MSU WRL VIRTUAL ASSESSMENT SYSTEM

Midlands State University

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BY

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Abstract

The basis of the research project was to develop an online Work Related Learning (WRL) System for the Midlands State University. As it is a requirement for MSU students completing their second year in their respective degree programs to go for Work Related Learning in their third year .The MSU WRL Virtual Assessment System aims to solve the problems faced by the MSU Work Related Learning department after a realization that students on work related learning may not manage to meet the deadline of the submission of work related learning logbooks or reports due to some critical work commitments for example travelling abroad frequently to perform work activities there or for some workshops and hence a need for a platform for them to submit it online to their Academic Supervisors online. The current system was further studied in the analysis phase in order to gain a clear understanding of the problem area. This phase incorporated three fact finding tools namely, questionnaires, interviews and observations. These exposed weaknesses and strengths of the existing system.

However an information system entitled MSU WRL Virtual Assessment System was developed to counteract on the identified problems. This system was developed using PHP Laravel Framework, Bootstrap and MySQL database. It has turned out to be a success since it passed all testing stages elucidated in the implementation phase.

Therefore there is need for consistent maintenance of hardware and software that support the system. This is done so as to as to upkeep high system productivity within its operation. Systems network structure is also of concern since there is need to accommodate high information movement on the web server.

Declaration

I, Rodney Chikodzi hereby declare that I am the sole author of this dissertation. I authorize Midlands State University to lend this dissertation to other institutions or individuals for the purpose of academic research.

Signature…………………………………………

Date…………/……………./20…………..

Approval

First I want to thank GOD for his endless love and grace that saw me through this dissertation. I would like to thank my supervisor Mrs. TG Zhou for the professional guidance rendered to me during the whole project development process. I would like to thank all the lecturers that taught me and imparted me with knowledge throughout my four year degree course. This dissertation entitled "MSU WRL Virtual Assessment System" by Rodney Chikodzi (R153810M) meets the regulations governing the award of the degree of BSc Honors Degree in Computer Science at the Midlands State University, and is approved for its contribution to knowledge and literal presentation.

Supervisor…………………………………………..

Date…….……. /………………….. /20…................

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Dedication

I would like to dedicate this research to my parents and my brother Gerald Chikodzi for their unwavering love and continued support in my educational studies. Without them none of this would have been possible. Dedication also goes to all my family and friends.

ACRONYMS

MSU (Midlands State University)

WRL (Work Related Learning)

SQL (Structured Query Language)

IRR (Internal Rate of Return)

NPV (Net Present Value)

SQL (Structured Query Language)

EER (Enhanced Entity Relationship)

ANSI-SPARC (American National Standard Institute Planning and Requirements)

R.O.I (Return on Investment)

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CHAPTER ONE: INTRODUCTION

1. 1 Introduction

Midlands State University Work Related learning Virtual Assessment System is developed to enable the student to write his log book of what he learns on a weekly basis and his workplace supervisor digitally approving it or disapproving it depending on the truth being spoken by the student thereby reducing the chances of a student plagiarizing some logbooks of some students who were once atatchees before him thus, the work related learning process will be effectively assessed as this will enforce a student to write the correct information of the work activities he will be learning on a daily basis under the fear of disapproval by the workplace supervisor which will eventually be observed by a lecturer in charge of that student's work related learning assessment as this proposed system will allow him to observe whatever is being written, approved or disapproved and commented on his logbook and his work related learning report over the internet as the system is an online system. A comprehensive report will be submitted on the second assessment online using this system hence fuel costs will be cut in the sense that, if a student misses a deadline for its submission, he will not encounter an expense of coming physically to MSU and give it to his lecturer but rather since it enables a student and lecturer interaction online, a lecturer will receive it over the internet. The existence of a chat platform on this proposed system will enable efficient communication between Academic Supervisor and their respective students and their respective Employer Supervisors since each one of them will be having accounts on this system. The problems that the current system is imposing are to be defined fully and the objectives of the proposed system are also discussed which will then help us to resolve the problems that the current system is imposing to the organization. This system will cut fuel costs of students trying to move from their workplaces to come and submit their work related learning documents. Upon carrying out this research the rationale of coming up with this system is to be discussed below.

1.2 Background of the study

Technology is playing a huge role in how we human beings operate and must be utilized whenever a gap for it to be applied is observed or arises. Having realized that students on work related learning may not manage to meet the deadline of the submission of work related learning reports or logbooks due to some critical work commitments for example travelling abroad frequently to perform work related activities there or for some workshops. An Academic Supervisor may visit the student's workplace and not find him. In this instance, an Academic Supervisor may do a survey of the workplace and do a conversation with an Employee Supervisor regarding the student and the activities carried out by the student on the various work stations at the organization .When a student comes back, he may have to submit his documents to the Academic Supervisor. Instead of physically coming to the University to submit it, he will have to submit it to the lecturer who came to his second assessment visit, online via the MSU Work Related Learning Virtual Assessment System which has all the technological facilities to accept document inputs by a student, its approval or disapproval and comments put by an Employee Supervisor thus an Academic Supervisor can easily observe this from his side of this proposed system as a result, fuel costs for both a student and University are cut.

1.2.1 Background of the Organization

The idea of a University in the Midlands dates back to the foundation of the National University of Science and Technology when Gweru, which was seen as a possible site for a second university campus in the country, lost its bid to Bulawayo .Two other opportunities to host institutions of higher learning (the Open University and the Catholic University) were also missed by the Midlands Province ,when the two initiatives gradually converged to give birth to what has since become the Midlands State University .The former President R G Mugabe, on the nudging of the Provincial political leadership of the Midlands ,accepted the idea of a national university being built in the Midlands. This coincided with the then Ministry of Higher Education and Technology policy of devolution, which was aimed at expanding access to higher education by converting teachers and technical colleges into degree granting institutions .It was through the process of devolution that starting in 1998 Gweru Teachers College started to enrol students studying for the Bachelor of Commerce with Education and the Bachelor of Science with Education degrees offered by the University. Universities in Zimbabwe have WRL as part of their programme to as "student attachment, others have adopted the term WRL. The Midlands State University (WRL)

provides a platform for students to link theory and practice. When effectively carried out, WRL can benefit students, academic staff/institutions as well as employer.

1.2.2 Organizational Structure

An organizational structure is a system that outlines how certain activities are directed in order to achieve the goals of an organization (Weber, 2017). An organization can be structured in many different ways depending on its objectives. This type of organizational structure below tends to simplify and clarify authority, roles, and accountability relationships

Internal audit

Projects works and estate

Work .Related. Learning

Cleaning .Services

I.T.S

Vice Chancellor's Office

ProVice Chancellor's Office (academic Affairs)

ProVice Chancellors (Business Development)

Registry

Bursary

Faculties

Student Affairs

Library

Examinations

Central Records

Central Services

HR and Appointments

Secretariat

Admissions & Academic

Affairs

Student records

Buying &

Stores

Student Accounts

Planning &

Control

Accounting & Finance

Accounts

Arts

Commerce

Science & Tech

Natural Resources

Management &

Agriculture

Education

Social Science

Catering

Residence

Student health

Sport

Counseling

Ecumenical service

Employments &Graduate Employment

Readers service Technical service

Fig 1. 1 MSU Organogram

1.2.3 Vision

To be a unique, development-oriented, pace-setting and stakeholder-driven University that produces innovative, enterprising and internationally acclaimed graduates for the empowerment of society and creation of wealth.

1.2.4 Mission Statement

Guided by its Vision, Midlands State University aims at being a leading internationally respected University which embraces diversity and community engagement whilst at the same time inspiring a spirit of life-long learning. This would be achieved through commitment to:

- a results based culture of problem solving through quality and relevant research, teaching and training by means of flexible packaging, work related learning and strategic partnerships with the University's stakeholders for the immediate and ultimate benefit of humanity;
- sustainable socio-economic transformation through promotion of managerial skills and generation, dissemination and application of knowledge,
- total human capital development in an environment of a caring institution;
- the use of Information Communication Technologies (ICTs) and the virtual classroom as principal teaching and training modes of delivery and research;
- gender equality and equity in student admissions, staff recruitment and promotion policies;
- enhancing the quality of people's lives through new ideas and skills for sustainable utilization of resources;
- promotion of relevant and actionable quality research through both taught and research post graduate studies as means of generating new knowledge;
- good corporate governance policies and practices which are underpinned and expressed through the values of honesty, integrity, accountability and transparency and internationalization of higher education

1.3 Problem definition

Midlands State University (MSU) offers honours degrees and students are expected to complete a one-year Work Related Learning (WRL) process whereby the student is attached at an organization. The WRL requirements are that the student writes a log book of what he/she learns on a weekly basis and writes a work related learning report at the end of his year of work related learning. The problem comes as the students plagiarize log books and reports that were written by the previously attached students, thus, the work related learning assessors misses track of what is really being learnt by the students. Prior to a bad economic situation, it will be costly to visit every student on attachment for assessment as some of them will be located in remote areas and sometimes out of the country hence the fuel expenses will be high prior to this bad economic situation in Zimbabwe. Conversely after assessment, students are sometimes asked to bring their reports in person for marking which is more costly. Most students do not update their log books in time and other work related learning documents for assessment which at last, may cause them to end up taking other people's work at the instance where it will be needed at the sudden assessment visit moments which are uncertain to the students. It is clear that some students may learn some stuff which are not well relevant to their areas of study in order to just bear a name that they are on work related learning.

1.4 Aim

To develop an online WRL assessment system with digital logbook through a daily online logging of activities and skills learnt. Also a generation of report based on skills learnt throughout the year. The system will assist the online WRL assessment process through an Employer Supervisor and Academic Supervisor's evaluation of the student attachee through the provision of comments and recommendations. Digitalizing the logbook update by a student will ensure that the student strives to learn something new every day in order to write something new since his work supervisor will be digitally approving or disapproving and writing comments in relation to what the student will have written on his digital logbook basing on his successful assigned tasks' completion or failure all in the eyes of the employee supervisor monitoring the student. This will also motivate the academic supervisor to ensure to that he gives various work activities for the student to learn something new every day as he will be well equipped with the knowledge of the learning expectations from a student at the end of his one year WRL process since the academic supervisor

in charge of the learning process of the student will have passed that knowledge to the Employee Supervisor.

1.5 Objectives

- To enable log book upload and online logging of students on WRL.
- To enable online supervision by both the employee supervisor and academic supervisor.
- To provide student training tracking and completion of WRL requirements.
- To provide two-way communication between the employee supervisor and a student.
- To allow the university's WRL board to analyze the students training trends.
- To facilitate moderation of employer's assessment reports through his digital approvals, disapprovals and comments on the work related learning activities assigned to the student basing on his successful completion or failure of carrying them out.

1.6 Instruments and methods

Instruments are a set of basic components and accessories that help software developers create programs in a more efficient manner (Meding,Staron, 2018). The instruments and methods to be used for this system are:

- PHP LA ravel Framework – LA ravel is a free, open-source PHP web framework, created by Taylor Otwell and intended for the development of web applications following the Model View Controller (MVC) architectural pattern and based on Symphony. Some of the features of LA ravel are a modular packaging system with a dedicated dependency manager, different ways for accessing relational databases, utilities that aid in application deployment and maintenance, and its orientation toward syntactic sugar. This instrument was chosen because error and exception handling is already configured for any new LA ravel-based project. In addition, LA ravel is integrated with the Monolog library, which provides support for a variety of powerful log handlers.

- Bootstrap – Bootstrap is a free and open-source front-end Web framework. It contains HTML and CSS-based design templates for typography, forms, buttons, navigation and other interface components, as well as optional JavaScript extensions. Unlike many earlier web frameworks, it concerns itself with front-end development only. The bootstrap instrument was chosen because it has a consistent framework that supports major of all browsers and CSS compatibility fixes.

- MySQL database – is an open source relational database management system (RDBMS). Its name is a combination of "My", the name of co-founder Michael Widenius's daughter and "SQL", the abbreviation for Structured Query Language. This instrument was chosen because it has got features with a distinct storage-engine framework that facilitates system administrators to configure the My SQL database server for a flawless performance. MySQL meets even the most demanding applications while ensuring optimum speed, full-text indexes and unique memory caches for enhanced performance.

1.7 Justification and rationale

The system will increase real time communication between Academic Supervisor and Employer Supervisor and also with the student as it allows two way communication through the use of the chat platform .The system will assist the work related learning department assess students through offering a platform for daily online logging of activities, skills learnt and a generation of a report based on skills learnt throughout the year. It will also create a surface area for evaluation by an Employer Supervisor and Academic Supervisor of a student attachee through platforms which are on the system which allows them to write comments and recommendations. The system will provide regular updates from the attaché and the employer, it will provide a better and effective assessment of students.

1.8 Conclusion

The proposed system is a much needed solution to wipe out plagiarism during WRL and provide an effective assessment for each student. The system will provide the university with the types of trainings offered by the organization which they will use to recommend students with different careers to organizations that offer trainings that are aligned to their career goals.

CHAPTER TWO: PLANNING PHASE

2.1 Introduction

This stage succeeds the introduction chapter which outlines the objectives and the problems of the proposed system. This phase is going to be investigating the proposed system considering business goals of the MSU WRL Virtual Assessment System. Feasibility study and risk analysis will be the basis for the development of the proposed system where the researcher will be deciding whether the proposed system is feasible or not. This stage focuses around the need to draft a work plan of what is intended to be done during the execution of tasks. Planning phase demonstrates the fundamental explanation for building up the proposed system. Finally the researcher is going to employ tools like Gantt charts and schedule tables to show the period that the proposed system is expected to take.

2.2 Business Value

Business value is not (just) about money .It is about how positive impact is perceived by end-users, employees, partners or shareholders. The proposed system will significantly enhance all the activities under MSU WRL department as it is easy to learn and will improve the Work Related Learning department's efficiency in their work processes.

2.2.1 Stakeholder Value

Stakeholder value is a management method that focuses on maximizing the interests of a company's stakeholders (including shareholders, clients ,workers, and the community) as its prime objective (Filho,2019). The MSU WRL Virtual Assessment System is going to provide a chatting facility which will enable the stakeholders to communicate.

2.2.2 Managerial Value

Managerial values are abstract ideals that act as guiding principles for managing enterprises. Organizational entities connote the central, enduring, and distinctive features of an organization.

2.2.3 Employee knowledge

Refers to the knowledge of an employee who works at any of the tasks of planning,acquiring,searching,analyzing,organizing,storing,programming,distributing,marketing, otherwise contributing to the transformation and commerce of information and those (often the same people) who work at using the knowledge so produced (Malik,Athota,2019).

2.2.4 Organizational Value

Organizational values are abstract ideas that guide organizational thinking and actions. Organization values represent the foundation on which the company is formed.Defining an organization's unique values is the first and most critical step in its formation and development (Vveinhardt,2017).The MSU WRL Virtual Assessment System will ensure that a student on work related learning strives daily to learn something new at his work place every day since whatever he writes in his logbook platform in the system will be closely monitored by his academic supervisor and employer supervisor online and also the two way communication between an employee supervisor and academic supervisor will enforce the learning of the student thereby supporting the vision of The Midlands State University which states that, "To be a unique, development-oriented, pace-setting and stakeholder-driven University that produces innovative, enterprising and internationally acclaimed graduates for the empowerment of society and creation of wealth."

2.3 Feasibility Study

Feasibility study is an analysis that takes all of a project's relevant factors into account-including economic ,technical ,legal, and scheduling considerations to ascertain the likelihood of completing the project successfully (Sotiriadis,2018).This study is conducted to see if the proposed system can be implemented or not by considering its technical, economic, social as well as operational feasibility .This study is becoming very crucial for every firm to succeed in terms of investing in technology .Basically this study is carried out to test the workability of the proposed system.

2.3.1 Technical feasibility

Technical feasibility study is the complete study of the project in terms of input, processes, output, fields, programs and procedures (Rosenblatt, Tilley, 2016). The technical assessment is taken to answer some of the questions such as, does the requirements needed for the proposed system exist or not. Technical expertise is a key resource in developing the MSU WRL Virtual Assessment System. Whether the individuals with the required expertise are available or not. Midlands State University will have three alternatives to opt for in identifying the required developers which are:

I.   Outsourcing
II.   Special personnel training to attain the technical expertise required.
III.   Recruiting a new developers with the expertise required.

One alternative will be selected which turns out to be more cost-effective but delivering the greatest quality result. MSU acquiring an I.T department with competent staff will instead send one developer for special coaching to enhance his expertise in Website development. This turns out to be more cost-effective instead than hiring a new personnel with no awareness of the institute's culture.

Hardware and Software Requirements

This comprises of the software programs and hardware that is required in developing a computer software system (Shinde,2017).These components differ with the kind of application under development and their ease of access. The tables below show the software and hardware required for developing the MSU WRL Virtual Assessment system.

Table 2. 1 Software requirement

HARDWARE ITEMS	RECOMMENDED SPECIFICATIONS	QUANTITY	SUPPLIER DETAILS
Application server	4AGig Ram 500HDD SATA-RAID,3GHz DUAL CORE Processor, DVD/RW	1	Name :First Pack Computers Location :Harare
Hp Desktop machines	4AGig Ram 500HDD SATA-RAID,3GHz DUAL CORE Processor, DVD/RW	10	Name :First Pack Computers Location :Harare
Database server		1	Name :First Pack Computers Location :Harare
Printers	Samsung laser jet	3	Name :First Pack Computers Location :Harare
Network switch		1	Name :liquid telecoms Location :Harare
Ethernet Cable	100 meter reel	1	Name :First Pack Computers Location :Harare
RJ45 and Crimpling tools		3 pockets	Name :liquid telecoms Location :Harare

The following diagram displays software specifications required

Table 2. 2 Software requirements

software		quantity	Supplier details
Operating system	Windows 8	1	Name :First Pack Computers Location :Harare
browser	Chrome	1	Download on the internet
Development Software	Microsoft Visual Studio	1	Download on the internet
Development Software	Android Studio	1	Download on the internet
Database	SQL Server Database	1	Download on the internet
Antivirus Software	Norton 2015	1	Download on the internet

2.3.2 Economic Feasibility

Economic feasibility is the most commonly used method for determining the efficiency of a new project (Diaz-Casas, Castro-Santos, 2016). A project is economically feasible that is if the benefits are greater than the costs. This segment of assessing feasibility consists of the cost evaluation that come up as an outcome of the system under development versus the positive aspects that will be come to the realization when the system is entirely functional. The project will be economically doable when the anticipated gains outweigh the anticipated expenditures.

Cost benefit analysis

It is important to determine if the project under development is the ideal for various possibilities, even if the projected advantages surpass the projected expenses. Cost benefit analysis is an assessment of determining the expenses and gains of developing the project and running the application and articulating these expenses and gains (Aurum and Wolhin 2012).

Table 2. 3 Cost benefit Analysis

Types of Cost	Estimated Values	Estimated Values	Estimated Values
	2019	2020	2021
Stationery	RTGS$50.00	0	0
Printing and Photocopying	RTGS$35,00	0	0
Consumables	RTGS$40.00	0	0
Additional Software	RTGS$70.00	0	0
Development labour	RTGS$500.00	0	0
Further Research	RTGS$35.00	RTGS$200,00	RTGS$100.00
Operational Cost			
New Hardware	RTGS$300.00	RTGS$150.00	RTGS$100.00
Personnel Training	RTGS$1500.00	RTGS$700	RTGS$200.00
Maintenance	RTGS$2500	RTGS$900.00	RTGS$500.00
Backup	RTGS$250.00	RTGS$250.00	RTGS$200.00
Total Costs	RTGS$5430	RTGS$2200.00	RTGS$1100.00
Direct Benefits			
Reduced paperwork	RTGS$1000.00	RTGS$1400.00	RTGS$20000.00
Reduced Telephone Costs	RTGS$350.00	RTGS$300.00	RTGS$500.00
Total Benefit	**RRGS$3350.00**	**RTGS$3700**	**RTGS$4800.00**
Profit(+) or Loss(-)	**RTGS$-2080**	**+RTGS$1400.00**	**+RTGS$3700.00**

Benefits

Benefits can be identified as positive aspects taken from setting up the proposed system. Online applications have many advantages. They are time saving, no physical limitation to attain the desired WRL placement updates. Firstly MSU students on work related learning will benefit from quick interaction between employers and their academic supervisors. The benefiting PHP system notifies students on pending work related activities. It is highly efficient and powerful meaning to say that an instantaneous communication of the progress of work related activities being logged by the student into the system will ensure that the employee supervisor is aware of the progress being done by the student even if he is out of the country with work. Using the MSU Work Related Learning Virtual system, the Assessment System, MSU students on work related learning can be directed straight to a platform whereby they will be enabled to link with their academic supervisors online. The proposed solution allows a considerably much structured, consistent approach than the paper-based work related learning process.

Tangible benefits

These are gains that are attained form the utilization of the system and portrayed in financial terms Pfleeger and Atlee (2016). The proposed solution will be anticipated to impact the subsequent adjustments to the income of the institute.

- Revenues from employers WRL.
- Increased number of students who start their WRL period in time.

Intangible benefits

These are gains that are nearly impossible to evaluate but depend on estimations these include:

- A good reputation
- Increased professionalism and reliability

Net Profit

In accordance to Burkholder (2015) Net profit is computed by obtaining the subtraction of the total income and the total expense. It includes all earnings for the lifetime of the system. When result is favorable (total earnings exceeds total expense) it will be called net profit and when totals expense exceeds total earnings it is called net loss.

It is computed as : **Net profit = Total Benefits – Total Costs**

= RTGS$(3350+3700+4800) – RTGS$(5430+2200+1100) = RTGS**$3120**
When the net earnings for the three years have been computed and subtracted from the addition of their individual expenses and revealed that favorable net earnings will be appreciated. This indicates that the proposed solution is anticipated to generate revenue to the Institute and hence demonstrating to be financially feasible.

Payback Period

In accordance to Wang and Hong (2017) Payback entails the choice of a capital expenditure assessment strategy that gives back the original capital expenditure of a project in a brief interval. This is the time utilized by the project's long run inflows to restore the original expenditure.The original expenditure is the overall expense the institute would have utilized in creating the solution. It is computed as:

Where: a = number of years.

b = Amount required to pay the remaining. (RTGS$ 2200)

c= the amount received in the payback year. (RTGS$3700)

Payback period = a+(b/c)*12

= 1 + (4383 / 4500)*12

= **1 year 6 months 21 days**.

The outcomes demonstrated that the payback interval is roughly 1 year 7 months which demonstrates a brief timeframe and consequently from the payback run the task is worth under taking and has minimum risks.

Return on Investment (R.O.I)

Return on investment measures an effectiveness of a financial commitment (Burkholder 2012). It is computed as follows (overall income – expenditure). The result is indicated as a percentage. Its formulation is shown below:

Return on Investment = (Average Annual Profit * 100)/ Average Total investment

=RTG$(-4034+1411+334)/6*100

RTGS$(5680+2400+1100)/3

= (4653.3/3720)*100 = 28.54%

2.3.3 Social feasibility

Social feasibility is one of the feasibility study where the acceptance of the people is considered regarding the product to be launched .It describes the effect on users from the introduction of the new system considering whether there will be a need for retraining the workforce (Christian, 2016). Carrying out social feasibility is done to verify the impact of the proposed system to its stakeholders as well as the society as whole. It is also concerned on how friendly the proposed system is to those that are directly affected with it that is, the system should be socially acceptable.

- Reduce computer literacy in the sense that all students will be in a position to use a computer on a daily bases and be forced to use it.
- Stress free since it will reduce the work load.

2.3.4 Operational feasibility

- Operational feasibility refers to the measure of solving problems with the help of a new proposed system. It is carried out to gain knowledge of whether the proposed system will be likely to triumph the current problems.
- It is easy to use because the interfaces are very clear and friendly.
- The system will offer reports which will then be used by the work related learning department for their decision making.
- Service efficient as it provides quick feedback.
- Enhances two-way communication as the students will communicate with the lecturers.
- Security and privacy as the system will maintain user personal information.

2.4 Risk analysis

Risk analysis is the process of investigating any state, situation, or event that happens and would be a threat to the success of the project constitutes a risk to a project (Yoe, 2016). Identifying risks is therefore a process of foreseeing what can go wrong in any project .This can be technically, financially, time and changes.

2.4.1 Technical risks

System failure, in the event of disk or system crushing, it may be hard to restore back the system, thus there is need for system support and backups frequently. Use of offsite backups will help to manage the risk. Some people resist changes, it is therefore important to give full support and backup since the system will be new and most users are not familiar with languages used to develop the system.

2.4.2 Financial Risks

Most categories of risk have a financial impact, in terms of extra costs or lost revenue. But the category of financial risk refers specifically of a sudden loss. The MSU WRL Virtual assessment system caters for some financial losses due to abruptly constantly fluctuating fuel prices to facilitate WRL vehicles moving to each and every student's workplace.

2.4.3 Time as a Risk

Time is very important in the development of a system. Poorly scheduled project could eventually be abandoned because they would have taken too long to complete there by becoming liabilities to organizations. It must be well managed so that the team can focus on the important aspects of the system so as to be able to finish projects on time.

2.4.4 Changes as a risk

There will always be many changes hence be a solution, some will be easy to identify and implement, whilst others will be more challenging. A risk in a project sense is an outcome that causes a change whether that change has a benefit or adverse effect on the running of an organization.

2.5 Stakeholder analysis

Stakeholder Analysis is a systematic way to analyze stakeholders by their power and interest. High power, high interest stakeholders are Key Players. Low power and low interest stakeholders are the least important (Leitzinger, King, Briscoe, 2018). It generally focuses on whether a proposed system is socially satisfactory. Below are some of the stakeholders which are going to enjoy the proposed system.

2.5.1 Management

The implementation of the proposed system will provide positive benefits to the management since it leads to an increase in employee's morale which really reduces the need for close supervision.

2.5.2 Employees

The proposed system will benefit MSU employees as it leads them to a stress free working environment, since it is going to replace the old system which requires a lot of effort for example, so many companies throughout the country need to be visited by academic supervisors from across many departments at the University using the University's work related learning vehicles and outside which is tiresome and very demanding as far as fuel buying is concerned.

2.5.3 Students

The implementation of the proposed system will give a lot of benefits to the students for example, students' satisfaction in the sense that there is no longer need to go to the MSU to manually submit some left out documents like employers' manuals and academic reports to respective academic supervisors at the University by the students thus fuel is saved as well as transport costs, thus self – service since the documents will now be written online on this MSU WRL Virtual Assessment System proposed system and students will not be forced to come physically to the University in the event that they miss their academic supervisor upon his assessment visit at the student's work place.

2.5.4 WRL Employer

An employer is a person or institution that hires employees. Employers offer wages or a salary to the workers in exchange for the worker's work or labor (Steingold, 2017).Due to the implementation of the MSU WRL Virtual Assessment System, the MSU employer will encounter less costs of giving academic supervisors extra fuel since they will be visiting the student only once since much of the student's interaction will be done on this proposed system.

2.6 Development Work plan

Work plan refers to a timeframe between the commencement and completion of the project (Soriano, 2016). It provides an estimate of the duration of each activity and is likely to take the sequential order in which they are going to be carried out. This is illustrated below with a project schedule that consists of dates in correspondence to phases.

Table 2. 4 project schedule

Phase	Starting date	Ending date	Duration (days)
Proposal	01/06/19	30/06/19`	30
Planning	01/07/19	31/07/19	31
Analysis	01/08/19	31/08/19	31
Design	01/09/19	20/09/19	20
Implementation	21/09/19	10/10/19	19
Maintenance	11/10/19	16/10/19	5
Documentation	17/10/19	---	Ongoing

2.6.1 Gantt chart

A Gantt chart is a horizontal bar chart developed as a production control tool in 1917 by Henry L. Gantt, an American engineer and social scientist. Frequently used in project management, a Gantt chart provides a graphical illustration of a schedule that helps to plan, coordinate and track specific tasks in a project (Mubarak, 2015). Below is a table which illustrates the sequence of activities in the form of a Gantt chart.

Fig 2. 1 Gantt chart

Duration (weeks)	1	2	3	4	5	6	7	8	9	10	11	12
Proposal	■											
Planning		■										
Analysis			■	■								
Design					■	■						
Implementation							■	■	■			
Maintenance										■	■	■
Documentation	■	■	■	■	■	■	■	■	■	■	■	■

2.7 Conclusion

For a certain system to appear there are certain requirements needed to come up with that system therefore this chapter has addressed such resources needed to come up with a project which is a success as well as assessing its feasibility and deductions that the project is feasible to develop. The next chapter is the analysis phase which will discuss the weakness and how the data of the existing system will be collected.

CHAPTER THREE: ANALYSIS PHASE

3.1 Introduction

A clarity of an in-depth knowledge of processes and functionality of a current system is provided by an analysis phase. It clearly explains the requirements of the user for the proposed system which have been acquired through techniques for finding facts. It also provides an alert of the current system's operations, how the existing processes are modelled. An evaluation and examination of the system development alternatives is done in the analysis stage so as to comprehend the highest accurate one. The proposed system provides an overview of the current system challenges and what is expected.

3.2 Information Gathering Techniques

Information gathering techniques are defined as procedures of measuring ,collecting and analyzing accurate insights to assist research by the use of standard techniques which are validated (Flick, 2017).The external and internal stakeholders of a firm are the sources of data concerning the proposed system hence certain techniques are used to come up with that data. The functionality of the present system's knowledge was put together like for this instance only through interviews, observations and questionnaires.

3.2.1 Interviews

An interview is referred to as a meeting which comprises of an analyst chatting with someone else so as to assemble intrigue (Wojcicki, 2019).In this case, stakeholders went through structured interviews hence information was obtained in depth of the current system operations and the improved system proposed opinion. Structured interviews were chosen because of their effectiveness. One structured interview can offer the same amount of information which is accurate as four unstructured interviews making a research process not only more accurate, but more efficient. The advantages and disadvantages of structured interviews are as follows:

Advantages

- High response rate as new respondents can be accessed if sample size drops.
- The interviewer is present to explain the question to avoid misinterpretation.
- The questions are standardized and as a result standardized response will be obtained from all respondents faced with the same questions in the same order

Disadvantages

- The interviewer can potentially effect the answers through using tone of voice and body language.
- People may change their answers because of 'social desirability bias' since they don't want to sound bad in front of someone else.

3.2.2 Questionnaires

A questionnaire is an instrument used for research and consists of questions for the purpose of gathering respondents' information (Wolf, Joye ,Smith, 2016). The decision for responding by a defendant are described by open ended surveys. The advantages and disadvantages of the functionality of the current system's comprehensive data was gathered through closed questionnaires which were spread to both the management and employees.

Advantages

- Scalability: questionnaires allows one to gather information from a large audience.
- Comparability: when data has been quantified, it can be used to compare and contrast other research and may be used to measure change.
- Questionnaires can cover every aspect of a topic.

Disadvantages

- Unanswered questions: when using questionnaires, there is a chance that some questions will be ignored or left unanswered.
- Differences in understanding and interpretation: The trouble with not presenting questions to users face-to-face is that each may have different interpretations of questions on the questionnaire.

3.3 Analysis of the Current System

An interior examination of how the present system work is provided by the analysis of the system. The logbooks and work related learning reports are submitted as hard copies to the academic supervisor upon his visit to a student's work place. Upon hearing that an academic supervisor is coming for an assessment visit ,a student may not have been witting his report and logbook and under pressure may just find himself copying and pasting previous student's logbook contents into his and have it signed quickly by his workplace supervisor before the academic supervisor comes in. Sometimes when a student goes for an off-duty or out of the country to conduct work for the organization during the assessment visit period unknowingly .The academic supervisor will come and talk with the student's workplace supervisor, assess the environment and do a survey about what actually takes place in that work environment and leave a message for the student to bring his logbook, report and like for example if a student is from the department of Computer Science he will be supposed to display the system he programmed physically to his academic supervisor in order to solve problems for that organization hence the student will be supposed to seek for an off so that he can travel to MSU to submit the work related learning documents to his academic supervisor and present the system to him hence this is an expense as transport costs in Zimbabwe are now abruptly high. Thus the current system does not inform the actual dates for the student assessment visits.

3.3.1 Description of the current system

Currently the Midlands State University is using a manual system whereby the academic supervisor visits the student's work place to assess the student. Upon arrival at the student's work place, the academic supervisor interacts with the workplace supervisor and carries out an interview with him regarding the student's work conductions. The academic supervisor will then ask the student's work supervisor to fill in an employer's manual which he will take from the work place. He then physically carries out an interview with the student asking him questions like, how is the work environment, what are you learning and are you getting a full appreciation of your area of study in the department. An academic supervisor may then ask a student to do a physical demonstration of some work related activities which he does on a daily basis. After the physical structured interview, he requests the student to produce his logbook and a work related learning report which he has readily. In the event that the student's work related learning documents are not ready, he will be supposed to bring them physically to the university and submit it to his academic supervisor who came for his assessment visit and missed him hence a student will encounter fuel or transport costs which are now high in Zimbabwe and be disturbed of some work related activities he was supposed to carry out..

Inputs

An input is information fed into a data processing system or computer (Chaturvedi, 2017).For a system to function well it should have inputs which are correct and expected to be processed and in the absence of inputs the system will not be able to work. The inputs needed by the MSU work related learning department are:

- Student details
- Company details
- Employer Supervisor's personal details
- Work Related Learning documents
- Student's academic information

Processes

A process is a series of actions which are carried out in order to achieve a particular result (Rajlich, 2016).The processes for the current system include academic supervisor's assessment visit to a student's workplace.

➢ Notifies University
➢ Output

This is the data generated by a computer (Succi, Janes, 2014). After undertaking the processing actions successfully the outputs were:

➢ Feedback to students

3.4 Data Analysis

Data analysis is the process of inspecting, cleaning, transforming, and modeling data with the objective of discovering useful information, arriving at conclusions, and supporting the decision making process (Zhaohao,2019). It is carried out by the use of context diagrams and DFDs. It is very clear that the project team used the above to analyze the system's data movement.

3.5.1 Context Diagram

Context Diagram shows the system under consideration as a single-high-level process and then shows the relationship that the system has with other external entities (systems, organizational groups, external data sources, etc. (Weilkiens ,2016) .It demonstrates constraints and overview of the system at a look including other systems that has an interlink with it.
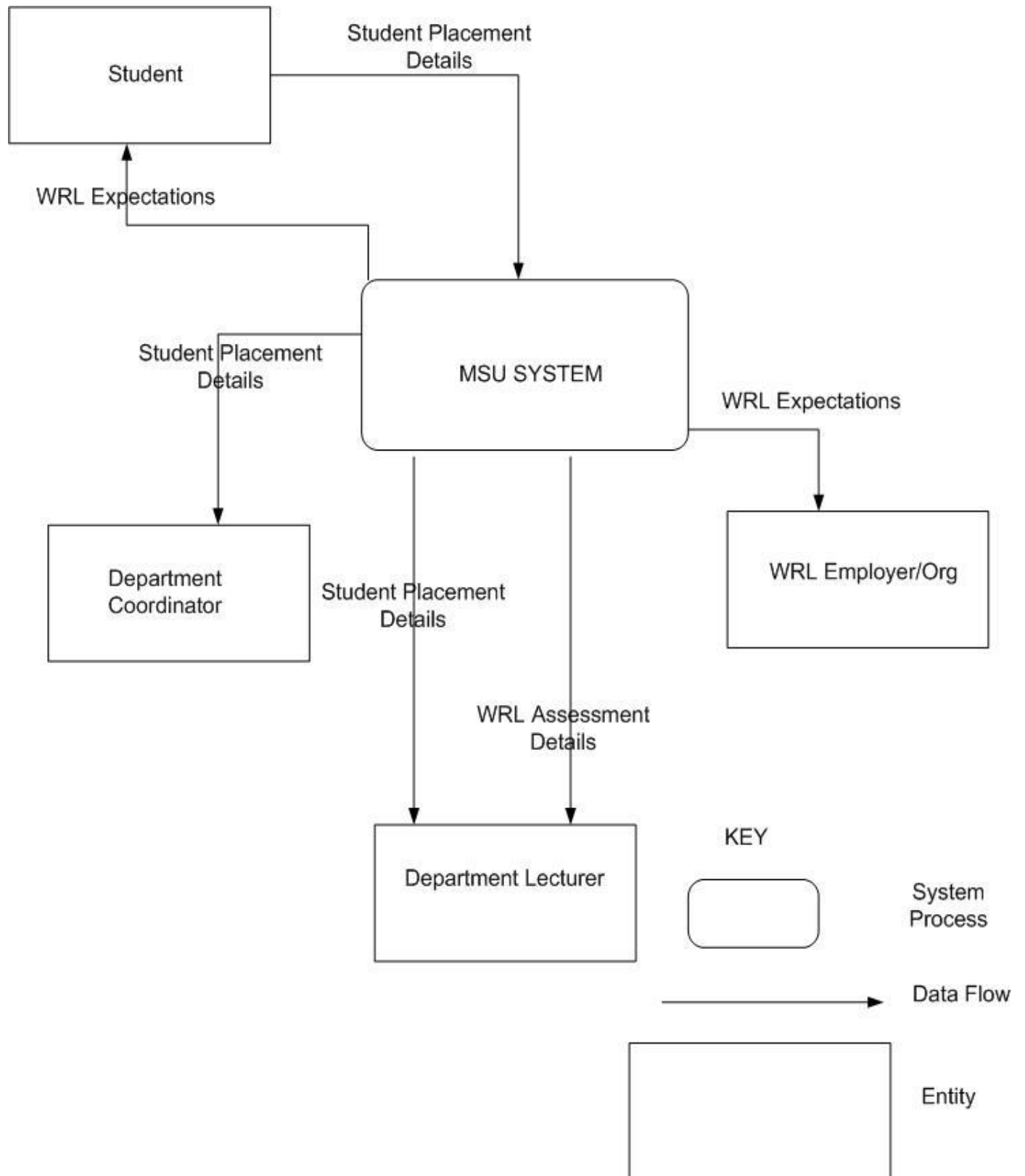
Fig 3. 1 Current System Context Diagram

3.5.2 Data Flow Diagram

Data Flow Diagrams are used to graphically represent the flow of data in a business information system (Rosenblatt, Tilley, 2016) .The dataflow diagram for the current system was created by the project team.
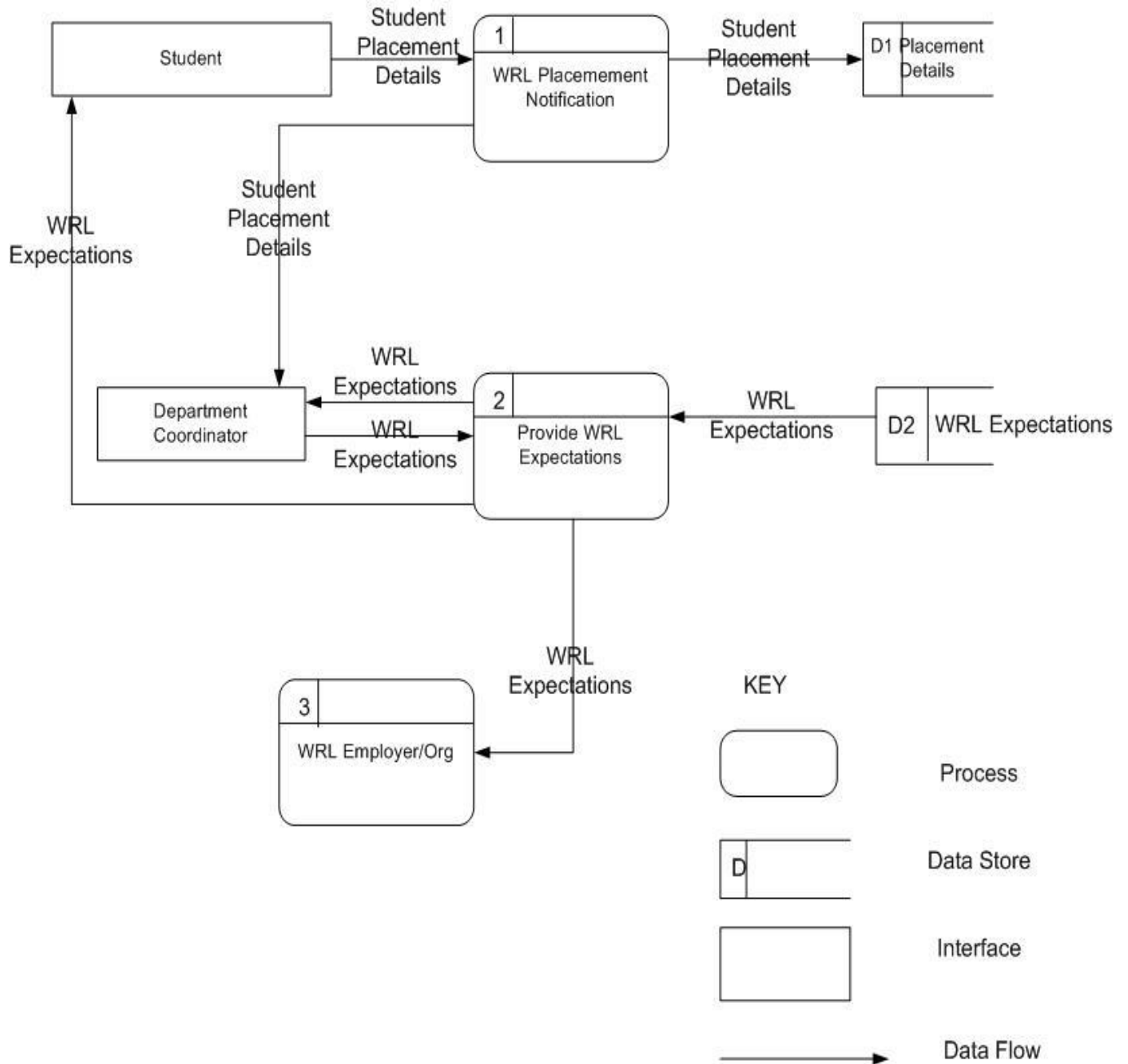
Fig 3. 2 Current System Dataflow diagram

3.6 Weaknesses of Current System

The current system needs an academic supervisor to visit the student on work related learning's workplace for him to communicate with his employee supervisor for the first time which might be a disadvantage for the assessment process as the academic supervisor may be in a hurry to assess many students working for example in a certain city hence he will have limited time to have a conversation with that employee supervisor and assess the student's work related learning environment hence, the full level of technical skill achievement acquired by a student may not be fully understood to some extent by the academic supervisor. Considering the Implementation of the MSU WRL Virtual Assessment System an academic supervisor's visit time should not to be eliminated at all but rather, there should be an ongoing communication between an academic supervisor and an employee supervisor before an assessment visit period for the assessment to be more effective and cut the assessment visit to one from the original two which is being used by the current Work Related Learning Department System. The current Work Related Learning system for MSU does not offer a continuous two way communication between an academic supervisor and an employee supervisor throughout the work related learning period of a student at an organization hence the student's work related learning process is not assessed more effectively.

3.7 Evaluation of the Alternatives

In a consideration of building a new system there are different alternatives which the organization/business can put into consideration basing on present expenses and the required time for that specific alternative. For evaluation three alternatives namely outsourcing, improvement and in-house development were deliberated in order to obtain a most accurate one and the one to be taken must be less costly and not take a long time to create.

3.7.1 Outsourcing

Outsourcing is basically an arrangement made by a business to hire a third party software contractor to do the software related work that could have been done in-house (Samantha, 2019). The development of a new system is achieved by holding onto giving a contract to an external firm/professionals to help.

Advantages

- Makes it possible to access highly knowledgeable experts who may not be available within a firm.
- Bringing the system into operation will not take a long time.
- System alterations can be done on the request license of a user and then cost of maintenance fees will be paid.

Disadvantages

- On a firm, outsourcing may fail to solve problems identified.
- Indirect costs are experienced in using outsourcing as compared to in-house system development.
- Custom databases are difficult to link with a general purpose software.
- Information systems function control can be lost.

3.7.2 Improvement

Improvement is an act or process of improving something that enhances value or excellence (Bird,Menzies,Zimmermann, 2015).Improvements may need to consult additional workforce and lengthen some processes in order for the stated goals to be achieved. However by creating a computerized tutoring system present problems identified can be solved effectively.

Advantages

- Due to being used to the system, it is easier for users of the system to use it.
- Time for the firm and reduction of expenses is achieved through system improvement.
- Changes made to the system have a little probability of happening.

Disadvantages

- In a long run most challenges will rise.
- Increased costs for the firm due to some firm's processes, activities and members of staff are a result of upgrading.

3.7.3 In House Development

The user and firm's organizational requirements are met superlatively when experts work together with users of the system and some of the members of staff within a firm. Midlands State University has adopted this method.

Advantages

- Since the group of developers are within a firm, a reduction of costs is achieved.
- The skills and developer's knowledgebase progress is achieved.
- A faster and easier development is achieved from an extreme sustenance from professionals of IT.

Disadvantages

- Delivering a functioning system in an estimated time may take a longer time.
- If the system does not work as per the requirement a risk loss will be encountered.

3.7.4 Alternative Selection

Considering all the alternatives stated above, an impression of being the most appropriate technique is provided by in-house development since there is evidence that it will overwhelm the current problems.

3.8.1 Functional Requirements

According to Mall (2009) the functional requirement part has to discuss the functionalities required from the system. Each function of the system can be considered as a transformation of a set of input data to the set of corresponding output data through the system processes. It simply focuses on the inputs to the system, its processes and finally the outputs and thus highlighting what the system is capable of doing. This researcher has identified the following functional requirements for the MSU WRL Virtual Assessment System;

- The system must be able to create a register of users.
- It should enable the capturing, storage of records.
- The system should also facilitate records and making of queries.

- **Use Case Diagram for the current system**

A Use Case Diagram is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved (Sadakath, 2018).It is a collection of relations amongst entities and the system under a deliberation where a common situation is a demonstration of a use case, and signifies a certain route through the use case. The use case diagram below signifies various scenarios:

Fig 3. 3 Use Case Diagram

Key

☐ (rectangle)	System boundary
⬭ Use (ellipse)	Offers an overview about how the system will interact with system
───────── (line)	Communication between use case and actor
🧍 (stick figure)	Actor
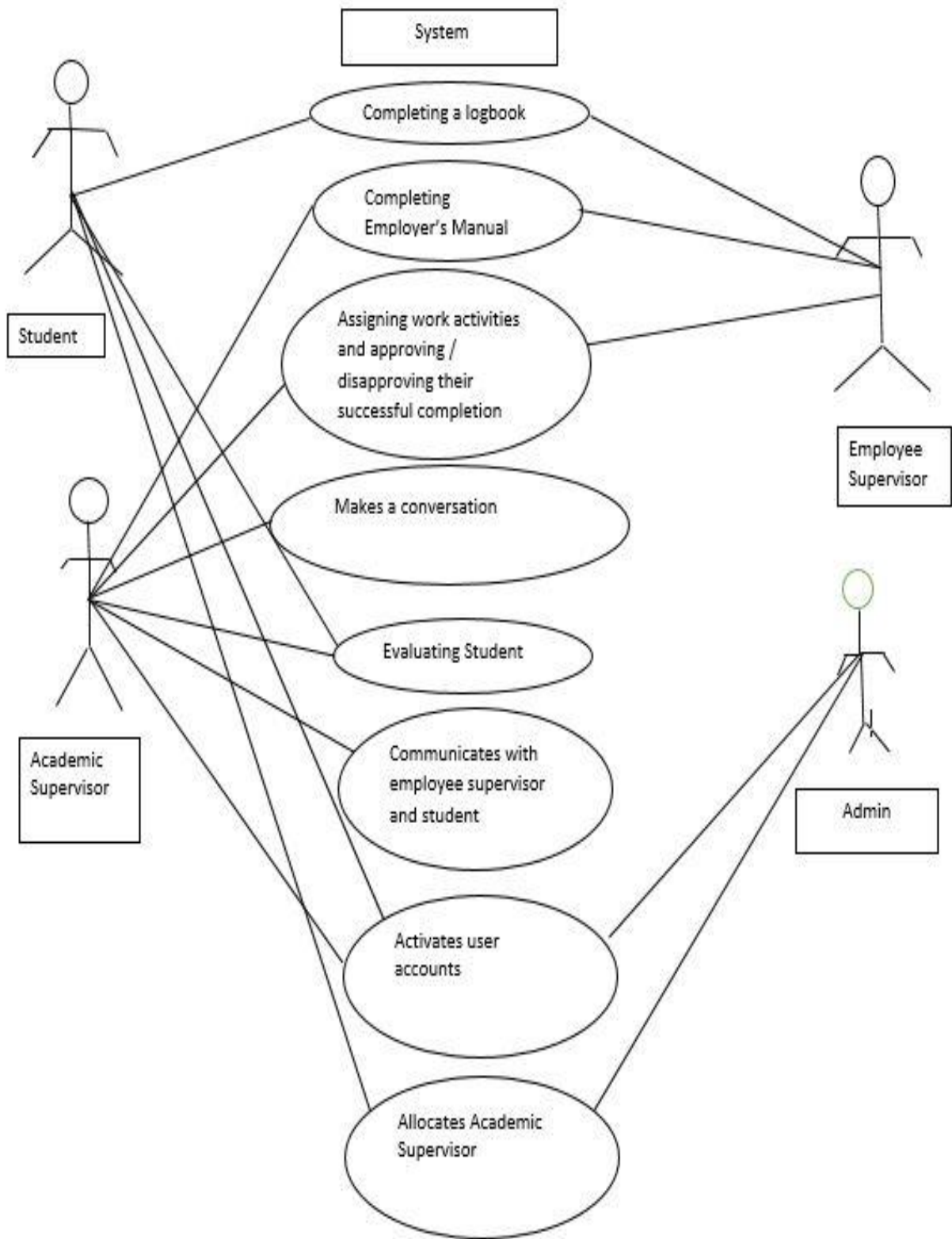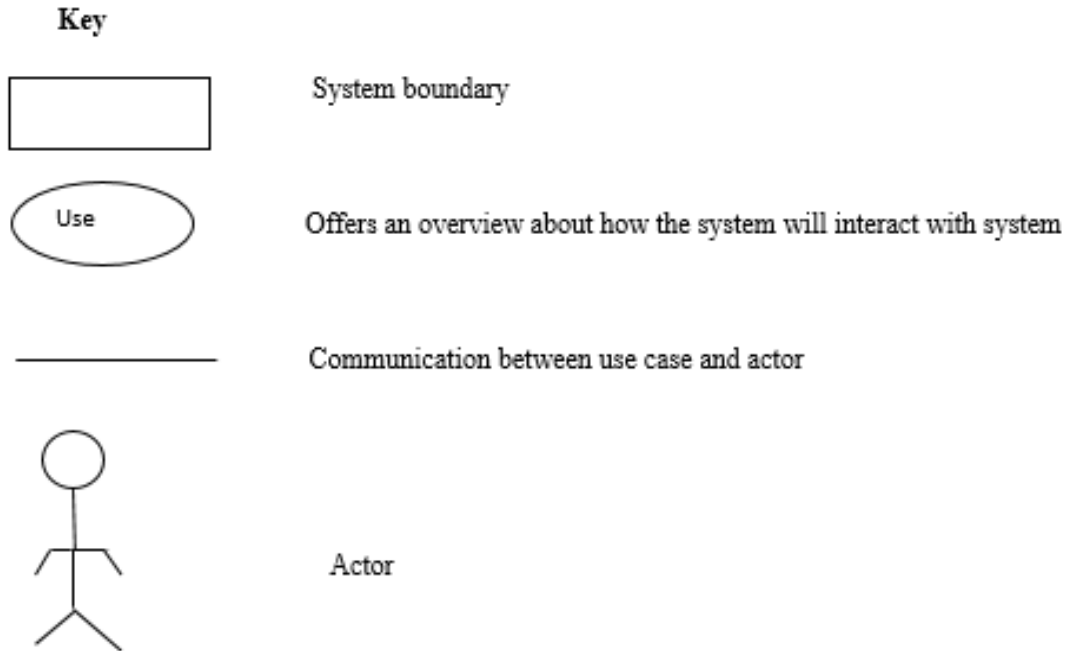
3.8.2 Non-functional Requirements

Non-functional requirements define system attributes such as security, reliability, performance, maintainability, scalability, and usability (Paradkar, 2017). They act as a standard of how a function ought to be delivered. The qualities below are acquired from the new system.

a)Interface which is user-friendly

- Learning and using the system is easy.
- Contains an exciting and coherent user interface.

b) Security Issues

System Security is ensured through:

- Creating different access to different system users.
- Secret codes' authentication is acquired.
- Making sure that passwords covers a minimum space of 8 characters.

3.9 Conclusion

A clear picture of how the present system works is revealed by the analysis phase. Techniques of gathering data were used to acquire information about the present system. A process of evaluating alternatives was also carried out hence, a developer made up his mind to create a new system since it was seen to be the best among all other alternatives. A next chapter of designing was moved onto by the researcher.

CHAPTER FOUR: DESIGN PHASE

4.1 Introduction

The architectural design is mainly emphasized in this phase, the design of the interface as well as the design of the database of the proposed system. The system functionality is clearly explained in this chapter. This system's design must be trustworthy, and be able to be maintain and fulfilling the user requirements. Data flow diagram, context diagram and entity relational diagram will also be put into consideration in this chapter.

4.2 System Design

Haldar (2015) defines system design as a process of designing the elements of a system such as the architecture, modules and components, the different interfaces of those components and the data that goes through the system. The system which is proposed will have the following non-functional features:

- User friendly-The system should offer a way which is friendly to the user and easy to learn thus decreasing the consultation of the user in using the system which is new.
- Maintainability-Because of the changes in technology, this system should offer a room for improvements.
- Compatibility-Any operating system should be able to facilitate the functioning of this new system hence it should fit in any machine.
- Flexibility-Modification surface area by the system user must be enabled by the new system like for instance update, add and delete.
- Security-The system must not allow any unauthorized personals to access it and obtaining authentication on usage of secret codes.

4.2.1 Context Diagram

A context diagram, is a critical instrument in the functional modelling of the proposed system boundaries. It reflects how the system interacts with the external environment (Health, 2016). The diagram below is a context diagram for the new system depicting the communication among several entities like students, lectures and employee supervisor and the actual system as well as

their relationships.
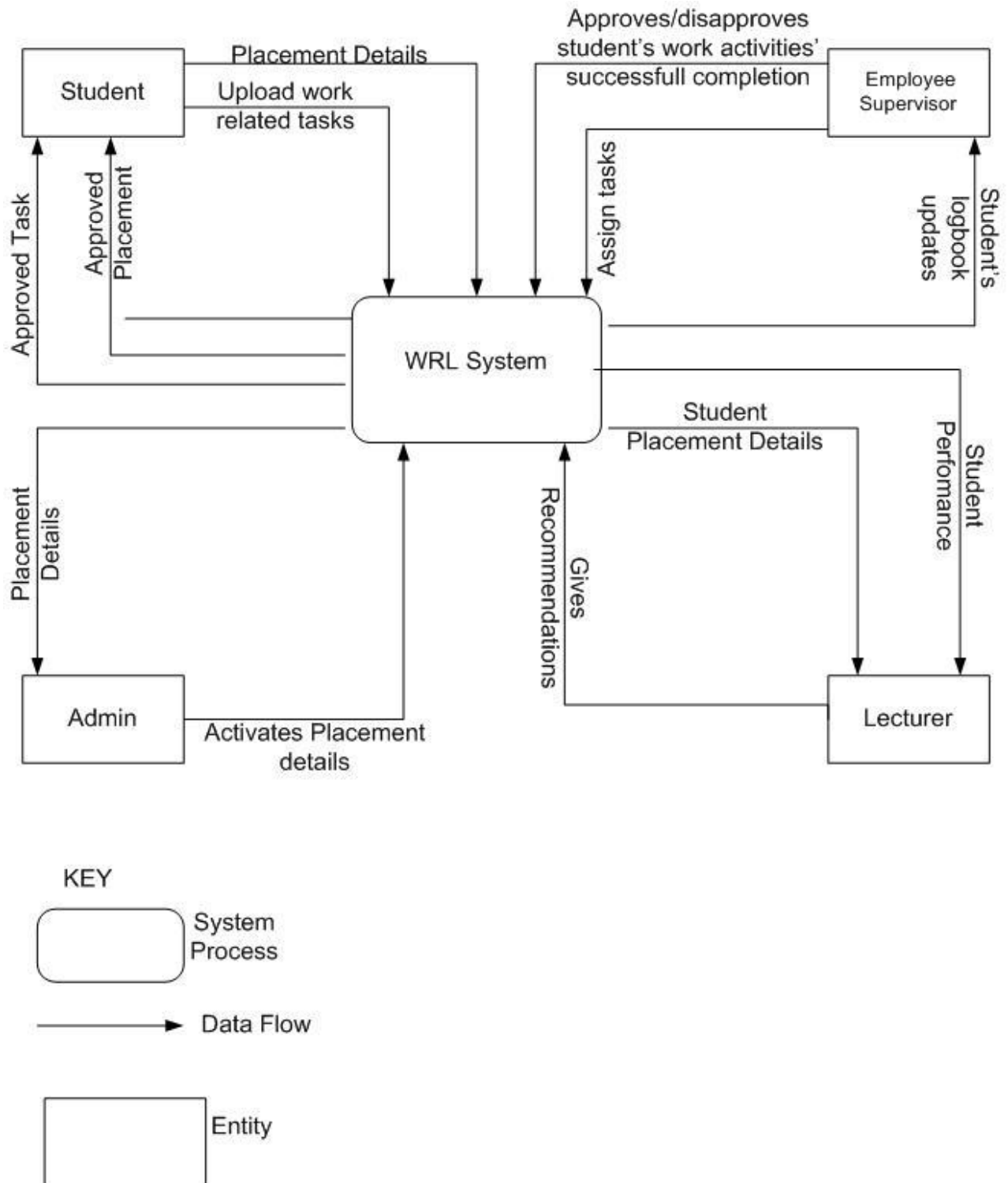
Fig 4. 1 Context diagram

4.2.2 Data flow diagram

According to Dennis (2019) a data flow diagram illustrates a pictorial view for the movement of data in a system depicting all its processes .A number of tools including entity, data stores, processes and data flow to show the activities clearly. Below is a dataflow diagram for the current system.
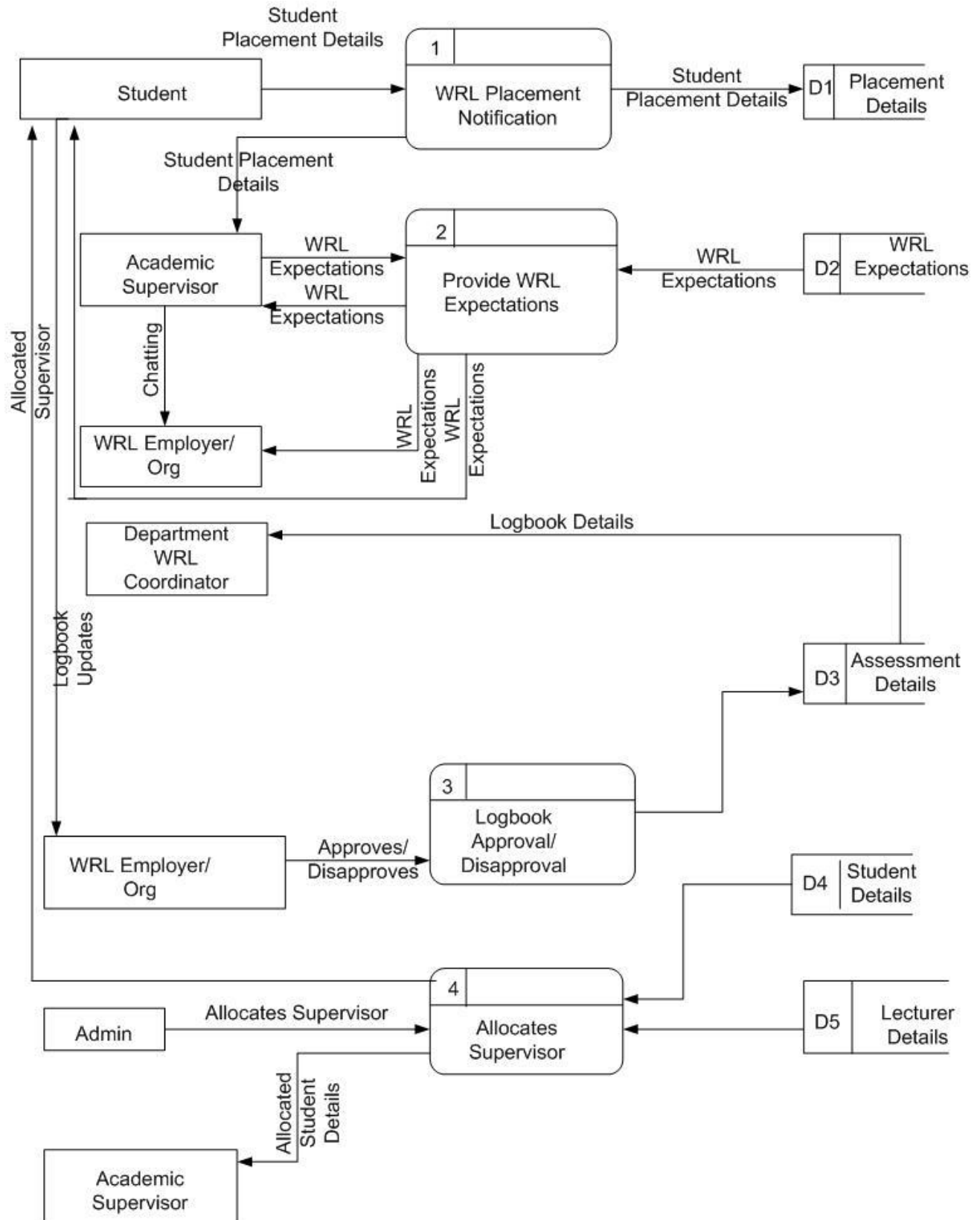
Fig 4. 2 Dataflow Diagram

4.3 Architectural Design

Architectural design is a process of defining a collection of hardware and software components and their interfaces to establish the framework for the development of a computer system (Zoya,2016).The interfaces of the new system will include reporting, requesting, posting, vacant application and the server will handle the management of data which includes data storage and anomalies. The server of the database will then process the functions of the system and give feedback to the students through the interaction of the server. Below is the architectural diagram for the current system.
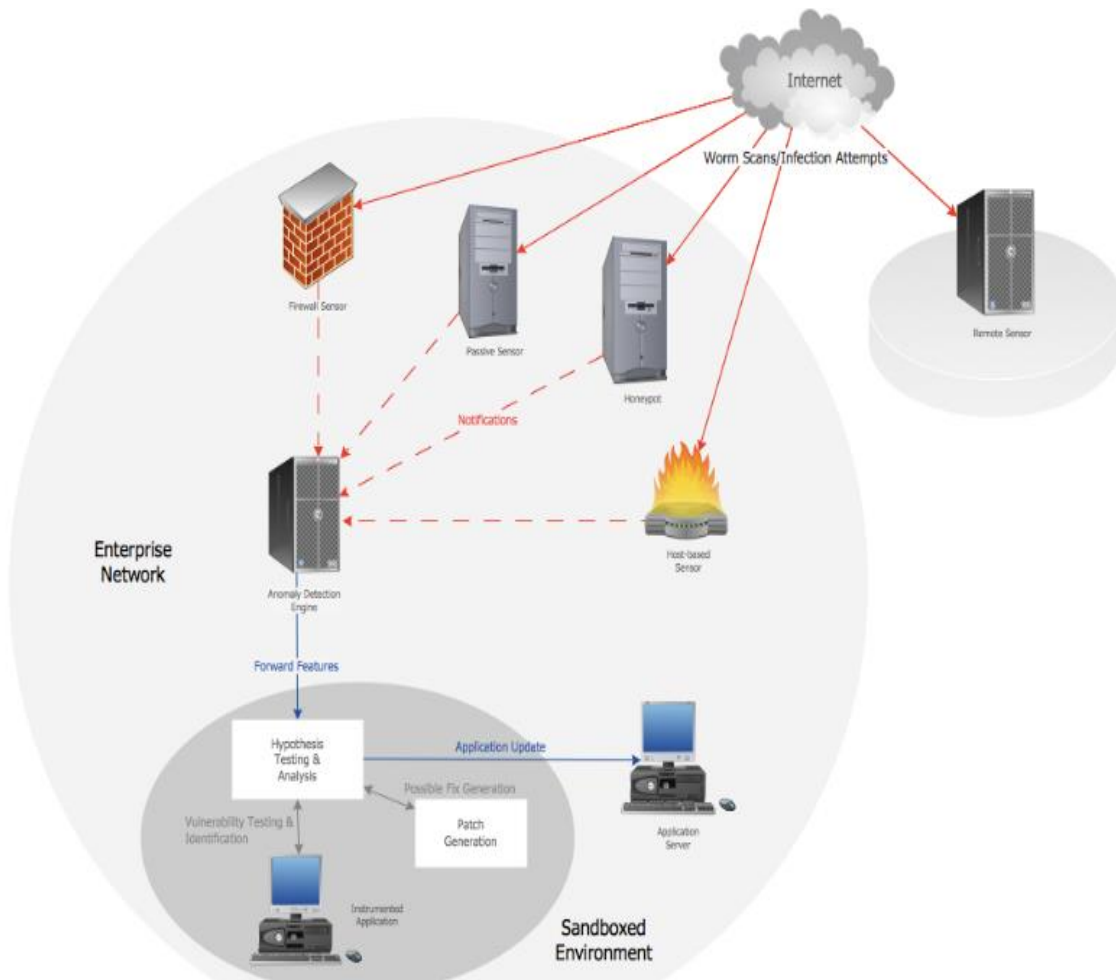
Fig 4. 3 Architectural Design of the proposed system

4.4 Physical Design

The physical design is a graphical representation of a system showing the system's internal and external entities, and the flows of data into and out of these entities (Mahfuj, 2012). The members of the MSU Work Related Learning department will use Internet to access the new system using their mobile devices and computers to communicate. In order to produce the desired output, the system inputs, processes and output needs to be investigated. The diagram below shows the physical design of the new system.

4.5 Database Design (ER or Tables and EER diagram)

Database Design is a collection of processes that facilitate the designing, development, implementation and maintenance of enterprise data management systems (Morris, Coronel, 2019) .The two level techniques used to develop a database are data level design and physical level design. Data level design is the one in which the requirements of the user are initially recognized before database design in contrast physical level design deals with the transformation of data level design to the management system of a certain database which is used in the system application. The architecture that will be used for the database development for the new system is called ANSI SPARC .A proper design of a database should provide the following:

- Data Consistency
- Minimal data redundancy
- Data Integrity
- Efficient data integrity support and data recovery

4.5.1 The ANSI-SPARC: The three level architecture

The ANSI SPARC architecture is a three layer architecture which defines how the data is to be structured, and how the SQL operations to be carried out (Hauck, 2018).
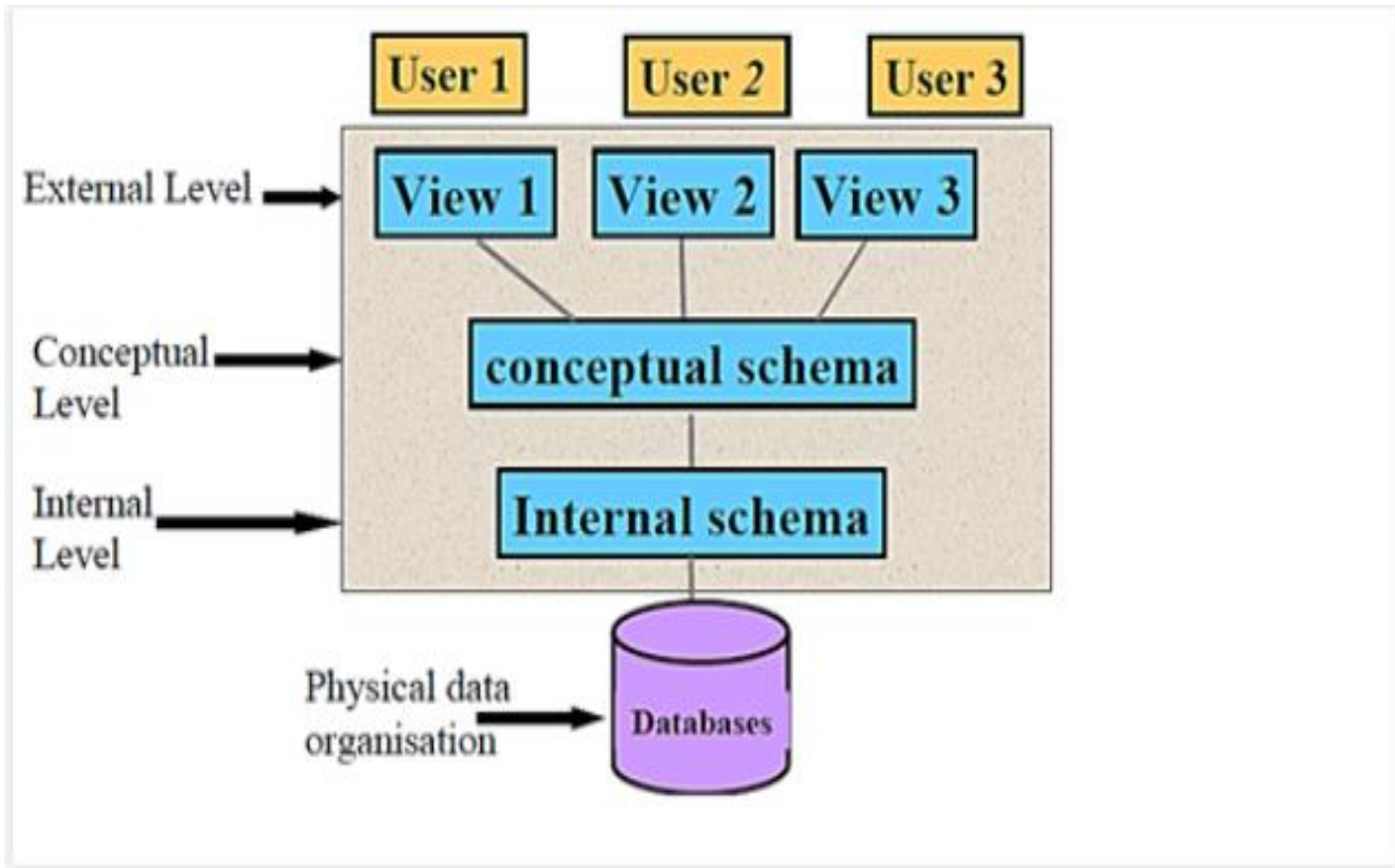
Fig 4. 4 Ansi-Sparc model

Internal Level

Internal level is the physical representation of the database on the computer (Beyer, Jones, Petoff, 2016) .Record placement is also its point of concern as well as the encryption of data, storage allocation and forms description. Under the internal level is the physical level which is managed by the operating system under the directives of the DBMS. In MySQL database for the MSU Virtual Assessment System, the database was physically represented and the captured passwords upon users' registration are encrypted automatically into the respective tables in the MySQL database on a computer for example a student's username, other details and his password upon registering are automatically sent to the students table in the database with the passwords encrypted by the management of the operating system under the directives of the DBMS.

Conceptual level

The middle level in the three level architecture is the conceptual level (Beyer, Jones, Petoff, 2016). Each external view is supported in that any data present to a user must be delivered easily from the conceptual level.

External level

External level describes that part of the database that is relevant to each user (Beyer, Jones, Petoff, 2016).The user's view of the database is represented by this level as it describes that portion of the database important to a particular user. Different representations of the same data may be provided by this level. For example in the MSU WRL Virtual Assessment System at this level was used whereby there are portions like the admins and students' tables in the database created which are important to the Systems Administrator and Students' login authorization.

4.5.2 The Tables and their Attributes

Tables can be defined as a format that is structured within a database that hold related information. It involves column and rows. Several tables will be used to display how the relational database will function like. The tables below include student details tables:

Table 4. 1 Login Table for Registered Student:-

Field Name	Data Type	Key Attribute
Regnumber	varchar(50)	Foreign Key
Password	varchar(50)	Not Null

Table 4. 2 Login Table for Registered Employee Supervisor:-

Field Name	Data Type	Key Attribute
Email address	varchar(50)	Foreign Key
Password	varchar(50)	Not Null

Table 4. 3 Login Table for a Registered Academic Supervisor:-

Field Name	Data Type	Key Attribute
EC Number	varchar(50)	Foreign Key
Password	varchar(50)	Not Null

Table 4. 4 Student Details Table

Field	Data type	Key Attribute
Name	Varchar (45)	Not Null
Surname	String (35)	Not Null
Program	String (35)	Not Null
Department	String (35)	Not Null
Email	Varchar (35)	Not Null
Reg number	Varchar (8)	Primary Key
Password	Varchar (25)	Not Null

Table 4. 5 Employee Supervisor table

Field	Data type	Key Attribute
Name and surname	Varchar (25)	Not Null
Email address	Varchar (25)	Foreign Key
Id number	Varchar (20)	Primary Key
Organization Name	Varchar (10)	Not Null
City	Varchar (15)	Not Null
Password	Varchar (25)	Not Null

Table 4. 6 Table Academic Supervisor Table

Field	Data type	Key Attribute
Name	Varchar (25)	Not Null
Email	Varchar (25)	Not Null
Ec number	Varchar (25)	Foreign Key
Programme Code	Varchar (20)	Foreign Key
Programme Name	Varchar (20)	Foreign Key
Password	Varchar (25)	Not Null

Entity Relationship Diagram

An entity relationship diagram (ERD) shows the relationships of entity sets stored in a data base (Heath, 2016). Generally, ER diagram is a way for data processed that shows the relationship between different objects that makes up the complete system. Below is the entity relationship diagram for the current system.
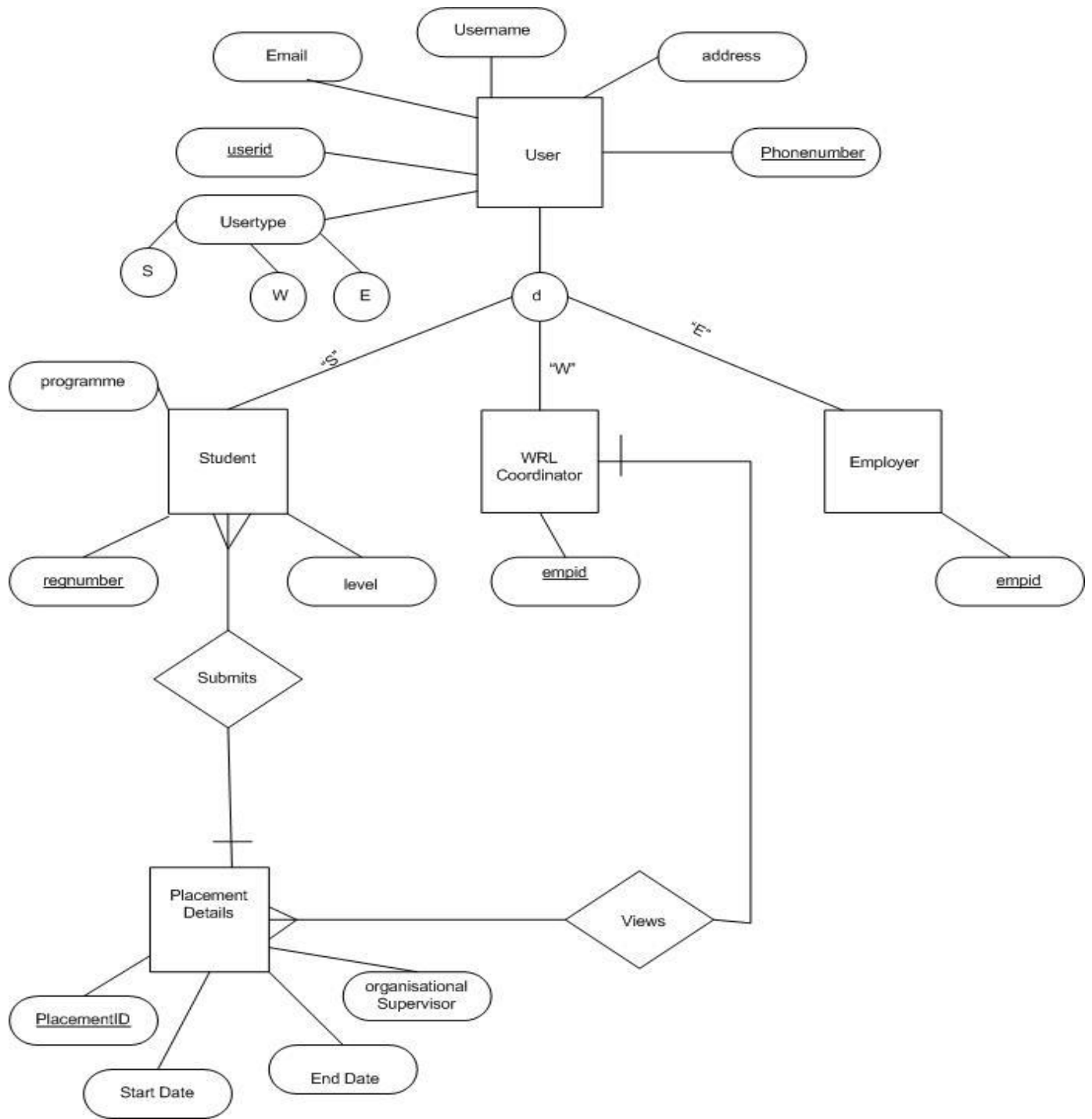
Fig 4. 5 Entity Relationship Diagram

4.6 Program Design

Program design is the process that an organization uses to develop a program. It is most often an iterative process involving research, consultation, initial design, testing and redesign (Doyle,2015).It also refers to a way for designing and documenting methods and procedures in software and it ensures that code is understood, organized and integrated (Smith,2007).The following tools or diagrams will illustrate the program design:

- Sequence diagram
- Class diagram
- Package diagram

4.6.1 Package diagram

A package diagram is a unified modelling language diagram that is composed of packages and the relations between them (Knapp, Zeratsky, Kowitz,2016). Below are the logical relationships amongst packages.
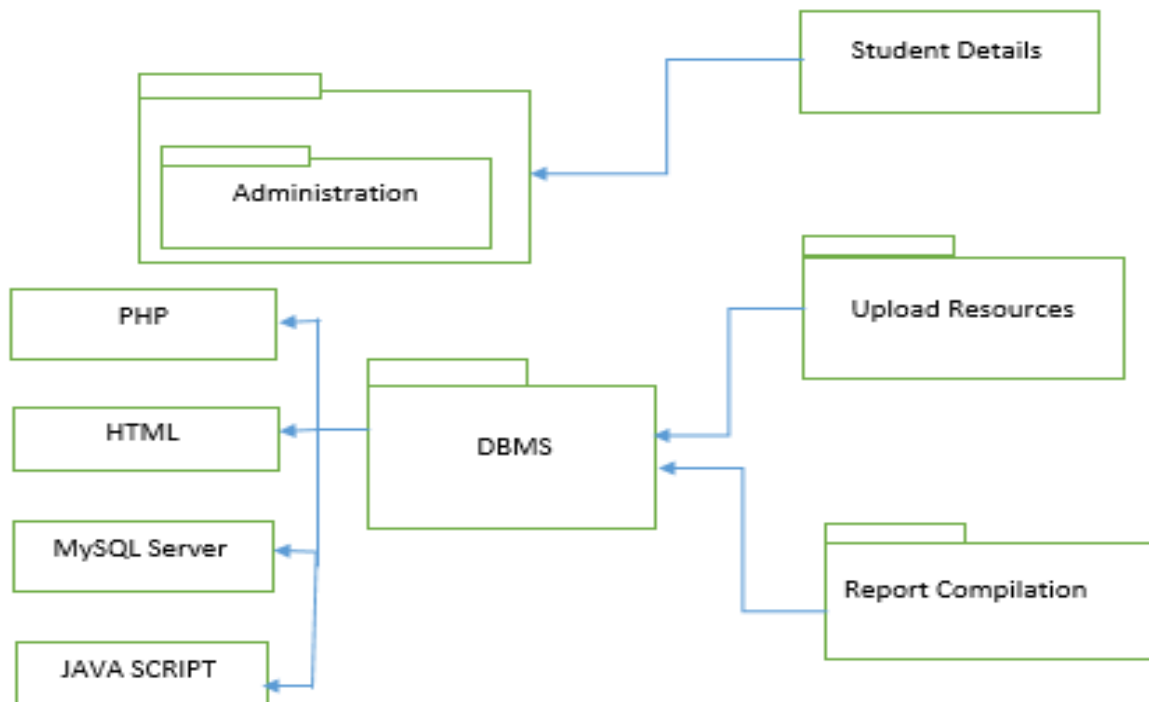
Fig 4. 6 Package Design

4.6.2 Class Diagram

Class diagram is a type of static structure diagram that describe the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects (Rumpe, 2016). The class diagram below represents a new system.
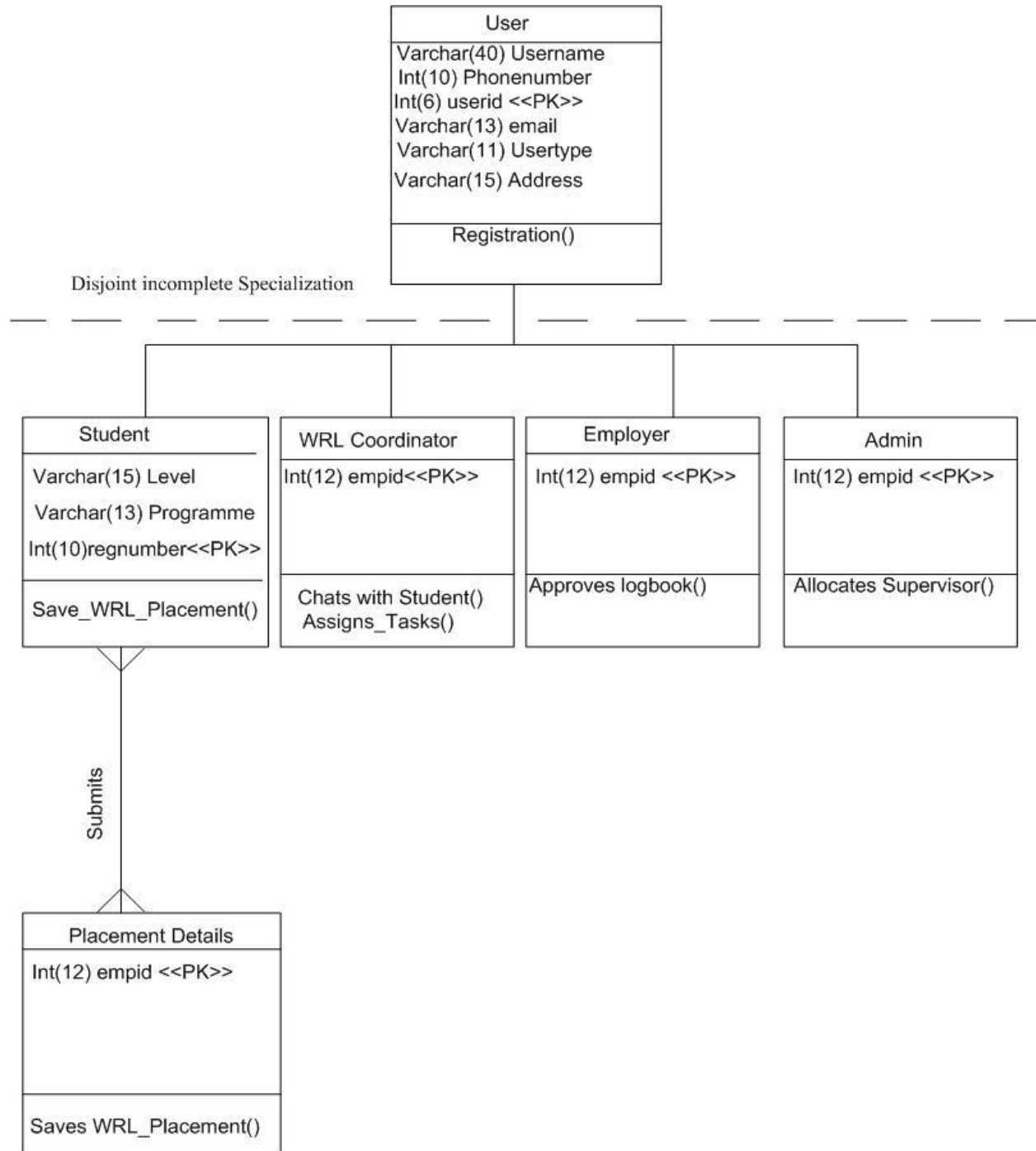
Fig 4. 7 Class Diagram

4.6.3 Sequence diagram

A sequence diagram simply depicts interaction between objects in a sequential order i.e. the order in which these interactions take place (Rumpe, 2016).Sequence diagram displays object interactions arranged in time sequence and it also depicts the objects needed to carry out the functionality of the scenario. It is sometimes called event diagram. Below is a sequence diagram for the new system.
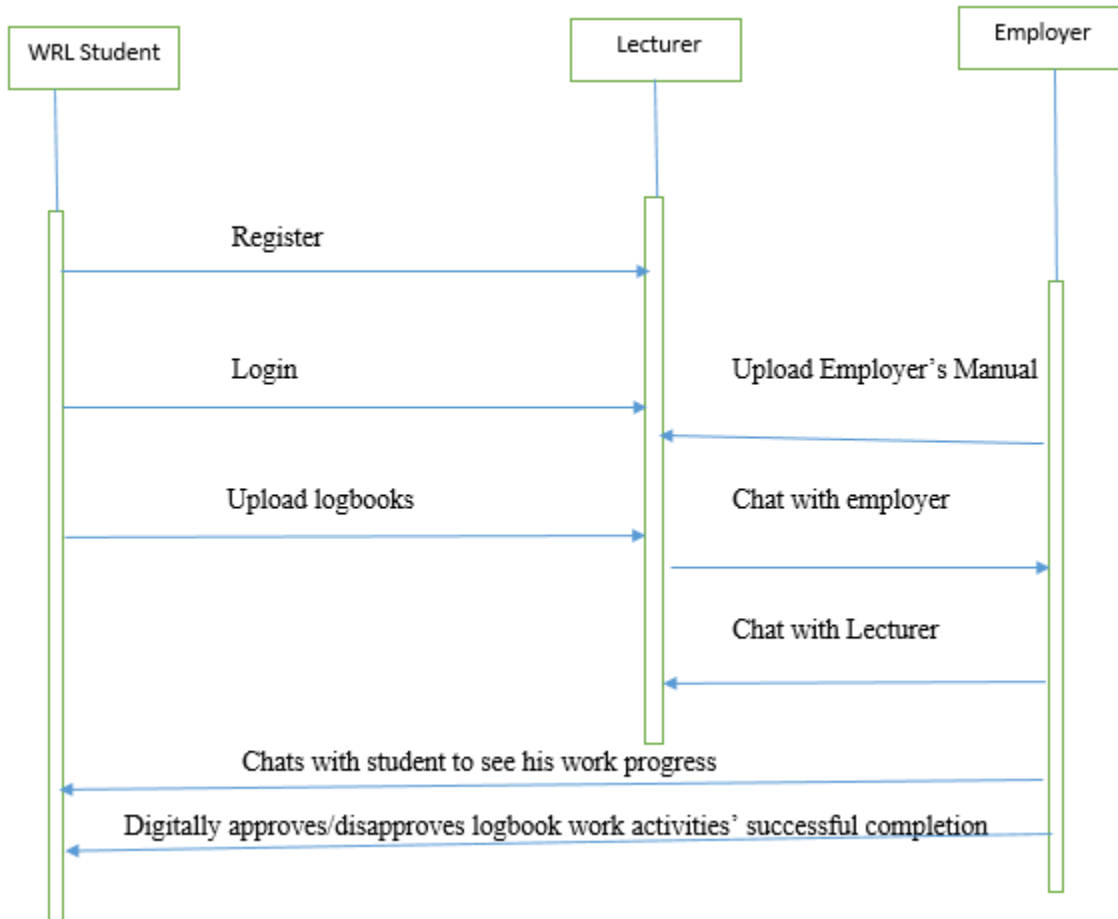
Fig 4. 8 Sequence Diagram

4.7 Interface design

User interface design (UI design) refers to the design of various types of software and hardware interfaces through which users interact with computers and other technologies .Interface design is an activity that focuses on designing ways that makes it possible for communication and the

system components interaction (Krishna, 2015).The new system was designed in such a way that will make it easier for a user to interact with the proposed system and was also designed to decrease the amount of time trying to get how to access the provided service by the system and able to accomplish the goal within a short period of time. The diagram below is an illustration of the desired user interface design.

	MSU WRL Virtual Assessment System		HOME	ABOUT	LOGIN

WELCOME TO THE MSU WRL VIRTUAL ASSESSMENT SYSTEM

Fig 4. 9 User Interface Design

4.7.1 Menu design

A menu is a graphical control element used in graphical user interfaces (Jackson, 2017)**.**A desired system will have a main interface which controls and co-ordinates the complete system as all main activities should be carried out within this page. Before activities are accessed an individual has to access the system by entering important requirements details for example valid registration number and password.

4.7.2 Input Design

Input design is the link between the information system and the user (Deliyannis,Sun,Fidler ,2019). In particular, it is a process of changing a user oriented description of the input into a system which is computer based. The goal of designing a form of input is to make it easier for data entry and to be error free. Below are the input design forms for the MSU WRL Virtual assessment system.

Fig 4. 10 Student Registration form

	Login	Register

Reg Number

Password

☐ Remember me

Login   Forgot Password?

Fig 4. 11 Student login interface

Fig 4. 12 Employee Registration Interface

Home	Login	Register

Employee Supervisor login

Email Address

Password

☐   Remember me

| Login |

Forgot your
password?

Fig 4. 13 Employee Supervisor login interface

Fig 4. 14 Academic Supervisor Registration Interface

Fig 4. 15 Academic Supervisor login Interface

This is the main menu for Students on Work Related Learning after logging into the MSU WRL Virtual Assessment System
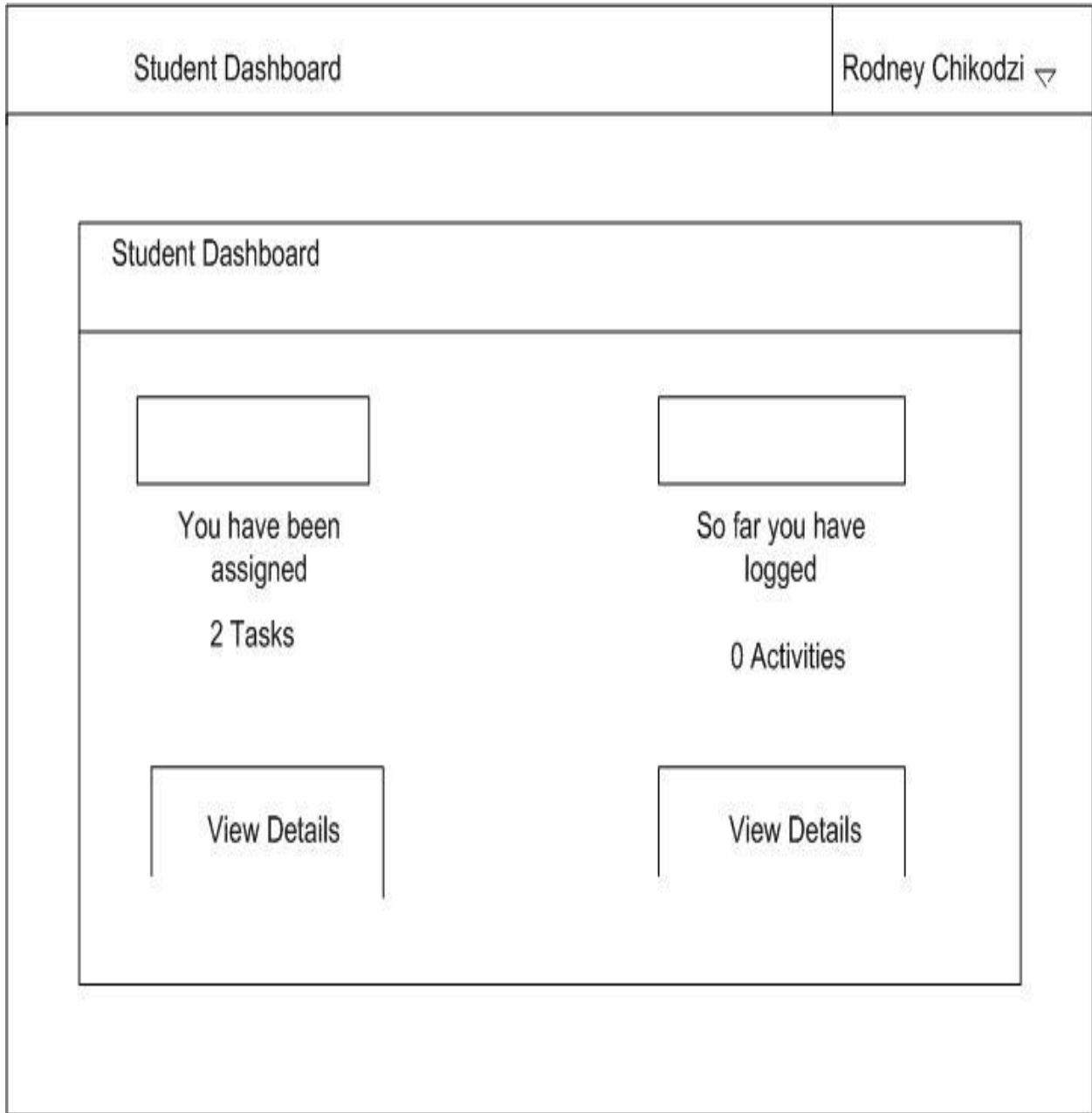
Fig 4. 16 WRL Student menu Interface

Below is the main menu for an Employee Supervisor's Interface to log into the MSU WRL Virtual Assessment System.

Home	Login	Register

Employee Supervisor login

Email Address

Password

☐ Remember me

Login   Forgot your password?

Fig 4. 17 Employee Supervisor Interface

Employee Supervisor Dashboard	Intern Daily Activities ▽	Assigned	Current Interns	EthelChikodzi ▽

Current Interns => Organisation : Hippo Valley - Triangle

Fig 4. 18 employee supervisor menu

Above is the main menu for the employee supervising the student after logging into the MSU WRL Virtual Assessment System.

4.7.3 Output Design

During output design, developers identify the type of outputs needed, and consider the necessary output controls and prototype report layouts (Deliyannis,Yichuang,Fidler, 2019).Output design is the process of presenting data to the user that is after it has gone through all the processes and is now a final output product. The output data will be in report and will be viewed based on the user access rights. The reports to be produced should be relevant, simple and easy to access.

The figure below shows a Student report

WRL Student Report							
Name	Surname	E-Mail Address	Reg Number	Programme Name	Programme Code	Organisation Name	City
(value)	(value)	(value)	(value)	(value)	(value)	(value)	(value)

Fig 4. 19 Registered WRL Student Report

The figure below shows a Registered Employer's report:

Registered Employee Supervisor Report				
Name	E-Mail Address	ID Number	Organisation Name	City
(value)	(value)	(value)	(value)	(value)

Fig 4. 20 Registered Employee Supervisor's Report

The figure below shows a Registered Lecturer's report:

Registered Employer Report				
Name	E-Mail Address	EC Number	Programme Code	Programme Name
(value)	(value)	(value)	(value)	(value)

Fig 4. 21 Registered Lecturer's Report

4.8 Pseudo Code

Pseudo code is a detailed yet readable description of what a computer program or algorithm must do, expressed in a formally-styled natural language rather than in programming language (Rouse, 2019)**.** It assists users to know the additional parts that leads to the construction of the system which is proposed. The code snippet below displays the phase of code used by the programmer during the system development.

Create Account

IF

USER is new

Then show

You have successfully registered

Else

User already exist

End

Login

Enter registration and password

    If correct then

      Proceed to the main interface

Else

    Please insert correct details

End if

End

Connecting to Database

Check if connection has been made

    If invalid yet set then

      Set the connection

Else

  Using the established connection, save details

ENTERING A NEW STUDENT

Validate all the information

    If invalid input is entered

      Report error

Else

Using the established connection save the details

UPDATING DATA IN THE DATABASE

Get the key fields

Check if record does exist

If not then

*   Report error*

Else

*   Validate all the information*

If some of the input is invalid

*   Report error*

Else

*   Using the established connection, save record*

4.9 Security Design

Security by design is an approach to software and hardware development that seeks to make systems as free of vulnerabilities and impervious to attack as possible through such measures as continuous testing, authentication safeguards and adherence to best programming practices (Sur-Kolay,Ray,Bhunia,2017)**.** Security design is a protocol used in software and hardware development that targets to keep a system safe from vulnerabilities and impervious to attack as possible through actions like continuous testing, authentication safeguards and sticking to the best programming languages.

4.9.1 Physical Security

Physical security is the protection of personal, hardware, software, networks and data from agency or institution (Fairley, 2019). For firm to safeguard their system from the above risks, the following procedures can be used. Physical access controls which can be obtained in several ways which include a system's electronic key, conventional key and electronic combination lock. Physical security protection which adapts onto two forms that is physical barrier such as security monitors, doors which locked, protocols and backups will be used and a separate server will store the information and in the cloud.

4.9.2 Network Security

Network security is any activity designed to protect the usability and integrity of your network and data (Papadimitratos, Camenisch, 2018)**.** Network security involves the safeguarding of data during information exchange or data exchange .It also involves a process of physical and software measures which are preventive to protect the infrastructure of the network from unauthorized access. Procedures which can be implemented to protect the network include, data encryption, antivirus usage, detection of malware and firewalls to safeguard the server.

4.9.3 Operational Security

Operational security (OPSEC) also known as procedural security, is a risk management process that encourages managers to view operations from the perspective of an adversary in order to protect sensitive information from falling into the wrong hands (Alberto, Alzate,2017).

4.10 Conclusion

The phase assisted the developing team with an insight on how the system should look like and how it should function .The inputting, outputting and processing of the proposed system have been designed with care so that the interface of the user will easily be used and functionally efficient meeting the requirements of the user and objectives of the system and objectives of the system. The developing team was equipped for the implementation stage.

CHAPTER FIVE: IMPLEMENTATION PHASE

5.1 Introduction

At this stage, the system which was created and a database was set up in the surrounding production and hence tests were performed to ensure that the system worked and could be of use in a University environment safely. After the system testing process and approval by the users, the system was assembled to help the University functions it was created for. System users and operators' training was involved in this phase. Set up of computer hardware, installment of software onto computer systems was also done

5.2 Coding

Coding is basically the computer language used to develop apps, websites and software (Andress, 2016).PHP, HTML, JavaScript and CSS were used by the developers as the instruments that will be utilized in the source code improvement.

5.3 TESTING

Software testing is a process, to evaluate the functionality of a software application with an intent to find whether the developed software meet the specified requirements or not and to identify the defects to ensure that the product is defect free inorder to produce the quality product (Winkler,Biffi&Bergsmann,2015).

Black-box testing

It is also called as Behavioral/Specification-Based/Input-Output Testing. Black Box Testing is a software testing method in which testers evaluate the functionality of the software under test without looking at the internal code structure (Audet, Hare, 2017).

BLACK BOX TESTING APPROACH
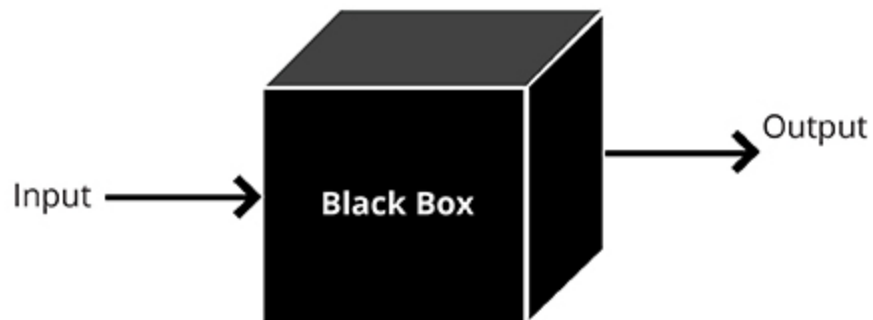
Fig 5. 1 Black Box Testing Diagram

Structural Testing

Structural testing is the testing of the structure of the system or component .Structural testing is often referred to as 'white box testing' because in structural testing we are interested in what is happening inside the system/application (Black, 2016).
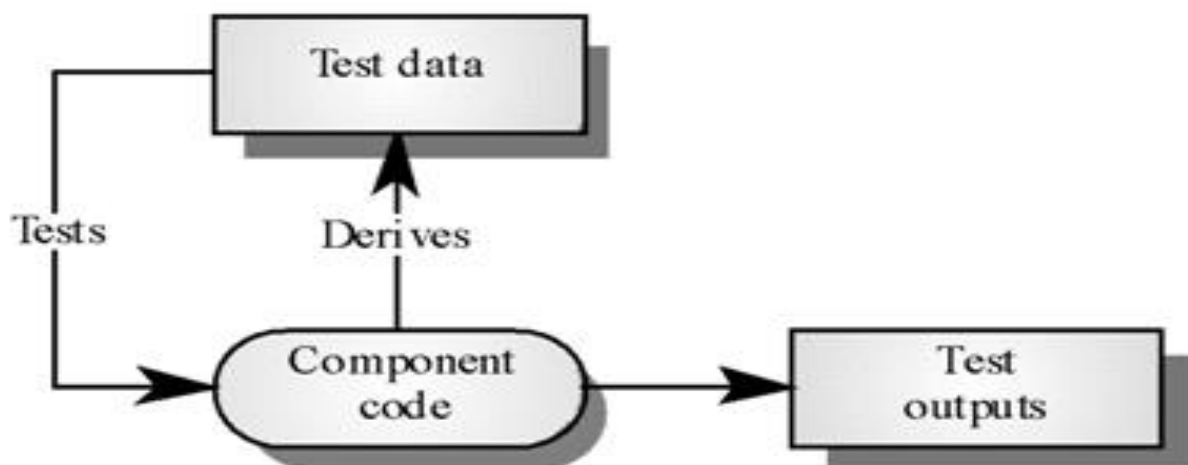
Fig 5. 2 Structural Testing Diagram

5.3.1 Unit Testing

Unit testing is a software development process in which the smallest testable parts of an application, called units, are individually and independently scrutinized for proper operation (Dooley, 2017).It is further clarified that this testing is done during the development process by the software developers .The main aim of unit testing is to separate written code to check and determine if it works as expected.
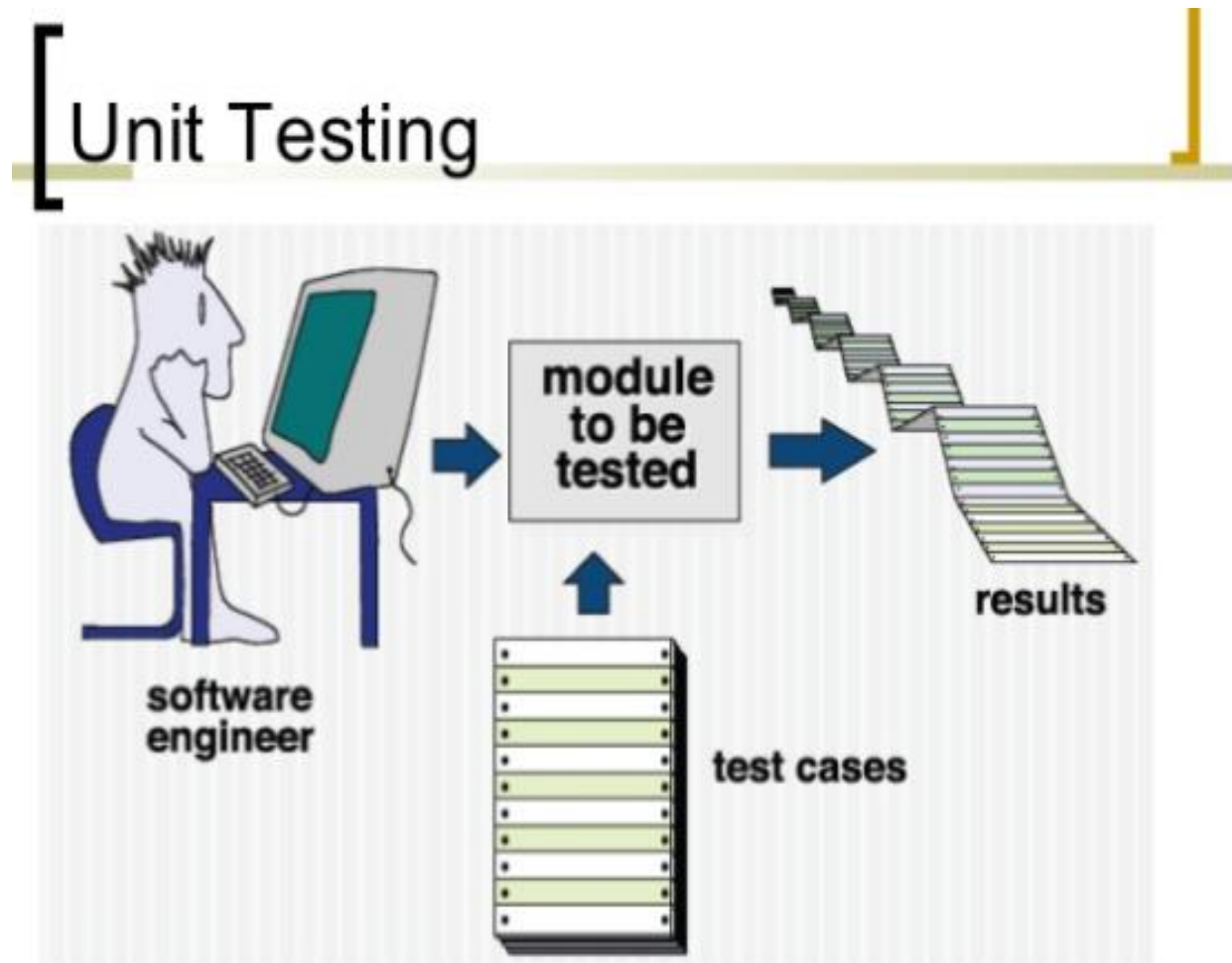
Fig 5. 3 Unit Testing Diagram

5.3.2 Integration Testing

Integration testing is a level of software testing where an individual units are combined and tested as a group. The purpose of this level of testing is to expose faults in the interaction between units. Test drivers and test stubs are used to assist in Integration Testing (Rajib, 2018).
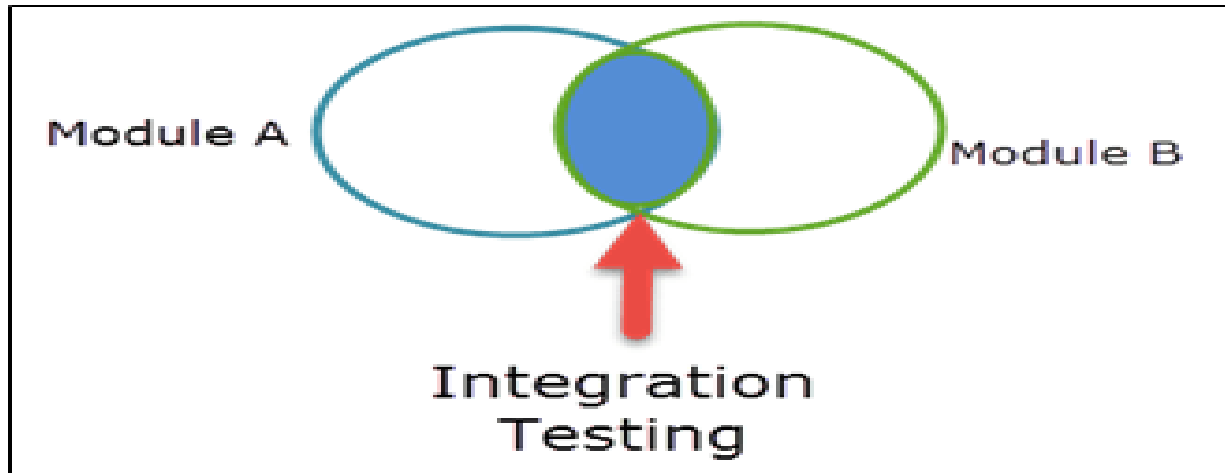
Fig 5. 4 Integration Testing Diagram

5.3.3 System Testing

System testing is a method of monitoring and assessing the behaviour of the complete and fully-integrated software product or system, on the basis of pre-decLPided specifications and functional requirements. It is a solution to the question "whether the complete system functions in accordance to its pre-defined requirements?" This System testing tests the integrated system and validates whether it meets the specified requirements of the client (Desai, Srivastava, 2016).

5.3.4 Acceptance Testing

User Acceptance is defined as a type of testing performed by the Client to certify the system with respect to the requirements that was agreed upon. This testing happens in the final phase of testing before moving the software application to the Market or Production environment (Carroll, 2018).
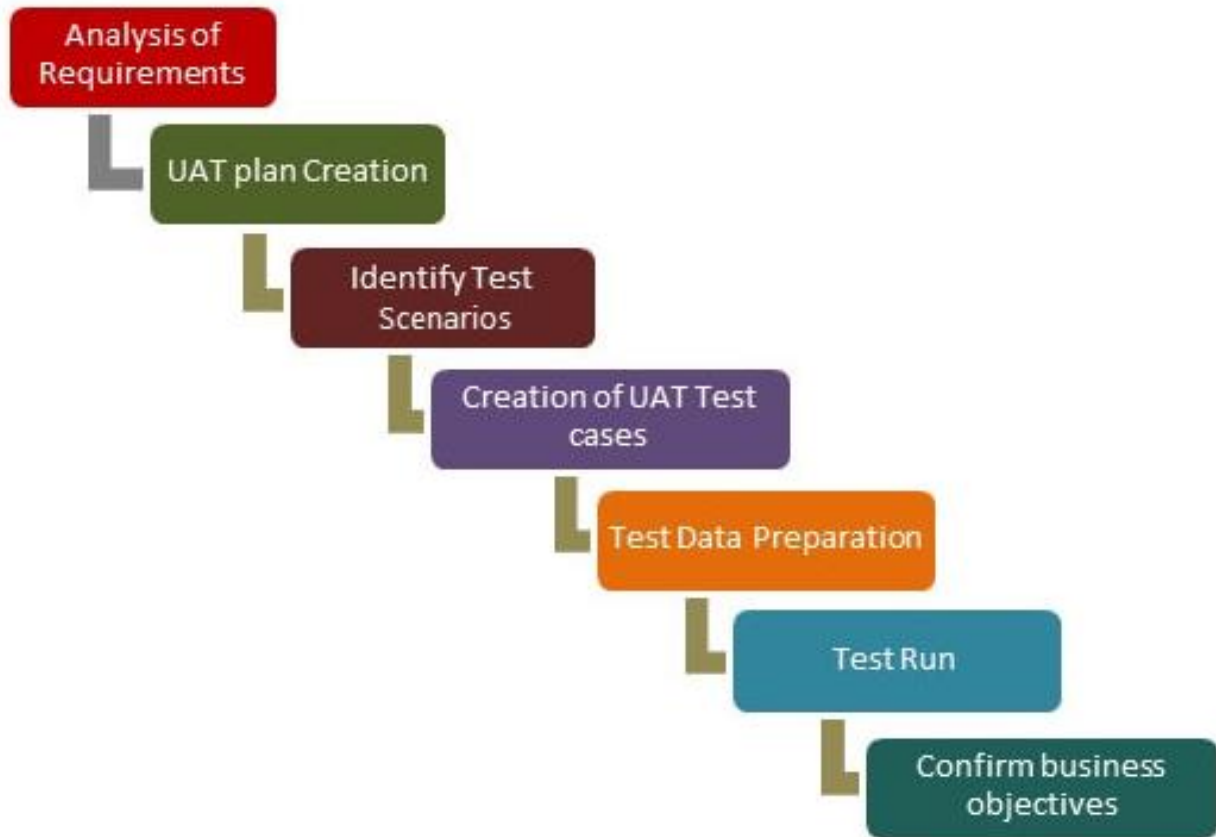
Fig 5. 5 Acceptance Testing Diagram

5.3.5 Verification and Validation

Verification is the process of evaluating software to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase. Verification is a static practice of verifying documents, design, code and program. It includes all the activities associated with producing high quality software: inspection, design analysis and specification analysis. Verification will help to determine whether the software is of high quality, but it will not ensure that the system is useful. Verification is concerned with whether the system is well-engineered and error-free (Gruver, 2016).

Validation is a process of evaluating software during or at the end of the development process to determine whether it satisfies specified requirements. Validation is a process of evaluating the final product to check whether the software meets the customer expectations and requirements. It is a dynamic mechanism of validating and testing the actual product (Gruver, 2016).

Fig 5. 6 Verification and Validation

Fig 5. 7 Empty Field Validation

Fig 5. 8 Incorrect Details Validation

Your account is not yet activated Rodney Chikodzi ▾

Student Dashboard

Tasks

Activities.

You have been asigned

2

Tasks.

So far you have logged

0

activities.

View Details

View Details

Fig 5. 9 Student login Homepage

Fig 5. 10 Employee Supervisor incorrect details upon trying to login error

Fig 5. 11 Employee Supervisor Main Menu

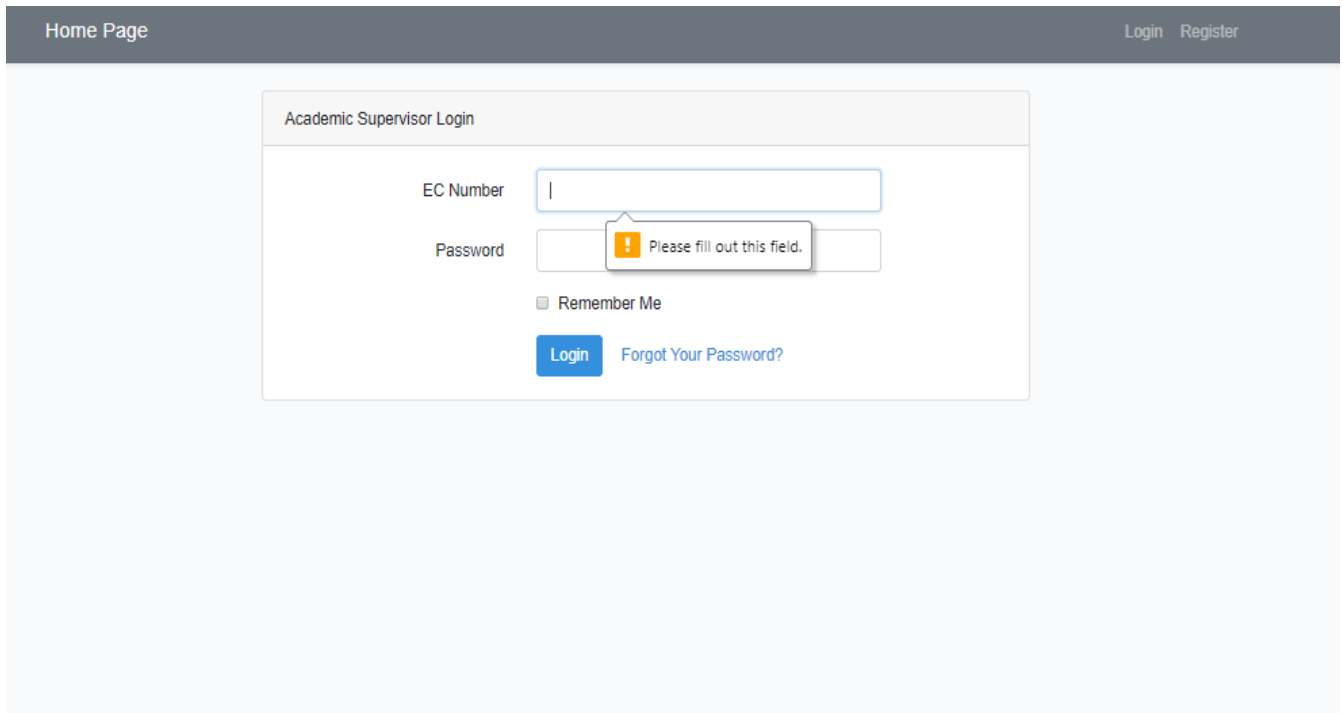**Fig 5. 12 Academic Supervisor Invalid email format**

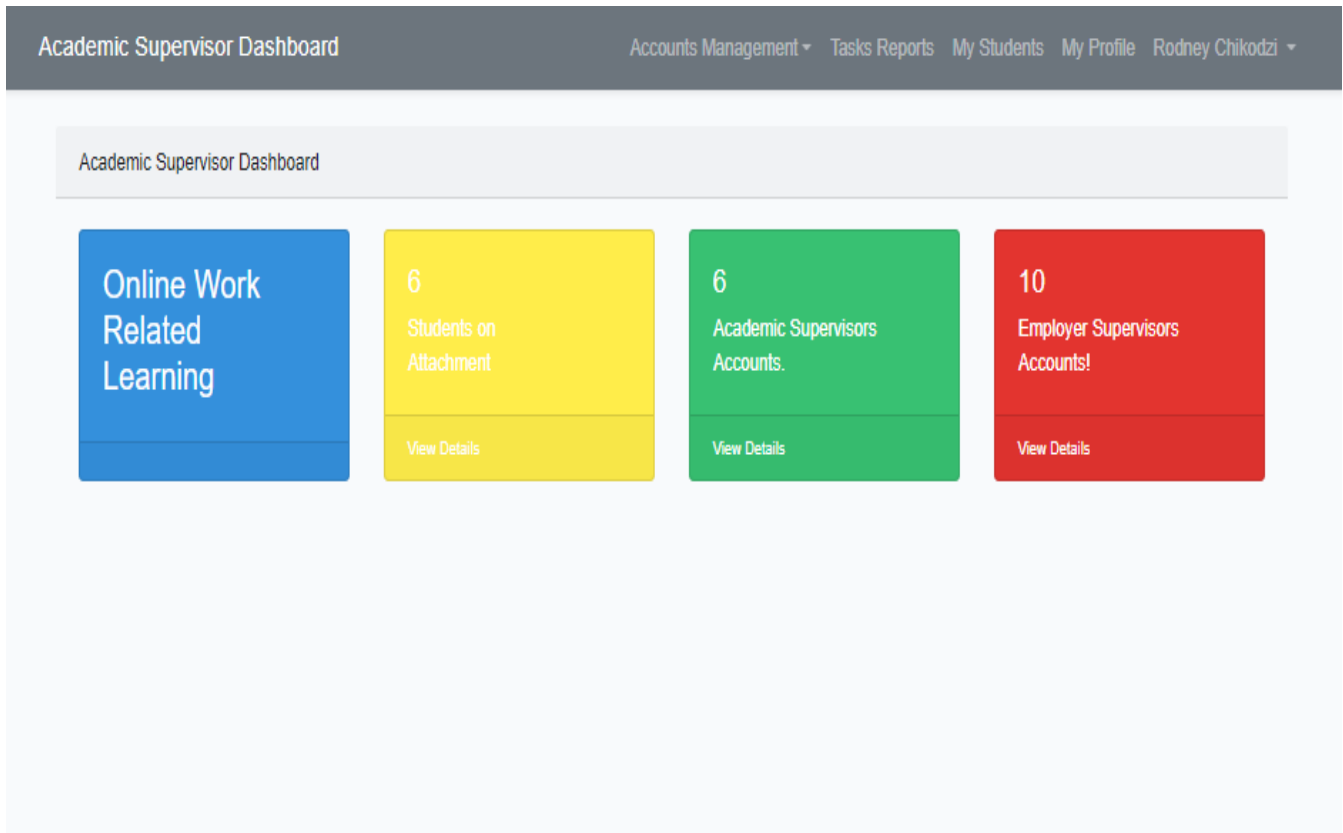**Fig 5. 13 Academic Supervisor empty field validation**

Fig 5. 14 Academic Supervisor homepage

Conclusion on Conducted Tests

The distribution of the program was made sure by the performance of the group as it was a crucial examining procedure. The group solved all the errors which were encountered with an uncommon interest given to the errors that were quick by the approval investigations.

5.4 Installation

This includes installing the software into existing systems carrying out regular maintenance and finding support for your software when it is needed (Vasilkov, 2015).After the program design and putting through all the examining skills, observed errors were fixed and the program was good for execution at the Midlands State University. The developers made a choice to stick to the suggested design for the program structure that was written in Section Four.

5.4.1 System Change-Over

Midlands State University has no automated system for supporting the upload of work related documents online by the students on work related learning as well as the employer's manuals written by their work place supervisors. The designed system is not going to affect or alter the present way of function but is going to improve the current system by providing an automation of functions. Three transition alternatives namely, direct, pilot and parallel changeover techniques were put into consideration by the developers.

Direct Changeover

Direct changeover is the implementation of a new facility, system, process, product or procedure at a point in time. The term implies a major change that is launched all at once as opposed to a more conservative approach such as a phased implementation or parallel run (Spacey ,2017).The past system is no longer available for use from that factor forward. In the ground of then data source solution for MSU WRL Virtual Assessment System's intension is that the old paper-based way of WRL be phased out completely. The suggestions were not to put into implementation using this transformation technique, as the current and new techniques are highly uncommon to each other. The highest problem was the studying curve needed by lectures and other staff members to have a successful communication with the new program. Other clear risks involved the new program not performing as expected in relation to the need for review requirements which would certainly affect the company in a significant adverse way as the old program would be available no more as a repetitive failover. The risks to the company of immediate changes were abruptly greater than the economic advantage from generally changing off the present program and instantaneously changing it with the new remedy.

Fig 5. 15 Direct Changeover diagram

Pilot Conversion

A pilot conversion is a hardware or software migration method that involves rolling out of the new system to a small group of users for testing and evaluation. During the pilot implementation, the test group users can provide valuable feedback on the system to make the eventual rollout to all users go more smoothly. Once the test group has approved the system, it can be rolled out across the organization. The testers can then help train other employees for the new system. On the other hand, the test group could determine that the system is not a viable option for the organization (Kushan, 2018).At some point in time, soon enough, the lead program is set up for all customers and members and the current program is then switched off. Pilot conversion is appropriate for certain scenarios, such as retail shop stores, where a new pos program can be set up in one shop as a test, and on success after a period interval, the program is implemented to every other retail shop outlet. In regard to the Midlands State University, the difference between a phased change and a lead change is blurry in this scenario. Pilot change did not apply in this uncommon circumstances.
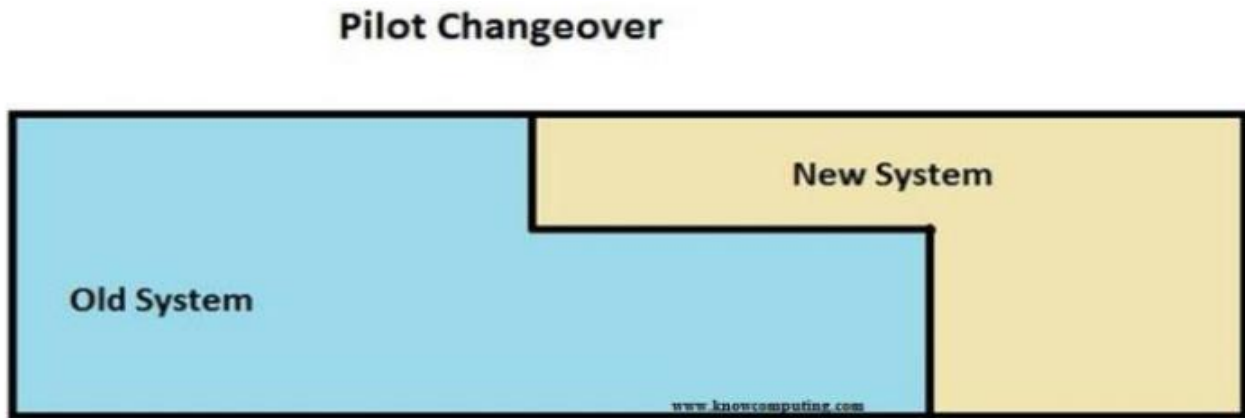

Fig 5. 16 Pilot Changeover diagram

Parallel conversion

Parallel conversion strategy is when both the old and new information systems operate alongside one another for a specified time (Vermaat ,ME, 2016).Once the results have been compared between the old and the new system, the organisation may choose to gradually welcome in the new system or immediately end the previous system (Hussain,M,2019). At some point in time, the current program is decommissioned wholly and all customers and members communicate completely with the new program. In the event of the MSU WRL Virtual Assessment System; it engaged operating the digital source of data plus the current guide program. Lookups on information could be conducted digitally on the provision that the access to information was carried out both digitally on the new program and via the current guide program.

Fig 5. 17 Parallel Conversion

System Conversion Decision

The appropriate change method was the phased transformation, where the current paper based program was transposed with the new program, procedure by procedure. Verifying and coaching took place during the execution of each new element during execution. Time taken for complete change took longer than direct transformation and more expensive, but the risk of program wide disastrous failing was reduced by the benefits of a phased transformation. Coaching which is comprehensive was needed as the current and new program were diametrically unique. With a phased transformation, the coaching took place over a prolonged time period in contrast to all at once.

5.5 BACKUP OF SYSTEM

Cloud storage is the most secure way to store up data that is critical in form therefore the source code for the program will be saved on a cloud generate and for further back-up techniques, on two other difficult disks. The team put forward an outline of the conservations responsibility to do a back-up of the source data every week on its server. The program manager will play the part of program backing up the program and verify that all back-up techniques are adhered to when it comes to this process.

5.6 Recommendations for future/further Development

Due to the high prices of fuel nowadays in Zimbabwe, it is always wise to go for decisions which save fuel. The system can also be utilized to ensure that all students submit all their work related learning documents on this system. An assessment visit should become one so as to cut fuels costs associated with two student visits hence, it should be a moment of physically interacting with an employee supervisor and a student and assess his work environment once, all documents drafted online.

5.7 CONCLUSION

A certain phase of execution described the pseudo requirements that were put into use for the designing of the program and the requirements that were used to create the program software. Verification was done to check the execution of protection measures which are significant in the program. Despite being a procedure which is continuous, program servicing was also researched.

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APPENDICES

APPENDIX A: USER MANUAL

System Technology

The following technology supports the system:

- PHP LA ravel Framework

- Sublime text editor

- Bootstrap containing HTML and CSS-based design templates for typography, forms, buttons, navigation and other interface components, as well as optional JavaScript extensions.

  - MySQL database

Starting up

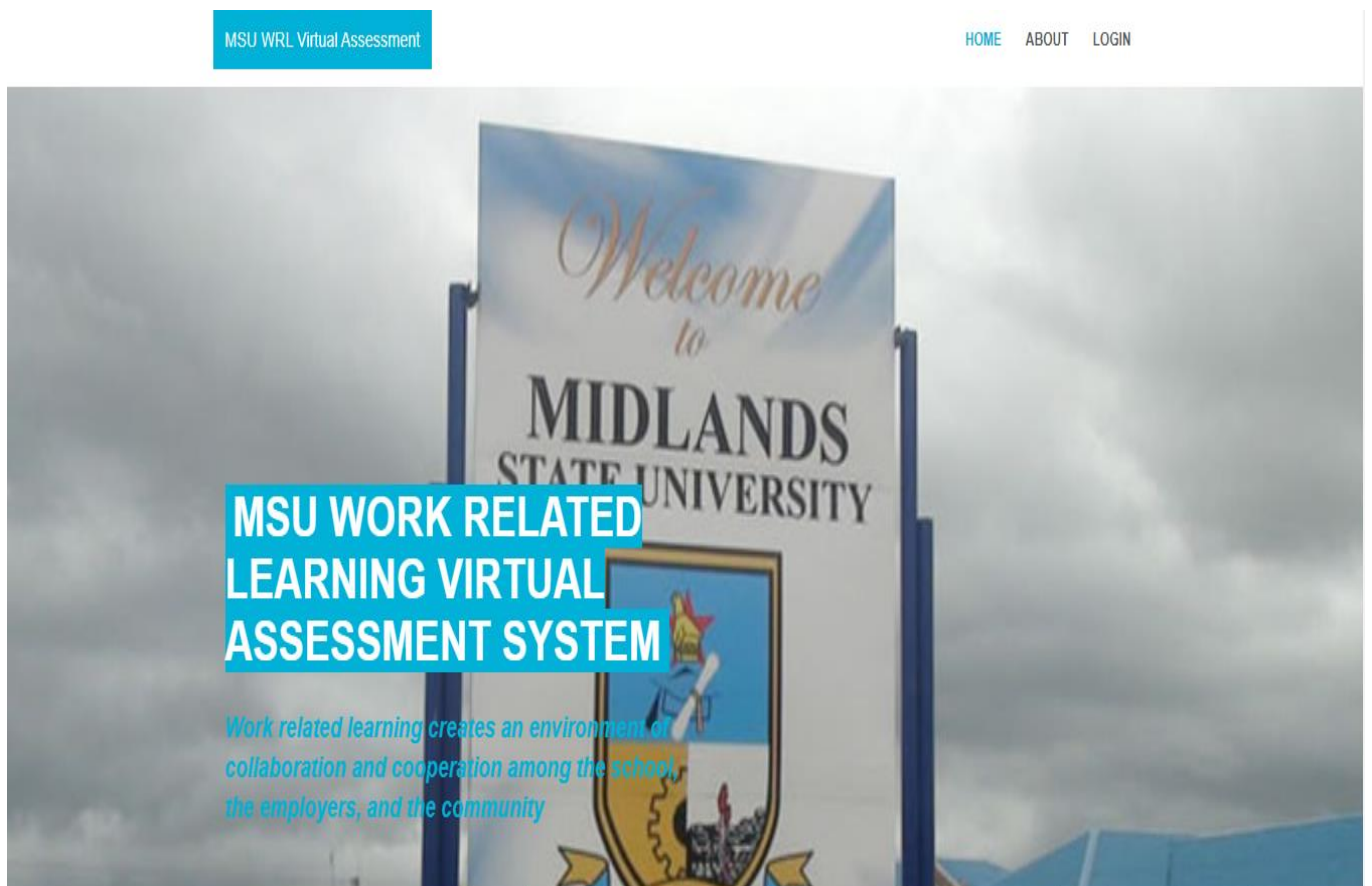Start the MSU WRL Virtual Assessment System and home activity will open shown in Fig A1.

Fig A 1: Home Activity

The login link will redirect you to the following login activity:

Fig A 2: Login Page

Employee Supervisor Account creation

Employers will need to have a user account created in order to access the MSU WRL Virtual Assessment System. Employee Supervisors will register and fill in their company details. The administrator will verify if the employee supervisor details are authentic. Fig A3 shows the employee supervisor's activity for creating an account. To register employee supervisor will follow the steps below:

1. Click the employer registration link.

2. Fill in the required field details

3. Click register user

After a successful account creation a confirmation message as in Fig A3 will be shown on the screen showing that user details have been captured.

Fig A 3: **Account Creation Form**

Logging in

For a user to access the system's functionalities, they should provide valid username, password and access level to the system. The login details that the user inputs will determine the page that they can be directed to, based on their role e.g. a user account created under employer will direct the user to the employer home page. Fig A5 shows Employee Supervisor home page when logged in:

Fig A 4 Employee Supervisor Home Page

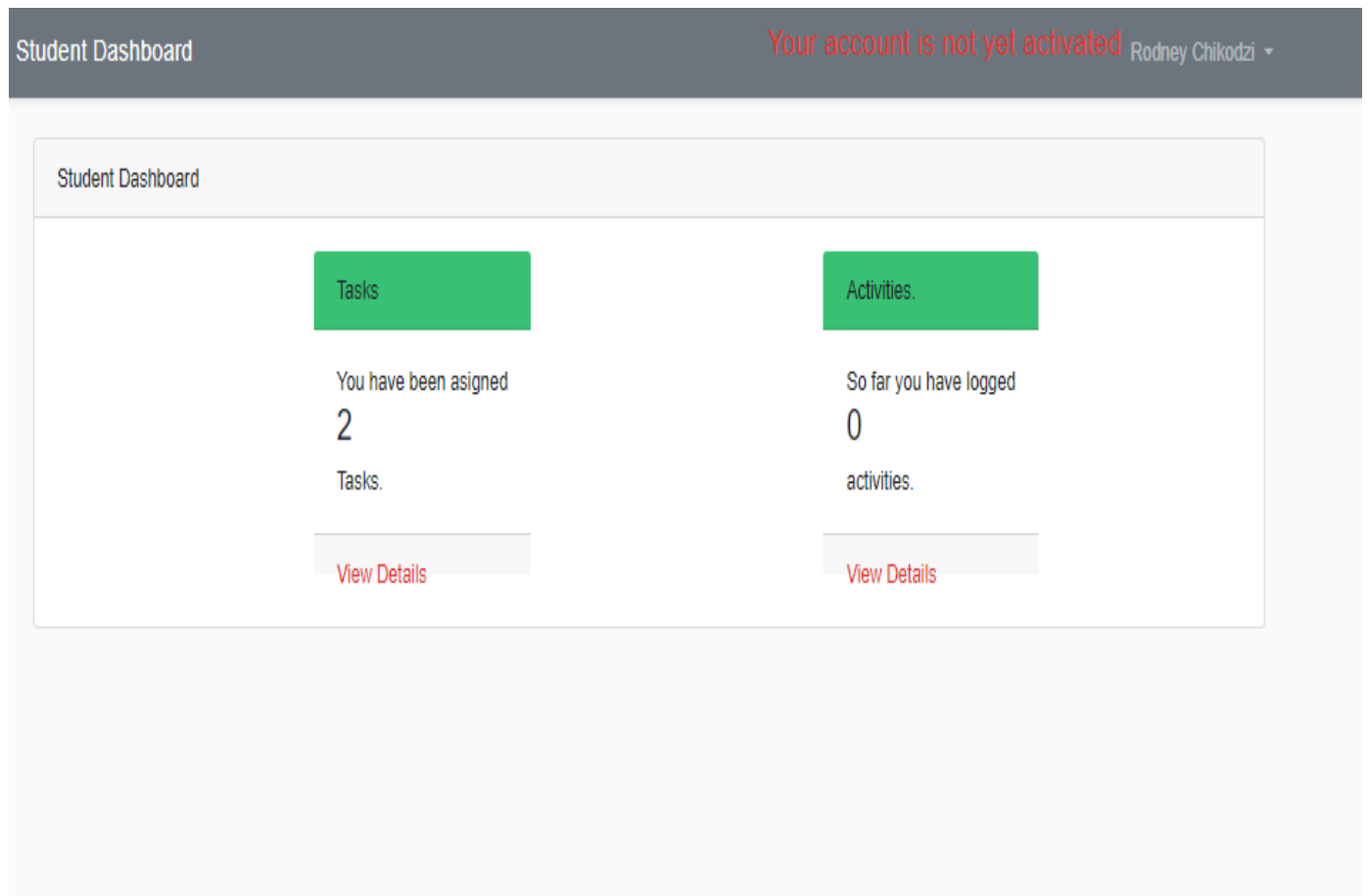Fig A5 shows Employer home page when logged in:

Fig A 5 Student on WRL homepage

The user only has 3 attempts to input valid login details. The user will need to communicate with the system administrator in order to get their account unlocked. If a user enters a wrong password the system will notify the user as shown in Fig A7.
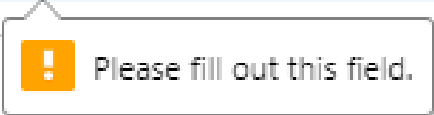
Fig A 6: Invalid login details

System Errors

If a user tries to save blank fields the system will handle the action as an error and notifies the user to reenter or cancel the operation. Fig A.7 illustrates this event.

Fig A 7: Blank field saving error

Fig A8 shows the error when a user tries saving text characters in fields which are specific for emails only.

Fig A 8: Email Validation

Logging out

To exit the system one can click the logout button on extreme right of the menu. They will be re-directed to the system's login page.

APPENDIX B: INTERVIEW

The following is an example of the questions asked during interviews with MSU students on WRL at the Midlands State University.

1. Describe in brief your experience of your WRL learning process at the organization where you are attached.

2. What are the challenges you have come across in during your WRL process so far.

3. How did this affect the expectations of your learning process from your department at the university?

4. Are you satisfied with the current WRL system?

5. Do you feel that the system can be improved? If so please suggest how.

6. How would the introduction of an MSU WRL Virtual Assessment System affect the current system?

7. What areas would you like the new system to address?

APPENDIX C: QUESTIONNAIRE

My name is Rodney Chikodzi. I am a final year student at the Midlands State University studying for a BSc Computer Science Honours Degree. In partial fulfilment of this degree, I have undertaken a computer project entitled MSU WRL Virtual Assessment System. I am kindly requesting for your input to this project by a way of completing this questionnaire.

<u>Please note</u>: You are not required to indicate your name on the questionnaire.

The information that you will provide will not be disclosed and will only be used for scholarly purposes.

Where applicable, please use a tick (✔) to indicate your answer

1. What system is used for application for WRL placements at your organization?

Manual [ ]   Automated   [ ]   Both [ ]

2. Who is involved is actively involved in the WRL process of a student at your organization?

…………………………………………………………………………………………….

3. What is the documented procedure for applying for WRL placements at the organization?

…………………………………………………………………………………………….

…………………………………………………………………………………………….

APPENDIX E: CODE SNIPPETS

ACADEMIC SUPERVISOR'S REGISTRATION CODE SNIPPET

```php
<?php

namespace App;

use Illuminate\Notifications\Notifiable;
use Illuminate\Contracts\Auth\MustVerifyEmail;
use Illuminate\Foundation\Auth\User as Authenticatable;

class Admin extends Authenticatable
{
    use Notifiable;

    protected $guard = 'admin';

    /**
     * The attributes that are mass assignable.
     *
     * @var array
     */
    protected $fillable = [
        'name', 'email', 'password', 'ecnumber', 'programme_code', 'programme_name',
    ];

    /**
     * The attributes that should be hidden for arrays.
     *
```

```php
     * @var array
     */
    protected $hidden = [
        'password', 'remember_token',
    ];


    /**
     * The attributes that should be cast to native types.
     *
     * @var array
     */
    protected $casts = [
        'email_verified_at' => 'datetime',
    ];
}
```

LOGIN CONTROLLER CODE SNIPPET

```php
<?php

namespace App\Http\Controllers\Auth;

use App\Http\Controllers\Controller;
use Illuminate\Foundation\Auth\AuthenticatesUsers;
use Illuminate\Http\Request;
use App\Student;
use App\Admin;
use Auth;
use Hash;

class LoginController extends Controller
{
    /*
    |--------------------------------------------------------------------------
    | Login Controller
    |--------------------------------------------------------------------------
    |
    | This controller handles authenticating users for the application and
    | redirecting them to your home screen. The controller uses a trait
    | to conveniently provide its functionality to your applications.
    |
    */

    use AuthenticatesUsers;
```

```php
/**
 * Where to redirect users after login.
 *
 * @var string
 */

protected $redirectTo = '/home';

/**
 * Create a new controller instance.
 *
 * @return void
 */
public function __construct()
{
    //$this->middleware('guest')->except('logout');

    $this->middleware('guest', ['except' => ['logout', 'userLogout']]);
    $this->middleware('guest:student')->except('studentLogout');
}

public function userLogout()
{
    Auth::guard('web')->logout();

    return redirect('/');
}
```

```php
    public function showStudentLoginForm()

    {

       return view('auth.student-login');

    }


     public function showStudentRegister()

    {

       return view('auth.student-register');

    }


    public function studentLogin(Request $request)

    {

       $this->validate($request, [

          'regnumber'   => 'required|min:7',

          'password' => 'required|min:6'

       ]);

       // $reg = request('regnumber');

       // $student = Student::where('regnumber', $reg )->get();

       // $email = $student[0]->email;


       if (Auth::guard('student')->attempt(['regnumber' => $request->regnumber,
'password' => $request->password], $request->get('remember'))) {


          return redirect()->intended(route('student.dashboard'));

       }

       return back()->withInput($request->only('regnumber', 'remember'))->with('error' ,
'Reg Number or password incorrect');

    }
```

```php
 public function studentLogout()

{

    Auth::guard('student')->logout();


    return redirect('/student/login');

}


public function studentRegister(Request $request)

{

    $this->validate($request, [

        'name' => 'required|min:4',

        'email' => 'required|email',

        'regnumber' => 'required|min:8',

        'programme_code' => 'required|min:4',

        'programme_name' => 'required|min:2',

        'organisation' => 'required|min:3',

        'city' => 'required|min:3',

        'password' => 'required|min:8'

    ]);

    $pro_code = request('programme_code');

    $lecturer = Admin::where('programme_code', $pro_code )-
>orderByRaw('RAND()')->take(1)->get();

    $ecNum;

    if (count($lecturer) > 0) {

        $ecNum = $lecturer[0]->ecnumber;

    }else

    {

        $ecNum = 'not allocated';

    }
```

```php
$pass = request('password');

$password = Hash::make($pass);

$acc_status = 'closed';

$wrl_status = 'pending';

$reg = request('regnumber');

$std= Student::where('regnumber', $reg)->get();


if (count($std) > 0) {


    return redirect()->back()

     ->withInput('name', 'email', 'regnumber', 'programme_code',
'programme_name')

     ->with('error', 'Registration number already available.');

}


$student = new Student();

$student->name = $request->input('name');

$student->email = $request->input('email');

$student->regnumber = $request->input('regnumber');

$student->programme_code = $request->input('programme_code');

$student->programme_name = $request->input('programme_name');

$student->password = $password;

$student->wrl_status = $wrl_status;

$student->ecnumber = $ecNum;

$student->organisation = $request->input('organisation');

$student->city = $request->input('city');

$student->acc_status = $acc_status;

$student->save();
```

```php
        return redirect()->route('student.login')->with('success', 'Registration succeded.');
    }
}
```