INTRODUCTION

Background of the Project

In this new era of modern technology where every transaction is only on the tip of our fingers, progressive development and innovations in information and communications technology (ICT) have been rapidly manifested worldwide. The electronic application in various transactions within the government and private educational institutions, multinational and even local small-scale companies and industries are increasingly adapted due to the growing demand of people's needs.

Web browsers such as Firefox and Internet Explorer are the means to deliver the information on a webpage, the basic foundation of a website which has the basic structure (architecture) written in web Program. Nowadays information age, the majorities of organizations have a website with their policy and their artifact and service information. It is perhaps the mainly economic and the most suitable way to disseminate information and data all over the world (Tupas, 2015).

For years in the past and up to the present times, some of the higher educational institutions (HEIs) in the Philippines are globally competing, establishing linkages abroad and adopting technologies from various institutions worldwide. The adopted technologies were then applied to hasten the academic transactions. These technologies also require huge funding, so HEIs are eager to extract and slice up budget from their school funds just to cope up to these

needs. At present, many HEIs are in their advanced and upgraded status in terms of computerized and web-based academic transactions. Some HEIs are still on the process of developing their computerization processes, while others still manually do the jobs.

One of the HEIs in need to having a computerized transaction is the Notre Dame of Midsayap College. NDMC is a member of Philippine Association of State Universities and Colleges (PASUCs) which was established in the heart of Northern Mindanao specifically located at Quezon Avenue, Poblacion 5, Midsayap, Cotabato. Due to its growing student populace, the institution is in need of faster and efficient electronic transaction to accommodate its clients; one of these transactions is the clearance of the students.

A clearance is a certificate giving permission to disengage from an institution (Agbo-Ajala, Makinde, 2015). In NDMC, the clearance is a system or method of checking the students' liabilities at certain offices in the campus before permitted to graduate or to enroll on the succeeding year. The college is still using manual system of student clearance where each student is required to visit the designated offices stated in the clearance form in order to acquire signatures. Once the designated signatures are completed, the student is permitted to enroll for the next semester. The manual clearance system has been a problem and headache of many students at the end of every semester due to its time, money and energy consuming aspect.

Hence, to resolve the long-term dilemma faced by the institution, a Secured Web-based Student Clearance System intended for NDMC is

implemented. The system will benefit much the stakeholders such as the students, faculty and administration of the institution in addressing the problem; hasten up the transactions efficiently and effectively; uplift the knowledge and positively expose the stakeholders to the advance technology at present.

The study on online clearance system is not a novel thing anymore. It has been studied and implemented already in other countries and some universities/ schools in the country to resolve the problems and issues faced by the different sectors such as the academic institutions regarding the manual clearance system. With the same dilemmas and concerns faced by the latter, this study is formulated to develop a web-based system for the purpose of addressing the tedious and stressful problems on manual clearance system of the NDMC students.

Likewise, the main objective of this project is to provide solution to the long-time quandary of manual clearance among the students. Another purpose of this study is for the benefit of the faculty and office staff designated to sign the hard copy clearance form. They can clear and lift students' liabilities seen on their computer monitor can be cleared by just a click of a mouse button.

This capstone project is limited to the development of a secured web-based student clearance system intended for the students of NDMC. Additional stakeholders of the study are the faculty and staff of the institution.

Moreover, the main feature of this project is to provide the Security encryption for data transport and two-factor authentication.

Software prototyping with extreme programming approach is the prescribed model or guideline technique used for the development of this project. The system to be developed will be carried out through the use of Hyper-text Transfer Protocol (HTTP), Hypertext Pre-processor (PHP), Sublime editor, Bootstrap and MySQL as the database tool.

RELATED LITERATURE

Student Clearance

Anigbogu's study (as cited by Umezinwa Chukwuebuka Ben, et.al, 2015) states that clearance is a status granted to individuals, typically members of the military, university graduates and employees of government and their contractors, allowing them to classified information. According to Agbo-Ajala and Makinde (2015), clearance is a certificate giving permission for something to be done. In a higher institution of learning, final year students that have satisfied the academic requirements to graduate must undergo a clearance process before they disengage from the university. A student is allowed to collect his/her graduation certificate only after he/she has been cleared.

Manual Student Clearance

Traditional Clearance forms are provided by university institutions to graduating students, which have to be taken in hard copy to the different offices for signing and when duly signed, confirms that the student has fulfilled all requirements and is not indebted to any of the departments or units that the student was associated with within the institution. This approach has been found to be time consuming as the students have to physically visit each office (Idachaba, et.al, 2015).

In the case study performed by Umezinwa, Uwakwe and Abode (2015), the clearance system of Imo State University in Nigeria was a manual one which makes the system so tedious and time consuming. In the said university

the students have to visit all the clearance offices with a form for them to sign. The student will only be cleared once the forms are signed of which the procedure would take some months to be completed. This would only bring a lot of stress to both staff and the students involved.

According to Usman, Olusanya, and Adedeji (2016), in the manual system, the clearance forms are documented in a file cabinet. Each time the clearance form is needed, a search operation is conducted on the file cabinets to locate a particular student's clearance form. To alleviate this problem, there is need to develop an efficient web-based platform that is reliable and cost-effective, which can manage the process efficiently.

Online Student Clearance

Online clearance system is a research work that will help build an effective information management for schools. It is aimed at developing a system for making clearance after graduation. The designed software will serve as a more reliable and effective means of undertaking students clearance, remove all forms of delay and stress as well as enable you understand the procedures involved as well as how to do your clearance online (Umezinwa Chukwuebuka Ben, et.al, 2015).

Web Development

Web development is developing the business identity on the web. It is creating a synergetic effect between both facets of your business - online and offline. It is using the successful combination of graphic design, copywriting,

programming, usability, human computer interaction, and online marketing skills to develop and execute a successful project on the web. A successful web development company will find the balance and make it all work (Tupas, 2015).

As cited by Tupas (2015) from Turc, T., Gligor, A. (2011), web services are applications provided by service servers. The use of Web services implies the use of simple protocols that are easy to implement in comparison with other methods.

Web Portal Applications

A web portal is a website that brings information from diverse sources in a unified way. Usually each information source gets its dedicated area on the page for displaying information (a portlet); often, the user can configure which ones to display. Apart from the standard search engine feature, web portals offer services such as email, news, stock prices, information and databases, and entertainment (Idachaba, et.al., 2015).

Web API

A Web API would provide an interface where both components server (***Simone***) and client side (***web-based clearance***) could evolve independently. Web API is a software interface exposed on the Web using Hyper Text Transfer Protocol (HTTP) and is used for developing Web applications accessible via the website. Web APIs give freedom and flexibility in customizing a Web application. In addition to that, Web API is a software interface exposed to the Web over

Hyper Text Transfer Protocol (HTTP). Web APIs are used for developing Web applications accessible via the website.

Furthermore, API provides an interface for developers to build a software application for colleagues, partners, or third-party developers. It allows developers to access data and services to build applications.

HTML, PHP, and MySQL

Hypertext Mark-Up Language (HTML) is a language that specifies how a webpage is to be displayed in a browser. It is used to create documents that can be accessed over the web. This is used to control the appearance of the web page and content. Hypertext Preprocessor (PHP) is a server-side scripting language designed specifically for the web. The PHP code is interpreted at the server and generates HTML or other output that the visitor will see. It runs on the web browser and not on the web server. PHP is a server side HTML embedded scripting language for creating dynamic web pages. MySQL Database is a very fast, robust, relational database management system (RDBMS). MySQL server controls access to your data to ensure that multiple users can work with it concurrently. It runs on a server daemon where users on the same or even remote computers can connect (Idachaobablba, et. al, 2015).

Software Firewall

According to Okonigene Robert, E. and Ikhajamgbe, O. (2009), the software firewall system has the following description; it accepts inbound

network traffic and analyzes the following: IP source address, Protocol destination address, Protocol (TCP or UDP), and ICMP message type. We applied the policy table probe on the traffic information. Software firewall process also determines whether the inbound or outbound traffic should be allowed or denied.

Two-Factor Authentication

Two-factor authentication is an information security in which two means of identification are combined to increase the probability that an entity, commonly a computer user, is the valid holder of that identity.

As cited from Monisa, N. et. al, (2017), they concluded that “two-factor verification does enhance security, it also builds client resistance. Integrated two factor authentication gives the best convenience to better security, so a two-factor confirmation innovation that can be moved up to coordinate the two elements all the more nearly has the best capacity to become as requirements change and also to amplify client uptake of discretionary two-factor authentication. As the confirm mechanism for authentication our view can be suitably and securely used. The fundamental thought is that using our proposed two factor authentication will provoke more essential security.”

Moreover, Vaithyasubramanian, S. et. al. (2015) said that, the two-factor authentication system is a user friendly approach and require memorability of both authentication passwords. The goal of computer security to maintain the integrity, availability, and privacy of the information entrusted to the system can be obtained by adapting this authentication technique.

SQL Injection

SQL injection is a technique that exploits a security vulnerability occurring in the database layer of an application. This attack is possible when the user input is not filtered by the script and passed into an SQL statement (Shanmughaneethi, V. & Swamynathan, S. 2012).

Furthermore, SQL injection attack (code injection) is the most common and easiest type of vulnerability technique adopted by the web attackers through data-driven web applications. By using simple SQL commands such as Select, Where, Insert, Delete and Update, the malicious attackers efficiently re-structure the actual SQL code (statements) and executes vulnerable code into the web applications (Kanchana, N. & Sarala, S. 2012).

Hence, to resolve this concern, “The implementation of the SQL-injection free technique has been done under Java Programming Language, Php programming language and Structured Query Language. The proposed technique is generic in any web applications and it is language independent, can be implemented in any programming language. Source code analysis plays a major role in the detection of SQL injection attack.” “This technique uses the same approach and it lies with source code analysis and procedures followed to detect SQL-injection attacks” (Kanchana, N. & Sarala, S. 2012).

Secure Sockets Layer (SSL)

According to Prabhjot, Kaur and Gurjeet, Kaur (2017), the Secure Sockets Layer (SSL) protocol is the most popular protocol used in the Internet

for facilitating secure communications through authentication, encryption, and decryption. SSL protocol also uses a combination of public-key and symmetric-key encryption to secure a connection between two machines that can be a Web or mail server and a client machine, communicating over the Internet or an internal network. An organization needs to install the SSL Certificate onto its web server to initiate secure sessions with the browsers. Once installed, it is possible to connect to the website over the domain as this tells the server to establish a secure connection with the browser. When SSL Certificate is installed on any of the web servers, it activates the padlock and the https protocol and allows secure connections between web server and a web browser.

Furthermore, as cited from Tulika, S., and Shweta, S. (2016), SSL is a standard security technology for establishing an encrypted link between a server and a client—typically a web server (website) and a browser, or a mail server and a mail client.

METHODOLOGY, RESULTS AND DISCUSSION

Requirements Analysis

In this context, Table 1 shown below is the matrix of roles of the designated offices to both graduating and non-graduating students of the current existing manual student clearance system of NDMC. The student clearance form (see Appendix D) contains blank spaces corresponding the designated positions of persons in certain offices wherein they can sign once the student is cleared from his/her responsibilities. The persons in-charge of signing the student clearance are the Graduating Class Association (GCA) Treasurer, Laboratory Custodian, Cashier, Librarian, Academic Related Services (ARS) Director, SPEED Director, Department Chairperson, College Dean, and the Registrar.

Table 1. Matrix of the designated offices in the current clearance system

Students	**Student clearance form**								
	Cashier	**ARS/GCA**	**LabCust**	**Library**	**SPEED**	**LSG**	**Dept. Chairman**	**DEAN**	**Registrar**
Graduating NON-Graduating	Check all unpaid balance	1. OR number of Grad fees **N/A**	1. Check the borrower s book **N/A**	Check the borrower s book	Check the borrower s book **N/A**	1. Check the list of unpaid requirement s and fines	Check if there is an initial by the LSG	Check if already signed by the Dept. chairman	Verify if all signed by the designate offices

Graduating Student Clearance System

Figure 1 shows the process flow of the clearance system for the graduating students. The clearance of the graduating students can only be acquired from the Cashier Office, where they need to settle first their financial liabilities. On the other hand, the graduating students with scholarship can acquire the clearance from the Assessment Office. Basically, as what has been practiced in the institution, the department chairperson will only sign the clearance once it contains the signatures from the Local Student Government (LSG) and Supreme Student Government (SSG) when they are already cleared from their liabilities.

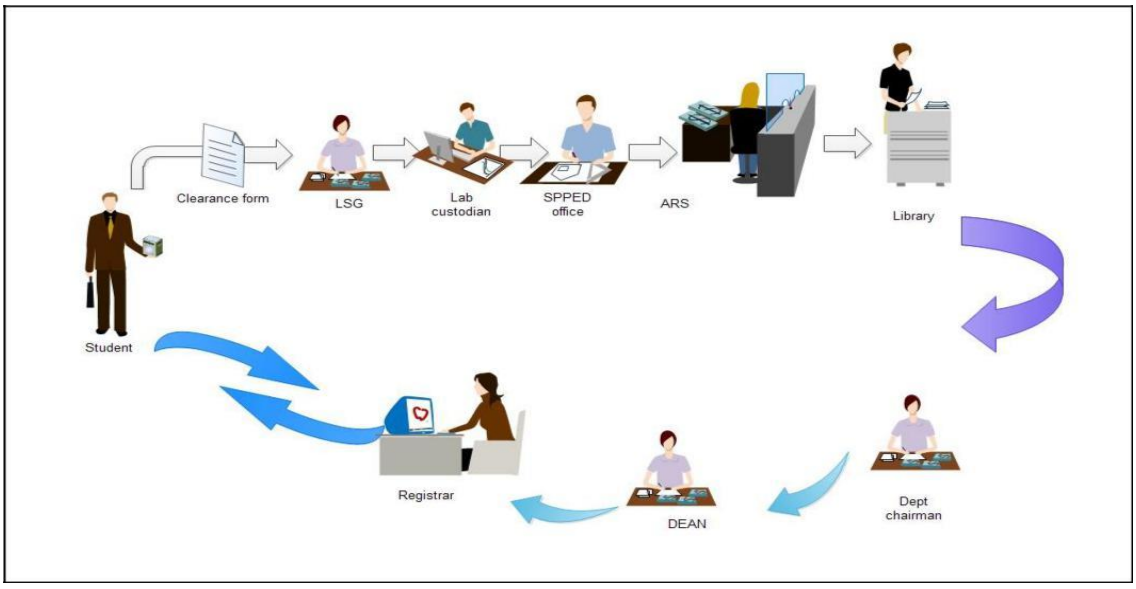

Figure 1. Process flow of the clearance system for the graduating students

Similarly, the college dean will only sign the student clearance if it is already signed by the department chairman. At that point, the registrar is the final step in the form where it can only be evaluated and signed by the College Registrar if the student has been done in gathering signatures and are freed from the liabilities from the preceding designated offices.

Clearance is being requested by the graduating student for the Transcript of Records and Diploma purposes.

Non-graduating Student Clearance System

For the non-graduating students, issuance of the clearance is being requested for the purpose of acquiring final grades required for the next semester's enrolment. Unlike the graduating student clearance form, non-graduating student clearance form has only few signatories namely the Cashier, the Librarian, the Department Chairman and/or College Dean, and the Registrar as shown in Figure 2.

Similar to the graduating students, the non-graduating students who are regular in status, can only acquire the clearance form from the Cashier Office where they need to settle first their financial accountabilities. On the other hand, those who are scholars can acquire forms from the assessment office

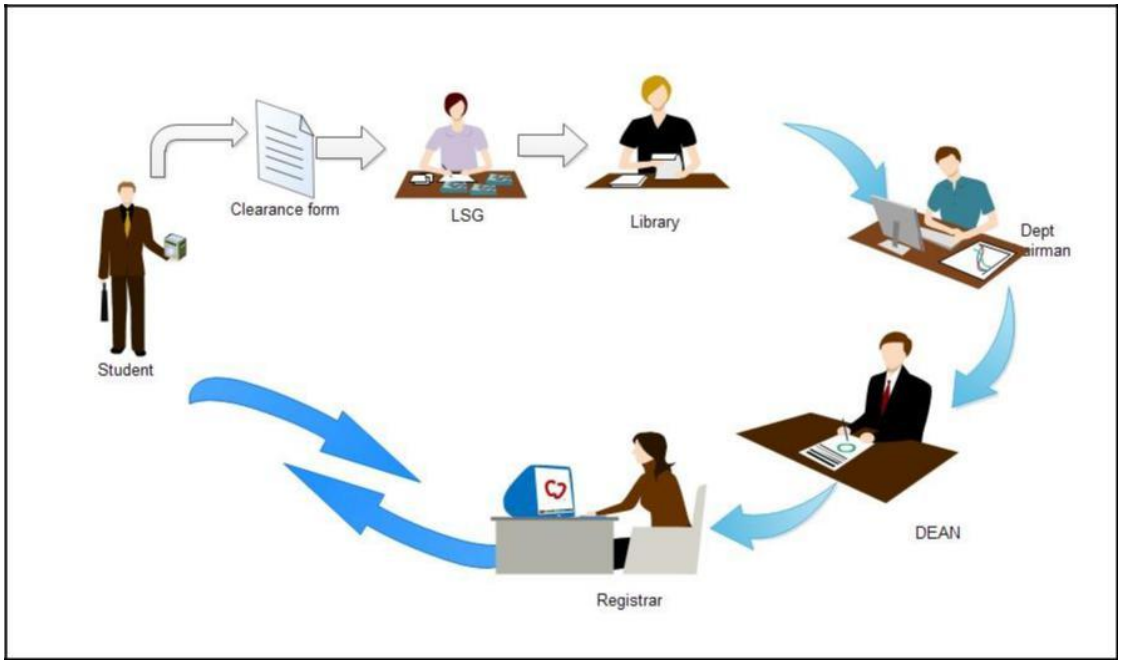

Figure 2. Process flow of the clearance system for non-graduating students.

Requirements Documentation

The Secured NDMC web-based student clearance system is designed for more convenience and efficiency of services to students as well as to the designated offices. Table 2 illustrates the function of the designated offices to the project which is applicable to both graduating and non-graduating students. The first five offices stated in the table namely; ARS/GCA, Science Laboratory, Library, SPEED, and LSG have the function of managing the students' liabilities such as payments for miscellaneous and tuition fees, graduation fees, departmental fees, other fees, laboratory and sports equipment.

Table 2. Matrix for the function of every designated offices.

Designated Offices	Designated offices function	
	Graduating	Non-graduating
ARS/GCA		
Lab	Manage student liabilities	
Custodian		
Library		
SPEED		
LSG		
Dept. Chairman		
DEAN	Verification	
Registrar		

Unlike the existing manual clearance system as shown in Table 1, in the Secured NDMC web-based student clearance system, only students with liabilities will visit the offices to lift or comply their pending status. Table 3 and Figure 3 below shows the activities of the students who have liabilities and the actions taken by the designated offices when using the said system.

Table 3. Matrix for the student who have liabilities

Students	**Students who have liabilities**									
	Online clearance	**Cashier A**	**ARS/GCA**	**Lab custodian**	**Library**	**SPEED**	**LSG**	**Dept. Chairman**	**DEAN**	**Registrar**
Graduating	Just visit the site	N/A	go directly to office	go directly to office	go directly to office	go directly to office	go directly to office	Verify on purpose only	Verify on purpose only	Verify on purpose only
Non-Graduating			**N/A**	**N/A**		**N/A**				

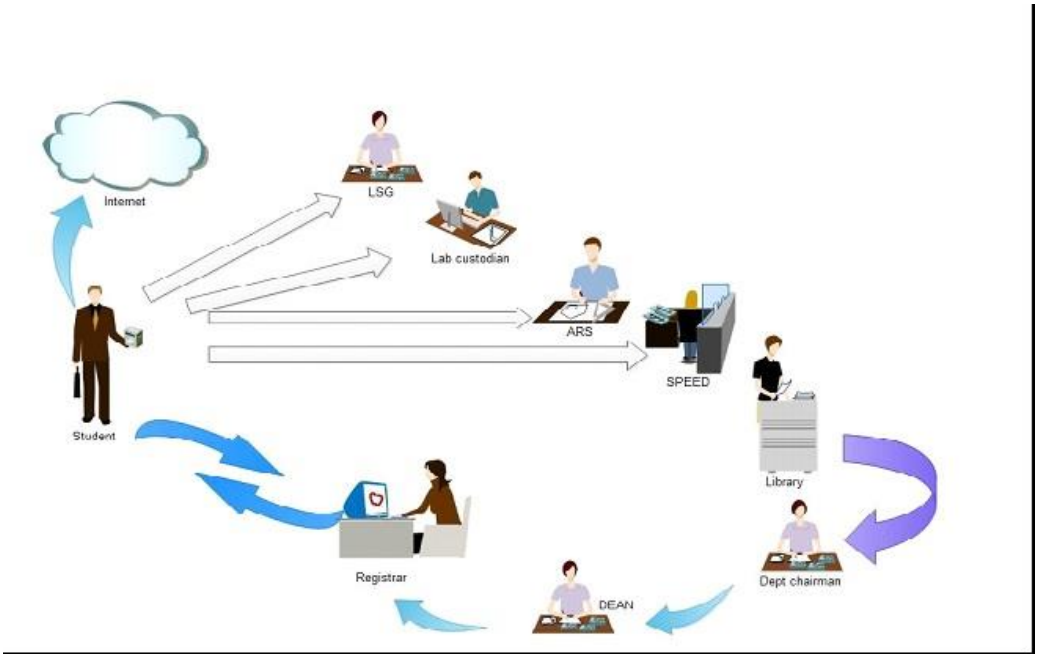

Figure 3. Process flow of students who have liabilities in the Project

The students who have no liabilities as shown in Table 4 and Figure 4 can no longer go to offices for clearance signing, they will only need to browse the Website for viewing their status. It can be seen also that the transactions involved in the system are lighter and easier as compared to the manual one.

Table 4. Matrix for the student without any liabilities.

Students	**Students without any liabilities**								
	Cashier	**ARS/GCA**	**Lab custodian**	**Library**	**SPEED**	**LSG**	**Dept. Chairman**	**DEAN**	**Registrar**
Graduating	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**			
Non-graduating							Verification purpose only	Verification purpose only	Verification Purpose Only

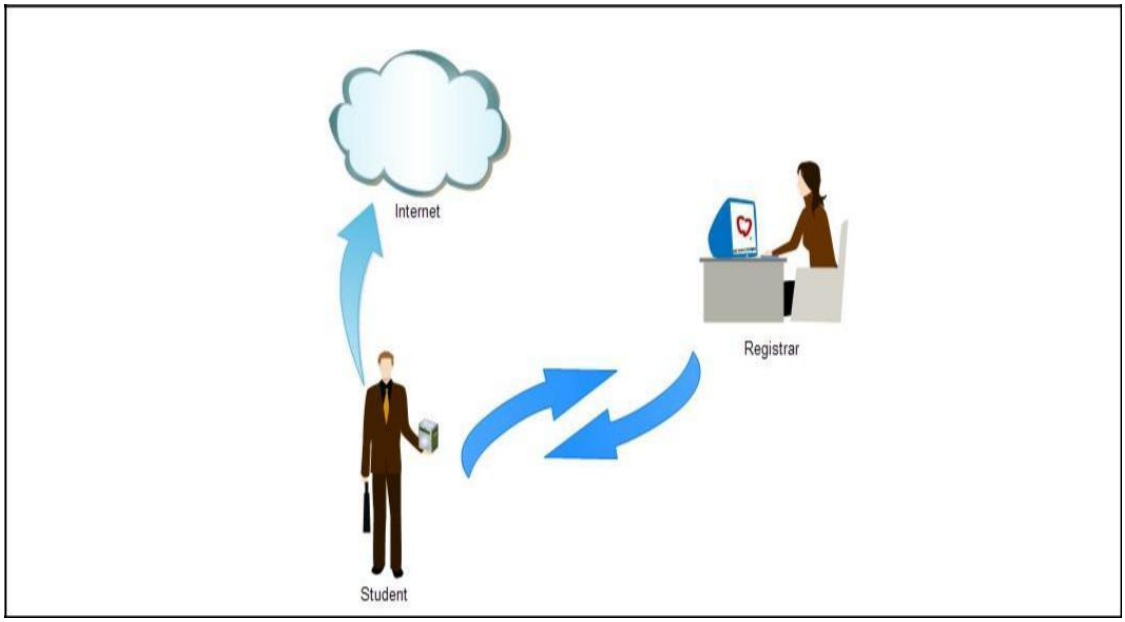

Figure 4. Process flow of students who has no liabilities in the Project

Design of Software Systems, Product and/or Process

Conceptual Framework

The conceptual framework of this project shows the overall components of input to output through the appropriate processes.

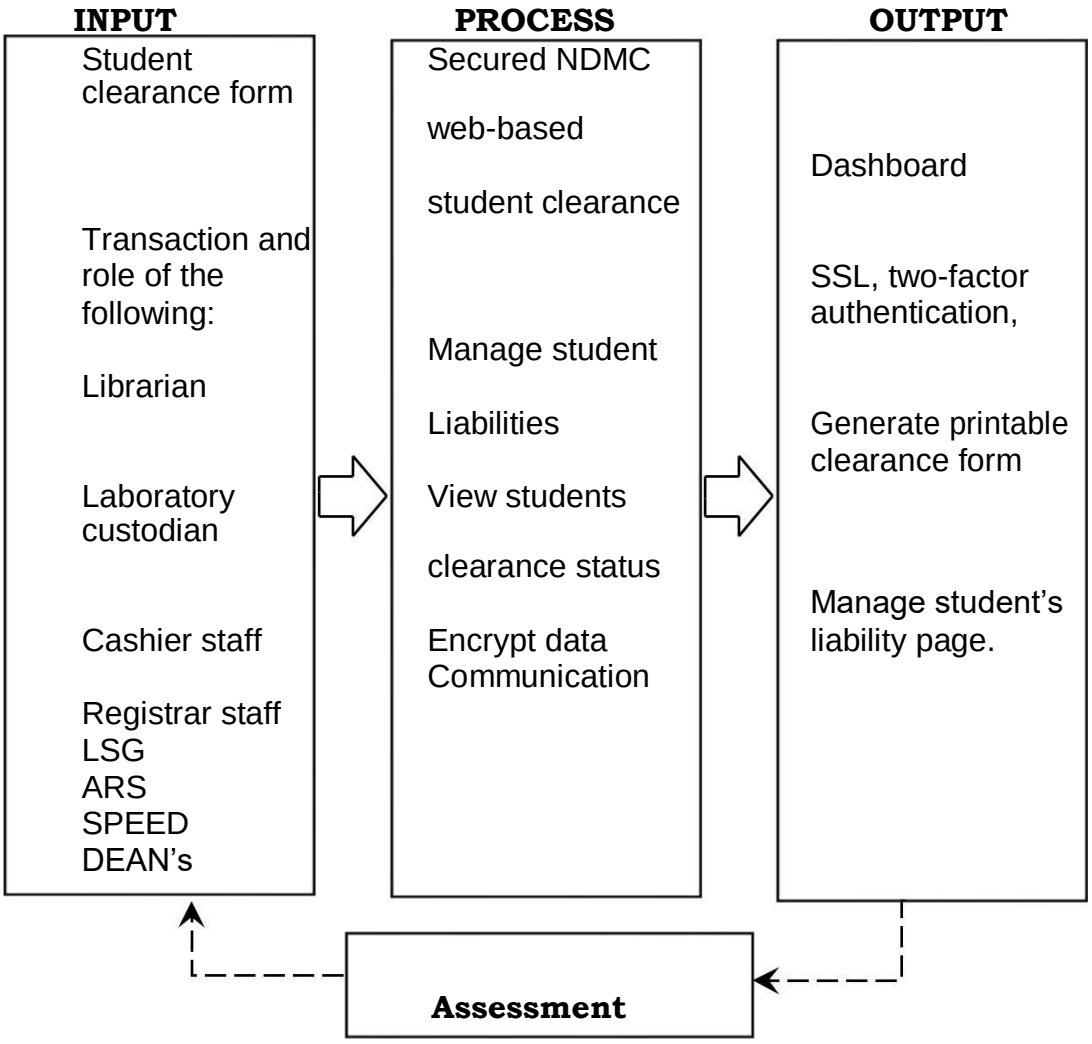

Figure 5. Conceptual framework of the Project

Figure 5 illustrates the conceptual framework of the proposed project. The conceptual framework components are as follows: (1) the Input, which involves the system requirements such as the student clearance form and the forms from the designated offices; (2) the Process, wherein it comprises the activities involved in the transaction of the system such as manage student liabilities, view students clearance status and encryption of data communication; and (3) the Output, that is the system implemented which is the secured NDMC web-based clearance system dashboard, SSL and two factor authentication, generate printable clearance form and manage students liability page.

System Architecture

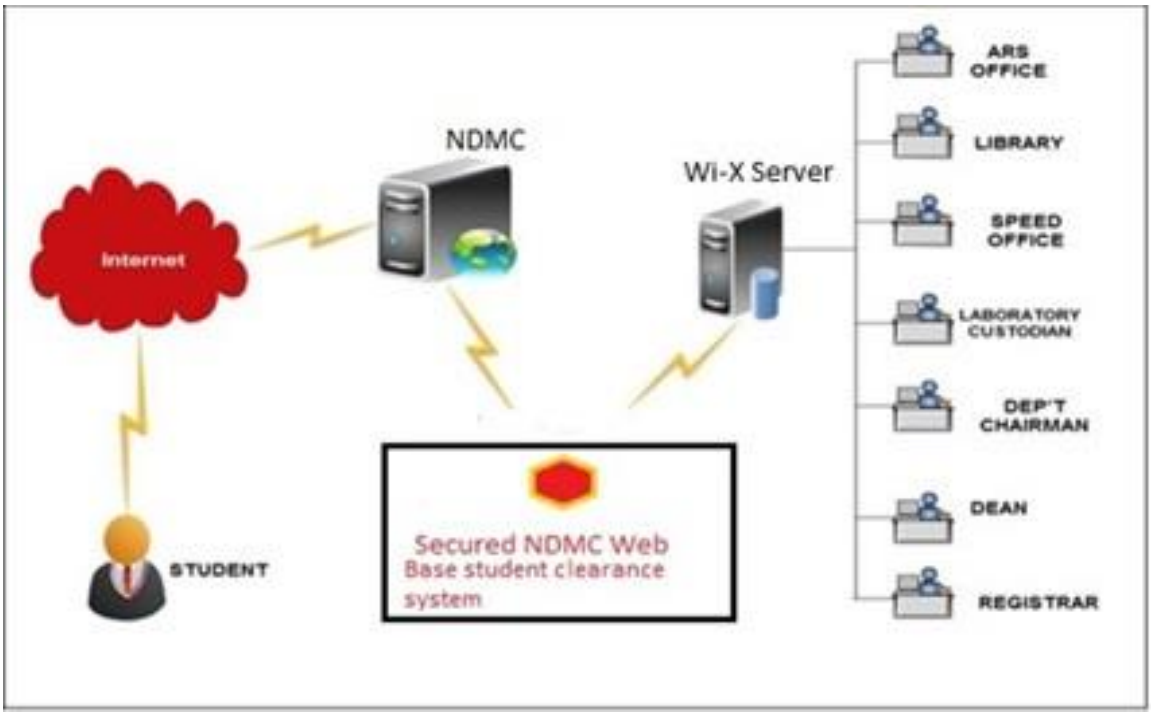

Figure 6. Architectural overview of the Project

In Figure 6 describe the architectural overview of the system. Firstly, the Secured NDMC web-based student clearance system will incorporate to the Simone server and established a small system for the different designated offices namely: ARS Office, Library, SPEED, Laboratory Custodian, Dean, Dep't Chairman and Registrar. The system also linked to the NDMC portal to be accessed by the student.

First, the student needs to register his/her temporary (username and password) on the Secured NDMC web-based student clearance system. Now then after the registration process, the student should go to MIS office to authenticate the validity of the student and verify the registered account. The instruction for web-based clearance transaction is mandated.

Second, after a successful MIS authentication, the student can browse the NDMC portal and click the **online clearance** tab. Therefore, he/she will be able to view his/her clearance status from the designated offices to settle first if there are any pending liabilities before he/she can proceed to the final step which is the Registrar. If he/she has liabilities, there will be a statement that he/she is not cleared and then he/she will see the designated offices where he/she has liability/ies. On the other hand, if the student has no liabilities, he/she can also see a statement, but it will say "COMPLETED" (see Appendix D).

Third, the Secured NDMC web-based student clearance system and Web API will link to the NDMC Portal so that only Web API will stand as connector between Wi-X System and the web-based clearance.

The role of the Wi-X System will provide only a student master list on the Secured NDMC web-based student clearance system including designated offices operation as well as the account status from the Cashier and the profile of the students from the Registrar. In addition to this, the web-based clearance will only fetch a certain data from Wi-X System through the use of Web API. Therefore, there is no any possibility of data alteration.

Furthermore, the proposed system will develop a small system for ARS, Laboratory custodian, SPEED, LSG and the Library in order for them to integrate to the entire transaction by the Wi-X System.

Fourth, the other function of Registrar is the final step and the issuance of the necessary requirements such as final grades for non-graduating students and TOR and diploma for graduating students. In the proposed system, the Registrar can be able to verify the student clearance status. And just like the Registrar, the role of Dean and Dept. chairman is a verification purpose only.

Data Model

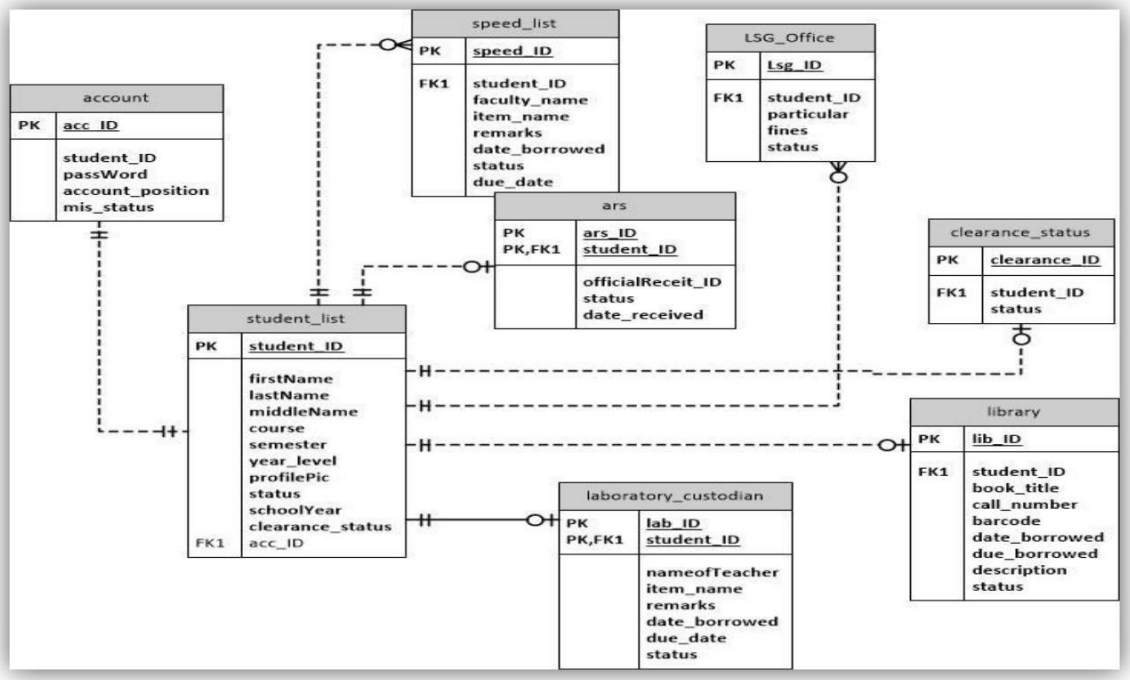

Figure 8. Data model

In the figure 8 shown above is the structure of the tables (entities) in the project database. This structure involve the relationship between entities. The account and student_list relationship is one to one since every student can have only one account in the system. The student_list and speed_list relationship is one to zero or more since every student can have zero or more liabilities in the SPEED office. The student_list and ARS relationship is one to zero or one since every student can have zero or one liabilitiy in the ARS office. The student_list and LSG_Office relationship is one to zero or more since every student can have zero or more liabilities in the LSG office. The

student_list and laboratory_custodian relationship is one to zero or one since every student can have zero or one liability in the laboratory custodian. The student_list and library relationship is one to zero or one since every student can have only zero or one liability in the library. And lastly, the student relationship with clearance_status is one to zero or one because every student can’t have any liabilities or can have only one.

MENTORSHIP BLUEPRINT

Task List	JUNE		JULY				AUGUST				SEPT.	
		4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd
Immersion Application, Acceptance and Orientation												
Workplace orientation												
Define System Goals												
Prepare Overall Design and Proposal												
Presentation of Project Proposal												
Collecting Data												
Development												
Testing and Fixing Bugs												
User Orientation												
System Evaluation												
Preparation of Reports and Requirements												

Figure 9. Project timetable

The figure 9 shows the schedule of activities of the proposed project. It follows the System Development Life Cycle particularly software prototyping and extreme programming approach which includes: Determining objectives, Design, Software development, Refining days or equivalent to (4) months, Documentation, Testing and Implementation. The estimated time duration to finish the project is 76 days including the holidays.

Development and Testing

The Secured NDMC web-based student clearance system evaluation describes its method using the ISO 9126-1 international standard tool. In this method, the expected quality of the proposed project will be evaluated.

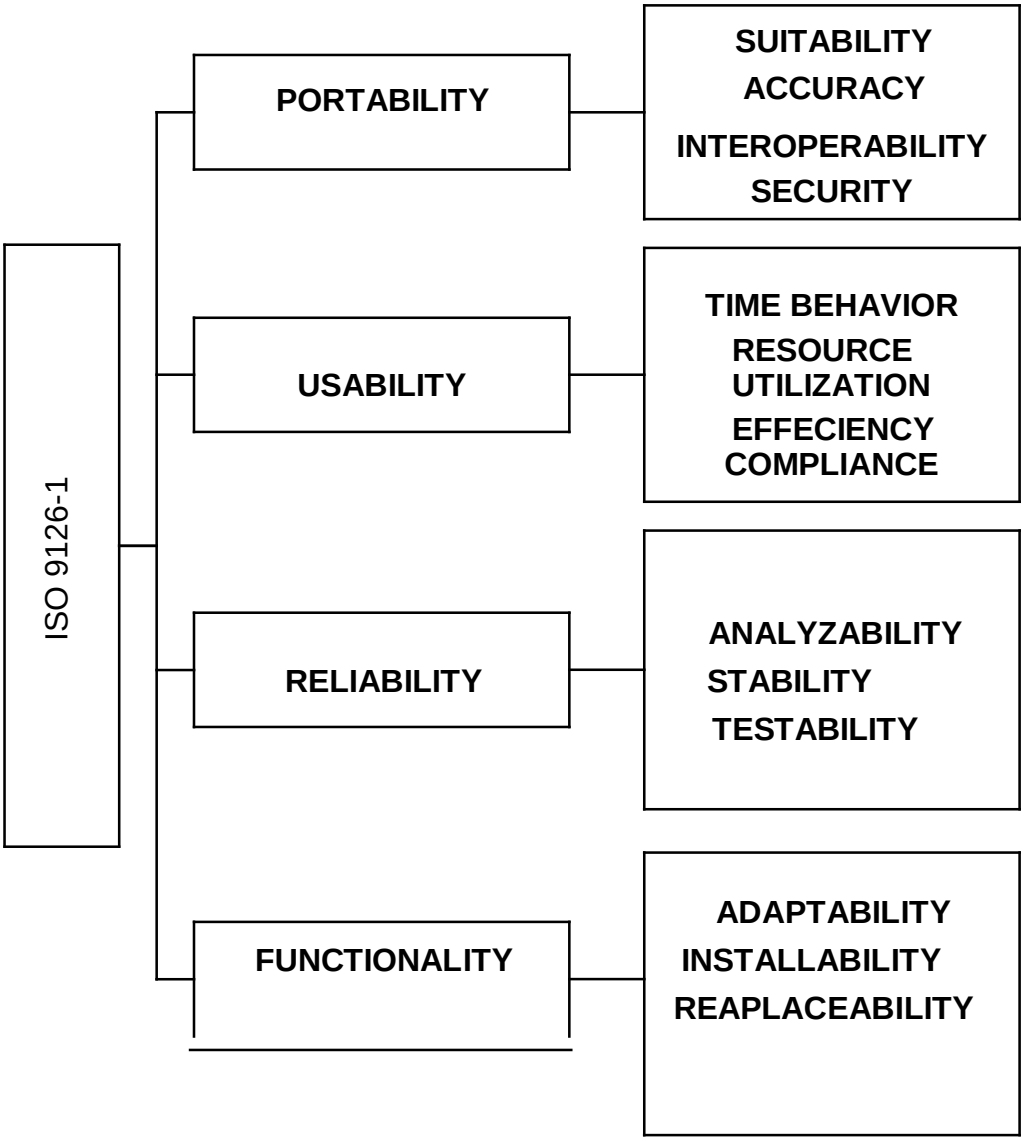

Figure 10. Attributes of the Project to be tested

Implementation Plan

According to (Robert Cliff, 2001) several system implementation projects today involve the integration of purchased enterprise level software packages. Unless there is a unique competitive advantage, it is simply not cost effective to develop your own corporate systems when similar systems are used by most enterprises.

Moreover, this plan involved the risk management, point-of-contact, staffing requirements, system security measures, implementation support, training of implementation staff and the budgetary summary. All of the mentioned plans were discussed accordingly.

Table 5. Points-of-Contact

Role	Name
MIS Administrator	Engr. Jason V. Pagara
MIS Database Administrator	
MIS System Administrator	
MIS Network Administrator	
MIS Technical support	
MIS Technical support	

In the table 5, it describes the right person who will be tasked to deploy and implement the project which includes the project provider and the MIS administrators and technical support.

Table 6. Hardware

Devices	Minimum	Recommended
PC desktop	Intel dual core 1gb or higher display 1gb or higher RAM	Core i3 or higher 4gb display or higher 4gb RAM or higher
HDD	500gb	2tb or higher
Server/Hosting	5Mb bandwidth	10Mb or higher
UTP Cable	Cat5	Cat6
RJ45	For cat5 and cat6	
Optical mouse	Logitech	
Keyboard	Logitech	
Flash drive	8gb	

In Table 6, describes the various hardware requirements for the propose project. This table also include the specification and quantity in every Hardware devices.

Table 7. Software

Software	Minimum	Recommended
Hypertext Preprocessor*(Php)*	V3.0	V7.0
MySQL Database	V5.0	
Windows Operating System	v7	v8 or higher
Xampp	V7.0	
cPanel	Stable release	

Table 7 also describes the different software requirements in the project. It also provide the specification for this requirements.

Table 8. Personnel

Role	Name
MIS Head	Engr. J.V. Pagara
MIS Database Administrator	
MIS Network Administrator	
MIS Technical support/cabling/modem installation and setup	
MIS Technical support/maintenance	

Table 8, describes the individual names that will manage the project. This table also described their specified role in the proposed project.

Implementation Results

In the context of seeking and developing solutions to the dilemmas of populated academic institutions in terms of clearance at the end of every semester, extensive research preparations and testing must be done. This chapter explains the results and discussions of the design, security development, testing, and evaluating the web-based student clearance system for the Notre Dame Midsayap College. The study was designed, developed and tested at the designated offices and computer laboratories of Notre Dame of Midsayap College. This chapter also discusses the results that aim to meet the general objective that is to develop a secured web-based student clearance

system for NDMC, and the specific objectives that are: to implement two-factor authentication for students and to apply the security encryption for data transport.

Secured NDMC Web-Based Student Clearance System

The general objective of the project is to develop a secured NDMC Web-based student clearance system that caters the students, designated offices staff/directors and the MIS staff. Figure 11 shown is the default page display for the students where they are required to click the login button. It is also the welcome page of the project which can be access in its domain name: ndmc-studentonlineclearance.com.

Moreover, this page can acquire by the students using their preferred browsers then just go to the URL and type the above-mentioned domain.

Figure 11. Default page

Figure 12, shows the login page for the students where they need to input their username and password. The student must input his/her student ID number as the username and his/ her own created password. Whenever student does not have any password yet, the student may log in first using their student ID number and follow the instructions. The instructions are for the creation of their own password. The student must create first their own password of their choice. An alphanumeric password is highly recommended for stronger security. Then, the student can already explore the contents of the webpage.

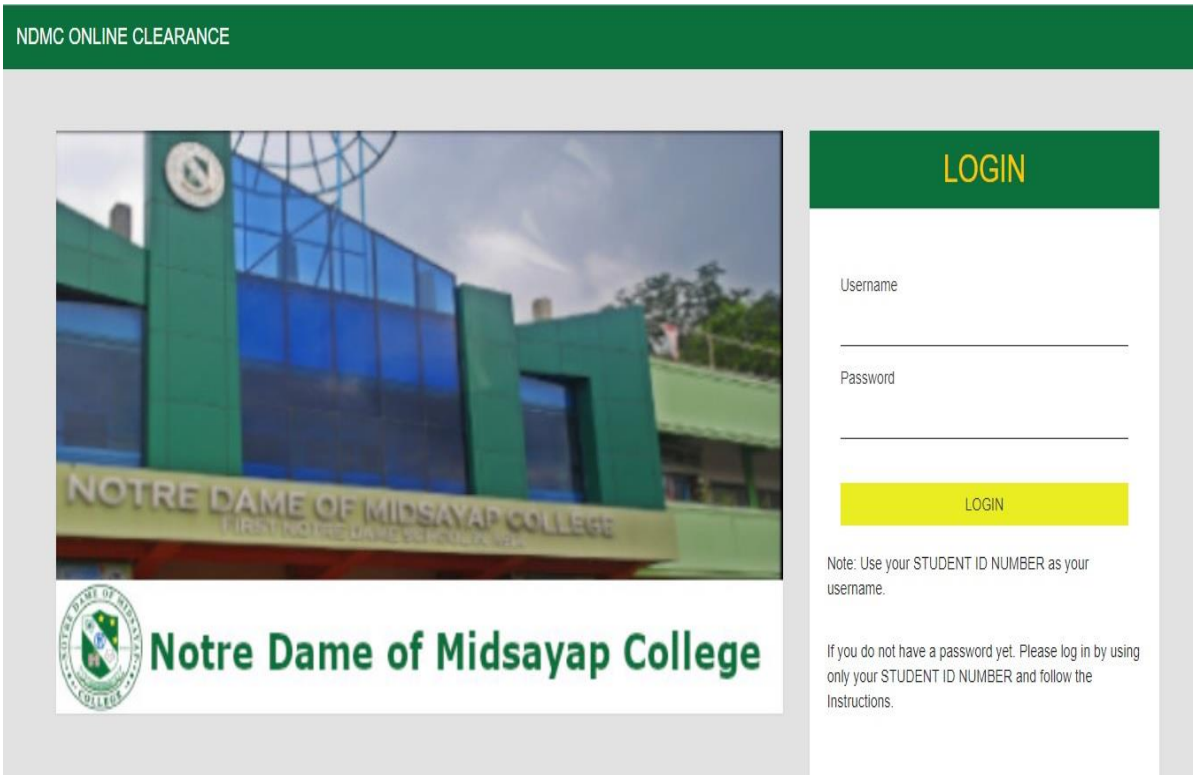

Figure 12. Student login page

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In Figure 13, the student users is displayed. The pending and cleared liabilities and as well as the profile details are the highlights on this page. The home page contains the profile photo of the user of which the student may change anytime through the button found at the bottom labelled as “Change Profile Picture” as well as the password found in the maroon button marked as “Change Password”. The profile details composed of the student’s name, student ID number, department and the semester are found just below the profile photo. The designated offices are displayed on a tab form.

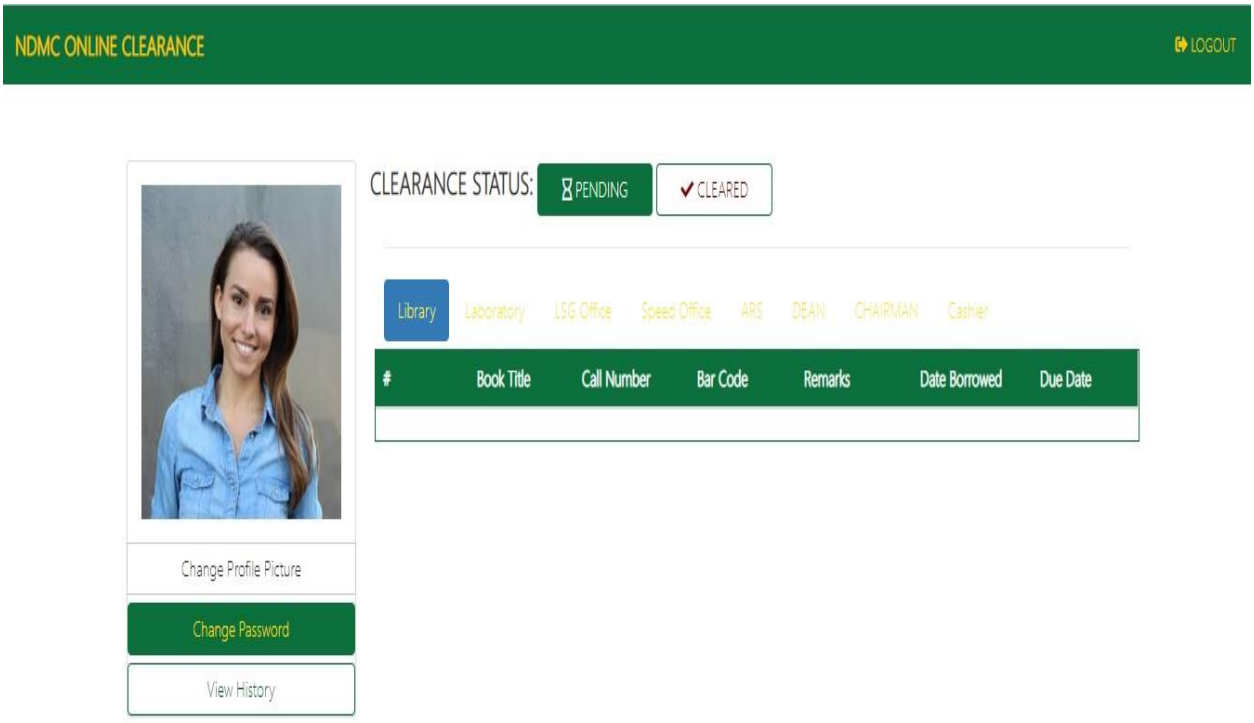

Figure 13. User Display

Figure 14, shows the login page for the designated offices where these offices can input their username and password. It is also the Homepage of the project which can be accessed in its domain name: ndmc-studentonlineclearance.com/Wi-X system.

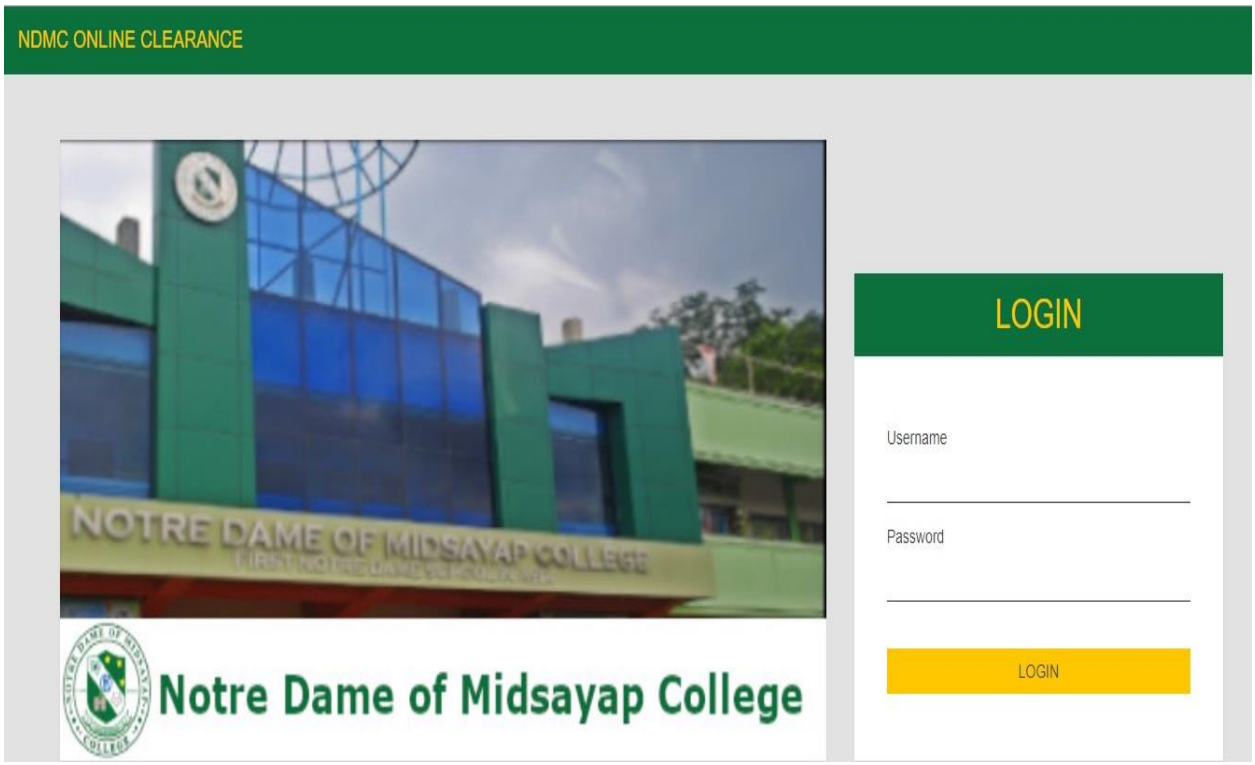

Figure 14. Designated NDMC offices login page

Figure 15, is the home page for the library office where the librarian staff can see the student profiles. On the other hand, figure 16 the library staff can manage the student liabilities. Moreover, other designated offices like ARS, SPEED, LSG, LAB CUSTODIAN, DEP'T CHAIRMAN, DEAN and the Registrar staff pages/modules are shown in *Appendix E*.

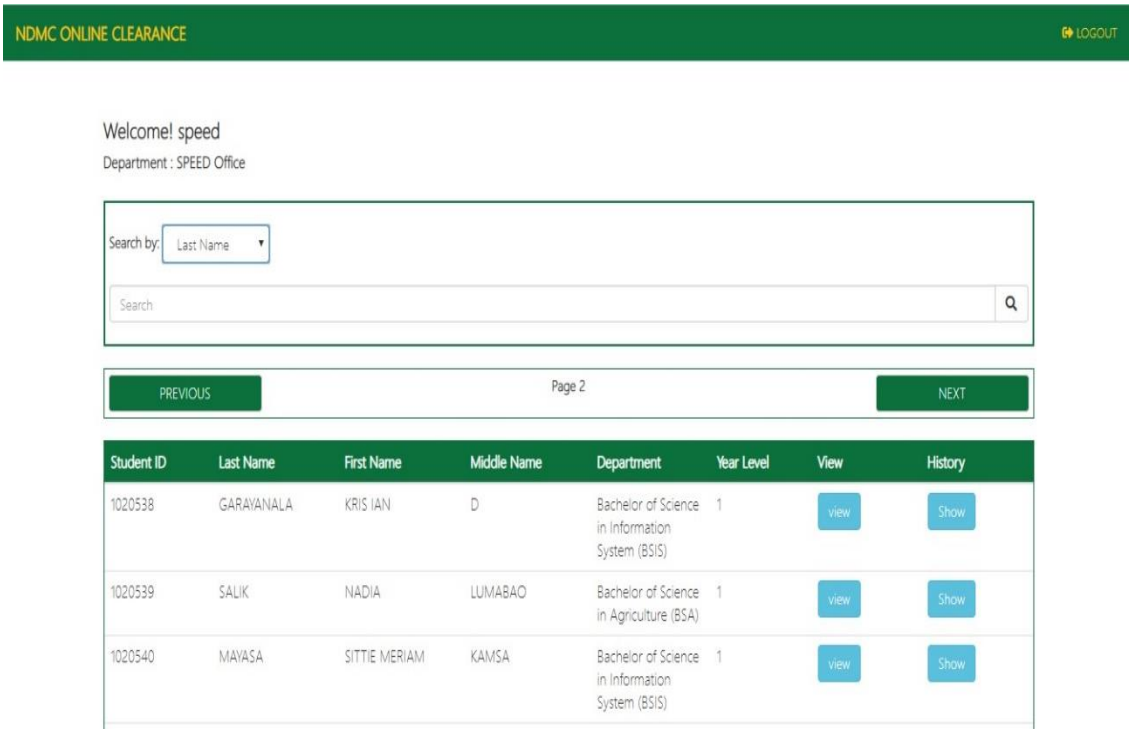

Figure 15. SPEED OFFICE

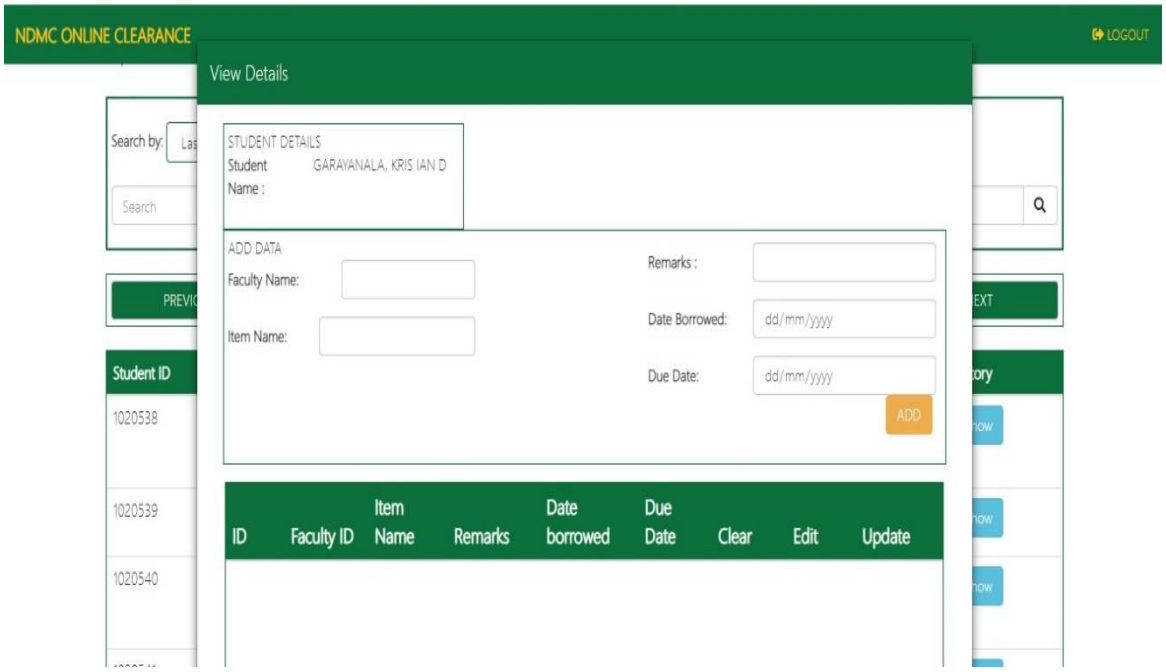

Figure 16. Manage student liabilities (SPEED)

Two-factor authentication for users

Two Factor Authentication is the first objective security feature of the proposed system. The students will undergo a multi process of authenticating their account in the system. This security feature is fully tested with the stakeholders during the pre- and post- deployment of the system.

Figure 17, shows the interface for first factor authentication where students are required to input their ID Number as username and the verified password from MIS.

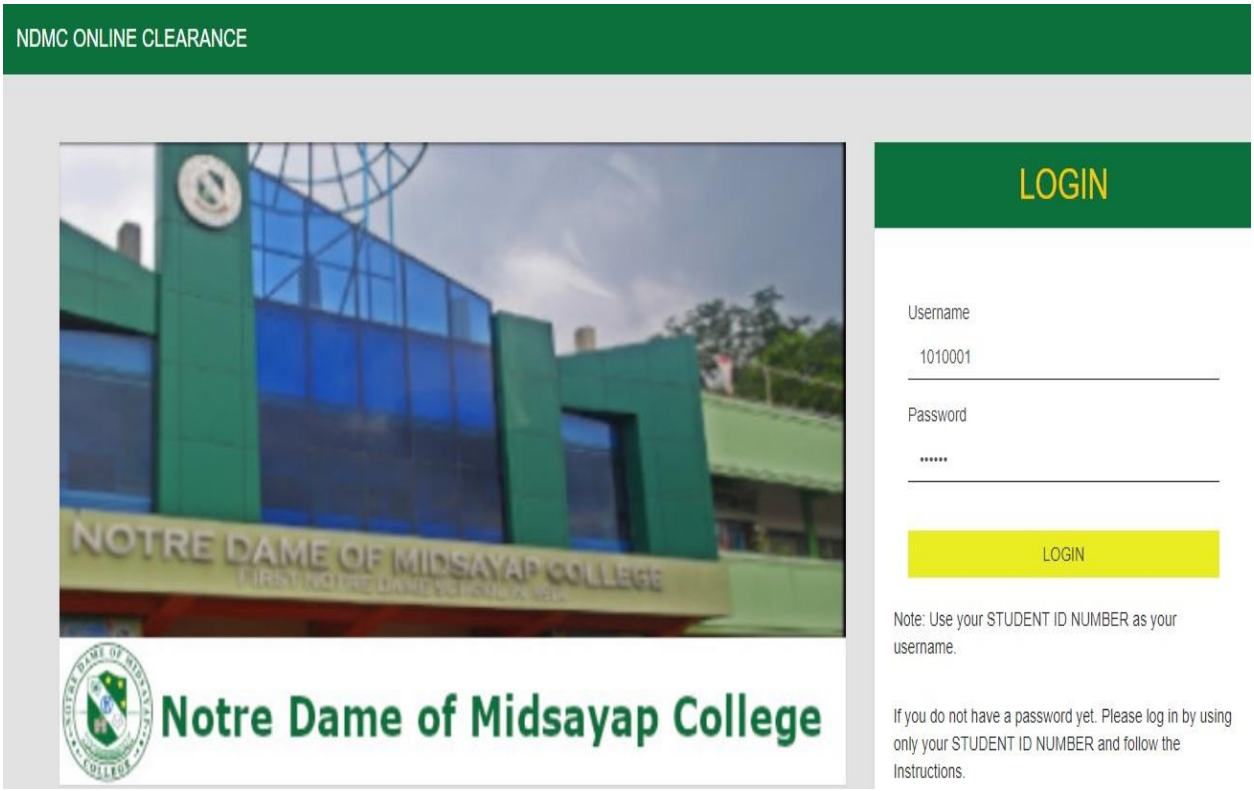

Figure 17. First factor authentication

In order to fully access the student clearance interface to view his/her liabilities, if there are any, he/she must answer the randomized second factor

authentication items namely: the six-digit pin numbers, year level, birthday and last name, as shown in Figure 18 to 21. So, on the next access or logging in of the student, the user's guide will pop up appearing another second-factor authentication item different from the previous one.

Figure 18, shows the user's guide requiring pin as the second-factor authentication. The required pin is composed of six (6) digit numbers acquired during their registration of their account, verified by the MIS.

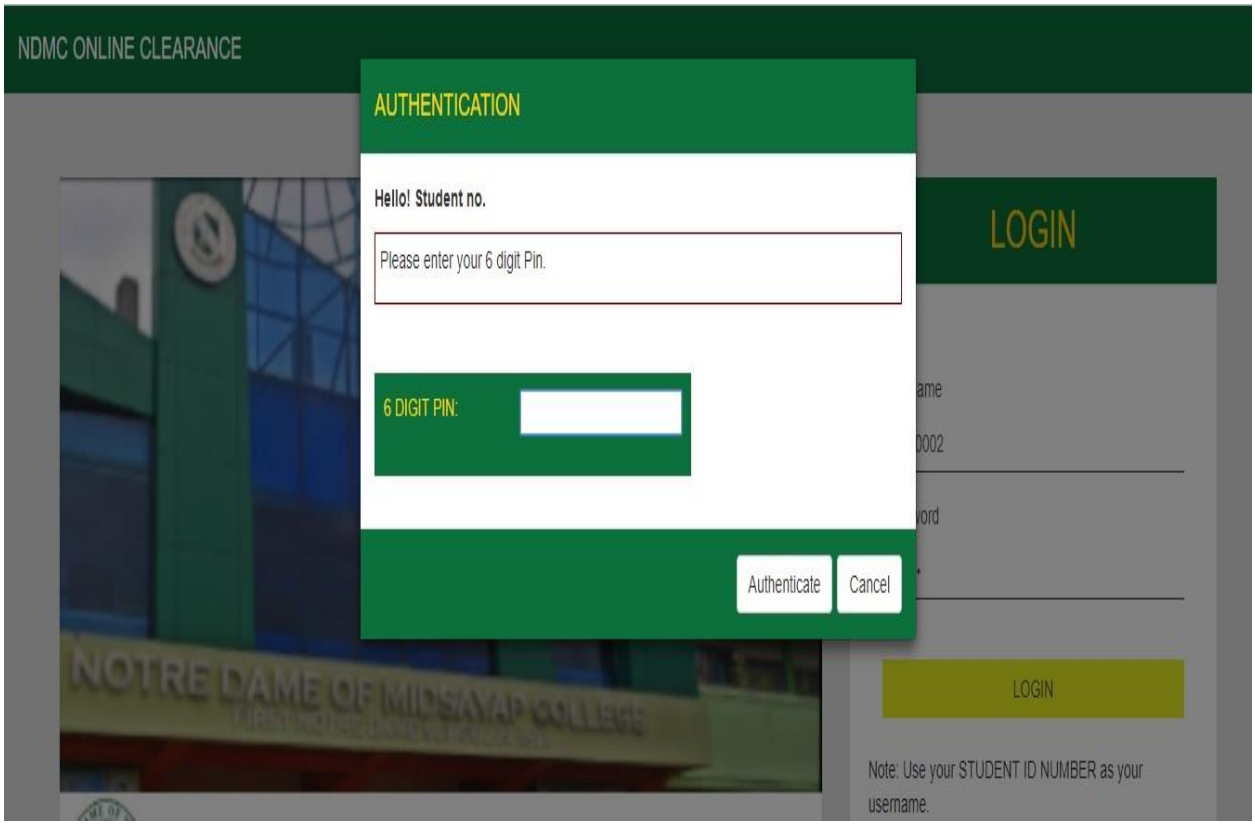

Figure 18. Second factor authentication (PIN)

In Figure 19, the year level of the student (another second factor authentication item) comes up requiring a response to fully access the clearance site.

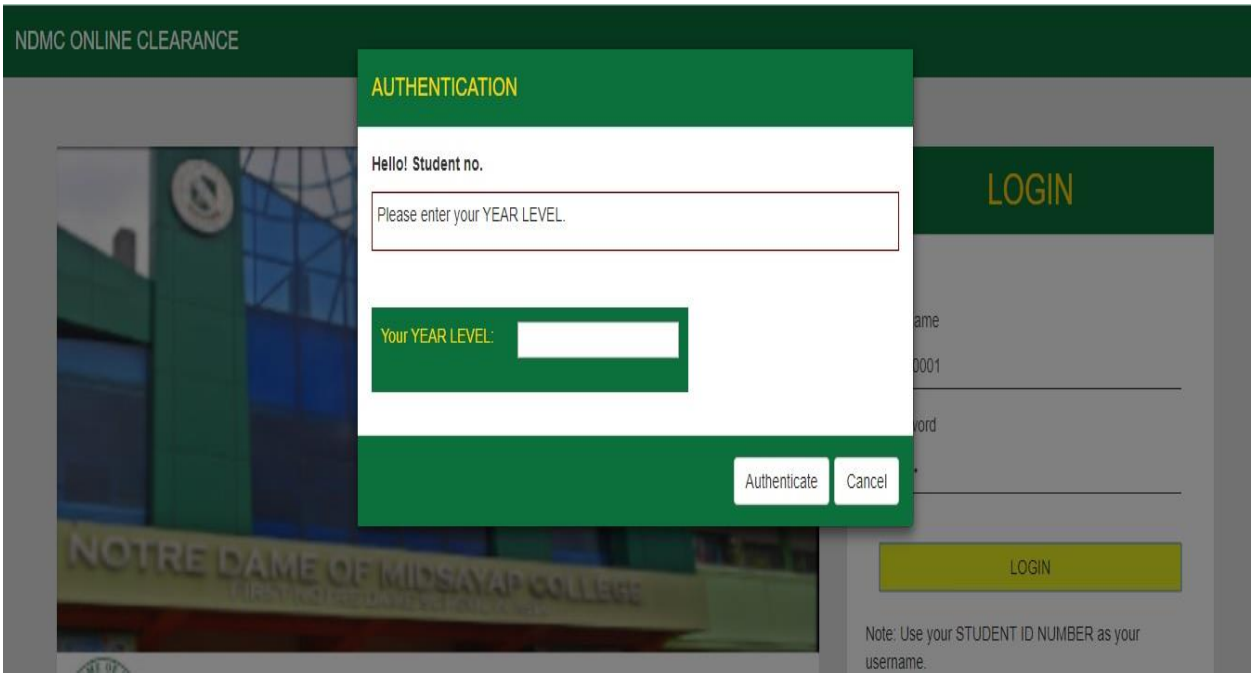

Figure 19. Second factor authentication (YEAR LEVEL)

Figure 20, depicts the user's guide requiring birthday as the second factor authentication. The birthday to input is from the information provided by the student to the MIS.

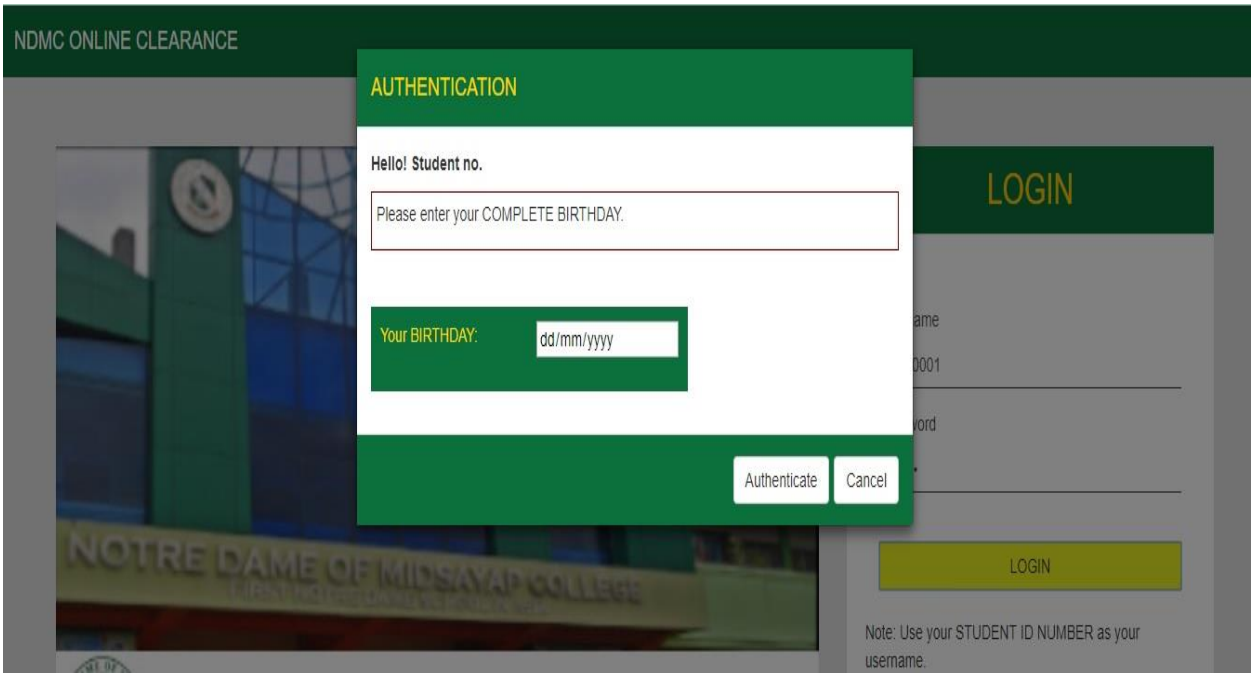

Figure 20. Second factor authentication (BIRTHDAY)

Figure 21 shows the user's guide requiring the last name of the user as the second factor authentication. The student must be officially registered in MIS Office.

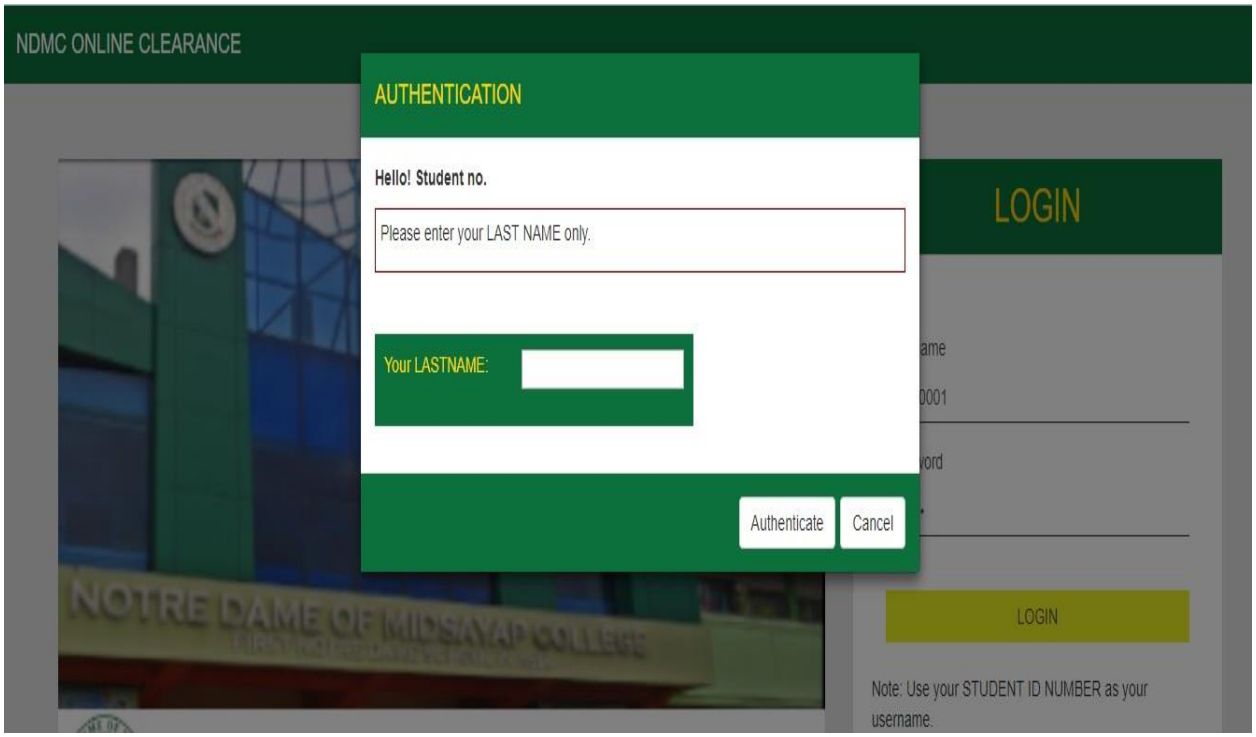

Figure 21. Second factor authentication (LASTNAME)

Encryption of web connection

The main focus of the project is how to secure the data over the internet. Hence, SSL is applied, tested and fully implemented in order for the project system and existing system will assure its data privacy and to preserve the data against any malicious attack.

EVALUATION RESULTS OF FUNCTIONALITY, RELIABILITY, USABILITY AND PORTABILITY OF THE SYSTEM

This juncture discusses the data result obtained from conducting the evaluation survey on various respondents who are also the recipients and the end-users of the said online clearance system. The survey was conducted at the NDMC campus with the students from first year to graduating students (4th year and 5th year) and the persons-in-charge from the designated offices as the respondents. The survey instrument used was the ISO 9126-1 International Standard Tool for Software Evaluation which assesses the Functionality, Usability, Reliability, and Portability of the system. The respondents evaluated the system using the rating scale for every item of the questionnaire. The purpose of the questionnaires are to gather and to assess the convenience of use, response and discernment of the users about the performance of the proposed system. The result of the evaluation as well as the comments, suggestions and recommendations of the users will serve as the basis for improving and upgrading the system.

Statistical Tools Used for the Data Gathered

This study uses a checklist and a rating scale questionnaire to gather the needed data and responses. To evaluate the Functionality, Usability, Reliability, and Portability of the system, the participants should evaluate the system by rating each item in the questionnaire using the rating scale shown in the Table 3.i The frequency of each rating is counted and the weighted mean is computed and interpreted using the formula below.

$$= \frac{(\quad) \qquad + (\quad) \qquad + (\quad)}{}$$

where

WM = weighted mean

n = number of respondents (designated offices + students)

fDNA = frequency of Does not apply response

fD = frequency of Disagree response

fA = frequency of Agree response

Table 9. Interpretative Scale used to interpret the Weighted Mean

Range of Mean	**Interpretation**
2.01 – 3.00	Agree
1.01 – 2.00	Disagree
0.01 - 1.00	Does not apply

Results of Systems Evaluation

The data gathered from the evaluation conducted on the participants who are the stakeholders/end-users of the system were tabulated and computed. The category and number of participants are shown in Table 10. The categories of the participants are: the designated offices, graduating students (composed of 4th and 5th year students) and non-graduating students (1st, 2nd and 3rd year students).

Table 10. Category and Number of Participants Involved in the Evaluation

Category of Participants	Number of Participants (n)
Designated Offices-	11
Graduating Students-	17
3rd Year Students-	10
2nd Year Students-	10
1st Year Students-	10
Total:	**58**

Table 11 below illustrates the evaluation result on the functionality of the system. As to the weighted mean (WM), most of the values computed are within the range of 2.01 to 3.00 as shown in Table 9 which falls on the interpretation Agree (A). The highest WM are the items 1.3 and 1.4 while the lowest rating is the item 1.5. The total WM is 2.95 which indicates that the participants “Agree” on the functionality of the system.

Table 11. Functionality of the system

I.	FUNCTIONALITY				WM	Interpretation
1.1	The software does what is appropriate(adequacy)	56	2	0	2.97	Agree (A)
1.2	The software has available all the functions required for its execution(adequacy)	57	1	0	2.98	Agree (A)
1.3	The software does what was proposed correctly(Accuracy)	58	0	0	3.00	Agree (A)
1.4	The software interacts with the Specified modules(Interoperability)	58	0	0	3.00	Agree (A)
1.5	The software has capacity for multiuser processing(Interoperability)	53	2	1	2.83	Agree (A)
1.6	The software has the capacity to operate with networks(Interoperability)	56	2	0	2.97	Agree (A)
1.7	The software has secure access through password (Secure access)	56	2	0	2.97	Agree (A)
1.8	The software has an internal back up routine (Secure access)	55	2	1	2.93	Agree (A)
	Total				**2.95**	**Agree (A)**

In terms of reliability, Table 12 shows the result of the test on the reliability of the system with 2.64 weighted mean which implies that the participants "**Agree**" that the system has its ability to maintain a certain level of performance when used under definite conditions. On the other hand, the participants tend to answer "**Disagree"** on the possibility of system failures.

Table 12. Reliability of the system

II.	RELIABILITY				WM	Interpretation
2.1	The software has frequent failures (Maturity)	0	55	3	1.95	Disagree (D)
2.2	The software reacts appropriately when failures occur (Tolerance to failures)	57	0	1	2.97	Agree (A)
2.3	The software informs users concerning invalid data entry (Tolerance to failures)	58	0	0	3.00	Agree (A)
	Total				**2.64**	**Agree (A)**

Table 13 describes the result on usability of the system with 2.98 weighted mean. The WM denotes that the participants "**Agree**" that the system has its capability to be conveniently operated, learned and utilized by the user, when used under specified circumstances.

Table 13. Usability of the system

III.	USABILITY				WM	Interpretation
3.1	It is easy to understand the concept and application (Intelligibility)	58	0	0	3.00	Agree (A)
3.2	It is easy to perform its functions (Intelligibility)	56	2	0	2.97	Agree (A)
3.3	It is easy to learn how to use (Learnability)	57	1	0	2.98	Agree (A)
3.4	The software facilitates the user's data entry (Learnability)	55	2	1	2.93	Agree (A)
3.5	It is easy to operate and control (Operability)	58	0	0	3.00	Agree (A)
3.6	The software provides help in a clear manner (operability)	58	0	0	3.00	Agree (A)
	Total				**2.98**	**Agree (A)**

Table 14. Presents the portability of the proposed project. With a total of 3.0 WM, respondents "**Agree**" that the system has the capacity to be adapted and installed.

Table 14. Portability of the system

IV.	PORTABILITY				WM	Interpretation
4.1	It is easy to adapt to other environment (Adaptability)	58	0	0	3.00	Agree (A)
4.2	It is easy to install in other environment (Capacity to installed)	58	0	0	3.00	Agree (A)
	Total				3.0	Agree(A)

RECOMMENDATIONS

From the plotted results and observations of the proposed project, the researcher highly recommend that the proposed project is capable to be fully deploy and implement due to the foreseen and timely solution on the current and long-time quandary of the NDMC students in attending their clearance obligation every after-semester break or summer term. Second, a Kiosk machine with clearance system function is also recommended during its implementation. Next, the user interface of the clearance system website and its features inside can be enhance, update and upgrade.

Additionally, the author recommends to include the web-based clearance system transaction for the faculty and staff at the end of every semester as replacement to the manual one. For the future researchers, the author recommend to conduct further study about clearance system in order for the system to be more functional, efficient and reliable.