

Design and Development of a Secondary School Payment System

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Abstract—The extensive developments in Information and Communication Technologies have made impact in all sectors of the society, including institutional payments management. This has seen the proliferation of numerous web applications bearing various functionalities such as health records management, business records management, registration operations, payment for services and much more are done using the web. It is now mandatory for learning institutions across the globe to declare their payments for services offered at each needed moment to for the purposes of enhanced decision making based on factual payment patterns. However, this when done manually as it is at the present moment is associated with multiple fallacies inherent in manual systems. This unpleasant trend prompted the researcher to seek to design and develop a computerized secondary school payment to present an automated way to keep track of school payments

to reduce the extant pen and paper based manual method of declaring school payments. Replacing the tedious old method this system will save time, reduce the amount of work the administrators have to do and will replace the stationery material with a computer based system.

Keywords— local area network, information technology, information system, information and communication technology, government of the republic of Zambia, electronic payment system, consumer to consumer, business to business, business to consumer.

I. INTRODUCTION

Developments in Information and Communication Technologies (ICTs) have made impact in all sectors of the society, including education. In higher education, application of ICTs in form of eLearning is changing the mode of learning and teaching processes. School management process is now done online, records are being kept in databases that are accessible through the web. In addition, Registration, payment of school fees, generating timetables and much more are done using the web. The world of IT has gone far and wide that now makes us see the importance of using automated systems rather than manual systems.

Proper financial management is important to the general development of the school. Accounting for finances is one of the key in managing finances in any organization. A school like any other organization requires finance in order to run. There must be an efficient control of finance to keep the school afloat. Funds have to be obtained, utilized and budgeted for. Efficiency in handling school funds requires proper records to

avoid misappropriation (Mwamba and Musonda, 2017). Monitoring of expenditures is another important role of a head teacher in managing finances. Educational scholars and practitioners such as (Mwamba and Musonda, 2017). Agree that the school administrator or the head teacher in Zambia is the most influential factor in the success of the school. According to (Mwamba and Musonda, 2017). The Zambian Ministry of Education in 2015 reviewed that the head teacher oversees the entire educational programs of the school he or she and is in the best position to provide the necessary direction to various aspects of the school (Mwamba and Musonda 2017).

School, students are required to undergo a thorough clearance process which is aimed at (Pelekelo K. J, 2017) determining their status whether they owe the School anything worth of return such as , unpaid fees, mattresses, books, and many other such items in order to successfully permit them to disengage. A clearance form is given to such students where all parties represented on the form are required to clear the student up to the final authority who mainly happens to be the School Head Teacher (Shamaoma and Kabutu, 2017). This is common among students that have satisfied the academic requirement and go back to their former Secondary Schools to get their statements of results or school certificates. The process of student clearance involves many parties such as Boarding, Faculty, Bursary, Library, and Sports,

Examinations etcetera after which the student is allowed to collect their School certificate or given transfer for those under transfer to other Schools (Shamaoma and Kabutu, 2017).

Referring to the problem of school fees and hostel allocation as the Secondary School Payment System (SSPS) problem with the large number of learners that are typically involved in such problems, there is a growing interest in automating the process of payment using centralized matching schemes that incorporate efficient algorithms for SSPS. Examples of similar automated systems are in use in several learning institutions.

In recent years, the advancement of technology has thus brought us into a new era of Web-based systems (Nonny, 2013). These systems are also known as enquiry systems and have the ability to input data, with a guaranteed response time and an assurance that the information is accurate and timely, then one is said to have a “Real Time System”. A real time system is also a Web based system and comprises mainly of four (4) main components:

A data-gathering component that collects data from the external environment.

An analysis component that transforms the received information as required by the application.

A control component that responds to the external environment.

A monitoring component that co-ordinates all other form of these components so that real-time response can be achieved.

Due to these advancements, organizations need no longer be centralized when information services can reach the home and offices for processing from a number of geographical locations. However, Web based systems have helped tremendously in every field of human existence today. Hence this project work provides and creates a Secondary School Payment System (SSPS) for secondary schools through the development of a Web based system that will in turn improve the efficiency and effectiveness of the secondary school.

Motivation and Significance of the study

The existing system or mode of payment results to stress due to the factors and conditions encountered during registration. Every new and returning learner has to register at the beginning of every term. Most learners are in a state of confusion during registration either because they do not currently have the money to pay for their school fees or will have to come down to school to pay during process with no guaranteed accommodation or send the money to a friend who is in school.

Based on these observations, a Web based system for Payment which will enable learners overcomes these problems during registration will be designed and implemented. The system

will allow a learner to open an account at a designated bank and keep his/her school fees in the account anytime and any day. Due to the present situation of the country, parents can also keep their children's entire school fees in their account. Therefore, the system allows you to keep your school fees incrementally or at once. The development of this Web based system will eliminate the major problems of the existing system.

Literature asserts that, for nearly every business, the simple act of collecting payments from consumers is actually quite complex and yet organizations want to make it easy and convenient for customers to pay, so they offer multiple choices of payment types and channels. Therefore, this project proposes the development of an alternative platform that enables learners and their sponsors securely pay secondary school fees online from wherever during registration. This will reduce the lengthy queues, and congestion at banks for payments. Sponsors of learners will also be able to save their school fees before the period of registration and as such will make it easier to cater for their wards.

The significance is threefold:

To the Students: Through this system, the students will be able to use the portal to effectively do their online school payments and registration processes especially for registering their personal information. **To the Faculty Members:**

Through this system, the faculty members can provide all the necessary information and resource material to their students and also be able to get the student information from the website.

To the Future Researchers:

The future researchers could gain knowledge from the study on the benefits, advantages and disadvantages, impact of developing web portals which they may apply to their research in the future. By improving on the portal in such a way that is being connected with inter-switch whereby students will be able to make any necessary payment through the website, payment like school fee, acceptance fee, and departmental fee and so on.

A. 1.3 Scope

The scope of this project is to develop a Secondary School Payment System for the Zambian Secondary Schools. The system will accommodate only the administrator, bank staffs and learners into one integrated Database system. This project is also scoped to only grade 8-to-12 levels at the Zambian Secondary School.

Problem Statement

In most Zambian Institutions of learning especially the secondary schools, learners' enrolment to these institutions is continuously on the increase, and each year every learner is expected to register for a term and therefore the learner has to make payment for the term. This

increase in learner's population over the years makes the period of registration stressful and payment of school fees and hostel accommodation a very tedious exercise. Pelekelo and Silumbe (2017) reviewed that there have been a lot of legislation in our country, Zambia, towards the implementation of ICTs and e-governance, but none of it seems to focus on E-Systems for administration and management for schools. The existing system of payment of school fees and hostel allocation in the Zambian Secondary Schools involves a learner going to the bank to deposit the money into the school account and take the payment slip to the school accounts office for verification and issuance of meal card (BOZ, 2016). Pelekelo and Silumbe (2017) also established that the electronic school management system brings about workflow automation, better knowledge management, efficient communications management, management of records in effective and efficient manner, quality assurance, better productivity management, better performance management, better cost-effectiveness, ease in accessibility, accountability with better audit trails and more integration of all departments and offices in schools. This process is causing a lot of problems because many learners will have to line up in unending queues in offices and banks where so many unforeseen events might happen. A learner might lose his/her money or payment slip; get tired due to stress and so many other events. Most

learners during registration are always at home and will have to come back to school for registration once queues are reduced.

Aim

The aim of this project was to develop a Secondary School Payment System (SSPS) that allows learners securely and comfortably pay their school fees and accommodation fees during registration.

Objectives

The principle objective of this research project was to design and develop a secure web application dubbed Secondary School Payment System for Zambian public schools for the purposes of capturing and management learners' school fees payments seamlessly.

The specific objectives where to:

To identify and analyses the acceptable requirements for modern web-based school management systems.

To design a model for a secure school payment system riding on the identified requirements.

To develop, test and validate the Secondary School Payment System.

Research Questions

The researcher devised and adopted the following research questions to inform the study?

What are the acceptable requirements for modern web-based school management systems?

What are the primary functional requirements for modern school management information systems?

What are some of the crucial software testing techniques?

CHAPTER THREE: METHODOLOGY

Understanding of what system analysis mean will be great importance before giving into detail discussion about analysis of existing system. In order to just computerize without solving the problem, information collected should be organized and analyzed because it is when the problems and potentials are clearly identified that the new system could be used to solve the problem.

BASELINE STUDY

As a best practice in keeping with the research ethics, the researcher obtained a letter of introduction from the Research department at the Information and Communications University to facilitate the gathering of all the necessary requirements in this research. Hastily, the researcher drafted the objectives for the research and sought to devise a semi-structured questionnaire which was administered to the purposively identified respondents aurally.

To ensure that we deliver an application meeting the needs for the customer accurately, we gathered all the necessary functional requirements from the Ministry of General

Education offices in Lusaka which we could easily generalize. This was key to ensure that we identify the needful objectives and help to elaborate and analyze all the objectives as identified at the start of the first phase in the sequential order. Alternative solutions for the first phase were proposed within this phase for redundancy ahead of time.

As earlier stated, the researcher employed purposive sampling strategy of enquiry. A purposive sample is a non-probability sample that is selected based on characteristics of a population and the objective of the study. Purposive sampling is also known as judgmental, selective, or subjective sampling. Strictly speaking, we used the variation/heterogeneous purposive procedure.

A maximum variation/heterogeneous purposive sample is one which is selected to provide a diverse range of cases relevant to a particular phenomenon or event. The purpose of this kind of sample design is to provide as much insight as possible into the event or phenomenon under examination (Banda, 2019). For example, when conducting a street poll about an issue, a researcher would want to ensure that he or she speaks with as many different kinds of people as possible in order to construct a robust view of the issue from the public's perspective. This was

important to help us gather various views concerning the proposed system. The following figure simplifies this phase.

Development of the application

The development model chosen for this system was the spiral software development model. Spiral Model is a combination of a waterfall model and iterative model. Each phase in spiral model begins with a design goal and ends with the client reviewing the progress (Sharma, 2017). The spiral model was first mentioned by Barry Boehm in his 1986 paper. The development team in Spiral-SDLC model starts with a small set of requirement and goes through each development phase for those set of requirements. The software engineering team adds functionality for the additional requirement in every-increasing spirals until the application is ready for the production phase.

In the development of the SSPS web application, we used such tools as HTML and CSS, JAVA, MySQL and PHP. This is a client and server system which where the server searches the data and sends it back to the client. As a matter of fact a client server system is a special case of a cooperative computer system. All such systems are characterized by the use of multiple processes that work together to form the system solution.

FIGURE 1: Research Approach

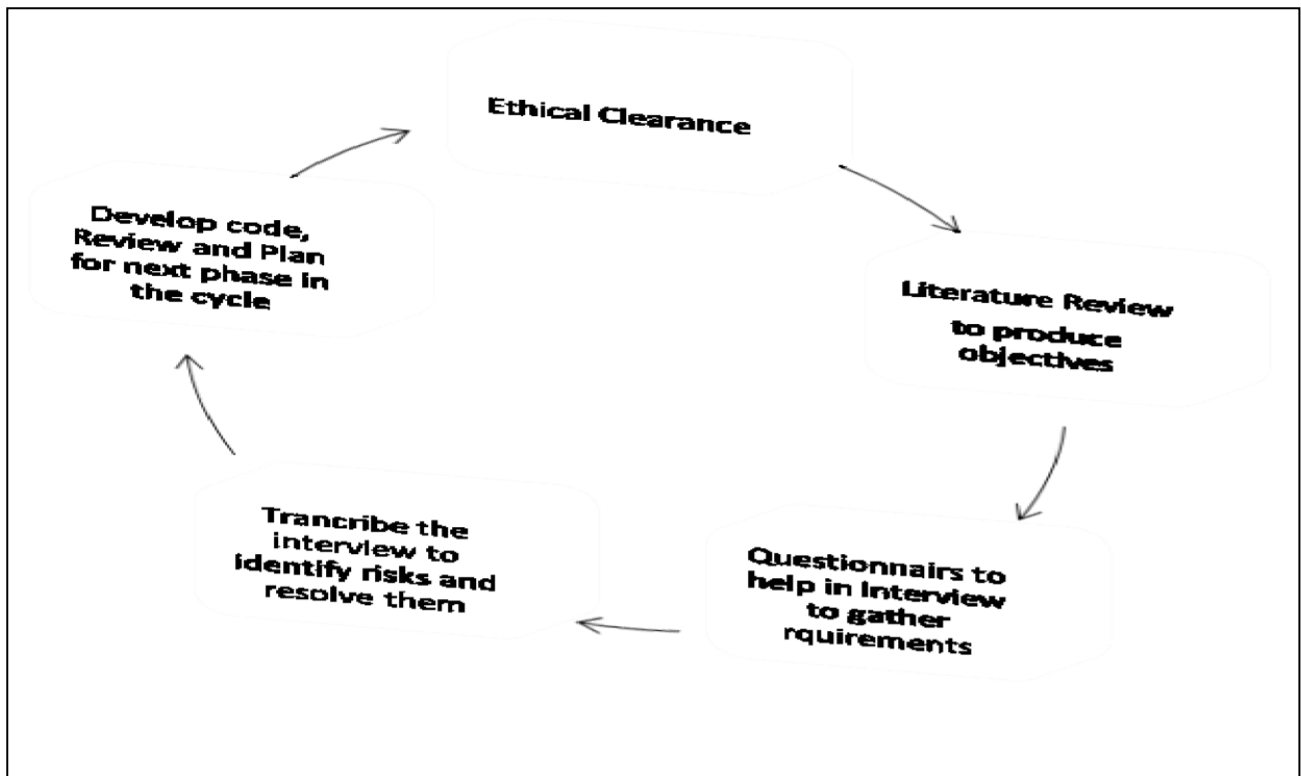


FIGURE 2: SYSTEM DESIGN

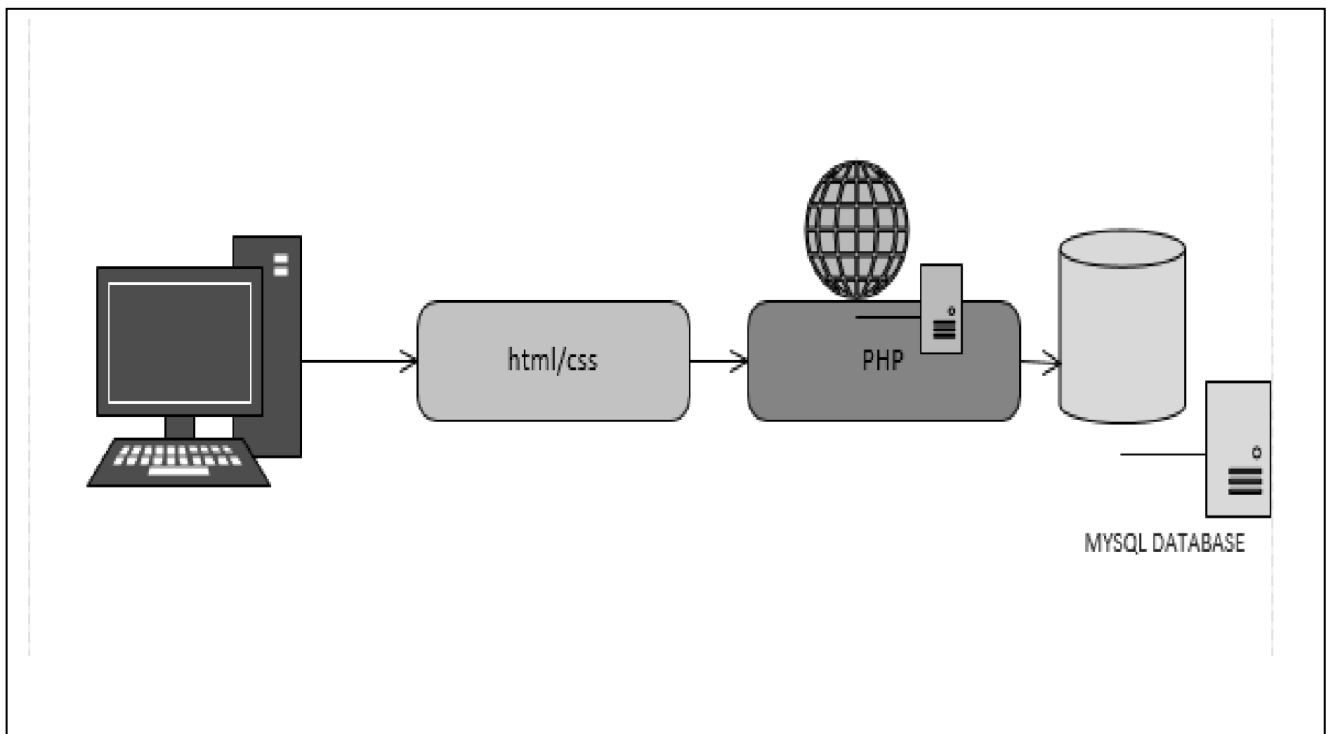
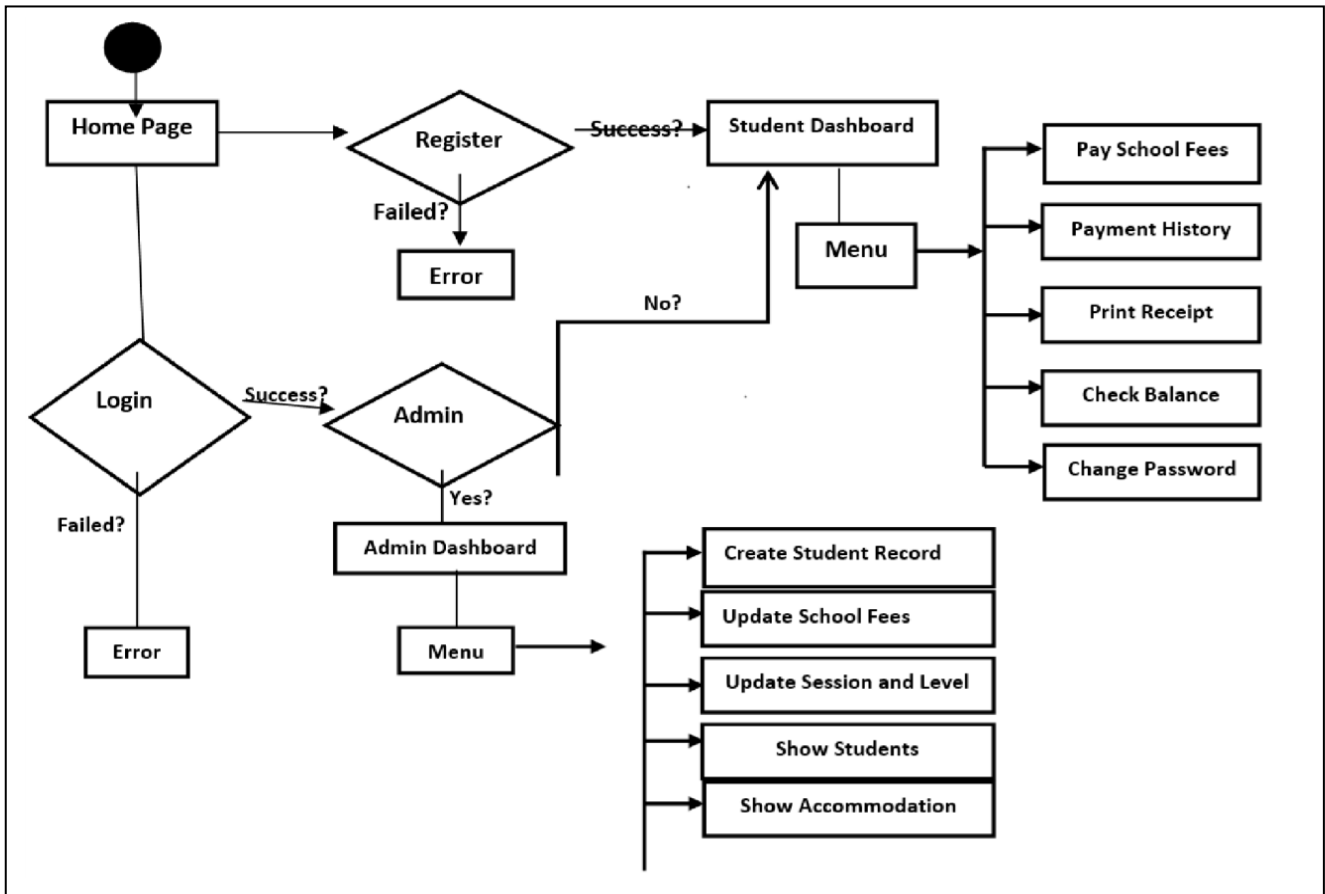


FIGURE 3: System Software Level design



Based upon the experiences of the previous registration process, it was anticipated that 30 workstations would be necessary for the purposes of the registration exercise. These workstations, which would be a mixture of PC-compatible machines and Apple Macintosh systems, would be distributed throughout the school departments and campus. For each of these two types of system, a user-friendly interface program (front-end) was written, which would display the equivalent of the original paper registration form. The student data would be retrieved from an information store, written using

System. In the following sections we shall examine this architecture in more detail.

System Class Diagram

One major consideration of the work is to determine a suitable file structure and organization so as to maintain integrity, reduce redundancy, and ensure easy retrieval of data from the application. This phase specifies all the files to be used for the system and their structures. The database will be designed using MySQL. The Secondary School Payment System (SSPS) designed specifically for the case study of Zambian public Secondary School will be made

of database objects such as entities (tables), routines, attributes (fields), views (virtual tables) etc. The table names, field names, data type, character length, attributes, null, default values, extra action and other descriptions for all tables used are also specified.

SSPS Database Schema diagram (Author compilation)

The schema in the above figure comprises of various entities (tables) such as new Learner: This table will keep records of all the details of learners to be created by the administrator. It will show the learners of the secondary school that will have been created by the administrator.

Registered Learner: This table will keep records of learners that will have registered to use the SSPS system.

Account Details: This table will keep records of a learner's account details which will include the learner's account number, learner matric number and the amount of money in the learner's account.

Receipt: This table will keep track of the learners' receipt for every deposit to be made into his/her account. It will include the date of payment, receipt number, amount deposited, the name of who made the deposit etc.

Payment: This table will keep track of what a learner has paid for and the amount such item costs. It will also include the date of payment, who made the payment and some other details.

Payment Status: This table will keep record of learners that will have paid their school fees. It will include the name and matric number of the learner, transaction id for the payment, term for which the payment is made and the amount paid and the status of the learner to show that he/she has paid his/her school fees.

Bank Staffs: This table will record the name, username and password of bank staffs that have access to the SSPS system.

Hostels: This table records the details of each bed space in the hostel. It contains the hostel name, gender that uses the hostel, block name, room name and bed space.

Admin Users: This table will record the name, username and password of the administrator and the date and time the admin last logged into the system.

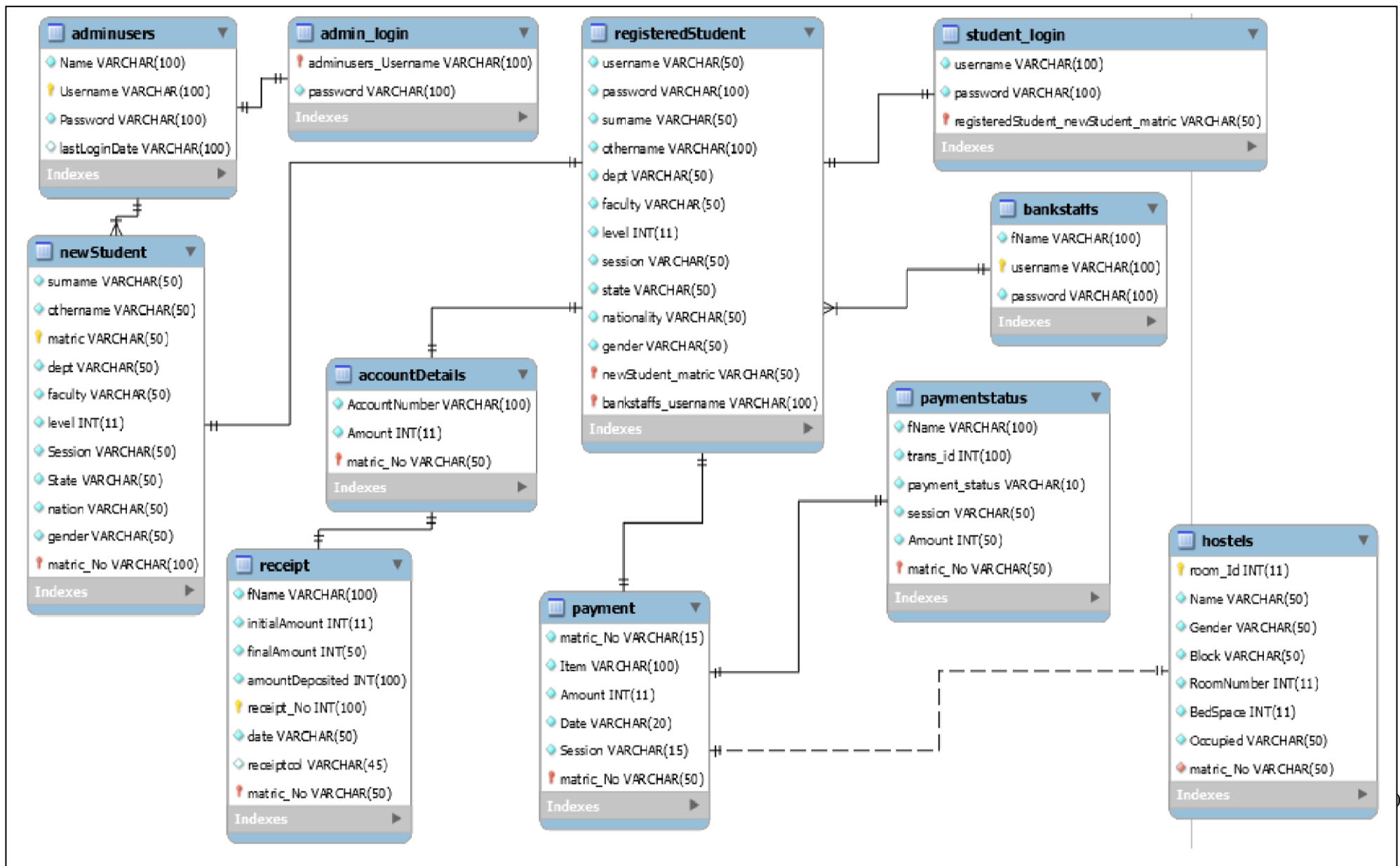
System Data Model Design

SSPS is a web-based application to be hosted on a web server that communicates to a database server. The user on a web interface makes a web request which is received by the web server. The web server processes the request and interacts with the database server using SQL embedded in PHP scripts. The response is a web page data sent on the web interface for the user.

The SSPS system will consist of three different parts. The Learner Interface, Administrator Interface and the Bank Interface.

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Data Model Design

The Learner Interface will provide the functionality which enables a learner pay his/her school fees, view his/her payment details, check balance, get hostel accommodation and change password. Secondly, the Administrator interface allows the administrator to create a new learner, update learner school fees, update term and level

and also view learners and accommodation. Lastly, the Bank interface allows a bank staff to register a learner, confirm learner deposit whenever a learner deposits into his/her account.

Input Specification

This is an interface between the user and the system that allow the user to enter data. Data input is generally done through the standard terminal keyboard or with the mouse in case of combo boxes, option lists (or command buttons). At this stage, different screen (window or forms) will be designed to guide data entry procedure. The input variables needed for this work will be based on three categories of users:

Learner -: Login form that requires username (matric number) and password, after logging in, there is the pay school fees form that allows a learner pay his/her school fees, an accommodation form that allows the learner get hostel accommodation and finally a change password form that allows modification of existing passwords etc.

Administrator -: Login form that requires username and password, after logging in, there will be a form to allow the administrator create new learners, a form to update term and another form to update level and school fees etc.

Bank Staff: Login form that will also require username and password. When the bank staff logs in, he/she can view a learner profile, deposit a sum of money into a learners' account, print

receipt for the learner payment and view the learners deposit history.

User Interface Design

This provides an interface that restricts an unauthorized user from accessing the application, its objective is to validate and authenticate a user

before granting access to him/her based on his/her access level (i.e. Student or Administrator) so as to access different aspect of the application, depending on their privileges defined by the application. It also allows new students that have being created by the administrator to register and use the application.

FIGURE 5: System Structure

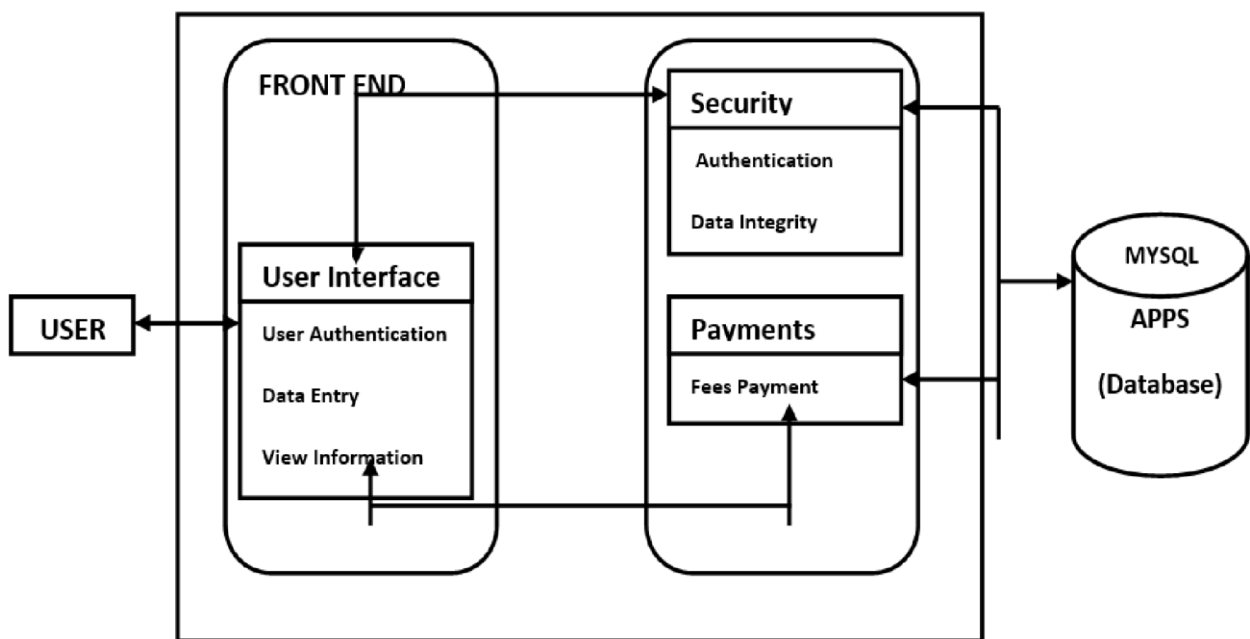
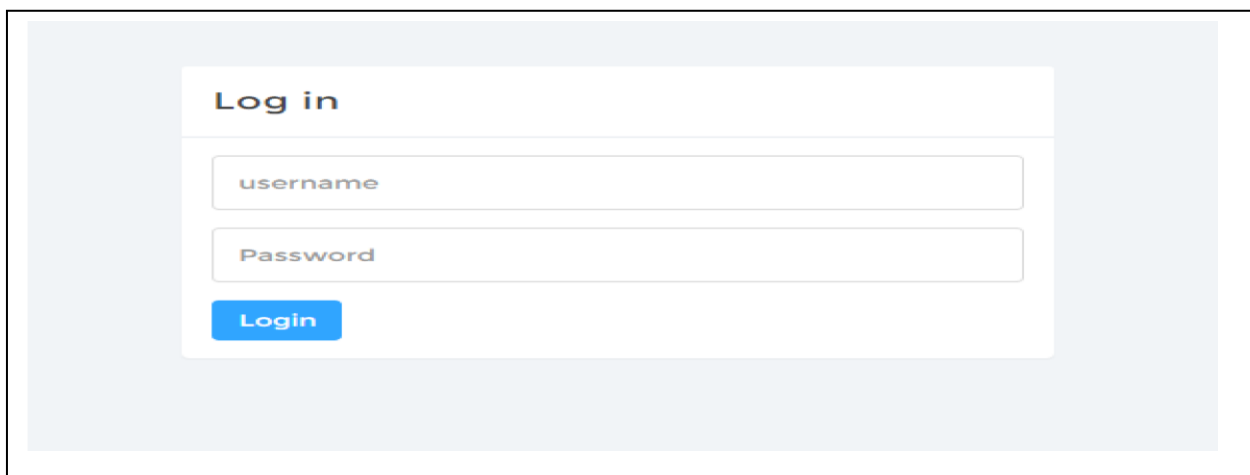


FIGURE 6: Login in



CHAPTER FOUR: RESULTS

This chapter is intended to give the main findings derived from this research study. We concatenate the survey results and the discussion. We conclude by discussing resonant matters concerning the system implementation results. Within this section we show and identify a fully documented operational system that is implemental on a computer system. By so doing, the following activities would be carried out; Development of computer-based software. To test-run the computer program with capture data to ensure proper execution and preparing the documentation.

BASELINE STUDY RESULTS

We present the baseline study results in the following section.

SURVEY RESULTS AND DISCUSSION

Implementing the Proposed Project

For a computing service to support the mission aims and strategic direction of its institution, its support devices must be responsive to and flexible in meeting the needs of those who are their customers and it must undertake research into what is required of them. In order to achieve reasonable success in implementing this project, the following aspects must be considered.

To design by making affordable hardware for the implementation scheme, Configuration of the hardware which will be discussed in the next phase, Handling of online registration

information, Continuous updating and upgrading of the developed systems and Infrastructures and the types of network implemented.

Network Scale

The type of network to be used in this project as discussed earlier is the local area network (LAN). We will consider the network scale which will determine the number of client computer to use, the review of the software and some special requirement that will leads to the configuration of the network client/server. The entire organization will be preferred to run on a single server network. This allows the centralization of a number of file services, the maintaining of a strong control over the network environment, workflow and group ware achieving simple administration and easy installation configuring the network server.

The server here performs the following tasks: client-server application, Database and communication. They are the waiters of the network world, existing simply to satisfy the requirements of the clients. Many computers rely on the services of a server. Good network operating systems are therefore implemented with features such as protected pre-emptive multitasking which prevents poorly server components software from crashing the server and strong security which allows the management of whoever has access to the different resources stored or provided by the

server. The only difference between a server and a client is the software each one is running.

Network operating system, which runs on the client and provides access to the resources shared by the server. The purpose of the client network software is to make the services that are available on the network appear to the client's computer. After the network server software installation is the network adapter card configuration. Servers communicate on the network through their network adapter card.

Network Clients and Network Services

The final link to connecting the client computers to the network is the network clients and the network services software. They are packages that bring a log into the Network but with the application of Sequential query language (SQL) database, it makes the work very easier because SQL package is already a network-based server, and the most important thing needed is the installation of Database on the server and the interface in the client system.

How it Works

The database runs on the server computer and only the user interface runs on the client-server database. It provides a better database performance and reduces the network traffic. The database runs a program in the server computer that takes over the tasks of manipulating the database files stored on the file server. Then, the client database program send requests to the

database program to perform and manipulate for them.

Implementation

As discussed earlier in the previous chapter about the module we have in the program, we shall review them by starting the program one by one, to really see how each module is implemented.

Using the Graphical User Interface Forms

A very good example of a graphical user interface (GUI) form is the student data form. This serves as a link/platform between the user and the database. This page provides all the functionalities a student can perform i.e. Pay school fees, check payment history, print receipt, check balance, accommodation and change password.

This is where new records are brought into the system; there is a need to keep the records of each one of the students. Clicking the login button on the password form, enters the student data and immediately changes until student data is made and it is updated by confirm payment button on student data form which updates the data entered and also data could be edited by clicking on the edit button. The same process of opening the Graphical User Interface (GUI) form is applicable to the other modules available as will be demonstrated here below.

FIGURE 6: Student Page: Showing the Dashboard of a Student

The screenshot shows a 'STUDENT DASHBOARD' with navigation buttons for Home, Pay School Fees, Payment History, Update Profile, and Moonga kelvin. The main content area features a 'Make Payments' form with the following fields:

- Student ID:** Input field containing '2'.
- Student Name:** Input field containing 'Moonga kelvin'.
- Amount Paid:** Input field with placeholder text 'eg. ZMW 1,554'.
- Term:** Dropdown menu with 'SELECT TERM'.
- Payment Type:** Dropdown menu with 'SELECT PAYMENT TYPE'.
- Receipt Batch Number:** Input field.
- Description:** Text area.
- Attachment:** 'Choose File' button and 'No file chosen' text.

A green 'Confirm Payment' button is located at the bottom of the form.

FIGURE 7: Student Page: Viewing the Student Balance

The screenshot shows the 'STUDENT DASHBOARD' with the same navigation buttons. The main content area features a 'Payment History' section with a blue header bar. Below the header, a payment record is displayed for the date 2019-07-04:

- Payment Type:** School Fee
- Term:** 1
- Amount:** K 1,200.00 ZMW
- Status of Approval:** approved
- Receipt Batch Number:** 23173691873
- Description:** Registration, meals
- Attachment:** [📎](#)

Figure 8 Deposit Page

STUDENT DASHBOARD Home Pay School Fees Payment History Update Profile Moonga kelvin

Make Payments

Student ID

Student Name

Amount Paid

Payment Type

Description

Term

Receipt Batch Number

Attachment
 No file chosen

FIGURE 9: SCHOOL FEE PAYMENT PAGE

SCHOOL PAY ADMINISTRATION

Nyondo Maria
 ONLINE

Dashboard

Manage Student +

Manage School +

Manage Users +

Logout

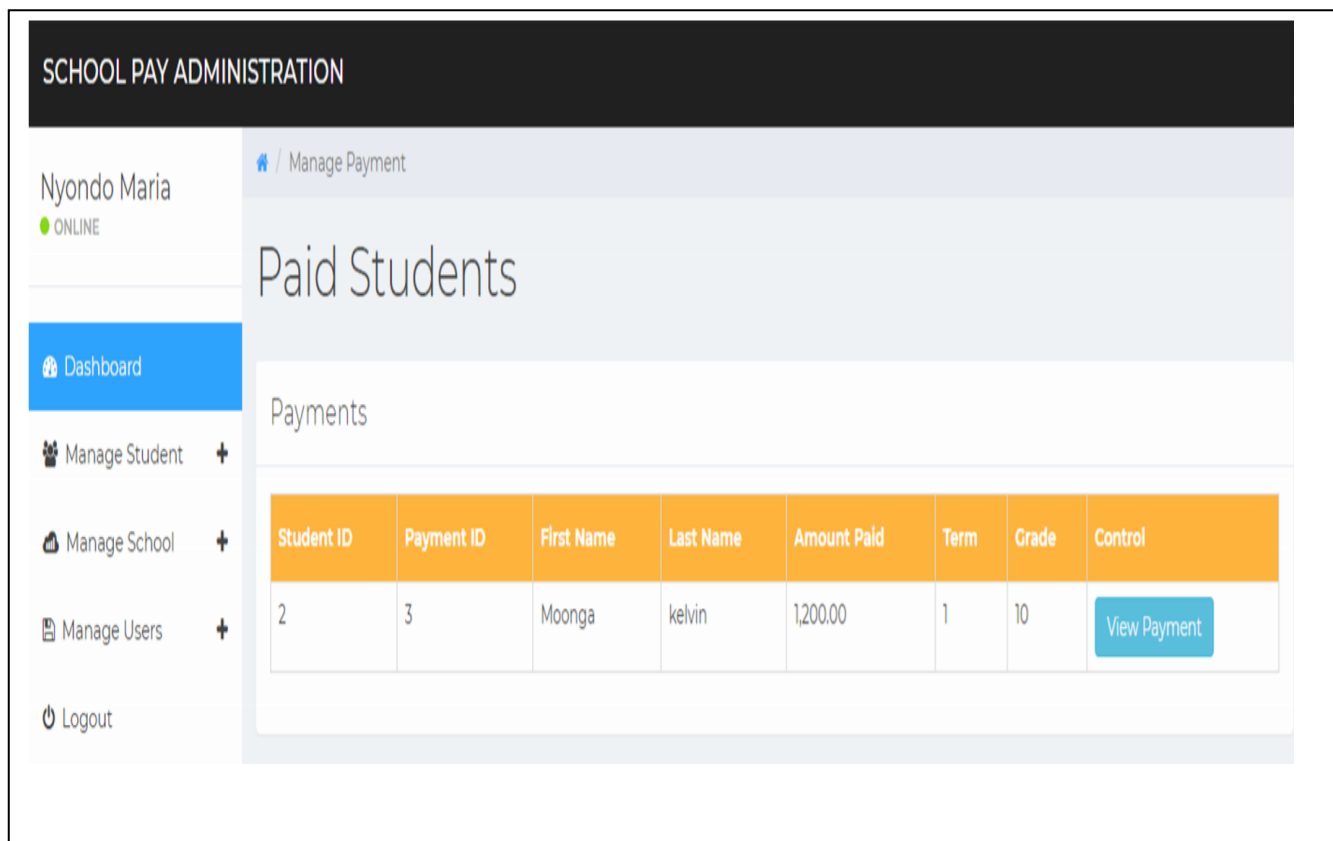
Manage Payment

Approve Payments

Payments

Student ID	Payment ID	First Name	Last Name	Amount Paid	Term	Grade	Control
1	2	Mudimba	Headson	9,201.00	2	10	Approve Reject
1	4	Mudimba	Headson	200.00	1	10	Approve Reject
1	5	Mudimba	Headson	377.00	3	10	Approve Reject

FIGURE 10: School Admin



Deposit Page

This page provides the basic functionality of the bank staff i.e. allows a student to pay into his/her account. The payment is confirmed by the bank staff. This page provides a way for students to credit their accounts anytime.

School Fees Page

The functionality enclosed in this page is to allow student successfully pay his/her school fees without having to walk to a bank to make payment. It however only confirms the payment if the student has enough funds in his/her account or otherwise tells the student to credit his/her account before making payment.

SYSTEM IMPLEMENTATION RESULTS

Functional Requirements

The system shall accept valid input of registered learners' payment details from users intending to pay fees online.

The system shall process fees payment transactions so that learner fees accounts are credited with the specified amount in each transaction.

The system shall produce a receipt as a proof of payment for every transaction made.

The system shall produce a listing of transaction information to learners.

The system shall provide feedback to the learner describing the status of the transaction.

The system shall be able to generate payment reports to learners.

Non Functional Requirements

The system should be easy to maintain.

The system should be compatible with different platforms.

The system should be fast as customers always need speed.

The system should always be available online all times.

The system should be secure.

The system should be accessible to online users.

The system should be easy to learn by both sophisticated and novice users.

The system should provide easy, navigable and user friendly interfaces.

The system should have a standard graphical user interface that allows for the on-line data entry, editing, and deleting of data with much ease.

Hardware and Software Requirement

The SSPS can be implemented on any micro-computer configuration with the following capacities:

An hard disk of at least 120 GB , 4 GB RAM memory ,Core i3 1.6 GHz ,Window 7 operating system ,Macromedia Dreamweaver CS5 ,Wamp server and a Microsoft Office suite .

Any microcomputer of the above capacity is required to be used, the only important thing is

that PHP is used to design the package resides on the hard disk. The computer used in designing and implementing this package is Lenovo ThinkPad T430. Processor 2.5 GHz, 2.9 GHz, 8 GB of RAM, 500 solid state drive capacity.

B. CHAPTER FIVE DISCUSSION AND CONCLUSION

This research has come at a good time when the Government of the Republic of Zambia has invested so much in the field of Information and Communications Technology. The use of technology would benefit the Zambian public schools all around the country, and deploying such a system, we would be assured of efficiency, accuracy, reliability and unquestionable position of flawless payment management and reporting. This technology implementation would help reduce the flaws associated with the manual systems in present use.

Use of technology

Looking back at what has been revealed in this project report, the manual system in discharging critical financial management operations is not free from human error. Hence a system which automates the school payments management operations with use of various algorithms is highly needed to curtail the present challenges. Zambia has for long been crusading the agenda of e-governance and digital culture and such a system as this one comes in at a right time which

the tech environment is still in the Greenfield awaiting exploitation.

Development of the system as a solution

SSPS accumulate and analyze payments data in order to make good payments management decisions in running the school. It can be realized that numerous school payment management software do exist in many localities around the globe today. The likes of AIMS at the information and Communications University and others.

C. 5.2.4 Comparison with other similar works

Each of these applications have their own strengths and weaknesses. Our application rides on some of the strengths mined from the reviewed applications and adds some few fascinating features. Unlike the other discussed applications, ours is light on memory uptake and takes a defence in-depth approach to bar known possible attacks. A system such as this one halves the existent problems and brings about enhanced efficiency.

Possible application

This software's main potential application is in the management of school payments in Zambian schools to bring in the much needed efficiency in such operations.

SUMMARY

This section has offered a general view regarding the discussion and conclusions based on the

developed system. It has also illustrated that other such software are already in existence though variant in functionalities.

CONCLUSION

There is an enormous amount of potential for the schools to exploit the implementation of the SSPS. This technology can stipulate schools' growth and development. The scope magnitude of change that are occurring in department today are both exciting and daunting, very particularly we are contemplating how we will manage the many streams of technological innovations pouring into our department and networked information world.

Therefore, it is concluded that studies on user requirements of e-payments and e-registration should be continuous and at intervals to receive feedback from users by managers of the portal with a view to meeting user requirements for better ease of use. It may not be enough to just initiate online payment and registration and associated services without taking into consideration user perceptions, requirements, needs and challenges, all of which will contribute to the overall goal of the institution to enhance learning and at the same time manage student records appropriately. It becomes even more important to conduct similar studies in our 21st century electronic driven environment.

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