Mbizo high school integrated administration system

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By

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Submitted in partial fulfillment of the requirements for the degree of

BSc. Honors Information Systems

Department of Computer Science and Information Systems

in the

Faculty of Science and Technology

at the

Midlands State University

Gweru

May 2018

Supervisor: **Dr. M Zhou**

ABSTRACT

The idea of developing Mbizo high school integrated administration system was hatched due to the lack of a suitable IT based solution to administrative processes of schools classified in class B. Many school administration systems available off-the-shelf are not fit for most of the school in Zimbabwe and study have shown that they are prematurely abandoned due to their unsustainability. The new system is tailor made to suite well in environments of class B school like Mbizo high school. The integrated school administration system uses web based technology to support admission of students and profiling, fees payments, staff attendance and eLearning. PHP was used as a server scripting language, HTML was used for client scripting and MySQL was used for databases. The system integrates all this modules through the use of one main database. Data was gathered though the review of documents, questionnaires and interviews. These data gathering techniques where instrumental in trying to understand the old system and the formulation of requirements for a new system. A comprehensive feasibility study was carried out, testing if the system was worth doing of which the system proved to be worth developing. After the formulation of functional and non-functional requirements, working designs of the system where formulated and implemented. Parallel changeover was used as strategy to migrate from the old system to the new system as it protects against data loss in an event of a new system failure. The newly developed Mbizo high school integrated school administration system can be improved as further developments can focus on extending modules to add functions left on the initial system. The development and implementation of the system was a success.

DECLARATION

I, Takaindisa Nyasha W, hereby declare that I am the sole author of this dissertation. I authorise the Midlands State University to lend this dissertation to other institutions or individuals for the purpose of scholarly research.

Signature:……Date:……...

APPROVAL

This dissertation, entitled **"Mbizo high school integrated administration system"** by **Nyasha Washington Takaindisa** meets the regulations governing the award of the degree of **BSc Honours Information Systems** of the **Midlands State University,** and is approved for its contribution to knowledge and literary presentation.

Supervisor's Signature: …….

Date: ……..

ACKNOWLEDGEMENTS

I would like to take this opportunity to give thanks to the Almighty Lord for strengthening me through the course of this project. His grace and love is evident in the successful completions of this project and I am forever grateful for that. I extend my gratitude to Mbizo High School for their patience and willingness to assist on this project. Special thanks to my supervisor Dr. M Zhou, for his timely and unparalleled guidance in making this write-up meaningful. I would like to thank my family as well for their unwavering support and their immense contribution to my academics. I would have not succeeded on this project without their emotional support and encouragement. My gratitude also goes to all those whom I did not name on this acknowledgement but contributed directly or indirectly on this project. God bless you all.

DEDICATION

I dedicate this research project to my father Mr. Washington Takaindisa for his unquantifiable contribution to my education and his faith in me.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS

I T - Information technology

PHP – PHP: Hypertext preprocessor

HTML – Hypertext markup language

ROI – Return on investment

DFD – Data flow diagram

EER – Enhanced entity relationship diagram

Chapter One: Introduction

1.1 Introduction

The ministry of education introduced a new curriculum recently which is largely IT biased. This has prompted the administration of Mbizo High School to look for a best solution of computerising the whole administration of the school. This write-up will document the development of a robust integrated school administration system for Mbizo High School. This chapter will give a brief description of the school, the systems objectives and the justification of developing the proposed system.

1.2 Background of the study

Young (2013) argued that it is of importance to give the background of the study as it summarises factors that lead to the project. The need of developing an integrated school management system rose after the management of the school realised high costs in implementing independent packages for administration purposes. The system being developed will provide integrated administration packages. These packages will share the same database thereby increasing efficiency and reducing data redundancy.

1.2.1 Background of the organisation

Young (2013) also defined the background of the organisation as brief histories of the entity were the project is being done. Built in 1987 and being among the first secondary schools in Kwekwe, Mbizo High School is located on the east of the Kwekwe CBD in a township called Mbizo. Started off as a secondary school while providing a vital service of educating the communicate, Mbizo High School then became a high school on the turn of a millennia and is one of the biggest schools in the midlands province. Mbizo High School is rapidly expanding and its innovative leaders have decided to computerise the school administration system in its entirety.

1.2.2 Organisational Structure

Aquinas (2009) defined an organisational as a formal system of task and authority relationships that control how people coordinate their actions and use resources to achieve organisational goals. Below is an organisational structure of Mbizo high school.

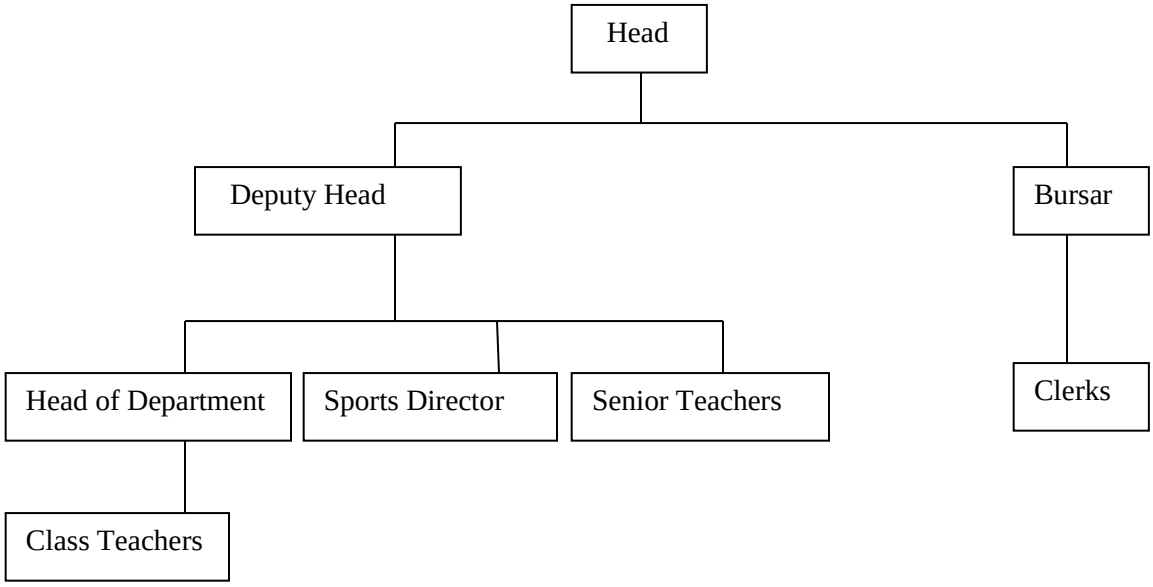


Figure 1.1 Organisational structure

The headmaster is on the top of the structure followed by the deputy headmaster and the bursar. The bursar is responsible for managing government funds on the school and the deputy headmaster is responsible for the academic activities of the school. The head of departments are under the deputy head and class teachers under department heads.

1.2.3 Vision

Aquinas (2009) also defined a vision statement as description of the targeted achievements of the organisation either in the long or short term. The vision of Mbizo high school is **t**o be amongst the best two, day high schools in the midlands province

1.2.4 Mission Statement

According to Strydon (2008), a mission statement tries to highlight organisational goals and philosophies in few lines. Mbizo High School endeavor to mold a learner into

- Sociable
- Self reliant
- Accountable and
- Versatile individual

With acquired knowledge skills, and positive attitude. All developed through our open and hidden curriculum for an ever changing environment.

1.2.5 Motto

Strydon (2008) defined an organisational motto as a short phrase that captures the drive of an organisation. The Mbizo high school motto is **"**Commitment breeds excellence".

1.3 Problem Definition

McDermid (2013) argued that a problem definition is a short and precise description of the area of concern or a problem to address. Since the introduction of the new curriculum by the ministry of education, Mbizo High School and other schools across the country has been looking for complete solution for school administration but most of the systems available on the market either addresses a single administrative issue like fees payment or admissions. Some complete system on the market may not be suitable for the local education system since they may be developed for school in other countries. The researcher has discovered that Mbizo high school and other schools across the country have bought and installed more than 3 systems only for administration.

These systems will have their own databases there by duplicating data among these system since you can have a student details table in each of the system. This write-up is documenting the development of an integrated school administration system whereby a single large database will be created and all other application like the school website, e-learning and the student profiling system will be built upon a single database.

1.4 Aim

The aim of the system being developed is to create an integrated administration system for Mbizo High School .The system will create a clear and uniform image of the school while increasing efficiency and effectiveness as all modules on the system will be accessing the same data.

The system being developed will seriously reduce redundancies as a single database will be supporting all the modules on the system.

1.5 Objectives

According to Hill (2009), project objectives are high level statements that clearly outline what the project is trying to achieve at the end of the day. A clear definition of project objectives contributes to the overall success of a project. Below are brief descriptions of the objectives of the administration system.

- Admission – the system will capture details of all the students from personal details, guardian details, medical details up to the previous academic results and sports accolades
- Fees payment – the system will generate invoices at the beginning of each term and facilitates fees payment keeping a record of all the transactions done by the student and the amount a student owes the school
- E-learning – the system will enable students and parents to create online profile so that they can pull out fees statements and content uploaded by their teachers. The e-learning will automatically update fees statement if a payment is made since all the systems will be using the same database
- Student profiling – the system will capture all the student's results from form one to six as a requirement from the ministry
- E-library – the system will also provide an institutional repository like function where the librarian can upload e-book and journals so that students can access them online. The function will also have best student projects from IT ,Science ,Agriculture and other departments
- Stuff attendance logging – instead of manually logging, this system will enable teachers to log in the time they got on the school premises and the time they leave

1.6 Instruments and methods

In order to successfully complete this project the following components are to be used

1.6.1 Notepad++

According to Smith (2009) notepad++ is an open source, source code editor which supports tabbed editing and syntax highlighting amongst other useful scripting functions. The major advantage of using Notepad++ is that it is open source and support scripting of many languages include PHP and jascript.

1.6.2 XAMPP

XAMP is an open source web-server package with Apache, MySQL, PHP and other platforms on the package. XAMP is free and readily available for use. This tool will be used during the development of the integrated school management system.

1.6.3 MySQL

According to Nixon (2014), MySQL is an open source, free to use database management system which provides data security and high performance. The main reason why the researcher chose MySQL is due to its reduced to zero ownership cost and easy to use.

1.6.4 PHP

Nixon (2014) also defined PHP as speed and open source which are the main reasons why the researcher chose to use the server scripting language. PHP is stable and can be run on any platform including windows, linux and Mac.

1.6.5 Data gathering method

For the researcher to have a full understanding of the current systems and understands what users will expect from the system. Below are the data collection methods that will be used by the researcher to collect data about the old system.

- Interviews
- Questionnaires
- Document review

These methods will be discussed in full in chapter three which is the analysis phase.

1.7 Justification

Eason (2014) argued that a justification seeks to clarify the rationale of developing a new system. A justification tries to show the importance of developing a new system by highlighting some of the advantages to be realised after implementing the system. The integrated school administrations system was justified as follows:

- The system being developed will financially benefit the school as they will reduce costs of maintaining two system they have currently and also save on purchasing other systems to carter for those administration processes which are still manual

- The school website and e-learning services on the system being developed will to a greater extend improves the communication between the school and its horde of stakeholders including parents, potentials students and others
- The system being developed will go hand in hand with the ministry of education's new curriculum which encourages schools to invest in ITC solutions
- The system being developed will also answers to the ministry's call to capture and create student's academic records so that a student profile can be created from form 1 to form 6
- The most important justification of the system being developed is its ability to integrate all the school administration processes and save the data into a single database so that each process can each process can easily access the database without duplicating data

1.8 Conclusion

The system being developed will definitely change school administration to the better as it will provide a complete and effective solution to school administration problems. The main thrust of this chapter was to clearly define the problem that prompted the study as well as the objectives of the study. The next chapter will be the planning phase.

Chapter 2: Planning Phase

2.1 Introduction

Young (2013) concluded that the planning phase develops the roadmap of the project buy clearly defining the project's business value, project feasibility and the risk associated with the project. This chapter will help the researcher to ascertain if the project is worth doing by analysing the costs, available resources for the project and the social impact of the project. The phase will then lay down the work plan to be adhered to during the development of the integrated school management system.

2.2 Business value

James (2012) argued that the project business value is the project's net benefit realised by the stakeholders of the project. Thus how the implementation of the system is valuable to the Mbizo high school stakeholders. The business value of a system can extends to satisfaction of customers, managers and other stakeholders. These forms of value are not easily converted to monetary value hence they are of paramount importance to the organisation. The Mbizo high integrated school administration will bring a new dimension into the learning and teaching environment of the school.

2.2.1 Shareholder value

Sward and David (2006) defined shareholder value of a project as the value delivered to shareholders due to the implementation of a project. The value in most of the times is the monitory value of the functional and intangible benefits of the project. Mbizo high school is government school and there for the government is the only shareholder. The government will benefit from transparence as the system will capture all the financial and admission transactions done by the school. The system will also be in accordance with the government's call to electronically keep students academic records to be used for the student's final assessment.

2.2.2 Customer value

Sward etal (2006) defined customer value as the total value realised by the end-user customer due to the implementation of a project. Students are the major customers of the integrated school administration system. Student will be able to access their financial and academic records from

their e-learning. These records will be up to date as the e-learning platform will be accessing the main database of the school. This is of great value as students are able to access their financial and academic records even from remote locations and anytime.

2.2.3 Employee knowledge

Employees are an important asset to an organisation and it is of paramount important to provide relevant information to employees for them to perform ultimately. The system being developed will provide a platform to the school employees who are teachers, clerks and others. Teachers will be able to easily access information like students financial records thereby improving their work knowledge.

2.2.4 Managerial value

Bhatia (2002) concluded that a successful project should add value to the managerial processes of a company. The headmaster and his deputy are basically the management of a school and the integrated administration system will provide baseboards to them to view specific reports about the school. The system will provide a bird's eye view to the school management about the financial, academic and administration of the school.

2.2.5 Societal value

Institutions like schools provide services to the society and an improvement to the school processes will be of value to the society. Queues will be significantly reduced at the school premises as some documents like fees statements and invoices will be available online for students and parents. This is of value because there will be no need to come to school for those documents. It will also be quicker to make fees and other payments as there will be writing of manual receipts but an amount is just entered in the system. This will significantly reduce queues at the institution.

2.3 Feasibility study

According to Mansaka (2013), the feasibility study of a project tries to establish if the development and implementation of the proposed system is technically, economically, socially and operationally achievable. A feasibility study can conclude if a project is worth doing and or

not. The accuracy of the study is based upon the realistic of the data and figures used during the study. Below is a discussion on the types of feasibility study

2.3.1 Technical feasibility

Mansaka (2013) concluded that a technically feasible project is a one in which the organisation has enough technical expertise to successfully development and implement. This technical analysis seeks to identify if the organisation in this case the school has enough hardware, software and humanware to develop the integrated school administration system. Below are the technical requirements of the integrated school administration system.

2.3.1.1 Human requirements

The integrated school administration system will be operated mostly with Mbizo high school staff members. The school senior teachers will be responsible for adding students into the system while the school clerk will be responsible for entering fees payments. The school bursar will be responsible for configuring the fees payment and running end of term reports. The IT head of department will be the system administrator as he is actively involved in the development on the system. After fully implementing the system and training users no other functional personnel is required as the system will be operated and maintained by the school staff.

2.3.1.2 Hardware requirements

Mbizo high school has fully functional network infrastructure in place connecting all the classrooms and staff offices on the school. This is a major boast to the project as there will be no need to create a new network from scratch. Below is a list of hardware components needed during development and implementation

HP workstation z800

This computer will be used as a server machine during development and after implementation. HP workstation z800 is a very robust machine with the ability to be easily customised. This is a cheaper option rather than to buy specialised servers for the project.

1 terabyte external hard drive

The external hard drive will be used for backing up program files during the development of the project. An external storage device is ideal for backing up in case the main server crushes. The backup option is also cheaper to use.

2x 16 gigabyte flash drives

These flash drives are to be used for transferring files and other uses during the development of the integrated school administration system. Flash drives are necessary during the development as they can make it easier to transfer small amounts of data from one source to another.

22 inch smart touch screen

The touch screen will be used to staff logging purposes. The screen will be positioned on the staff entry point so that a staff member can just touch on his/her name to login and do the same to logout at the end of the day.

2.3.1.3 Software requirements

For the successful development and implementation of the integrated administration system, the following software is required

Notepad++

According to Smith (2009) notepad++ is an open source, source code editor which supports tabbed editing and syntax highlighting amongst other useful scripting functions. Notepad++ will be used for both server and client scripting during the development of administration system. There are other great but costly text editors on the market but notepad++ is free and robust.

XAMPP

According Godfred (2012), XAMPP is a multi-platform web server solution that is open source and developed by Apache and friends. The platform consists of the following components

- PHP and Perl programming languages
- Apache HTTP server

- MariaDB database

The platform makes it easy to create a local web server, test and deploy websites. The platform also makes it easy to transform websites from a test server to a live one. XAMPP will be used in the development of the integrated school administration system.

2.3.2 Economic feasibility

Simon (2007) defined economic feasibility as an analysis to ascertain if a project is economically viable by mainly comparing the economic costs and benefits of a project. The economic feasibility of a project tries to economically justify the project development. The school management which is the school development committee is very keen on the price of doing a project. Therefore the economic analysis tries summarily outline the cost and benefits of the project.

2.3.2.1 Development and implementation costs

As shown in the technical feasibility analysis, the school is supposed to buy some hardware and software to facilitate the development and implementation of the integrated school administration system. The following is a table showing all the components needed for the development and there prices.

Table 2.1 Development and implementation costs

Components		
Description	**Quantity**	**Total Price ($)**
HP Workstation Z800	1	2300
1 Terabyte external hard drive	1	100
16 gigabyte flash drive	2	25
22 Inch smart touch	1	410
Training costs	-	600
Total costs		**3435**

Benefits

Project benefits are categorised into 2 categories namely tangible and intangible benefits. Tangible benefits are those benefits which can be easily converted into monitory value. Intangible benefits are those benefits which cannot be easily converted into monitory values. Both the tangible and intangible benefits are to be considered when carry out a cost benefit analysis and a reasonable value of intangible benefits is to be assigned. Below is a table showing the approximation of tangible benefits of implementing the system.

Table 2.2 Benefits

Benefits accrued (2018)	
Description	**Total Price ($)**
Elimination of maintenance costs of the admission stand alone system (annual license fee)	1200
Elimination of maintenance costs of the fees payment system (annual license fee)	1600
Estimated reduction in stationary costs	800
Total	**3600**

The table figure is showing the estimated amount that the school will save in the year of implementing the integrated school management system.

2.3.2.2 Intangible benefits

According to Simon (2007), intangible benefits can be simply be defined as those project benefits of a project that cannot be easily converted to monitory terms. The integrated school administration system will benefit the following to the school

- Parent's goodwill – the implementation of the system will increase parent's confidence in the school as they will be quickly served and readily access information about their children enrolled at the school.

- Effective decision making by the school management - the school administration team will be able to make sound decisions from the reports produced by the system.
- Reduced manual work in writing invoices and receipts as the system can automatically print those.
- Improved school staff and process productivity
- Improved security of the school information

Tangible benefits

Tangible benefits are those benefits that can be easily be converted into monitory value.

2.3.2.3 Cost benefit analysis

Brent (2007) defines cost benefits analysis as a systematic way of weighing economic costs and benefits of carrying out a project. The analysis aids in deciding if the project is economically feasible or not. The cost benefits analysis helps the school management to decide to or not to the project based on the result of the analysis. Below is a table summarising the cost and benefits of the project.

Table 2.3 Cost benefit analysis

Projected cash flows		
Benefits	**$**	**$**
Tangible		3600
Intangible (Estimated)		200
Total		**3800**
Costs		
Development and implementation	3435	
Total	**3435**	
		3435
Net Benefits		**365**

Comments on the cost-benefit analysis

The cost benefit analysis showed that the project benefits outweigh the cost showing an annual profit of US$345. Using the results from the cost benefit analysis, the school management can decide to carry on with project as it brings benefits to the school. The problem with the cost benefit analysis is that it does not factor in the timing of the cash flows therefore a return o =n investment analysis should also be made.

2.3.2.4 Return of investment

Philips and Philips (2006) defined return on investment as the efficiency of an investment thus the amount of return of a project compared to the initial investment. After performing a return on investment metrics, a project will show either a positive of a negative return on investment. Management may be attracted to fund a project with a positive return of investment rather than the one with a negative one. Below is the calculation of the return on investment for the development of the school integrated administration system.

$$\text{Return on investment} = \left[\frac{\text{Gain of the investment} - \text{Cost of the investment}}{\text{cost of the investment}}\right] x\ 100\%$$

$$= \left[\frac{3800-3435}{3435}\right] x\ 100\%$$

$$= 10.6\ \%$$

Comments on the return of investment analysis

A yield opportunity of 10.6% is attractive and the school management can decide to carry on with a project with such a yield opportunity. The only limitation with the return on investment metrics is that it does not consider the time that the cash flows are realised. In this instance the development and implementation the school administration system will yield benefits to the school after 1 to 2 years after implementation. The return on investment analysis does not consider this factor.

2.3.3 Social feasibility

O ‘brien and Marakas (2011) defined social feasibility as the project’s positive and/or negative implications on the community or communities. The school administration system is to be

installed on a public high school so the implementation will have a direct impact on the society. The school will now have an online presents meaning that all its stakeholders will have a direct link to the school. The system will enable students to access their financial and academic records without manually visiting the school. As for parents, the school contact details and banking details will be readily available online to facilitate easy access to the administration. The implementation of this system will see the society better off than they were before implementation.

2.3.4 Operational feasibility

Mesly and Olivier (2017) defined operational feasibility as the assessment of how well the proposed system solves the problems at hand. Operational feasibility also assesses how the system will be accepted by its end users. This analysis also measures the effects of the proposed system on the organisational politics and culture and how the system fits in the existing business environment.

The overall success in the operational of a newly implemented system is the system's ability to compensate the current work practices. Users are motivated to use the newly implemented system if it makes life easier for them. A system that changes their work practices completely is likely to be rejected so for the new administration system to be accepted at Mbizo high school it has to have the following characteristics :

- Accurate – As Mbizo high school is public organisation and subjected to public audit, the system should be accurate and produce accurate reports especially on handling students' fees payments.
- Reliability – the integrated administration system must produce constant results so that users can depend and trust on it.
- Usability – the system should be easy to learn and provide user-friendly interfaces. Complex interfaces can affect the adoption of the administration system so the system will have simple and clear interfaces.

An operational feasibility analysis does not assess if the system can work but also evaluate whether the system will work in the real life situation. The integrated school administration will

be accurate, reliable and user friendly meaning that it has all the ingredients to accepted and used by its end users.

Comments on feasibility study

Berrie (2008) argued that feasibility analysis is a tool used to justify a project therefore the analysis has to answer the following questions:

- Does the project have financial benefits to the organisation and if it does, when does the organisation rip these benefits.
- Does the project have enough resources to successfully develop the system
- Will the system work and how will it integrate with the current working environment and organisational politics

The researcher's economic feasibility analysis concluded that the development of the integrated school administration system will have financial benefits to the school thereby the project is financial viable. The technical and operational feasibility analysis also shows that the school is able to carry out the project and the system's end users are poised to use the system. The school management can now confidently sponsor and support the project as it justified by the analysis.

2.4 Risk analysis

Rausand (2011) explained the process of risk analysis as the identification, assessment, management and eradication of potential negative outcomes on a project. It is of paramount importance to identify risks and potential risks of a project so that they can be managed and eradicated. Unmanaged risks may lead to failure in project implementation. Below are some of the risks that may be encountered in the life cycle of the proposed system.

- Change of management – the risk associated with change of management is scope creep. As this system is to development and implanted on government school. There is a possibility of a change in school administration and a new head can come with his/her ideas for the system objectives. This may affect the scope of the project therefore the process of change of management has to be properly managed.
- Resistance from end users – user resistance can be viewed as operational risks were users may desist from using the system due to complex interfaces and organisational politics.

This risk can be eradicated by creating simple interfaces, user training and creating system that does not change user practices but simplify them.

- Lack of funding – Lack of funding is another risk to be anticipated during a software project development. The school administration can lack interest on the project and pull out the funding of the project. To avoid such a scenario the objectives of the project are to be communicated to the school administration. Progress is also to be communicated to the administration so that they can see what their money is used for.

2.5 Stakeholder analysis

Cameron and Seher (2010) defined stakeholder analysis as the assessment of the project on interested and relevant parties. A stakeholder analysis helps the researcher in shaping the scope of the project as the researcher get opinions from the most powerful stakeholders of the project. Acquiring support from the project sponsors can be critical to the success of a project therefore a stakeholder analysis should be done to identify the needs of sponsors. There basically two types of stakeholders which are as follows:

Primary stakeholders

These stakeholders are directly affected either positively or negatively by the project. As for school administration system, primary stakeholders are as follows:

- **The head**

The school headmaster is the custodian of the system being developed. He is responsible for approving the project sponsorship and explaining the need for the system to the school development association who are the representatives of the parents. The school head yields both power and interest on the project and requires close management. The head is to be updated on the progress of the project for him not to lose interest on the project. There is a risk of losing sponsorship if the school head looses interest on the project.

- **School administration staff and teachers**

The success of the project is measured upon the satisfaction of these stakeholders. The implementation of the system will affect the work of administrators either positively or negatively. These stakeholders may have less power but they have full interest on the project.

The researcher works hand in hand with administrators in formulating objectives of the system as well as defining the smallest details of the system. Failure to address the needs of these stakeholders will lead to unsustainable implementation of the system.

- **Students**

The system being created will be used to administer students. The learning platform will be provided for students to view their financials, results and access learning material. The expectations of the students are to be closely monitored.

Secondary stakeholders

This category of stakeholders houses those stakeholders who are not directly affected by the implementation of the system. These key stakeholders are not indirectly linked to the project. The following are the secondary stakeholders of the school administration system:

- **The ministry of primary and secondary education**

The ministry of education is the governing body for all primaries and secondary so the development of the system should be accordance to the legal and other ministry regulation. The ministry expects the system to comply with the laws of country and only used for educational purposes

2.6 Work plan

Filicetti and John (2008) defined a project work plan as the mapping of the project activities in a simple way that can be easily followed. A work plan involves allocating time and resources to project activities. The main advantage of a work plan is that it enables managers easily track progress and predict the end date of a project. Below is a Gantt chart that shows the project schedule.

2.6.1 Gantt chart

Weaver and Patrick (2018) defined a Gantt chat as a bar chart representation of the project schedule. A Gantt chart uses an early start time approach as an activity starts as its prerequisite ends. Below is a Gantt chart showing the schedule of developing and implementing the integrated school administration system.

Table 2.4 Gantt chart

Stage	Time (weeks)								
	1-2	**2-4**	**4-6**	**6-8**	**8-10**	**10-12**	**12-14**	**14-18**	**18-20**
Documentation									
Proposal									
Planning									
Analysis									
Design									
Implementation									
Testing									

As shown by the above Gantt chart, the project will run for approximately 20 weeks. The design phase has more time as the database of the system will be reasonably big and requires a high level of finesse to successfully complete. The testing phase will phase as soon as the implantation phase as the researcher will be fixing bugs on implementation.

2.7 Conclusion

This chapter justified the development of the system through the feasibility study and identified the needs of the stakeholders of the system. The chapter also defined the risks associated with the project and gave possible solutions to the risks. The next chapter will be analysis phase.

Chapter 3: Analysis Phase

3.1 Introduction

Whitten, Bentley and Dittman (2004) argued that the analysis phase defines the requirements of the system by thoroughly studying the existing system and coming up with the functional and nonfunctional requirements of the new system. The analysis phase create the basis of the study as the researcher now try to understand the weakness of the old system and coming up with solutions to the problems. This phase will highlight on the data gathering methodologies used, weaknesses of the current system and examines the alternatives available in addressing the problems defined.

3.2 Information gathering methodologies

Lescroël, Ballard, Grémillet, Authier and Ainley (2014) defined information gathering as the process of systematically acquiring and processing data to get useful information. The researcher used the following methodologies of gather information about the old system and what the users expects on the new system.

3.2.1 Interviews

King H (2010) defined an interview as one of qualitative research tools where questions are asked to obtain information. Interviews allow the researcher to have a face to face conversation with the project stakeholders. Relevant questions will be asked in a bid to elicit relevant information that can be used in the formulation of system objectives.

Designing and scheduling the interviews

The researcher scheduled to interview the school head, accounting assistant, head department and a teacher. The researcher interviewed the school head to get the overview of what the headmaster is expecting from the system. After interviewing the head, the researcher then sat down to interview the accounting assistance as they are the one's responsible for book keeping. The researcher then went on to interview the head of department and finally the teachers. The researcher choose to use interviews as a method of data gathering due to the following reasons

Advantages of interviews

As a data gathering technique, interviews have the following advantage over other data gathering techniques:

- The major advantage of using interviews is that it creates a relationship between the interviewer and the interviewee as it creates a mutual understanding between the two parties. The researcher was able to read into the interviewee's characters and find the suitable way to ask them question.
- Another reason why the researcher chose interviews is because the data gathering method saves time. The researcher gets instant response from questions and saves time of printing questionnaires and waiting for response if using questionnaires.
- Another major advantage of using interviews as a data gathering methods is that they are flexible. A situation can be framed differently according to the current environment. Other questions may also accumulate depending of the answers of the interviewee hence acquiring more information.
- Interviews provided clarity to the interviewee in a case that the interviewee found a question confusing. The researcher further clarified in simpler or relative teams if the interviewee fails to understand the question.
- Interviews helped the researcher to note not only verbal but verbal cues as well. Non-verbal cues can communicate useful information to the interviewer hence improving the data collected.

Disadvantages of interviews

As much as interviews have their advantages, the researcher also noted some disadvantages of using interviews

- The major drawback of using interviews is that there is a limited sample size of interviewees as the researcher was unable to interview the whole about the implementation of an integrated school administration system. Only a limited number of stakeholders can be interviewed and in this case only 5 stakeholders were interviewed by the researcher out of the whole school system.

- Another disadvantage of interviews is that they break the flow of work as the interviewee has to leave his or her work to attend the interview. This make it difficult to schedule for interviews as the targeted interviewees may be at time busy.

  Findings from the interviews

  - The major highlight from the interviews was the enthusiasm of the school head towards the implementation of the new system. The school head applauded the idea an integrated school management system as it will improve efficiency on the school administration
  - The accounting assistants at the school highlighted the need for a secure system as they will be dealing with public funds. The accounting assistants also highlighted that the system should not change their business processes but should complement and improve them
  - The head of department and teachers also applauded the implementation of the new system as they wish to move with times and technology

Interview questions are attached at the back of this document.

3.2.2 Questionnaires

Saris W and Gallhofer B(2014) defined a questionnaire as a list of questions that have to be answered in a data gathering exercise. Questions on a questionnaire can be open ended or close ended. Open ended questions provide a space to write a meaningful answer while an close ended question usually requires a yes or no answer. The researcher distributed questionnaires to stakeholders who did not get a chance to be interviewed. Questionnaires were given to students, school development council chairperson and other teachers. The researcher chose to use questionnaires for the following advantages.

Structure and Administration of questionnaires

The researcher created questionnaires for the headmaster covering what the expectations of the headmaster on the new administration system. The next bunch of questionnaires went to the accounting assistance covering the handling of fees payments and other money handling questions. Selected teachers were also given questionnaires asking their expectations as well on the implementation of the proposed system.

Advantages of questionnaires

- The researcher was able to acquire data from a large number of stakeholders through the use of questionnaires. Only few stakeholders were interviewed but the questionnaires enabled the researcher to gather data from other stakeholder who did not get the chance to be interviewed.
- Questionnaires reviewed some information which was not acquired from interviews as other stakeholders responded to questions with anonymity. Questionnaires distributed to teachers reviewed some of the teacher's expectations on the system of which these expectations were not identified during interviews.
- Questionnaires did not interrupt the flow of work at the school as stakeholders answered the questions on free time. This was a major advantage as no work was interrupted due to the data gathering process
- The questionnaires got a response of 94% which is a good response as a large number of stakeholders were given the questionnaires.

Disadvantages of questionnaires

- The major drawback noticed was that some of the stakeholders failed to interpret the questions and ended up giving wrong answers. This problem was noted mostly on open-ended questions which were poorly answered.
- Some questions on the questionnaire were skipped. This affected data analysis as these questions were importance for the data analysis process
- Another major drawback for questionnaires identified by the researcher id failure to capture emotions and feelings of stakeholders towards the development and implementation of the system.
- 4% of the questionnaires were unanswered as some stakeholders failed to take the exercise seriously.

Findings from questionnaires

- Almost 90% of the stakeholders responded to the questionnaires liked the idea of the development of an integrated school administration system.

- 5% of those responded to the questionnaires had mixed feelings on the proposed system as they fear that work processes may be changed.
- The major take away from data gathered using questionnaires is that the majority of the stakeholders are happy with the idea of an integrated administration system.

Samples of questionnaires are attached to the back of this document.

3.2.3 Document review

Kane and Sally (2013) defined document review as a data collection method that enables the researcher to analyse document and the data they process in order to gain useful information. The researcher used document review on the school financial document. The researcher used this method as it is suitable for acquiring quantitative data. Major finding from the document review was how the school separates the capturing and use of school and government funds. The review also concluded that there is a real need for computerising the school fees payment processes, secure and reliable storage of student's fees payment information.

3.3 Analysis of the existing system

The administration process at Mbizo high school starts with student admission. This involves receiving of application forms of potential students. Application forms are vetted and students with enough qualifications are enrolled. After enrollment, selected students are allocated classes and pay fees. After this process, learning starts with the student access to class teachers and the library. At the end of a term, students are given an examination and results are only given to those who have paid full school fees.

Table 3.1 Development and implementation costs

Entity	Input	Process	Result
Student	• Student details • Fees payment • Examination Answers	• Saving of student details • Fees payment processing • Examination writing	• Receiving of fees payment receipt and examination results
Teacher	• Learning material • Examination Questions	• Teaching– delivering learning material to students • Delivering and marking the examination scripts	• Issuing of examination results
Accounting assistants	• Student Invoices	• Recording of fees payments	• Issuing of fees payment receipts
School head	• School policies • Supervision	• Overall monitoring of All school activities	• Performance reports

Table 3.1 summarised some of the input, processes and outputs of selected entities of the current Mbizo high school administration systems. The school head gives out the overall school performance in financials, academics and sports given data from all departments.

Summary of the existing system

Many of the old system processes are done manually and excel sheet are used for data capturing. These excel sheets mostly used for capturing student fees payments and general accosting processes. The current system is affected by traditional effects of manual systems which are redundancy of data, lost of data and absent of useful and well structured reports. If a record is requested, athe school record keeper will have to dig into tones and tones of paper work to retrieve one record and at times a record is never found.

3.4 Process Analysis

Dennis (2011) argued that process analysis is a systematic may of breaking down a system process into logical phases that turn input into output. The process analysis will focus on how the old system worked.

Activity diagram of the current system

An activity diagram is simple a flow that show the flow of data from one entity to another. The diagram shows the dynamics of the system as it describes the operation of the system according to Dennis (2011).

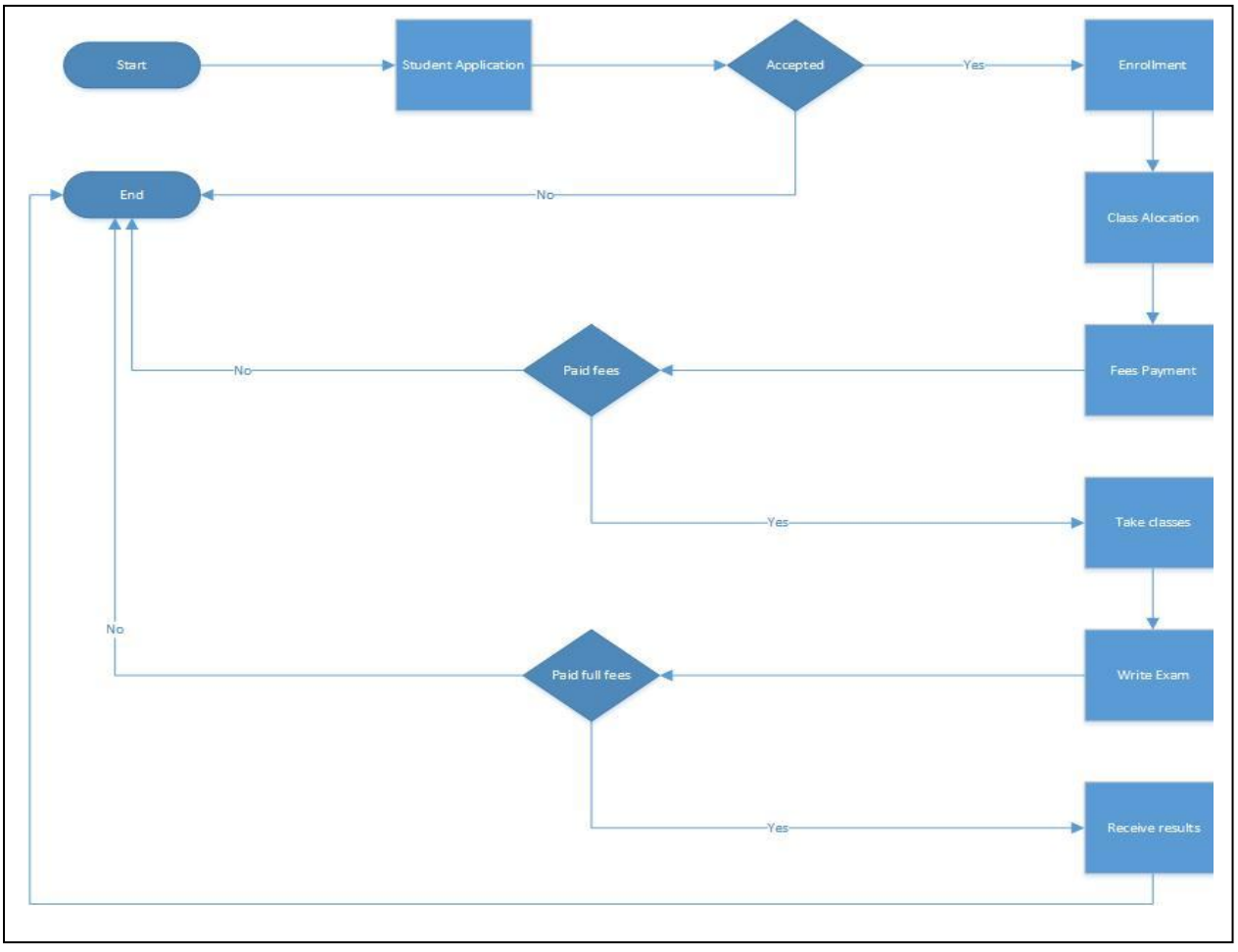


Figure 3.1 Activity diagram of a current system

3.5 Data analysis

Rankin J(2013) defined system data analysis simple as the structured study of information flowing in a given system. This phase tries to identify and define the process and activities done on the old system. This helps the researcher and understanding the current system so as to correctly define improvements to be made. Below is a data flow diagram of the current system.

3.5.1 Context Diagram

A context diagram shows the system's boundaries, defining how the system interacts with its entities according to Rankin J(2013). As a high level view of the system, the context diagram shows the system as a whole and the input and output from external entities. A context diagram provides a bird's eye view to the system as it show the system and summarises how it interacts with other systems.

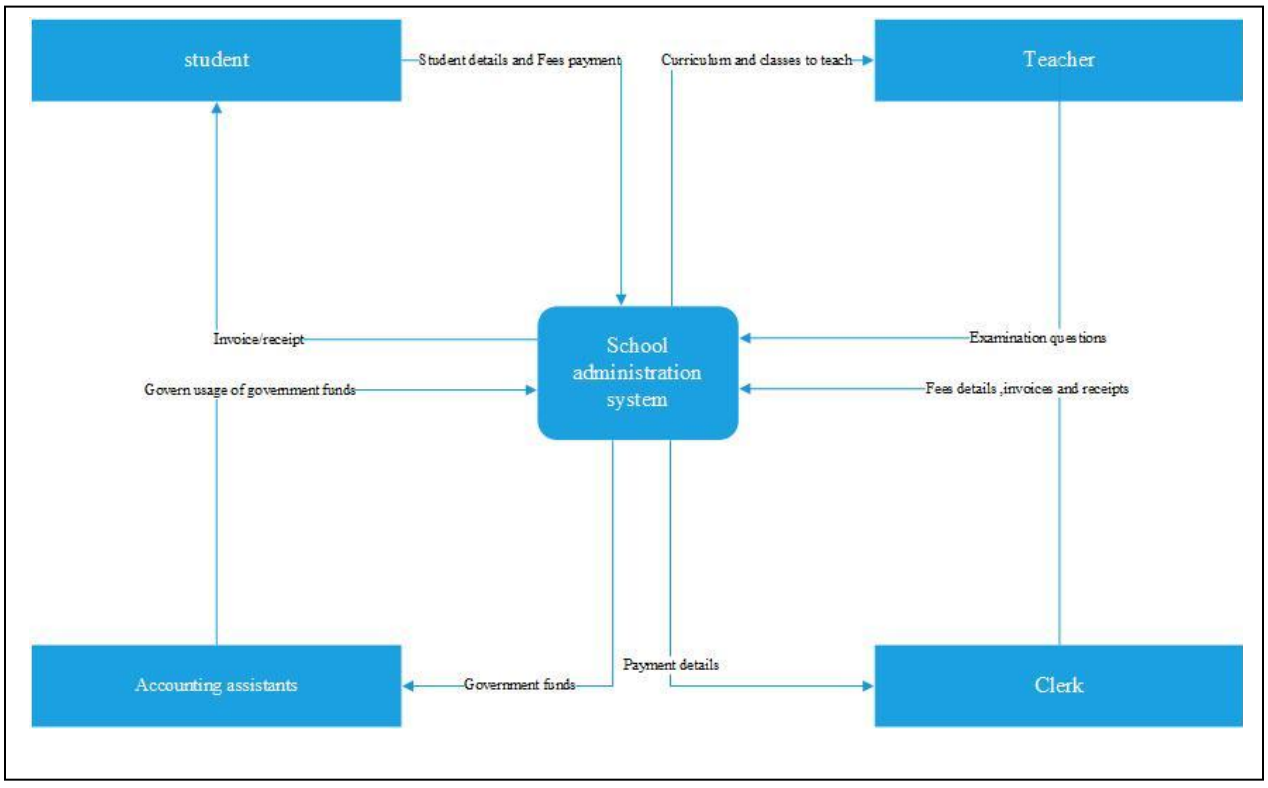


Figure 3.2 Context Diagram of current system

3.5.2 Dataflow diagram

Manoj K.C (2012) argued that studying the dataflow diagram of the current system help the researcher in understanding and improving the current system. below is dataflow diagram of the current system

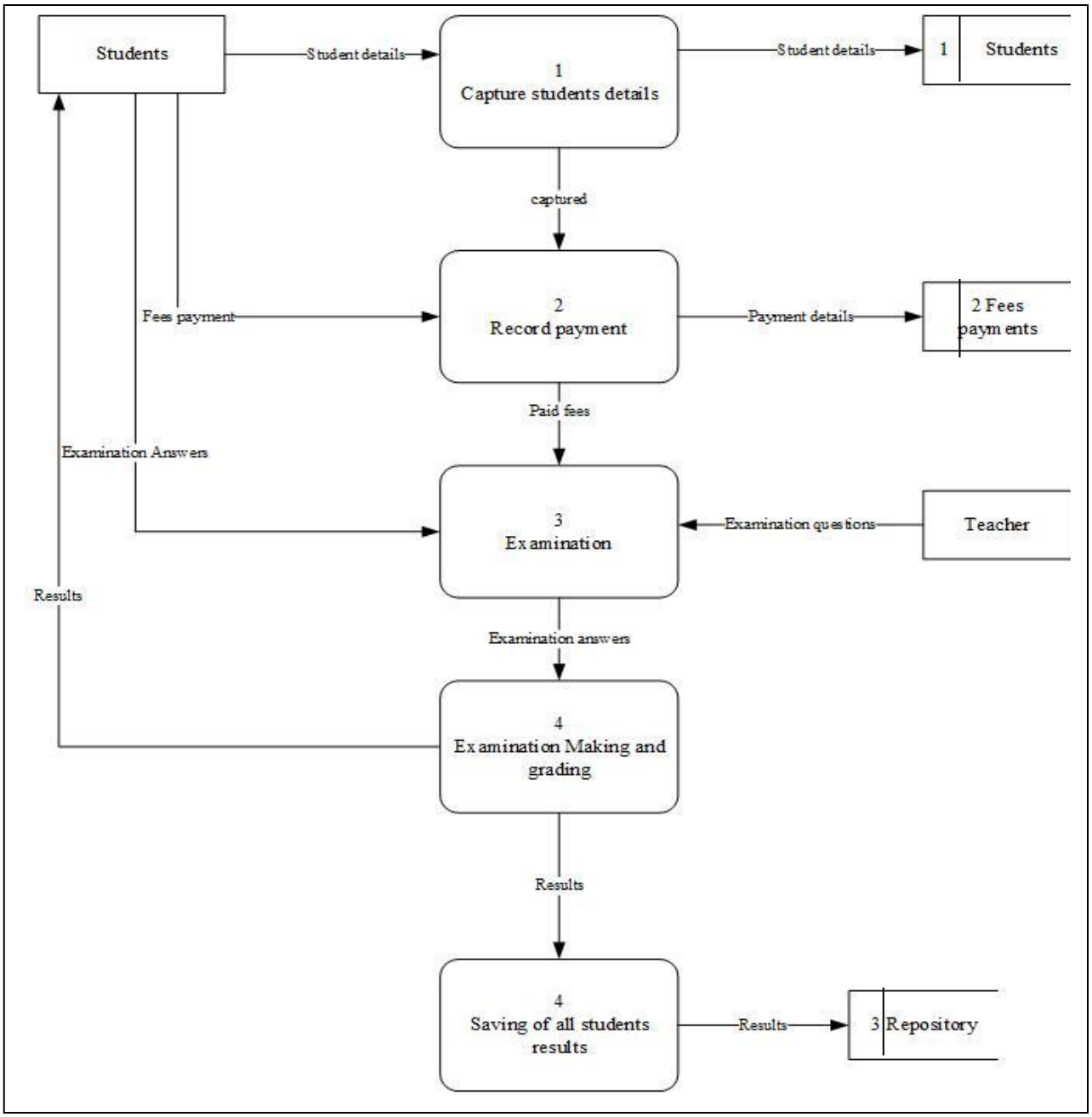
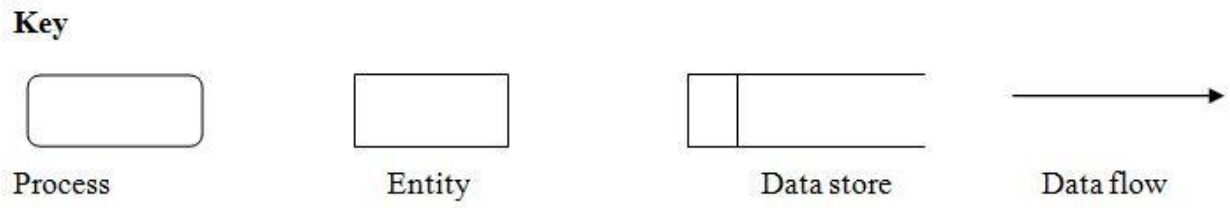


Figure 3.3 dataflow diagram of a current system



3.6 Weaknesses of current system

The current system has the following weaknesses to be addressed by the implementation of the integrated school management system:

- The first weakness of the current system is that most of the administrative process are manually done thus manually capturing, storing and retrieval of data. Manual records are stored and are subjected to manipulation and lack of access control.
- Excel sheets are kept for some information thereby a lack of integration between these sheets encourages data redundancy as at some point student details are saved in the accounting and admissions sheets. This calls for the development if an integrated database to reduce redundancies
- Another major weakness of the current system is the lack of logical backup facilities. Since data is stored manually on physical records, only one copy of that record is stored and in an event that the copy is lost or damaged, all the information goes with the record.
- Security is also another weakness to note on the current system as there is no access control on who access some crucial administrative documents.

The points noted are some of the major weaknesses that the current system have. These weaknesses are to be addressed by the implementation of the proposed system.

3.7 Evaluation of available alternatives

In an article, evaluation of alternatives in decision Gaurav (2011) explained alternative evaluation as the selection of the best solution to a problem after considering a number of options. The alternative should be technically and economically feasible. The researcher had three alternatives buying an off-the-shelf system, improvement and development.

3.7.1 Buying an off-the-shelf

In an article written by Gaurav (2011) about open source software, the term is defined as that software which is made not for a specific customer but for public consumption. Off-the-shelf software is usually ready for implementation and has the following advantages:

Advantages of buying and off-the-shelf software

Buying off-the-shelf software has got its own advantages as compared to other alternatives. These advantages are:

- Available immediately
- Little or no bugs associated with the product
- A horde of support from other users who are already using the system
- Availability of upgrades and compatibility

Disadvantages of buying and off-the-shelf software

Buying off-the-shelf software can have the following disadvantages to the school as an alternative.

- Comes with a lot of unnecessary features which are bought and may not be used
- The school will have to pay customisation cost to fit the school's purpose
- A lot of school administration software on the market are not suitable for the local schools since they are usually make for European countries with different education curriculum
- No direct access to the developers or the source code when a major bug is encountered

3.7.2 Improvement

This involves improving the current system. The current system is mostly manual and this alternative seeks to improve these processes in order to meet the new requirements. The advantage of this alternative is that it is cheap to implement. The alternative however makes it difficult to meet the requirements.

3.7.3 In-house development

The article by Tarhini, Yunis and El-Kassar (2018) went on to define in-house software development as production of a software product within the organisation and to be used within the organisition as well. The successful development of the software is pinned upon the quality of the defined objectives and the availability of the talent to develop the system.

Advantages of in-house-development

- This alternative offers the school full control of the system since they will have access to the source code
- The system developed is of high quality as it answers the real needs of the school.
- No unwanted functions as the system is developed according the current needs of the school
- The development of the system required around $3435 which is cheaper as most off-the-shelf school administration system cost around $6000 going up.

Disadvantages of in-house-development

- The school may risk losing money if the system fails to meet the requirements
- In-house developed system may have several bugs which may delay the implementation of the system
- The alternative is time consuming as there is need time to propose, design and develop the system

The in-house development alternative was selected as it is suitable for the current environment and economically viable.

3.8 Requirements analysis

Wiegers and Beatty (2013) argued that requirements analysis looks at the business needs and make them technical objectives. There are functional and non-functional requirements of the proposed system..

3.8.1 Functional requirements

Functional requirements define how the system is supposed to functions according to Sommerville (2006). This is how the system handles input, processes and output. Below are the functional requirements of the system

- Reliable back-up plans
- Security for administration information
- Integration of all administration processes
- Creation of student and teachers portal
- Handling of fees payments

Use case diagram

Sommerville (2006) defined the use case diagram as the diagrammatic representation of the user's interaction with the system processes. The diagram show how a user is involved in the system processes and the relationship between a process and a user. Table 3.4 is a case diagram of the system

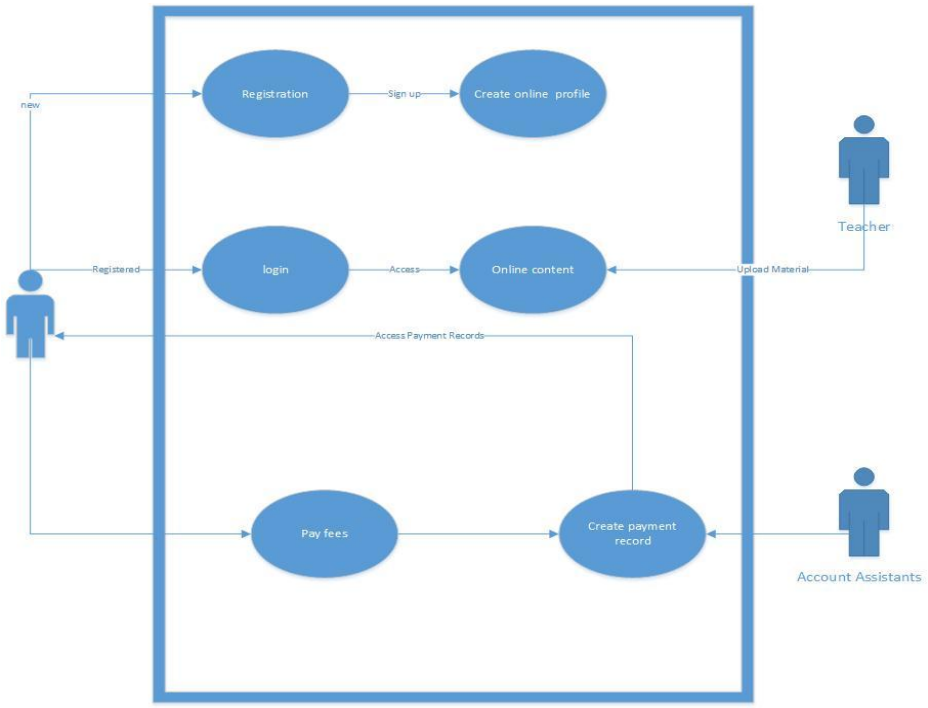


Figure 3.4 use case diagram of current system

3.8.2 Non-functional requirements

Chen (2013) defined non-functional requirements as that requirement that be used as a criteria to judge the operation of the system. these requirements show if the system is fit for purpose and safe to use. Below are the Mbizo high school integrated administration system non-functional requirements.

- Maintainable – the system should be easy to maintains and this can be achieved by the use of comment when coding
- Security – system data should be accessed by authorised personel
- Reliable – the system should quick to recover in an event of a system crush
- Usable – the system should be easy to learn and use
- Modifiable – the system should provide a room for improvement as technology is not static

3.9 Conclusion

This phase illustrated how the old system works through the analysis of the data acquired through data collection. The phase also analysed the alternatives available for the school to solve the problem defined and the development alternative was chosen. The chapter concluded by defining the functional and non- functional requirements of the proposed system. The next chapter is the design phase.

Chapter 4: Design Phase

4.1 Introduction

Ralph and Wand (2009) concluded that the design phase is the transactional phase that conceptualise an idea into a model of a real life working system. One of the main goals of the design phase is to meet the functional and non-functional requirements of the system defined in the analysis phase. This chapter will highlight on the system interface design, database design and security design as well.

4.2 System design

According to Ralph etal (2009) system design involves addressing the problem definition through planning for a software solution. The system interfaces, database and other components are defined under this phase. The system design also defines the alignment of the system modules and how data is to flow in the system. The researcher is to use a dataflow and system flowchart to diagrammatically illustrate how information is to flow in the current system. A good system design is said to reliable, efficient, maintainable, portable and secure.

Description of the new system

The integrated school administration system is to have mainly four modules in total. These modules are, the admissions module which will be responsible for capturing and manipulation student details. The second module will be the fees payment module which is responsible for generating invoices and handling fees payment. The third module will be the e-learning module which enables teachers and students to create online portals. Another major module is the administration module which will enables the headmaster to monitor the overall school activities which are teachers attendance, school financial and other administrative processes.

4.2.1 Context Diagram

Manoj (2012) defined a system context diagram as a model that shows a system as a high level process clearly defining the system boundaries and the process that it interacts with. The context diagram shows the boundaries of the new system and how it interfaces with other system s. This diagram benefits all stakeholders as if does not require expertise to read and understand. Below is a context diagram of the new system.

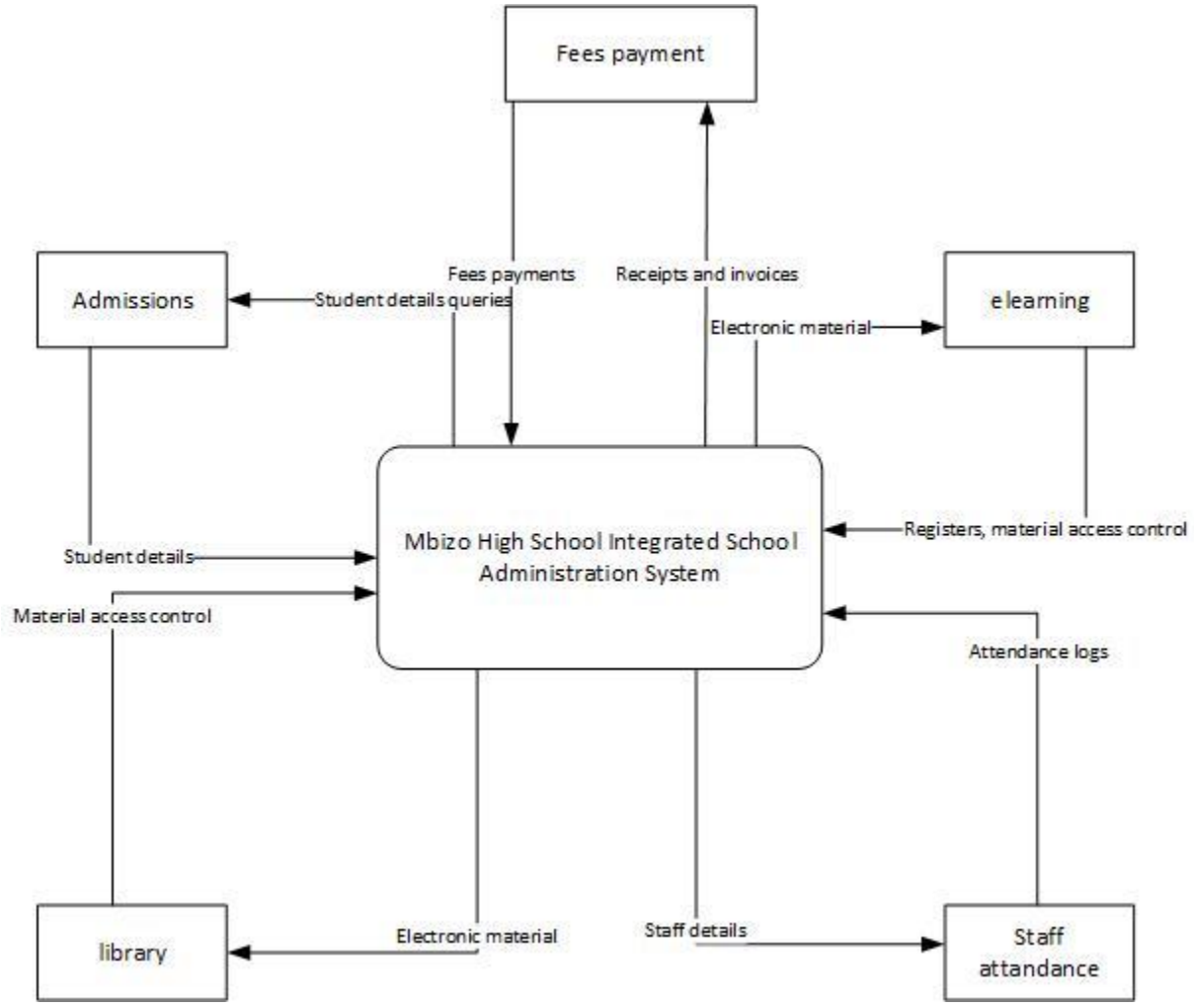


Figure 4.1 Context diagram of new system

4.2.2 Data flow diagram

According to businessdictionary.com, a dataflow diagram is a two dimensional diagrammatic illustration of how data is transformed and transferred in a system. A dataflow diagram will show the type of data to input, the system processes, output to be produced by the system and how the data will be saved in the system. A dataflow diagram diagrammatically shows how the system will transform data through defined processes and how the transformed data will then be stored. Stakeholders at Mbizo high school can easily understand the flow of data in the new system as the dataflow diagram summaries the whole system.

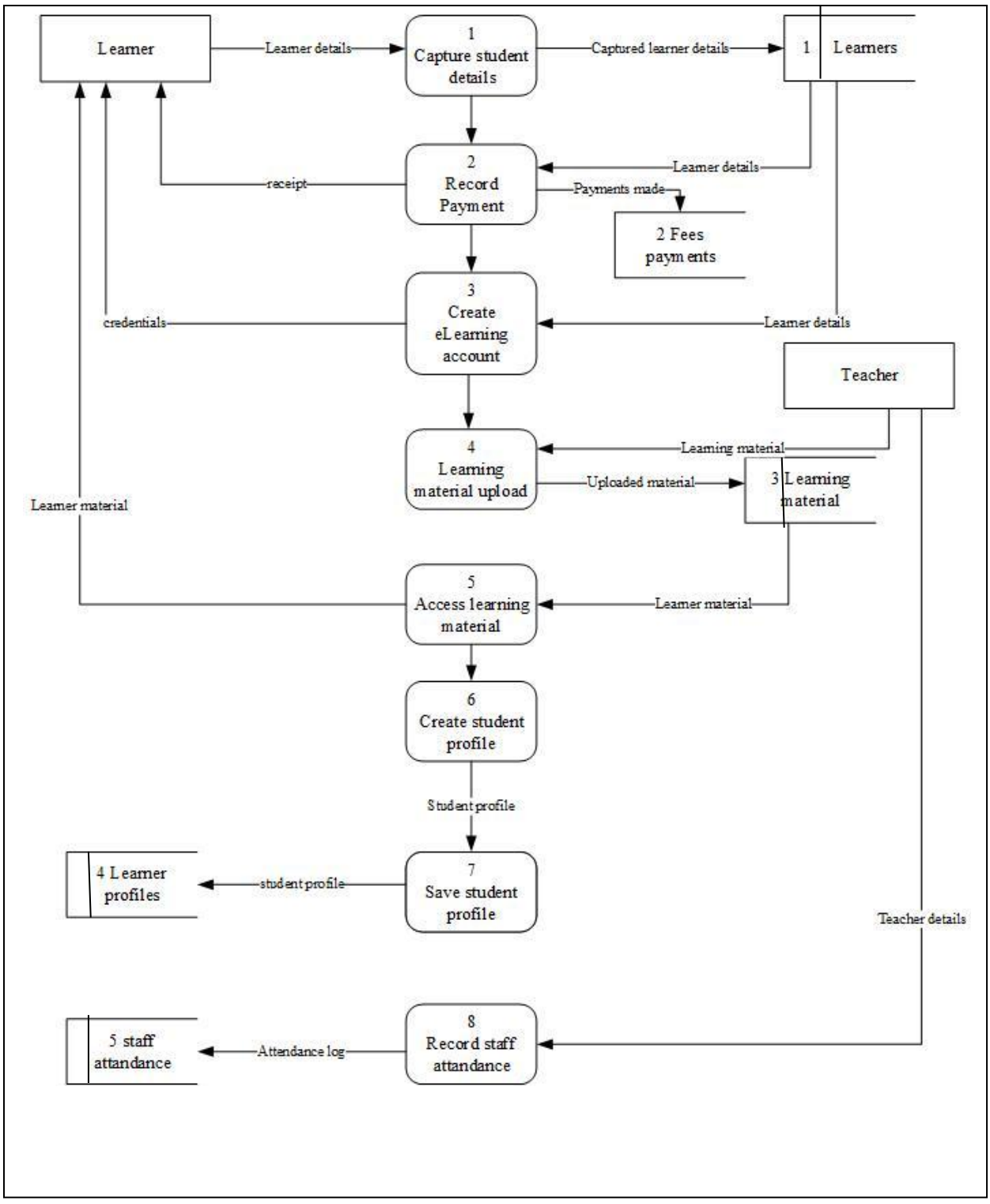


Figure 4.2 Data flow diagram of new system

4.3 Architectural design

Whitten, Jeffrey L ,Bentley ,Lonnie D ,Dittman and Kevin C (2004) defined architectural design as the definition of all the hardware components required for the functionality of the system. These hardware components include networking and server hardware components. Architectural design also gives an overview of how the system components are interconnected for the system to be functional. Below is a diagram illustrating the architectural design of the proposed system.

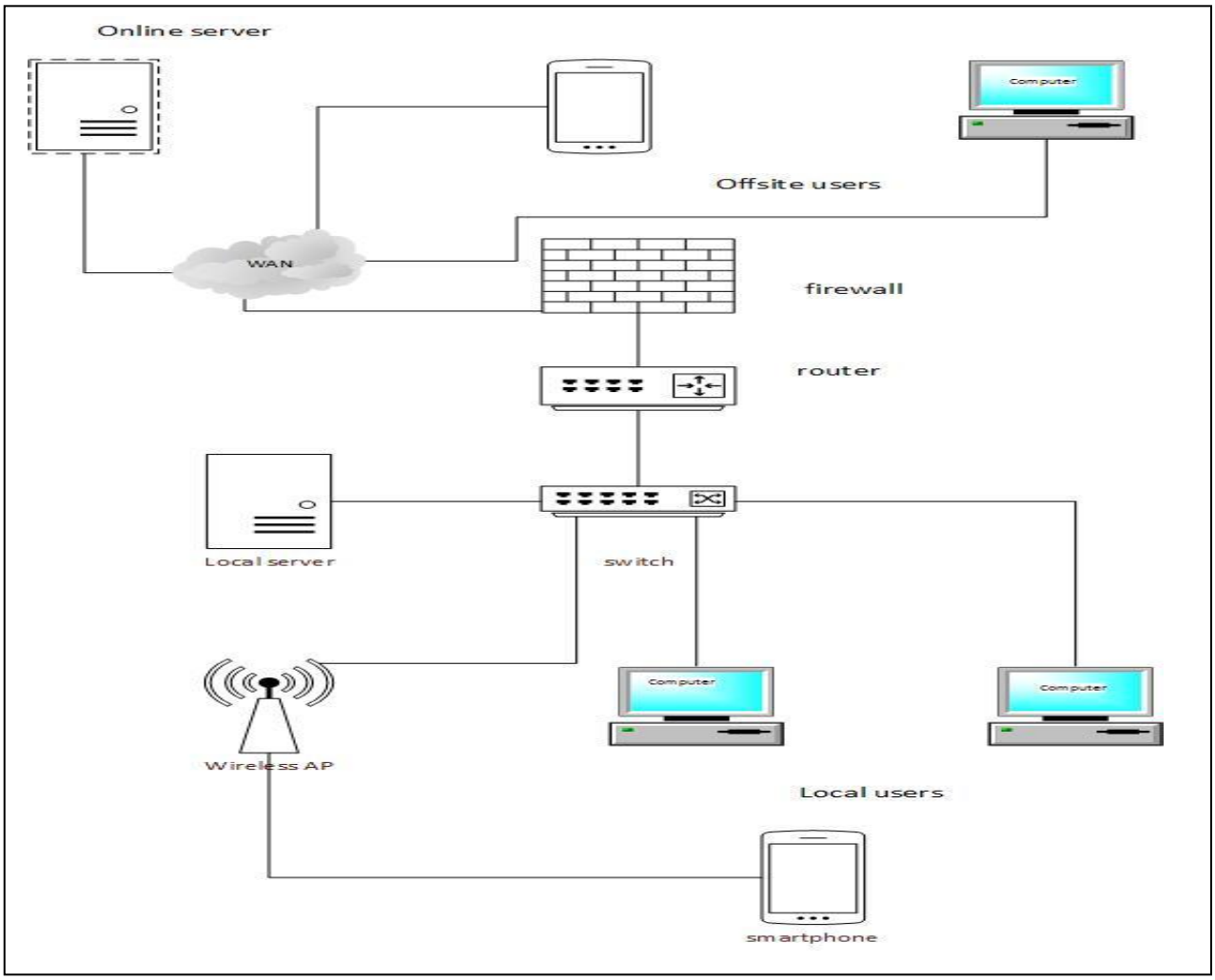


Figure 4.3 Architectural design

4.4 Physical design

According Teorey and Lightstone (2009) a system's physical design defines the system's internal and external entities and how data flow between these entities. Physical design defines how all the hardware of the system interacts with the software. Another objective of the physical design is to define the input from external entities and internal components to process these inputs hence output. Below is a diagrammatic illustration of the physical design of the school administration system.

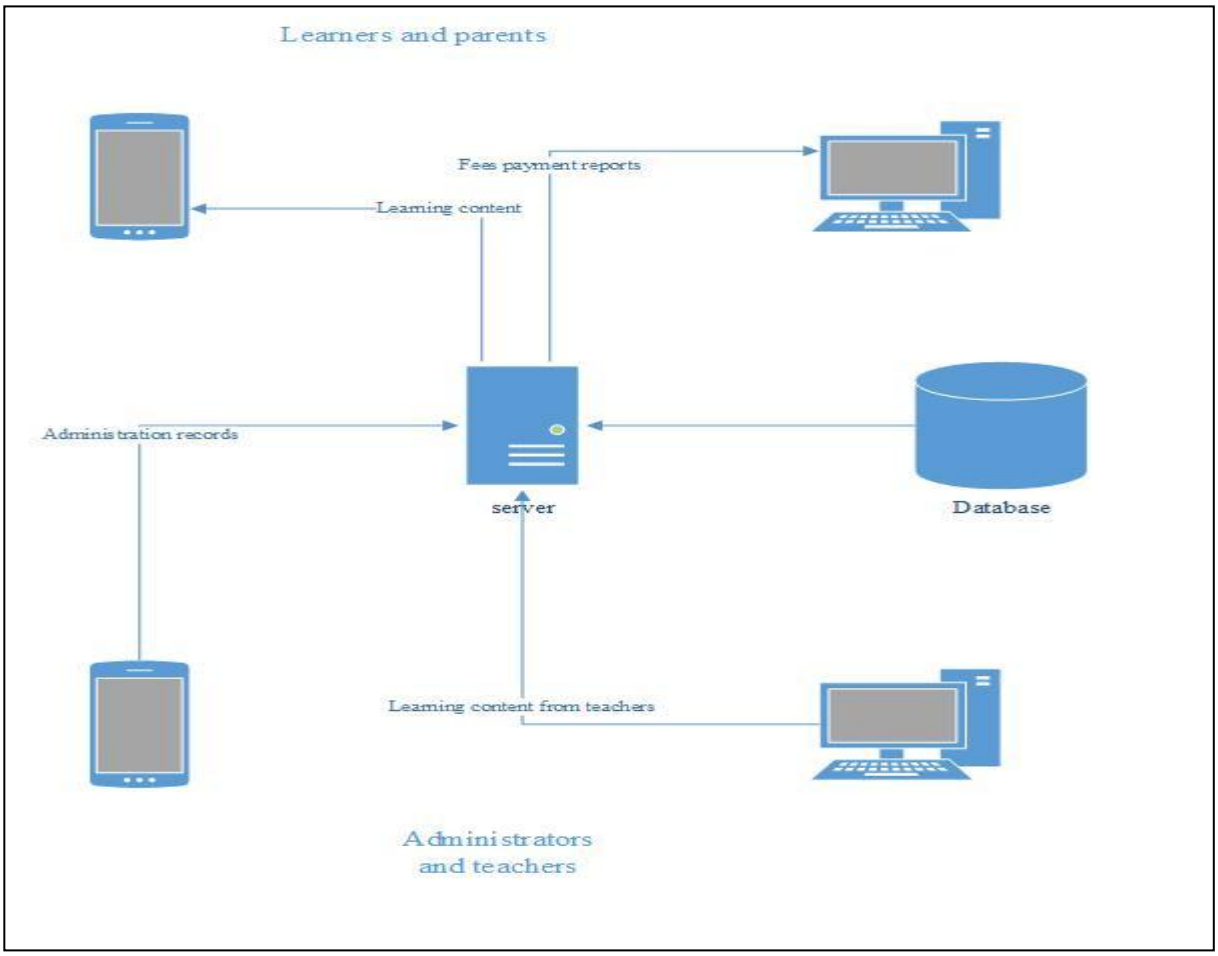


Figure 4.4 Physical design

4.5 Database design

Teorey etal (2009) defined database design as coming up with a comprehensive data model of a database. This involves defining the logical, physical and storage parameters of the database making it easy to create the actual database. The researcher acquired all the system data requirements before engaging in a database design process. After determining the data to be stored, the researcher defined the relation between different elements for example the relation between a student and a class. The final step in the database design is to optimise the database into third normal form to avoid data duplication and other redundancies. Below are the tables designs of the proposed system database.

Students' details

Column	Type	Null
Reg_number	varchar(250)	No
Firstname	varchar(250)	No
Second_name	varchar(250)	No
Surname	varchar(250)	No
Date_of_birth	date	No
Gender	text	No
ID_BC_number	varchar(250)	No
Picture	longblob	No
Birth_certificate	longblob	No
Residential_address	varchar(250)	No

Contact_numbe r	varchar(20)	No
Nationality	varchar(25)	No
District_of_birth	varchar(250)	No
Province_of_birt h	varchar(250)	No

Teachers' details

Column	Type	Null
Ec_number	varchar(250)	No
Firstname	varchar(250)	No
Second_name	varchar(250)	No
Surname	varchar(250)	No
Date_of_birth	date	No
Gender	text	No
ID_BC_number	varchar(250)	No
Picture	longblob	No
Birth_certificate	longblob	No
Residential_add ress	varchar(250)	No
Contact_numbe r	varchar(20)	No

Nationality	varchar(25)	No
District_of_birth	varchar(250)	No
Province_of_birth	varchar(250)	No

Admissions

Column	Type	Null
Ec_number	varchar(250)	No
Reg_number	varchar(250)	No
Class_id	varchar(250)	No
Admission_date	date	No
id	int(11)	No

Invoicing

Column	Type	Null
Invoice_num	varchar(250)	No
Current_amount_due	decimal(10, 0)	No
Total_paid	decimal(10, 0)	No

Current_balance	decimal(10, 0) 0)	No
Old_balance	decimal(10, 0)	No

Master invoices

Column	Type	Null
Invoice_num	varchar(250)	No
Current_amount_due	decimal(10, 0)	No
Total_paid	decimal(10, 0)	No
Current_balance	decimal(10, 0)	No
Old_balance	decimal(10, 0)	No

Transactions

Column	Type	Null
Transaction_id	int(11)	No
Transaction_date	varchar(250)	No

Reg_number	varchar(250)	No
Amount_paid	varchar(250)	No
Method_of_payment	varchar(250)	No
Ec_number	varchar(250)	No

4.5.1 Enhanced entity relationship diagram

Elmasri and Navathe (2011) defined an entity relationship diagram as a high level data model that defines interrelated domains in a given system environment. Enhanced entity relationship diagrams are an extension to the traditional entity relationship diagrams. Enhanced entity relationship diagram introduces subclasses and super classes, specialisation and generalisation to the basic entity relationship diagram. Below is an entity relationship diagram of the integrated school administration system.

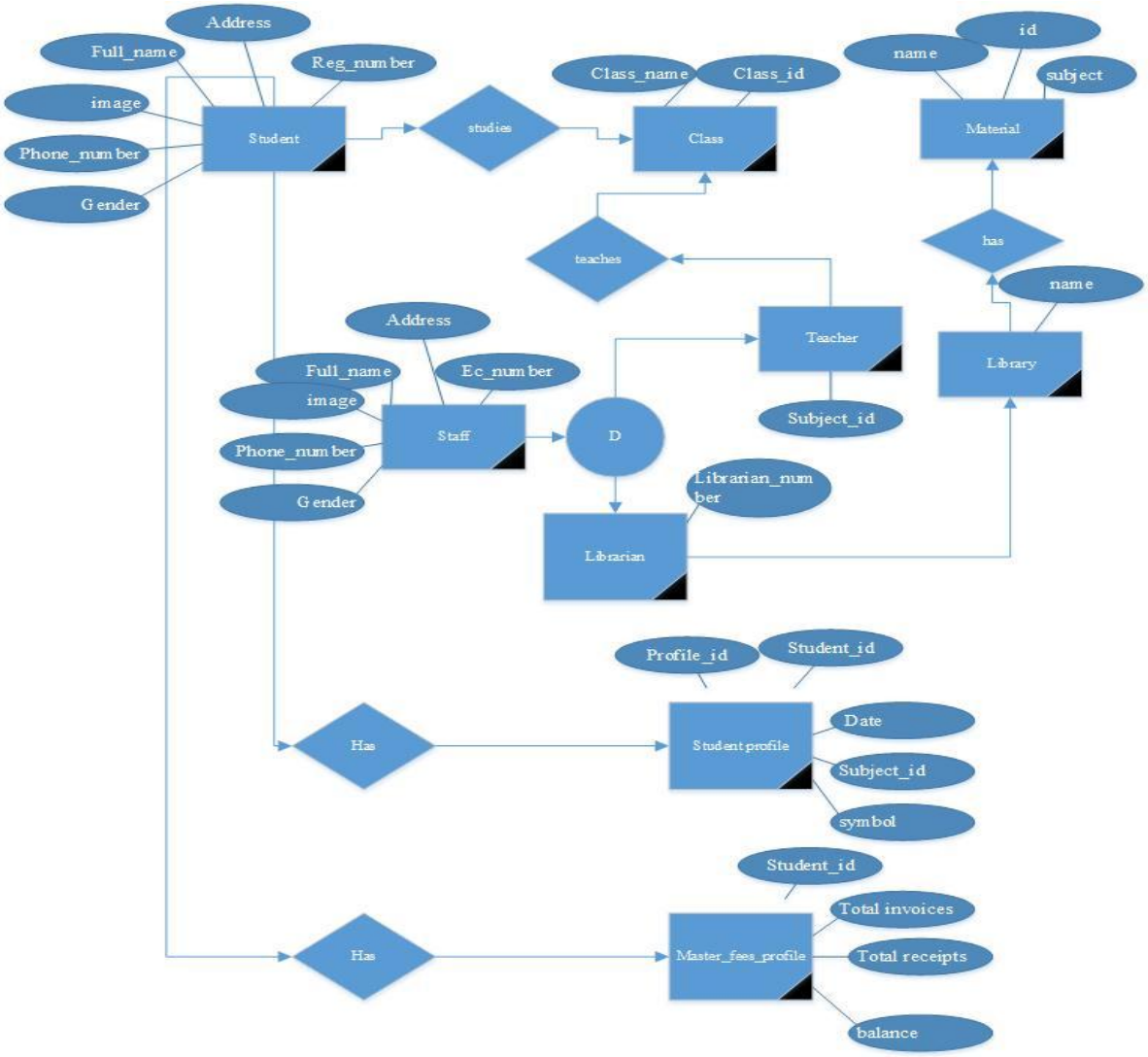


Figure 4.5 Enhanced entity relationship diagram

4.6 Program design

According to Scott (2009), program design is the process of converting system specifications into program description. This is also a phase of the system lifecycle which defines what the system is supposed to do. In system design, a the proposed system can be modeled and diagrammatically illustrated using package, class and sequence diagrams.

4.6.1 Package diagram

A package diagram represents relationships between packages that make up a system or a model according to Encyclopedia.com. Package diagrams are part of Unified modeling language.

Below is a diagram summarising on the packages of the proposed system and how these packages interact.

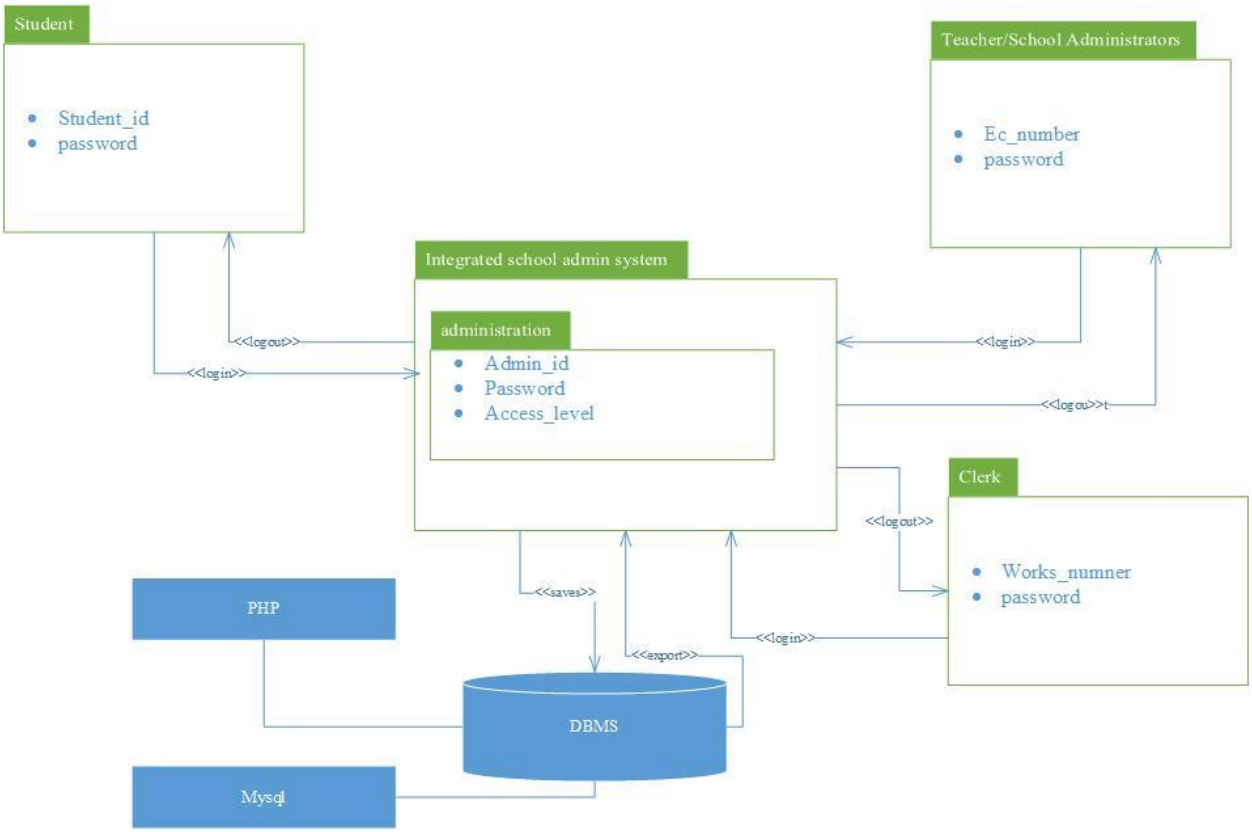
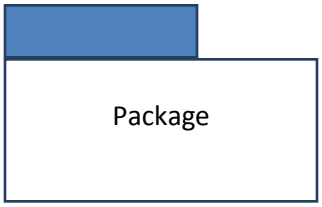


Figure 4.6 Package diagram

Key



<< Send >> Dependency

- Private attribute

In his article Unified modeling language class diagrams, Scott (2009) defined a class diagram as a static structure diagram that shows system classes, attributes, operations and relationships

between system objects. In simpler terms, class diagrams illustrate system modules and how these modules relate.

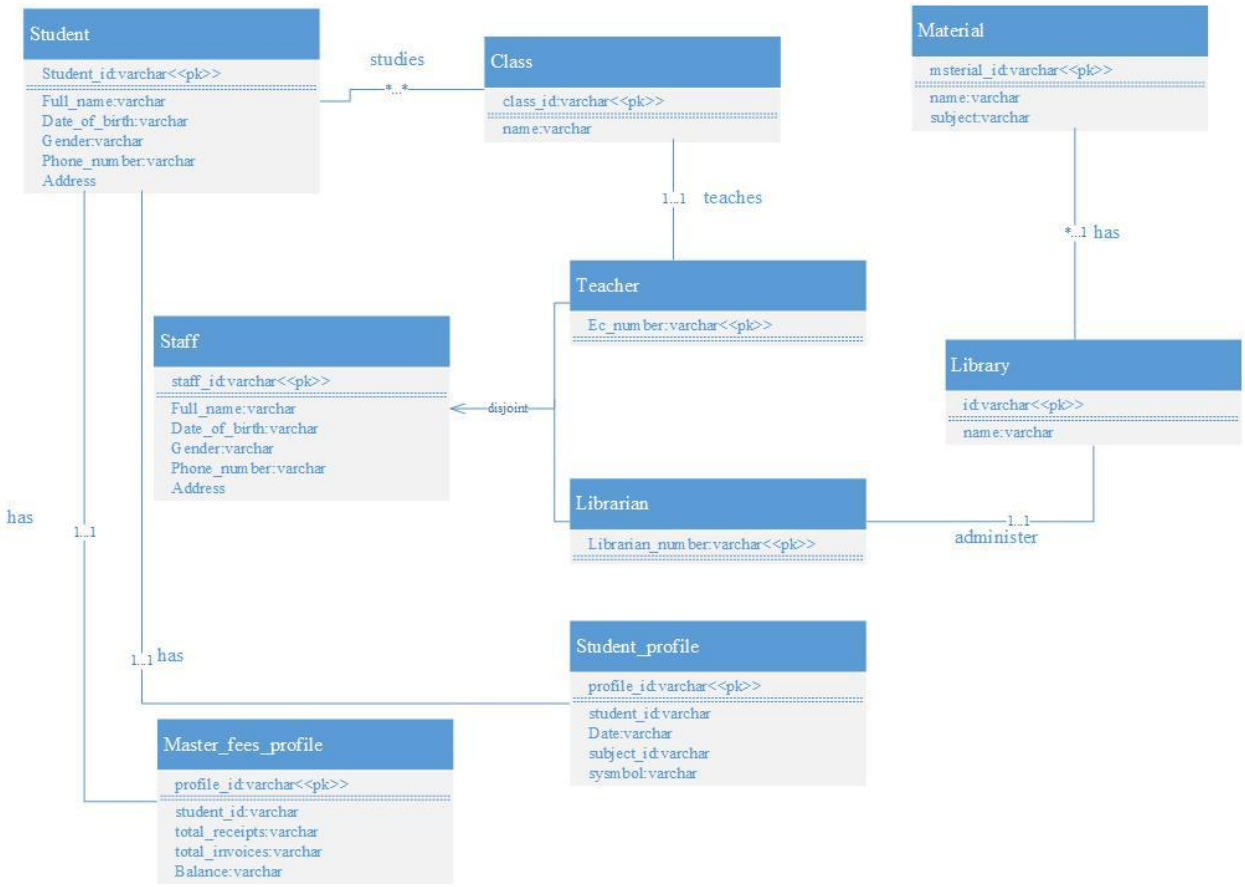


Figure 4.7 Class diagram

4.6.4 Sequence diagram

Scott (2009) went on define a sequence diagram as a diagrammatic illustration of system object interaction arranged in a time sequence. A sequence diagram factors in time to briefly illustrate system events and communications between these events. Below is a sequence diagram of the school integrated administration system.

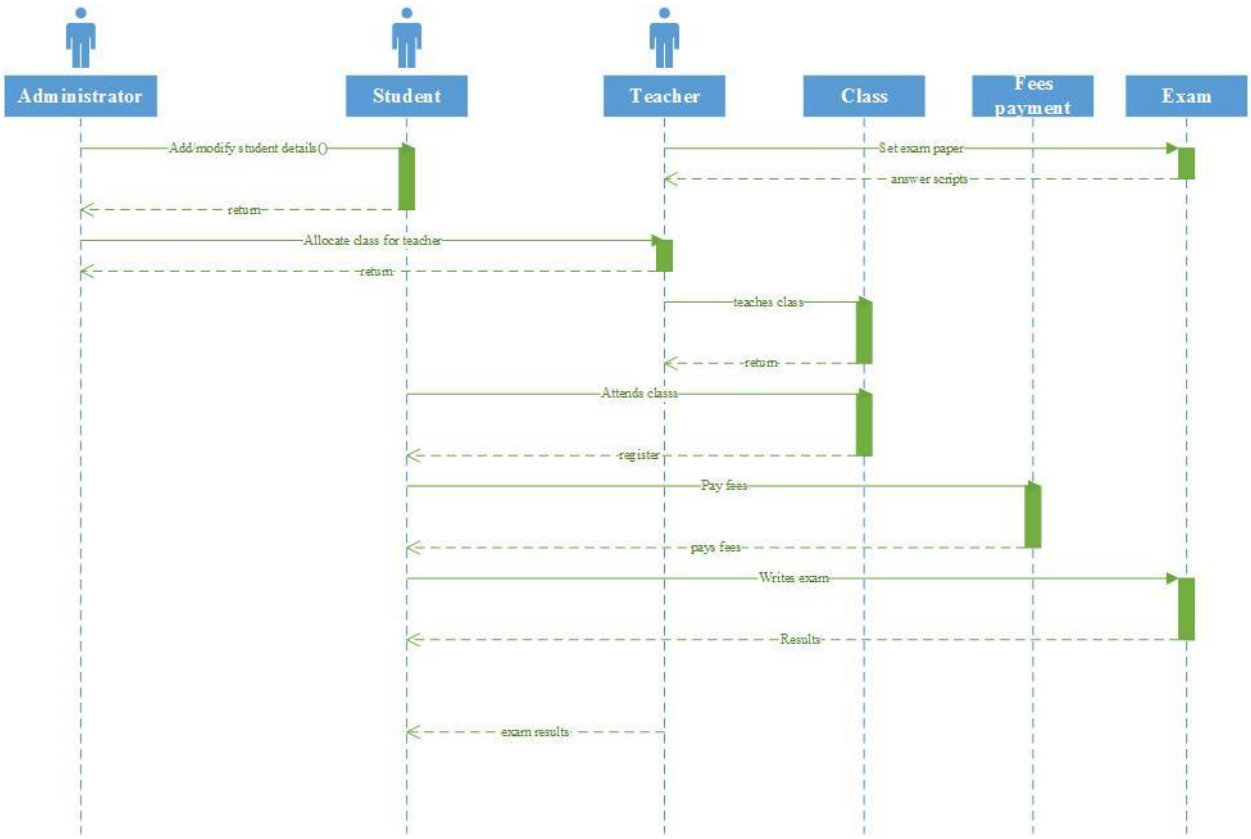


Figure 4.8 Sequence diagram

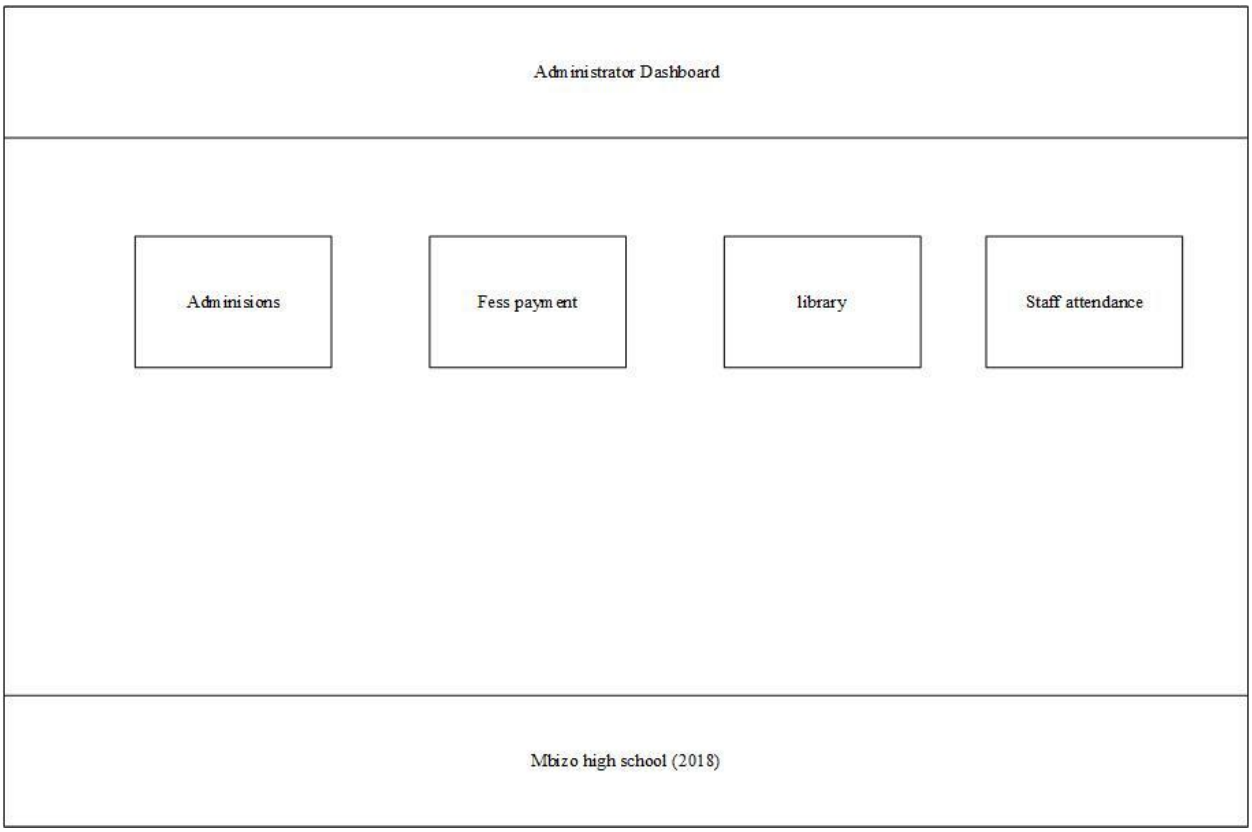
4.7 Interface design

Norman (2014) defined user interface as the art of designing and implementing user interfaces for humans to interact with computer systems. A user interface is supposed to be user oriented organising related information together and separating unrelated items. A good design is supposed to simplify common tasks easier by providing shortcuts and tutorials on how to use the system. A good interface should be structured in a way that it does waste time and should not change the user's business processes.

4.7.1 Menu design

A menu of a computer system can be defined a list of commands given to a user for selection. The user selects an input from the menu list and the main menu is the first page the user sees when the user enters the system. Norman (2014) concluded that the main menu should be simple and easy to follow. Below is an example of a main menu from the integrated school management system

4.7.1.1 Administrator menu



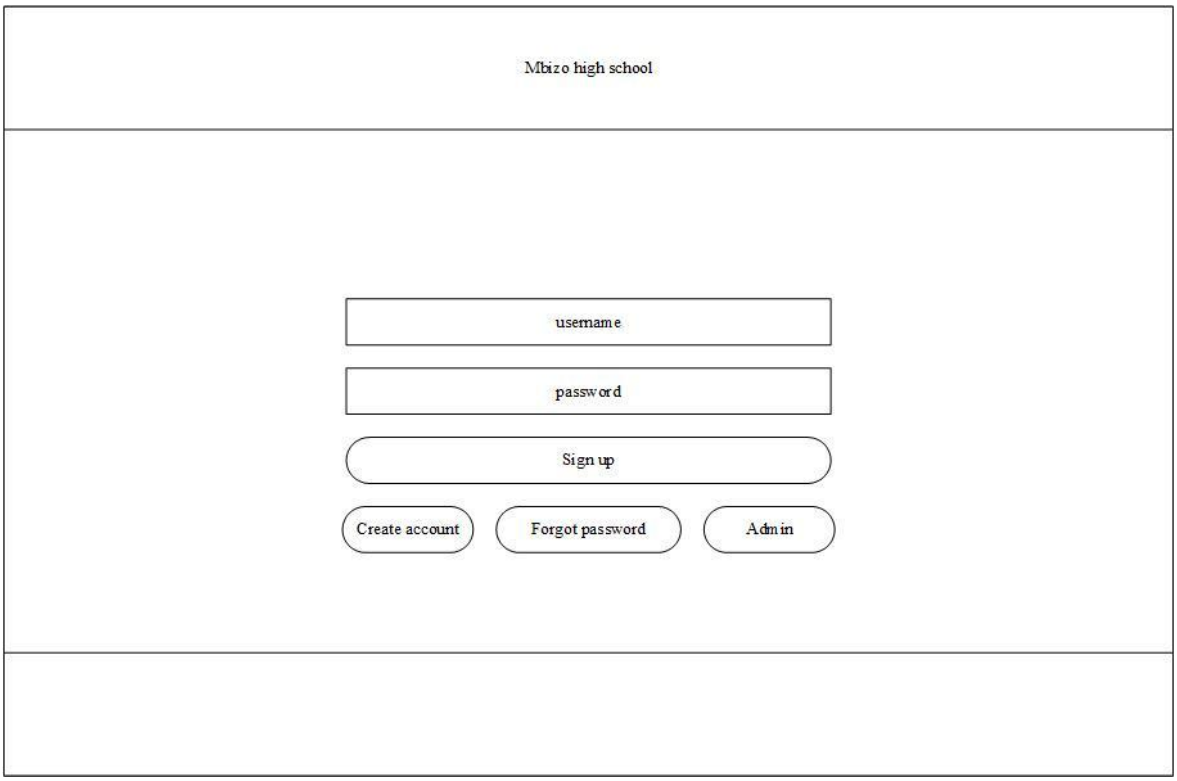
4.7.1.2 Sub-menus

A sub-menu is an extension to a menu item showing items relating to the menu item. Sub-menus usually show as a pop up after clicking a menu item Blandford A (2014). Below is an example of a submenu from the integrated administration system.

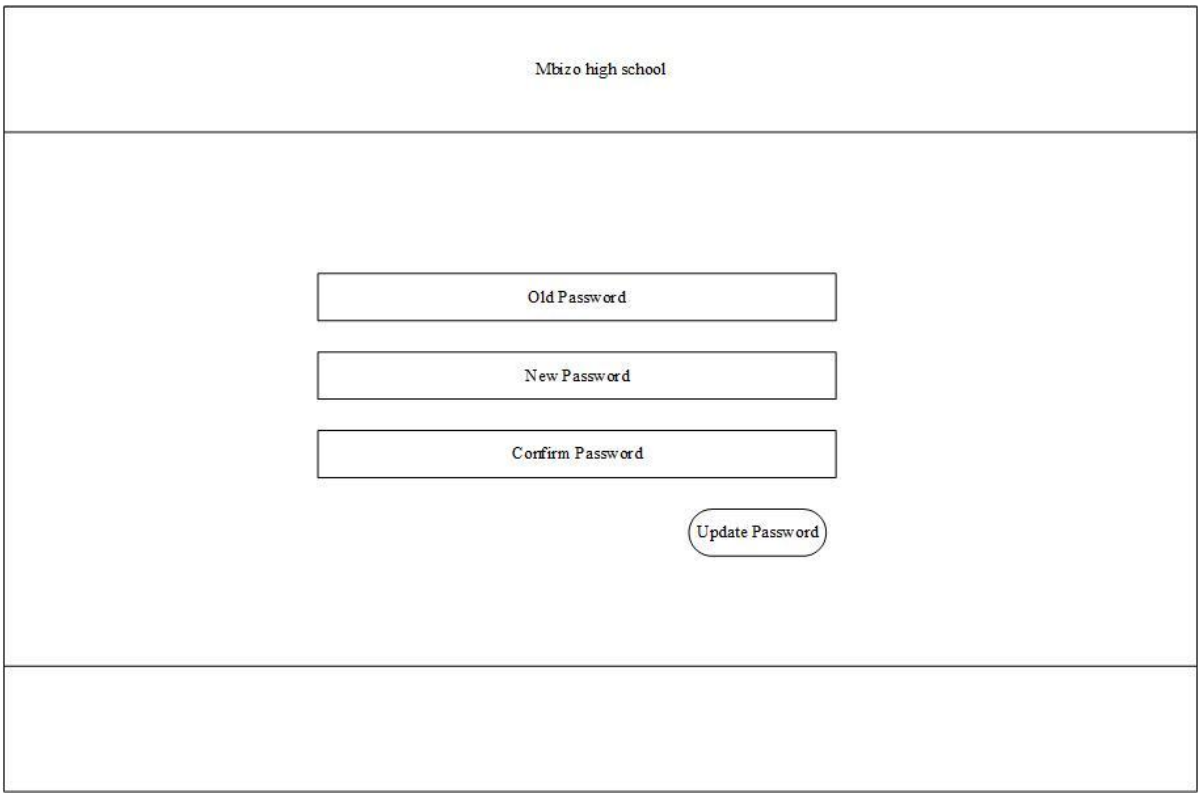
4.7.2 Input design

Null and Julia (2006) defined input design as a way of creating an interface of accepting user input for processing. The system requires user input for it to process the data and produce input. The input design should be simple and understandable so that the user enters correct information. Techniques like validation and verification should be used to ensure the integrity of the data entered.

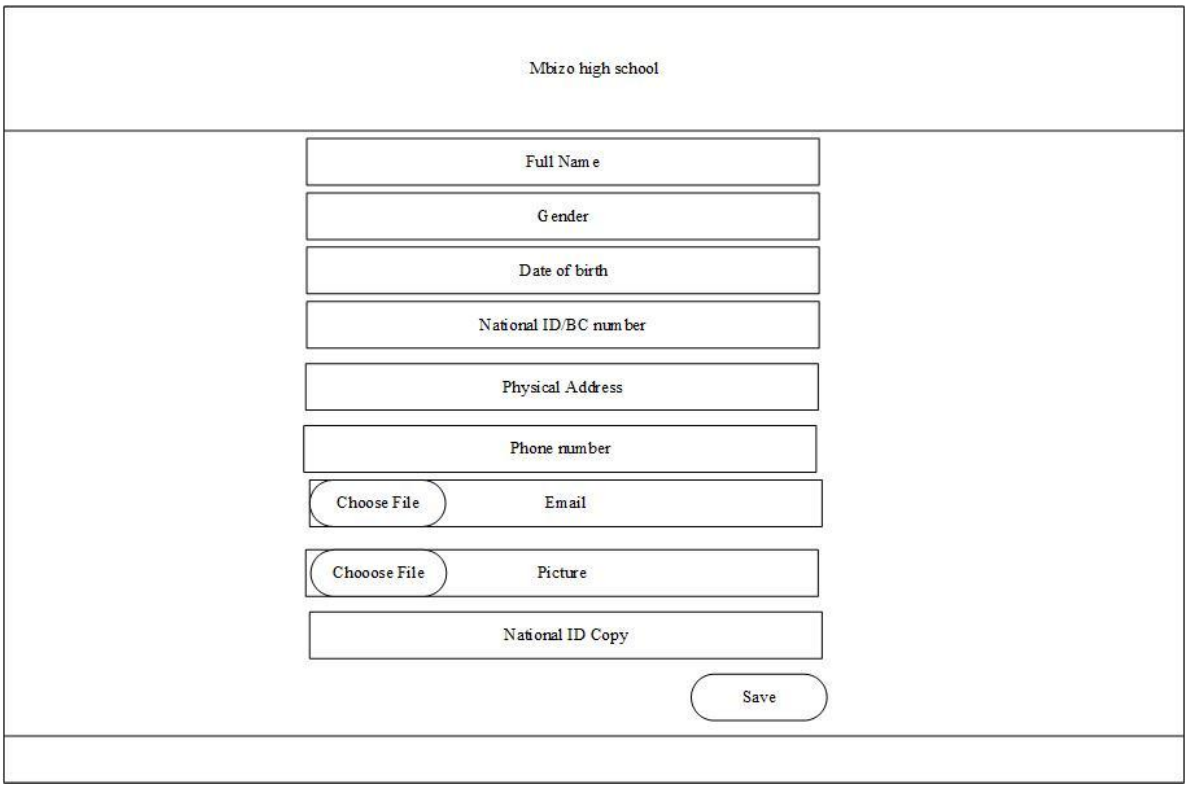
Login



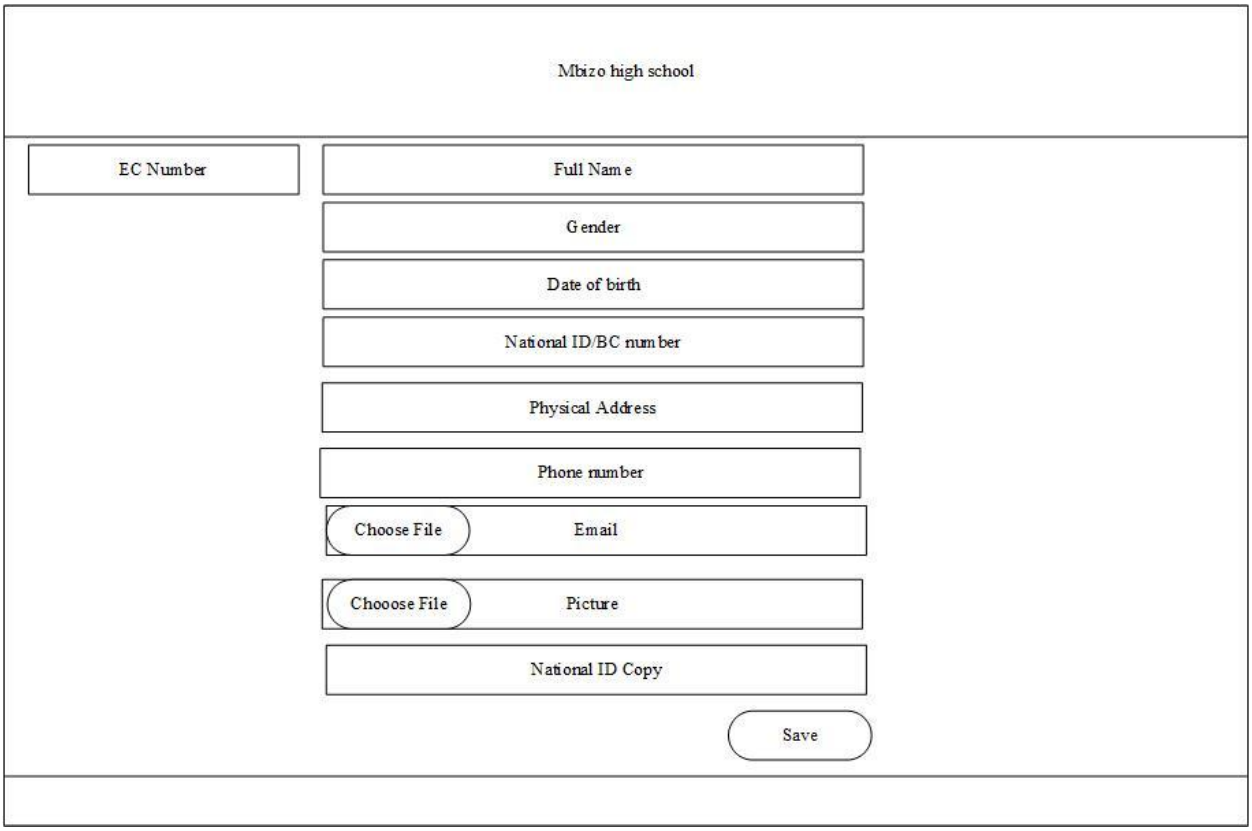
Change password



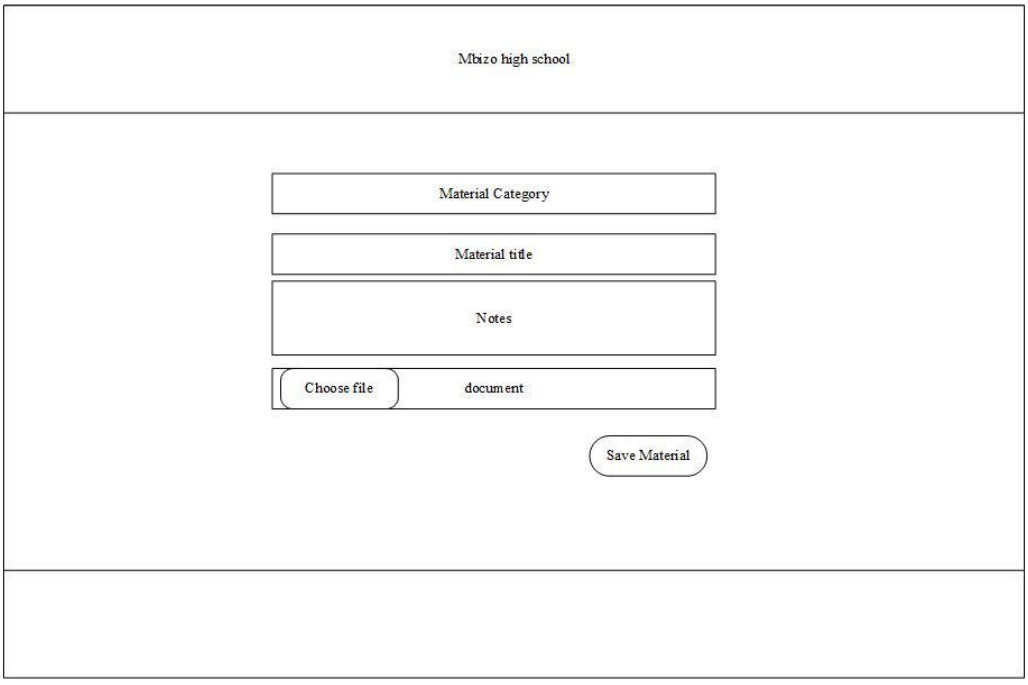
Add Student



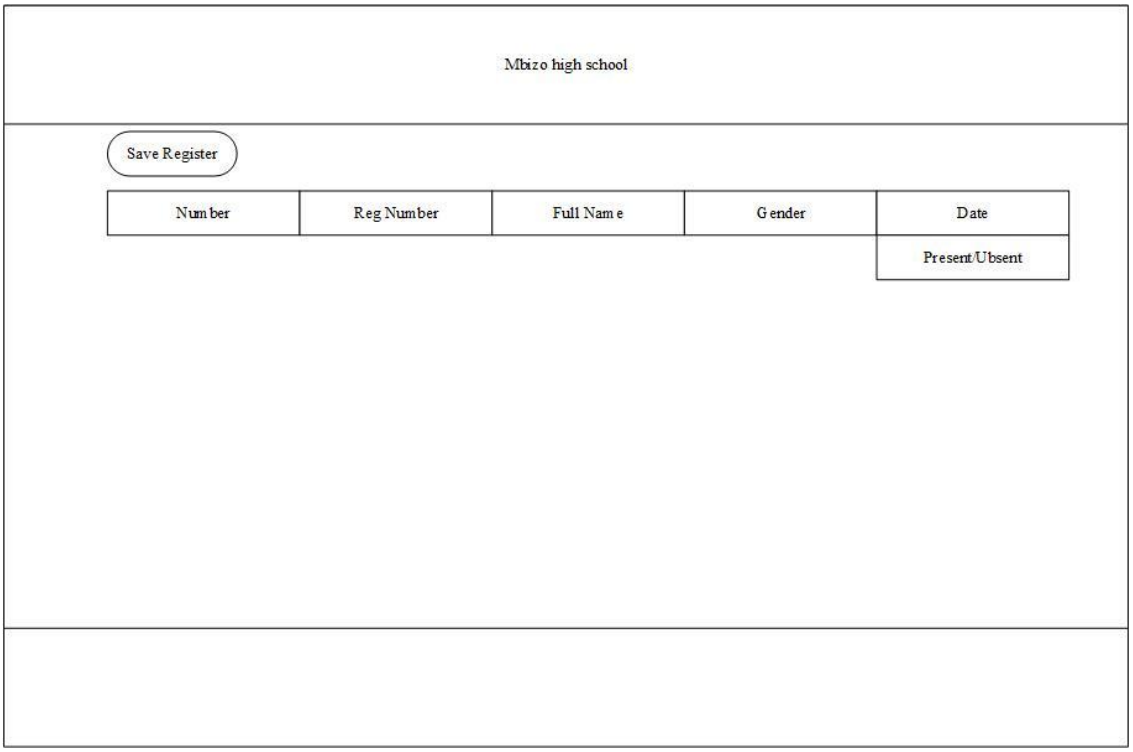
Add Teacher



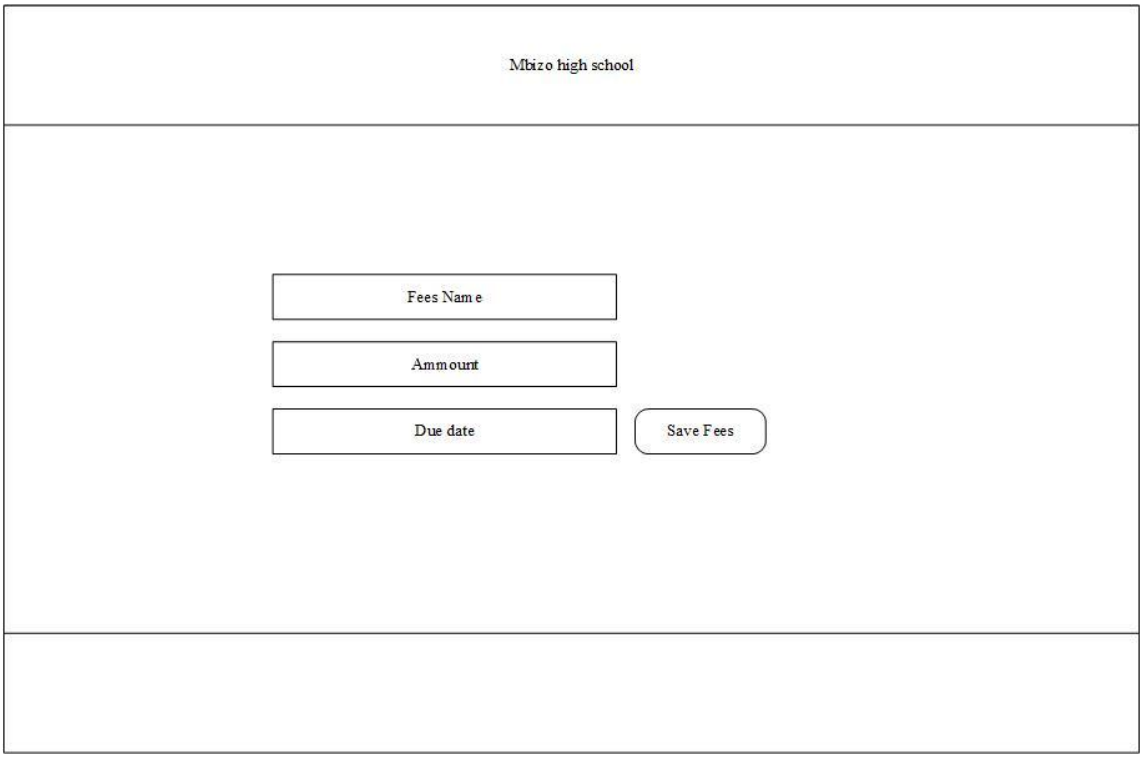
Upload material



Mark register



Save password



4.7.3 Output design

Null etal (2006) defined output design as an important task of identifying the out of a system and considering necessary output controls. Reports are a major part of output and most systems and these reports should be in right format and readable to the intended user. System output should be always accurate and available to the right user when needed.

Table 4.1 Students details

Reg Number	Full Name	Date of birth	Physical Address	Phone number	Email	Guardian	Guardian phone number	Guardian Physical address
MBHS18001	Innocent Moyo	12-04-99	Mbizo kwekwe	0778342789	inno@gmail.com	Kylia Moyo	0773432123	Mbizo kwekwe

Table 4.2 Student's results

Date	Reg Number	Subject Id	Exam id	Symbol	Comment
23-04-2018	Mbhs17001	Scie001	Exm002	B	Pass

Table 4.3 Subject Details

Subject Id	Subject Name	Department
Sci002	Biology	Science and Technology

Table 4.4 Transactions

Date	ID	Reg Number	Amount Paid $	Method of payment	Ec Number
23-04-2018	Trans002	Mbhs17002	200	EcoCash	98093892M

Table 4.4 Material

Date Uploaded	Material id	Category	Link	Notes	Title	Subject id
23-04-2018	Mat002	Assignment	Material/bio.pdf	Due next lesson	Osmosis	Scie001

4.8 Pseudo code

Zobel (2013) defined pseudo code as a high level notation of the underlying operation of a computer system or algorithm. A pseudo code uses English like detailed statements that are intended for human understanding. A pseudo code can be translated to any programming language as it not written in a specific programming language. There is no standard syntax for a pseudo code as it can vary from design to design but the main the idea behind pseudo codes is that they should be understandable to a programmer from all backgrounds. Below are some of the pseudo codes of the integrated administration system.

Login

Enter username and password

If username = correct and password = correct then

Check access level

If access level = admin goto admin dashboard

If access level = clerk goto clerk dashboard

If access level = senior teacher goto senior teacher dashboard

Register new user on elearning

Enter student details

Allocate Reg number

Enter reg number and email

If reg number = correct and email = correct then

Enter new password

Save new password and login

Saving and selecting data

Set data connection

If connection = success

If saving ,Run insert sql statement

If selecting,Run select sql statement

Else

Show failure message

Validation

if filed = empty

show “please enter the required field”

if filed = format mismatch

show = “format mismatch”

else

show exception error

4.9 Security design

Daniel, Rabih and Julie (2017) defined system security as those measures put in place to protect a system from unathourised access, manipulation of data or any other damages that can be done to the system. A secure system increases user confidence and saves owner a lot of money in recovery.

4.9.1 Physical security

The physical security of a system refers to the measures put in place to protect a computer system from vandalism, theft, sabotage, fire and floods according to Daniel, Rabih and Julie (2017) .

Threat	Counter and or Corrective measure
Fire	Install carbon dioxide based fire suppression systems.
Theft	Use lock and key
Floods	Create remote backup files
Sabotage	Monitor access to the server room

Table 4.8 physical threats

Carbon dioxide based fire suppression systems are the one suitable for a server as they produce carbon dioxide to suppress and kill of the fire.

4.9.2 Network security

Network security refers to those policies and procedures implemented to project data on the network according to www.cisco.com. Network security includes both network and software technologies used to project a network and the data on the network. The school can secure its network using access control thus using passwords and the use of a firewall to protect the local area network. The school can also use antivirus software to protect the network from malware. Mbizo high school currently Eset Endpoint to protect from viruses and malware. Another significant network threat of late is ransomware. This is when all the data on the network is encrypted and the organisation has to pay a sum of money to get the decryption key. This threat can be countered by using up to date software and avoiding the opening emails from unknown sources.

4.9.3 Operational security

Daniel etal (2017) argued that operational security is the identification of system sensitive data and users of the data. After the identification process, policies and procedures are formulated to protect this data from sabotage. There are 3 main users of the integrated administration system at

Mbizo high school which are administrators, teachers and students. All these users access the system using passwords. These users are encouraged to change their passwords regularly to avoid unauthorised access. These passwords are supposed to be alphanumeric with a length of more than 5 characters

4.10 Conclusion

On a conclusive note, the design phase highlighted the underlying designs of the proposed system and defining the database and security procedures to be implemented on the system. The phase also defined the structure of the database with an entity relationship diagram. The phase also highlighted on the system pseudo code making it easier to programmers to understanding the system. The next phase is the implementation phase.

Chapter 5: Implementation phase

5.1 Introduction

The implementation phase refers to the systematic way of effectively integrating a software solution into a workflow of an organisation according to Wainwright (2009). This phase succeeds the design phase it implements the designs done in the design phase. The implementation phase is a delicate phase in the software development life cycle as it requires a high of finesse because it can determine the success of failure of a project. The actual coding is done on this phase together with other processes like installation and user training.

5.2 Coding

Wainwright (2009) also defined coding as the actual writing of computer programs. This process is also known as programming as it involves writing, compiling and debugging a computer system source code. The developers of the Mbizo high school integrated school management system used PHP for server scripting and HTML5 for client scripting. The developers also used JavaScript for making the system responsive. The developers used MySQL as a database management system. MySQL was used due to its robustness and cheap to acquire. The system was modularised into sub systems which share some common data amongst them.

5.3 Testing

Software testing can be referred to as a process of verifying and validating if a newly developed software product:

- Work as intended
- Meet the objectives and user requirements which lead to its development
- Is fit for purpose and safe to use

Andreas, Tilo and Hans (2014) argued that testing accesses the quality of a software product by comparing the actual output against the expected one. During testing, developers are able to identify bugs and solve them before fully implementing the developed system. The major advantage of system testing is that it saves the organisation money in trying to fix bugs when the system is live and running. The process of system testing can also be used for optimising interfaces to ensure the best user experience.

5.3.1 Black box testing

According to Ehmer (2011) black box testing can also defined as behavioral testing which mainly involves the testing of the functionality of a newly developed system. Black box testing does not require any expert to perform as the tester is not required to have knowledge of the systems source code or internal structures. The process is mainly done for validation testing.

Test case 1: Upload learning material – Upload only PDF document only

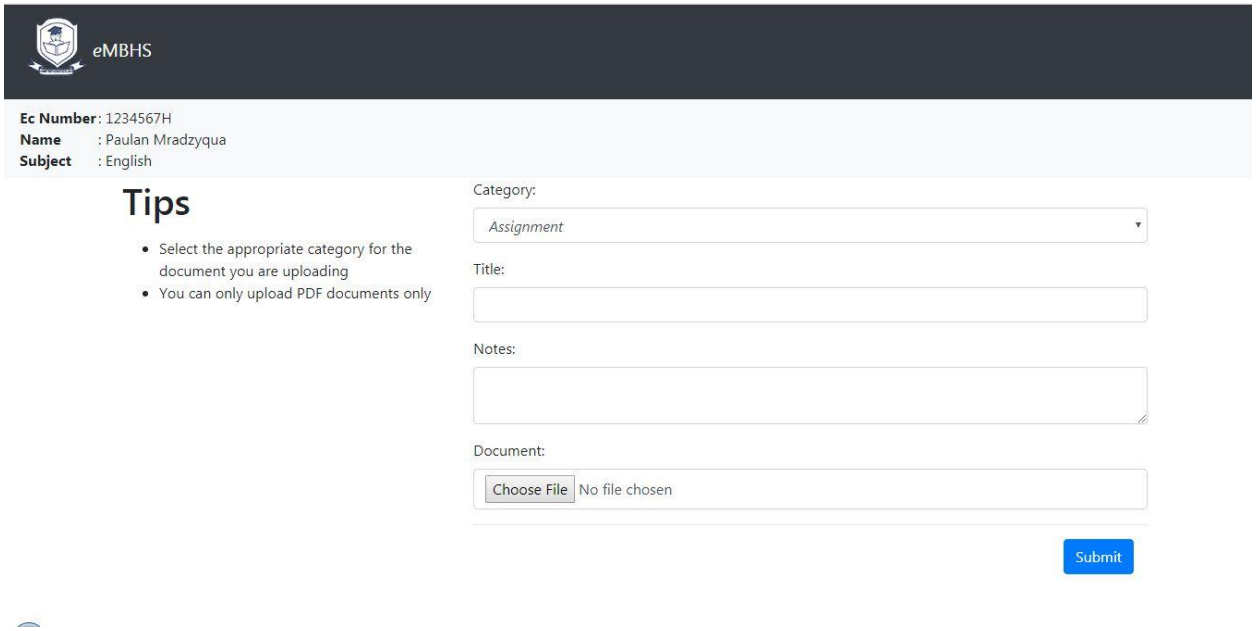
- A teacher is only allowed to upload PDF documents only

Precondition

- A teacher should be logged in and have a class

Test steps

i) Navigate to upload material page

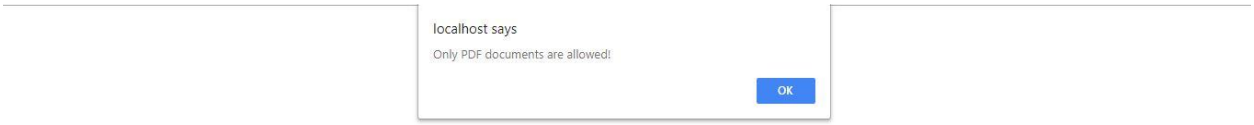


ii) Enter material title and notes

iii) Choose a document file which is not a PDF

Expected results

- A messages should popup prompting user to enter select only PDF documents



5.3.2 White box testing

As opposed to black box testing, white box testing is when the internal structures of a software are tested according to Ehmer (2011). Testers with a high level understanding of the system code are required for white box testing. This testing technique is done to make sure that the source code is working as intended. White box testing enables developers to optimise code and create a minified version of the code if required.

Testing can divided into levels which are unit testing, integration testing and acceptance testing.

5.3.3 Unit testing

Langr, Hunt and Thomas (2015) defined unit testing as the process of breaking down a system into a module that can be tested individually. This method helps in isolating a problem easily rather than testing a system as a whole. On unit testing, the system is tested for functionality when the expected results are noted down. Using the black box testing method, a clerk was given the system was given to test some of the basic functionality of the system and the following test cases where recorded.

Test case 1: Clerk login page – Authenticate a clerk successfully

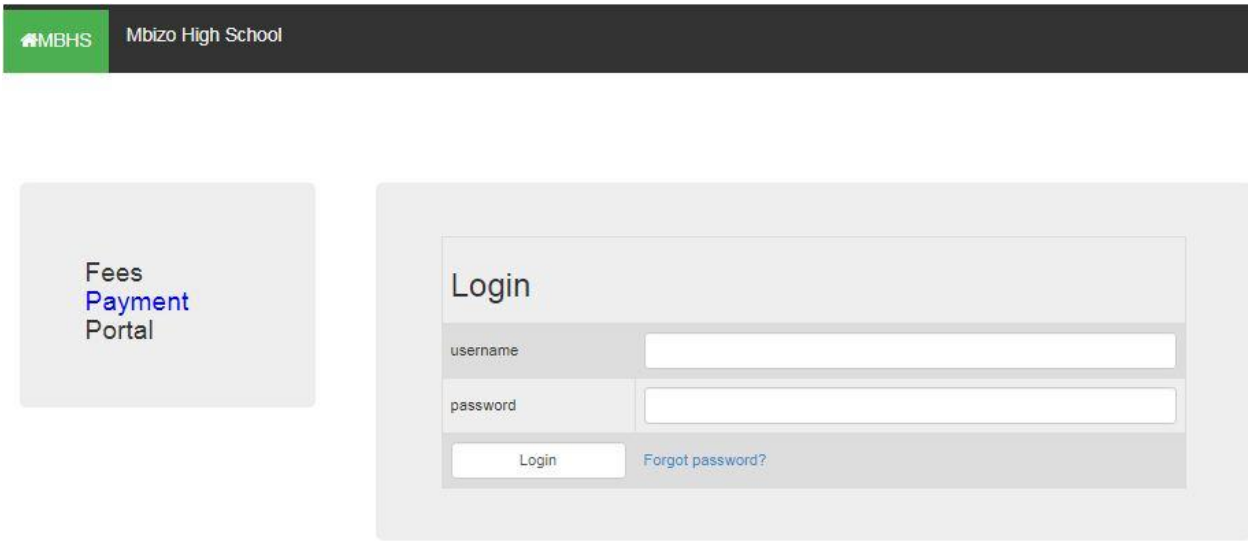
- A registered clerk is supposed to successfully login into the fees payment system

Precondition

- The clerk is supposed to be already registered into the system

Test steps

iv) Navigate to the Mbizo high school integrated school administration system – school fees management sub-system login form

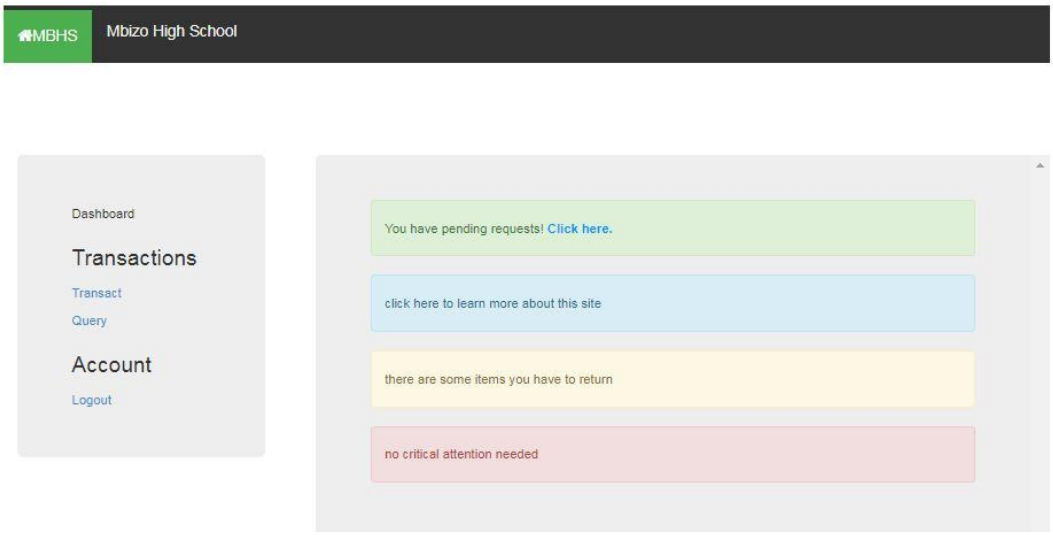


v) Enter username and password of the registered clerk

vi) Click login

Expected results

- The page showing a clerk's account to record fees payments should load



Test case 2: Student Pay fees – The clerk records student's fees payment

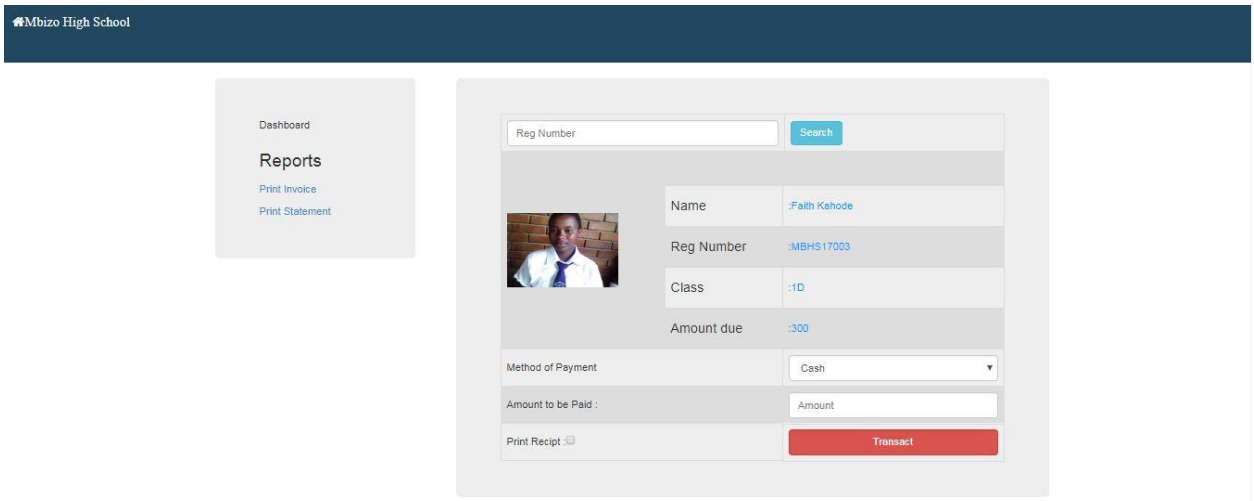
- A Clerk is supposed to record a fee payment of a registered student

Precondition

- The clerk and the student is supposed to be already registered into the system
- The clerk is supposed to be already registered into the system

Test steps

i) Navigate to transactions form



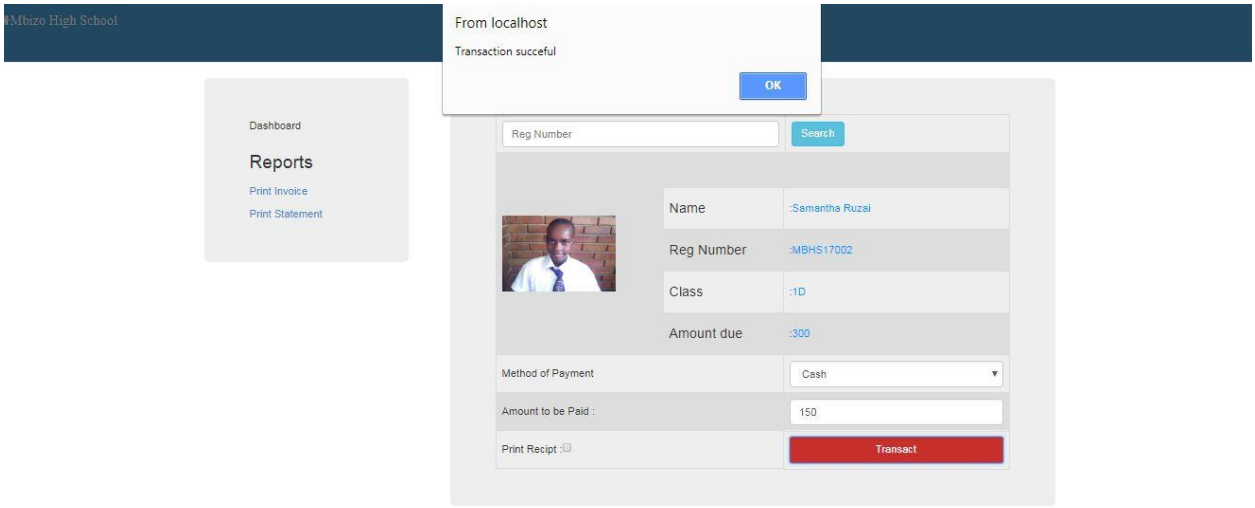
ii) Select method of payment and enter the amount to be paid

iii) Select print receipt to get a receipt after a transaction

iv) Click transact

Expected results

- A message showing a transaction success message should pop up



Test case 3: Student login page – Authenticate a student successfully

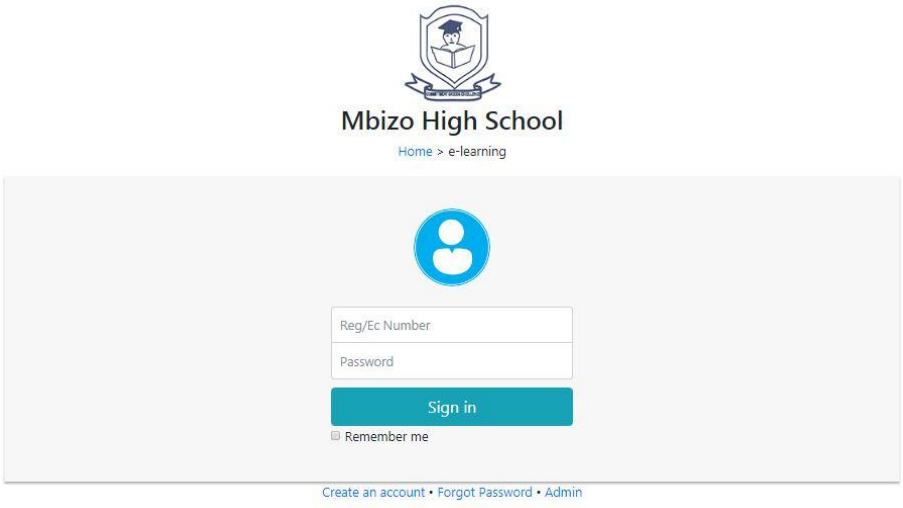
- A registered student is supposed to successfully login into eLearning platform

Precondition

- The student is supposed to be already registered into the system

Test steps

i) Navigate to the Mbizo high school integrated school administration system – eLearning platform

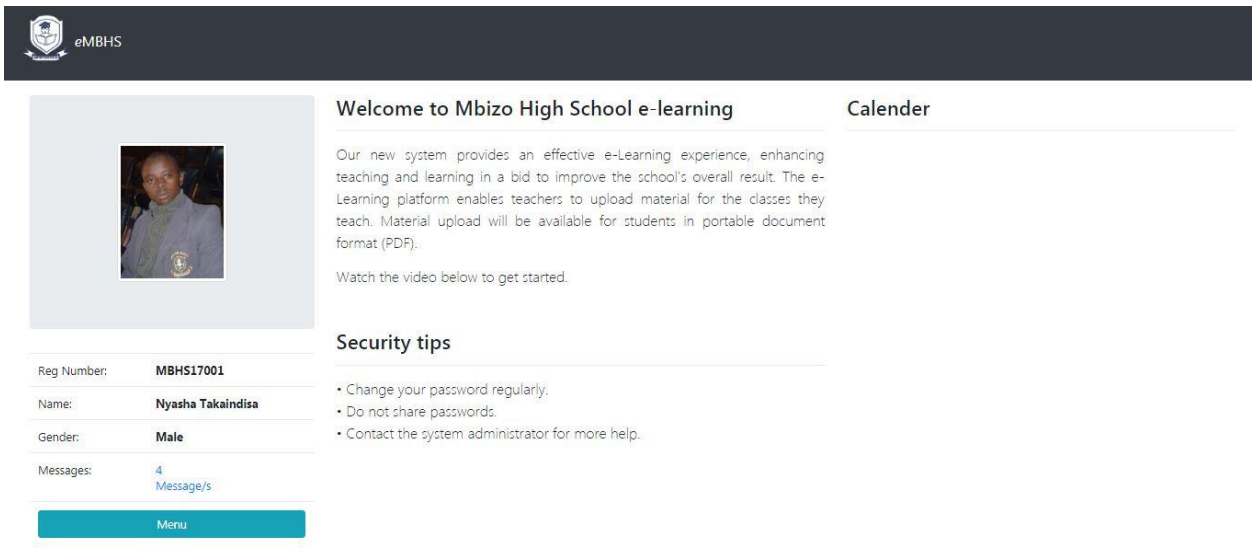


ii) Enter username and password of the registered clerk

iii) Click login

Expected results

- The page showing a student's eLearning



Integration testing

Stannett and Gheorghe (2015) defined integration testing as the process of integrating system units and test them as a whole. After successfully carrying out unit tests, the integration testing follows to see how the units perform when they come together. Since the integrated school management system have many modules in form of sub-systems and these sub-systems have to share data in order to meet the user requirements. Integration testing is repeated until the modules flawlessly share data and produce required results. Below are some the test cases under integration testing

Test case 4: integrating the admissions module and the fees payment module

- Data saved by the admission module should be accessible the fees payment module

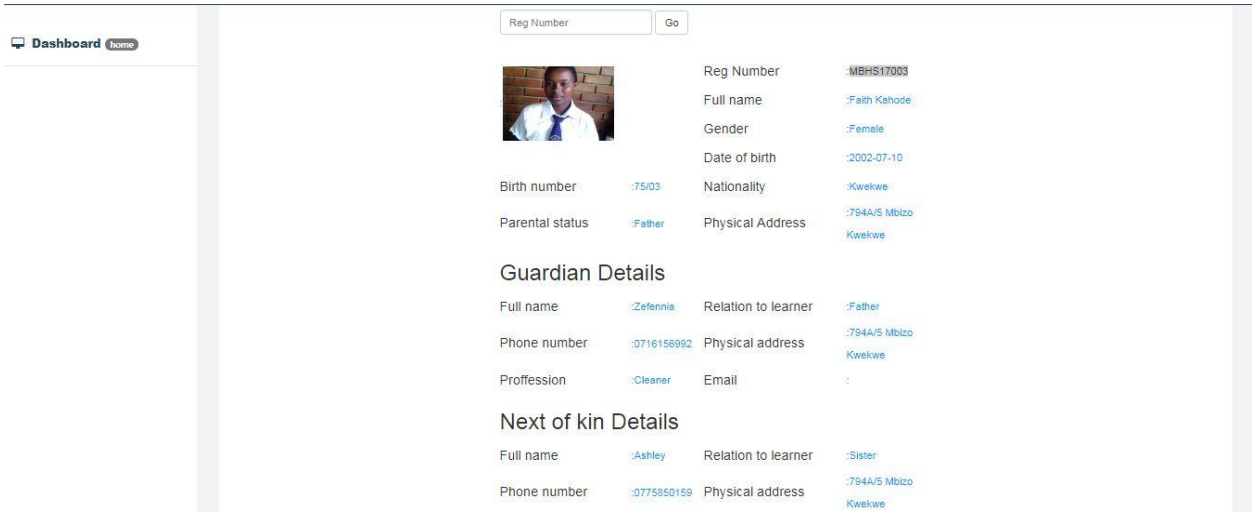
Precondition

- A student should have been saved

Test steps

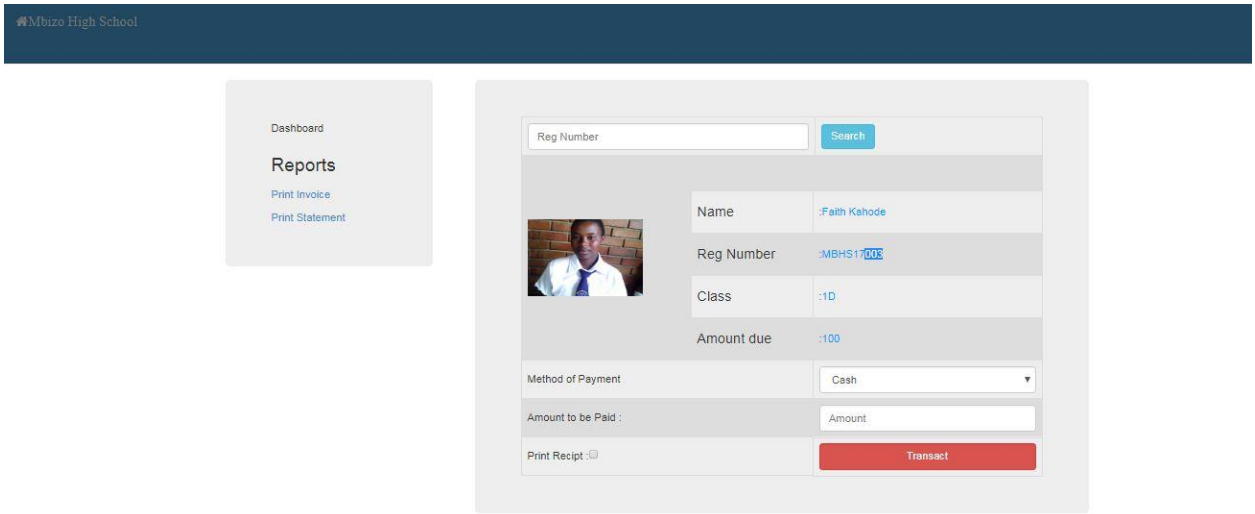
i) Navigate to student profiles on the admonitions dashboard

ii) Enter student Reg number and click enter



iii) Navigate to the fees payment module

iv) Enter the student Reg number the same as the one entered in the admissions module



Expected results

- The student details shown in the admissions module show be the same as the one shown in the fees payment method

The test case above was testing if the admissions module is communicating with the fees payment module. Student details are saved in the admissions module and retrieved in the fees payment module when the student wants to make a fees payment. If the details are the same, then the modules are communicating well.

Security testing

Security testing is a process of making sure that system data cannot be accessed with an unauthorised person. The integrated school administration system is equipped with login systems that enable only those with access right to access the system data. Stannett and Gheorghe (2015) argued that security is the most important aspect of a system as users draw confidence from good system security. Since the proposed system is a web based system, the developer ran SQL injections to test the security of the system.

Test case 5: Perform simple SQL injections on the login page

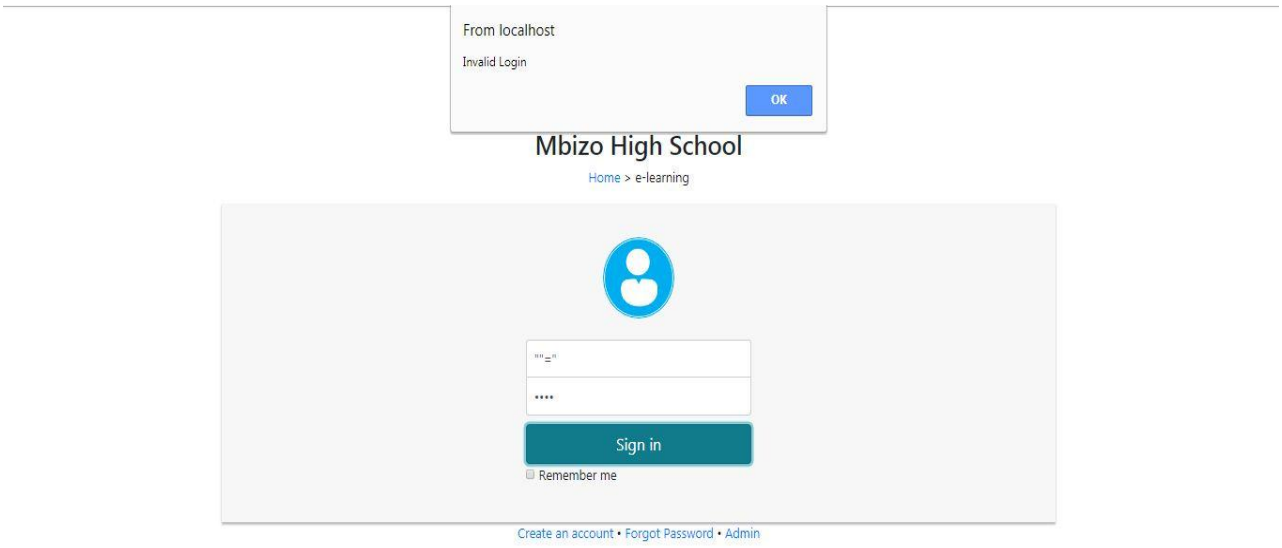
- The system should not accept SQL injections statements to gain access to the system.

Precondition

- A student should have been saved

Test steps

v) Navigate to login form
vi) on username enter SQL injection “”=” and “”=” in password
vii) Click enter



Expected result

- The system is supposed to give an invalid login popup to show that it have rejected the injections.

The above test shows a user trying to use an SQL injection statement to login into the system.

Acceptance testing

Acceptance testing is process made to make sure that the users are going to use the system prior installation according Langr, Hunt and Thomas (2015). Acceptance testing ensures that the system complies with the business requirement. This process involves giving end users a chance to use a beta version of the system and open up channels for response. The developer will act on the responses given by users to make the system perfect.

After a successful acceptance testing, the installation process will start as the developer's will be sure that the users are going to use the system prior installation.

5.4 Installations

Stannett etal (2015) referred to software installation as the process of implementing the newly acquired or developed system into business processes. The Mbizo high school integrated school management will be divided into two parts which are as follows:

- Web portal – the web portal will have the school website and the eLearning platform. The school will have to buy hosting space and a domain to put the system online. The website will have the capability to copy some of the data from the local database
- Locally hosted system – the locally hosted part of the system will house the remaining part of the system. This decision of hosting some part of the system on a local server is because the internet is not always available on the school and this might disrupt business processes.

The installation phase will be done in a period of a week if all goes according to the plan.

5.4.1 System changeover

According to an article on Prahlad (2016), system changeover is the process of shifting from software system to another. This is a delicate process in the software development life cycle as the developers will to minimise business disruption during the changeover process. There are basically three popular methods of system changeover available which are:

5.4.1.1 Direct changeover

This method of system changeover involves identifying a single point in time where the organisation stops using the system and adopt the new one. This method is cheap and is suitable for systems that are of low risk. This method cannot be implemented on large and critical systems according to Foster (2014). The main problem with using this method on large systems is that if the new system contains errors then business processes might be interrupted trying to fix the bug. This method was not suitable for the integrated school administration as it is a huge system which handles sensitive data therefore there was no room for a mistake.

5.4.1.2 Parallel changeover

Foster (2014) defined parallel changeover as the process of running the new software and new one side by side. This involves using entering live data on both the old and the new system. This method is used up and until the new system is free of bugs and satisfied the users. This main problem with this method is that it is costly to run to system concurrently as both systems would require a team to run them. This method however gives the developers a chance to fix bugs without affecting the business processes.

5.4.1.3 Phased changeover

This type of change divides a system into phased of which these phases are installed one after another. Foster (2014) said that the method gives time to monitor the system before it is installed into the whole organisation. The strategy is said to mimimise looses on the event that the system fails to perform as expected. The organisation can use the installed phase as a training group for users thus users can be trained on the basic functionality and use of the system. The major advantage drawback of this strategy is that the results from the pilot phase may not represent the whole system.

5.4.1.4 Strategy recommendation

The researcher recorded the use of the parallel changeover strategy. This strategy will enable the developer to monitor the system before it is fully implemented. The current administration system holds public data therefore there is no room for an error.

5.4.2 Data migration

Prahlad (2016) defined data migration as a process of transferring data from data storage to another or from data format to another. In software development, data migration is a process of moving data from a manual system to a computer system or from on computer system to another. Most of the administrative at Mbizo high where being done manually and the developer was face with a task of data capturing as the all the administrative data was supposed to be captured into the system.

The researcher and the school stakeholders concluded to just transfer teacher details from papers to the system and start digital records for form one and form 5 incoming students. The old students were to be entered into the system gradually as there was no mainly to commit to data capturing.

5.4.3 User training

The success of an information system is anchored on the ability of the end users to it and training are crucial argued Dwivedi, Y K (2015). User training is a logical process of familiarising the users of the system to the system. User are taught how to use the system during the trainings. The

researcher identified four groups who needed training for an efficient operation of the integrated school management system. These users were administrators, teachers and students. Below is a training matrix for Mbizo high school:

Day 1:

Groups	**Courses and duration**			
	Introduction to the system (1 hour)	Creating an account and account management (2 hours)	Uploading leaning material (2 hours)	Accessing leaner materials (1 hours)
Administrators	✓	✓	X	X
Clerks	✓	✓	X	X
Teachers	✓	✓	✓	X
Students	✓	✓	X	✓

Table 5.1 day 1 schedule

Day 2:

Groups	**Courses and duration**			
	Setting up fees payment and generating invoices (2 hours)	Capturing fees payments (2 hours)	Capturing student and managing student details (2 hours)	Staff logging in and creating student profiles (1 hours)
Administrators	X	X	✓	✓
Clerks	✓	✓	X	✓
Teachers	X	X	X	✓
Students	X	X	X	X

Figure 5.2 day 2 schedule

The trainings were done in a period of two days and the training matrix above highlights who took the trainings.

5.5 Maintenance

April and Abran (2008) defined system maintenance as the modification of a software product in effort to correct error, improve functionality on improve the security features of the system. A system can be maintained periodically thus scheduled maintenance or can be maintained after an event happening. There are 4 types of system maintenance which are:

5.5.1 Adaptive maintenance

April etal (2008) went on to define adaptive maintenance as the modifications of the software product to adhere to a changing business environment. The integrated school administration system will have scheduled maintenance quarterly and unscheduled maintenance as per required. The adaptive maintenance will be based upon the changing of the system user requirement and will be done to meet these requirements.

5.5.2 Perfective maintenance

Perfective maintenance refers to that kind of maintenance that seeks to enhance the functionality of the system. This may include optimising interfaces by creating easy access to the mostly used functionalities. Perfective maintenance may also include installing patches to the system to improve the systems' reliability and efficiency according to Dwivedi (2015). There was no scheduled perfective maintenance plans for the system but the arrangement can be altered as seen fit.

5.5.3 Corrective maintenance

According to Ehmer (2011), corrective maintenance refers to fixing bugs found by users on a system. This type of maintenance is done frequently during the first months of installing a new system as users discover errors and these errors have to be fixed until there are no errors anymore. As the system get to use for a longer period and all functionalities are explored, these errors tend to reduce meaning that corrective maintenance is usually done during when the system is still new. These maintenances are usually scheduled but are triggered by the users error

reports .Developers first rule is that don't change what is working therefore these type of errors are not to be done if the system is working correctly.

5.5.4 Preventative maintenance

To prevent is to avoid an event from happening and preventative maintenance is the process of altering a software product that an event that threatens the system may not happen according to April etal (2008) .This begins by identifying a threat to the system and patch the system to avoid these events from happening. As the system processes more data, it turns to get slower and this can be prevented by optimising the source code to execute faster and avoiding dragging of the system. Preventative maintenance makes the system sustainable and can extend the lifespan of a system. All maintenance work have to be documented properly so that it is easier for other developers to understand the structure and direction of the system an even event of change management.

5.6 Recommendations for future/further development

Due to the limited delivery time of the system, some areas of the system may not have been done to justice and below are some of the further developments that can be done to the system:

- Each and every module can be further be developed to include those functions which were dimmed not important in the initial development. These functions may include the payroll for the school development community staff members amongst other functions.
- An android application can be developed for the e-learning platform to enable easy of sharing of learning material amongst students and teachers.
- Parents portals can also be created to enable parents to directly view all students records
- The whole system can be served on a cloud if the school secure a reliable and fast internet connection with more than 99% uptime

Other recommendations may arise as the system get to work in a real life environment and those recommendations are most welcome.

5.7 Conclusion

The Mbizo high school staff are humbled but at the same time excited with the successful implementation and testing of the system. All the stakeholders are looking to a better learning environment through this system and this chapter gave a detailed description of the implementation phase making a success in the project development. The system now writes its own history in improving the learning environment and its sustainability will depend on the collective post implementation work of both the developers and other stakeholders. The project was a success.

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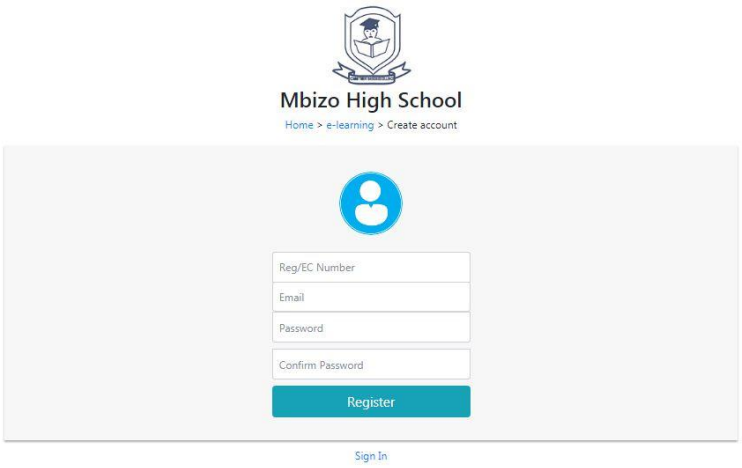
Appendices

Appendix A: User Manual

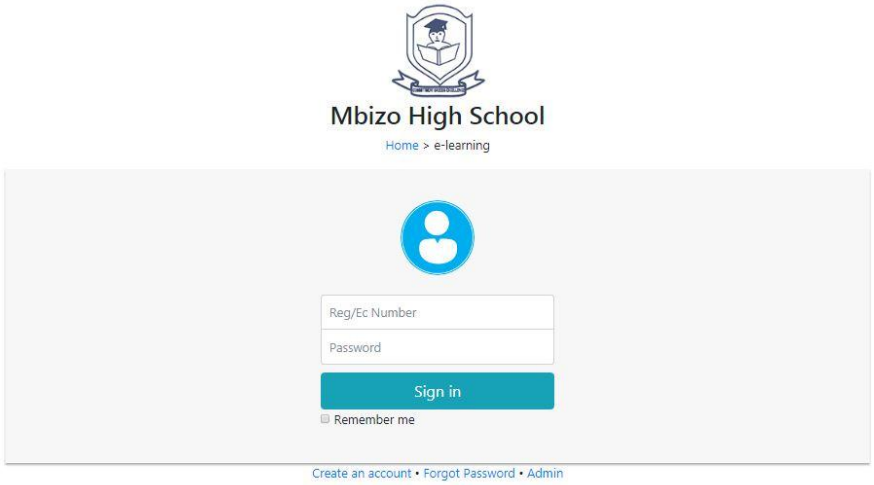
The user manual helps system end users to navigate through the systems' main functions. Users can refer to this document on how to perfume basic tasks on the system.

Create account and login



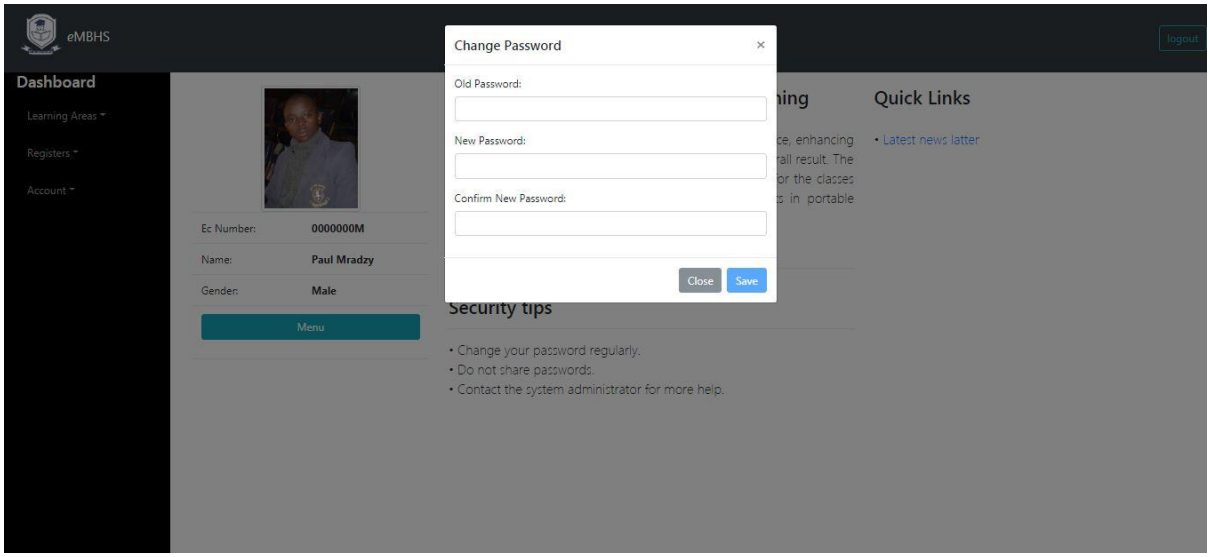
- To register a new account enter email your eg numbr / Ec number, email and your desired password
- Press register to create account

Login



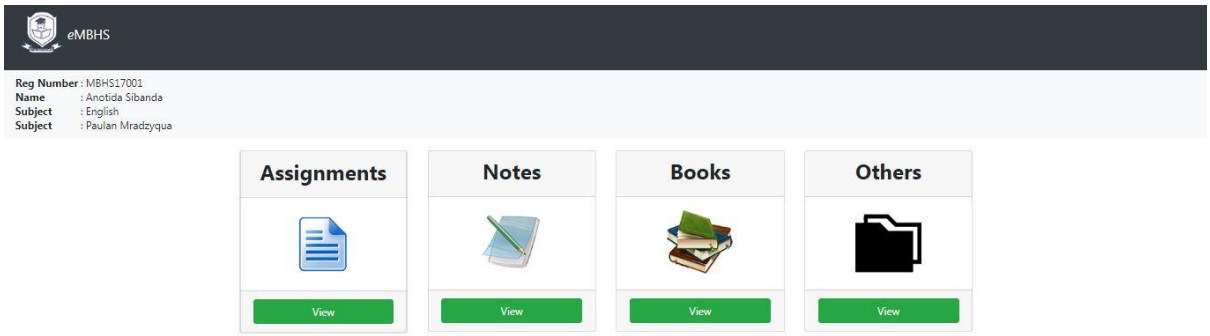
- Enter Reg numbr / Ec number and password
- Press sign in to log in

Change password



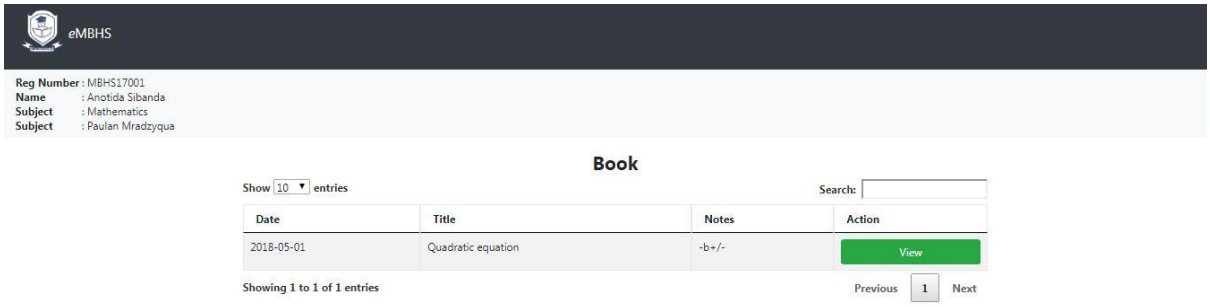
- To change password, navigate to account and selected change password on the drop down menu
- Enter old password and the new desired password
- Click save to save the password

Download material



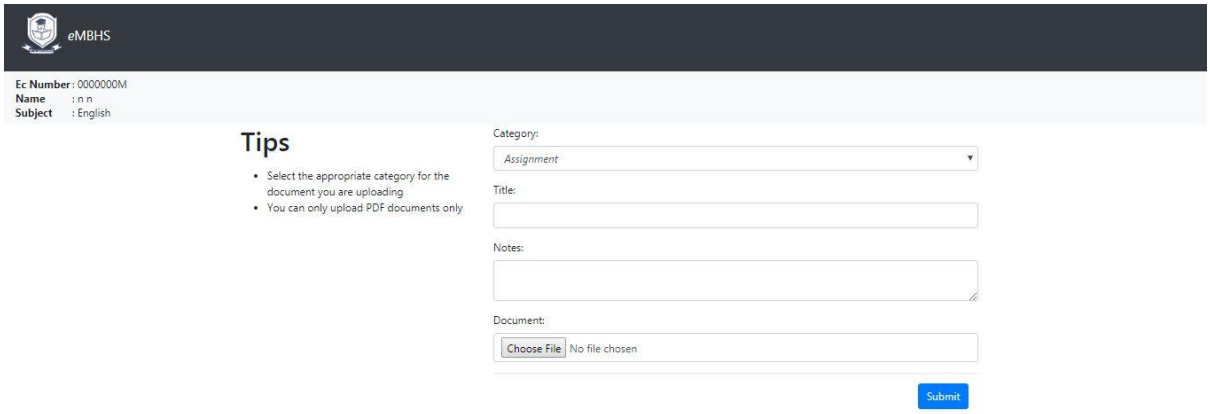
- Navigate to learning material

- Select material type
- Click view



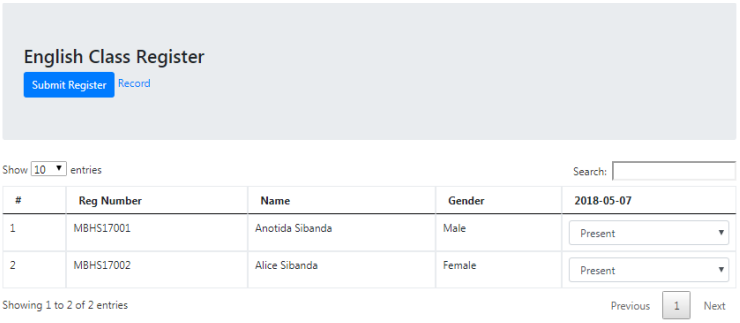
- Navigate to the material you want to download
- Click view to download the material selected

Upload Material



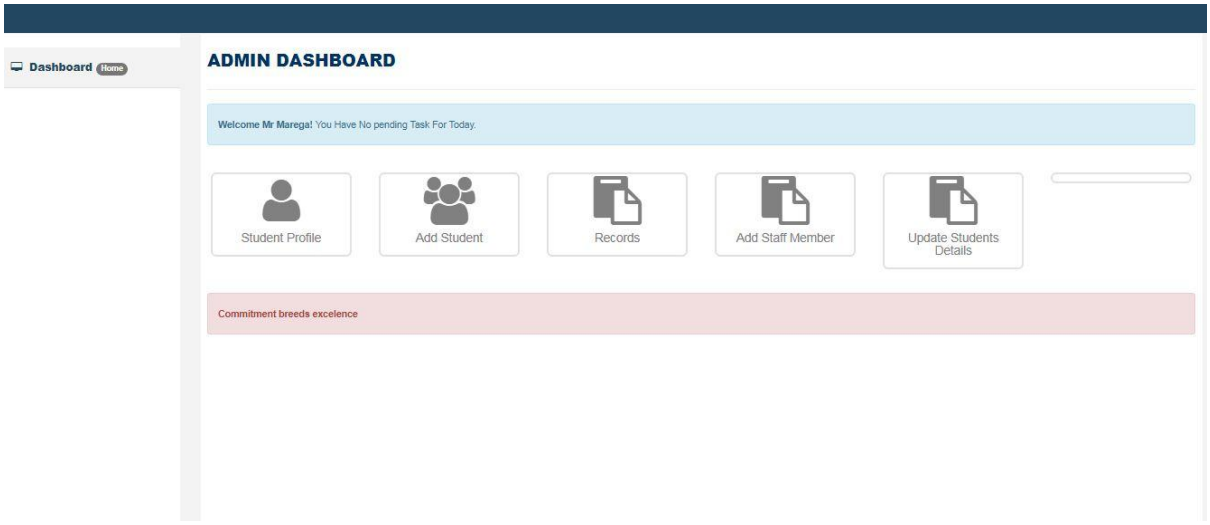
- Navigate to teaching areas and click the subject you wish to upload material on
- Click upload material and enter material details including the document to be uploaded
- Click submit to save the material

Mark register

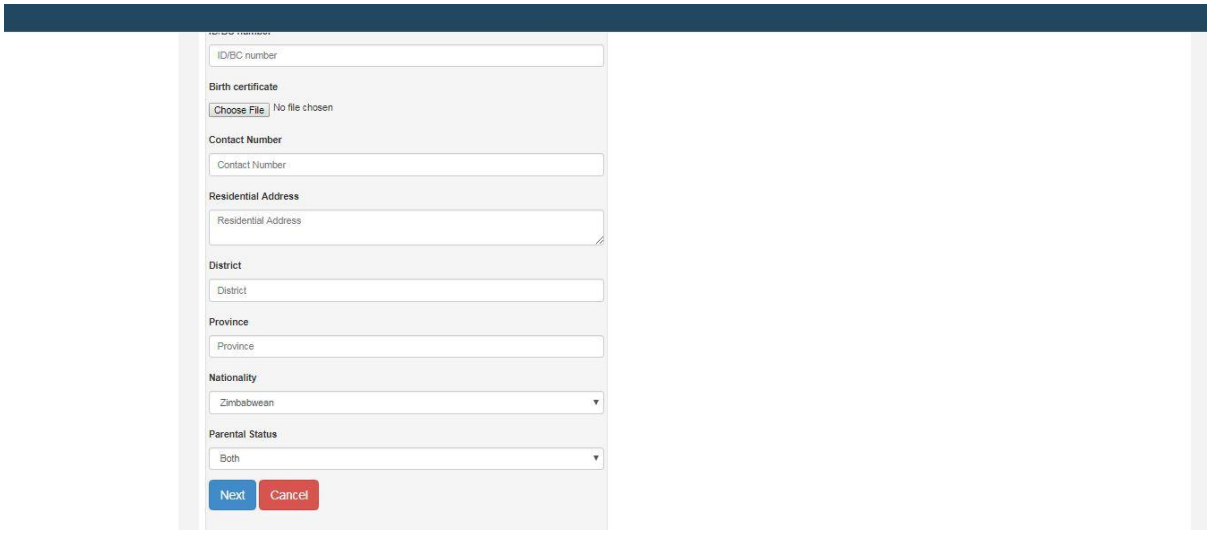


- Navigate to registers and click a subject you want to mark a register for
- Select present if the student attended the class on absent if the student was not in the class
- Press submit to submit the register

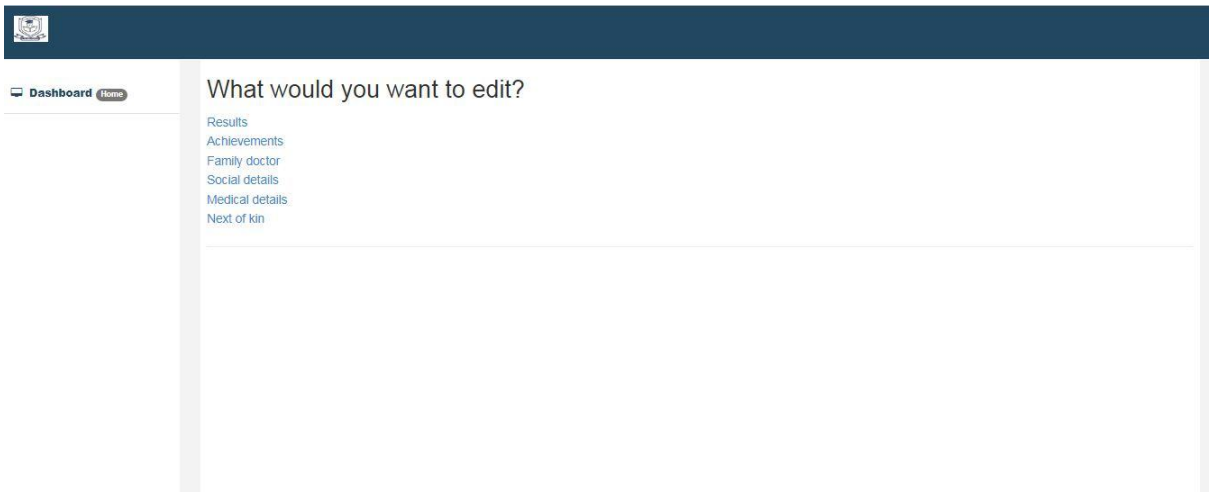
Add Student



- Navigate to admin dashboard
- Click add student



- Add all student details and click next
- To update student records navigate to update student records on the admin menu and het to select the details you want to update



- Select details you want to edit and alter the details

Appendix B: Interview Checklist

Disclaimer: Data acquired from this research will be used for scholarly purposes only and will not be made public.

Interviewer name……

Interviewee position……

Interviewee department…..…….

Date……

Questions

Q1. Explain briefly why an integrated school administration system is needed?

.....
.....
.....
.....

Q2. How does the current system work?

.....
.....
.....

Q3. What are the main challenges associated with the current system?

……
……
……
……..

Q4. What do you think can be done to curb all these challenges?

……
……
……
……

Q5. What are expectations on the new system?

.....
.....
.....

Appendix C: Questionnaire Checklist

Please answer all questions

1. Are you satisfied with the current system?

Yes No ☐ ☐

If not, what are your suggestions for the new system?

……
……

3. What weaknesses of the current system?

….....
.....

4. Have you ever used an eLearning platform before?

Yes ☐ No ☐

5. If yes what are your thought on implementing the platform at Mbizo high school

……
…….

6) Do you think the new system will be of benefit to the school and highlight the reason for your answer?

……
……

DATE……

Appendix E:Code snippets

Add student code

```
if(isset($_POST['save'])){
        $con = mysqli_connect($server_name,$mysql_user,$mysql_pass,$db_name);
        $sql_query = "select * from ids where id='1';";
        $result = mysqli_query($con,$sql_query);
        $row = mysqli_fetch_assoc($result);
        $counter_update = $row["counter"];
        if ( strlen($counter_update) == 1 )
        {
        $place_holder = "00";
          }
         else if(strlen($counter_update) == 2 )
          {
        $place_holder = "0";
         }
         else if(strlen($counter_update) == 3 )
          {
        $place_holder = "";
          }
        $counter_update = $counter_update + 1;
```

```
$Reg_number = "MBHS17".$place_holder.$counter_update;
$sqli_query =  "Update ids Set counter = '$counter_update'";
                mysqli_query($con,$sqli_query);



$image = addslashes($_FILES['image']['tmp_name']);
        $name = addslashes($_FILES['image']['name']);
        $image = file_get_contents($image);
        $image= base64_encode($image);
        $bc = addslashes($_FILES['bc']['tmp_name']);
        $bc_name = addslashes($_FILES['bc']['name']);
        $bc = file_get_contents($bc);
        $bc= base64_encode($bc);
        $fname =$_POST["fname"];
$sname =$_POST["Sname"];
        $surname =$_POST["surname"];
$gender =$_POST["gender"];
        $id_bc_number =$_POST["id_bc_number"];
        $res_add =$_POST["res_add"];
$contact_number =$_POST["contact_number"];
        $parental_status =$_POST["parental_status"];
        $district =$_POST["district"];
$province =$_POST["province"];
$nationality =$_POST["nationality"];
```

```
$year = $_POST["year"];
                $month = $_POST["month"];
                $day = $_POST["day"];
                $dob = $year ."-".$month."-".$day;
$qry = "insert into students
(Reg_number,Firstname,Second_name,Surname,Date_of_birth,Gender,ID_BC_number,Picture,
Birth_certificate,Residential_address,Contact_number,Nationality,District_of_birth,Province_of
_birth,Parental_status) values
('$Reg_number','$fname','$sname','$surname','$dob','$gender','$id_bc_number','$image','$bc','$re
s_add','$contact_number','$district','$province','$nationality','$parental_status')";
            $result= mysqli_query($con,$qry);
        if($result)
        {
                echo "data saved";
    $_SESSION['Reg_number'] = $Reg_number;
                header('Location: Guardian_details.php');
                }else
                {
                echo "failed to save";
                }
}
```

Login code

```
$user_name = $_POST["login_name"];
$user_pass = $_POST["login_pass"];
$sql_query = "select name from user_info where user_name like '$user_name' and user_pass like
'$user_pass';";
$result = mysqli_query($con,$sql_query);
```

```
if(mysqli_num_rows($result) > 0)
{
        $row = mysqli_fetch_assoc($result);
        $name = $row["name"];
        echo"hello ".$name."";

}
else
{
echo"Login failed...";
}
Upload material
$db = con();
$Rec = "Material";
$counter = 0;
$sql_init = "select * from ids where Rec = :Rec";
$statement_init = $db->prepare($sql_init);
$statement_init->bindParam(":Rec",$Rec);
$document_name = $_FILES['doc']['name'];
$documemnt_size = $_FILES['doc']['size'];
$documemnt_type = $_FILES['doc']['type'];
$temp_name = $_FILES['doc']['tmp_name'];
$ext = substr(strrchr($_FILES['doc']['name'], "."), 1);
$location = 'Material/';
$upload_date = date('Y-m-d');
```

```
$link = $location.$document_name;
if(isset($_POST['save'])){
if($ext != "pdf"){
echo "<script> alert ('Only PDF documents are allowed!')</script>";
                                                                    }
else
                                                                    {
$statement_init->execute();
$row_init = $statement_init->fetch(PDO::FETCH_ASSOC);
if($row_init){
$counter = $row_init['counter'] + 1;
$status = "live";
//$user_data = array();
$sql = "Insert into material (material_id,date,ec_number,title,Notes,category,link)
values(:material_id,:date,:ec_number,:title,:Notes,:category,:link)";
$sql_two = "Update ids Set counter = :counter Where Rec = :Rec";
$sql_three = "Insert into material_subject (material_id,subject_id,status)
values(:material_id,:subject_id,:status)";
$statement_three = $db->prepare($sql_three);
$statement_three->bindParam(':material_id',$counter);
$statement_three->bindParam(':status',$status);
$statement_three->bindParam(':subject_id',$_GET['subject_id']);
$statement_two = $db->prepare($sql_two);
$statement_two->bindParam(':counter',$counter);
$statement_two->bindParam(':Rec',$Rec);
```

```
$statement = $db->prepare($sql);
$statement->bindParam(':date',$upload_date);
$statement->bindParam(':ec_number',$_SESSION['Ec_Number']);
$statement->bindParam(':title',$_POST['title']);
$statement->bindParam(':Notes',$_POST['notes']);
$statement->bindParam(':category',$_POST['category']);
$statement->bindParam(':link',$link);
$statement->bindParam(':material_id',$counter);
//create subject-material relationship
$result_three = $statement_three->execute();
//update counter
$result_two = $statement_two->execute();
//insert material
$result = $statement->execute();
if ($result && $result_two && $result_three &&
move_uploaded_file($temp_name,$location.$document_name)){
echo "<script> alert('Material uploaded successfully');</script>";
                                                                    }
else
                                                                    {
echo "<script> alert('Material failed to upload') </script>";
                                                                }
}
else
                                                                    {
```

```
echo "<script> alert ('Error in creating material id')</script>";
                                                                    }
}
}
```