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Development of an Electronic Secure Students' Industrial Works Experience Scheme Placement System

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Abstract: This research developed a secured student industrial work experience scheme (SIWES) placement system to take care of the security challenges of the existing automated systems. There are attempts by researchers to ameliorate the challenges associated with the scheme by developing various systems. However, the developed systems are subjected to security vulnerabilities. This research, in an attempt to avert the security challenges associated with the existing automated systems, designed a new scheme which includes security architectures in the kernel and application layers. This new system was able to achieve two important tasks; first, the system automation and second, the inclusion of security architectures to cubs the application's vulnerabilities. The present process involves students manually seeking placement to undergo the program, and due to this, students end up applying at organizations that are not relevant to what they are studying. Despite the fact there are no much existing systems that digitally caters for this component of the scheme, the available existing systems are subjected to security vulnerability. Therefore, leveraging on secure web application technologies using Unified Modelling Languages for design, HTML, CSS, JavaScript, PHP for its implementation and user privilege and password hash to ensure its security, this project developed a secure solution to this pertinent challenge. The system is tested using unit testing component of each design, integration testing and general system testing. The implementation shows the system works according to the design, by ensuring all units of the development perform necessary functions of data storage, data retrieval, error alerting, and interface/server appropriate communication. In addition, the security architecture, design and implementation of the system's design are better than the existing ones.

Index Terms: Student Industrial Scheme, Industrial Skills, SIWES Scheme, Industrial Training, Experience Training, SIWES Placement.

1. Introduction

The Student Industrial Work Experience Scheme (SIWES) is an industrial skill acquisition program that is part of

the approved minimum academic requirements in several degree programs in all universities in Nigeria. It was launched in 1973 by the Industrial Training Fund (ITF) under the Federal Ministry of Education. The scheme aims to close the gap between theoretical knowledge gained in the classroom and practical knowledge gained in the workplace [7]. The existing operations like students' registration, placement and payment processes for the scheme is almost manual if not semi-manual. However, in the 21st century, some of the processes involved in the processing of SIWES have been automated. For instance, the payment process is now being handled by the Industrial Training Fund (ITF) in which payments are made into the beneficiary's bank accounts. Departments have to collect data manually from their students through a coordinator and forward same to ITF. This is in reaction to rising public demand and legislative accountability requirements, which have prompted higher education administrators and scholars to evaluate the possible influence of student work programs on skill development, which has a direct impact on national development goals.

An annual challenge faced by students in higher institution of learning is the issue of finding suitable placements based on organizational preferences and their location for this mandatory programme. Due to frustration, the student ends up settling for placements where they get minimal or no relevant training as it relates their course of study, thereby defeating the overall aim of the SIWES programme, created to help close the gap between classroom learning and industry. Sadly, minimal effort has been made to digitize this aspect of the SIWES program. Closest being the work done by [14], though not fully implemented, this proposed a mobile based system for SIWES placement recommendation that catered majorly on functionality. Other researchers have also developed SIWES management systems that categorically tends to automated other manual aspects of the programme, that includes geo-location [13], online logbook filling and complaint lodging [3], registration, payment systems and assessment [1, 15]. Deploying solutions on the World Wide Web (WWW), which is a medium for exchanging information on the internet [16] means these infrastructures and technologies that supports it will be prone to attacks irrespective of the information contained in them, hence a need to adequately put in place mechanisms that will secure them, and this is a major criterion lacking in these developed SIWES solutions.

Users' roles and permissions are vital components to security web application, and that is the major security implementation of this system. Users in this instance describes the core actors, roles define their functions, and permissions, what authorizations those functions can do. This system amongst other things will afford the students an opportunity of applying online to placements that are relevant to their course of study. Despite the acceptability of the scheme and continuous support from the relevant bodies and government, it is still faced with several challenges that inhibit the full realization of its objectives and one of such is the issue of placement. Right from the onset, the search for place of attachment has been done manually as reported by various researchers. In such scenarios, students are left with no other alternatives but to leave school or their respective homes to several parts of the country in search for a suitable location where they could conduct the SIWES programme. Due to lack of information, lack of link between the institution and industries, and also proper supervision and communication channel, they most times end up applying at organizations that are not relevant to their course of study thereby resulting in gaining little or no experience at all.

In addition, Considering the huge number of resources that goes into SIWES scheme and the process involved in searching for placement location is manual, there is therefore a need to leverage exiting technological advancements in other to automatically recommend suitable placement for those embarking on the training, considering their choice of location and course of study. Also, existing system of SIWES management is not well evaluated and not reliable, hence a need to build a system that focuses on security implementation. This study will enhance the effectiveness of SIWES among key players thereby helping to realize the set objectives of the program in universities when eventually adopted. At the end of this study, the web application will help to endorse the appearance of the university among her equals and also help foster relationship between key actors involved in the placement function of the scheme. On the part of the student. It will reduce the time spent in seeking for placement as available database with a rich content of placement opportunities would have been created. The organizations seeking to have student carry out the mandated scheme would have an easy means of getting enrolled on the system as a one-time password (OTP) will be generated for enrollment, thereby ensuring security. Also, this provides them an easy medium of reporting back to the organization. Institution based supervisors will easily have a means of accessing and grading the students as at when necessary, making the process easier. With the aforementioned challenges associated with this scheme, it is therefore pertinent to design and implement a secure system for the placement of SIWES students that tends to create an avenue where actors (users) will be able to interact with the system, and further allow organizations get enroll easily, all in a means to provide the student with easy access to good placement. The remaining parts of this article is arranged as follows; the related researches to this work is discussed in section two while section three is used to discussed the methodology adopts in this research. Section four is used to discuss the results and explanation of the results. Recommendations were highlighted in section five while the conclusion of the research was given in section six.

2. Related Works

In 1973, the Industrial Training Fund (ITF) created the Students Industrial Work Experience Scheme (SIWES) in response to a rising concern among industrialists that graduates of higher education institutions lack enough practical background studies to prepare them for work in industry Sylvester et al., (2017). The ITF withdrew from managing the

scheme in 1979 due to organizational logistics issues and increased financial burdens as a result of SIWES' rapid expansion, but this has since changed as the scheme is now funded by the Federal Government of Nigeria (FGN) and managed by the ITF Yemisi (2015). In 1985, the FGN reviewed the Scheme, and Decree No. 16 of August 1985 required that "all students enrolled in specialized engineering, technical, business, applied sciences, and applied arts should have supervised industry attachment as part of their studies." It also directed the ITF to resume full administration of the Scheme in collaboration with all the institutions supervising agencies (NUC, NBTE and NCCE) Adeyewa, Z. D., (2015). The Scheme's aims, which include bridging the gap between theory and practice among engineering and technology students in Nigerian institutions of higher learning, have been actively and effectively pursued. Though gratifying to note that Scheme is crucial and aimed at producing skilled labour required by the Nigerian economy, it is constantly encountering array of challenges. There are some visible challenges facing students' industrial work experience scheme which hinder the fulfillment of its objectives even in Federal University of Technology, Minna (FUTMINNA).

In a bid to identify these challenges, Ogbuanya et al., (2018) carried out research which postulated 10 unique challenges faced by the scheme. These includes challenge of finance to the students and supervisors to ease their burden during the programme, challenge of securing a place for attachment, lack of proper planning of SIWES programme among others. This literature recommended solutions to these identified challenges. This is also in agreement with Oladimeji et al., (2017) who stated that the challenges were also not limited to inadequate finance, difficulties experienced when searching for placement, delay in payment and lack of proper orientation. Worthy of note is the lack of adequate placement for prospective students, and from study undertaken by Ogbuanya et al., (2018), this takes the second place on prevalent challenges bedeviling the scheme aside inadequate or proper financing. The article recommended provision of adequate places of industrial attachment.

Considering the increase in number of students and departments participating in SIWES programme in FUTMINNA and other institutions, it has become difficult to place all the students for the SIWES training by the unit in-charge so most students are left with the task of sourcing for placement themselves hence the need to leverage information technology for this selfsame function. Information Technology (IT) and computers in general has a major impact on the society and the last few years have seen an incredible increase in the capabilities and use of technology. Going on is an era of simplifying almost all complicated works using technology, Bhamra et al., (2016). According to Adeyewa, Z., (2015), the traditional way of operating the programme has been that of manual or analogue method over the years, there is a need to modernize the operations for effectiveness and efficiency in the placement function of the scheme. The internet is a popular medium for accessing and sharing information in today's technological environment, as it is the simplest and fastest means to transmit and retrieve information. It also provides an unlimited access to anyone, at any place and time. The intended system of digitalization intends a user-friendly operation which possibly will resolve ambiguity and achieve certainty based on a web application that pays attention to security.

Security is another concerned with the confidentiality, integrity, and availability of systems and data in general. Confidentiality refers to the ability to keep data secret and protected against unlawful disclosure to only authorized parties. Integrity echoes information accuracy and necessitates technology and methods that prevent unauthorized parties from improperly altering data. Availability on the other hand refers to the ability that guarantees that information is available to end users on a timely basis in order to meet assigned requirements Fredj et al., (2021), Gaikwad, P. & Bhatt, P., (2016), Li, J. (2020). Security in the context of a Web application simply means safeguarding the confidentiality, integrity, and availability of Web assets (Web pages and databases). Understanding the vulnerabilities being faced by existing web applications will help the underlining study in knowing how to go about building a secure web application. The Open Web Application Security Project (OWASP) is a nonprofit foundation dedicated to enhancing and providing a source for securing the web application Kirk, J. (2017), the de facto standard for categorizing web application vulnerabilities prioritizes the top 10 according to their prevalence, exploitability, detectability and impact which greatly reduces the confidentiality, integrity and availability of web applications. Using this guild provides a means to developing secure web application software that minimizes vulnerabilities.

Adding to previous research that suggests that undergraduate work experience in general, and the SIWES program in particular, has a positive impact on a student's early career success, Oladimeji et al., (2017) found that those who work in government establishments, including the organized private sector, are exposed to better opportunities for developing employability skills than those who work in the private sector. Ogbuanya et al., (2018) carried out a study to evaluate the effectiveness of SIWES programme using an entire population of about 130 respondents, lecturers and industry supervisors inclusive and based on the findings of the study, 10 challenges of SIWES in developing the required skill in the industry and 15 approaches that can be assumed in evaluating the effectiveness of SIWES in Nigeria were also agreed.

Moreover, in an early attempt to obtain feedback on the Students' Industrial Work Experience Scheme from students who are the major beneficiaries of the scheme, Ibegbulam et al., (2017) carried out a research and in its findings posited that the industrial training as it is presently organized is not sufficiently meeting the practical needs of students. Stakeholders involved should be involved in the programme from placement to the actual training. Adeyewa, Z., (2015) stresses the numerous benefits of modernizing the SIWES programme through the use of ICT which includes efficiency, promptness, cost effectiveness, scalability, mobility and the satisfaction of stakeholders. Through the

powerful combination of technology and people, the pitfalls of the past can be avoided to create a better tomorrow. By leveraging on the enormous potential of IT and our dynamic youth, the SIWES programme can become an interesting and a very successful venture. In addition, Adeyewa, Z. (2015) stresses that placement of students could be automated from the robust database in the enrolment system. The enrolment database essentially becomes a shopping center for organizations or any stakeholder to pick candidates. It must therefore be a searchable database. Students who are placed either directly by companies or through the students by own efforts are flagged and documented appropriately in terms of name of company, location.

After discovering that the current system of student management during the SIWES period is ineffective, as it frequently involves supervisors physically visiting students, incurring some operating costs, and that, in addition to monitoring, mentoring is another important role of the supervisor Babalola et al., (2015), leveraging-on-web-based-technology to solve these problems. Students registration and payment processes for the scheme being semi-manual lead Sylvester et al., (2017) to design a system web based in order to automate these processes enabling the SIWES unit to be able to manage the large amount of data inflow during the SIWES period. Furthermore, Zachariah, B. & Yabuwat, P. (2016) made a research to develop a cloud based that would allow for near real-time collaborative supervision of students' experience during SIWES and recommendations were made that would allow for proper management of the processes by the Institutions, Industries, and Industrial Training Fund (ITF), students being able to report their daily activities and also upload picture of themselves in such sessions; and both the ITF, Industrial, and Institution-based supervisors can monitor and make recommendations to the students. The system was executed using PHP, JavaScript, CSS, Ajax technologies, MySQL database and hosted on Google Cloud Infrastructure. The online software could not be reviewed properly as servers were down.

Considering the difficulties encountered in securing placements for SIWES and how its negatively impacts the final grades of some undergraduate students, Ogunde, A. & Idialu, J. (2019) proposed a recommender system to solve this challenge. Using past SIWES data, the developed system can recommend suitable place of placements for students based on classification approach. The researchers collected data through questionnaires only in the 20 local government areas of Lagos state Nigeria, and basing its scope on software development and networking company. Though security of the system was not mentioned, it was observed that many companies are aware of this essential program of the government and are doing their best to comply. It is worthy of note that most of these researches had no mention of security in its implementation, except for Oluwatosin, I. (2018) who developed a framework that uses time and location in preventing false reporting of logbook. Using the Google API, students can have access to the system only when they are at their place of primary assignment. Though implemented, the system had access control issues.

This research, having identified the challenge of security vulnerability and threats associated with online and automated SIWES system, developed a new system with adequate security architectures in the kernel and application layers. The system was evaluated against vulnerabilities and found working with the architectures.

3. Research Methodology

3.1. Research Design

The methodology used in developing this project work include obtaining information on manual system of placement systems. The methods also include: analytical and critical study of the existing systems, observation and obtaining information by searching through the internet. The design was then carried out using UML Use Case Diagram, Sequence Diagram and Entity Relation Diagram (ERD). HTML, CSS, JavaScript and PHP programming language was used for the implementation. Using the backend programming language, PHP, the role-based access control (RBAC) model was utilized in creating roles for different classes of users for various job functions, and permissions to perform certain operations tied to their specific roles. Lastly, the iterative waterfall model, where the entire system was broken into several subsystems and each subsystem was further sub-divided into different modules in other to achieve a secure system at unit levels. It is simple to use as it allows for parallel development and a feedback path.

3.2. Data Collection

The study used both primary and secondary data collection methods to obtain information for the proposed system's development from different stakeholders, including the ITF, institutional-based SIWES coordinators, and SIWES supervisors who have been in the scheme for at least six (6) years. Through a thorough observation of the existing system mostly as it operates within the School of Information and Communication Technology (SICT), FUTMinna, so as to know ways to improve on what is obtainable. This process helped obtained vital information that helped in the design of the system.

3.3. Proposed System

The proposed placement system is meant to provide more ease to actors involved in this aspect of the scheme. Once access is granted to the application front end, users are able to see all schedule/event as available to them based on level of authorization. There are mainly four (4) types of users;

1. Class A: Coordinator, who is the master user with the most priority and access.
2. Class B: Supervisor
3. Class C: Student
4. Class D: Organization

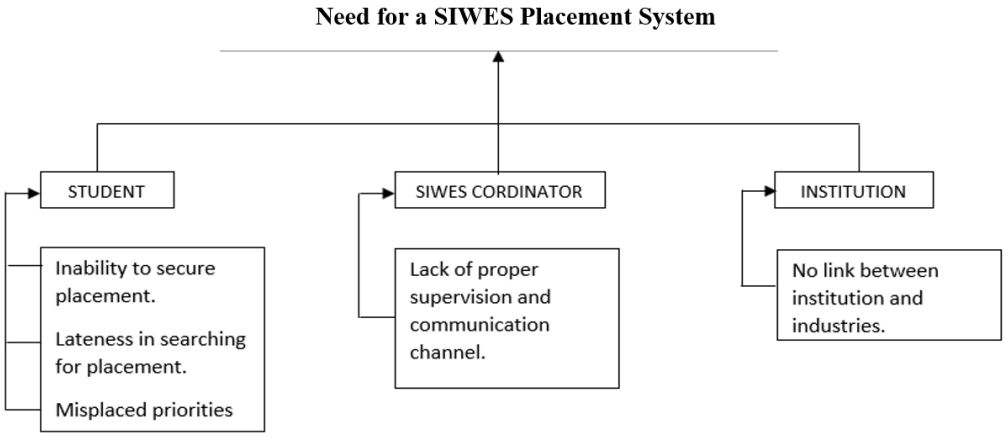

Fig.1. Need for a SIWES Placement System

With the proposed system, students are able to conveniently apply for placement based on advertised or available openings without having to go around physically to look for placements. This system came into existence with the sole aim of dealing with the shortcomings of the traditional method of searching for placements, and it has many advantages over them. For the purpose of this study, emphasis is placed on presenting the system with grouping of different types of models that best suits the concept which are architectural and use case models as displayed in figure 2.

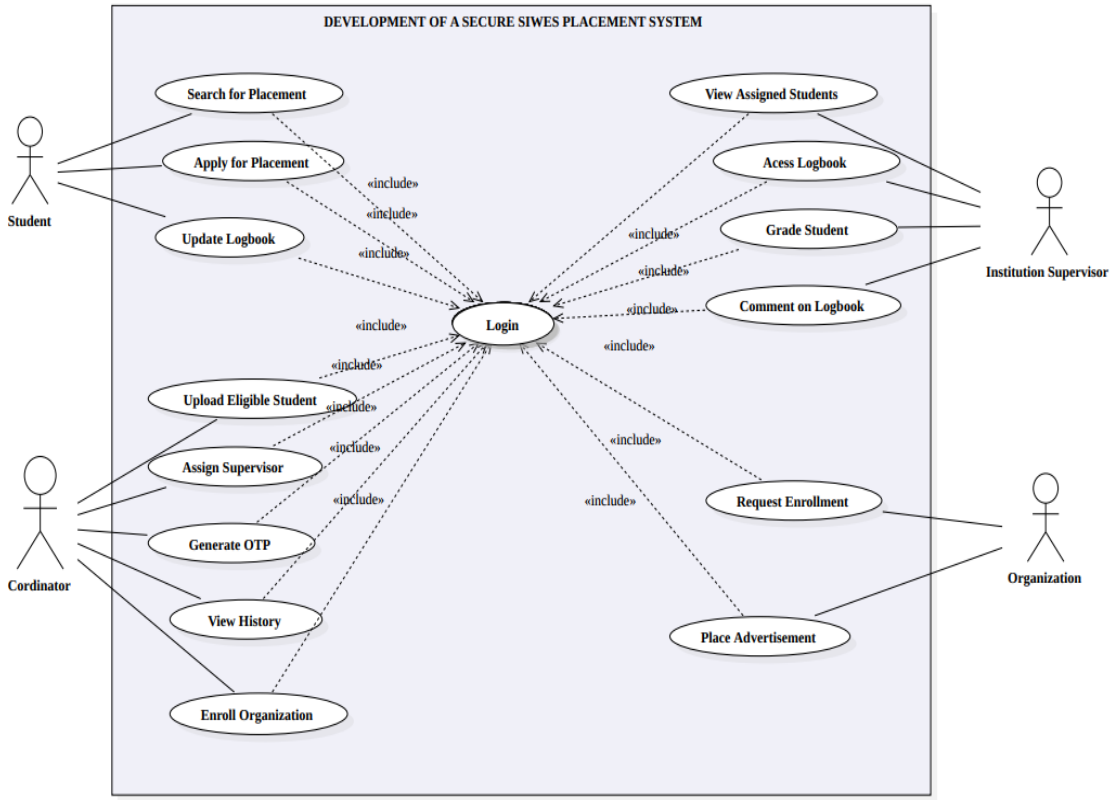

Fig.2. Use Case Diagram of the system. Source: (Author)

3.4. Architectural Design

Architectural design defines the process of collection whereby hardware and software components and their respective interfaces interact with the established framework of the developed system. Also, this can be defined as the concept that focuses on elements of a system that unifies the coherent and functional aspects as one depending on set

objectives. Information about the organization is stored in the organization database, the system issues advertisement to the application users who interact with the system using the web interface and details of interactions are stored in profile tables in the database. Tools used in creating the secure placement system were selected based on the following criteria and considerations:

1. For non-commercial purposes, the tools should be freely available.
2. The tools should be operating system independent, thus easily portable and platform independent.
3. The database is an independent server, therefore, different and upgraded versions can be used for dynamic purposes.

This system's graphical user interface (GUI) was developed using Hypertext Markup Language (HTML) forms, Cascading stylesheets (CSS) and JavaScript. In lunching the system, a PHP embedded scripting language was used, PHP programing language was chosen because of it is portable and efficient. Also, its object-oriented capabilities, which enables reusability of programs, allowance of a web server and user inputs being easily processed via HTML forms. PHP provides convenient and built-in functions, Open Database Connectivity (ODBC) that enables connection to databases. The database security implemented on the system can be easily implemented using PHP. A multi-user database system, that is royalty-free and open-source software called MySQL was adopted as the database. Availability of ODBC driver for MySQL was a crucial factor for choosing this database as it also allows the same code to be used to link with a different database just by simply modifying the diver, thus, making it database independent.

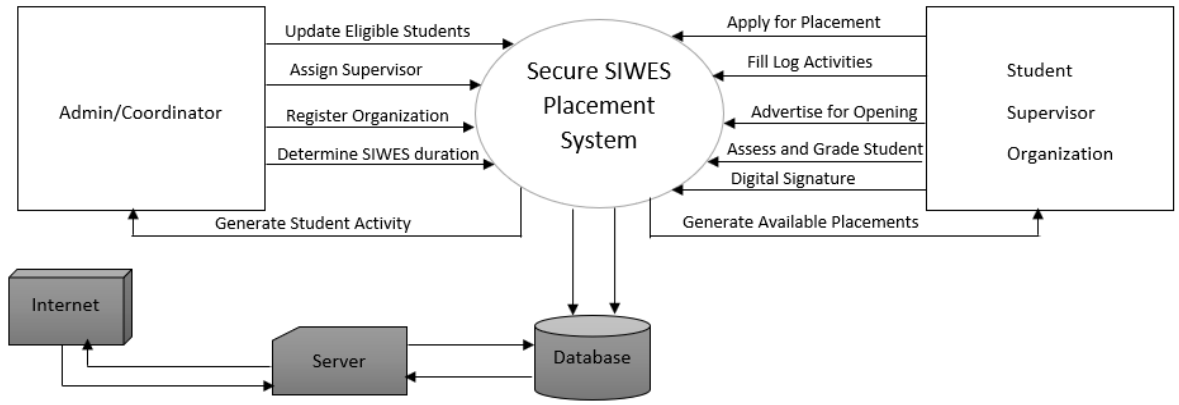

Fig.3. Architectural Diagram. Source: (Author)

3.5. Database Design

The database system is created around the demands of the algorithm while adhering to the principles of safe database development. It is meant to be implemented using MySQL stored procedures. The schemas will contain the signup/registration file, organization details file and a complaints/report file. The main point of a database-driven web site is to store the site's information in a database and dynamically extract that material from it to produce web pages that visitors can see using a standard web browser. When a user accesses a page on the placement database system, the following sequence of events occurs:

1. A standard URL is used by the visitor's web browser to request the web page.
2. When the web server software (usually Apache) identifies that the requested file is a PHP script, it launches the PHP interpreter to run the script's code.
3. Specific PHP instructions connect to the MySQL database and request material for the web page.
4. The MySQL database sends the requested material to the PHP script as a response.
5. The PHP script saves the material in one or more PHP variables and then outputs it as part of the web page using echo statements.

3.6. Security Consideration of the System

In order to incorporate security into previous SIWES system upgrades, it is important to first define security actions that will help to guarantee the integrity, confidentiality, and availability of the system under consideration are maintained at all times. When looking at the types of data that the system will handle and the operations that the system will execute, these security activities will be discovered. Access control mechanisms must therefore be regarded as the heart of the information security requirements of any computing system, hence, in this system, user privilege mechanism of access control ensures that only authorized users can gain access to the objects in a system. It is also important to ensure that the objects protected by the mechanism are classified correctly.

The only method to accurately analyse all of the information included in an application system is to examine how the information flows throughout the application system, because information is continually updated to various databases of the system. Several workflow diagrams can be used to depict the flow of information between objects in an application system. In this instance, activity diagram is a graphical depiction of sequential activity and action processes that includes support for choice, iteration, and concurrency. Figure 4 below shows the activity of users in accessing the system functionalities based on user privileges. In this system, permissions are defined for individual users. This involves a many-to-many relationship between users and tasks with permissions as shown.

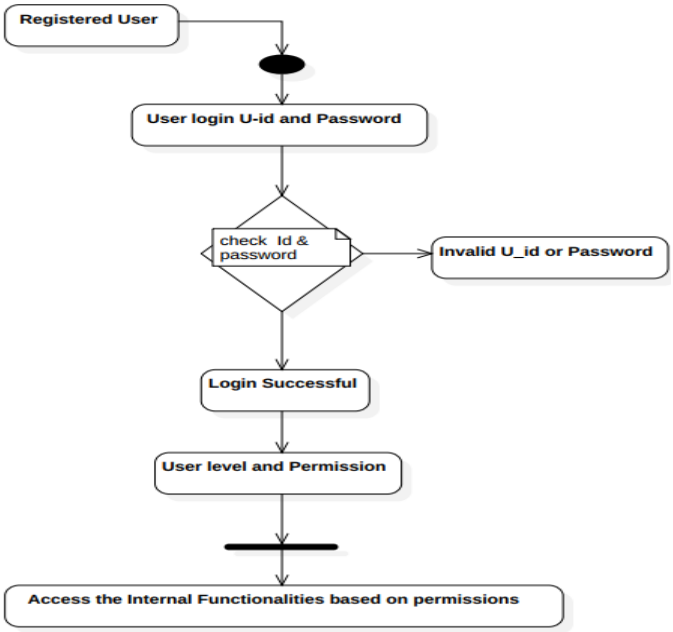

Fig.4. Activity Diagram of User Login. Source: (Author)

4. Results and Discussion

4.1. System Main Menu Implementation

On executing the system, it displays the home page screen which contains the users' subsystems from which users can create an account, and also sign in if user has an account already. The users can therefore see roles and functions based on user privileges. Also, the home page has an advertisement section where organizations can place requests for certain numbers of students they need in their organization. The systems further display number of registered students, supervisors and organization. Figure 5 shows the home screen of the system currently having two organization, one supervisor and four registered students enrolled.

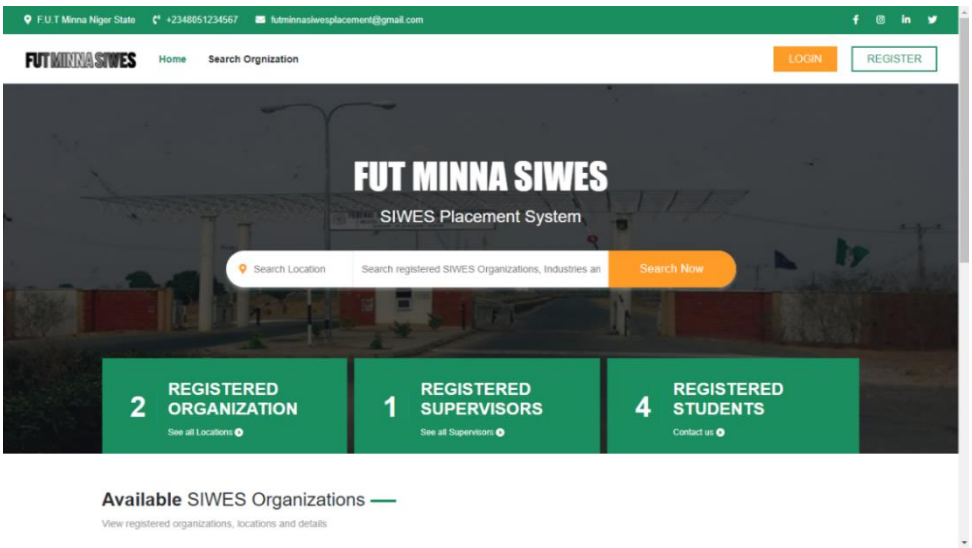

Fig.5. System Home Screen

4.2. User Registration

The figure 6 shows the registration interface of the application where users of different categories (student, coordinator, supervisor and organization) can get enrolled on the system before they can have access to its functionalities based on their user privileges.

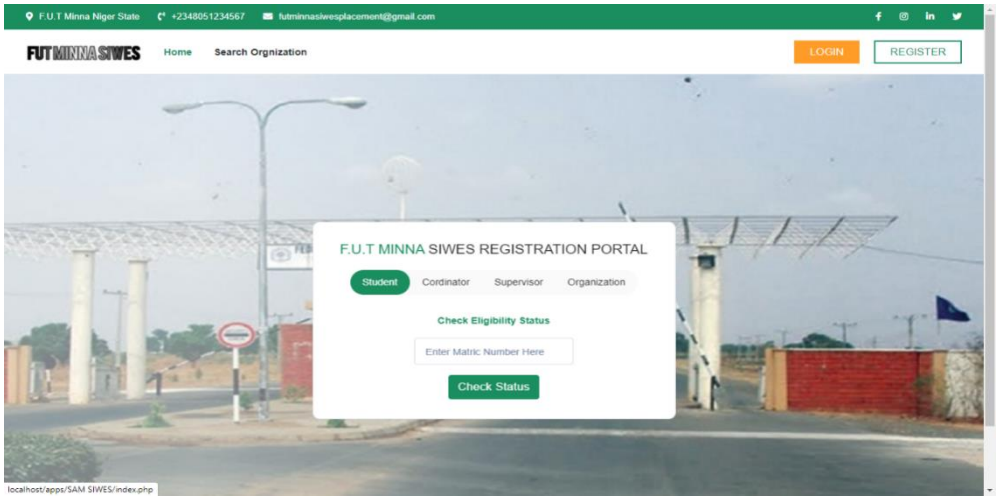

Fig.6. User Registration

4.3. User Login

For the student user category, the student is first expected to check his eligibility status using his or her matriculation number before proceeding to enroll on the system. User categories of coordinator, supervisor and organization are required to supply an OTP sent by the admin of the system to their respective email addresses before they can be enrolled on the system. Once enrolled, the user can then login to access the applications functionality as displayed in figure 7.

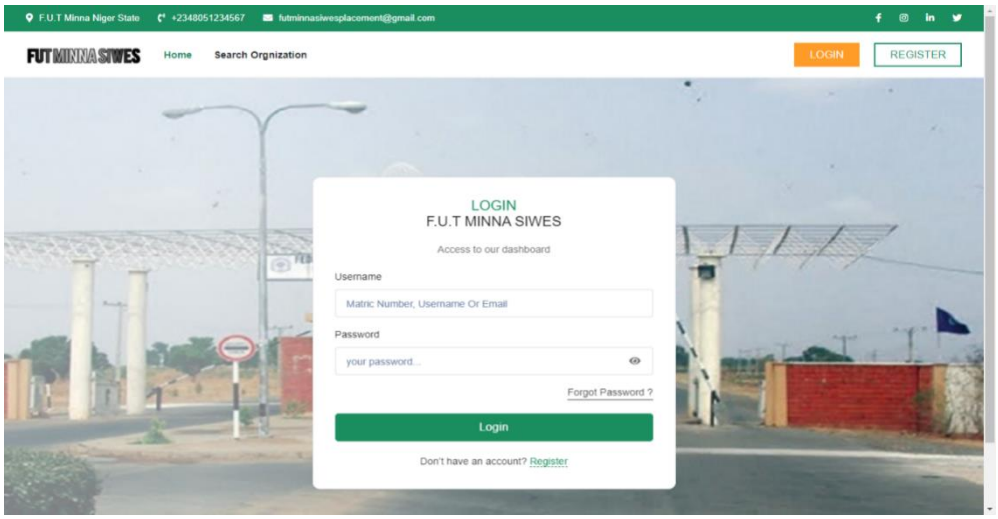

Fig.7. User Registration

4.4. User Dashboard

The developed system has four classes of users with different access level privileges. Based on design, the user with the most privilege is the coordinator. His/her function includes but not limited to, first populating the database with list of students who are eligible to undertake the SIWES program, declaring the duration of the program, generating OTPs for enrollment by the organizations and supervisors, assigning organization and supervisors to students, comment on student's overall performance, view records of students and also send broadcast messages to other users. Another class of user is the institution's supervisor who can view assigned student and their organizations, have access to logbook that needs to be commented and signed on. Also, chat and send notification to his assigned students for easy reach.

An organization can place advertisement on the home page requesting for students. Also, when students have been assigned, through this dashboard gradings and signing can be digitally done on the student's logbook. For faster reach, the handler of this account can also send message to the institution's supervisors and coordinator to intimate them with the activities of the student or pass across messages and information to the students using the inbuilt chat system. For a student that has been authenticated as cleared by the coordinator to embark on the program, upon validation of registration details and assigning of organization and supervisor, can also update their weekly activities digitally for easy assessment by the organization and supervisor. A typical dashboad of a user will look like what figure 8 is deplicting.

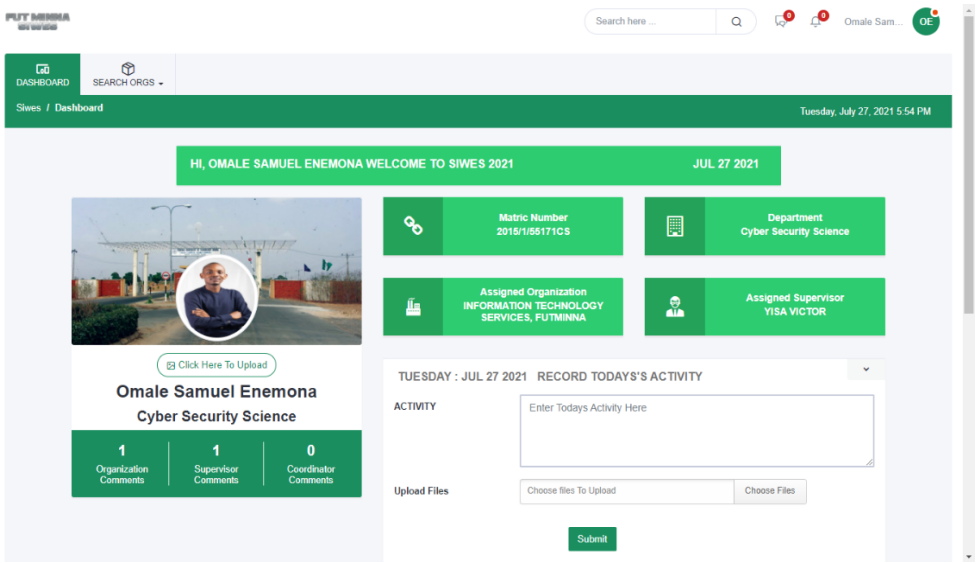

Fig.8. User Dashboard

4.5. OTP Code Generator

As a way of ensuring integrity of the system and making sure user privilege is not overridden, the system makes use of OTP that will be sent to supervisors and organizations alike. Figure 9 displays the OTP being generated to be sent to an Email address of users for verification.

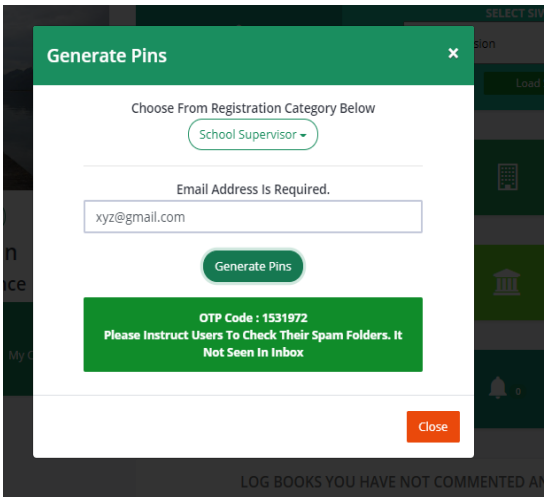

Fig.9. OTP Code Generator

4.6. Database Implementation

The term database implies a pool of relations also referred to as tables and other objects such as indexes. A table basically consists of rows and columns. The necessary credentials or information of a user that is required for registration and authentication is stored here. This scheme therefore will make use of a database. Figure 10 below displays the login table showing users encrypted password credentials.

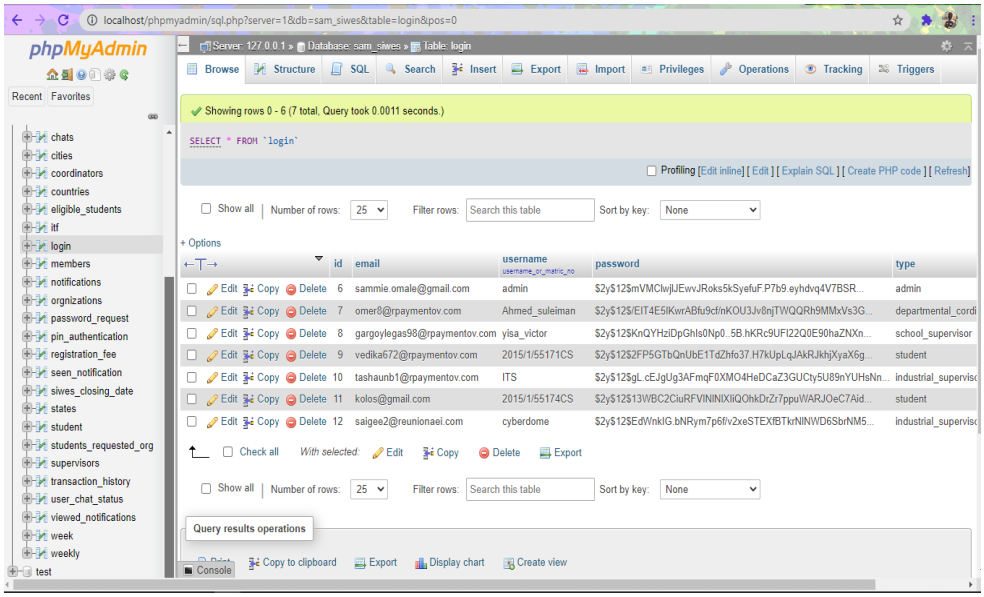

Fig.10. Database Table

4.7. System Testing and Integration

This test verifies that the software program satisfies the user's expectations. System validation's goal is to give the maximum level of confidence that a certain process will consistently deliver the same outcome and match predefined standards and quality characteristics. This ensures the system's functionality and dependability. The validation method aids in the removal of several problems from the code base, with the goal of making the program bug-free. Achieving security requirements is impossible without a validation procedure, and the primary aim of testing is to safeguard delicate user data from malevolent users.

Testing a software is a critical element of software development process, according to experts, emphasis is needed to be placed on the testing of components while building such a software. Testing has the capabilities of uncovering different classes of error such as syntax error, logical error, runtime error and compilation error, when any of this error is discovered, then debugging process can begin. A test plan which is a document detailing the strategy that will be used to verify and ensure that a system meets its design specifications and other requirements needs to be developed. There are three major types of testing utilized on this system and they are unit testing, subsystem testing and system testing. The table 1 below shows the result for the system testing performed on the developed system. Table is use to present the evaluation of new developed system (Secure SIWES) and existing systems. The new system is better in terms of design, implementation, security architecture and design. It is the only system that inculcates all necessary design components at the same time the design implementation.

Table 1. System Test Results

S/N	System Testing	Results
1.	Install the system into server.	Pass
2.	Start up all servers such as MySQL database server.	Pass
3.	Run tests by using real data on all test cases	Pass

Table 2. Evaluation of New Secure SIWES with Existing System

	Research System	Implementation	Methodology (Secure Design)	Security Architecture Availability	Web based design	Mobile based
1	Adetiba et al. (2012)	Yes	No	No	No	No
2	Adeyewa, Z., (2015)	No	No	No	No	No
3	Gaikwad, P. & Bhatt, P., (2016)	No	No	No	No	No
4	Michael, O., & Kolawole B. O. (2016)	No	No	No		Yes
5	Kirk, J. (2017), Ibegbulam, I (2017), Oladimeji et al., (2017)	No	No	No	No	No
6	Sylvester et al.(2017)	Yes	No	No	Yes	No
7	Ogbuanya et al. (2018)	No	No	No		
8	Oluwatosin, I. (2018)	Yes	No	Yes	Yes	
9	Ogunde, A. & Idialu, J (2019)	Yes	No	No		
10	Secure SIWES System (2021)	Yes	Yes	Yes	Yes	No

5. Conclusion

This research examined the existing system, designing and implementing a new and security focused solution with the whole aim of tackling the challenges faced with the current manual system. The data were collected to understand the problems and for the design and development of the new digitalized SIWES system. The implementation of the new system was carried out using programming languages and tested with collected data. The Unified Modelling Language diagram was illustrated to show how classes, objects and their attributes as well as their actions communicate with each other. It is worthy of note that computers have taken over the world; one would hardly find any organization operating without the use of computers. The need for an automated and secured platform for SIWES placement cannot be overemphasized. The newly developed system in comparison to the manual system is more flexible, provides information security to certain level (because security itself is a process and not a goal), reduces the stress students will go through in seeking placement, and also the need for manual assessment by supervisors.

The developed system was tested using unit testing component of each design, integration testing and general system testing. The implementation shows the system works according to the design, by ensuring all units of the development perform necessary functions of data storage, data retrieval, error alerting, and interface/server appropriate communication. In addition, the security architecture, design and implementation of the system's design are adequate compare to the existing ones. It's fair to say that user privilege is a good way of ensuring security for this type of system based on the category of user data collected and stored on the database, all in a bid to provide a system that caters for student's convenience in seeking out placements, and also affords the institution a means of having a link with organizations, enabling them to register on the platform. It is recommended that for further development, this system security should be improved by considering other suitable methods that will guarantee balance of usability, functionality and security. Also, the system can be made available as a mobile based system for easier accessibility.

6. Recommendation

Artificial intelligence system can be used to automatically recommend placements for students and also make use of biometric systems as a mode of security implementation in a bid to ensure the secure web application practices is leveraged on.

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