are there fake certificates in circulation? What is being done to curb their circulation?

There is an equal number of fake certificates as there are genuine ones in circulation. The vice is growing as the technology adoption continues and there is eminent pressure to put this to a halt.

Manual methods of verification are in use. These include calling up host institutions, certified copies or even confidential letters. These method have been have not been automated and therefore they consume resources and will not fit for urgent recruitment cases. In a typical interview process most interviewers trusted the certificates presented without no any known facts or the security features the certificates hold. These security features can be copied and created via common tools. The effective way to curb the vice is using an electronic verification technique such as one proposed. The technique will avail a quick simple process that will consume very little resources.

The adoption of the technique is on two phases – from the consumer or the implementer’s perspective. All bodies that awards certificates for academic qualification purposes are the best implementers of this system. Centrally Kenya Accountants and Secretaries National Examinations Board (KASNEB), Commission for University Education (CUE) and Kenya National Examination Council (KNEC) among all other institutions of higher learning can team or separately implement the technique to add hope and sanity in the academic award system. The project is instrumental further to all organizations that hire including the Federation of Kenya Employers (FKE) and its members. They will always obtain the right candidates from minimal effort in verification. The Independent Electoral and Boundaries Commission (IEBC), which is mandated by law to vet all candidates for the specific posts, will benefit immensely from use of this technique in vetting of candidates academic suit abilities. This applies well to national commissions (such as Salaries and Review Commission (SRC)).

The e-verification project cannot stand on its own as the system will require some legislation and service level agreements between host institution and the project implementers. This requires support, resources, further training and seamless hosting capability to avail the search capability to all at all times.

The prototype only reveals an academic exposure but there is potential and implementation in other sectors which require other kind of certificates or business registration documents that need validation or verification.

The prototype also calls for some standards for academic certificates. Other methods proposed include attaching self-read QR-Codes or bar codes, which when scanned can verify or return certificates data with little effort.

6.2 Recommendations

In view of the findings and prototype conclusions, the following recommendations are made in a bid to fight the fake academic testimonials in circulation.

The education authorities which includes the Commission for University Education (CUE), The Kenya National Examination Council (KNEC), should standardise the certificates layout, structure and components. The certificate should hold the country of award, the course, the names of the student, year of graduation, unique certificate serial number, the graduation lot, among other information.

Universities and other institutions of higher learning should host separate verification systems for any certificate that was issued by the institutions since inception. This applies well to examination bodies like Kenya Accountants and Secretaries National Examinations Board (KASNEB) and Kenya National Examination Council (KNEC).

A comprehensive awareness program should be undertaken. A collective joint effort on fake certificates should be undertaken to clearly portray the verification procedures using the proposed e-verifyIT System.

Ministerial policies should be enforced to mitigate the uptake of the system owing to legal battles that may arise on individuals who may not like their certificate information from being shared. This will also offer an authoritative source of contact and a baseline guideline for implementation.

Further research can be undertaken on the differences in academic certificates information that can inhibit collective verification of their validity. This should span from middle level colleges to institutions of higher learning. A comparative analysis can also be undertaken on the significance of the adoption of the proposed E-verification system.

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Appendices

E-Verification - A case of Academic Testimonials - Appendix i

I am an MSc Student at the University of Nairobi, School of Computing and Informatics conducting an academic research on the verification methods used to prove the validity of all (academic) papers presented for the purposes of recruitment or other considerations. It is a baseline survey towards developing a solution that will weed out fake certificates in offer. This in Partial fulfilment for the award of an MSc Degree in Distributed Computing Technology.

The information collected will be treated confidentially and only for academic purposes. Your name and organisation need not appear anywhere.

Thanks for your co-operation.

*** Required**

1. What is the Nature of the Organization you work for? * Mark only one oval.

- Government / Parastatal
- NGO
- Business (For Profit Making)
- Educational/Academic Institution
- Not Employed / Self Employed
- Other:

2. Do your organization hire or sometimes outsources the services to another company? *
Mark only one oval.

- Outsources Hiring
- Sometimes hires sometimes outsources
- Hires

3. In your organization or any other, have you ever participated in the recruitment process? *

Mark only one oval.

Yes

No

4 What was your role in 3 above? Check all that apply.

Application Sorting and Shortlisting

Interviewing Applicants

Interviewee

Other:

5. In the tasks in 4 above, were the (or your) academic testimonials or papers properly scrutinised? * Mark only one oval.

Yes

No

6. What methods were used to prove validity and/or 'ingenuity'(the clever means of acquiring something by false pretence)? Check all that apply.

Mere Trust

Holograms or Institution Seals provided

Certified True Copy(s) By a Jury/advocate or document Issuer

Institutional Lists

Other:

SECTION 2: Past Academic Enrolment Experience

7. What was the last academic institution type you were last enrolled? * Mark only one oval.

- Public University
- Private University
- Middle Level College
- Skills Polytechnic
- Other:

8. What was the minimum qualification set? * Mark only one oval.

- An academic past Grade
- Experience Level
- Other:

9. What was the method of Application? * Mark only one oval.

- Online with testimonials attachment
- Online with No attachment
- By Post or By Mail
- Other:

10. Before being enrolled was there an attempt to verify your certificates? * Mark only one oval.

	1	2	3	4	5	
Very little	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Satisfactory

11. What method was used in 10 above * Check all that apply.

- Mere Trust
- Holograms or institution seals
- Certified True copies of the Original (By an advocate, Jury or document Issuer)
- Confidential letters to document issuers.
- Other:

SECTION 3: SELF ACCOUNT

12. In your life have you ever encountered a fake academic certificate? * Mark only one oval.

- None at all
- Once
- 2-9 times
- 10 or More

13. Do you know or Suspect any one hired out of fake academic certificate? * Mark only one oval.

- No (None at All)
- Yes (Only One)
- Yes (More than one)

14 Have you ever forged or even tried to forge a certificate? Mark only one oval.

- Yes
- No

15. If Yes in above, what was the motivation.

.....

.....

.....

.....

.....

16. Do you know anyone or organization or a tool used to forge certificates? * Mark only one oval.

- Yes
- No

17. In a linear scale, where one represents few cases and five represents extreme, how would the availability of fake certificates score? Mark only one oval.

- 1
- 2
- 3
- 4
- 5

Few Extreme

Section 4: Case and Solution Review

18. Supposedly, you went to School X for your undergraduate studies and graduated with a Bachelor’s Degree in Computer science. Do you think if Company Y wants to hire you, there is a sufficient method available that can prove and validate the credentials you avail in an interview? * Mark only one oval.

- Yes
- No

19. What would you like School X to inform Company Y on your academic achievements? *

.....

.....

.....

.....

20. What would you not like AT ALL, School X to inform Company Y on your academic achievements? *

.....

.....

.....

.....

21. Under what situations would you want the schools to share your Academic information to the public or employers? Check all that apply.

- When seeking for a Job
- When seeking a political assignment
- When seeking an enrolment to another school or institution.
- Other:

E- Verification Prototype Evaluation Form - Appendix ii

A while Ago on the Month of Oct-Nov 2014 you filled in a questionnaire on a survey - 'E-Verification - A case of Academic testimonials', The survey assessed the recruitment process with a bias on verification of academic papers. The survey sought to measure the score of fake certificates over genuine ones and whether an ICT method exist to curb the spread of the vice. It is our sincere gratitude that you participated in the survey. We were able to gather overwhelming results from your response enough to build a prototype.

We are calling on you again to evaluate the proposed prototype that will be an add-on to the existing systems. The prototype is available at <http://50.87.153.95/~verifyit/>. Please evaluate a successful Case using Kenya as the Country and any university in the school selection, a certificate serial Number QUH85730803 on the year 2014 or 2013. For other non-successful cases use any other serial number.

This in Partial fulfilment for the award of an Msc Degree in Distributed Computing Technology of the University of Nairobi, School of Computing and Informatics.

The information collected will be treated confidentially and only for academic purposes. Your name and organisation need not appear anywhere.

Thanks for your co-operation.

* Required

1. Were you able to access the link above? * Mark only one oval.

Yes

No

2. What is the first impression of the landing page? * Mark only one oval.

Professional

Skeletal but serves the purpose

Very poor designed

3. Look at the landing page, for some 10 seconds, have you ever seen such other in your life time? * Mark only one oval.

Yes

No

4. If you search for QUH-857308-03 as the certificate Serial Number, What is the name of the Student? * Mark only one oval.

Austin, Arlo

Stout, Krish

Coleman, Irene

Fowler, Kamille

5. Looking at the input text and option boxes in the choices below, what is missing in your last academic certificate? * Check all that apply.

Country

Institution or School

Certificate Serial Number

Year of Award

None

6. Is there any help in the landing page above? Was it helpful? * Mark only one oval.

Yes, Very helpful

Yes, Not helpful

No, not helpful at all

7. Which elements are not working? *

8. If you had a magic wand, what would you change about the prototype? *

9. If you were one of the student of the institutions, would you object to your data being shared in a system similar to this? * Mark only one oval.

- Yes
- No

10. If you owned one of the institutions listed, would you have issues on sharing the data? if yes why and what should be done to make you not object in future? *

11. Does the prototype present a solution to document forgeries? In a scale of 0 to 5, 0 represents no impact, where 1 to 5 represents an upward scaling impact. Please rate the impact. * Mark only one oval.

	0	1	2	3	4	5	
No Impact at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very High Impact