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Design and Implementation of Web- Based Certificate Verification System (Case Study Adamawa State University Mubi)

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Abstract— A Certificate verification system is a system designed to digitize the process of adding certificates and verifying the certificate records considering the problems faced by doing this manually. The system was studied and relevant officials were interviewed to acquire the required data. This designed system allows for easy retrieval of information that is accurate for effective and efficient allocations. It has easy maintenance of information as well as time saving and reduction in operation. The front end of the system was designed using HTML and CSS, while the backend was developed using PHP. The output is an interactive, menu-driven and user-friendly system which provides timely and accurate information about certificates. The certificate operations are recorded and stored in the computer and retrieved at will. The system also ensures security as users must log in before and after any certificate is added or printed.

Keywords— certificate verification system, web-based, programming.

BACKGROUND TO THE STUDY

Globally, most institutions and organizations rely on the use of traditional paper verification methods to verify the documents presented to them [1]. These organizations and institutions often times do not have the capacity to verify the documents presented to them instantly [2] One of the problems associated with traditional based verification, is that people, especially recruiters and employers find difficult to ascertain the validity of documents such as academic certificates. [3] Certificate verification systems are applications which are generally small or medium in size and can be used by school management's to create and manage student certificates through a digitized system where the school can create, print and verify the certificate of any student [4]. With a digitized system, the hassle and stress involved in the verification process is eliminated [1]. Once the admin logged in, will be able to create and maintain all the certificates of students [5]. The add certificate, view student record, print certificate, are the modules in the program which the Registrar will use to manage all the student certificates with more convenience and in a more efficient way and it also help in verification of student certificates in an easy and stress-free way[10]. This work is centred on the need to adopt real time verification systems that will eliminate the hassles of manual verification method [1]. This will enable an employer or an interested party to verify an institution's certificate anywhere without having to officially to send a request to the s school either directly or otherwise [1]. All that is required of the employer is to login to the verification page and use the verification

code printed on the certificate to verify the authenticity of the certificate or use a Smart Phone Application and scan the QR Code which is a digital signature that contains data such as holder's name, enrolment number, grade etc. which will have already been approved be signed by university authorities [10]. Traditional based certificate verification has been one of the major challenges facing Academic institutions and employers of labour [5],[1],[13]. One problem that is easily encountered is the issue of forgery of printed certificates [6]. Similarly, the low skill threshold for counterfeiting academic certificates is also a major issue. [7]. The difficulty involved in the traditional verification process has resulted in unnecessary delays as well as inconveniencies arising from long distance travel for the purpose of verification [2]. However, with improvement in information and computer technology, there is need for paradigm shift from traditional based verification to real-time verification [8]. The study aimed at developing an application that will automate the verification of certificates. The study employed the use of encrypted QR codes print graduation certificates. This QR codes will then be used to verify the authenticity of any certificate. The system will do the following:

i. Provide a login page where the registrar can have access to register and generate certificate for student
ii. Enable the registrar to automatically generate unique certificate codes and a QR code for each certificate added.
iii. Resolve the issue of manual verification by student and any employer
iv. Easily confirm the authenticity of any certificate by student and any employer.
v. Reduce time required in certificate verification.
vi. Design a system that can help to minimize the high rate of manipulation and falsification of certificates in higher institutions.

LITERATURE REVIEW

Certificate verification is the process of ensuring certificate presented by a prospective employee to a prospective employer is genuine and that the holder is the rightful owner [4] Certificate verification is the also the process of determining or confirming that a certificate is original [9]. Moreover, a graduation certificate has to be verified to ensure that its content is true and also to ensure that the issued certificate comes from a real source [10]. This confirmation is often, but not always, provided by some form of external review, education, assessment, or audit [11]. Accreditation is a specific organization's process of certification [1]. According to the National Council on Measurement in Education, a certification test is a credentialing test used to determine whether individuals are knowledgeable enough in a given occupational area to be labelled "competent to practice" in that area [1]. One of the most common types of certification in modern society is professional certification, where a person is certified as being able to competently complete a job or task, usually by the passing of an examination and/or the completion of a program of study [3]. In today's global labour market, certificates are used to assess the candidates' knowledge and skills [11]. Some professional certifications are valid for a lifetime upon completing all

certification requirements [13]. Others expire after a certain period of time and have to be maintained with further education and/or testing [14]. Certifications can differ within a profession by the level or specific area of expertise to which they refer [14].

For example, in the IT Industry there are different certifications available for software testing, project management, and software development [10]. Institutions issue certificates to those who have successfully completed the requirements for graduation [10]. A graduation certificate is still in the form of a paper-based document because, as yet, an electronic document cannot effectively replace a physical certificate [2]. However, due to the presence of advanced and cheap scanning and printing technologies, the forgery of certificates has increased, which threatens the integrity of both the certificate holder and the university that has issued the certificate [11].

Therefore, document validation and verification has become an important task [10], it is the process of ensuring that the graduation certificate presented by a prospective employee is genuine and that the holder is the rightful owner [12]. Educational establishments try to combat fraud and forgery in several ways; however, most of the methods are time consuming because they are manual and involve human interaction [1]. To check the validity of a certificate, much time is spent in either reaching out to the university to verify a certificate or in awaiting a reply from the university to confirm that the certificate is valid, and the information is accurate [10]. This process can be extremely laborious and expensive especially if a company needs to check the certificates of several hundreds of applicants [2]. Hence, this study attempts to model a cloud-based service to verify graduation certificates and preserve the confidentiality of the information in them [3].

Verification is the evidence that establishes or confirms the accuracy or truth of something while verifying is the act to prove the truth of, as by evidence or testimony [4]. There are so many reasons a certificate might want to be verified [1] Academic affair's is usually in charge of student result and up to date of the honours awarded to each students[10]. It has a collection of sources, resources, and services, and the structure in which it is housed [10]. There can be no doubt that much of the certificates in this area speculates on the future role of safe means (mini-library) – none of which is particularly clear. Since (1995), or what Tenopir calls the "post web world" (2003), libraries have been seen as in danger of "substitution" The web is becoming "a ubiquitous source of information" giving an "illusion of depth and comprehensiveness" that leads to a questioning of the value of libraries and their collections []. This review will not speculate on these future roles but will focus instead on the certainty of changing technology, increasingly digital information resources and societal shifts that have changed user expectations of online certificate verification system [].

Types of certificate verification

There are two major ways to check the authenticity of a certificate.

Manual verification

This is a type of verification in which the person/team that wants to verify a certificate writes a letter to the school they want to verify from and has to wait until the letter is replied. This type of method is time consuming and the transfer medium of the information is usually very slow [1]

Web-based certificate verification

To meet the demands posed by the huge growth in educational content, resources and student numbers, a suitable environment needs to be adopted that can accommodate such advancements in the educational sector. The introduction of a web-based certificate verification process would be an important contribution to developing proper educational environment [8] Web-based Certificate verification has many of characteristics and its benefits can be summarized as follows:

i. The user can access and verify the certificate through a browser anytime, anywhere.
ii. Web-based Certificate verification system allows for efficient utilization of resources.
iii. Online Certificate verification is scalable and affordable.
iv. Performance monitoring is easily executed.
v. Fewer IT skills are required in order to verify a certificate online.
vi. The security of the online certificate verification system can be better than the security of traditional systems.

Features of certificate verification system

[2] Outlined the features of a certificate verification system. The features are as follows;

i. Adding student details for certificate printing. This system handles the adding of student's details ranging from their names, grade graduated with, year graduated, faculty, and department. These details are therefore used to print out certificate for graduating students. Therefore, the system also serves as a management system.
ii. Saving certificates for further printing. The system automatically saves all details of any certificate printed therefore a new certificate can easily be printed for a student in the case of theft or missing result. The system can also serve as a source of data collection.
iii. Easy verification of certificates can be done with this system. When a certificate needs to be verified, the body/person that needs to verify the certificate will use the certificate verification code (CVC) and check the site for the authenticity of any Certificate.

Information keeping and management

According to [12] information cannot be accurately ascertaining without adequate and authentic records made available when needed, the computer as an electronic processing devices given out results based on a set of instructions given to it [4]. Record is a collection of data elements; such as the students' records or information. Record management as used here is talking about manipulation of these data to achieve

certain objective which is for keeping of students' information [9]. The record keeping of information in a computer system can be done in sequential where information is stored sequentially [4]. Secondly, in a direct access-filling, a situation where records or information stored may be accessed in a random manner i.e. without waiting to be accessed sequentially or otherwise. This provides immediate access to data and is mostly stored on disk.

Existing system

Certificate verification method that is prevalent today is a manual process, in this process the institution/organization that wants to verify a result will have to travel down to the university or send a written request so as to verify result [2].

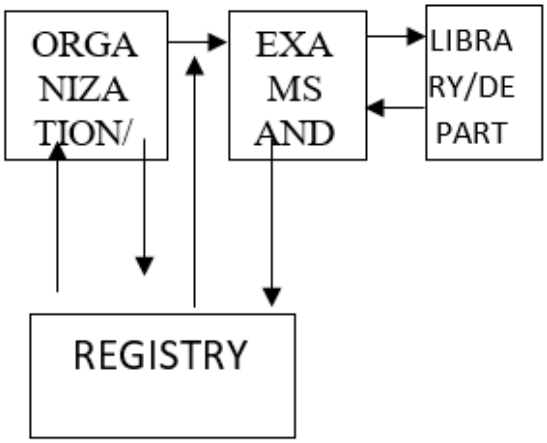

Figure 1: Graphical view of the existing

Process of document verification

The graduation certificate is one of the most important documents issued by universities and other educational institutions [2]. It is proof of a graduate's qualification [6]. However, due to advances in printing and photocopying technologies, fake certificates can be created easily and the quality of a fake certificate can now be as good as the original [1]. The certificates of many prominent universities have been forged and these forgeries are very difficult to detect [2]. Moreover, many factors have led to reduced operational efficiency in student services at universities [5]. One of the most significant factors that have had a detrimental effect on the quality of university services is the verification process for educational certificates and related documents [3].

Yet, certificate verification is essential in order to ensure that the holder of the certificate is genuine and that the certificate itself comes from a real source [1]. However, manual verification is a tedious task for any organization and its inaccuracy is one of the key reasons that document forgeries continue to be made and go unnoticed [3]. The manual verification process can consume a lot of the resources (time and money) of both the issuer and the verifier and it imposes an extra burden on the university or college [10].

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Reasons for certificate verification

There are so many reasons a certificate might want to be verified. The following are some of the important reasons why a certificate might want to be verified.

Certificate Verification for Higher Studies

If a person tends to attain a higher degree in a particular field of study e.g. when a B.sc holder wants to further studies in other to get a Master degree, the B.sc certificate need to be verified before the person can be allowed to start the course for the Master's program [11].

The role of verifying a certificate can never be underemphasized, it is a part of the system and it will always be in the system [6].

Certificate Verification for Employment

During a job interview, the panel can ask a question like "which school did you graduate from?" and the job applicant will answer sharply to the question asked [12]. So many thought might go through the mind of the panel members such as "How are we sure he/she graduated from that school?

When are we going to write a letter to the school to confirm the authenticity of the certificate? And other questions" They later tell the applicant to go home while they verify the credentials brought before them by the job applicants.

Verifying a school certificate can be very tedious and can also be very easy, depending on if the school has a certificate verification system, if there is no easy online system to verify certificate for a school then it will be a very tedious means to verify the certificate which will include writing of letters and waiting for a while before response finally comes in [1].

Certificate Verification during Travels

When travelling we might drop our certificate as a form of identity and such certificates will need to be verified before they can be used for any purpose [14]. Names and other important details can be gotten from the school to actually authenticate the claim that the owner of the certificate graduated from the school and the certificate is actually his/her own [2].

There are so many instances in which certificate verification is vital and it is of outmost importance that the process in which a certificate is to be verified is easy and should not be stressful [13].

Process of certificate verification

At present, the process of certificate verification involves three parties, the university, the owner (graduate) and the verifier (company/prospective employer) as shown in figure below.

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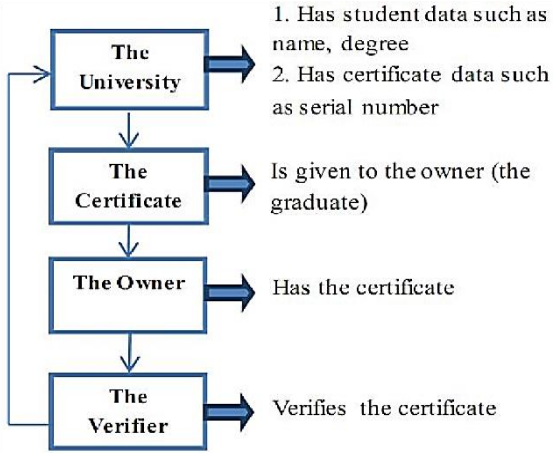

Figure 2: Process of certificate verification

It is clear from Fig 2. above that the verification process for a graduation certificate involves several steps that need to be taken by each of the three key parties in order to successfully accomplish verification and that three key parties are involved in that process [8]. This research aims to enhance the certificate verification mechanism by proposing a web-based model in order to combat the forgery of such certificates and preserve the confidentiality of the information in them [8].

Benefits of proposed model

The proposed model has several benefits that can be classified into internal benefits and external benefits [12]. Internal benefits include improved work processes and ease of use for university staff due to the digitization of the verification process [9]. External benefits include the receipt of faster and more efficient verification results by students/alumni and employers [4]. The proposed model could also improve the links between universities and government entities such as the Secretariat, gaining more reputation in the far-sightedness [14]. A specific benefit for universities would be that some staff and hardware resources would no longer be required as the time-consuming manual verification process would be eliminated [5]. An important benefit for the graduate would be that the information in his/her certificate would be confidential making it difficult for unauthorized persons or entities to use their certificate illegally [2]. A key benefit for the verifier would be that less resources such as time and money would be needed for verification as, for example, there would no longer be a need for the verifier to call the university and for the university to consult its records and reply to the verifier [12]. Several methods can be used to verify a document and can guarantee the originality and confidentiality of a document, including cryptography techniques and cloud services [7] This section describes how the proposed model can improve the security, validity and confidentiality of the certificate validation process [11].

Security

Online Certificate Verification System is designed to address several security objectives such as confidentiality, data integrity, non-repudiation and authentication [3]. Confidentiality means that the

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information can be understood just by the intended people while data integrity refers to the information being impervious to being altered illegally [3]. Non-repudiation means that neither the sender nor the receiver can deny the creation or transmission of the information, while authentication refers to the bone fide nature of all parts of the document [8]. Since the university is solely responsible for issuing certificates for their graduates, the security aspect has to be considered and ensured by the university itself [9]. Unquestionably, all universities should apply a security mechanism when issuing certificates for their graduates. Educational institutions should have a mechanism to combat fraud both in the misuse of their name or to identify fake documents [2]. The increasing incidence of fake documents has led to the introduction of many techniques such as holograms, stamps and wet-signatures [7]. However, these techniques can easily be duplicated to create forged documents [4]. Hence, the proposed model includes a step to generate a Certificate Verification Code (CVC) [2]. A CVC can be generated easily by using the proposed system because it is an online web-based system that is hosted on the university's own website [11]. When a graduate wish to apply for a job, they can request a CVC that can be used by their potential employer to verify and validate their graduation certificate [5]. To successfully generate the CVC, the graduate must provide the system with a secret code and the Registration number on their certificate [3]. A code is generated by the university for all graduates when they receive their original certificate [1].

Validity

Here, validity means that the issued certificate has been checked to ensure that it comes from a real source and also that the content of the certificate is true [8]. This aspect is the main concern of the verifier (prospective employer/company/university) [7]. Clearly, the verifier will have been given a copy of certificate and will want to validate it [9].

The potential inaccuracy of manual verification is overcome by allowing the verifier easy access to the proposed online system [2]. To verify and validate the certificate the verifier must access the online system available on the university's website [1].

The verifier has to provide an input in order to successfully verify and validate the certificate [11]. The input is the CVC mentioned above, is the code number on the certificate that can easily be taken from the certificate in hand [11].

Confidentiality

Degree certificates and transcripts contain information that is confidential to the individual concerned and should not be easily accessible to others [8]. Hence, there is a high need for a mechanism that can guarantee that the information in such a document is original, which means that document has originated from an authorized source and is not fake [12]. In addition, the information in the document should be confidential so that it can only be viewed by authorized persons [11].

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Confidentiality is the most important feature of information security [10]. Therefore, it is crucial to ensure the confidentiality of information on the certificate and this aspect is taken into consideration in the proposed solution [4].

Let us assume that a copy of a certificate comes into the hands of an unauthorized person or entity such as a fake company and that they want to use the certificate illegally [13]. The above-mentioned secret key can prevent this from happening [11]. The secret key is required in order to verify and validate the certificate [6]. However, it is impossible for unauthorized people to verify and validate the certificate because that secret key is unavailable to them [3].

METHODOLOGY

Analysis of the Proposed System

This certificate verification system will follow the same process in an institution, but this time it will be online and automated.

The system will be customized to have each certificate number linked to the student's detail. Each person or organization that want to verify the certificate must have the Certificate Verification Code (CVC) and type it into the field named "enter certificate number" or scan the QR cod on the certificate

System Design

Systems design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development.

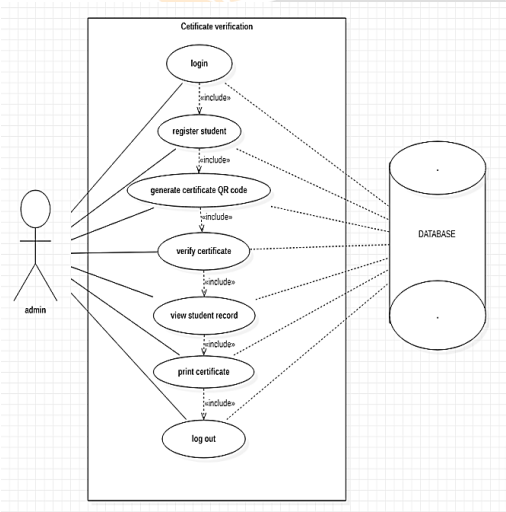

Figure 3: System design

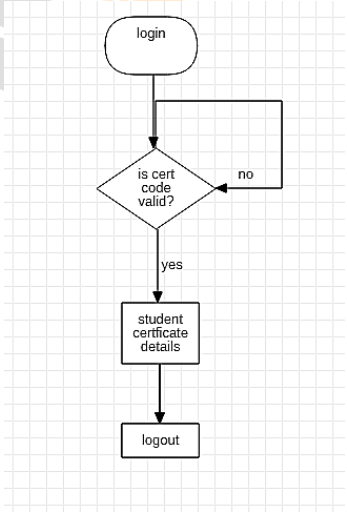

Figure 4: Flow chart for verifier

This certificate verification system will follow the same process in an institution, but this time

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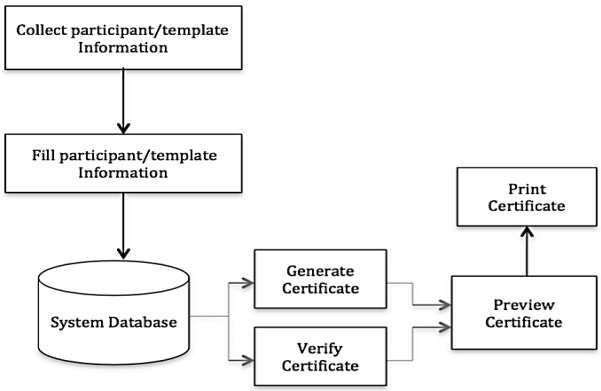
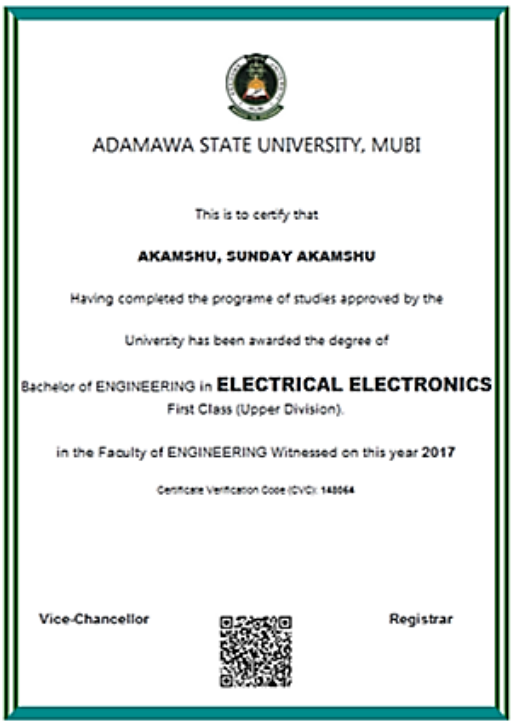


Figure 4: System architecture

CERTIFICATE VERIFICATION FORM

First Name: AKAMSHU
Middle Name: SUNDAY
Last Name: AKAMSHU
Department: COPTUTER SCIENCE
Course: COPTUTER SCIENCE
Year Graduated: 2017

Figure 5: Input Design



ADAMAWA STATE UNIVERSITY, MUBI

This is to certify that

AKAMSHU, SUNDAY AKAMSHU

Having completed the programe of studies approved by the

University has been awarded the degree of

Bachelor of ENGINEERING in **ELECTRICAL ELECTRONICS**

First Class (Upper Division).

in the Faculty of ENGINEERING Witnessed on this year **2017**

Certificate Verification Code (CVC): 148064

Vice-Chancellor Registrar

Figure 6: Output design

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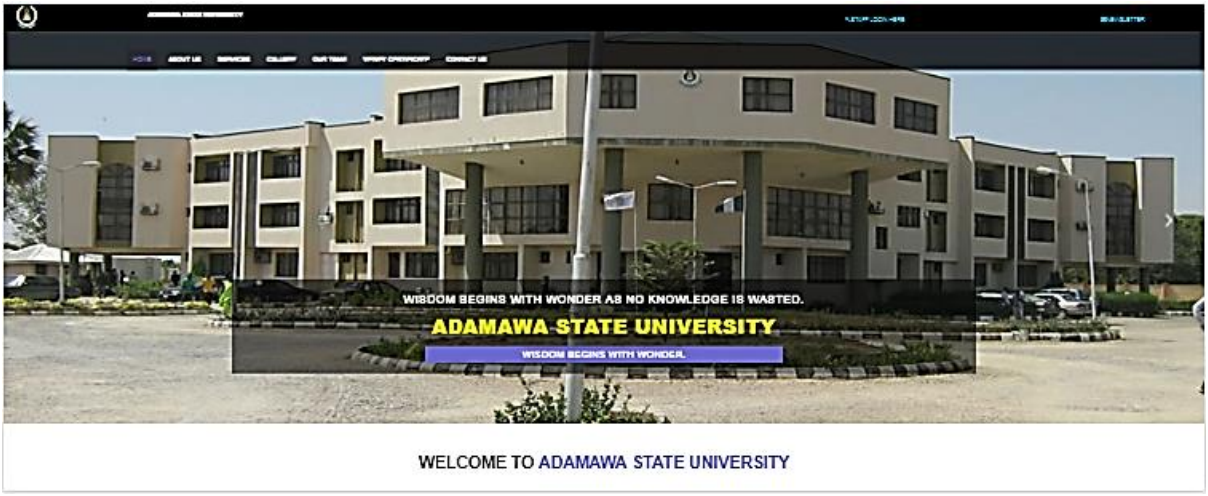

Figure 7: Home Page Interface

Figure 8: Interface of the Verification Page

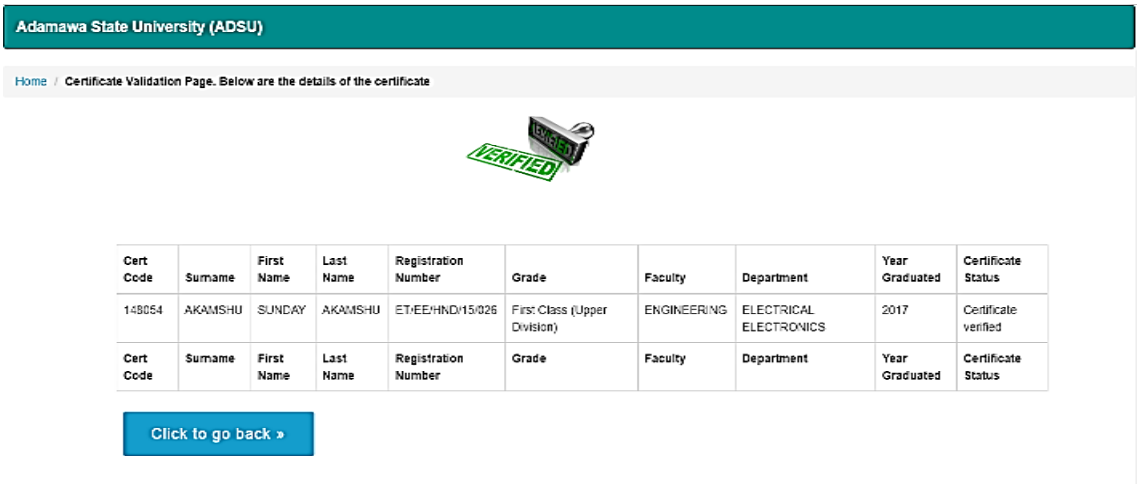

Figure 9: Interface of the verification output

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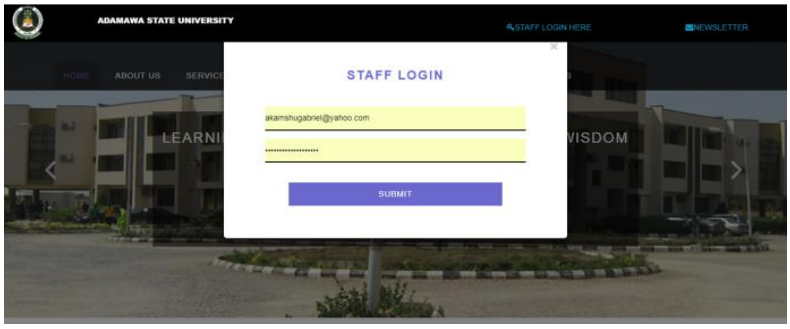

Figure 10: Admin login interface

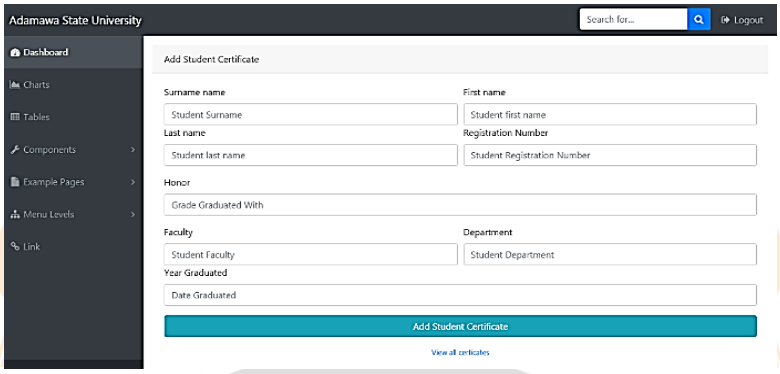

Figure 11: Add certificate interface

This project highlighted the practical implementation of an online certificate verification system for higher institutions (case study of Adama).

RECOMMENDATIONS

The website developed for the implementation of this research can be used by Admin, employer and thus, the following recommendations are proposed:

i. Awareness should be created on the benefits that can be derived from the use of this system.
ii. Staff must be computer literate
iii. I recommend that the imperfection of this software design should be dully observed and considered by future researchers.

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