

DOCUMENT AND CERTIFICATE VERIFICATION SYSTEM

BY

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**A PROJECT SUBMITTED IN THE DEPARTMENT OF COMPUTER SCIENCE AND
MATHEMATICS, COLLEGE OF BASIC AND APPLIED SCIENCES, IN PARTIAL
FULLFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF BACHELOR
OF SCIENCE.**

AUGUST, 2022.

DECLARATION

I hereby declare that this project report written under the supervision of **Dr. Funmilayo Kasali** is a product of my research work, information derived from various sources has been duly acknowledged in the text and a list of references provided. This research project report has not been previously presented anywhere for the award of any degree or certificate.

ADEGBOYEGA OLUWASEGUN MAFUZ

Date

CERTIFICATION

This is to certify that **ADEGBOYEGA OLUWASEGUN MAFUZ; 18010301048** undertook this research work **DOCUMENT AND CERTIFICATE VERIFICATION SYSTEM** and meets the requirements for submission to the department of computer science and Mathematics Mountain Top University, in partial fulfilment for the award of Bachelor of Science (B. Sc) Computer Science Degree 2021.

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DEDICATION

I dedicate this project to the Almighty God, who has been my strength and provider. Also, to my parents Mr. and Mrs. Adegboyega for their constant prayers, advise and unending support.

ACKNOWLEDGEMENT

I want to first of all thank the Almighty God for granting me good health and protection throughout my stay in Mountain Top University most especially in the course of this research work. Glory be to God.

The completion of this project was possible, thanks to the cooperation and support of a number of people, for their inestimable investment in my education; God will surely reward you and will help me not to fail you.

To my project supervisor, Dr. Funmilayo Kasali apart from accepting the noble task of supervising my project work, you have been like a mother to me, thanks for everything.

To all the lecturers of Computer Science department. Thanks for impacting the best of your knowledge into me.

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ABSTRACT

As the name specifies “DOCUMENT AND CERTIFICATE VERIFICATION SYSTEM FOR SCHOOLS” is a software developed to automate and digitize the process of adding certificates and verifying the certificate records considering the challenges involved in doing this manually. The manual process of issuance of degree certificates from schools was studied, as well as the stressful procedures of validating the originality of issued certificates was also reviewed. Considering the certificate issuance system of Mountain top University, this research work reviewed the procedures involved in obtaining certificates from the school admin and subsequently designed a system to solve the identified gaps in obtaining and verifying degree certificates by past students of the institutions. It has easy maintenance of information as well as time saving and reduction in operation. While the backend of the system was created using PHP, the front end was made using HTML and CSS. The result is a user-friendly, interactive system with menus that delivers timely and accurate information about certificates. The certificate operations are documented, saved, and retrievable at any time using a database management system. Users must log in before and after any certificate is added or printed, which further increases security for the system. This specific project addresses the issues with managing a student certificate while avoiding the issues that arise when doing things manually.

CHAPTER 1

INTRODUCTION

1.1 PROBLEM DEFINITION

Generally, most institutions or schools rely on the use of traditional paper verification methods to verify and authenticate documents presented or claimed to be issued by them (Izuchukwu et al., 2020). These institutions most times do not have the capacity to verify the documents presented to them in realtime (Ahmed et al., 2017). One of the challenges linked with manual-based verification process, is that people, especially recruiters and employers find it increasingly difficult to validate the genuineness of the documents such as academic certificates. Certificate verification systems are applications which can be used by school managements to create and manage student certificates through an automated and digitized system where the school can create, print, and verify the certificate of any student on demand. With a centralized and digitized system, the challenges involved in the verification process is eliminated. The platform admin is able to create and maintain all certificates of students of such institutions. The Registrar will use the program's add certificate, view student record, and print certificate modules to manage all student certificates more conveniently and effectively. These modules also make it simple and stress-free to verify student certificates. (Rafi et al., 2020). This work is aimed at the need to adopt real time verification systems that will eliminate the hassles of manual verification method in Mountain Top University. 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 school either directly or otherwise. All that is required of the employer is to logon to the verification page and use the verification by submitting a unique identifier like Matric Number or registration number seen on the certificate.

1.2 STATEMENT OF PROBLEM

Verification of certificates and document is a major concern in academic settings and within corporate societies. Every now and then, recruiters and employers are faced with issues of certificate forgery by new hires. Employers have been experiencing high alarming rate of fake certificates. This is as a result of a huge collection of unverifiable certificates tendered by their employees or new hires. The difficulty involved in the manual verification process has resulted in unnecessary delays in hiring process, as well as inconveniencies arising from long distance travel for the purpose of certificate verification. However, with improvement in information and computer technology, there is need for paradigm shift from manual-based verification process to real-time verification system. The study aimed at developing an application that will automate the verification of certificates. After a careful review and analysis of the current method of certificate verification, this study identifies a list of problems associated with manual method of certificate verifications.

- There is always a time delay in the manual method of certificate and document verification.
- Organizations and industries do not have easy and immediate access to present system.
- Certification verification is not done instantly and is marked by prolonged response time, resulting to prolonged hiring process for corporate organizations.

This paper explores the different way certificates and document are being verified and the difficulties in guaranteeing their authenticity. Such procedures include by mail, e-mail or in person which is known to be time consuming and hectic. Hence, the need to standardize these services in a unified portal will be made by designing and developing a web-based application to verify student documents and certificates.

1.3 AIM AND OBJECTIVES

The aim of this project is to develop an efficient Certificate and Document Verification System and the specific objectives of the project are to:

- Design a framework for certificate and document verification system.
- Model the framework define using unified modelling language.
- Implementing the framework defined using current technology.
- Testing the framework defined for certificate and document verification system.

1.4 SIGNIFICANCE OF STUDY

This project focuses on a web application development where a user can access in real-time store school certificate by merely entering in a placeholder unique identifier of the individual whose certificate is to be verified. The significance of this study is to assist and benefit the student, faculty, administration, and anybody else who wants to confirm the legitimacy of a school certificate. The system will offer organizations, recruiters, and employers the ability to rapidly authenticate the certificate. It will assist in lowering the stress in higher institution due to the use of manual processes.

Mainly the system eliminates the use of fake certificates and losing certificates due to movement with the original copy of your certificates in different places. When the project goes online there are a number of advantages that will be benefited by the users of the system in our society specifically recent and past graduates from Mountain Top University. Some of the benefits to the alumni network of the school include:

- Easy and fast verification of valid certificates records as the recruiters and employers will have the opportunity to verify the certificates presented to them thus it would help the recruiting agencies in verifying academic certificates held by an individual.
- The record verification system reduces instances of academic fraud, also the system reduces the process of sending people to advocates to verify their certificates credentials e.g., in university registration, etc. hence it saves time and cost for occasionally going to advocates.
- Other significances include reducing the risk of losing certificates, fair job qualification due to level of Education and originality of certificate records and lastly it offers easy management of certificates for Mountain Top University.

1.5 SCOPE OF STUDY

This study is mainly focused on building a web application where the recruiter, employer or even past alumnus of Mountain Top University can ascertain the genuineness of a certificate using the digitized certificate identification system designed using relevant web framework. This project uses Mountain Top University as the case study but can be adopted for use by any higher institution of learning.

1.6 METHODOLOGY

This certificate verification system will follow the same process in an institution, but this time it will be more optimized, repetitive, and unnecessary processes will be eliminated, the repository and database will also be online and relevant processes shall be automated. The web application will be designed 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 "Certificate Number".

CHAPTER 2

LITERATURE REVIEW

The purpose of this chapter is to show the link between what is presented for study and the existing knowledge, previous studies, or conventional body of works with relevant citation of other scholars work with respect to the problem. The advent of system development in recent years has sparked interest from different players of Information Technology (IT) and Computer science, such as academicians, corporate organizations, institutions, and enterprise environment.

2.1 OVERVIEW OF CERTIFICATE VERIFICATION SYSTEM

When we talk about a verification system, we refer to a set of actions used in checking the correctness and trueness of any component or element, such as a system element, a process, a document, a file, a service, a task, a requirement, etc. (SEBOK., 2017). These types of actions are usually well coordinated and planned and executed throughout the life cycle of the system. Verification is a generic term that needs to be initiated within the context it occurs. Verification is a process that spans every stage of the system's life cycle. The verification process, which applies to every activity and every product produced by an activity, is specifically carried out concurrently with the system definition and system realization processes during the system's development cycle.

Therefore, the process of establishing that a certificate provided by a prospective employee to a prospective employer or employment agent is legitimate and that the holder is the legal owner of the presented certificate is known as certificate and document verification (Obilikwu et al., 2019). The process of confirming or validating that a certificate is authentic and not faked is known as certificate verification (Osman, 2019).

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 the authentic source, usually the degree awarding institution (Rafi et al., 2020). This confirmation is often, but not always, provided by some form of external review, education, assessment, or verification agency. In today's global labour market, certificates are used to assess the candidates' knowledge and skills (Huynh et al., 2021).

A number of researchers have used cloud computing for verification. According to A.C & H.R (A.C & H.R, 2016) they developed a model for authorization of certificates in Government sectors using cloud computing Environment. The system was designed and developed using a model where a user can request, and the system administrator can authorize certificates online in different government sectors. They used fifth generation cloud computing environments to maintain data. The application allows users to query a request to get certificates on its online platform by filling user application form and attaching appropriate proofs like voter id, Driving License, etc. They authorize the certificates using digital signatures. They ensure data integrity and security using certain algorithms.

Several methods have been used to verify certificates and clear the issue of certificate forgery; however, certificate verification method still prevalent today is a manual process, whereby, whoever wants to verify a certificate takes a trip to the institution or send a written request or email to the awarding institution. For instance, Srushti et al (Srushti et al., 2014) presented a certificate generation system to ensure an efficient certificate management process using Big Data and to provide mark sheets for credit-based grading system (CBGS) in a very user-friendly manner. The administrator enters each student's grades into the system. After then, the data is kept in an internal database for collection information, and the percentage and grade are manually determined. The technology used an encrypted QR code to embed the digital form in the mark sheet, preventing any unauthorized users from accessing any data. But because the system is somewhat automated, scaling it up is inefficient.

In his research, Hampo (Hampo, 2011) used the Structured System Analysis and Design Methodology (SSADM), which emphasizes finishing one stage of software development before moving on to the next and having the flexibility to return to earlier stages in a strictly sequential fashion. The model used for this project is the Rapid Application Development (RAD) model proposed by International Business Machine (IBM) in 1980 and introduced to software community by James Martins through his book Rapid Application Development. Unfortunately, it was not a web-based application but a desktop application software which made the system less valuable as compared to web applications. The system is no longer relevant in today's world of Web 2.0 and 3.0 technology.

Osman (Osman, 2016) used cryptographic method and cloud-based model to improve the verification mechanism, thereby reducing the incidence of certificate forgeries and ensured that the security, validity and confidentiality of graduation certificates would be improved. It uses the Cloud-based model, some of the factors that result in reduced operational efficiency in student services at universities are addressed and this should have a positive impact on the quality of services provided by universities. However, since cloud infrastructures are owned and managed by service providers, like Azure-Microsoft, Amazon Web Services – Amazon, Google Cloud Platform- Google, the cost of implementation is also high. As a result, few institutions could afford to apply it.

Using a QR Code and smart phone application, Singhal and Pavithr (Singhal, 2015) developed a technique to stop the distribution of bogus degree certificates. The data, which includes the name of the degree holder, enrollment number, matriculation number, total marks or grade earned, etc., is digitally signed by university officials and is contained in a QR Code. A particular smartphone application that scans the Code and authenticates the certificate must be used to verify the digital signature. By including a QR Code on the degree certificate and introducing a smartphone application that can read the digital data from the QR Code, the system was able to combat credential fraud. It makes it possible to verify certificates without relying on the organization that issued them.

This not only enhanced a certificate's authenticity mechanism at a rate several times faster than human verification, but it also stopped fake certificates from being made. Musee (Musee, 2015) developed a cloud-based prototype that is used as Software as a Service (SaaS) to enable certificate verification in his study. He employed Agile Methodology and Unified Process modeling, by entering the name of the university, the year of graduation, the name of the course, and the verification number, users of the prototype may request and obtain academic diplomas' verification. These procedures were all completed in a private cloud accessible online. The main disadvantage of the system is the use of Relational Database Management System (RDBMS) which does not support horizontal scaling that is partitioning.

Boukar, Yusuf and Muslu (Yusuf, 2018) on the other hand adopted the use of Java DataBase Connectivity (JDBC) and MySQL connector jar file hence designed a web-based approach proposed to replace the traditional (manual) verification process by retrieving certificate data from institutions in JSON format and archiving them in a database from which verification can be made, thereby eliminating security threats and human error. An SQL query was executed to retrieve relevant information from the database. The GSON jar file and JSON library functions are used to parse the results and show them in a JSON format.

However, because using NoSQL capabilities in MySQL slows down system operation, it has become the system's main shortcoming. The Elliptic Curve Digital Signature Algorithm (ECDSA) and Secure Hash Algorithm-1 (SHA-1) algorithms, which provide strong cryptographic strength and optimize the computational performance as well as space, were combined in Tint and Win (Tint, 2014) to regulate fraudulent certificates.

2.1.1 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 and laborious.

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 (Ahmed et al., 2017).

The existing manual verification process is most times not a straight-forward one and has several loose components and becomes a challenge for the verifying organization to follow through. A sample representation of the process is described in Fig 1.0 below.

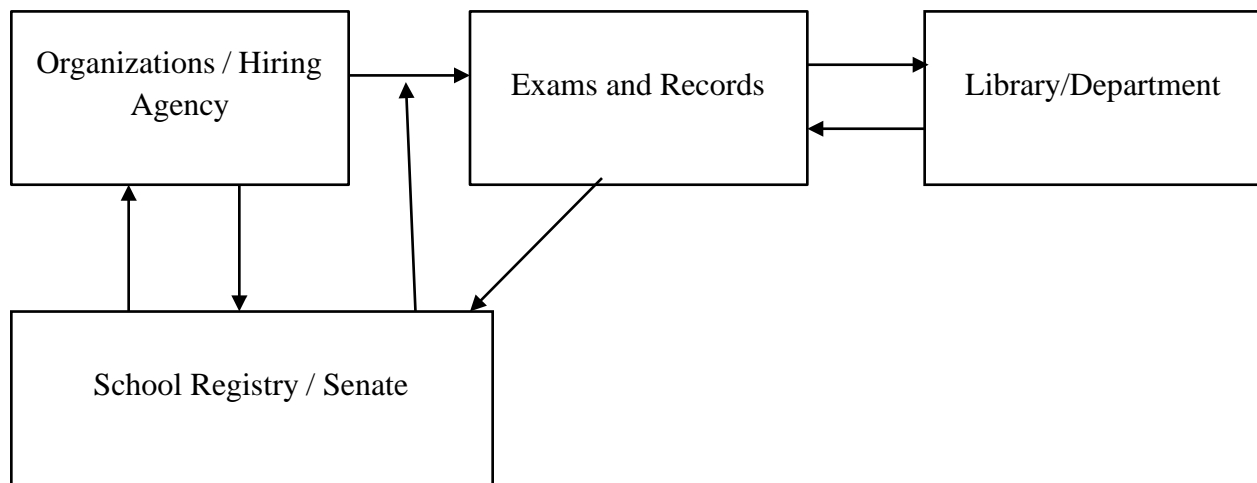


Figure 2.0: Graphical viewing of existing manual verification process

2.1.1.1 Process of document verification

One of the most important documents granted by universities and other educational institutions is the graduation certificate. It serves as evidence of a graduate's competence. However, because of improvements in printing and photocopying technology, it is now simple to produce phony and falsified

certificates, and the quality of such forged certificates can now be on par with the authentic ones. The certificates of many prominent universities have been forged and these forgeries are very difficult to identify. In addition, many reasons have led to reduced operational efficiency in student services at universities. 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.

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. Manual verification, however, is a time-consuming operation for any firm, and it's one of the main reasons why document forgeries continue to happen and go undiscovered in many corporate settings. The manual verification method can be time- and money-consuming for both the issuer and the verifier, and it places additional demands on the university, preventing them from concentrating on their primary function of educating the public.

2.1.2 Web-based certificate verification

To meet the increasing demands by the huge growth in educational content, resources and student numbers, a suitable platform needs to be setup to accommodate such advancements in the educational sector. The introduction of a web-based certificate verification process would be an essential contribution to developing proper educational platform. Web-based Certificate verification has many benefits which can be summarized as follows:

- i. Realtime access to verification of certificates by the verifier. The user can access and verify the certificate through a browser anytime, anywhere.
- ii. Web-based Certificate verification system gives room for efficient utilization of resources.
- iii. Scalability and affordability are key metrics. Online Certificate verification is scalable and affordable.

- iv. Performance monitoring metrics can be easily integrated to evaluate the performance of the system.
- v. Requires little or no IT skills in order to verify a certificate online.
- vi. Improved security model of the online certificate verification system which makes it better than the porous security of traditional systems.

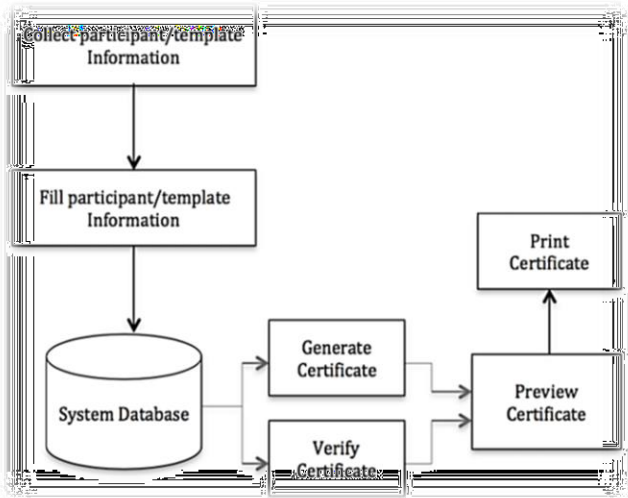


Figure 2.1: Proposed Certificate Verification System Architecture.

2.2 RELATED EXISTING SYSTEMS

There are some of related existing systems that verify certificates, these are described as follows:

2.2.1 Certificate Verification System of MOE-ST, Myanmar.

The Colombian government portal is integrated with Ministry of Education which consist of the certificate verifying site where members can sign up/register, then after successfully login a user can upload their certificate, within a period of one week the user can obtain the results in their account with a status either 'real' or 'fake'. The site has a simple and user-friendly interface which everyone can easily integrate with the system. Figure 3 shows the landing page of the Certificate Verification System (CVS) of Ministry of Education, Myanmar.



Figure 2.2: Home interface of Certificate Verification System (CVS). Reference: cvs.moe-st.gov.mm

Benefits of CVS:

- It is simple to use.
- It is highly beneficial for Myanmar resident.

Challenges of CVS:

- It has limited content and less detailed.
- Only verifies resident's certificates.
- Poor user interface.
- Poor security as anyone can register even if he/she is from a different country.
- It takes about a week to verify certificates.

2.2.2 Nigerian Education Verification system (NEVS)

Nigerian Education Verification system (NEVS) is a platform for all Nigerian students in higher Institutions (Universities, polytechnics, monotechnics, colleges of Education etc.) to have their data and academic records in a common database with the Federal ministry of Education (FME), providing access to the data gives their users like potential employers, Scholarship boards etc. avenue to verify the records from any part of the world

CV Integrated IT Solutions Nigeria LTD (CVIT) in conjunction with the Federal Ministry of Education Nigeria (FME) as part of a Public, Private Partnership (PPP), created an integrated collation system called Nigeria Education Verification Systems (NEVS) which would power the already existing Converged Education Sector Database of the Federal Ministry of Education.

NEVS in effect, provides a new world class solution that would track and manage students' academic records in real time, provide warning notification of potential lapses in certification, eradicate falsification of results, validate records, manage online resources and documents, provide technical support and security, excellent reporting tools, build recruitment databases, maintains statistical data for critical developmental decisions and generates automated reports to stakeholders. Figure 2.3 shows the homepage for NEVS.

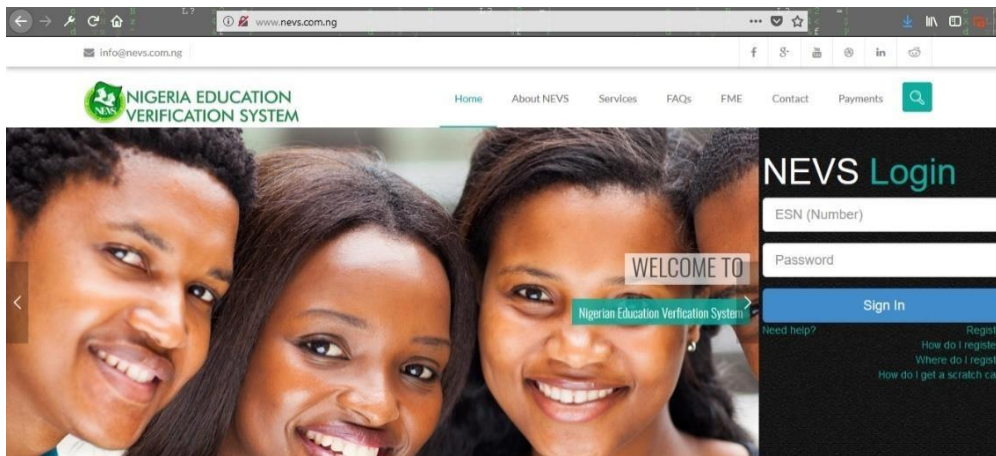


Figure 2.3: Homepage for NEVS. Reference: nevs.com.ng

The Federal Ministry of Education and other key agencies were first given the idea by CVIT in December 2008, and on May 30, 2011, the notion was officially adopted as a national educational strategy under a Public Private Partnership (PPP) structure.

Benefits of Nigeria Education Verification System:

- Ensures Proper Enrolment data
- Ensures proper access
- Ensures proper Assess
- Ensures proper levy
- Reduces lecturer / academic staff and student / scholar confrontation
- Institution and student consensus
- Relevance of student's presence in school and lecture attendance
- Nil manipulation of test results, exam records, report sheets and depository
- Proper Bursary and grants
- Student Test Record, Exam Records, Report Sheets, Receipts, Deposits, Study Guide Purchases and Bill Payments, Generating Report Statements and Other Reports.

- Education Data Verifications for employment
- Education Verification Services are sometimes referred to as Education Background Checks, Educational Checks, Degree Checks, Degree Verifications, Graduation Checks, Graduation Verifications, and Enrolment Checks.

Challenges of Nigeria Education Verification System:

- It is least used by the Nigerians as it can be shown in figure 2.3 the amount of data captured for verification.

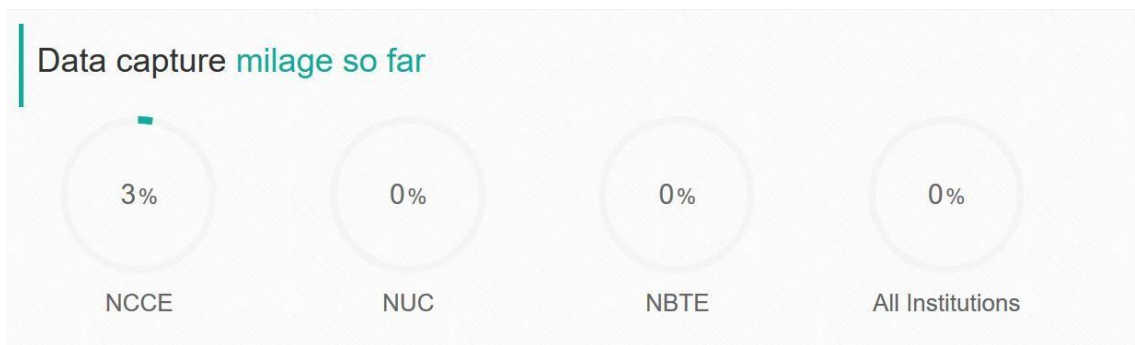


Figure 2.4: Data Capture - NEVS

- It is localized to Nigerians only.
- The services are not well organized in terms of FAQs or how to use the system.
- The services are no longer maintained and does not provide any verification at the time of collating this project work.

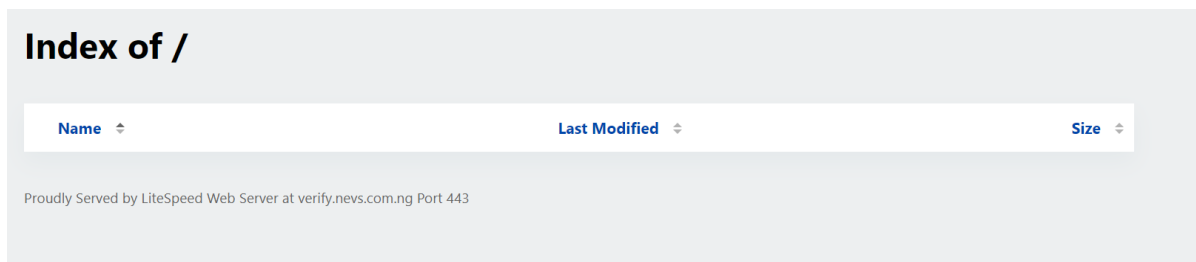


Figure 2.5: Empty page served on NEVS when the verification service is called.

2.2.3 iCredify India

iCredify is an education verification business that was established in 2014 and is fully owned by iCredify Info Services Private Limited. Bangalore, India, serves as the corporate headquarters for iCredify. A company that specializes in risk management and information technology, iCredify is expanding quickly. Through verification and certification, it protects those with integrity from fraud while allowing them to stand out. It is a major player in India's background check industry. It was created and incubated at Wharton and provides B2B services to Fortune 500 firms, web portals, and Indian corporates. Its architecture enables iCredify to simultaneously grow a consumer network.

iCredify enables businesses to develop highly qualified workers who are suited to the needs of the sector based on educational background. Many job applicants lie about their grades in the competitive world in order to progress their careers. For new graduates and senior associates, iCredify now provides degree certificate verification. iCredify is helping companies to get verified graduates with specific discipline with what we do best -college enrollment verification and marks verification solutions provided to give our clients a competitive advantage. iCredify collects information about academic credentials of job seeker or scholarship applicant. Figure 2.6 shows the iCredify homepage.

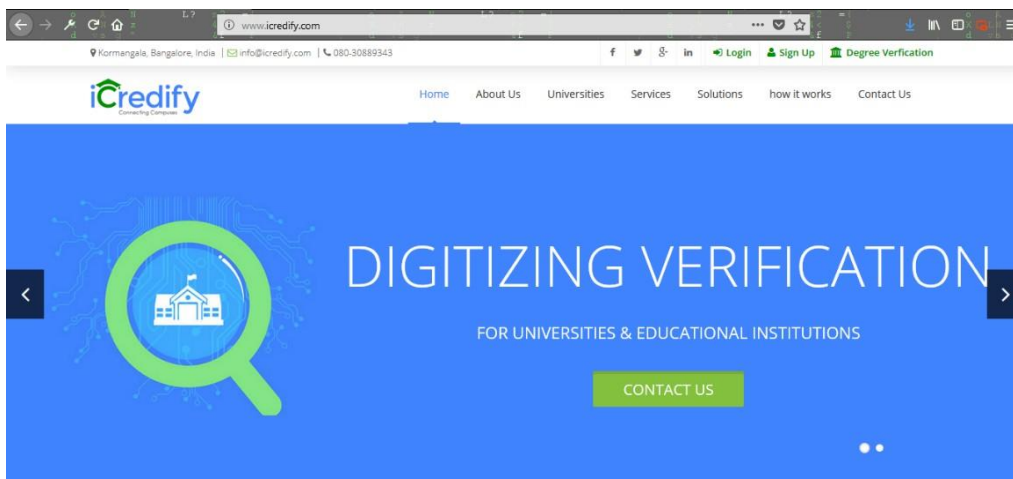


Figure 2.6: iCredify Homepage

Benefits of iCredify

- Offers attractive user interface that integrates with campus authentication and student records system.
- Offers the marks card, verification of percentages of marks and grades obtained in graduation.
- Verifies year of passing/years of degree and verifies student enrollment in a certain University/Institution.
- Verifies courses and the existence of universities.

Challenges

- Despite having an attractive interface, it is not user friendly as it has a lot of options in processes of verification, a user may fail to understand which option to choose or sometimes a user may need extra time to search for other details that are required to be filled.
- It is intended to be used worldwide however it is mostly used in India.

CHAPTER 3

SYSTEM ANALYSIS AND DESIGN

3.1 INTRODUCTION

Requirements specifications deals with collating of non-technical and technical requirements from various stakeholders that would interact with the finished product. Requirement analysis process analyzes collated requirements with respect to users or stakeholder's expectations and defines the problem domain. A specification document is also required for specifying the solution domain specific requirements, functions, processes, components, and time constraints etc. Requirements management manages the changes in requirements produced by business processes. The success of any organization depends on the production of good and quality software products, and good and quality software products can be produced by gathering and prioritizing the right requirements from stakeholders. If the requirements are wrong end product will not be according to user's expectations, and the whole essence of designing the system will be defeated.

This chapter shows how the research methods used for requirement analysis aligns with the functionalities of the system. The web-based certificate and document verification system would be built using PHP and with a MySQL database engine. It would include backend dashboard that can also perform CRUD operations via the dashboard. The language is chosen because it works seamlessly with a Relational Database Management System like MySQL and handling dynamic and server-side changes is easier to be done with PHP. The system at scale can be deployed on any of the following server engines:

- AWS EC-2
- Heroku
- Microsoft Azure

- Google Cloud
- 000WebHost

The core of the study was aimed at gathering information from relevant people that possess and need to screen certificates.

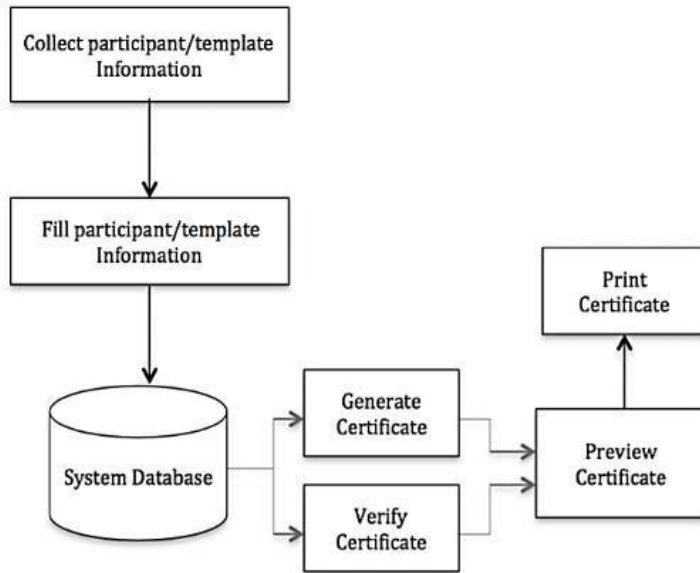


Figure 3.0: System Architecture for the Online Certificate Verification System.

3.2 INPUT DESIGN

The system design is divided into three portions. The Administrator section, the Verifier Section, and Graduates section.

The administrator will have control over whole users. He will be able to create a new admin, official, recruiter and add institution that issues certificates. Management of uploaded certificates will be issued here as well. The Administrator can also perform all CRUD operations at users' levels and Certificates levels.

The verifier role is the people/organization responsible to verify the certificates whether the school certificates records are real or fake. The user in the case of this system is the verifier who can either verify certificate or print a certificate.

Graduates can search or verify their certificates records if they are the same as the ones in the system, or they may search to get relevant records about their certificates as well as being able to reprint their certificates in the events the original issued certificates are missing.

3.3 PROCESS DESIGN

Process design plays an important role in project development. In order to understand the working procedure, process design is necessary. Data Flow Diagram and System Flow chart are the tools used for process design. System Flow Chart is a graphical representation of the system showing the overall flow of control in processing at the job level; specifies what activities must be done to convert from a physical to logical model.

Data Flow Diagram is the logical representation of the data flow of the project. The DFD is drawn using various symbols. It has a source and a destination. The process is represented using circles and source and destination are represented using squares. The data flow is represented using arrows. One reader can easily get the idea about the project through Data Flow Diagram.

3.3.1 Functional UML diagram of the system users.

This section shows several UML diagrams that are used in the identification of the functional requirement and non-functional requirement example is use case diagram.

Use cases diagram is a dramatically methodology used in systems analysis to identify, clarify, and organize systems requirement. The use case diagrams contain a set of possible interaction between the

systems and users in particular environment and related to a particular goal. The sets of interaction between the systems and the users are referred as use case. All system operations that are significant to the system's user are included in the use cases (Bittner, 2002). A use case can be thought of as a collection of potential outcomes connected to a specific objective; in fact, the terms "use case" and "goal" are sometimes used interchangeably. The following Figure 3.0 is a Use Case Diagram for the proposed system.

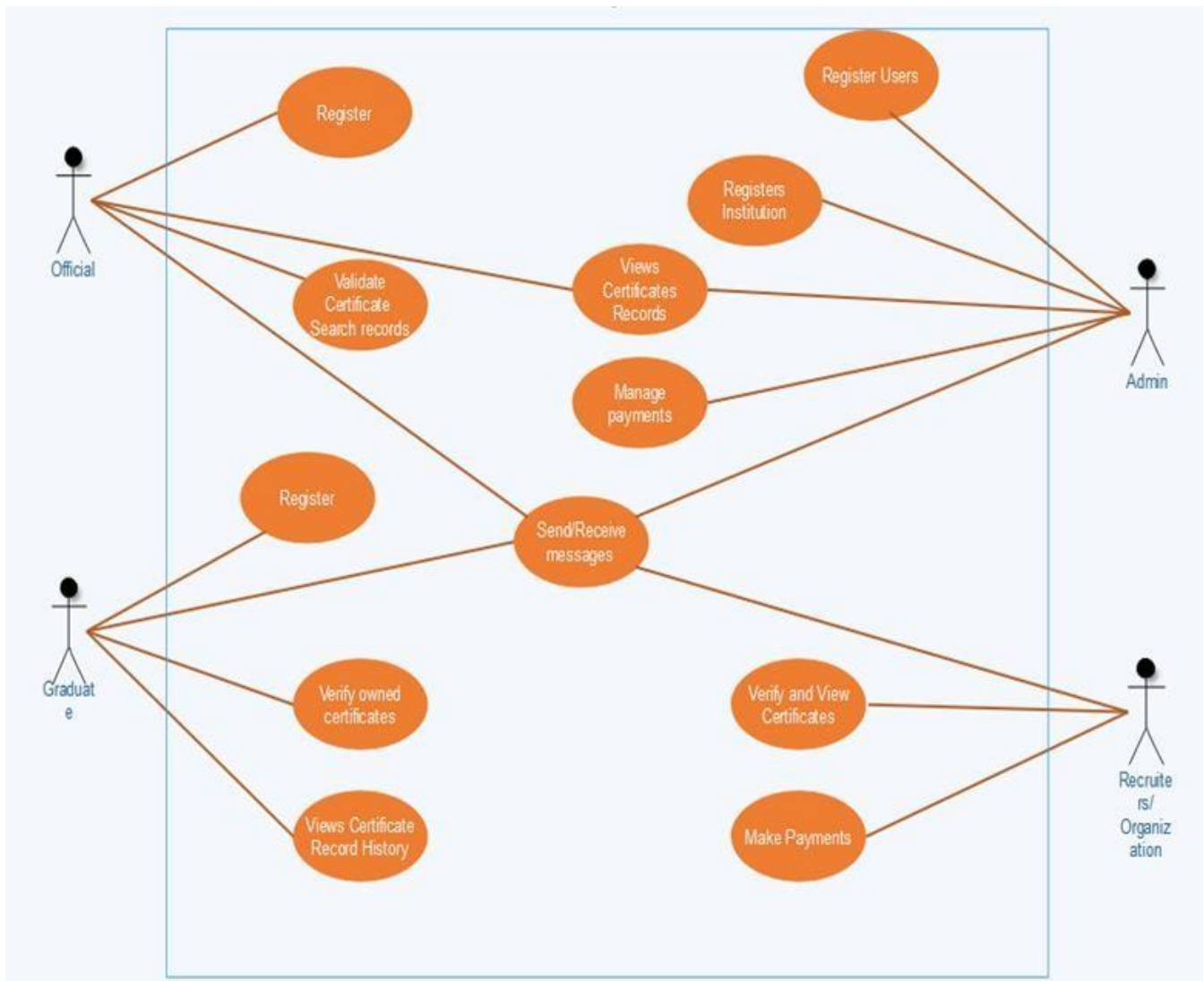


Figure 3.1: Certificate and Document Verification System Use Case Diagram. Image drawn with Sketch.io

The Use Case diagram recognizes four types of users on the system:

The Graduate- The major responsibility and privilege of this user is limited to Registration, verification of owned certificates, access to certificates in its record history, and ability to send and receive messages from the admin.

Recruiter/Organization- The functionalities enabled for this category of user includes Certificates verifications, send, and receive messages, as well as payments upload. The payment upload feature is currently inactive as there was no payment integration done on the system currently.

Official- The official user of the application can validate and search records, send and receive admin messages, and registration on the platform.

Admin- The admin user maintains all CRUD-related privileges, which includes: Users registration, Institution registration, payment managements, views certificates records.

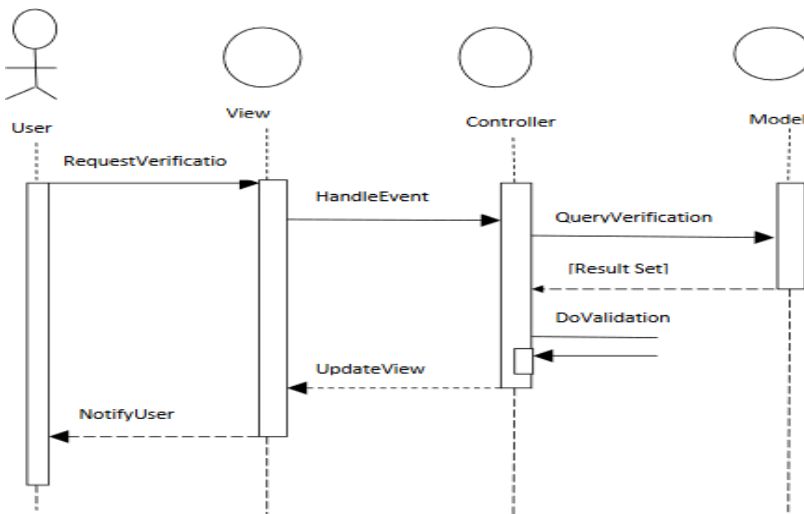


Figure 3.1: Sequence Diagram of the proposed verification system.

3.5 DATABASE DESIGN

The data in the system has to be stored and retrieved from database. Designing the database is part of system design. Data elements and data structures to be stored have been identified at analysis stage. They are structured and put together to design the data storage and retrieval system. The database that was implemented in this study is based on relational database approach. Data conceptual schema, the data required for the development of the proposed system is illustrated below.

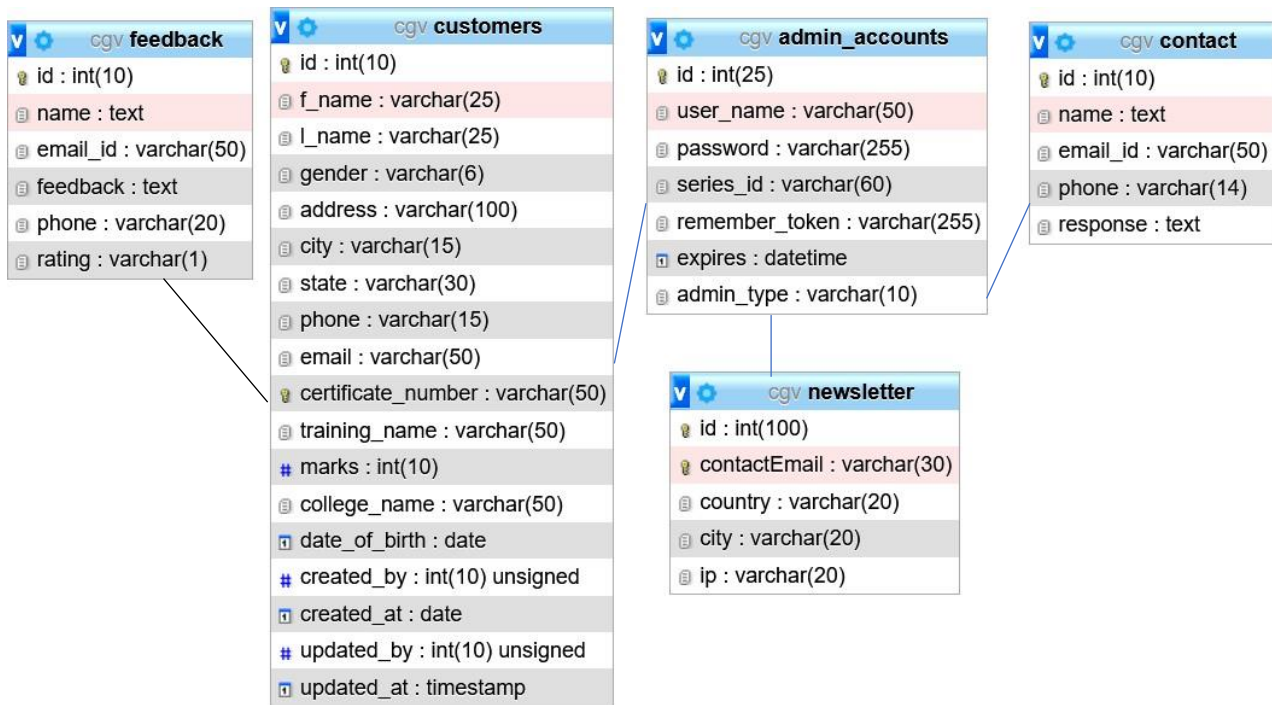


Figure 3.3: Database Schema for the proposed system

3.6 SYSTEM REQUIREMENT

System requirement is a description of the needs of a user for an information system. The unique requirements of a user are identified here. Documentation of requirements includes identification of requirements and software and system requirement specification (Nuseibeh & Easterbrook, 2000). The analysis involves gathering considerable amount of information. System analyst obtains information from people who will use the system, either by interviewing them or by watching how they work.

3.6.1 Functional Requirements

Functional requirements are the requirements that identify the function of the systems (Chung, 2012). In other word, functional requirements are the specific statements that the system should provide and how it should react to particular inputs.

Graduates/Certificate Owners

- Users shall be able to login
- Users will be able to request verification and receive the feedback in form of a certificate result.
- Users will be able to reprint valid certificate with valid certificate number.

Administrator

- Administrator shall be able to login and manage the user's account and their privileges/roles.
- Administrator shall be able to perform all privileged CRUD operations
- Shall be able to create admin (officials) users.

Officials

- Officials will be able to verify the uploaded certificates.
- Manages the certificates.
- Uploads the certificates records in the system.

Organization/Recruiter/Verifier

- Can check the certificate records of uploaded certificates.

Generally, the system shall be able to login, handle exceptions, responsive to device display, register Organizations, manage their organizations, add students, and upload the student's certificates. The system shall allow institution to make request for verification and get reply.

3.6.2 Non-Functional Requirements

Non-functional requirements define criteria that can be used to evaluate a system's performance rather than a specific behavior. A methodical and practical strategy to incorporating quality into software applications is presented in Non-Functional Requirements in Software Engineering (Chung, 2012). The system shall be able search the database for academic certificates and give feedback by comparing the record set in the database and the data given by a user to the system.

- The system shall provide appropriate views for the user to make request for verification.

-System shall provide an interactive interface so that the users can integrate with it easily.

-system should be made available over the cloud computing environment such as over the internet so that it can be accessed at any location. This can be easily achieved by integrating it into the university's existing online platform.

CHAPTER 4

SYSTEM TESTING AND IMPLEMENTATION

The project's implementation stage is when the theoretical design is transformed into a functional system, instilling confidence in the new system's ability to function successfully and efficiently among users. It entails meticulous planning, research into the existing system and its implementation limitations, design of transitional methods, and evaluation of transitional methods. Other than planning, the main tasks involved in getting ready for deployment include user education and training. Making a plan to implement the system is the first step in the implementation process. This plan specifies the actions to be taken, the resources and equipment to be discussed, and the additional equipment to be purchased in order to implement the new system. There is no need for additional resources with a network backup system.

The system behaved very normal while the php engine was serving the application. A screenshot of the system application performance was also taken while running the application as the only thread and tab on Wave browser. The result of the performance is shown in the image below:

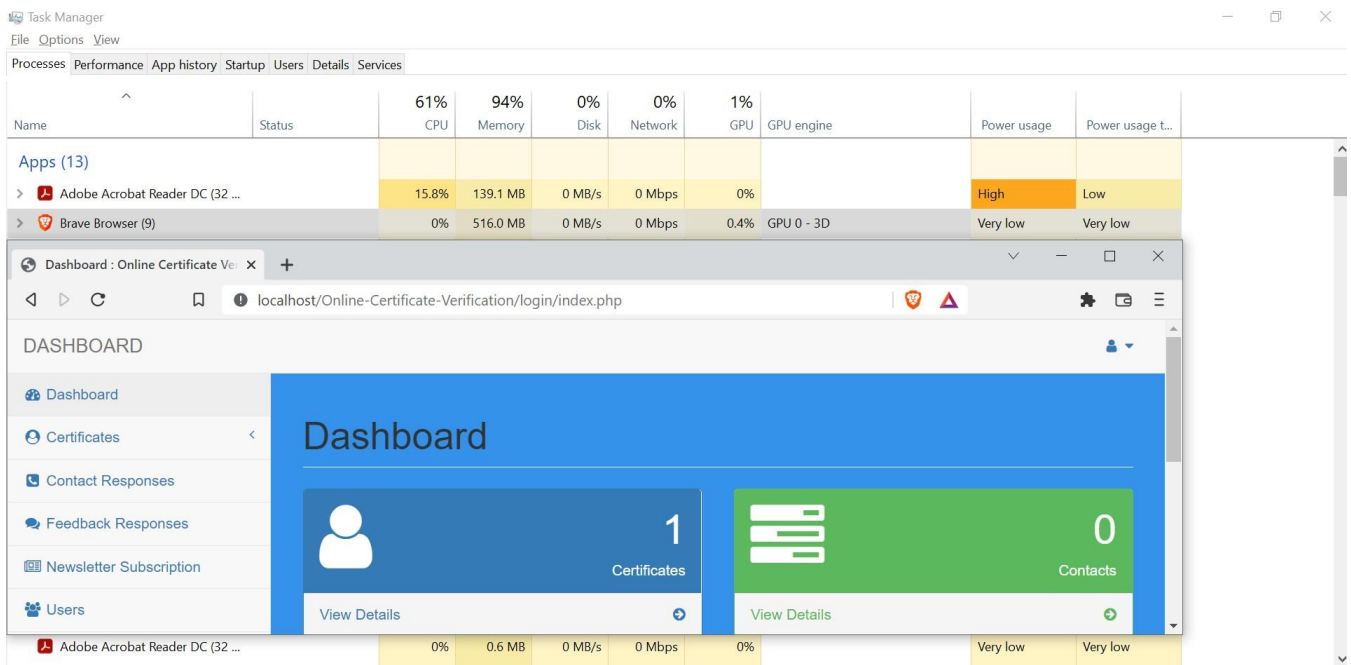


Figure 4.0: System performance indicating only 516mb Memory consumption, and Very Low Power usage.

4.1 USER TRAINING

One of the most crucial duties for the developer is to train the user after the system has been effectively implemented. For this purpose, Documentations and Readme files are prepared and handed over to the users to operate the developed system. Thus, the users are trained to operate the developed system. Both the hardware and software securities are made to run the developed systems successfully in future. In order to put new application system into use, the following activities were taken care of:

- Preparation of user and system documentation
- Conducting user training with demo and hands on
- Test run for some period to ensure smooth switching over the system

The users are trained to use the newly developed functions. All users are provided with user guides outlining the steps for using the functions featured on the menu. The system is confirmed to be implemented in accordance with user needs and expectations.

Generally, the application was run on a Core i5, 256GB SSD, and 2.4GHz processor laptop and it runs smoothly without any lagging or excessive resource utilization. This means the application passed User testing.

4.2 SECURITY AND MAINTENANCE

In this usage, maintenance refers to returning something to its original state. Insofar as adjustments are required to maintain satisfactory operations in light of changes in the user's environment, maintenance comes after conversion. Maintenance frequently entails making minor improvements or fixing issues that arise during system operation. Additionally, maintenance is carried out depending on resolving identified issues, updating the software's interface with other applications, or upgrading the software's hardware.

Any system that is created should be safe and shielded from potential risks. At many levels, security mechanisms are offered to prevent unwanted access to the database. Password protection and simple procedures to prevent the unauthorized access are provided to the users. The system allows the user to enter the system only through proper username and password.

4.3 OUTPUT DESIGN

Designing computer output should proceed in an organized, well throughout manner; the right output element is designed so that people will find the system whether or executed. When we design an output

we must identify the specific output that is needed to meet the system. The usefulness of the new system is evaluated on the basis of their output.

Once the output requirements are determined, the system designer can decide what to include in the system and how to structure it so that the required output can be produced. For the proposed software, it is necessary that the output reports be compatible in format with the existing reports. The output must be concerned to the overall performance and the system's working, as it should. It consists of developing specifications and procedures for data preparation, those steps necessary to put the inputs and the desired output, i.e., maximum user friendly. Proper messages and appropriate directions can control errors committed by users.

The output design is the key to the success of any system. Output is the key between the user and the sensor. The output must be concerned to the system's working, as it should.

Output design consists of displaying specifications and procedures as data presentation. User never left with the confusion as to what is happening without appropriate error and acknowledges message being received. Even an unknown person can operate the system without knowing anything about the system.

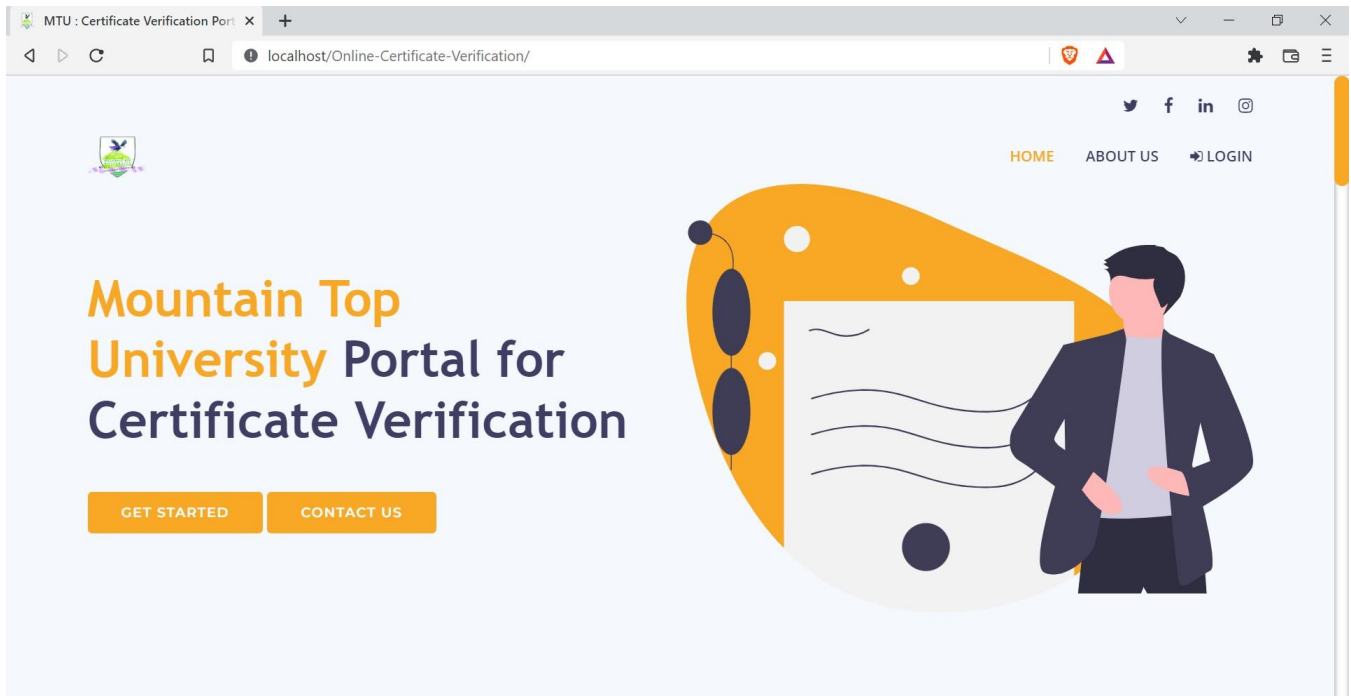


Figure 4.1: System Home page accessed via ... <http://localhost/Online-Certificate-Verification/>

System Home Page: The system home page is the first page you get to when you try to get access to the system. The system home page consists of the navigation menu which consist of the About us page, and the login page.

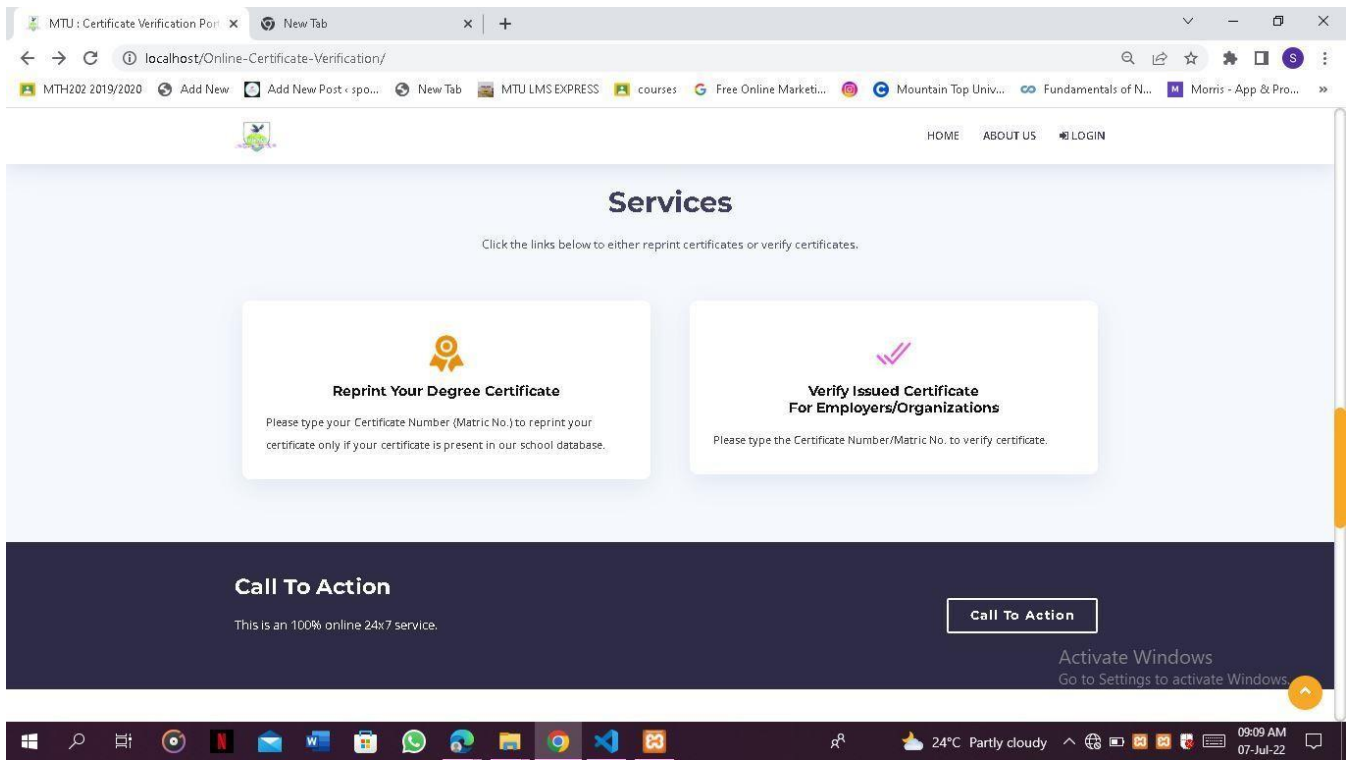


Figure 4.2: System service page accessed via ... <http://localhost/Online-Certificate-Verification/>

Service Page: The service page tells us about what the system does for you as the user and certificate verifier such as reprinting of certificate and verifying of issued certificate for employers and organizations.

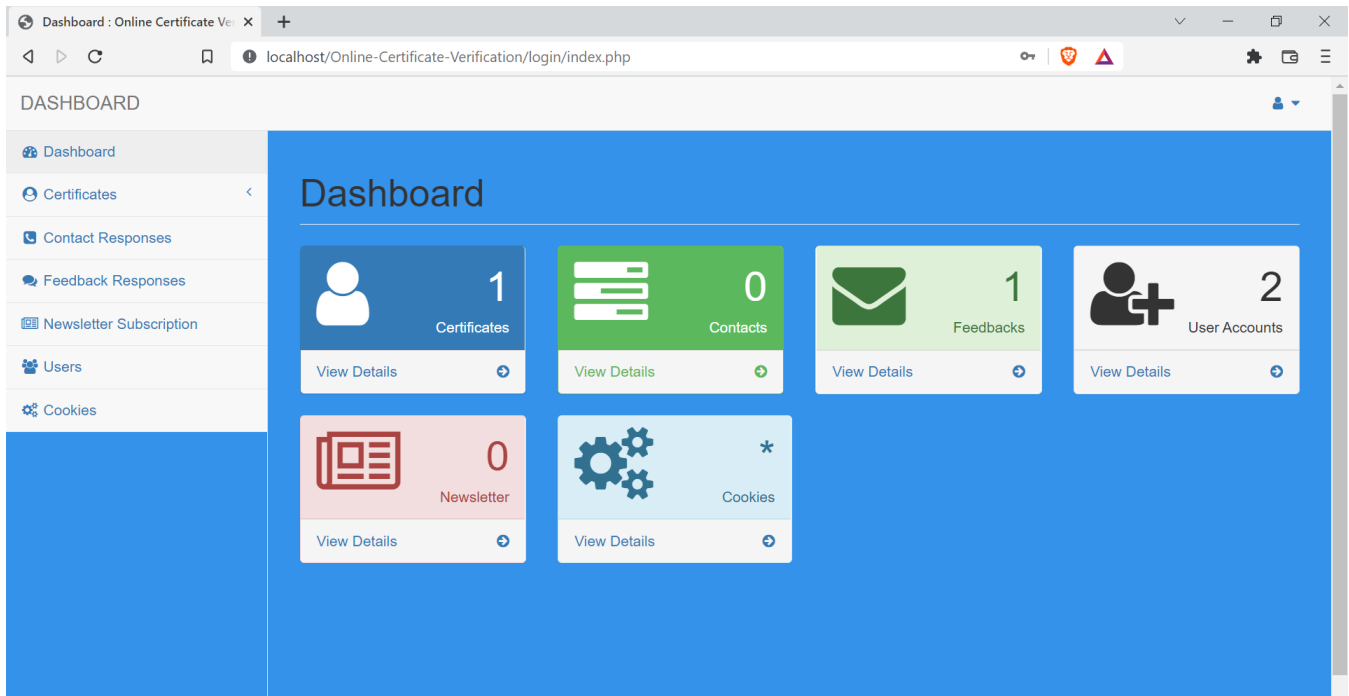


Figure 4.3: Admin Dashboard accessed via... <http://localhost/Online-Certificate-Verification/login/index.php>

Admin Dashboard: The Dashboard for the app gives visibility to the admin user to see all CRUD functionality from a single view on the dashboard.

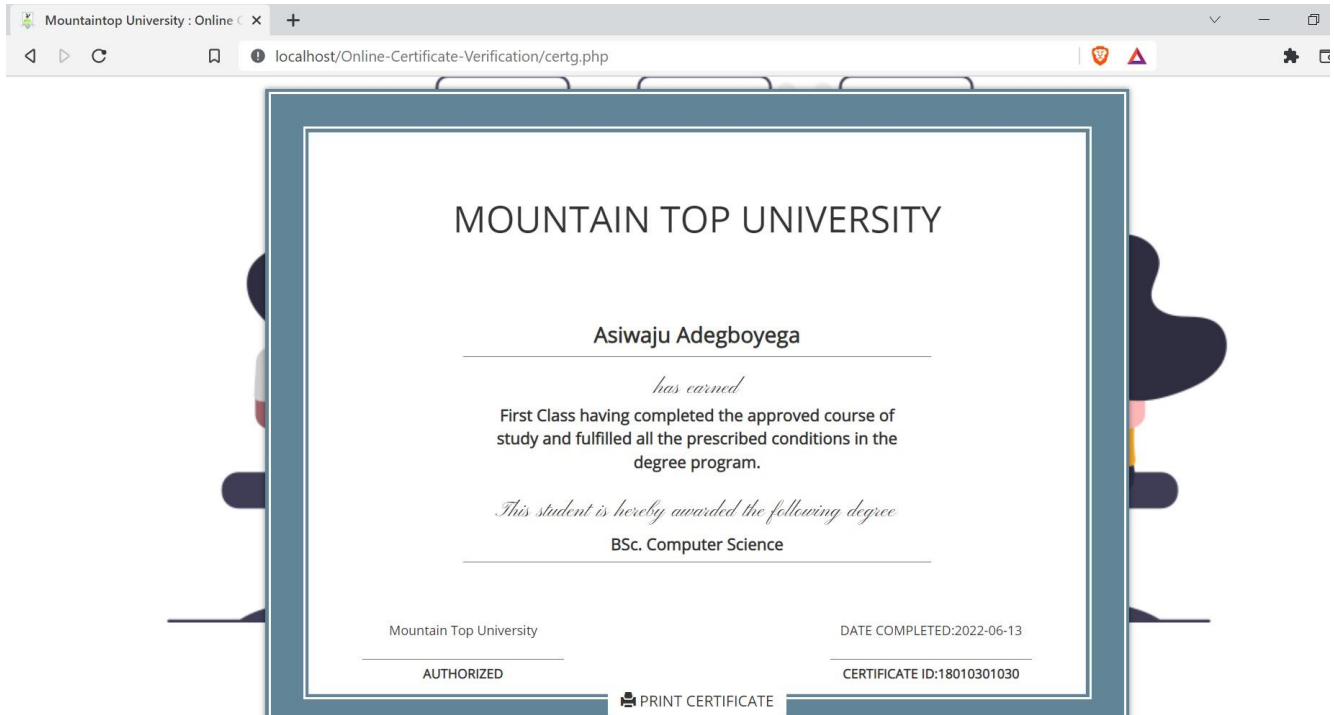


Figure 4.4: Certificate Generation page

Certificate Generation page: The Certificate generation page generate a digital certificate verification and printing.

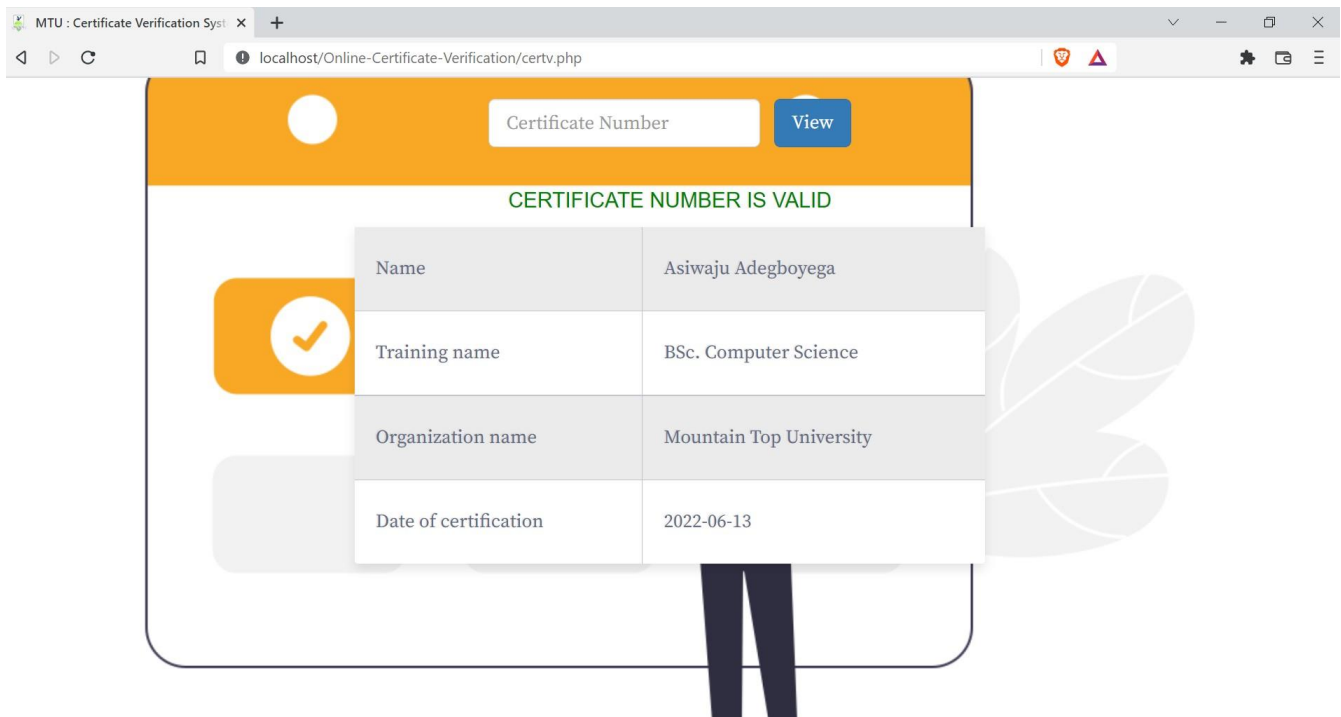


Figure 4.5: Official Certificate verification page showing Validated result from a certificate number.

Certificate Verification Page: Certificate verification page show if the certificate is valid using the certificate number provided. Displays Invalid certificate number if the number cannot be found on the database.

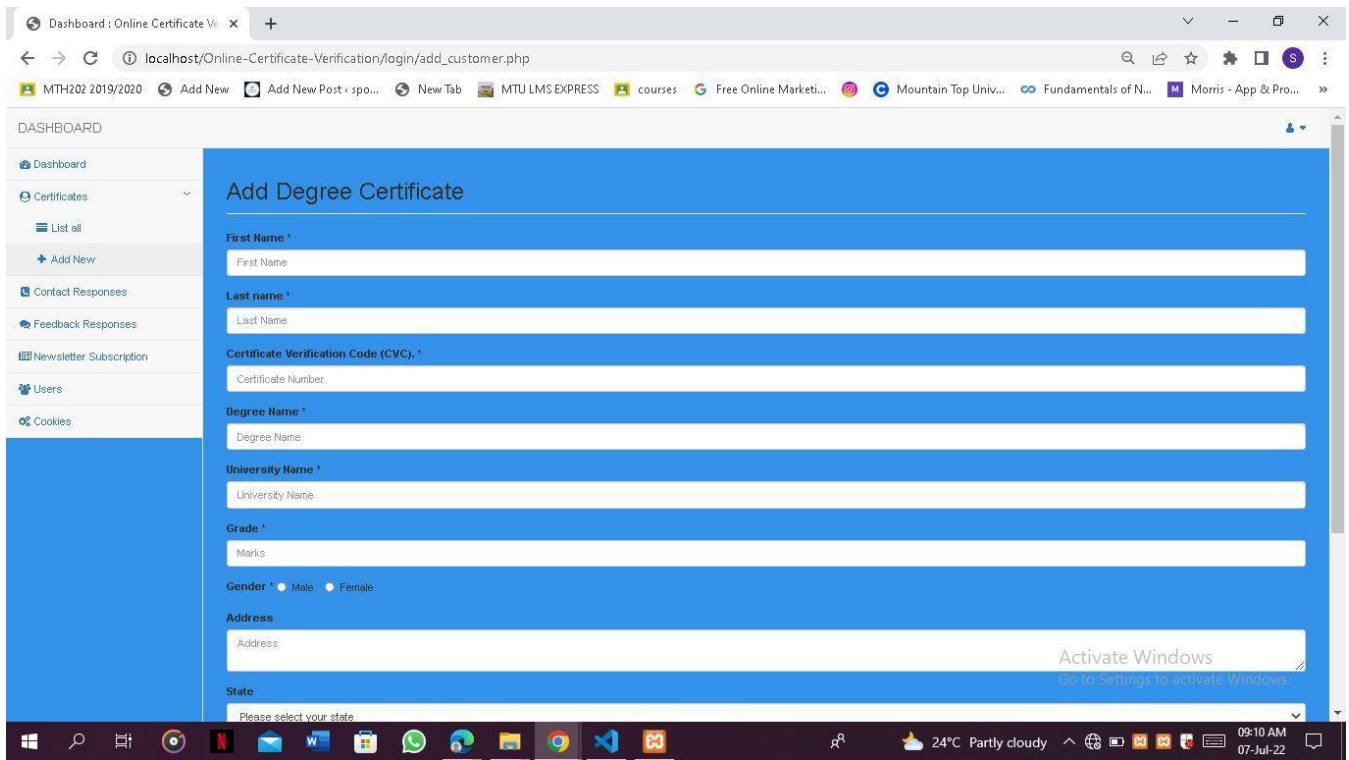


Figure 4.6: Add degree certificate page

Add Degree Certificate Page: The add degree certificate helps us to input the details of all certificates holders on the system including their certificate verification number, degree graduated with and address.

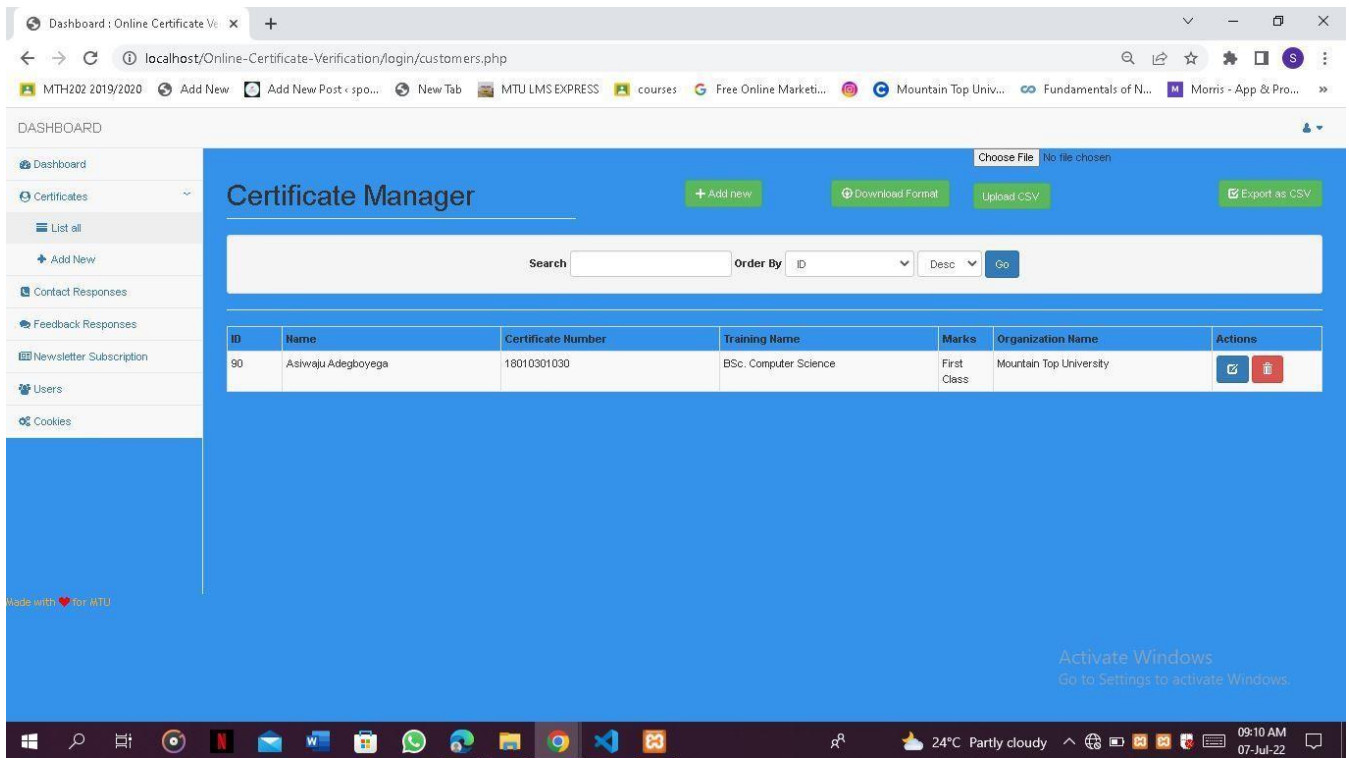


Figure 4.7 Certificate Manager Page

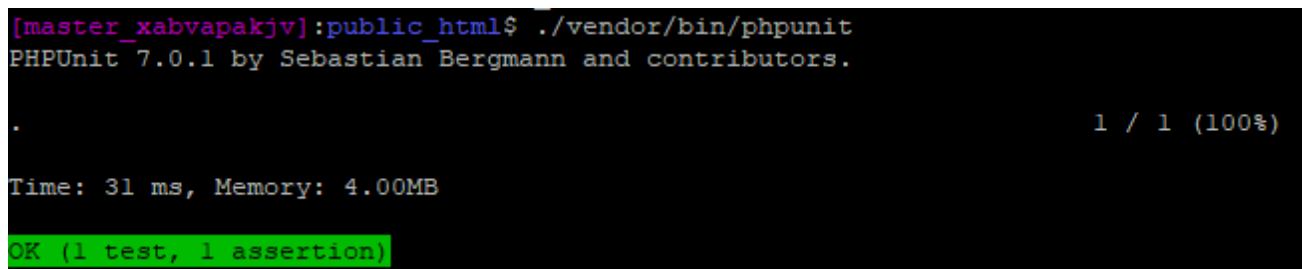
Certificate Manager Page: The certificate manager page helps us to manage all the certificate on the system by showing the number of certificates on the system. It allows the editing of certificate details and their deletion.

SYSTEM TESTING

System testing is the stage of implementation, which is aimed at ensuring that the system works accurately and efficiently before live operation commences. Testing is the process of executing the program with the intent of finding errors and missing operations and also a complete verification to determine whether the objectives are met, and the user requirements are satisfied. The ultimate aim is quality assurance.

4.4 UNIT TESTING

The software units in a system are modules and routines that are assembled and integrated to perform a specific function. Unit testing focuses first on modules, independently of one another, to locate errors. This enables, to detect errors in coding and logic that are contained within each module. Outcome of the unit testing code done using phpunit is shown in the figure4.4.



```
[master_xabvapakjv]:public_html$ ./vendor/bin/phpunit
PHPUnit 7.0.1 by Sebastian Bergmann and contributors.

.                                                                    1 / 1 (100%)

Time: 31 ms, Memory: 4.00MB

OK (1 test, 1 assertion)
```

Figure 4.8: Passed unit test done for the Document and certificate verification system.

4.5 INTEGRATION TESTING

Data can be lost across any interface, one module can have an adverse effect on another, sub functions when combined, may not produce the desired major functions. Integration testing is a systematic

testing to discover errors associated within the interface. The objective is to take unit tested modules and build a program structure. All the modules are combined and tested as a whole. Here the Server module and Client module options are integrated and tested. This testing provides the assurance that the application is well integrated functional unit with smooth transition of data.

4.6 USER ACCEPTANCE TESTING

The most important element in any system's success is user acceptance. By regularly communicating with system users while it is being developed and making adjustments as needed, the system under consideration is tested for user acceptance.

CHAPTER 5

RECOMMENDATION AND CONCLUSION

Based on the user's requirements, an analysis of the current system, and the ability for future improvement, this project was constructed mostly utilizing PHP and MySQL.

Modern software's increased functionality necessitates a suitable methodology for software development. This Document and certificate verification system is designed for organizations who want to validate or verify authenticity of students' certificates for the purpose of recruitment and other related employers-employees relationship. For the past few years, the number of educational institutions are increasing rapidly in Nigeria. Thereby the number of certificates to verify are also increasing for institutions. And hence there is a lot of strain on the authorities and organizations to be sure of the genuineness of certificates that are issued from institutions. This project specifically addresses the issues and stress related to handling issues that arise when things are done manually.

After identifying the shortcomings of the current system, a computerized system that is more user-friendly and incorporates accessibility principles into its user experience is designed to be compatible with the present system.

This system has been fully designed and developed, in such a way that it should be recommended for full utilization of its resources across the Mountain Top University and can be extended to accommodate payment integrations and opensource to other schools in Nigeria.

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