2022-08

Development of web-based system for tracking students' performance for early intervention: a case of darling wisdom academy

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NM-AIST

https://doi.org/10.58694/20.500.12479/1611

DEVELOPMENT OF WEB-BASED SYSTEM FOR TRACKING STUDENTS' PERFORMANCE FOR EARLY INTERVENTION: A CASE OF DARLING WISDOM ACADEMY

Thon Malek Garang

A Project Report Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Embedded and Mobile Systems of The Nelson Mandela African Institution of Science and Technology

Arusha, Tanzania

August, 2022

ABSTRACT

Student Information System (SIS) is critical for the effective operation of institutions of learning because it tracks student performance and allows for early intervention. The project's goal was to develop a functional, flexible, and convenient web-based SIS with user-friendly interface for enhancing students' performance tracking for early intervention. During the requirements elicitation process, the project included benchmarking of other schools' SIS. Benchmarking and user interviews were used to obtain requirements for the SIS. The system was developed through Rapid Application Development (RAD) and tested with unit, system, and integration testing. The survey showed that the system is 70% user-friendly, the system will provide easy interaction between students, parents, guardian, and school by 70%, 71% believe the technology will make student data management easier as 73% believe the system will help keep better records. The system provides a single login interface for school general secretary, students, and parents/guardians. The SIS allows students to monitor their academic progress, school management and designated staff manage student results, school general secretary deals with all aspects of system administration pertaining SIS. Secure Socket layer (SSL) certificate installed on the institutional domain where Information System (SI) is hosted. Object-orient Programming (OOP), prepared statements and password encryption were applied for IS security enhancement. SIS files and database were backup using JetBackup and log files were developed to enhance accountability. The efficiency and effectiveness of schools are dependent on the adoption of the SIS. The SIS provides timely student information to students, school management and parents. This system, however, will have to be integrated to other IS's of DWA to achieve consistent data flow within the institution.

DECLARATION

I, Thon Malek Garang, do hereby declare to the Senate of The Nelson Mandela African Institution of Science and Technology that this dissertation is my original work and that it has neither been submitted nor is concurrently submitted for degree award in any other institution.

Thon Malek Garang		05.08.2022
Candidate Name	**Signature**	**Date**

The above declaration is confirmed by:

Dr. Neema Mduma		09-08-2022
Name of Supervisor 1	**Signature**	**Date**

Dr. Dina Machuve		
Name of Supervisor 2	**Signature**	**Date**

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CERTIFICATION

The undersigned certify that they have read and found the project report titled ***"Development of Web-based System for Tracking Students' Performance for early Intervention: A Case of Darling Wisdom Academy"*** qualify for acceptance by The Nelson Mandela African Institution of Science and Technology (NM-AIST) in Arusha, in partial fulfillment of the requirements for the degree of Master of Science in Embedded and Mobile Systems of The Nelson Mandela African Institution of Science and Technology.

Dr. Neema Mduma	NMduma	09-08-2022
Name of Supervisor 1	**Signature**	**Date**

Dr. Dina Machuve		
Name of Supervisor 2	**Signature**	**Date**

ACKNOWLEDGEMENTS

I am thankful to God for the gift of life on which all endeavors of life depend and granting me an opportunity for a postgraduate qualification at NM-AIST in Arusha Tanzania as well as provision of all blessings inform of physical and material support which led to successful completion of the programme.

I am grateful to CENIT@EA for the scholarship which comprised of sufficient fund for both subsistence living and project financing which actualized the development and implementation of this project. A lot of heartfelt gratitude goes to Dr. Neema Mduma and Dr. Dina Machuve of the School of CoCSE at NM-AIST for supervisory support and mentorship necessary for the success of this project. It was not easy to sail through this journey, however, with help of my supervisors, this much has been achieved. Besides tireless support from my supervisors, special thanks go to NM-AIST family who support me during this journey in one way or the other.

Furthermore, I acknowledge DWA which gave me an opportunity to exercise the skills acquired during EMoS programme.

Lastly, I appreciate the study leave granted by my employer; Upper Nile University to attend EMoS program. May God bless the brain behind this idea which is in support of capacity building.

Thanks a lot indeed. God Bless You.

DEDICATION

I, Thon Malek Garang dedicate this dissertation to my family.

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LIST OF ABBREVIATIONS AND SYMBOLS

AI	Artificial Intelligence
CSS	Cascaded Stylesheet
CSV	Comma Separated Values
DWA	Darling Wisdom Academy
DWA	Darling Wisdom Academy
EMoS	Embedded and Mobile Systems
ERD	Entity Relationship Diagram
HTML	Hypertext Markup Language
IS	Information System
ML	Machine Learning
NM-AIST	Nelson Mandela African Institution of Science and Technology
OOP	Object-Oriented Programming
PDO	PHP Data Objects
PHP	Hypertext Preprocessor
SIS	Student Information System
SQL	Structured Query Language
SSL	Secure Socket Layer

CHAPTER ONE

INTRODUCTION

1.1 Background of the Problem

An information system is made up of interconnected components that collect, store, and analyze data as well as deliver information, knowledge, and digital products (Zwass, 2017). The importance of developing an information system that allows for the generation and maintenance of very accurate and up-to-date student information in nursery, primary, and secondary schools was underlined (Bharamagoudar *et al.,* 2013)**.** Therefore, student information is not good enough unless it stores accurate information, eases accessibility to intended users and simplifies workload to enhance effectiveness and efficiency of student information-oriented services, student information management and performance tracking. One of the studies reported that, key functions of student information system is to enhance students' performance review through statistical processing of student' information.

Making informed decisions based on students' information is vital for nursery, primary and secondary schools. However, having an insightful and summarized student information enhances effective and informed decisions that is aimed at monitoring and effectively track student performance. The sole development of student information system is, to create the administration of error-free, therefore, exceptional data regarding students' scholarly profession is very important (Walia *et al.,* 2014).

While developing an information system that gives a good guarantee for student information management, Liu *et al.* (2010) brings forward factors such as full functionality, flexibility, convenience, and user-friendly interface as best practice for development of effective and efficient student information system. For effectiveness and efficiency of student information system, Zhao and Wu, (2008) highlights to implement logging functionality aimed at tracking access of all the users to the system and guidelines for accessing data to increase efficiency and effectiveness of institution's student information management which can enhance quick service delivery of student information services. As the institution considers automating the processes, student information is at the heart of the institutional affairs (Zhao & Wu, 2008).

Given all the above-mentioned significance of student information system, it's relevant to carefully elicit all the requirements pertaining to develop the system which will serve the purpose of the intended users besides conformity to stipulated systems requirements.

South Sudan has less information communication technology intake. This has greatly affected the whole country. This effect also interferes with school operation because of inadequate accessibility to internet service. Some which can access internet do so at a high cost. This causes struggle among the schools and enterprises to adopt and use information systems.

Darling Wisdom Academy is in Hai-Mauna behind custom market, they use city power and occasionally generator. This power is sometimes unreliable. Internet service is rarely used at the institution. Those who use it mainly purchase bundles from the service providers of their choice. This alternative access to internet service is not a perfect solution for regularization and implementation of information system. This calls for a solution which works both online and offline. We have proposed a solution that works both online and offline. Web application is hosted on local machine and connected using land cables which is shared by users. The application hosted at school is the master database and the one online is slave. When internet is available, the system automatically uploads the offline data to online where it's accessible to parents or guardians.

1.2 Statement of the Problem

Late intervention in student performance review and monitoring causes a lot of complications in student's academic journey. Majority of students and pupils in Darling Wisdom Academy nursery, primary and secondary come from families where parents or guardians are so occupied by their endeavors (Majak, 2021). Due to the busy schedules of parents and guardians, they don't get enough time to come to schools on visitation days to monitor the performance of their sponsored students physically at schools. This gives parents and guardians limited time to focus on tracking the performance of their children. Therefore, most parents always rely on report cards produced at the end of the year which in most cases catches them by surprise when these students fail. The failure of these students calls for repeating classes which has time and cost implications. Due to large numbers of students, the schools find it hard to track the performance of each student manually. Some students always forge report cards upon realizing their poor performance and those sponsored by national organizations lose their

scholarship due to poor performance. Majority of the school dropout are the facilitators of criminal activities and hinder peace process in the country.

Software developers in different parts of the world have contributed significantly to early intervention in student's performance through the development of student information systems which provide functions such as registration and processing student results as well as making the results accessible to parents and guardians. However, most of these systems reflect developed world limitedly conforms to African environment and therefore these systems cannot easily reflect African technological infrastructure as far as student information system is concerned.

1.3 Rationale of Study

In order to reduce school dropout and frustration of students during their academic journey, timely mentorship, coaching and giving individualized student/pupil intervention is a necessity when managing students' performance. This can be achieved through early detection whether student is progressing well with his/her studies or not. It can help to reduce the risk of school dropout, frustration to students, financial losses resulting from repeated classes and more. With the help of web-based student information system, student results can be easily made available to parents and guardians as well as the school management for aggregating student's results and remarks (passed or failed).

1.4 Objectives

1.4.1 Main Objective

To develop a functional, flexible, and convenient integrated web-based student information system (SIS) with user-friendly interface for enhancing student performance tracking for early intervention at Darling Wisdom Academy.

1.4.2 Specific Objectives

(i) To analyse the requirements of a web-based student information system.

(ii) To develop a web-based student information system.

(iii) To validate and evaluate the developed web-based student information system.

1.5 Research Questions

(i) What are the requirements for a web-based student information system?

(ii) What are the best web technologies for developing a web-based student information system?

(iii) To what extend do validation and evaluation results confirm user acceptance of a web-based student information system?

1.6 Significance of the Study

This project developed a web-based SIS that will provide a timely and efficient student processing results and timely access of student performance by parents and guardians. This solution will enable parents intervene in advising students and pupils before performance deterioration occurs. This solution will enable schools to accurately monitor student performance for early intervention. This solution will as well provide summarize managerial reports which will help administration to strengthen measures for minimizing pupils and students' performance deterioration. Furthermore, the solution acts as ultimate solution to school dropout and enhancement of literacy rate in South Sudan. The developed solution will enable parents, guardians, and school administrators to give timely advice based on student academic track records hence, enhancing timely mentorship and coaching that reduces school dropout and academic frustration, redundancy, and engagement in criminal activities. With the help of web-based student information system, student results can be easily made available to parents and guardians as well as the school management for aggregating student's results and remarks (passed or failed).

1.7 Delineation of the Study

This study focuses on development of a web-based SIS at Darling Wisdom Academy, and this implies that the project excludes other modules of the school management system such as finance, logistics, admission, library, and human resource modules. Among many options of developing student information system, only web application was considered. Furthermore, this project aimed at developing a web-based student information system which can be accessed on both smartphones and computers connected to internet and responsive based on developer's definition. This project can work on smartphones, however, it's not installable as

mobile application though compatible to smartphones connected to internet. Out of many functions the web-based student information system can provide, we focused on the following:

(i) Student/Pupil registration and termly information registration.

(ii) Subject registration.

(iii) School fee structure setting.

(iv) Searching student.

(v) Generating reports.

(vi) User registration.

(vii) Uploading results using CSV or Excel files.

(viii) Online self-service portal.

(ix) Detailed administrative reports.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of the System

Many recent research studies and projects have focused on early intervention in student's performance tracking since late detection of student performance deterioration has long been a major difficulty when it comes to monitoring and managing student performance. Student academic performance deterioration presents various difficulties ranging from financial loss to parents, school dropout, early marriages, increases crime levels and many more. With late intervention in student's performance tracking challenges, better approaches for capturing, storing, processing, and communicating student's academic performance are required to minimize consequences that may arise because of late intervention.

Many researchers have proposed ways to reduce the occurrence of the problem, including the use of computational intelligence approaches for student performance management and prediction, such as the use of machine learning algorithms in student performance prediction as well as communicating student's performance to parents through online portal. Computational Intelligence approaches, such as machine learning algorithms, are well-known in academia for detecting student performance deterioration, and researchers are attempting to improve the accuracy of the various algorithms to maximize efficiency and reliability as well as accessibility of student-related information. The development of web-based SIS will significantly benefit from literature and the existing systems. The DWA Schools maintain records on books and list of registered students is later transferred to Microsoft excel. The approach of managing student results and performance might lead to a lot of errors in student results processing due to sufficient human errors and intrusion (Madhor, 2021). The student population of DWA approximates to 4000. There are a lot of results to be processed making student results to take longer than required. Student results are often inaccurate and processed lately due to manual processes leading to challenges in tracking each student's performance by class teachers, school management, parents, or guardians. Besides, the internet service in South Sudan is limited and available at very high cost. Electricity is also unpredictable. Therefore, the above two factors require a customized student information system. A solution which will work both offline and online so that the institution will use the system whenever the internet

service is unavailable, and the data uploaded offline can be synchronized with online system for accessibility by the parents or guardians as well as students when internet is accessible.

2.2 Existing Systems Outside South Sudan

Asif *et al.* 2011 developed SIS offers an opportunity for students to access their results remotely as well allowing the school management to manage students' information and processing. The database management system used here is dependent on Microsoft Structured Query Language (SQL) Server 2005 based on ADO.NET technology (Asif *et al.,* 2011). This solution is restricted to Microsoft SQL server and hence making it difficult for the users to scale the application to other database engines such as Oracle and other databases. This rigidity of database does not conform to dynamic business requirements.

Liu *et al.* 2010, in this research, web-based SIS is being used to capture and maintain students' information as well as offering remote access to students' and parents' services (Liu *et al.,* 2010). The application is hosted on institution domain. However, this solution lacks the functionality of uploading students' results using CSV. This makes results entry and processing cumbersome and may lead to delays in decision-making.

Hashim *et al.* 2013, developed a solution that focused on registration and updating the student information and used Rapid Application Prototyping (RAD) for the implementation of the system. Unlike the above-mentioned solutions on student information, this solution is a desktop application. It's difficult for parents and students to access student related information remotely (Hashim *et al.,* 2013).

Unlike Hashim *et al.* 2013, similar web-based and student management information system has been developed that caters for Faculty management of courses and grades, placement, and registration of students. Although this solution is sufficient, it lacks the functionality of comma separated values. This makes results entry tedious since students' results are entered into the system one at a time. Besides the above-mentioned gap, the solution uses MySQL database. This creates the dependence of application to MySQL database and limits the system to use MySQL database only and hence restricts the institution from using the application with another database engine. This makes the proposed solution relevant because it uses PHP Data Objects (PDO) which makes the application flexible to use any database engine instead of MySQL.

2.3 Existing Systems in South Sudan

To efficiently design and implement a web-based SIS, it is vital to consider surveying other systems available in South Sudan. Salam nursery, primary and secondary schools maintain student academic records on access database which is maintained in the office of General Secretary. This database is efficient; however, students only receive their results after processing reports cards. Students are unable to access their results remotely and this applies to parents as well. The system requires username and password for admin login, and this guarantees basic level of security. However, there is no backup for the system and the system downtime is overwhelming (Ayuen, 2021).

Unlike Salam, Malong Foundation maintains student management information system on local machine (localhost) where student results are processed. Student results are processed timely as compared to Salam; however, results are not accessible to parents and guardians remotely and this therefore makes it harder for parents and guardians to track performance (Mawien, 2021).

Juba Academy are currently developing an information system which will integrate to mobile application. Meanwhile, they are starting with student information system hosted remotely. Meanwhile, the student information system is hosted remotely and later to integrate to mobile application for parents and students. However, results are entered into the system manually, which might take a lot of time for data entry (Maker, 2021).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

Student information abroad knowledge that stems from school management system in relation to the effective and efficient student results processing, performance review and monitoring aimed at enhancement of student's smooth academic journey. This project links effective student information processing and early intervention. As a result, development of reliable student information is crucial to improve effective early intervention and management of student information by parents and schools.

There has been an observable increase in the usage of internet and mobile technology in South Sudan by 8% in 2021 (Datareportal, 2021) and this creates a favorable environment for information system to thrive especially when accessed through the web by parents, pupils, students, and school management. This solution is aimed at the public by engaging users of school information related activities, improvement of access to the quality student information services and encouraging the behavior of user which includes looking for solutions for processing student information (Rick *et al.,* 2013). Given ubiquitous advantage brought about by mobile phones, it has laid a solid foundation for ease of access to student information services at one's convenience just like it applies to other available online information services.

This section describes the system's implementation process. The technology enables an interactive flow of web-based student information and allows for user engagement. The developed solution takes the form of web-based student information system and is intended to improve early intervention in student performance through effective and efficient student information system implementation in Darling Wisdom Academy.

3.2 System Requirements

3.2.1 Functional Requirements

The functional requirements for developing this web-based student information system address the issues of business requirements, which are a collection of institutional information that school management and parents suggest, which are a collection of student information concerning student information system improvements added by school management for better

accessibility of student information to both parents and students as well as well-thought approaches which ease the management of student information by school.

Table 1: Functional requirements

No.	Requirements	Descriptions
1.	Single login page	The system will allow all registered users to have access through one login page where users are directed based on their privileges.
2.	Manage user accounts	Administrator will register users of the system and manage all user's accounts
3	Student registration	The administrator will register students by uploading CSV files to the system and the registration details displayed to database for further manipulation.
4	Manage termly details	All the termly registration details are captured by the system using update interface
5	Upload Student results	The administrator upon login will upload CSV files of student results where its available for view by parents and students as well as school management inform of reports.
6	Online self-service	Upon login the parents will view student results
7	Detailed student report	The system will generate detailed report, for example termly student registration report, registration printout, categorical student performance administrative report etc

3.2.2 Non-functional Requirements

In this section, self-service section where parents can access results included in this as part and parcel of functional requirements. This is provided as tabulated report and categorical report. The system's non-functional requirements address concerns such as system operability, maintainability, performance, and security. The system is expected to provide an integrated solution for student information system in DWA, that is challenged by poor access, late intervention, and unreliable student information due to the lack of a computerized system to deal with information storage and no methods of online accessibility to available student information, which is predominantly unintegrated.

Table 2: Non-functional requirements

No.	Requirements	Description
1	Maintainability	A system will be able to provide support, change and restructure over time
2	Usability	A system will provide easy use.
3	SIS Performance	A system will be able to answer user queries as soon as user query from the system.
4	SIS Security	A system will enable authentication of users within an encrypted password.
5	Accountability	The system will provide log files for purpose of accountability

3.3 3.3 Proposed System Design

The proposed system enables DWA to deliver student information to the intended beneficiaries. In this functionality, the school captures student information upon registration, stores all student related details as well as results and the system provide an interface where parents can remotely access student information especially results through web-based student information system. This system provides relevant student performance such as use of remarks (" Failed" or "Passed") displayed based on the total scored in all the subjects. The system as well aggregates students' performance informs of reports available for managerial decision-making.

A model based on Software Development Life Cycle (SDLC) has been selected for the development of an accomplishing web-based SIS in order to complete the implementation portion of the proposed system. The SDLC is a framework that describes the activities that must be completed at each stage of the process definition and modelling. It is a detailed plan that defines the methods for developing, maintaining, replacing, and changing the specific software. The SDLC specifies the strategy for improving software quality as well as the entire development process (Schwaber, 2001). Rapid Application Development (RAD) was selected to expedite the delivery of the entire application (Fig. 1).

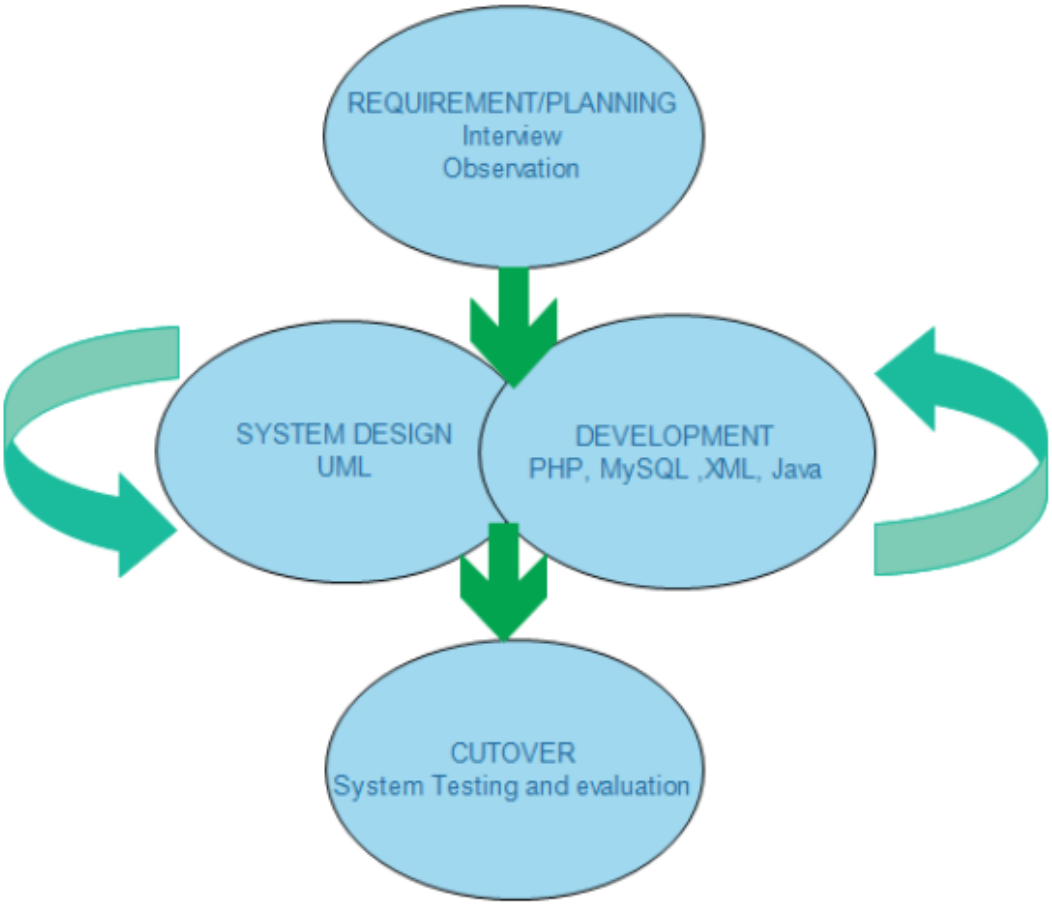

Figure 1: The system's rapid application development model

3.4 Context Diagram

The context diagram is also called level 0; it presents the overview of the whole proposed solution. Also, it involves the interaction between the system and its external entities (Ibrahim *et al.,* 2010). This approach provides a general understanding to the system analyst, developer and stakeholders (Fig. 1).

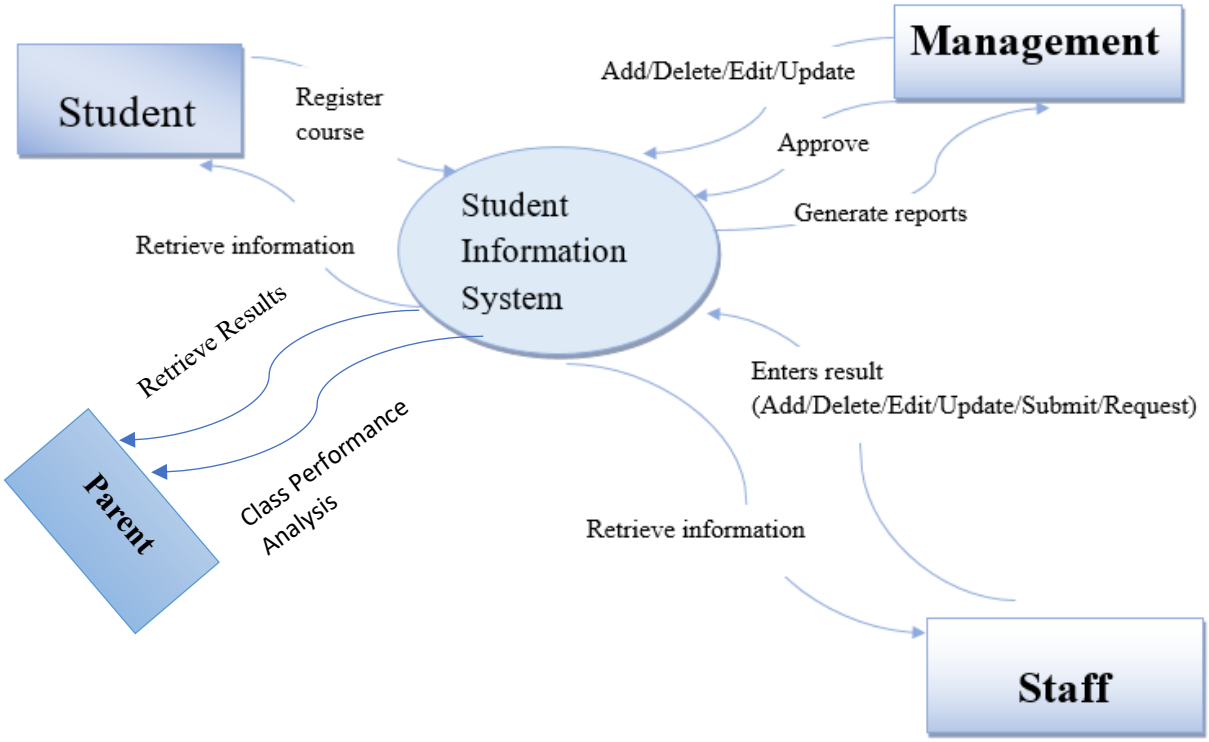

Figure 2: Context diagram

3.5 Conceptual Framework

The conceptual framework is useful in presentation of proposed system. It focuses on the presentation of system structure in terms of concepts (Shankar, 2020). Student information system architectural design comprises of teachers, students, parents or guardians and school management. The school secretary registers student details and termly information. Once the student is registered, the results are compiled at the end of the term using CSV file where each subject results are uploaded to the system. The upload to the system can be done either by class master or secretary. After all student information is successfully available in the student information system database, the school management can generate the reports for decision making. Parents or guardians and the students can access the termly results. Figure 2 shows conceptual framework of student information system.

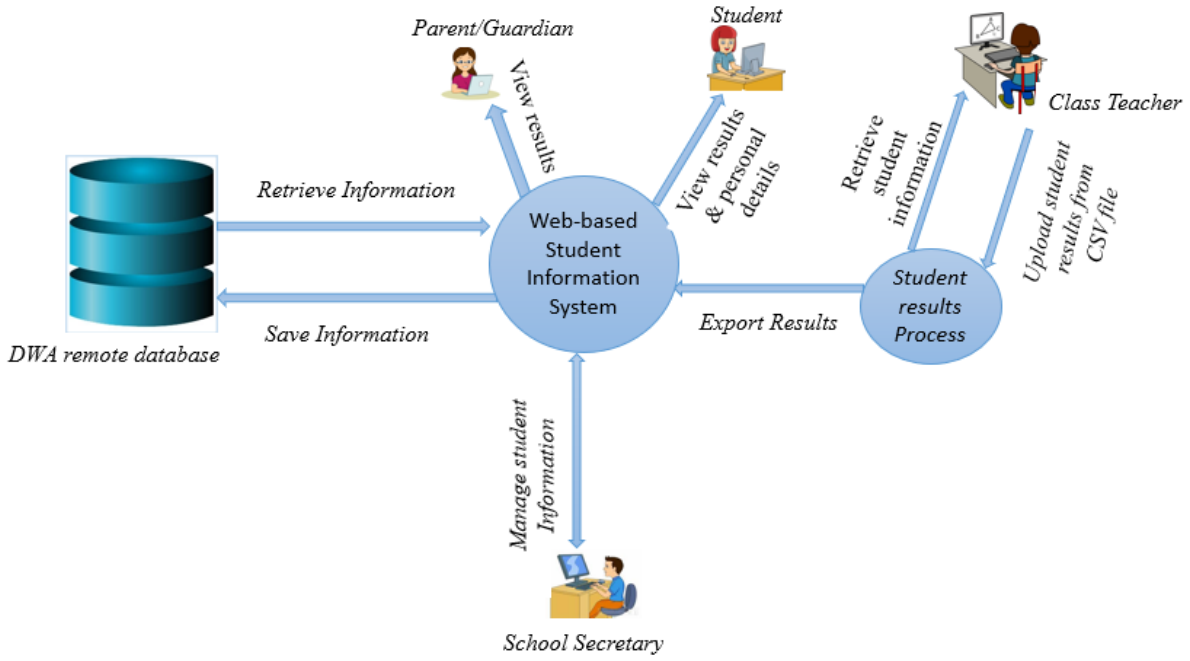

Figure 3: Conceptual framework

3.6 Entity Relationship Diagram

An entity relationship diagram (ERD), also known as an entity relationship model, is a graphical depiction of relationships between people, things, locations, concepts, or events in an information technology (IT) system. An ERD employs data modeling approaches to assist in the definition of business processes and as the foundation for a relational database.

Entity relationship diagrams serve as a visual starting point for database design and was used in the determination student information system requirements. After a relational database is implemented, an ERD can still be used as a reference point for future debugging or business process re-engineering. Figure 4 shows the ERD of student information system.

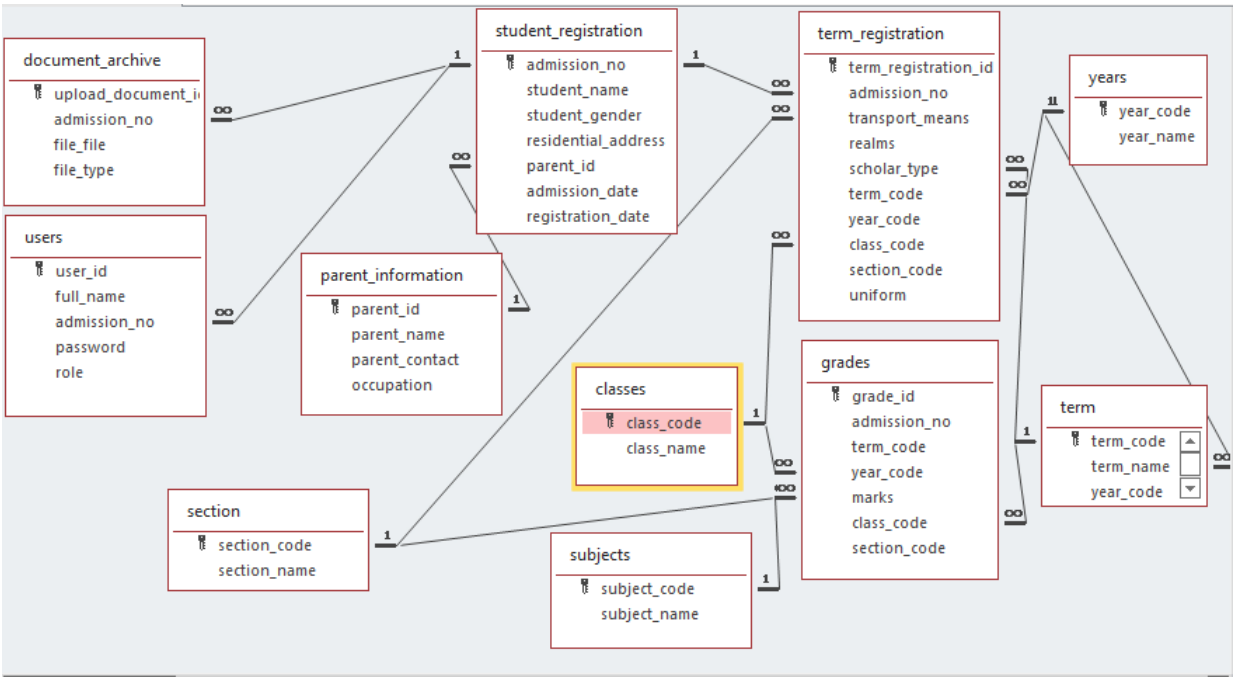

Figure 4: Entity relationship diagram

3.7 Use Case Diagram

Use cases depict and describe what the system accomplishes by describing system functionalities and primary functions performed by system users. Actors, use case symbols, and connecting lines are all included in use cases. Actors are external elements to the system that play a specific role and are always beyond the system's scope. Boundaries are defined by the communication channels that connect actors to the system.(Satzinger *et al.,* 2015) .

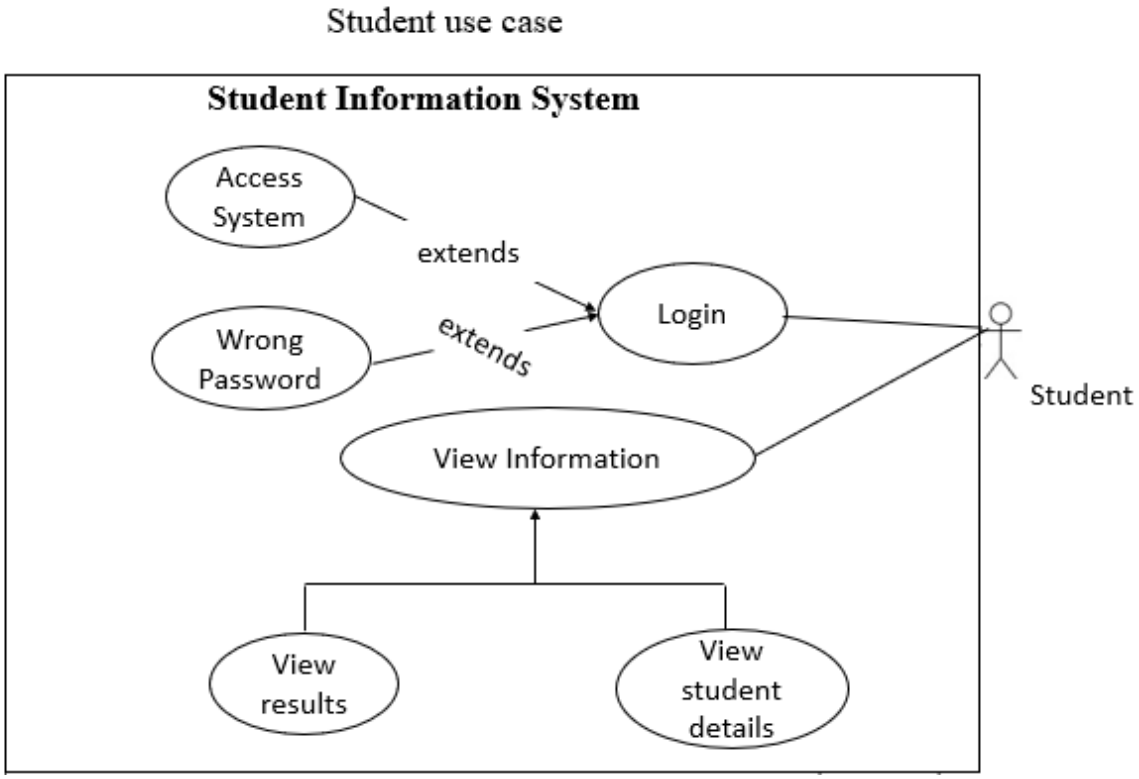

Figure 5: Student use case

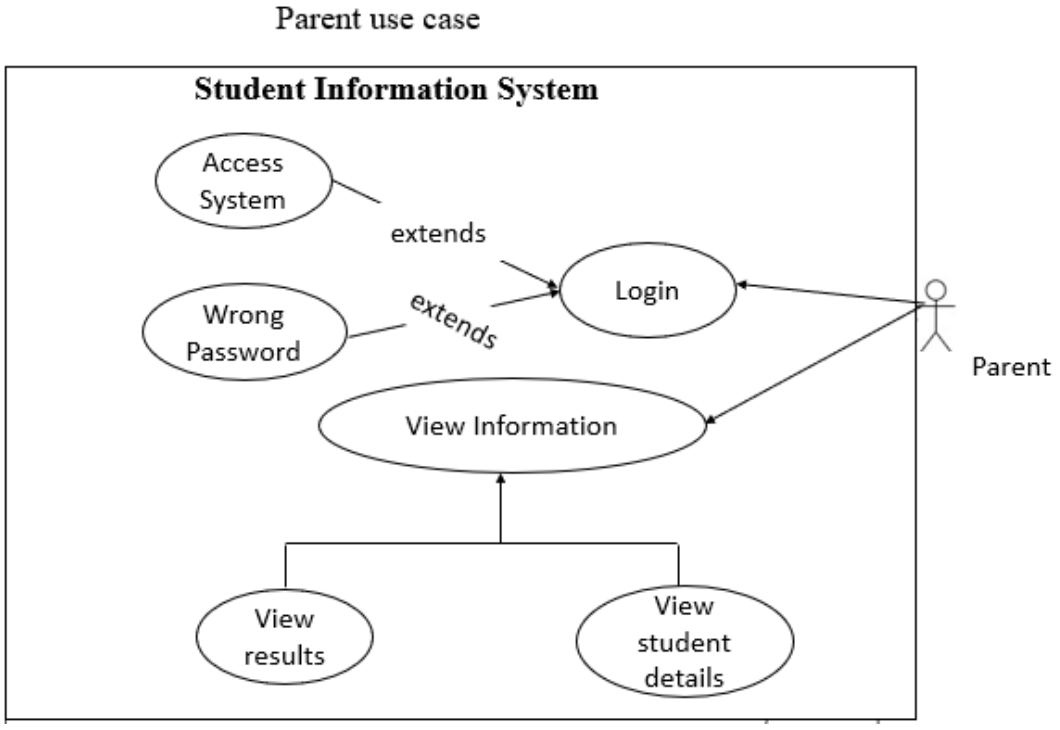

Figure 6: Parent use case

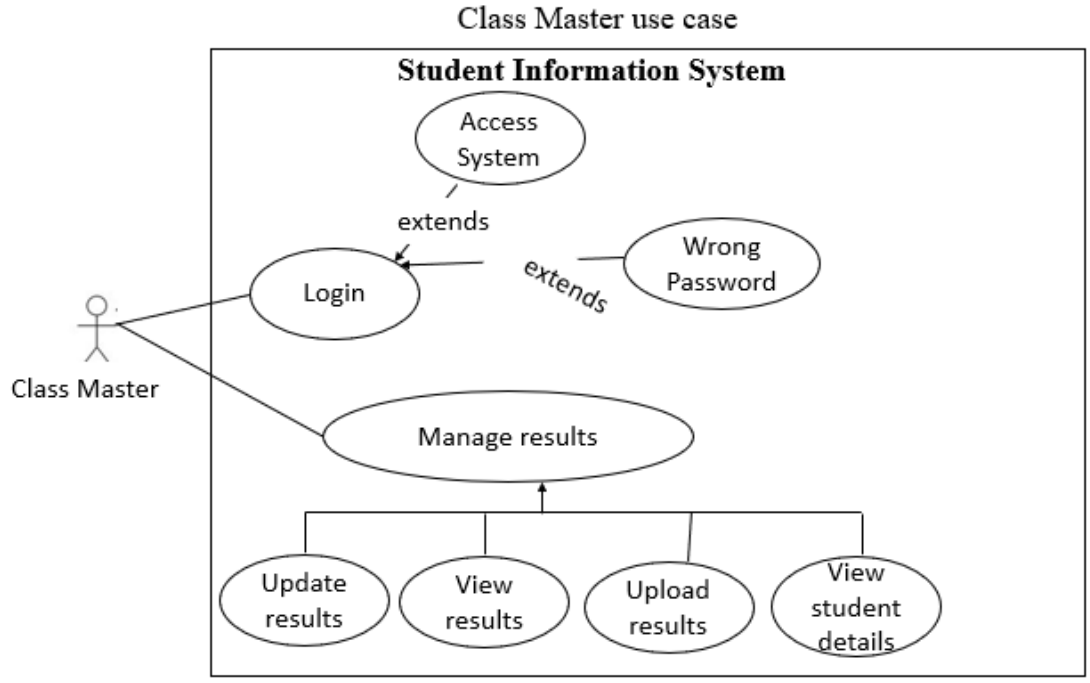

Figure 7: Class master use case

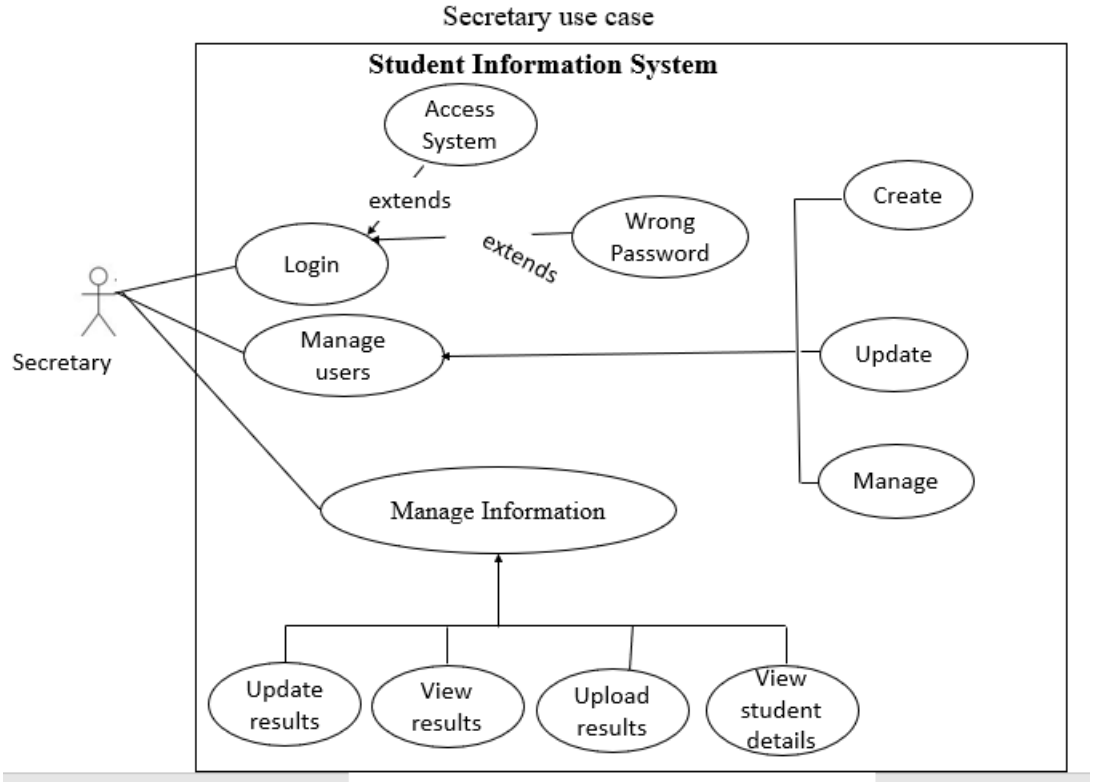

Figure 8: Secretary use case

3.8 Sequence Diagram

A sequence diagram simply illustrates the interactions between items in the order in which they take place. A sequence diagram can also be referred to as an event diagram or an event scenario. Sequence diagrams show how and in what order the components of a system work together. (Triandini *et al.,* 2019)

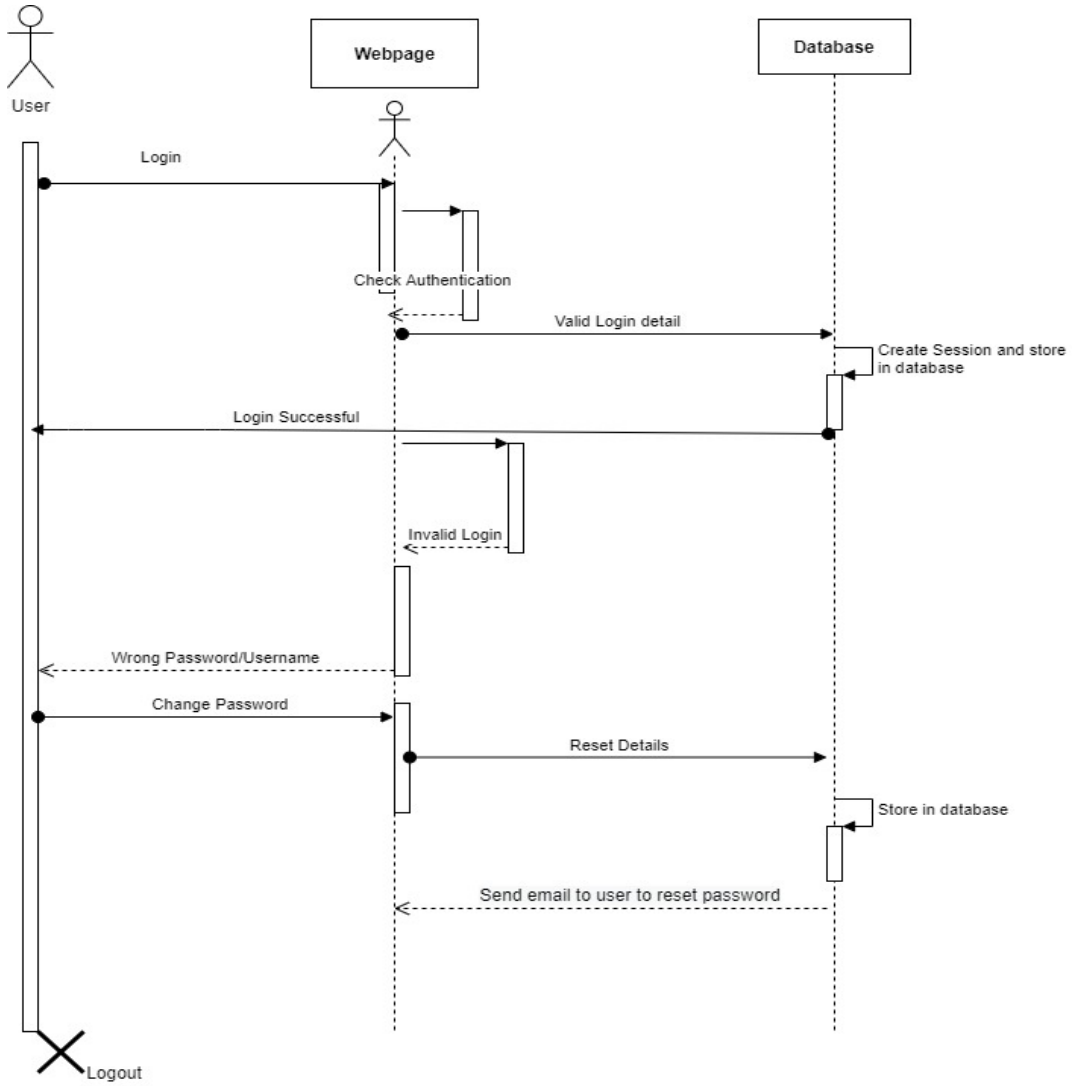

Figure 9: Login sequence diagram

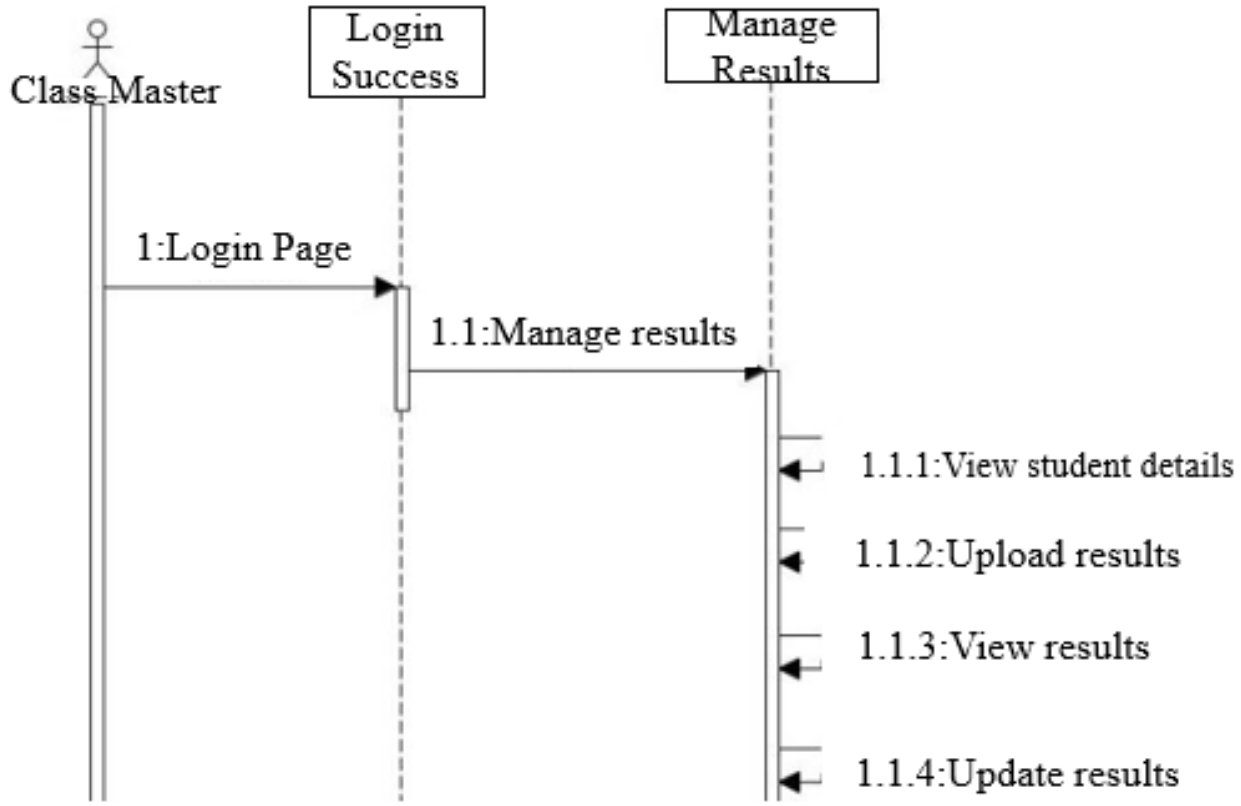

Figure 10: Class master sequence diagram

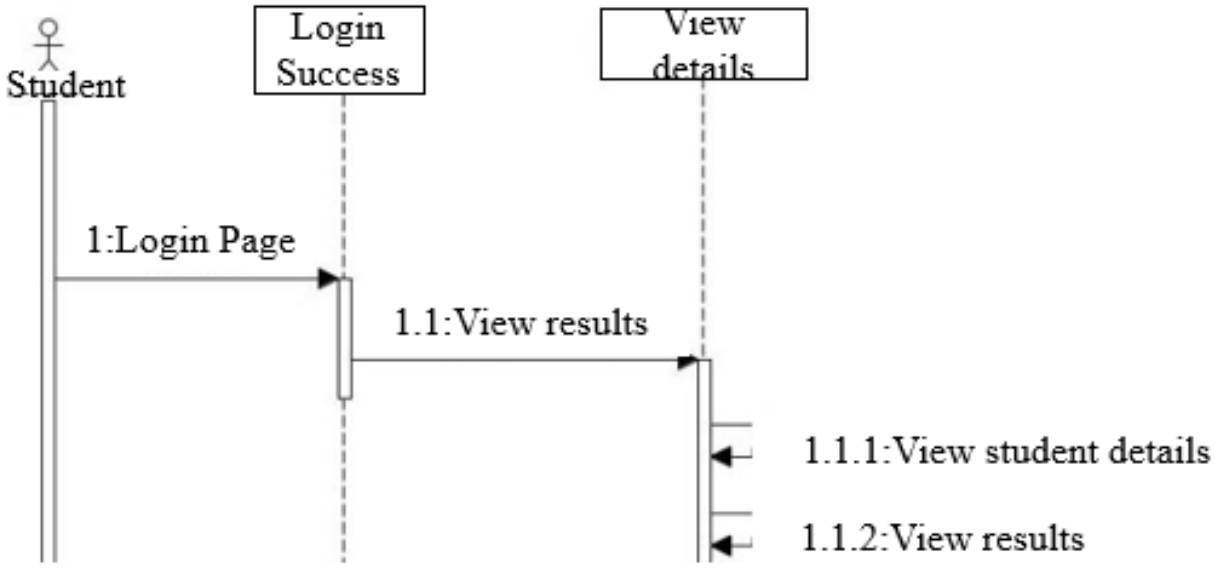

Figure 11: Student sequence diagram

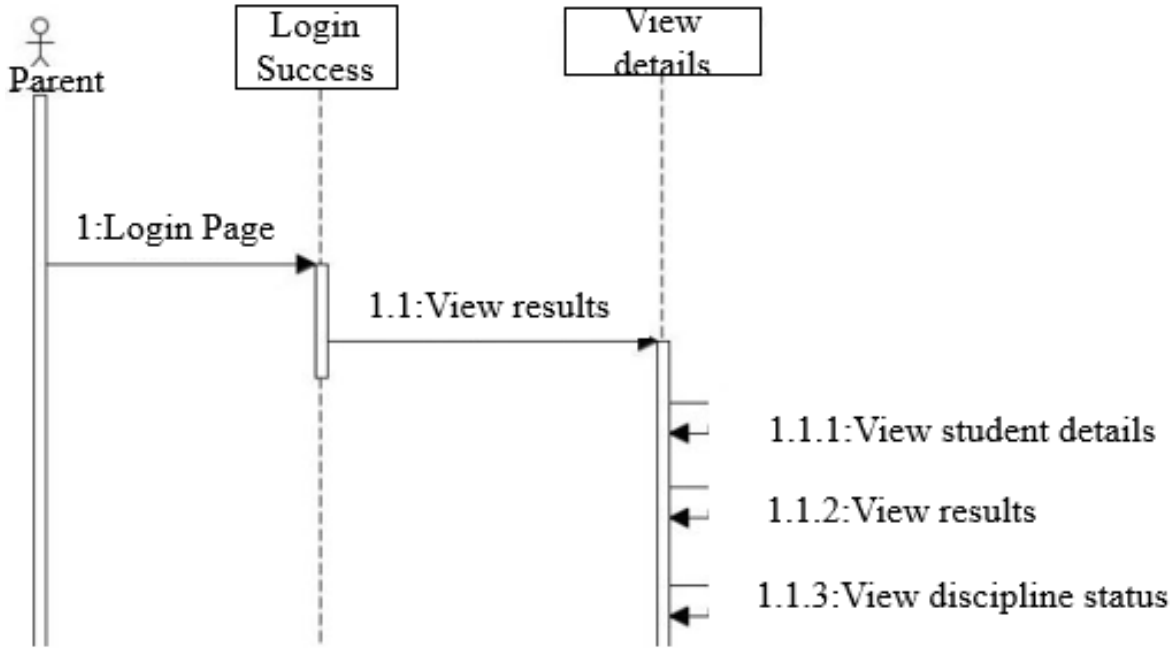

Figure 12: Parent sequence diagram

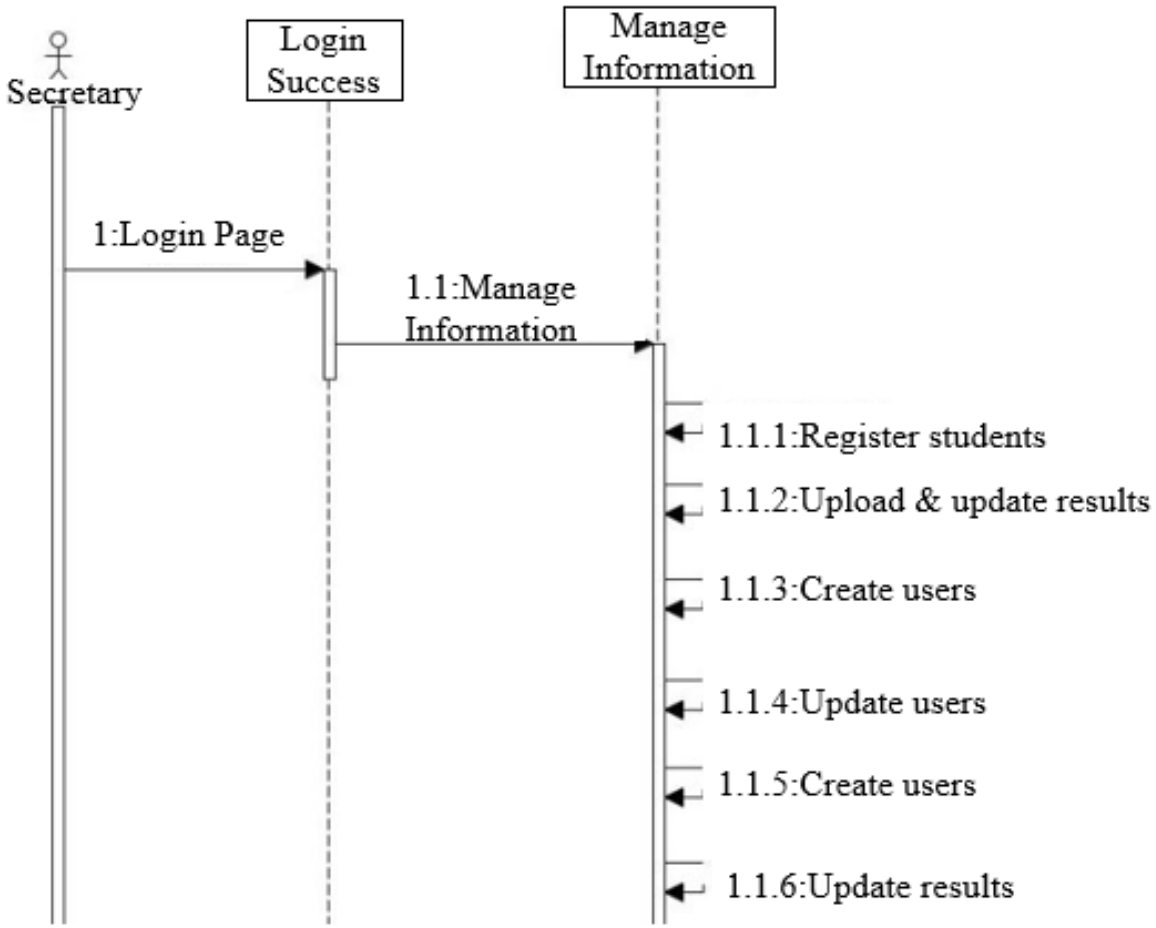

Figure 13: Secretary sequence diagram

3.9 System Requirements

(i) **Internet connection**: the web-based system needs internet connection to be accessible.

(ii) **Web browser:** Google Chrome, Mozilla Firefox, Torch and Internet Explorer.

(iii) **Operating system:** Web-based system operates in Windows 10 and onward versions, Mac

(iv) OS and free Open-Source Operating systems such as Ubuntu.

(v) **Hardware**: Smartphones, tablets, and personal computers.

3.10 Development Tools and Technologies

(i) Hypertext Preprocessor

Hypertext Preprocessor (PHP) was used in the developed of the web-based student information system since it is one of the server-side languages commonly used in software development and is an open-source scripting language that deemed suitable for developing this system. PHP was chosen for this project development because it is straightforward and hence simple to master. It operates efficiently on the server side, and its programs execute quicker since it runs in its own memory region, resulting in a quick loading time. PHP includes open-source software tools that are publicly accessible for usage. Furthermore, it is adaptable in terms of database connectivity and supports a diverse set of databases. Furthermore, PHP can connect to a variety of databases, however MySQL is the most often utilized because it is free to use (Monica, 2015).

In addition, PHP is compatible with almost all servers and its security features allow many functions to protect users against certain attacks. This language runs on various platforms such as Android, Windows, and many others.

(ii) MySQL

MySQL is one of the server-based database systems that employs the standard Structured Query Language (SQL). It is simple to use, dependable, and really quick. MySQL Database was employed in this study to allow the cost-effective delivery of a dependable and high-performance application. A MySQL database stores data in tables and provides a versatile programming environment (Christopher, 2010). Database systems are essential in computing and can be used as stand-alone utilities or as components of other programs.

The MySQL database server can support deeply integrated applications and gives platform flexibility; this is a MySQL strong feature. It enables for customization, making it simple for a programmer to expand the database server by introducing new features. MySQL has been utilized by many database experts because of its unique storage engine design, which allows the database server to be configured to achieve outstanding end results performance in certain applications. Aside from that, MySQL provides a wide range of unique high-availability database server choices, including high-speed master/slave replication setups, specialized cluster servers with rapid failover, and third-party suppliers. As a result, programmers can rely on it to be highly available.

MySQL secures data with remarkable security measures; it has robust procedures that guarantee that only authorized users have access to the database server and that other users are restricted to the client machine level. MySQL also has a granular object privilege architecture to guarantee that users only view what they are supposed to see. Another significant advantage is that it includes strong data encryption and decryption functions, which safeguard sensitive data from unauthorized users. To provide safe and secure communications, Secure Shell (SSH) and Secure Sockets Layer (SSL) are supplied. It also includes backup and recovery utilities that enable full logical and physical backup, as well as full and point-in-time recovery. MySQL provides complete application development assistance, and developers may receive all they need to create database-based information systems (MySQL, 2015).

(iii) Cascading Style Sheets and HTML

Cascading Style Sheets (CSS) is the language that specifies a document written in Hypertext Mark-up Language (HTML). It also specifies how HTML elements should be presented/displayed on a page. HTML, on the other hand, is the standard markup language for creating web application interfaces. It also makes web page structuring simple. The project's web application interfaces are formatted with CSS and HTML (W3schools, 2021).

(iv) Structured Query Language

Structured Query Language (SQL) allows the access and manipulation of databases. SQL is the standard of American National Standards Institute. SQL is used to execute queries against the database in terms of insertion, update, deletion, creation as well as creation of stored procedures in database. Views can as well be created using SQL. Besides creation of tables, SQL can also be used in setting permissions on tables (Bharamagoudar *et al.,* 2013**)**.

(v) JavaScript

JavaScript is famous and it's the language of World Wide Web. It's famous language of all time. We used JavaScript in developing data tables to enhance the responsiveness the feel attractive to users as well as creating searchable data tables. It's supported so many web browsers **(**Bharamagoudar *et al.,* 2013**).**

(vi) Hypertext Preprocessor Data Objects

Hypertext Preprocessor Data Objects (PDO) is a flexible database driver that enables the web-application to flexibly run on any database. The database can be implemented on any other database apart from the common MYSQL. We used PDO to make the application flexible to adapt to new business requirements as far databases are concerned (Popel, 2007).

(vii) Web Application

A web application (or web app) is application software that operates on a web server, as opposed to computer-based software applications that run locally on the device's operating system (OS). The user accesses web applications using a web browser with an active network connection. These programs are written in a client–server structure, with the user ("client") receiving services from an off-site server hosted by a third party (Wikipedia.org, 2021). The various features and services provided encourage the widespread usage of web-based apps. In this project, we consideration was taken on developing a web application to separate it from existing desktop applications which give limited information and provide insufficient and unreliable data storage. The rationale behind this is to enable engagement and give an interactive flow of information while still allowing access to a huge volume of information.

The process of establishing a technique in a system to connect and interact so that information may be exchanged is characterized as interface design. This serves as a communication route between users and the application. Interface design is concerned with predicting users' need to accomplish and ensuring that the interface has features that are simple to access, understand, and utilize in order to assist those actions (Usability, 2014).

First, the system administrator will register users by authorizing their registration requests since no one may use the system until they are registered. This application will be accessed via web either on phones or computer.

3.11 Areas of the Study

Study was conducted on guardians or parents, students, and teachers and school management. The above categories were interviewed since they are all student information stakeholders. Besides being stakeholders, the above users were selected because the felt the need of automating the institutional manual process pertaining to student results. DWA administration is welcome to new ideas and so it was easier to come in and interview their teachers, students, and school management. The school always celebrates DWA on the 7th of July and this made it easier to access the parents for their interviews.

3.12 Method of Data Collection

We used interviews to elicit student information system requirements from parents or guardians, school management, teachers, and students. It's easier to gain understanding through listening to peoples' stories because interviews allow people to share their experiences (Bolderston, 2012). The guided questions used during requirements elicitation are presented in appendix 1.

3.13 Sampling Technique

A random sampling approach was used to get all the participants. Everyone was welcome to participate because the door was left open. Any parent, staff member, student, or member of the school administration who came to the school had the opportunity to participate in answering the questionnaires if they were willing to do so.

3.14 Study Tools

The study is based on a working prototype of an integrated student information system and a semi-structured questionnaire. The prototype was an important tool since it allowed users to interact with the system during the review. To obtain input from users, questionnaires were used.

3.15 Ethical Consideration

Ethical issues must be considered in any data collection technique. The gathering and administration of information in human studies necessitate ethical procedures. In our study, we solely assessed the utilization of our system by giving users student information depending on

their jobs. Users could log in with their username and password. Only individuals who were willing to continue with the experiment were allowed to utilize the system after being informed about how the system would collect data. The developer also confirmed that the key stakeholders were consulted and given permission to operate throughout the requirements gathering and data collection process. The developer assessed the extend at which it is morally justifiable by ensuring the safety, social and psychological issues, privacy, confidentiality, disclosure, and security of the data gathered and participants.

3.16 Requirements Gathering Procedures

Before we could start collecting data, we needed authorization from the school administration, as well as requirements elicitation and an explanation of the study's concept. During the system review, users were allowed to register, get student information, and interact with the system as a whole. After using the system, every user was provided with a questionnaire to fill out in order to provide feedback on it.

3.17 Data and Requirements Presentation

Tables were used to present the assessment results. Because Google forms assist in data compilation, the questionnaire results were loaded and processed using google form service. This made it straightforward to receive a summary of the findings for future research.

3.18 Software Testing

The process of finding faults in a developed software application is known as software testing. It also examines to see if the actual results match the expected results and assists in the detection of faults, missing requirements, or gaps (Testim, 2021). The developed web-based student information was subjected to unit testing, integration testing and system testing in order to detect faults which may interfere with system functionality.

3.19 System Security

A system security strategy is a written plan that specifies how to safeguard a computer or information system. It provides a systematic method and procedures for preventing unauthorized users from using a computer, protects against worms and viruses, and protects against any other incident/event/process that might threaten the underlying system's security

(Techopedia, 2021). Several techniques were used to ensure security of student information system.

3.20 Database Backup

Backup and recovery refers to the process of producing and maintaining data copies that may be used to safeguard businesses against data loss (Netapp, 2021). JetBackup was used for backup and recovery.

3.21 Log files

Log files are critical data points for security and surveillance since they provide a complete history of occurrences throughout time. Log files can be found in apps, online browsers, hardware, and even email, in addition to operating systems (Precisely, 2021).

Businesses may avoid or swiftly correct issues in their operating systems by maintaining log files properly. Smart log tracking decreases downtime and the danger of data loss. Log data is often transferred to a secure server that serves as a central gathering point before being processed further by system administrators.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results

Web-based SIS passed through different stages of software development: requirements elicitation, requirements analysis, system design, implementation, testing, and deployment.

4.1.1 Requirements Gathering

Student information system requirements were elicited from parents or guardians, school management, class teacher. Elicited requirements were documented in software specification document. The main method of requirements elicitation were interviews; however, prototyping, existing documents, and brainstorming were used as well. Evolutionary prototyping was necessary because the system was developed incrementally and some of the stakeholders were not clear on what they wanted the system to do, and so, using prototyping helped them identify the requirements. Any changes in requirements were reflected in software requirements specification document.

4.1.2 Requirements Analysis

The requirements of the SIS were categorized into functional and non-functional requirements. Non-functional requirements included: performance, security, usability, accountability, and maintainability. Functional requirements were user single login, management of user accounts, student registration, management of termly information, upload of students results, online self-service of student performance by parents or guardians and detailed reports.

4.1.3 System Design

Several abstraction designs were considered in the development of student information system, for instance, Entity relationship diagram (ERD), rapid application model (RAD), context diagram, and use cases for student, parent, class master, and secretary as well as sequence diagrams for the main functions of SIS. The main function for this stage was to design SIS requirements.

4.1.4 Implementation

All the interfaces for SIS were developed using HTML, CSS, and JavaScript. The output of the system was implemented using PHP object-oriented programming. Each module was developed as follows: We started with users' module which comprised of user registration, validation, and management of user accounts, followed by student registration module, results upload, termly information, subjects, classes, reports, and search results. At this stage of SIS development, each module was tested independently to confirm its conformity to SIS functional requirements. SQL was used as the database language to link application to database.

4.1.5 Testing

After unit testing of each module, different modules of SIS were tested together using integration testing, for instance, student registration and results upload. This test was successful, and the output of this test was registration summary, results, and class-wise report. System testing was also applied, and it was confirmed that the system was conforming to requirements specification. Acceptance testing was applied in which user data about the system were collected and analysis gave an informative result.

(i) Unit Testing

Independent unit was tested to find out how it conforms to modular specification. Figure 14 shows the results of different units.

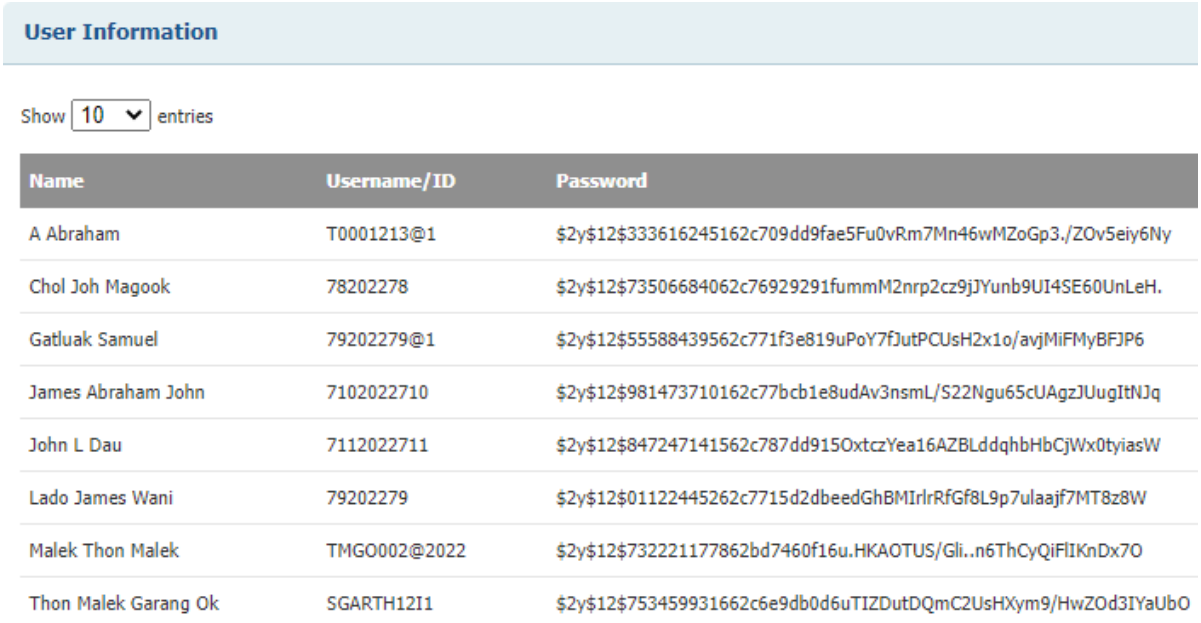

Figure 14: Unit testing

(ii) Integration Testing

Different modules were tested together to find out if they conform to user requirements. The results of integration testing. Student registration and grade entry modules were integrated to produce administrative reports illustrating students' performance (Fig. 15).

Class Performance.....S2.....T2.....

Show 10 entries

Subject	%Avg	%Passed	%Failed
Biology	29	33.33	0
Chemistry	29.33	33.33	0
CRE	25.67	33.33	0
Eng	44.67	33.33	33.33
Math	48.33	66.67	0
Physics	16	0	33.33

Admission No	Name	Marks	Comment
SGARTH12I1	Thon Malek Garang Ok	100	Passed
7112022711	John L Dau	88	Passed
	No. Students=2	Avg= 94	Passed = 2 Percentage passed = 100% and Failed = 0 Percentage Failed = ...

Class Results---P8---T2---2022

Admission No	Name	Maths	English	Sci	SST	CRE	Total	%	Remarks
SGARTH12I1	Thon Malek Garang Ok	28	100	78	82	86	374	74.8	Passed
7112022711	John L Dau	89	88	82	99	89	447	89.4	Passed
	No. Students=2								

Figure 15: Integration testing

(iii) System Testing

The system testing was performed to evaluate system requirements if they match with the developed system. The testing was done to check if the data are successfully stored in the system and updated when some changes are applied. We tested the complete system to ensure that the whole system runs as designed (Fig. 16).

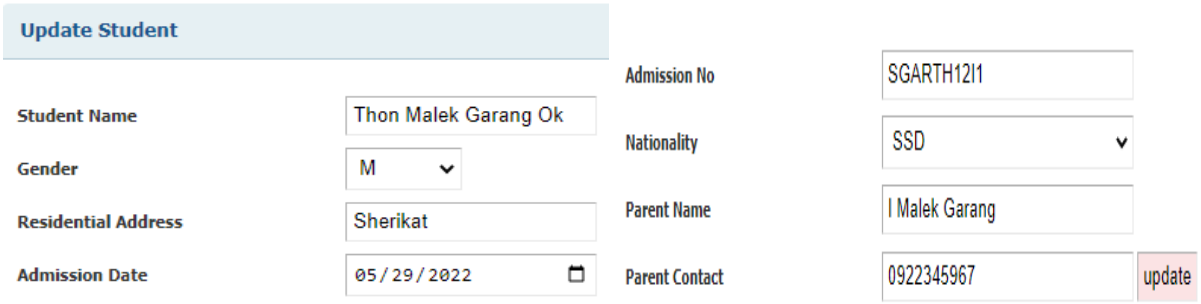

Figure 16: System testing

(iv) System Evaluation

In this project, the evaluation process was designed with an aim of assessing the acceptance and usability of the developed web-based student information system. Besides, the evaluation process also highlights relevant design alterations which could be implemented to enhance the future version of the system.

(v) Test Report Details

A test report was generated for unit testing, integration testing, and system testing. Tables 3 and 7 provide the details of the testing report.

Table 3: Login testing

Checked	Test	Result
Yes	Permission is granted to user with correct credentials	PASS
Yes	Permission denied to Wrong user credentials	PASS

Table 4: Database testing

Checked	Test	Result
Yes	Upon user registration, database updates are applied	PASS
Yes	When querying database, query results are retrieved accordingly	PASS
Yes	When information is sent to database, database gets updated	PASS

Table 5: User Forgiveness testing

Checked	Test	Result
Yes	When user fails to enter required data in the field, message is displayed	PASS
Yes	When forgets to enter data in mandatory field, suggestive message displayed	PASS

Table 6: Reporting testing

Checked	Test	Result
Yes	The system allows user to view the report based on his/role	PASS
Yes	The system allows user to view customized report	PASS

Table 7: System modules testing

Checked	Test	Result
Yes	The system allows parent/student to login and view termly results	PASS
Yes	The system allows school management to register users, students, subjects, fee's structure, termly information views and generate all the relevant reports and all well achieved successfully.	PASS
Yes	The system allows administrator to import, and export excel, csv files data from and to excel with consistency and accuracy.	PASS

(vi) System Analysis and Results

This section details the statistical analysis and validation which was done on the data captured through questionnaire. Data were transferred to Google Forms for analysis, and the findings are summarized in the tables shown in Tables 8 and 9.

Table 8: Usability testing

	Strongly Agree (%)	Agree (%)	Disagree (%)	Not Sure (%)
I found the system to be easy to use.	65	32	2	1
The system is user-friendly.	70	28	1	1
I believe the system will require assistance from a technical person to the user.	24	59	4	13
I believe that the majority of individuals will pick up on the system soon.	39	53	2	6

Table 9: User Acceptance testing

	Strongly Agree (%)	Agree (%)	Disagree (%)	Not Sure (%)
I believe I will continue to use this system.	35	63	1	1
I believe the system will help me keep better records.	73	25	1	1
The system will help me process student results.	40	57	2	1
The system will provide easy interaction between students/parents/guardian and school.	70	30	0	0
The technology will make student data management easier.	25	71	2	2
The method will come in handy for me.	79	21	0	0

Both sets of participants were quite happy with the method, as demonstrated in Tables 8 and 9. The designed student information system was strongly supported by the school management, parents/Guardians, and students.

4.1.6 Deployment

The student information system was hosted on the DWA domain. School management were trained together with teachers. Another session was conducted for students. Information

communication technology department was made responsible for the further training. Few parents who showed up on visitation day were trained on how to use the system. All necessary procedure on how to access and use SIS was made available. Support program was given for three months.

(i) Location and Time

The student information system was developed for Darling Wisdom Academy located in Hai-Mauna Juba, South Sudan. The system development took approximately six months from July 2021 to December 2021 and the other improvements on the system were considered as maintenance.

(ii) Login Page

After an administrator has issued a user the credentials for accessing the system, these username and password are used for accessing the system based on the privileges accorded to each user. There is only one login page for parents, school management and students (Fig. 17). When username or password is wrong, the system will display the message as shown in the Fig. 17. When username and password are correct, the user is directed to the page based on user roles.

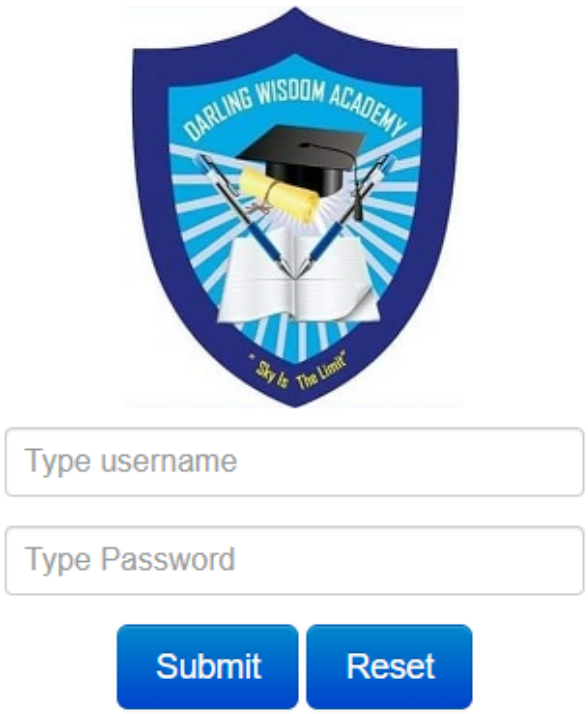

Figure 17: Login page

(iii) User Registration Interface

This section allows the user credentials to be registered before logging in to the system (Fig. 18). It is in the same section where user privilege is set, for instance the user is registered whether he/she student, administrator, or parent. User credentials can be updated as well. The user password is encrypted for security purposes. In this application, it is the user status which will determine the pages the system will direct a given user to.

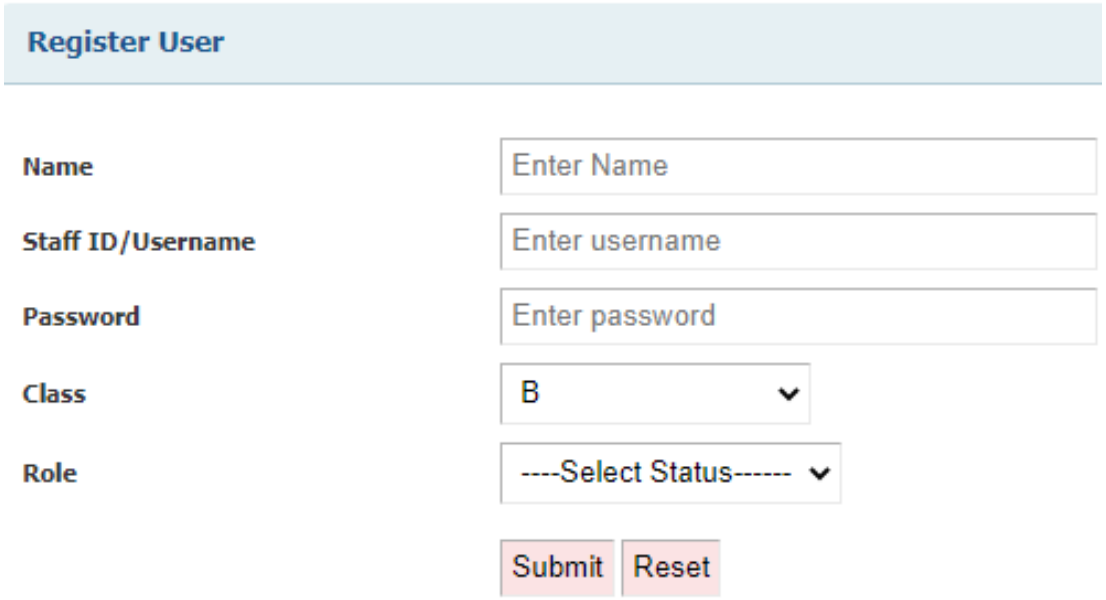

Figure 18: User registration interface

(iv) User Registration Module

When the user is successfully registered, the details are displayed in datable. The details can be updated using update button. Insertion and update of user details are shown in Fig. 19. The system was tested, and insertion and update were done without errors as indicated by data displayed in data tables.

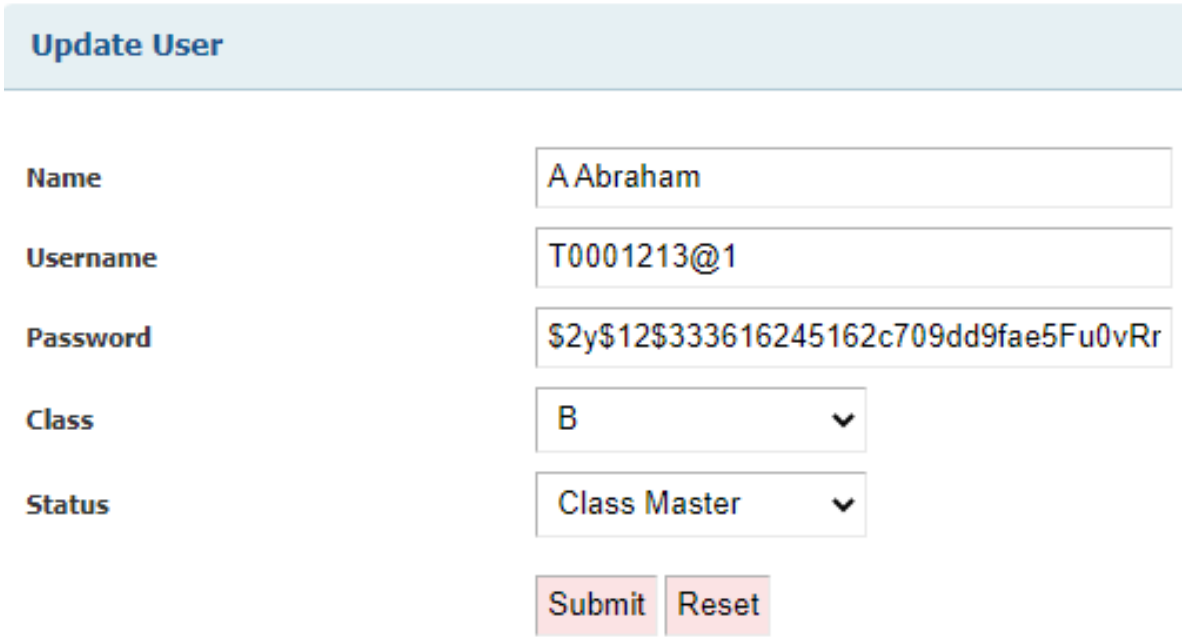

Figure 19: User registration module

(v) Change Password Interface

In case a user is interested in changing his/her password to new one, the interface provides an opportunity for the user to put current password, enters and repeat new password and the system will generate the message confirming the success of changing password. Otherwise, an error is displayed such as "Your password should be longer than six characters" or the current password does not exist or the password and the retype password do not match (Fig. 20).

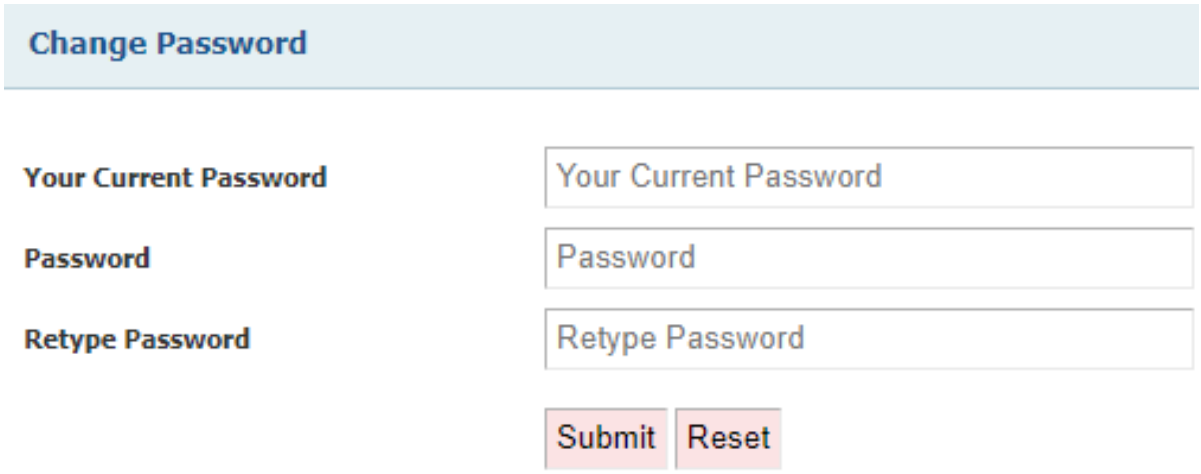

Figure 20: Change password interface

(vi) Reset Password Module

The user enters current password and the new password. Once the current password is wrong, the user will get the message (Fig. 21) and successfully changed password gives (Fig. 22).

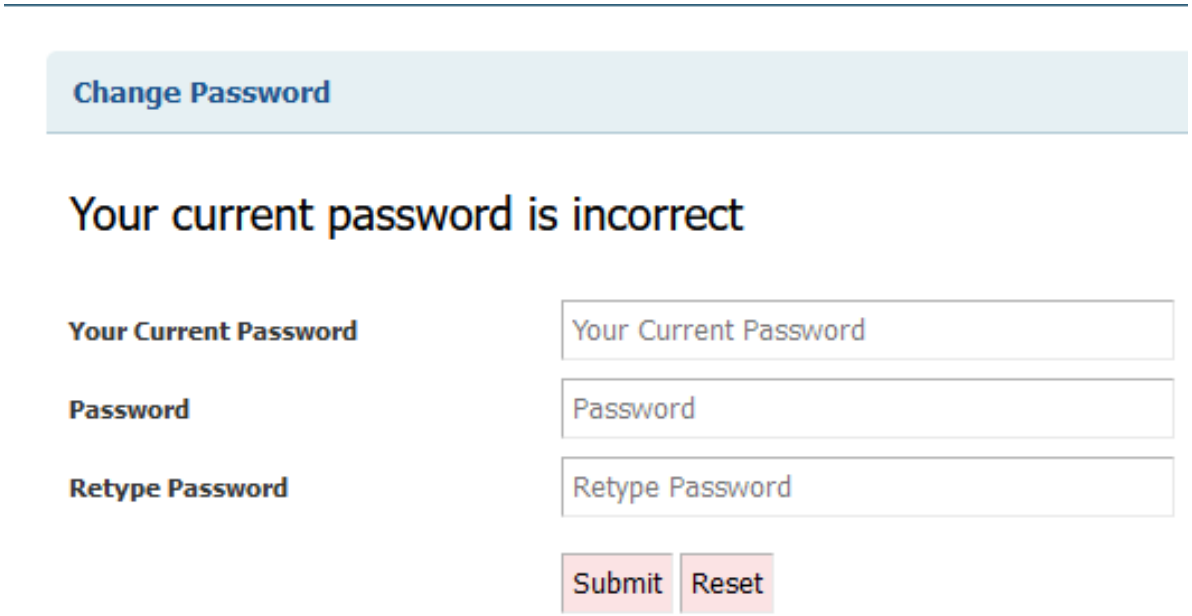

Figure 21: Reset password module

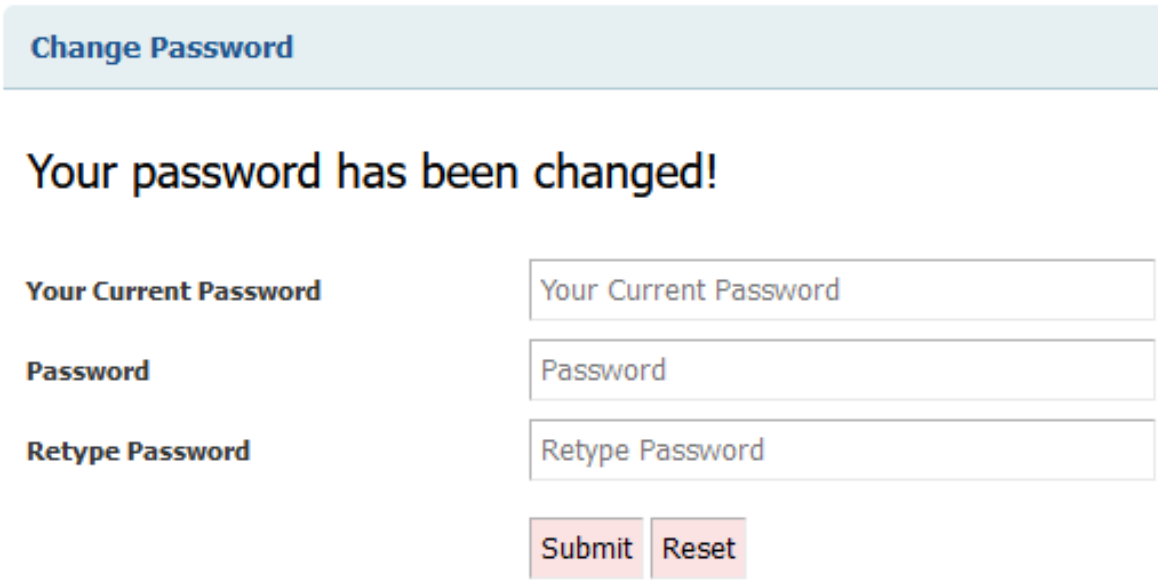

Figure 22: Reset password module

(vii) School Fees Setting Interface

Upon login, the user (school administrator) sets termly school fees for all classes (Fig. 23). This is sent to the database alongside categorical data such as class, term, year, scholar type (day or boarding) and status (NEW or OLD Student or pupil).

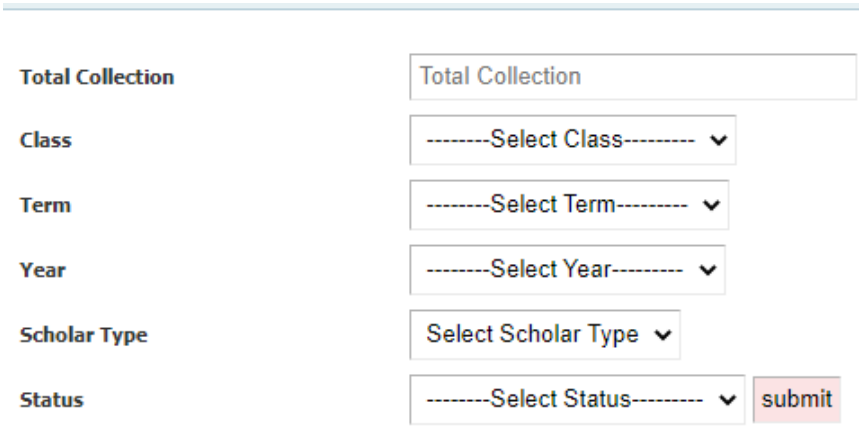

Figure 23: School fees setting interface

(viii) Student Registration Interface

This interface allows school administrator upon login to register students. Student's details are captured, and the interface allows capturing termly information through the Term info button shown in the Fig. 24. The interface as well allows updating student records when searched through the live search in the same figure. The datable used in this section makes display of live search results smarter and well organized.

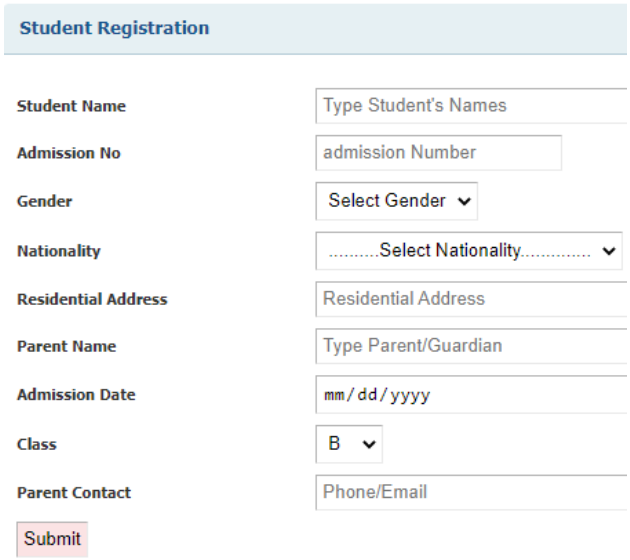

Figure 24: Student registration interface

(ix) Termly Requirements Interface

This interface allows school administrator upon login to capture routinely considered school requirements. These requirements are captured categorically as admission number, school bus (paid for or no), scholar type (day or boarding), realms of paper (brought or not), year, section (primary or secondary), class, status and stream. Once data captured through this interface, it becomes useful in logistical decision-making of the school (Fig. 25).

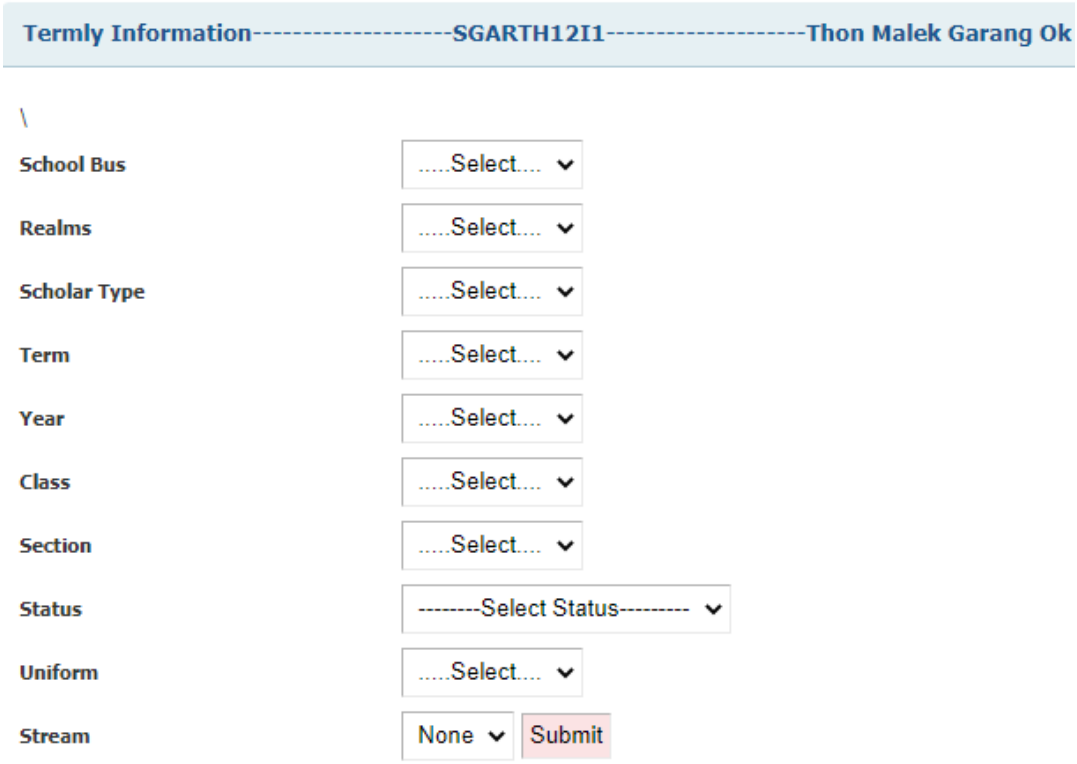

Figure 25: Termly requirements interface

(x) Online Self-Service/Parent/Student Portal

When parent or student has successfully logged in, he/she is directed to this page where he/she can view student results (Fig. 26). This displays the latest term only and the results can be displayed as organized by student name, class, stream, position, term, and the year. The above arrangement is followed by list of subjects, total scored in all subjects and the remarks.

Show 10 entries

Subject	Marks	Remarks
Biology	87	Passed
Chemistry	88	Passed
CRE	77	Passed
Eng	49	**Failed**
Math	77	Passed
Physics	48	**Failed**

Total: 426 **Average: 71%**

Subject	%Avg	%Passed	%Failed
Biology	29	33.33	0
Chemistry	29.33	33.33	0
CRE	25.67	33.33	0
Eng	44.67	33.33	33.33
Math	48.33	66.67	0
Physics	16	0	33.33

Figure 26: Online self-service/parent/student portal

(xi) Results Submission Interface

This interface allows school administrator upon login to upload students results by importing excel or CSV files from his/her computer (Fig. 27). This interface applies to results of all classes. The difference lies in choosing the subject to be submitted, section (primary or secondary), term, class and the year. This interface has eased the work of administrators through onetime upload of results as compared to manually capturing of each student results.

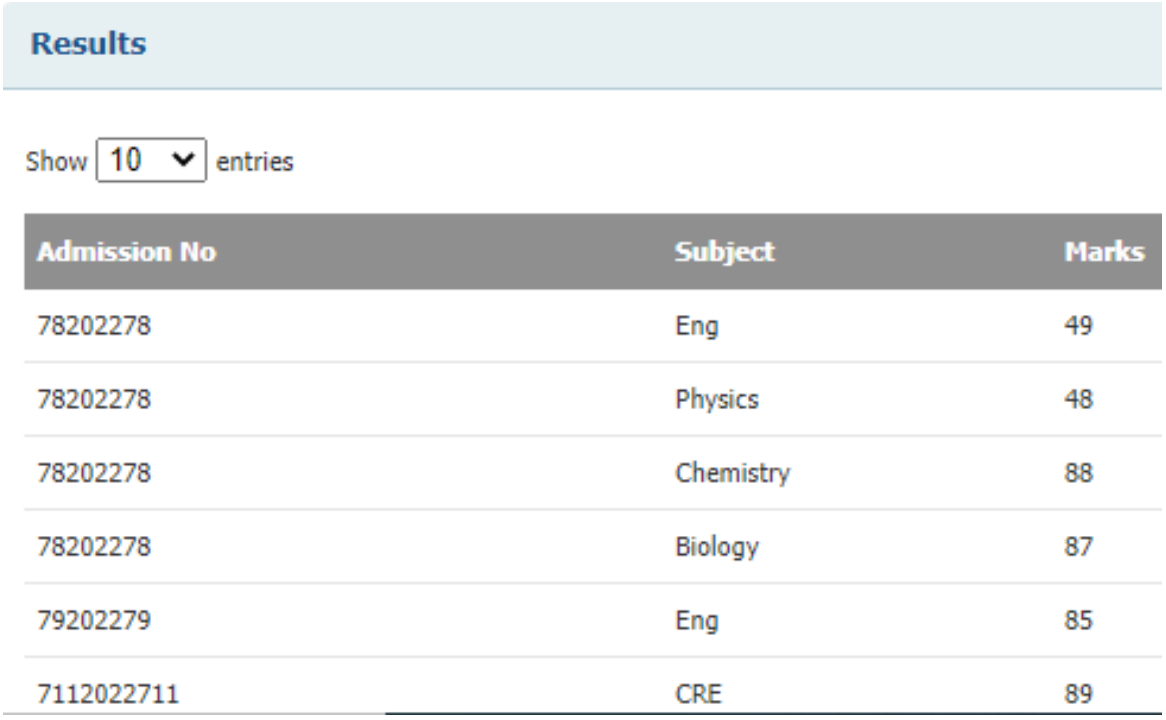

Figure 27: Results submission interface

(xii) Student Search Results

After administrator has entered admission number or part of admission number or name of the student, this system displays the corresponding details with the entered information to the search field and an empty datable implies that there is no results found in the database that matches with the search query.Precisely, the student either exists or does not exist in the database.This tool eases the work of school administrator by simply keying in the admission no or name of the student and the system generates the complete information about that particular student (Fig. 28).

Figure 28: Student search results

(xiii) Student Photo Upload Interface

After the registration of other relevant student details, the student photo is uploaded and attached so that it is captured in the student printout. This interface enables both the attaching of photo, uploading and attaching as well as viewing of the photo (Fig. 29).

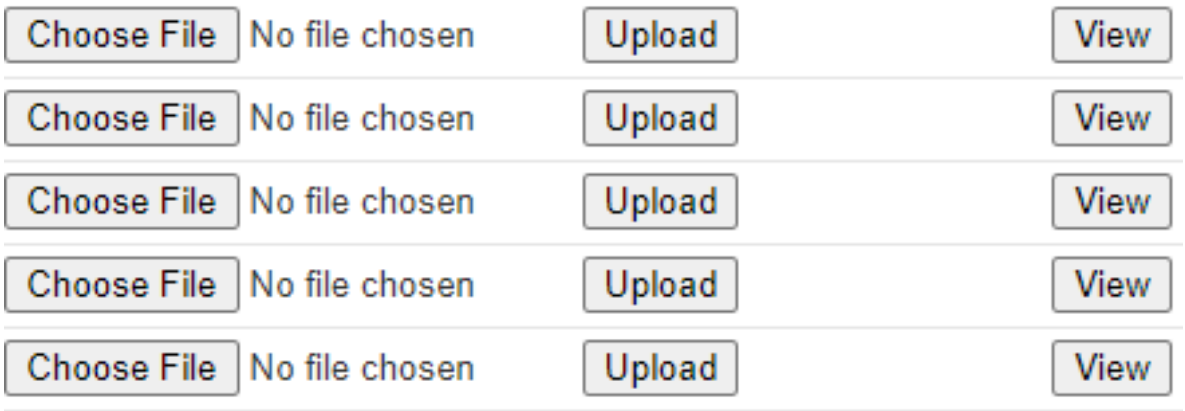

Figure 29: Student photo upload interface

(xiv) Student Registration Printout

After the student is fully registered, this document is printed as evidence of successful registration and it can be used by other departments of Darling Wisdom Academy for other services such as processing uniform, bus transportation and other logistical concerns of the institution (Fig. 30).

Class:	P8
Admission No:	7112022711
Name:	John L Dau
Gender	M
Nationality	SSD
Residential Address	Buluk
Parent/Guardian	Dau
Parent/Guardian Contact	dau@gmail.com

Figure 30: Student registration printout

(xv) Term Registration Report

This is an output of report generation from report generating interface which displays the list of all registered students in a particular term as organized by admission number and name (Fig. 31).

Admission No	Name
SGARTH12I1	Thon Malek Garang Ok
7102022710	James Abraham John
7112022711	John L Dau

Figure 31: Term registration report

(xvi) Grade Entry Module

Students' results maintained in Microsoft excel was uploaded in the system and the expected results were achieved; the system computed the results successfully and displayed them in the data tables (Fig. 32).

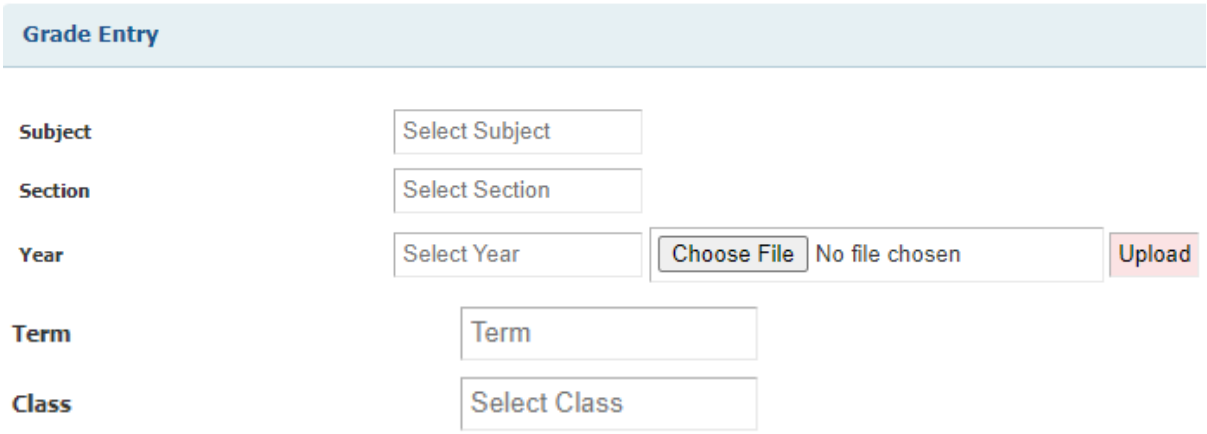

Figure 32: Grade entry module

(xvii) Student Search Module

Student search displays details when either student name or student registration number is entered in the search field. The system displays student displays when student related details are found and empty data table when no related information exists in the database (Fig. 33).

Figure 33: Search module

(xviii) Report Generation Interface

This interface enables school administrator to generate report based on report category (Fig. 34). The administrator upon login can generate termly registration, subject-wise results as organized by all classes, each class, year, and term. When send to the database, the required printout is generated for further administrative usage.

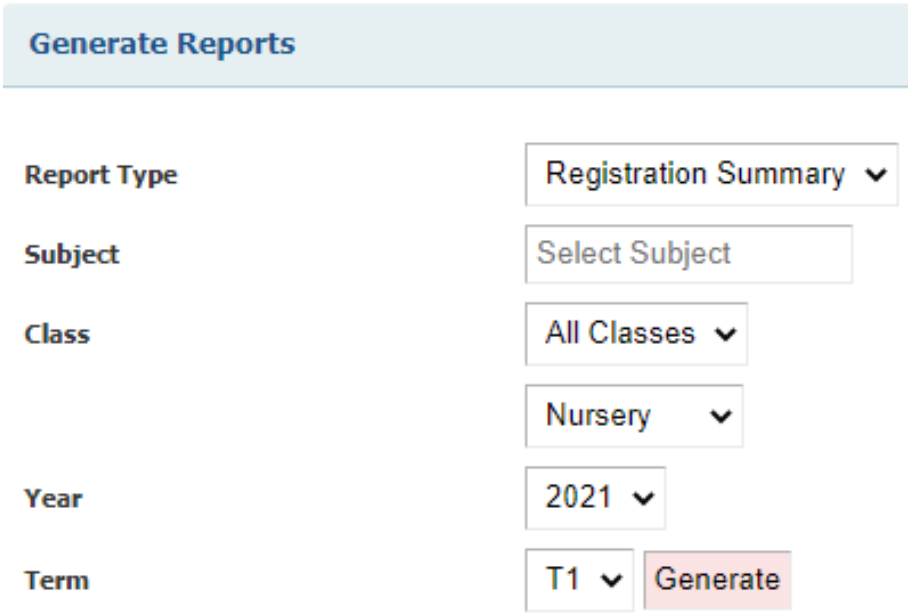

Figure 34: Report generation interface

(xix) Backup and Recovery of Files

The SIS files are being backed up daily at 11:59 using the JetBackup software (Fig. 35).

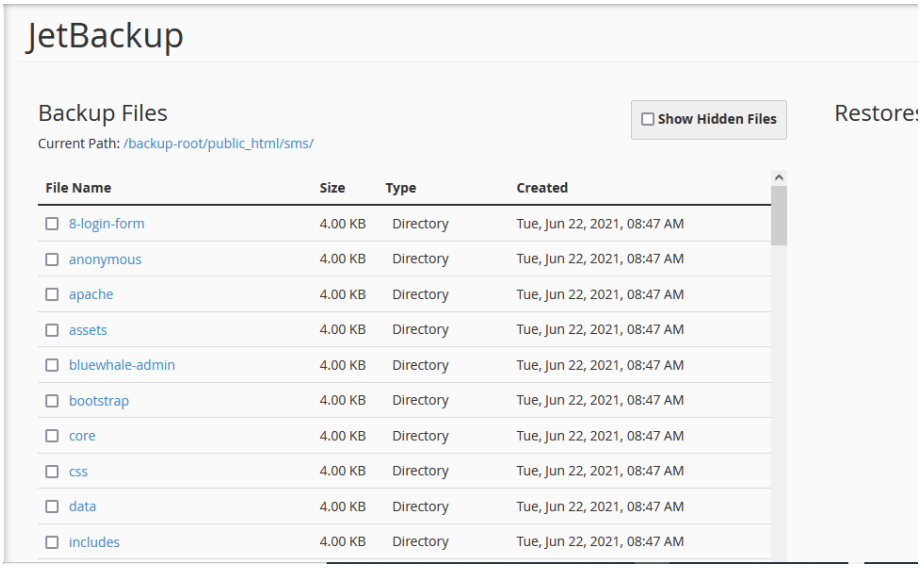

Figure 35: Backup and recovery of files

(xx) Backup and Recovery of Files

The SIS database tables, and queries files are being backed up daily at 11:59 using the JetBackup software (Fig. 36).

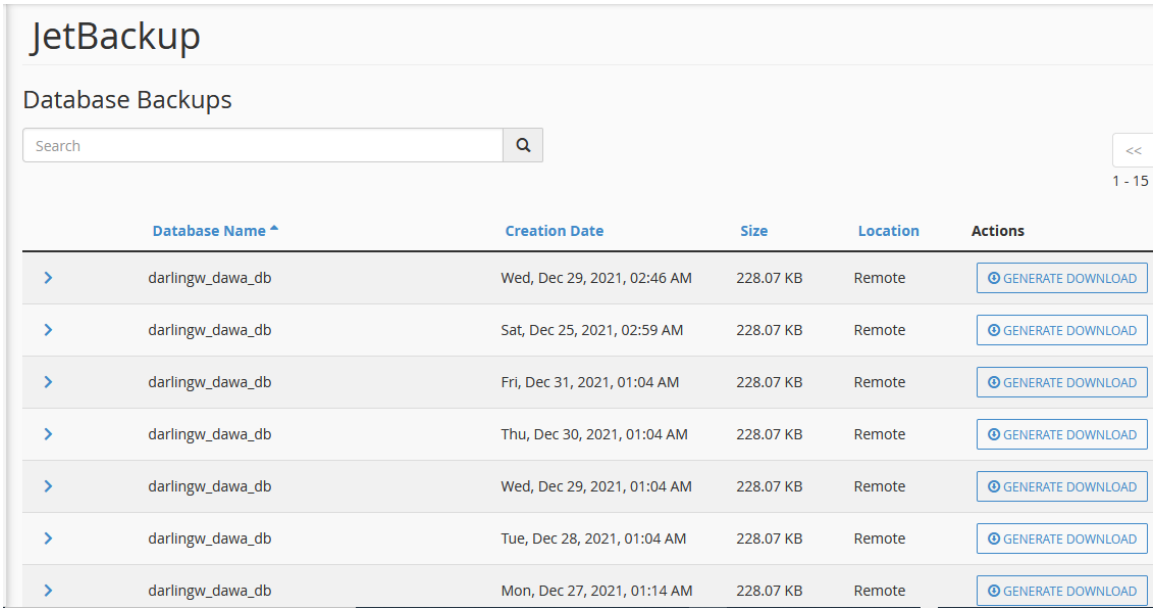

Figure 36: Backup and recovery of database files

(xxi) Password Encryption

When administrator registers users of the system, the password was encrypted to enhance security of student information system (Fig. 37).

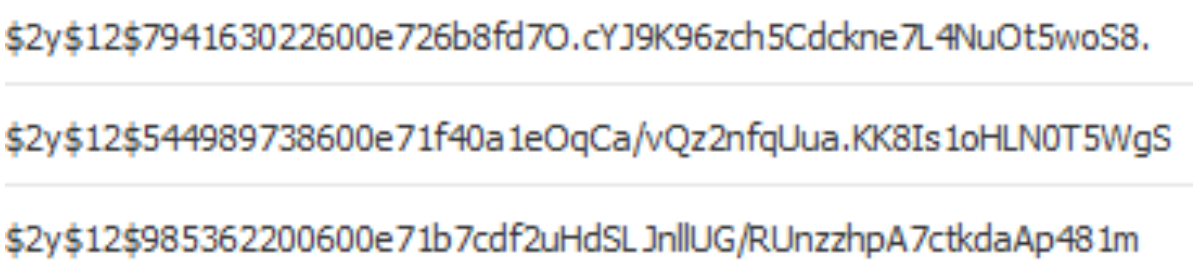

Figure 37: Encrypted passwords

(xxii) Secure Socket Layer

We used the SSL/TLS Manager to produce SSL certificates, certificate signing requests, and private keys. These are all aspects of securing our system with SSL. Secure Socket Layer enables protection of pages on websites and information systems so that information such as logins, credit card details, and so on is transmitted encrypted rather than in plain text. It is critical to safeguard student information transmitted over the internet (Netcraft, 2021). The success of the installation of Secure Socket Layer (SSL) certificates is confirmed in the image below with https and padlock (Fig. 38).

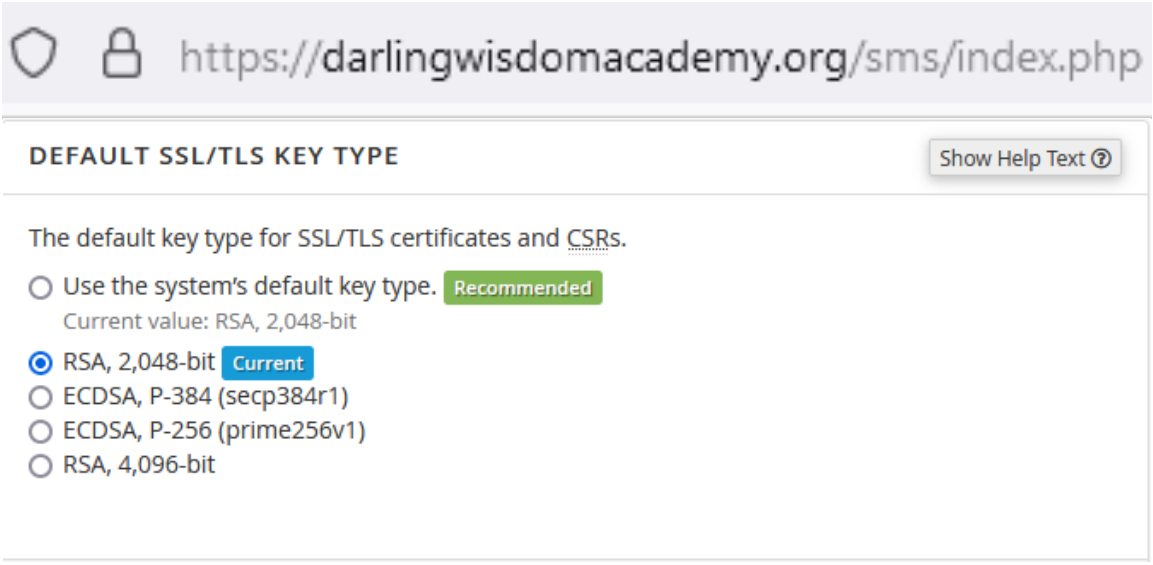

Figure 38: Secure socket layer certificate

Prepared statements are supported by the MySQL database. A prepared statement, also known as a parameterized statement, is used to run the same statement again while protecting against SQL injections.

(xxiii) Prepared Statements

The prepared statement execution process was divided into two stages: prepare and execute. A statement template was provided to the database server during the prepare step. The server checks the syntax and initializes the server's internal resources for subsequent usage. Execution comes after preparation. The client binds parameter values and passes them to the server during execution. Using the previously constructed internal resources, the server performs the statement with the bound values.

(xxiv) Single Login

In student information system, single login has been used for parents, school management as well as students (Fig. 39). This is to reduce security vulnerability resulting from multiple login pages. All users are registered with an encrypted password and the password length must be more than 6 characters.

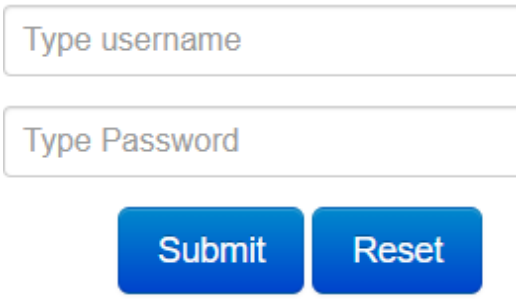

Figure 39: Single login

(xxv) Log Files

The system will enable school administrator to trace the system usage. Every user of the system will have the name, activity, date, and time recorded. This is to ensure accountability to the usage of the system (Fig. 40). The school administrator will generate the log files based on the dates.

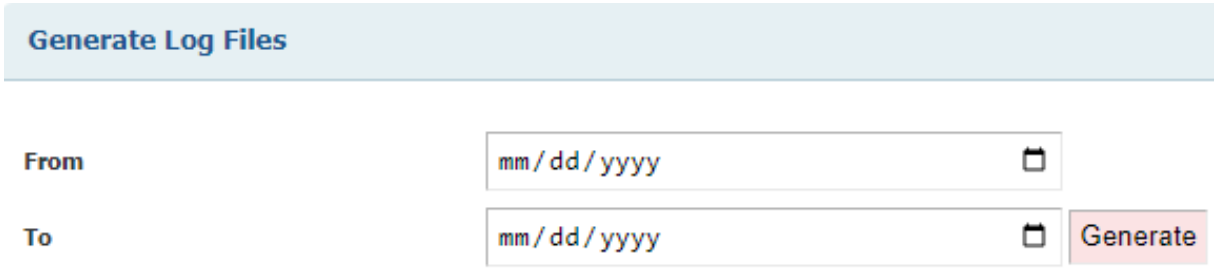

Figure 40: Log files

(xxvi) Summary

(a) User Registration

The administrator registers the user. If the user exists in the student information database, an error message is displayed suggesting to the administrator to consider choosing another username and password. The username or password must be 8 characters. In case the admin enters less than eight characters, the error message is displayed. Upon registration, the role is assigned: student, class teacher, secretary, or parent. Password is encrypted. User details can be added and updated upon admin login. Minimum of eight characters are required for user to login. User inputs are validated. Unnecessary wild characters are escaped. Incorrect username or password leads to error message "Your username or password is incorrect". Registered users can recover their login credentials through sending the recovery message to their emails and linking the email to the system to enable them to choose another password.

(b) Student Registration

Student details are entered through the student registration interface. Error message is displayed if similar unique student registration number exists in the system. Successfully registered students can be updated through the same portal. Termly information is added, for example, the class, section, stream and other details required termly are being added. This functionality is vital for tracing student termly registration. Termly information can be updated through the same portal. Student photo is uploaded, and student print out can be printed at the end of registration. Student printout and photo are available for view.

(c) Results Upload

At the end of the term, the class master compiles all the results for a class he/she is responsible for and converts to CSV for upload. Results are uploaded against the term, class, section, year. Only marks and student registration number are being maintained in CSV file. Uploaded results are available to class teacher for update. Class teacher can update results

(d) Summary Statistical Performance

Class performance is available to class teacher, students and event parents or guardians. This functionality enables the above-mentioned users to view the performance relative to other students in class. For instance, the average per subject, percentage passed and the percentage that failed.

(e) Search

System administrator and class master have this functionality to ease searching for student in the student information system database. Successful search displays specific student details, otherwise, the student does not exist. This functionality quickens search for students.

(f) Changing Password

Logged in users can change their passwords if their current password matches what they are entering to the system. Entering different password that is not the same with formerly registered password results to an error message suggesting “Your current password does not match”, otherwise, the user enters the new password and the confirmation of the same password. This new password will be the one to use in the next login.

(g) Report Generation

An interface is available for administrator where customized reports are generated. For instance, each class performance, each subject, class performance statistical summary, class registration summary, school registration summary, section registration summary. This report helps administration in decision making because each report comes with number of students and basic analysis for ease of understanding and interpretation.

(h) Log Files

The student information system maintains log files which are available for administrator mainly for accountability. Log files enable the school management to know who does what in the system at what time.

4.2 Discussion

The primary goal of this project was to improve student information collection, storage, processing, and delivery by utilizing web-based SIS that will allow an interactive flow of student information between parents or guardians, class teachers and school management. The system conceptualization provided in this project report was implemented and evaluated in the study. The developed system has a high potential for usage as a dependable instrument for collecting and communicating student information to all stakeholders of SIS at Darling Wisdom Academy, while reaching out to target groups: parents/teachers and school management.

This study's empirical contribution is the computerization of the student information system, which includes various services such as creating reports, storage, and processing student information, and enabling access to student information classified as student/pupil results. The main prerequisites for an efficient student system were outlined and demonstrated how to develop such a system in a methodical manner. We have designed and developed a functioning program that can easily be put into production after improving some aspects such as security acceptance testing. We have written a detailed project report outlining all that has been accomplished in the project.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Preliminary research done before to this investigation revealed that there is a dearth of student information and, as a result, inadequate student information management in Darling Wisdom Academy. The lack of appropriate technologies makes collecting, managing, processing, and accessing student information extremely challenging.

Despite several efforts to improve student information management, student performance deterioration continues to contribute to the failure of senior one student (34% of class population based on Term I results). Early intervention is usually broadly provided to classes without the customized individually oriented student early performance intervention advisory services. Furthermore, keeping track of the student information is difficult and tedious to manage. As a result, this study designed and developed web-based student information system.

Alternative approaches were assessed and established by others for improving student information system using survey findings and a critical literature analysis. Particularly, the study developed a solution which meets the business requirements and environment of Darling Wisdom Academy as the case area. The study proposed the use of web-based student system in order to enhance collection, storage, processing, and dissemination of information. The reason for proposing the web technology was based on the nature of this technology, which is very user friendly and easy to access. This technology is also cost effective compared to other technologies such as Unstructured Supplementary Services Data (USSD). After critically analyzing the requirements, the student system web-based solution had been modelled and developed. The system is a web-based application for student information. The requirements of SIS were elicited from parents or guardians, class masters and school management as well as students. SIS was tested using unit, integration, system, and acceptance testing. The testing achieved success and the system allowed registered users to login through username and password. Student information were sent and saved to the database successfully. Third party software application was used to cater for additional security. JetBackup was useful for daily application backup. Administrator registers users and their roles. The SIS allows school secretary to register students, update students results and details, generate reports, add termly information, search for students and manage log files. Class master uploads and manages class

results and details. Parents and students view results. The essence of this system is to allow the school management and parents or guardians to make use of student results for early intervention. Based on statistical summary of class performance and individual student's results, an immediate intervention can be planned by parents, teachers, and school management so that student's performance is rescued.

5.2 Recommendations

Although the results of this study demonstrate that users approved the system and claimed that it will improve student information management, we recommend additional empirical validation of the system to see if it has any influence on user attitudes about student information system management and the correlation with acceptance test. This is achievable by delivering the tool to one group while the other group maintains their current method and comparing the set measurement criteria between the two groups over time. There is also the possibility of extending the development of this system on Unstructured Supplementary Service Data (USSD) and cross platform mobile application. It is preferable to run on both USSD application and mobile application other than web-based application and supporting other mobile devices such as basic phones for USSD access. The application will be more informative to parents or guardians if it captures other information such as student attitude.

The aim of this project was to improve the management of student information for effective and efficient early intervention student performance. The system's goal was to augment the spoken method of conveying student information with computerized web-based application. Because the developed application requires users to attend the school to capture admission related information for school to start processing student information by school administration and access by parents and students via, web-based student information system, it is preferable to have a system that can capture student information without requiring parents to go to school through an online admission. However, further study is required to improve the developed application. This can be accomplished by extending the use of this application as web and mobile application for wider coverage.

Furthermore, since student information system is part and parcel of the school management system, it is recommended that it is integrated to other school management modules such as admission, finance, human resource, logistics and library modules to have an integrated school management system for an effective and efficient student processing and management.

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APPENDICES

Appendix 1: Interview Guided Questions

Requirements Elicitation

School Management and Parents Interview Questions

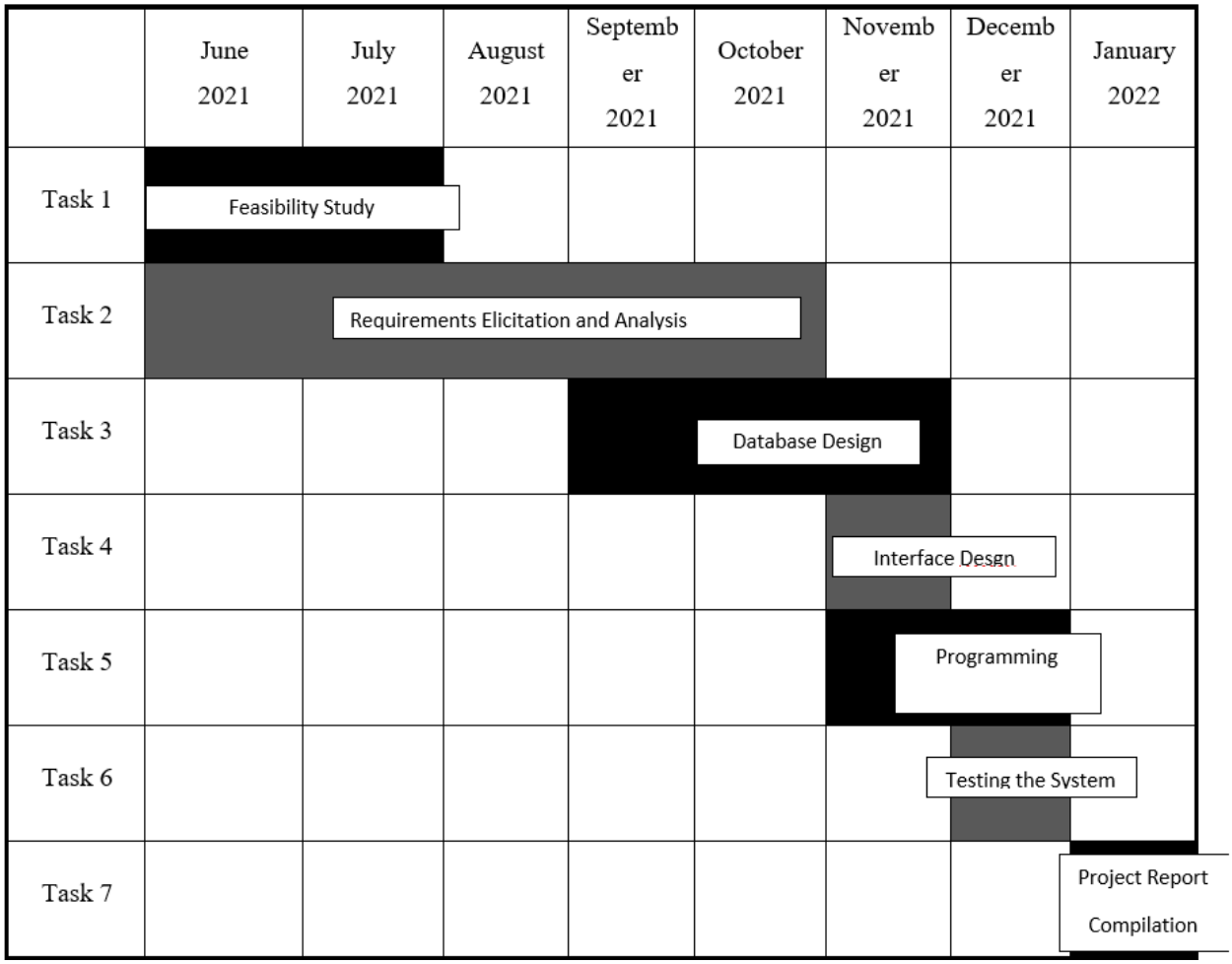
Introduction

I am Thon Malek Garang, a master's candidate from NM-AIST Arusha. I am currently doing requirements gathering for the development of web-based system for tracking students' performance for early intervention: Case of Darling Wisdom Academy. These interview questions aim at gathering requirements of the proposed system. Thank you for your willingness to participate in this exercise.

1. Do you have password or username for any system (i.e Facebook, Gmail etc)?
2. How do you keep your username or password (I just remember, notebook, my phone etc)?
3. Do you find it easy to manage password?
4. Do you find it convenient to collect report cards from school?
5. Who processes student results?
6. How do you correct errors in student results processing?
7. What format of report do you prefer (hardcopy, electronic copy etc)?
8. How frequently do you get updates on student performance (sometime, termly, yearly etc)?
9. Do you have a smart phone or computer?
10. How frequent do you get connected to internet (always, rarely, weekly, monthly etc)
11. After having student information system, how frequent would you want to view student's performance (anytime, termly, yearly etc)

Appendix 2: Work Breakdown Structure

Work Break Structure For



Appendix 3: Budget

Development of Web-based System for Tracking Students' Performance for early Intervention: Case of Darling Wisdom Academy

Item	**Cost (Euros)**	**Description**
Requirement's elicitation & analysis	600	Gathered and documented requirements
Logistics – Travel	300	Travel during Data Collection
Project documentation	400	Report printing and photocopying
Internet (Data Bundle)	400	Buying a Modem and Data Bundles
System hosting	300	Purchase domain name and hosting plan
Total	2,000	

Appendix 4: Login Class

```
public function login($username, $password) {

    global $bcrypt;  // Again make get the bcrypt variable, which is defined in init.php, which is included in login.php where this function is called

    $query = $this->db->prepare("SELECT password, user_id FROM users WHERE username = ?");
    $query->bindValue(1, $username);

    try{

        $query->execute();
        $data               = $query->fetch();
        $stored_password    = $data['password']; // stored hashed password
        $id                 = $data['user_id']; // id of the user to be returned if the password is verified, below.

        if($bcrypt->verify($password, $stored_password) === true){ // using the verify method to compare the password with the stored hashed password.
            return $id; // returning the user's id.
        }else{
            return false;
        }

    }catch(PDOException $e){
        die($e->getMessage());
    }

}
public function userdata($id) {

    $query = $this->db->prepare("SELECT * FROM users WHERE user_id= ?");
    $query->bindValue(1, $id);

    try{

        $query->execute();
```

Appendix 5: Students Class

```php
<?php
class Students
    {
    private $db;
    public function __construct($database) {
        $this->db = $database;
    }
    public function update_student($admission_no, $student_name, $gender, $residential_address, $nationality, $parent_name,$parent_contact,$admission_date,$regi

        $query = $this->db->prepare("UPDATE student_registration SET
                                    admission_no                    = ?,
                                    student_name                    = ?,
                                    gender                          = ?,
                                    residential_address             = ?,
                                    nationality                     = ?,
                                    parent_name                     = ?,
                                    parent_contact                  = ?,
                                    admission_date                  = ?
                                    WHERE registration_id           = ?
                                    ");
        $query->bindValue(1,$admission_no);
        $query->bindValue(2,$student_name);
        $query->bindValue(3,$gender);
        $query->bindValue(4,$residential_address);
        $query->bindValue(5,$nationality);
        $query->bindValue(6,$parent_name);
        $query->bindValue(7,$parent_contact);
        $query->bindValue(8,$admission_date);
        $query->bindValue(9,$registration_id);
        try{
            $query->execute();
        }catch(PDOException $e){
            die($e->getMessage());
        }
```

Appendix 6: Students Account Class

```php
<?php
class Student_accounts{

    private $db;

    public function __construct($database) {
        $this->db = $database;
    }

    public function update_student_account($school_code,$school_name,$school_id){

        $query = $this->db->prepare("UPDATE schools    SET
                                school_code                 = ?,
                                school_name                 = ?
                                WHERE school_id             = ?
                                ");

        $query->bindValue(1,$school_code);
        $query->bindValue(2,$school_name);
        $query->bindValue(3,$school_id);
        try{
            $query->execute();
        }catch(PDOException $e){
            die($e->getMessage());
        }
    }
    public function update_semester_fee($total_fees,$class,$term,$year,$status,$scholar_type,$fees_id){

        $query = $this->db->prepare("UPDATE term_fees            SET
                                total_collection            = ?,
                                class                       = ?,
                                term                        = ?,
                                year                        = ?,
                                status                      = ?,
                                scholar_type                = ?
```

Appendix 7: Grades Class

```php
<?php
class Grades{

    private $db;

    public function __construct($database) {
        $this->db = $database;
    }

    public function update_grade($admission_no, $course_code, $grade, $credit_hour, $grade_weight, $academic_year, $gradepoint, $grade_id){

        $query = $this->db->prepare("UPDATE grades SET
                                    admission_no        = ?,
                                    course_code         = ?,
                                    grade               = ?,
                                    credit_hour         = ?,
                                    grade_weight        = ?,
                                    academic_year       = ?,
                                    grade_point         = ?

                                    WHERE grade_id      = ?
                                    ");

        $query->bindValue(1, $admission_no);
        $query->bindValue(2, $course_code);
        $query->bindValue(3, $grade);
        $query->bindValue(4, $credit_hour);
        $query->bindValue(5, $grade_weight);
        $query->bindValue(6, $academic_year);
        $query->bindValue(7, $gradepoint);
        $query->bindValue(8, $grade_id);

        try{
            $query->execute();
        }catch(PDOException $e){
```

Appendix 8: General Class

```php
<?php
class General{

    public function logged_in () {
        return(isset($_SESSION['user_id'])) ? true : false;
    }

    public function logged_in_protect() {
        if ($this->logged_in() === true) {
            header('Location: user.php');
            exit();
        }
    }

    public function logged_out_protect() {
        if ($this->logged_in() === false) {
            header('Location: index.php');
            exit();
        }
    }

    public function file_newpath($path, $filename){
        if ($pos = strrpos($filename, '.')) {
           $name = substr($filename, 0, $pos);
           $ext = substr($filename, $pos);
        } else {
           $name = $filename;
        }

        $newpath = $path.'/'.$filename;
        $newname = $filename;
        $counter = 0;

        while (file_exists($newpath)) {
           $newname = $name .'_'. $counter . $ext;
```

Appendix 9: Bcrypt Class

```php
<?php
/* Create a new class called Bcrypt */
class Bcrypt {
    private $rounds;
    public function __construct($rounds = 12) {
        if(CRYPT_BLOWFISH != 1) {
            throw new Exception("Bcrypt is not supported on this server, please see the following
        }
        $this->rounds = $rounds;
    }

    /* Gen Salt */
    private function genSalt() {

        /* GenSalt */

        $string = str_shuffle(mt_rand());
        $salt   = uniqid($string ,true);

        /* Return */
        return $salt;
    }

    /* Gen Hash */
    public function genHash($password) {
        /* Explain '$2y$' . $this->rounds . '$' */
            /* 2y selects bcrypt algorithm */
            /* $this->rounds is the workload factor */
        /* GenHash */
        $hash = crypt($password, '$2y$' . $this->rounds . '$' . $this->genSalt());
```

Appendix 10: Initialization Class

```php
<?php
session_start();
require 'connect/database.php';
require 'classes/users.php';
require 'classes/courses.php';
require 'classes/students.php';
require 'classes/grades.php';
require 'classes/student_accounts.php';
require 'classes/general.php';
require 'classes/bcrypt.php';

// error_reporting(0);

$users              = new Users($db);
$courses            = new Courses($db);
$students           = new Students($db);
$programs_level     = new Programs_level($db);
$student_accounts   = new Student_accounts($db);
$grades             = new Grades($db);
$number_to_words    = new Integer();
$general            = new General();
$bcrypt             = new Bcrypt(12);

$errors = array();

if ($general->logged_in() === true)  {
    $user_id    = $_SESSION['user_id'];
    $user       = $users->userdata($user_id);
}

ob_start(); // Added to avoid a common error of 'header already sent'
```

Appendix 11: Database Connection

```php
<?php
$config = array(
'host'      => 'localhost',
'username'  => 'darlingw_dawa2020',
'password'  => '@88Ageer1234567#',
'dbname'    => 'darlingw_dawa_db',
);

$db = new PDO('mysql:host=' . $config['host'] . ';dbname=' . $config['dbname'], $config['username'], $config['password']);
$db->setAttribute(PDO::ATTR_ERRMODE, PDO::ERRMODE_EXCEPTION);
```

Appendix 12: Poster Presentation

Development of Web-based System for Tracking Students' Performance for Early Intervention: A Case of Darling Wisdom Academy

1. Thon Malek Garang, 2. Dr. Neema Mduma, 3. Dr. Dina Machuve
Email: malekt@nm-aist.ac.tz

INTRODUCTION

An information system is made up of interconnected components that collect, store, and analyze data as well as deliver information, knowledge, and digital products. The importance of developing an information system that allows for the generation and maintenance of very accurate and up-to-date student information in nursery, primary, and secondary schools was underlined. Therefore, student information is not good enough unless it stores accurate information, eases accessibility to intended users and simplifies workload to enhance effectiveness and efficiency of student information-oriented services, student information management and performance tracking. The key functions of student information system are to enhance students' performance review through statistical processing of student' information.

OBJECTIVES

MAIN OBJECTIVE

To develop a functional, flexible, and convenient integrated web-based student information system (SIS) with user-friendly interface for enhancing student performance tracking for early intervention at Darling Wisdom Academy.

SPECIFIC OBJECTIVES

- To analyse the requirements of a web-based student information system
- To develop a web-based student information system
- To validate and evaluate the developed web-based student information system

CONCEPTUAL FRAMEWORK

PROBLEM STATEMENT

Late intervention in student performance review and monitoring causes a lot of complications in student's academic journey. Most parents always rely on report cards produced at the end of the year which in most cases catches them by surprise when these students fail. The failure of these students calls for repeating classes which has time and cost implications.

System Login

CONCLUSSION

Preliminary research done before to this investigation revealed that there is a dearth of student information and, as a result, inadequate student information management in Darling Wisdom Academy. The lack of appropriate technologies makes collecting, managing, processing, and accessing student information extremely challenging. Early intervention is usually broadly provided to classes without the customized individually oriented student early performance intervention.