



ZEGU ADVERSE BEHAVIOUR AND PROTEST PREDICTION SYSTEM

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BY

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ABSTRACT

This document entails full details of research given in phases of the development of the Adverse behaviour and protest prediction system for Zimbabwe Ezekiel Guti University (ZEGU). It is a sentiment analysis system designed to read sentiments in text posted by students and members of the university community at large in order to aid the institution's administration in predicting possibility of protests at the university. It was seen necessary to develop this system due to several problems resulting from unforeseen protests at the institution as there was no way of reliably assessing the general mood in the student community. After the system was idealised and put forward for development, a feasibility study was conducted in various aspects namely economic, technical, social and operational feasibility in order to assess the viability of the system. The study on feasibility of the system proved that it was rational to embark on the development project and thus current system information was gathered using various methodologies namely interviews, questionnaires and records inspection. Analysis of the existing system commenced taking into account weaknesses that needed to be addressed. Further emphasis was put on the requirements of the new system in terms of functional and non-functional. Risks that were present to the project were outlined and noted with possible solutions given for them. Design of the system was then done with several Unified Modelling Language diagrams employed to represent the system and its data in different dimensions. A number of design aspects were discussed within the document which included physical, database, program and interface design. Visual illustrations of the designed concepts discussed were given across all design aspects to enhance understanding of the system. Security design was then explained in different dimensions and interest areas such as physical, operational and network security in relation to the system. Implementation of the developed system then came under discussion, clearly outlining the procedures and strategies used in testing and implementing the system. Various testing techniques were applied to the system and subsequently the changeover strategies considered for delivering the system were explained with the recommended strategy being noted. The system maintenance plans available for the system together with the conclusion given on recommending the one to adopt was given and this was the adaptive maintenance to make sure that the system evolves along with the everchanging technology in the modern age. The system recommendations for improvements in future were listed such as integrating it to other social sites for data analysis in order to broaden the opinion base for the institution.

DECLARATION

I **Tatenda Shadreck Tsimpu** hereby declare that I am the sole author of this dissertation. I do then authorise the **Midlands State University** to lend this dissertation to other institutions or any individuals whom they deem it necessary for the purpose of scholarly research.

Signature.....

Date.....

APPROVAL

This dissertation entitled **ZEGU Adverse Behaviour and Protest Prediction System** by **Tatenda Shadreck Tsimpu (R154561G)** meets the regulations governing the award of the degree of **BSc Information Systems Honours Degree** of the Midlands State University and is approved for its contribution to knowledge and literary presentation.

Supervisor.....

Date.....

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DEDICATION

I dedicate this scholarly work to my parents and the entire Tsimpu family as a token of appreciation for the unwavering support they have given throughout my educational journey. Without your support I would not have reached so far, I greatly appreciate everything.

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LIST OF ACRONYMS

1. ZEGU	Zimbabwe Ezekiel Guti University
2. DBMS	Database Management System
3. HDD	Hard Disk Drive
4. RAM	Random Access Memory
5. CBA	Cost Benefit Analysis
6. NPV	Net Present Value
7. ROI	Return on Investment
8. CBA	cost Benefit Analysis
9. SQL	Structured Query Language
10. PC	Personal Computer
11. IT	Information Technology
12. UML	Unified Modelling Language
13. DFD	Dataflow Diagram
14. EER	Enhanced Entity Relationship
15. LAN	Local Area Network
16. RAD	Rapid Application Development
17. API	Application Programming Interface

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CHAPTER1: INTRODUCTION

1.1 Introduction

ZEGU Adverse behavior and protest prediction system is a web-based sentiment analysis tool to be tailored for the purpose of monitoring and predicting unrest in an educational institution. The system is an integration of two platforms that will complement each other to come up with the intended predictions. The system will be designed using a number of different tools which will be later mentioned in the chapter. The system will have a social platform side where data will be captured from and a backend side which will perform the computations and analysis. Stakeholders and students will air their views and probable intentions through postings and comments on the social platform. The administrator side will show reports and dashboards giving handy information on the analytics made and the resulting predictions.

1.2 Background of the study

Sentiment analysis and prediction ideology has been in existence for some time now around the world and has become more widespread since the popularity of social media. This concept of data mining for predictive purposes has been used in various areas such as marketing and customer studying. It has also found its way into political study and monitoring. Recently in Zimbabwe, sentiment analysis has been used to predict social unrest nationwide by monitoring online social activity of citizens pertaining to the country's deteriorating situation. Owing to economic, political and social conditions that were prevailing in Zimbabwe, a group of researchers developed a tool to predict the possibility of having social unrest between September 2017 and August 2018 using sentiment analysis. (Mbunge, et al., 2017). This concept has however, not been widely embraced for small scale use to monitor situations in particular environments. Thus, the venture into developing a system based around the concept for analysing and predicting unrest within one given particular tertiary institution ZEGU.

1.2.1 Background of the organization

The Zimbabwe Ezekiel Guti University (ZEGU) is a private Christian University in the Zimbabwe tertiary education sector which started in May 2012. The University is located in Bindura town, address at 1901 Barrasie Road, off Shamva Road. It is a mission institution of the Zimbabwe Assemblies of God Africa FIF church in Zimbabwe. ZEGU is a degree awarding institution accredited by the ZIMCHE offering degrees that are recognised at an international level in 5 different faculties. The institution still has a relatively smaller population of students and also staff with the number increasing each semester.

1.2.2 Organisational Structure

An organogram is defined as hierarchical setup in the authority system of an organisation that shows how information flows within the organisation and the line of command at different management levels (Lim and Griffith, 2010). It also encompasses regulations and rules particular to a given company or organisation that outlines the delegation criteria of different tasks as well as responsibilities in coordination to achieve goals of an organisation. Below is ZEGU's organisational structure.

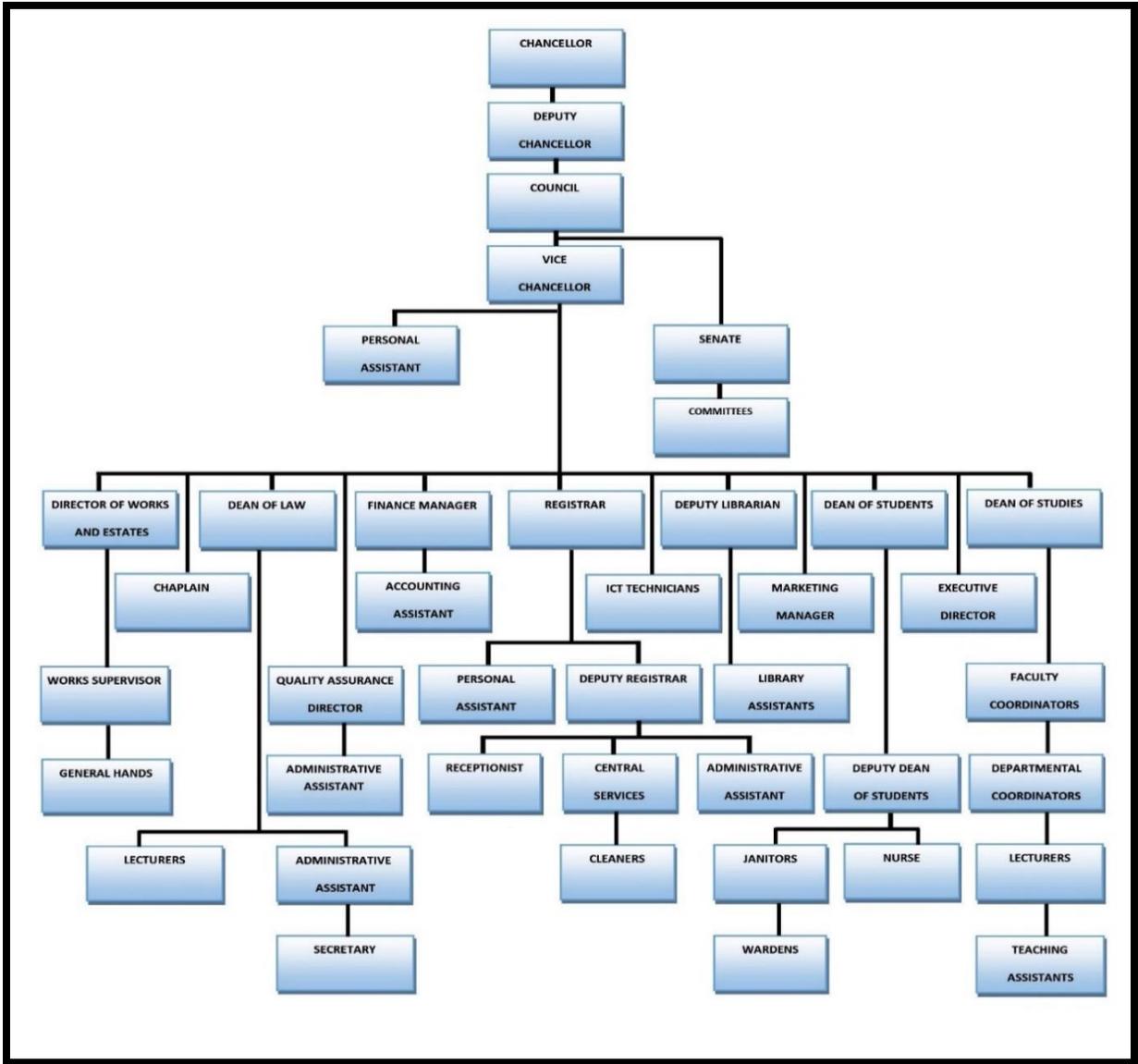


Fig 1.1 ZEGU Organisational Structure

1.2.3 Vision

ZEGU aims to be a leader in intensive research and a Christian university connected at a global level, nurturing enterprising and innovative graduates who are solution driven.

1.2.4 Mission Statement

A Christian centered institution that is intensive on research, ZEGU seeks to offer to the community a suitable environment conducive for entrepreneurial skills development. It also aims to nurture from the students, globally active citizens that will engage in economic advancement leading to an improved standard of life.

1.3 Problem Definition

After a research and study of the social environments and student communities in universities around Zimbabwe, several issues were identified relating to the failure of managing unrest and demonstrations. The institutions have reported several incidents of protests and ZEGU has come close to this undesirable situation and thus the problems associated with this are described as follows.

- Cases of unforeseen protests from students over grievances existing within universities' student communities some which result in elevated levels of distraction to institutions' operations.
- Grievances from students on failure of the institution to gather opinions from students that genuinely represent the student community on their welfare and other related issues. Due to the large numbers of students enrolled at the institution, getting a true representation of their opinions is a challenge.
- Non-existence of an effective channel of communication that allows for two-way communication between students and the administrative authorities.
- Failure to identify students' needs in due time to avoid possible demonstrations since there is no practical and effective way for the students to convey their needs and ideas to the university administration other than the traditional SRC channel which can be biased.

1.4 Aim

To develop an Adverse behavior and protest prediction system for ZEGU.

1.5 Objectives

- To analyse digital text from comments by students on a local social platform.
- To compute the probability of unrest and a protest from sentiment polarity scores.
- To create an interactive platform that allows for real-time two-way communication between the institution's authorities and its students.
- To alert the administrators of the system through email when the probabilities of a protest have gone beyond a set threshold.
- To conduct opinion mining through filtering opinions from the university community conveyed in the comments.

1.6 Instruments and methods

A number of different methods were implemented and will be used to carry out this research study.

Instruments and tools to be used in developing the system are as follows:

- **Sublime Text editor**

It is a free multi-platform development environment for code editing that encompass a Python API. It supports a number of markup and programming languages. Its main advantage is that users have access to and can integrate additional functions with libraries, typically community-built and maintained under free-software licenses.

- **Python**

Python is an easily understandable, powerful scripting language. It is characterized by efficiently high-level structures of data and a simple but highly useful and dependable approach to high-level programming. Python's clean syntax, coupled with its nature that is

interpretable, signifies it as a language ideal for writing complex applications across numerous platforms.

- **XAMPP Apache Server**

XAMPP is a freely available web-server solution from Apache Friends that runs across different platforms. It is a basic, light Apache distribution package which eases creation of locally based web servers for purposes of testing. The package has all the necessities required to establish a web. Due to the fact that many of the actual web server deployments have generally the same setup as XAMPP, it ensures that changing from a locally hosted server to a live server is done with much ease.

- **MySql Database**

MySql is a commonly used DBMS for medium-scale web projects. it implements Structured Query Language for defining, updating and querying the database. The advantage of using MySql is that it is an openly available relational DBMS which is freely accessible to developers and can be found embedded in other web server packages.

- **Microsoft Visual Studio C#**

It is programming language tailored for creating systems which run on the .Net framework and other selected platforms. It is object oriented and makes use of all the powerful object-oriented features of programming. This language has powerful predefined classes that makes it efficient and require less writing of lines of code.

- **Php**

PHP is a code writing language that is tailored for development of web applications. The acronym stands for Hypertext Pre-processor. Its code can easily be used along with HTML code, or it can be embedded with a number of web templates, content management applications and web frameworks. The main advantage of PHP is that it is also freeware and easy to use as it requires only a web browser to run on and any text editor that supports the language.

1.7 Justification and rationale

This system will be of great aid to the institution and a handy tool to maintain a good reputation for the university by combating and averting protests and any adverse behavior at the institution. The system will be a discrete mechanism to monitor the tempers around the university using a simple social platform that will be perceived as merely an interactive social site for the university. It will bring about various benefits to the administration and stakeholders of the institution including the following.

- A progressive Knowledge base of keywords that can be continuously updated to become more efficient over the course of time.
- Prevention of protests and uprisings against the institution's administration thereby maintaining a good name and reputation for the Christian valued university.
- Provide an online social interaction platform for communication purposes as a grapevine channel which is also essential in organisations and institutions.

1.8 Conclusion

The subject system under study has been introduced in this chapter along with what it aims to accomplish through looking at the existing current problems and listing of objectives to address the issues. The brief history of the organisation has been given and to understand the organisation's structure and setup better, an organogram has been illustrated together with the vision and mission statements. Tools to be used in developing the system were also explained and the rationale of the system justified. The next chapter which is the planning phase will further look at other aspects of the project such as the feasibility study, cost benefit analysis and related project planning activities.

CHAPTER 2: PLANNING PHASE

2.1 Introduction

This section looks at an informative planning of the whole project. An assessment of the business value is done to establish if the system will significantly add value to the institution and whether it is worthwhile undertaking. A thorough feasibility study of the system is going to be presented focusing on different aspects such as the economic, social, technical and operational aspects. A feasibility analysis is vital for an assessment on whether the system is worthy as an investment. This chapter will also outline all the associated risks to the project that need to be looked out for during proceedings with the system development. The stage on its completion will show a clear view of the schedules for the project and all the succeeding stages' timelines.

2.2 Business Value

Stellman (2005), outlines business value to be the subjective value of a business that encompasses all elements that determine the well-being and health of a business. The protest prediction system will help the institution in various ways that will bring value to the different stakeholders of the organisation. As the core aim of the system is to alert of any possible tensions within the university, it will allow for quick preventive action to be done or for negotiations to be done before any adverse effects occur. Thus, the system brings in value as it gives a preventive rather than a corrective approach. The following reflects areas of business value of the system

a) Administration

Protests in some cases, tend to involve disruptive violence which will leave the authorities with a challenging task of getting things back in order and according to schedule. If the system allows the administration to predict and take preventive action against a protest then this can be averted thus ensuring smooth administration of the institution.

b) Students

Students within the institution will feel that their opinions are valued when the institution attends to issues that arise or trend on the social site without them having to do anything radical. The system will therefore empower the authorities to keep good relations with the students which will be a two-way advantage.

2.3 Feasibility analysis

Feasibility analysis is defined as a study and thorough assessment of a project that would have been proposed to establish its degree of relevance and if it can be undertaken with success in a profitable way (Grant, 2010). This study on feasibility looks at various aspects under consideration. The aspects encompass economic feasibility, technical, operational and social feasibility. The mentioned categories will be explained in this section to establish whether or not the development of the proposed system is a feasible venture.

2.3.1 Technical Feasibility

This feasibility analysis basically focuses on the intensive examination of all technical requirements that can be availed at the given time of the project which are required for the development and successful completion of the project (Cadle and Yeates, 2008). It provides clarity on whether the proposed system will be undertaken successfully up to its implementation considering the constraints present in the technical environment. It is in this study, where intensive research and assessment is conducted in an effort to ensure the proposed system to be developed can practically be tailored for smooth compatibility with the technology in existence within the institution's scope. A deep assessment of technological requirements is conducted which focuses on the hardware requirements, software requirements as well as the knowledgeable personnel needed to undertake the project.

a) Technical Expertise

It ascertains the availability of a capable workforce at the institution that will have the capacity to interact with the system and possess adequate technical knowhow on how to handle technology systems. The need for skilled labour as a resource exists both during the development of the proposed system as well as during its lifetime use. ZEGU is an institution with vast intellectual personnel at its disposal therefore expertise for the system is readily available. Therefore, the organisation can afford access to suitable personnel to work with the system. The readily available qualified workforce they already have will only require minimum training on the particulars of the system. In terms of developing the proposed system, the institution has an option of out-contracting external parties that will oversee the development of the system working closely with internal representatives to ensure that requirements are fully conveyed and understood.

b) Technical Resources

This outlines the availability of technical resources needed for the development of the system and to be put to live use and their affordability in the scope of the organisation. Such resources that need to be specified in this feasibility study are hardware resources and software resources. There is need to evaluate the practicality of the technology requires and to assess if it is readily available of can be acquired by the institution in a feasible manner. In context of the proposed protest prediction system, most of the hardware required is already available at the institution and there may not be need to acquire new hardware equipment specifically for the proposed system.

Table 2.1: Hardware Requirements

Name of item	Specifications Recommended	Needed-Quantity	Currently-Available	Comment
Server Computer	Intel xeon V5 quad core 3.7 GHz, 64Gb RAM, 2 TB HDD	1	None	The organisation is willing to buy
Laptop PC	Intel core i5 5 th gen. 2.3 GHz, 8Gb RAM, 500GB HDD	2	None	The organisation is willing to buy
Wireless router	Wi-Fi Standard (802.11 a/b/g/n/ac)	1	1	
Ethernet cables	Cat 6, 1000 Mbps / 1 Gbps	2	3	

The software tools required for developing the system and to fully support the system operation and procedures are also analysed. The software needed is already in existence and can be easily acquired by the institution and some of it they already have and using in their daily operations.

Table 2.2: Software Requirements

Item Number	Name of Software	Comment
1	XAMPP	Open source and can be acquired
2	Sublime Text editor	Can be freely downloaded
3	PHP	Open source and can be acquired
4	Python	Open source and can be acquired
5	MySQL	Already available
6	Esset Antivirus	Already Available
7	Windows 10 pro Microsoft operating system	Organisation is willing to acquire
8	Microsoft Office 2013 or later	Organisation is willing to acquire

2.3.2 Economic Feasibility

It refers to analysis that looks at the costs and expenses that relate with the coming up of and operating of the system that has been proposed in order for a decision to be established basing upon whether the merits arising from use of the system are more than the incurrence of costs and money outflow in relation to the system (Brown, 2010). The study focuses on the costs involved in undertaking and progressing with the project in subject. This covers all costs encompassing those incurred and also savings emanating from reduction of costs arising from using the system. There are various ways of carrying out the economic feasibility study and for this project the techniques used include Cost Benefit Analysis, the Return On Investment and the payback period. These techniques will be looked at and further explained as below.

2.3.2.1 Cost Benefit Analysis

This is an evaluation criterion that is applied to weigh costs or expenses to be incurred on a project against the projected inflows as well as merits from the project. Buelens(2011), says that this criterion seeks to measure the expenditure and outcomes of outlined investment projects for guidance when choosing in terms of the desirability and selection of the investments.

In conducting the cost benefit analysis and if reliable results are to be output, the need to first look at different types of costs and revenues exists.

Costs

Costs are the expenditure on the resources of an organisation in order to acquire a given need, expressed in monetary value (Hall, 2010). The costs focused on in the scope of this project are developmental costs and costs of operation.

a) Development Costs

This is the expenditure incurred when developing systems and are thus, costs of the project. The expenditure comprise expenditure on acquiring required components and software necessary to conduct the system development to its completion (Brown, 2010). The below table outlines the costs od development for the ZEGU protest prediction system.

Table 2.3: Development Costs

Item-Description	Required-Quantity	Cost in (US \$)
Server PC	1	1 200
Laptop PCs	2	1 000
Development charge	n/a	2 000
Training	n/a	700
Total		4 900

b) Operational Costs

Expenditure that is incurred in running the system and during its operational lifetime in use are termed the operational costs (Heathcote, 2005). These costs comprise of costs of maintenance and other associated costs which are encountered in supporting the functioning of the software system.

Table 2.4: Operational costs

Item-Description	Cost in (US \$) 1st Yr	Cost in (US \$) 2nd Yr	Cost in (US \$) 3rd Yr
Operational Labour	700	1 000	1 000
Hardware Maintenance	100	200	300
Software Maintenance	100	100	100
Other Costs	300	550	500
Total	1 200	1 850	1 900

Benefits

Frankwood (2018), states that benefits are the inflows or goodwill value that an organisation realises from its operation. Therefore, in context of the system the benefits are the savings and value of good reputation that the institution is going to gain from using the system.

a) Tangible Benefits

They can be referred to as merits that are quantifiable and can be expressed in monetary value (Hall, 2010). These are realistic benefits, which are evident and can be justified easily. The tangible benefits that the ZEGU protest prediction system comes along with are as outlined in the below table.

Table 2.5: Tangible Benefits of using the system

Benefit	Cost Reduction US \$ (1st Yr)	Cost Reduction US \$ (2nd Yr)	Cost Reduction US \$ (3rd Yr)
Reduction in costs of communication	1 150	1 200	1 000
Reduction in the damage property	1 000	1 100	1 300
Estimation of expenses saved	800	750	600
Total	2 950	3 050	2 900

b) System Intangible Benefits

These benefits are those whose nature is rather qualitative than it is quantitative (Cappozzi, 2012). These benefits cannot be easily measured and it is difficult to ascertain monetary value to them. Intangible benefits normally surface after a long time period. The intangible benefits that will emanate from using the ZEGU protest prediction system are as tabulated below.

Table 2.6: Intangible Benefits

Benefit	Estimated Benefit US \$ (1st Yr)	Estimated Benefit US \$ (2nd Yr)	Estimated Benefit US \$ (3rd Yr)
Increased goodwill	1 200	1 400	1 550
Improved satisfaction of student needs	900	1 000	1 100
Improved student moral conduct	750	800	950
Total	2 850	3 200	3600

Cost Benefit Analysis Summary

System benefits are weighed against the expenditure costs related to the system and the outcome is tabulated as below.

Table 2.7: Cost Benefit Analysis

	year 1	year2	year3
Benefits	\$	\$	\$
Tangible	2 950	3 050	2 900
Intangible	2 850	3 200	3 600
Total benefits	5 800	6 250	6 500
Costs			
Development	4 900	n/a	n/a
Operational	1 200	1 850	1 900
Total costs	6 100	4 900	4 600
Net Benefits	(300)	1 350	1 900

The cost benefit analysis carried out shows results from which it is evident that the benefits of the system outweigh the costs within a minimum period of time as depicted by the figures in Table 2.7. The deficit of the first year of use is insignificant and will be recovered in the second year. Therefore, it is rational to consider undertaking the project as it will be advantageous to the to the institution. In subsequent years the system yields more benefits as it will be used at the organisation.

To complement the analysis of the system costs and benefits, further analysis must be carried out on the project in order to reach a final conclusion on the system's economic viability. The other technique that was applied on the project is the Return On Investment (ROI) which is shown next.

2.3.2.2 Return On Investment

ROI is an assessment method applied in the financial field which provides a basis to compute the rate of return on money put into given investments or compares the net returns to the initial outlay required (Frankwood, 2018). The formula for calculation of ROI is as given below.

$$\text{R.O.I} = \frac{\text{total returns} - \text{total costs}}{\text{Total costs}} * 100$$

The R.O.I for the ZEGU protest prediction system project therefore, is as follows:

$$\begin{aligned} & \frac{20\,550 - 13\,600}{13\,600} * 100 \\ & = \underline{51.10\%} \end{aligned}$$

The ROI calculation above shows that investment in this project will yield an annual return of 51.10% which is relatively a good investment and worth partaking.

2.3.2.3 Payback Period

Crosson and Needles (2008), defines payback period as the time period required to recuperate the initial project outlay. For any project, the shorter the time needed to recover the investment outlay the more lucrative the project is. The payback period for the ZEGU protest prediction system is calculated using the formula below.

Pay Back Period is equals to $Y + X/Z$

In the mathematical formula given above, Y is the last phase that has a cumulative cashflow which is negative. X is the absolute accumulated cashflow value at the end of period Y. Z is the absolute cashflow in the period following Y.

2.3.3 Social Feasibility

Marakas (2013), states that this feasibility analysis focuses on merits from the new proposed project which benefit the community being affected besides the institution in context. Therefore, this study looks at the society and community around ZEGU and the effect the system is going to have on them. The project proved to be socially feasible as it will have numerous benefits that will positively impact the society.

- A peaceful community within the campus that will be of benefit to both the staff residents at the university as well as the student community.
- Internship training opportunities for local IT related students at the institution as well as other local institutions as they can be attached to cater for the duties of maintain the system and its hardware.
- Avoidance of protests means that the local security forces will seldom be required at the university thereby allowing them to focus on other important issues within the surrounding community.
- A conducive student society that is demonstration free and improvements to the student society needs since their opinions can be quickly noticed through the social site.

2.3.4 Operational Feasibility

Bell (2005), says that this feasibility analysis is concerned with projection and analysis of the practicality of the system in context when it is fully developed and implemented for use, basing on the human resources available. It will thus look at the practicality of using the protest prediction system at ZEGU and the ease of use that the users will likely experience in their interaction with the system. The system is concluded to be viable in terms of operational feasibility due to the issues highlighted below.

- The institution has a vast well knowledgeable workforce at their disposal that can easily handle the system and its operations.
- The system will be deployed with a comprehensive manual that will aid in helping users understand operation of the system during training and for reference sake.

- Students are familiar with using social sites and applications therefore, the student side does not require any special training since they can comprehend and learn by themselves how to navigate around the social site.
- The confidential information pertaining to sentiments extracted from the students' comments will be only available to authorize administrators through authentication process that will ensure that the information is secure.
- There is already an IT department at the institution and this can be used as the maintenance team as they are well familiar with hardware and software.
- The administration was fully supportive of the initiative and were willing to influence every party related to the system to spread the acceptance.

Considering the overall feasibility analysis, the system was concluded to be viable and rational to be developed for and be implemented at the institution. Other analysis aspects such as risk analysis were then looked at next.

2.4 Risk analysis

Risks can basically be defined as generally the possibility of encountering an unfortunate event in the long run. Analysis of risk outlines risks with a probability of incurrence to the project and sets out measures to deter such from happening or alleviate their effect if they do happen (Cadle, 2008). It is used to scrutinize critically all the vulnerabilities that are related to the system. This section of risk analysis further goes on to discuss the possible solutions to the risks that will be identified.

The following factors are to be considered in relation to the risk analysis.

- One major risk that is encountered with software projects is deviations from expected timelines due to various constraints. The project planners need to ensure that resources required for each subsequent phase are readily available and acquired well before the project phase date arrives if it within the capacity of the organisation financing the project. The analyst should also make sure that the workplan is followed and that project phases do not run late.

- Another factor is the risk of virus attacks to the software, this will likely jeopardise building of the system as well as its operation. If the virus attacks the systems being used in developing the system, then this might impede the development or even result in the loss or corruption of project data. Therefore, to combat against this risk the developers and system users should make sure that they have up to date anti-virus utilities running and protecting the systems. Back up of the system data during development and use is another solution to this risk.
- Hardware failures have also been a common risk that has affected system development projects. It can also stall the operation of the system during its use. There is need to verify that the hardware being acquired for the project meet the requirements stated in the hardware requirements section. This will to a larger extent avert the risk of hardware failure.
- There is also technical risk that arise from lack of technical knowledge of the system by the users thereby slowing down the operation or development process when the users or project members fail to quickly understand issues relating to the system. To counter this risk there is need for careful selection of the development team or individuals from within the organisation that will work with the developers. Adequate training should also be given to users so that they fully understand the software and avoid technical mistakes that might affect smooth system operation.

2.5 Project Work Plan

Brown (2010), describes a workplan as a sequential outline of the way in which a team or individuals target and schedules the undertaking and finishing of tasks at different stages for a certain project. This will outline the sequence in which the tasks involved in developing the ZEGU protest prediction system will be undertaken. It basically schedules work for the system development project. It is a reference calendar which shows when the different project phases are scheduled and the planned duration allocated and for each phase.

Table 2.8: Workplan

Activity-name	Commencement	Completion	Duration in weeks
Introduction	27 Feb 2019	06 Mar 2019	1
Planning	07 Mar 2019	19 Mar 2019	2
Analysis	20 Mar 2019	27 Mar 2019	1
Design	28 Mar 2019	03 April 2019	1
Coding and testing	04 April 2019	03 May 2019	5
Implementation	04 May 2019	10 May 2019	1
Maintenance	10 May 2019	Ongoing	

2.6 Gantt Chart

Laudon (2013), describes a Gantt chart as an ordered outline of a project's work, shown in a graphical manner, to be done until the project finishes and the timeframes of each phase involved. The Gantt chart for the development of the ZEGU protest prediction system is shown overleaf.

Table 2.9: Gantt Chart

WEEK	1	2	3	4	5	6	7	8	9	10	11	12
Proposal	■	■										
Project Introduction			■									
Project Planning				■	■	■						
Analysis				■	■							
System Design						■						
Development							■	■	■	■	■	
Implementation												■
Documentation	■	■	■	■	■	■	■	■	■	■	■	■

2.7 Conclusion

This chapter has looked at the value and viability of the system to the institution through a thorough feasibility study which has looked at various aspects such as economic, technical, operational and social in relation to the system practicality. The feasibility study proved the practicality of implementing the system and together with the risk analysis also looked at in this chapter it has been concluded that the project can proceed. A work plan and Gantt chart of the project were then presented and the schedules clearly outlined. The succeeding phase is the analysis stage which is going to look at current operations and weaknesses involved that can be addressed by developing a new system. Aiding illustrations such as dataflow diagrams will also be shown to enhance an understanding of the current operations.

CHAPTER 3: ANALYSIS PHASE

3.1 Introduction

The currently existing system is intensively analysed and examined during analysis in order to identify its loopholes and weaknesses. The focus of the chapter is mainly on the facts gathering methodologies that were applied in undertaking project research and how they were advantageous. It further looks at the setup of the existing system through illustrations and explanation of the flow of the system through a level 0 dataflow diagram, dataflow diagram and other UML diagrams. In examining the current system, the inputs, processes and outputs will also be discussed. From a thorough analysis that will be done on the system, the newly suggested system's requirements will then be outlined and the alternatives that are available for delivery of the system.

3.2 Information gathering methodologies

In order for successful development of the system, there was need for acquiring relevant information on how the current set up was like and this was done using various information gathering methodologies. Brown (2010), described information gathering as a process of acquiring and putting together data or facts from the field. Different methodologies were used in the project to increase the reliability of the information gathered as each particular methodology has its own benefits when used for the process.

3.2.1 Interviews

Interviews are a form of communication that allows for the direct exchange of questions and responses between two or more persons involved within the exercise. Kielhofner (2012), defines an interview as an exercise of acquiring information characterized by asking of questions in relation particular subject and getting answers from the interviewee. Use of this methodology involved two parties, the interviewer who asked the questions and the interviewee who responded to the questions asked. Interviews were mainly conducted with the administrative staff at ZEGU to gather relevant information on how protest situations were being handled at the institution. Two types of interviews were majored on for this project which are structured and unstructured interviews and they had their merits and demerits.

a) **Interviews advantages**

- It allowed for questions adjustments asked by the analyst relating to responses given by the interviewees so as to get a deeper comprehension of the current system and how the new system should work like.
- The technique allowed for immediate responses to be obtained from the administrative staff at ZEGU and this was less challenging and less time consuming to the interviewer as there was no need for one to wait a given amount of time before getting the responses needed.
- Unclear areas and misunderstood questions were explained and made clear since the analyst gathering information was present and the respondents could easily ask for clarity where they had challenges understanding thus eliminating assumptions.
- Direct personal interaction allowed the interviewer to read and observe of body movements which became relevant to aiding understanding to the spoken facts. The interviewer was able to tell with ease basing on the interviewees' postures if they had confidence in the facts they were conveying thereby helping in assessing reliability.

b) **Disadvantages of interviews**

- Interviews needed setting aside the time and devotion to the exercise for the whole duration of the interview. Thus, they halted any other priority activities that needed to be done. The interview process was not be done at the same time with any other project activity.
- Other interviewees within the administrative personnel at the institution did not give accurate information and had bias in the opinions that they conveyed.

3.2.2 Inspection of records

It involves studying through the records at the institution in which events and occurrences relating to the project subject matter were recorded (Cadle and Yeates, 2008). This helps the analyst to gain more relevant information that can be added onto and complement the information that was obtained using other methodologies. It gave access to information such as the institution's policies and various practices and measures that they have put in place in previous instances.

The analyst was given access to the files and went through them to discover facts on previous handling of protests at ZEGU.

a) **Advantages**

- Records and documents provided information that could be relied on as the data recorded was direct and not tempered with and could be deemed trustworthy.
- The analyst could go through the documents and acquire required information without interfering with the staff and their daily operations as it did not require devoting of time by the institution's personnel.
- The exercise could be carried out thoroughly in the absence of any limitations. It was also the technique which, by far, had no boundaries in acquiring of information and facts in comparison to other methodologies employed.
- It allowed for the analyst to study the trend or patterns of occurrences of protests at the university which was useful in developing the new system and how it should identify such situations.

b) **Disadvantages**

- The methodology was relatively a difficult method of acquiring information as the records could not be easily interpreted and understood in the correct way to convey the accurate information intended to be conveyed.
- This information gathering technique required more effort from the analyst and was a challenging exercise as there were vast documents and records that needed to be studied and inspected.

3.2.3 Questionnaires

These are designed forms that presents well structured questions to the target audience and they provide spaces for written responses right below to the given questions (Capozzi, 2012). Questionnaires can be prepared and have multiple copies made thus they can reach a much broader and wider audience thereby enlarging the sample from which information can be gathered. These were distributed to the targeted persons at ZEGU and they could fill them in their own free time.

a) **Advantages**

- They afforded respondents enough time to carefully think over the responses to questions asked thus most of them provided meaningful information.
- They were the least in requiring involvement of the researcher and therefore, allowed other project tasks to be attended to at the same time with this exercise.
- The respondents were comfortably free to express their genuine opinions since they attended to these questionnaires on their own and without no close monitoring.
- The use of open-ended questions in the questionnaires allowed the researcher to incline the respondents into giving relevant information useful to the research that was being carried out.

b) **Disadvantages**

- The information gathering technique lacked personal interaction between the parties involved and therefore, the response that were given could not be complimented or supported by any non-verbal cues thus the researcher had only the written responses given to base upon.
- Not all the questionnaires issued out were responded to and recovered back since some personnel targeted to participate in the exercise did not attend to it or misplaced the document before it could be collected. Therefore, an insignificant number of the total questionnaires issued out was not recovered.

3.3 Current system analysis

From the information gathering methodologies employed to gather facts. A better comprehension of how the system currently functions was gained and the sequences of procedures. The research reviewed how the protests occurred at the institution and how the administration handled them to the end of the process. The protests at ZEGU occur in a natural manner and there is currently no way of possibly foreseeing their probability of occurrence. It initiates with the communication of a change or opinion from the university administration which they convey through one-way and non-interactive platforms in the form of online notices and notice boards around the school campus.

After the message has been conveyed to the student community, it is then circulated within the community sparking debates amongst the students on whether it is an acceptable move to them or not in relation to safeguarding their welfare and perceived rights. The communication channel currently in use is not flexible enough to allow for easy and quick feedback back to the institution's authority. Grievances from the students regarding issues raised or proposed or implemented by the administration wait for the SRC representatives to take action and convey the feedback to the administration or responsible authorities. Due to the hierarchical nature of this current setup, it normally leads to students growing out of patience as their feedback is slowly responded to. The vocal members of the student community and through extensive use of social media platforms, a protest is organized and the message is spread across the community to an extent that almost every student is made aware of the act. Protest plans by students come to the attention of the administration, when they happen to, when it is inevitable to stop the protest from happening. The students then protest by marching or some undesirable actions that they partake in all of which eventually result in the disruption on normal daily operations at the university. In response, the responsible authorities then conduct a mediation process with the student representatives in a bid to stop the protests or address the root cause of the protest. The problem that arises from the current system is that in some instances these protests may be extreme to the extent of leaving a trail of destruction which is costly to the institution along with the disruption of operations.

3.3.1 Process Analysis

a) Inputs

- Decisions and changes from the administration.
- Mediation opinions from the Student Representative Committee.

b) Processes

- Effecting of decisions by the administration.
- Diffusion of common opinion against decision within the student community.

c) Outputs

- Demonstration and protests.
- Resolution from consensus.

3.4 Data analysis

From the understanding obtained about the current system from the system and process analysis, data analysis seeks to outline the existing system in diagrammatic representations using various data analysis presenting tools. This serves to give a better and easy understanding of the procedures of system as well as how data moves around the system. Analysis of data is referred to as the scrutiny, changing and modelling of data for the purpose of identifying important information and supporting decision making, (Brookshear, 2013). Tools such as the level 0 DFD and dataflow diagrams are used to present the analysis of data for the current system.

3.4.1 Context diagram

This depicts the system centrally and shows the entities within the system environment associating with it (Bell, 2005).

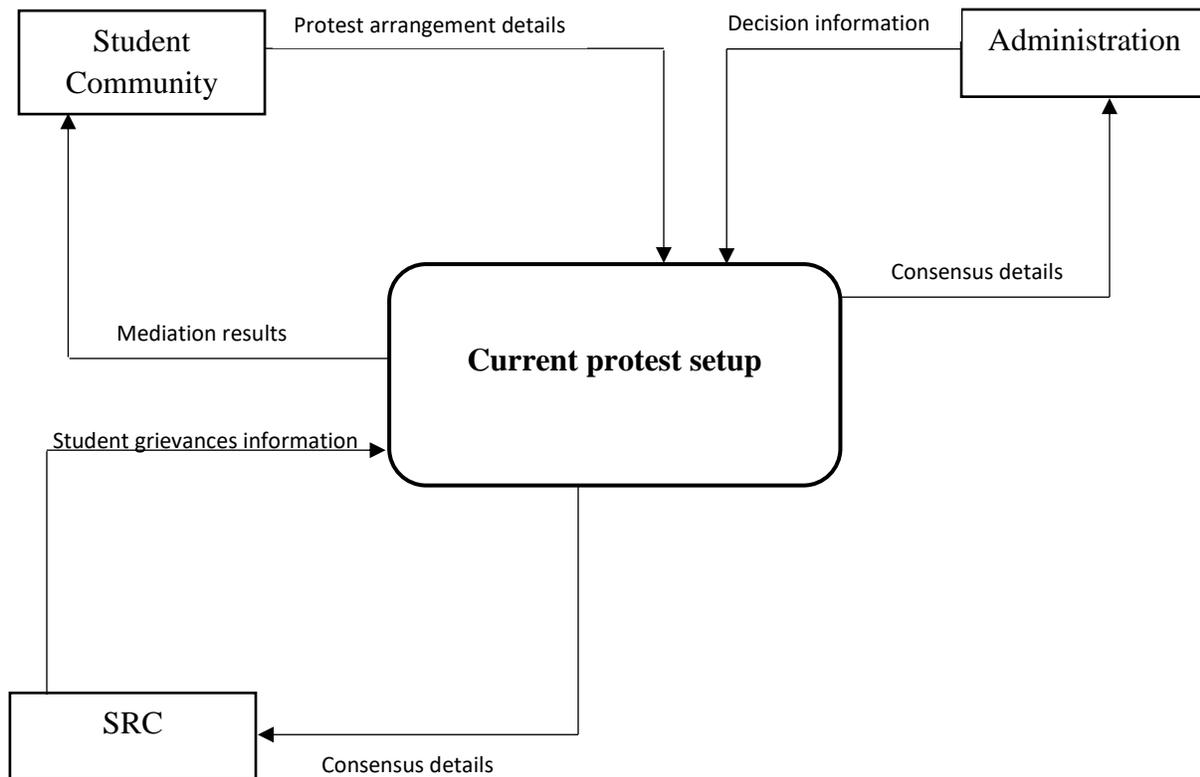


Fig 3.1 Context diagram

3.4.2 Dataflow diagram

This is known as a level 1 data representation tool that gives visualisation of data movement graphically through a system (Kielhofner, 2012).

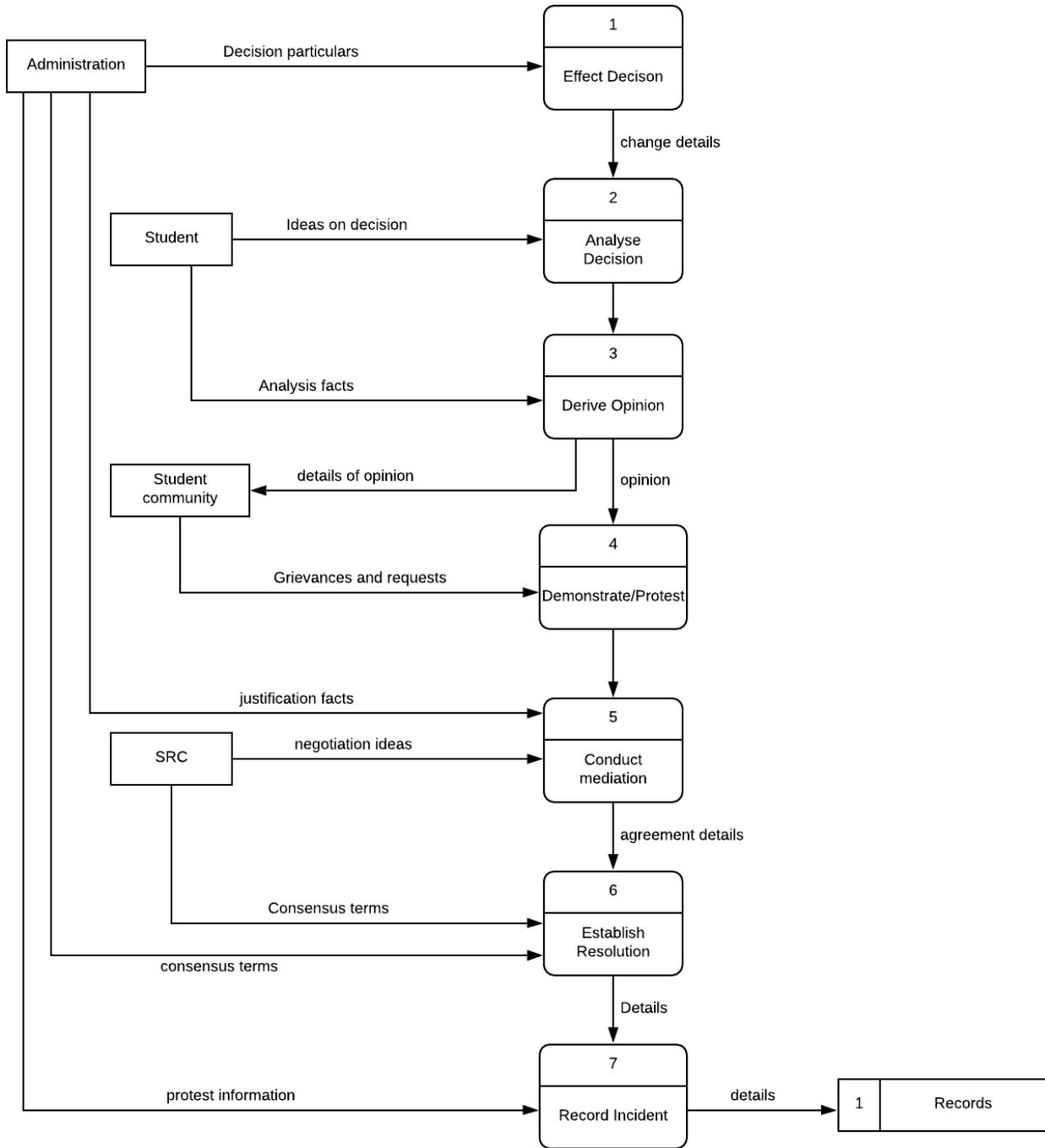
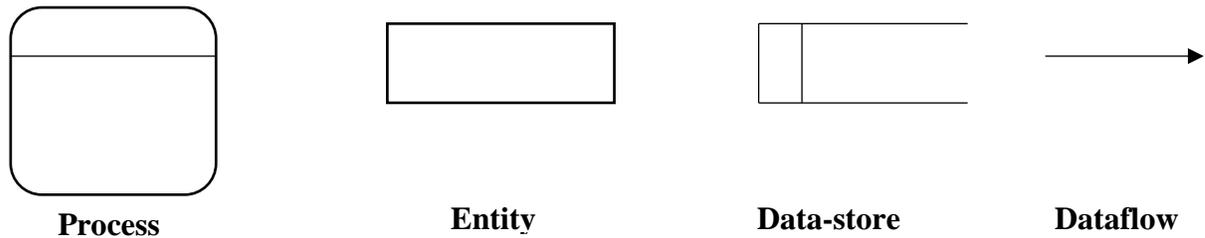


Fig 3.2 Dataflow diagram

Key for the data flow diagram:



3.5 Weaknesses of the current system

Analysis and detailed outlining of the currently existing system given in the previous sections gave light on the loopholes and shortcomings of the existing system and these weaknesses are as outlined below.

- Inflexible communication channel which is one way and mainly oriented on conveying information from the administration down to the students without allowing for easy sending of feedback. The channels and platforms used are not interactive.
- The current system only allows for mediation after action from the students has taken place as that is the way through which the administration notices grievances from the student community on their opinions. Therefore, the current system is post reactive and cannot prevent protests but only stop them after they have occurred.
- The system does not provide a systematic collecting of opinions from the student community. These opinions are fundamental for aiding in future decision making in order to prevent or curb protests as they highlight preferences from the student community.
- It results in unforeseen costs being incurred arising from the disruption of daily operations and possibly the destruction of some of the institution's property as there is no way of predicting a protest and therefore no effective way of preventing as well.

3.6 Evaluation of alternatives

There are several ways in which a system to provide a solution to the problems and weaknesses identified can be delivered and implemented to the organisation. A decision was established that there is need for the introduction of a system to address the protest issues at the institution. A further decision had to be made from the available alternatives that are within the capacity of the institution to implement the system. Alternatives available readily include outsourcing the system, improvement of the existing system and developing a new system.

3.6.1 Outsourcing

It involves assigning the task of development of a new system to another specialist firm that develops information systems for companies. Marakas(2011), defines outsourcing as a situation whereby an institution or organisation seeks an outside party to carry out a task or provide a certain service, that the company could have otherwise done by themselves in-house. An institution chooses not to employ a developer working internally from the organisation but rather normally goes for readily made software off the shelf when using this option. The assigned developing company simply develops the system basing upon provided institution's requirements. The paramount merit of this option arises from the fact that the system can be deployed to the institution within a minimum period of time or rather be selected from readily available software thereby cutting down the software delivery time. After considering various factors, this alternative was deemed to be not suitable to this project owing to reasons outlined below.

- Engaging an outside company for developing of this solution by the institution would expose more information to outsiders more than the university would consider tolerable and within acceptable boundaries.
- The resulting system may not well be suitable to the particular needs of the institution as the interaction between the developers of the system and the ultimate users will be limited.
- An outside company that will not work closely with the institution and providing bespoke software is likely to overcharge excessively the institution which is not favourable to the university management.

- The nature of the software solution required by the institution is more complex and requires development from within so that all requirements are fully understood and allowing for flexibility.

3.6.2 Improvement

Improving the current system in an effort that it matches the requirements on ground of the institution is another alternative to delivering a solution to the problems of an organisation. This is a process in which a system already in existence is redefined and modified in a bid to introduce additional functionality as required as well as improving the procedures of the system (Brookshear, 2013). Improvement of the system is only applicable where another computerised system was already in existence and being used at the institution. This alternative would be an advantageous one in the sense there will be a basis upon which to start development from rather than starting from scratch. Improvement of the system was not a feasible alternative for the project since there is no computerised system in existence that performs the task that the proposed system is intended to carry out at ZEGU. The system to be developed is a new initiative that is to address the problems identified in the current setup and therefore there is nothing to improve upon.

3.6.3 In-house Development

This is when the institution uses of its own IT personnel they hire, commonly termed an ‘in-house team’ to undertake the development and implementation of an information system specified to meet particular needs of the institution (Brown, 2010). This helps the institution to retain a larger part of its IT budget internally and is done after the administration have carefully evaluated the IT services market. The development team will be working from within the organisation and interacting with the end users more often up to the implementation of the system. This is the much favourable alternative for the delivery of ZEGU protest prediction system due to various reasons as stated below.

- The institution has total control on its system’s development and they are able to easily monitor the progress at every stage of the project to make sure the system comes out as what they want.

- Characterised by total involvement of the user as the system's end users can interact frequently with the developers. This option easily allows for the requirements changes by the users because they are active in the process until the system is completed.
- The institution will be able to maintain confidentiality of its internal information as no external party will be afforded access to the institution's file storages.
- There is a reduction in consultation fees since the reliance to an external company or provider is eliminated and users will better appreciate the system as they were partly engaged in developing the system.
- The institution will have ownership of this system thus allowing them flexibility to upgrade and modify the system at a lower cost.
- It minimises the risk of system failure whereby a system not meeting the required specifications may be delivered to the organisation. Developing internally ensures monitoring so that the system does not go off track.

3.6.4 Alternative Selection

The alternative that was agreed upon by the administrative authorities and the analyst after weighing and evaluating between the three alternatives was in-house development. Due to the numerous benefits developing from within the institution has, it proved to be the most feasible alternative. It gives better assurance of software meeting requirements being developed due to active interaction with the interested parties throughout the development of the system. In terms of cost, the alternative is also the most lucrative proving to reduce costs both during development and in the long run lifetime use of the system. The alternative facilitates good communication amongst all project stakeholders and is the most likely to result in a system that will satisfy the users.

The alternative however, has the disadvantage that it is the one that takes much longer to develop and implement as work on the system is started from scratch. The phases involved in the development will take long in order to fully understand what is to be developed.

It was concluded that developing the system in-house was the most suitable alternative to adopt as it was overall agreed upon by the stakeholders over the other alternatives.

3.7 Requirements Analysis

Buelens (2011), states that requirements analysis is an exercise of establishing expectations of users on an improved or new system. It is a thorough examination as well as scrutiny of the new system capacity to provide good and desired results to the end users. This study mainly focused on what should be delivered by the new system in terms of its functionality specifically to the users. The requirements are categorised into two sectors namely functional requirements and non-functional. At this point in the project progress, enough detail has been provided concerning the existing system setup. The loopholes as well as limitations have been exposed and a better comprehension of what is needed to address current issues can now be gained in the requirements analysis.

3.7.1 Functional Requirements

They are requirements concerned with the system's capabilities in relation to what is expected of it to facilitate functionality of the system successfully as well as characteristics which users interact with in order to derive content (Laudon, 2013). Functional requirements are commonly referred to as basically the primary utilities the system should provide to its users on a basic level.

The ZEGU protest prediction system is to meet the following functional requirements.

- Restrict access to the system information to only the administrative authorities by using authentication to gain access.
- Trigger alerts to the administrator when certain thresholds of probability figures set in the system are reached or surpassed.
- Email the system administrator of alerts pertaining to the thresholds of the system being reached.
- Consistency in concurrency access, where the system should allow more than one user to access the system given that they have an active internet connection.
- Allow feedback sending on posts posted from the administrators and respective authorities through the online social platform.
- Perform opinion filtering from the comments submitted by the students to gain a rough understanding of the students' sentiments towards the decision taken by the institution.

3.7.2 Use case diagram

This UML illustration depicts respective relations of individuals acting in the system environment and their operations within the system. A Use Case diagram basically shows the interaction of the user with the system showing all the relationships involved (Laudon, 2013). It identifies the distinct user groups in the system and the corresponding activities they have relating to the system.

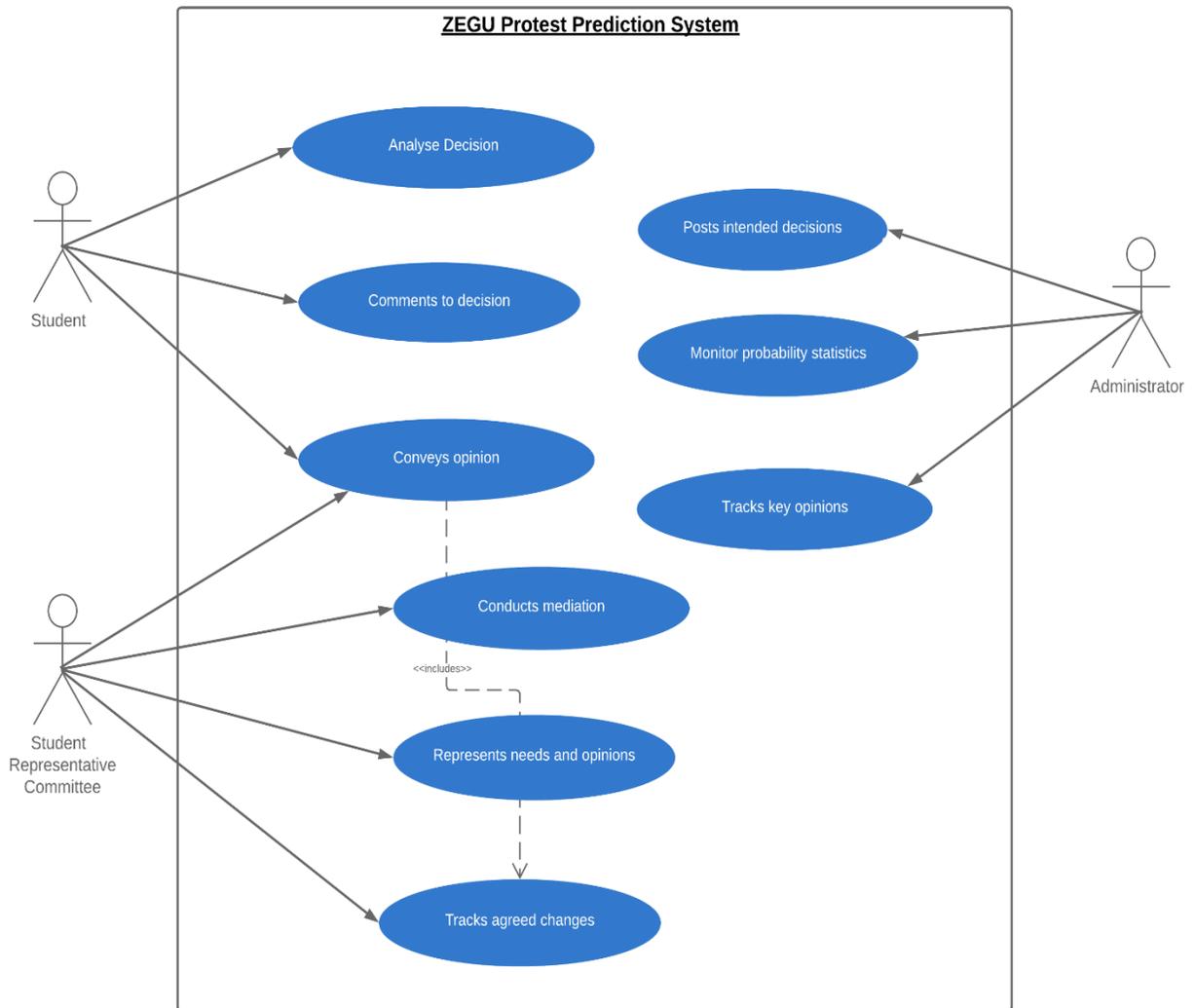


Fig 3.3 Use Case diagram

3.7.3 Non-functional requirements

The requirements are those which specify how the system should be or what the system as a product should be. They focus on the expected qualities and outline the criteria which can be applied for measuring or to assess the system operation (French, 2013). Non-functional requirements for the ZEGU protest prediction system are presented below.

- The system has to be simple and have an easily usable and understandable interface that users can familiarize with.
- The system must be easily maintainable and documented clearly to enhance ease of understanding on the features it has.
- It must provide a crash recovery functionality and back up facilities so that it can be easily restored to normal functioning in case of system failure.
- It must be efficient enough to minimise the time taken in data retrieval and logging into the system by users and also a higher throughput.
- The system should be portable and must not be entirely hardware dependent but should be easily used across different hardware with little or no modification required.

3.7.4 Constraints

During the system development, there are several challenges that may be encountered and constraint on the project. A constraint is referred to as any element which acts as an obstacle and impedes a project from getting to its optimum potential in relation to stated objectives (Hall, 2010).

- Time constraint – the development time of the proposed system is limited and due to uncertainties, the whole project may not fit within the schedule to meet the time deadlines and be delivered for use to the institution on time.
- The system plan and its requirements may need to be evaluated and updated regularly due to the rapid changes in the technology sector.

3.8 Conclusion

The system analysis was extensively undertaken producing adequate facts on functions of the existing system, procedures and operations. The fact-finding techniques that were used to acquire the information required in the analysis phase were outlined and described in relation to their application in this project together with their respective merits. Further system analysis was done using various data representation tools to illustrate the general information flow within the existing system. Weaknesses present in existing system were then outlined and the available alternatives for delivering the system to counter these weaknesses also given. Lastly, requirements were stated for the new system as well as related constraints. The subsequent stage is the design phase which will mainly look at the design of the new system as well as representations of data particular to the new system. The next chapter is going to discuss all the different design aspects of the system to be developed.

CHAPTER 4: DESIGN PHASE

4.1 Introduction

This section's focus is on designing and building the system proposed looking at several design aspects of the system. It seeks to illustrate the implementation of the requirements and functionalities described in the previous chapters. The system design will be illustrated through various data representation tools which include the level 0 and level 1 data flow diagrams to show movement of information within the system between processes and entities. Further emphasis will be on the design of the architecture and the system's physical design where an explanation of how the hardware specified for the system will interact with software design. The database and program design are also looked at in this chapter along with design of the interface that will show the forms end users are going to use to interact with the system. Security design is another design aspect that will be clarified and explained in terms of its different focus areas.

4.2 System Design

It is be outlined as a process of defining the setup, modules, architecture and interfaces of the system that seek to address the requirements specified for the system (Henry, 2004). The section aids in the understanding of the proposed system and how it will work as the system is fully described in relation to its functionalities through various its aspects. The system description will be aided by data analysis tools and graphical representations, in particular the level 0 and level 1 dataflow diagrams namely the context and the dataflow diagram in a bid to enhance a clear comprehension of the proposed system.

4.2.1 How the system works

ZEGU protest prediction system is a system that aims to approximate the discontent in people around the university environment which are mostly the students. The system is to use natural language processing to analyse text that will be posted online on the university's social platform which is part of the proposed system development. The authorities or the administration of the institution will post on the social platform information related to decisions which effect the welfare of the student community.

The posts will be public and the students can assess the information given in relation to these decisions and are able to give back their feedback on these posts through comments. The comments posted for each post will be captured into a database where they will be stored and retrieved for analysis to determine the sentiment of the general student community towards the decision that would have been posted. The system will have algorithms designed that will run through the text in comments analysing the negativity and positivity within the comments thereby establishing figures that represent the probability or likelihood of the students protesting against the decision. The probability figures will be visible to the system administrator and he will be notified through email when these probability figures surpass a set threshold.

4.2.2 Context diagram of the proposed system

French (2013), describes a context diagram as a tool for representing data that depicts a system defining its environment and the entities which act in the environment of the system and the data flowing around inside the system environment. It can also be termed the ‘level 0’ data flow diagram.

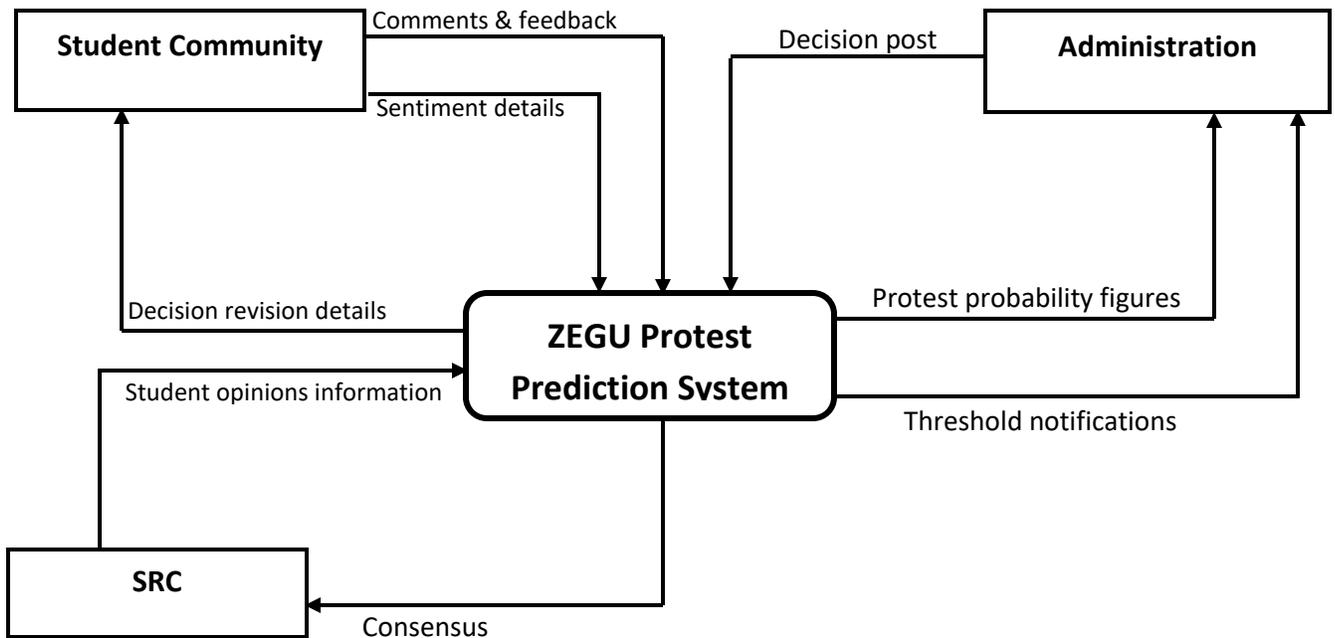


Fig 4.1 Context diagram of the new system

4.2.3 Dataflow diagram of the new system

It shows the way in which information flows through processes to and from entities within the information system and encompasses inputs, outputs as well as stores of data that information moves through (Bittner, 2003). The dataflow diagram is depicted using standard symbols that represent the entities in interaction with the framework, the data stores and the system processes.

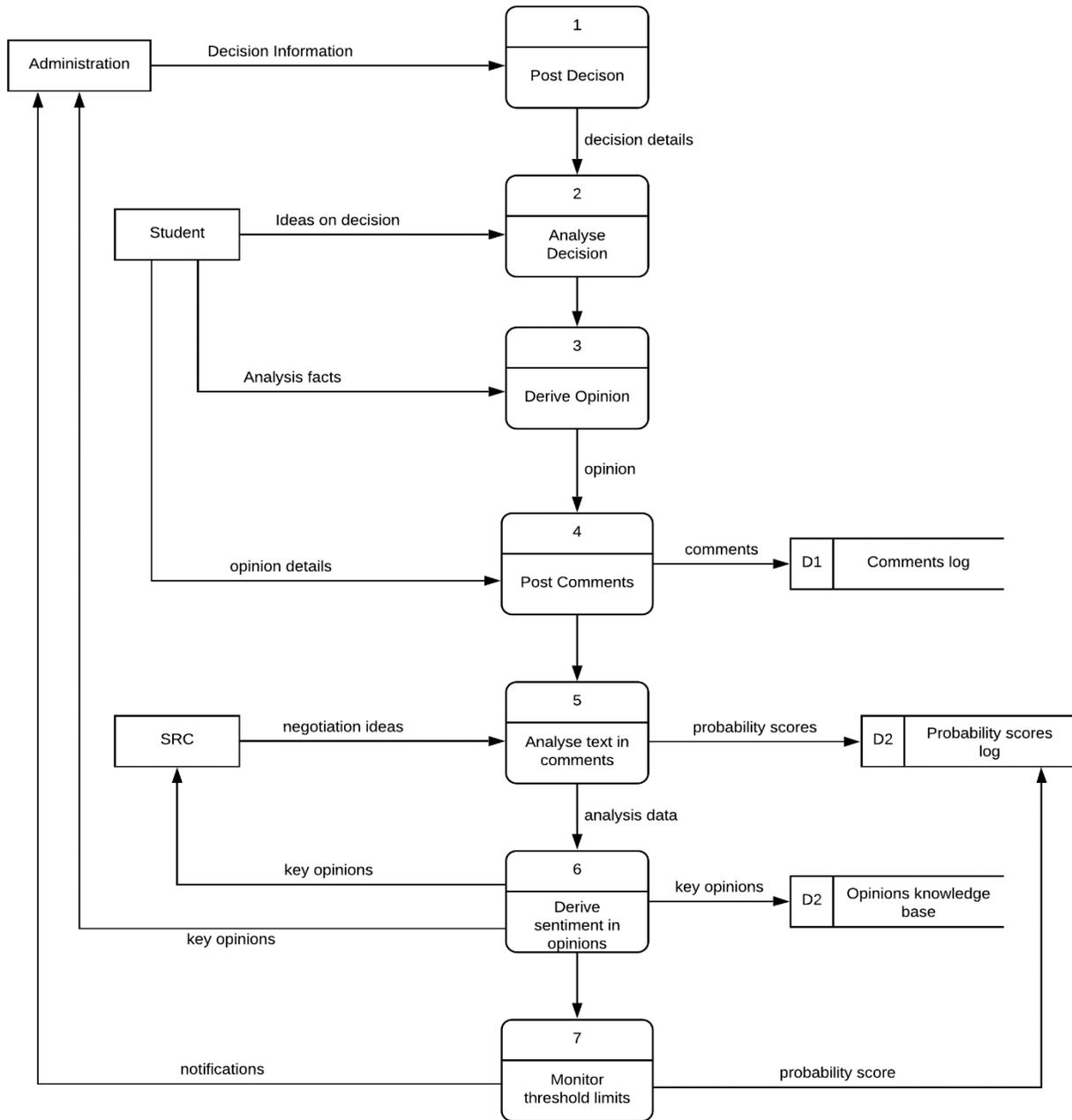


Fig 4.2 Dataflow diagram of the new system

4.3 Architectural Design

Thayer (2005), says it is basically the setup and technical structuring of the system which is concerned with hardware which is going to support running of the system to be developed in a bid to fulfil desired functionality. The ZEGU protest prediction system should be designed in such a way that it has to be compatible with hardware platforms specified for the development of the system in a setup which fully supports expected functionality.

The system's architectural design reflects on the system components namely the hardware as well as software components. It seeks to outline and illustrate clearly how the different system elements will interlinking. Components in subject include the servers and clients that will access the system. The design of the architecture guarantees that the software requirements and the hardware requirements of the system are set up in order to establish efficiency and reliability.

The architectural setup of the ZEGU protest prediction system will comprise of the following:

- **User machines** –any computerised device that will be used by end users to access the social platform and these can in any form such as PC laptops, desktop computers and mobile phones.
- **Server** – hosting computer where most of the system data will be stored and from which some background processes of the system not directly invoked by end users will be carried out. It will provide storage of the data client machines will be accessing.
- **Network cables** – they are to be used to network the server and other desktop computers that make up the system infrastructure and connect them to the local network and the internet.

4.4 Physical Design

Brookshear (2013), defines this design aspect as the manner in which hardware components to be used with the system will be setup and the layout that will be used for such in order to maximise efficiency in functionality. It also describes how the hardware components will be connected to enhance communication amongst devices within the system. Physical design further defines the configuration of the system network, security of the system data, the general data structure within

the system and also the storage setup. It depicts basically all the physical aspects of the system being developed. The ZEGU protest prediction will be centred around the main server which will host the main database which will capture the comments and process the algorithms for determining the sentiments within these comments. From this central server will other nodes be connected to the system such as client machines providing client browsers to access the social platform as well as the administrator's portal.

The below figure shows the setup of physical design for ZEGU protest prediction system.

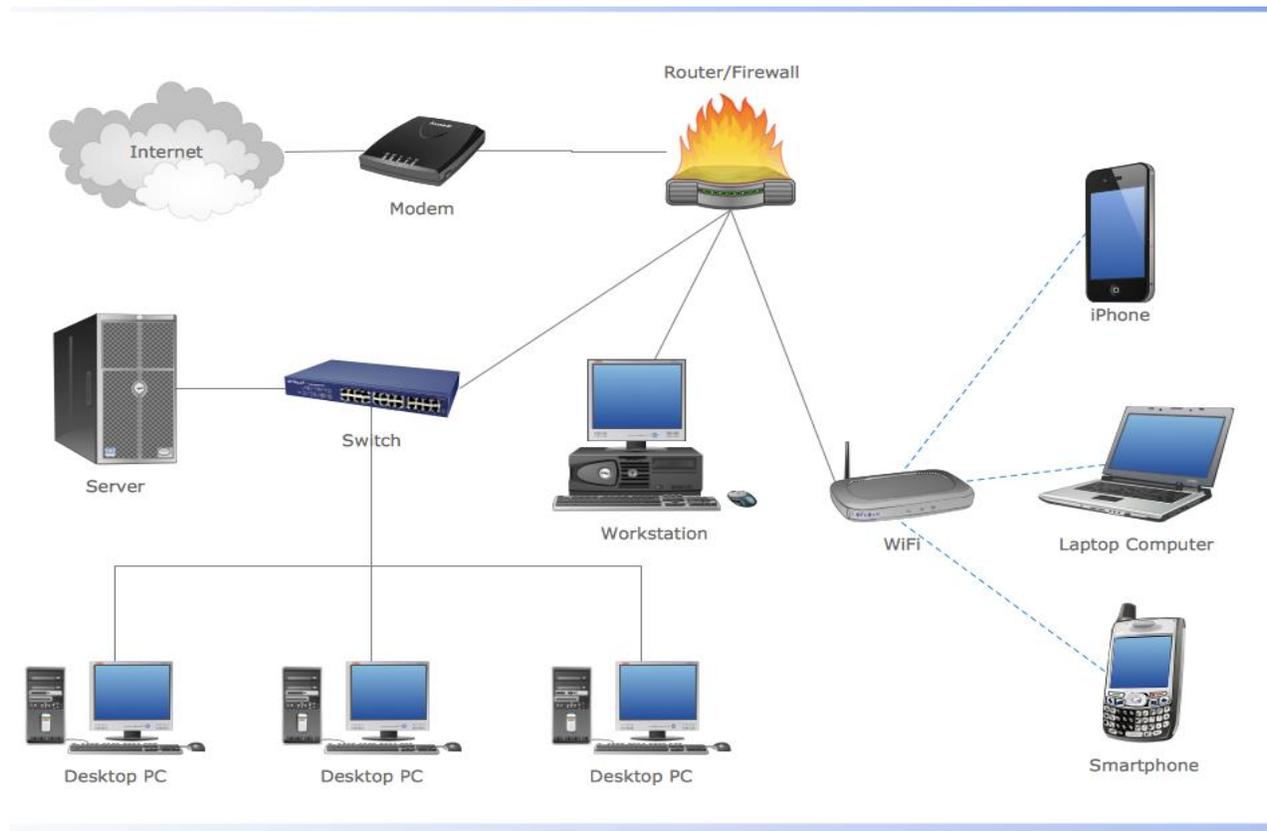


Fig 4.3 New system physical design

4.5 Database Design

The stage centres around the structure of the database which will provide storage of information and the data that should be handled by the system. The database is characterized as a well-arranged instrument that is fit for storing data in a logical relationship way through which data can be

recovered by the client in an effective way (Grant, 2010). The point is establishing the structure plan of the database and the underlying architectural setup. The design that will be described demonstrate the mappings of the database and the distinct dimensions that are encompassed. Additionally, the community view or schema that hosts the relations the database has will be laid out. The ANSI SPARC architecture is going to be utilized for the database design as shown and described in the underneath sections.

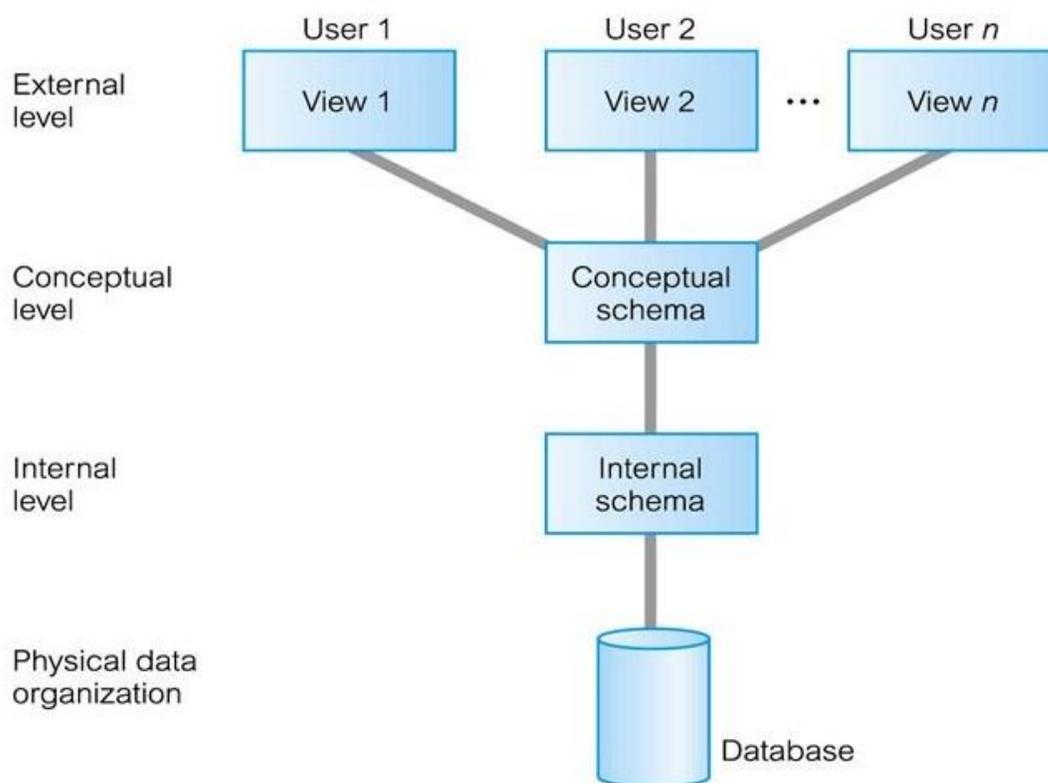


Fig 4.4 Database architectural design

The architecture of the database comprises of three important levels as shown in figure 4.4 namely the external, conceptual and the internal schemas. Underneath the mentioned levels in this section will be the exact database.

External Schema - a definitive client level that offers diverse perspectives on information to various people. It permits the accessing and controlling of information which is just important to a particular view.

Conceptual Schema – it is a community perspective on the database system that offers portrayals to information inside the database system and the connections that are there amongst the information.

Internal Schema – it is the bottom-most level that outlines how data within the database is stored on actual terms computer systems’ storage mechanisms. It is the bottom-most level of abstraction which not changed frequently.

4.5.1 Database Tables

They are utilized to store related information inside a database. They comprise of columns that determines properties and tuples which hold data relating to qualities of a particular entity (Brookshear, 2013). The database can include a number of tables that comprise the entire database.

Table 4.1: Users

Field-Name	Data-Type	Length	Field Description
Id	Int	-	Unique identifier field
Username	Varchar	40	Username of each user
Password	Varchar	40	Authentication credential
Email	Varchar	40	Contact credentials
Phone	Varchar	15	Contact credentials
Gender	Varchar	10	Identity data

Table 4.2: Comments

Field-Name	Data-Type	Length	Field Description
Id	Int	-	Unique identifier field
Message	Varchar	50	Content in comments
Date	Varchar	15	Date of comment
Post_id	Integer	5	Foreign key to another relation

Table 4.3: Posts

Field-Name	Data-Type	Length	Field Description
Id	Int	-	Unique identifier field
Message	Varchar	50	Content in comments
Date	Varchar	15	Date of comment
Post_id	Integer	5	Foreign key to another relation
Subject	Varchar	25	Decision subject

Table 4.4: Probability Logs

Field-Name	Data-Type	Length	Field Description
Id	Int	-	Unique identifier field
Polarity_score	Varchar	50	Probability figures
Comment_id	Integer	5	Foreign key to another table

Table 4.5: Opinions

Field-Name	Data-Type	Length	Field Description
Id	Int	-	Unique identifier field
Subject	Varchar	50	Opinion subject
Date and time	Varchar	50	Date recorded

4.5.2 Enhanced Entity Relationship (EER)

EER models, alternatively termed ‘extended entity-relationship models’, are an advanced version of UML database diagrams highly the same as regular Entity Relationship diagrams (Heathcote, 2005). EERDs are high-level UML models that clearly show the demands and complexities of sophisticated databases. The EER encompasses the following elements and properties which are the superclass and its subclasses, both concepts of a union type that serve to signify a collection of number of objects which are the combination of objects from several entity types. The EER design serves to make easy the challenging relationships that are present amongst objects in a relational database.

The EER for the ZEGU protest prediction system is shown overleaf.

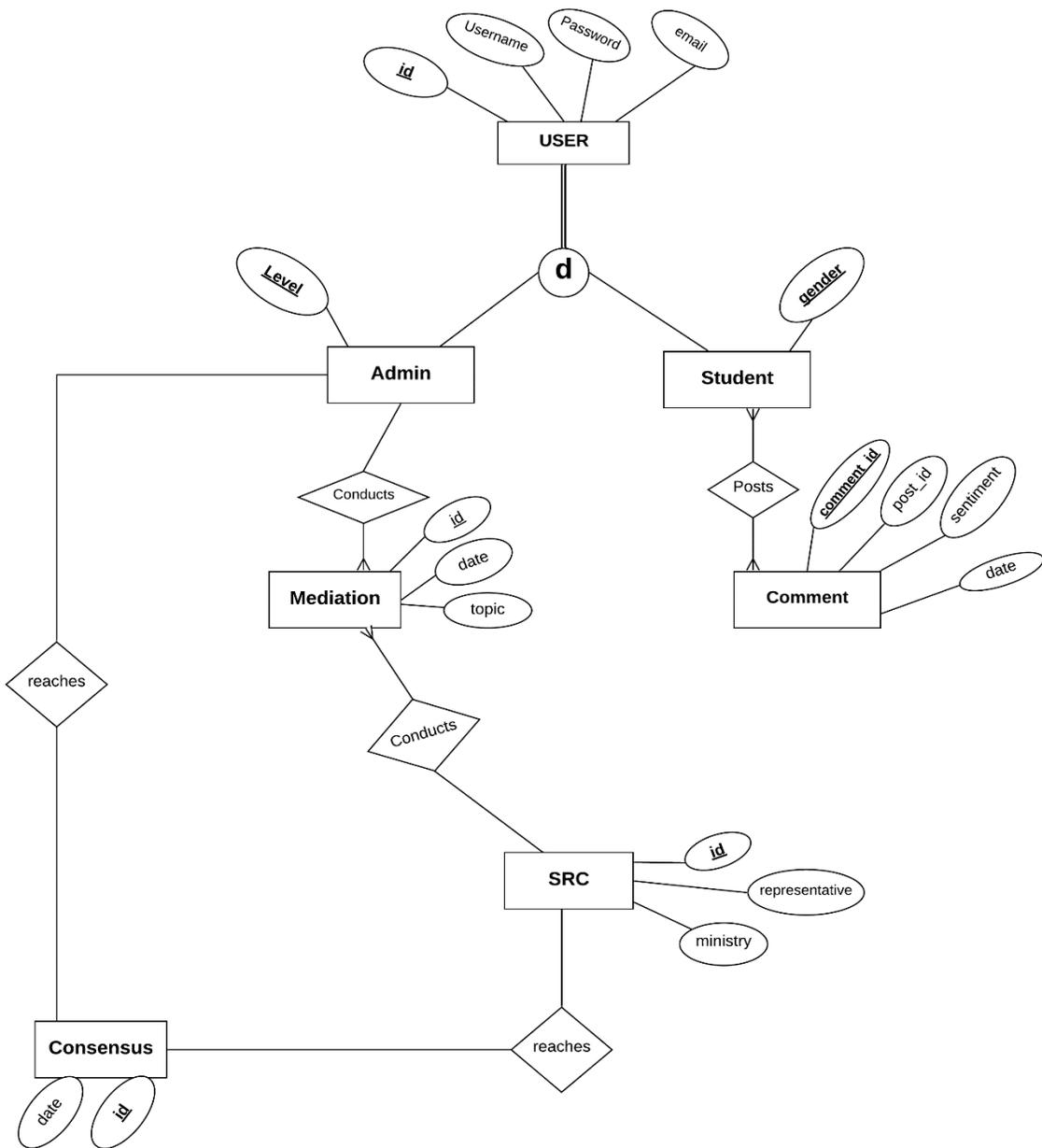


Fig 4.5 New system EER

4.6 Program Design

This design aspect outlines the different program modules which is the means by which the different modules will be structured as well as how they will communicate amongst one another and frame a combined solitary program (Heathcote, 2004). It incorporates the UML diagrams namely the class, package and sequence diagram which in this manner clearly outlines the system functioning sequence.

4.6.1 Class Diagram

French (2013) states that this diagram in Unified Modelling Language is a kind of static structural diagram that outlines the setup of a system by demonstrating the classes of the system, the characteristics they have, operations, as well as the relations among objects.

The ZEGU protest prediction system class diagram is as shown overleaf.

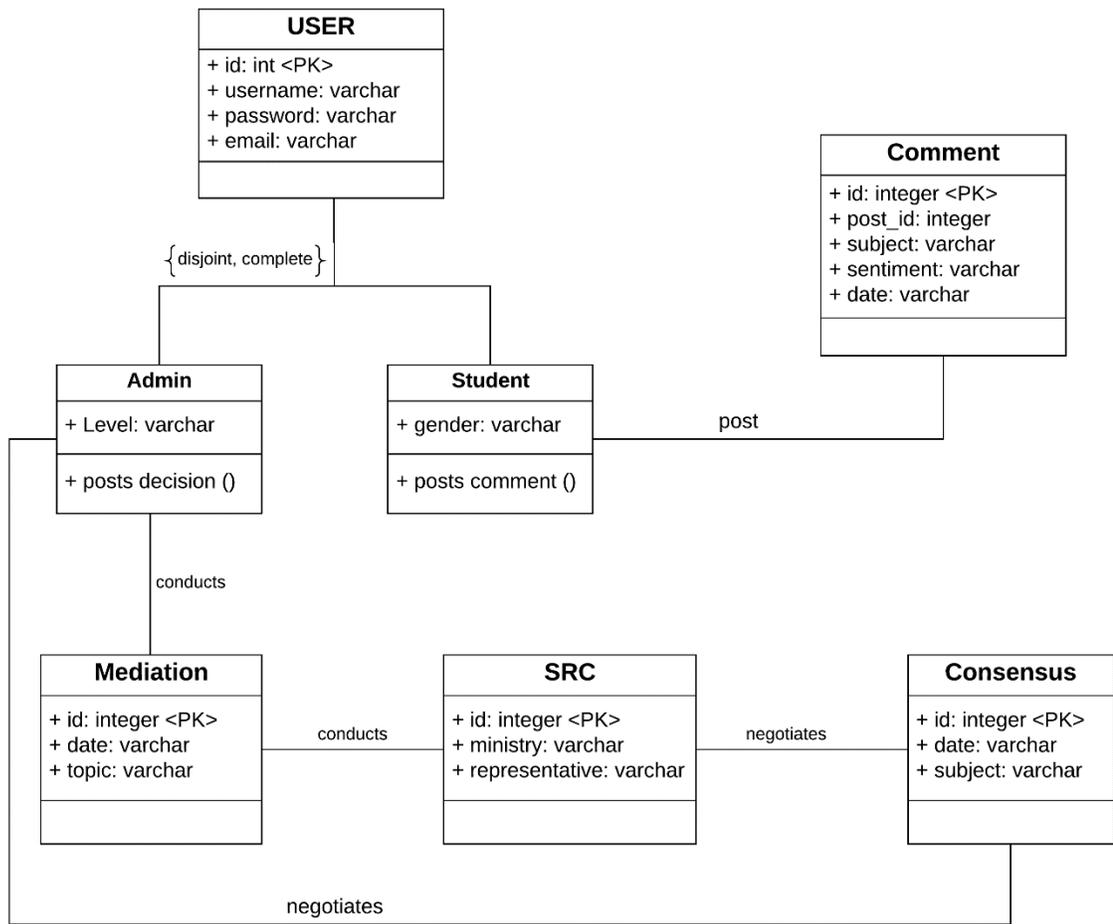


Fig 4.6 Class diagram

4.6.2 Package Diagram

This is an illustration that depicts packages within the system under development and their relationships. Packages are of significance in modelling components such as cases and classes into sets. The package diagram for ZEGU protest prediction system is as shown below.

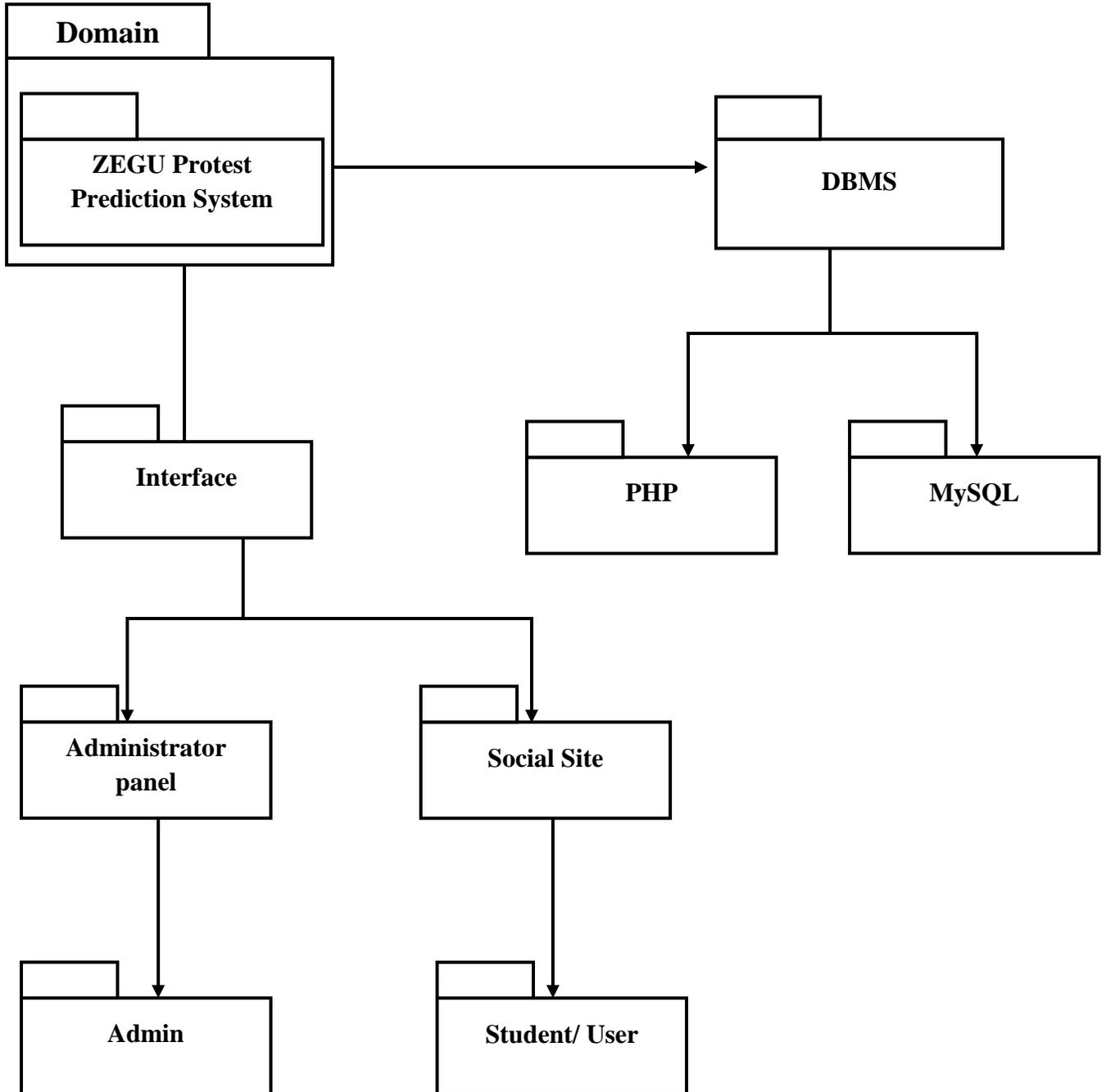


Fig 4.7 Package diagram

4.6.3 Sequence Diagram

It illustratively depicts how system entities relate in their sequential manner or order. It clearly describes the activities that the system entities partake and also describes the messages shared amongst them (Kielhofner, 2012). The messages and information shared normally passes through a number of objects or entities on its way to reach to the ultimate destination entity the message is intended for in the system.

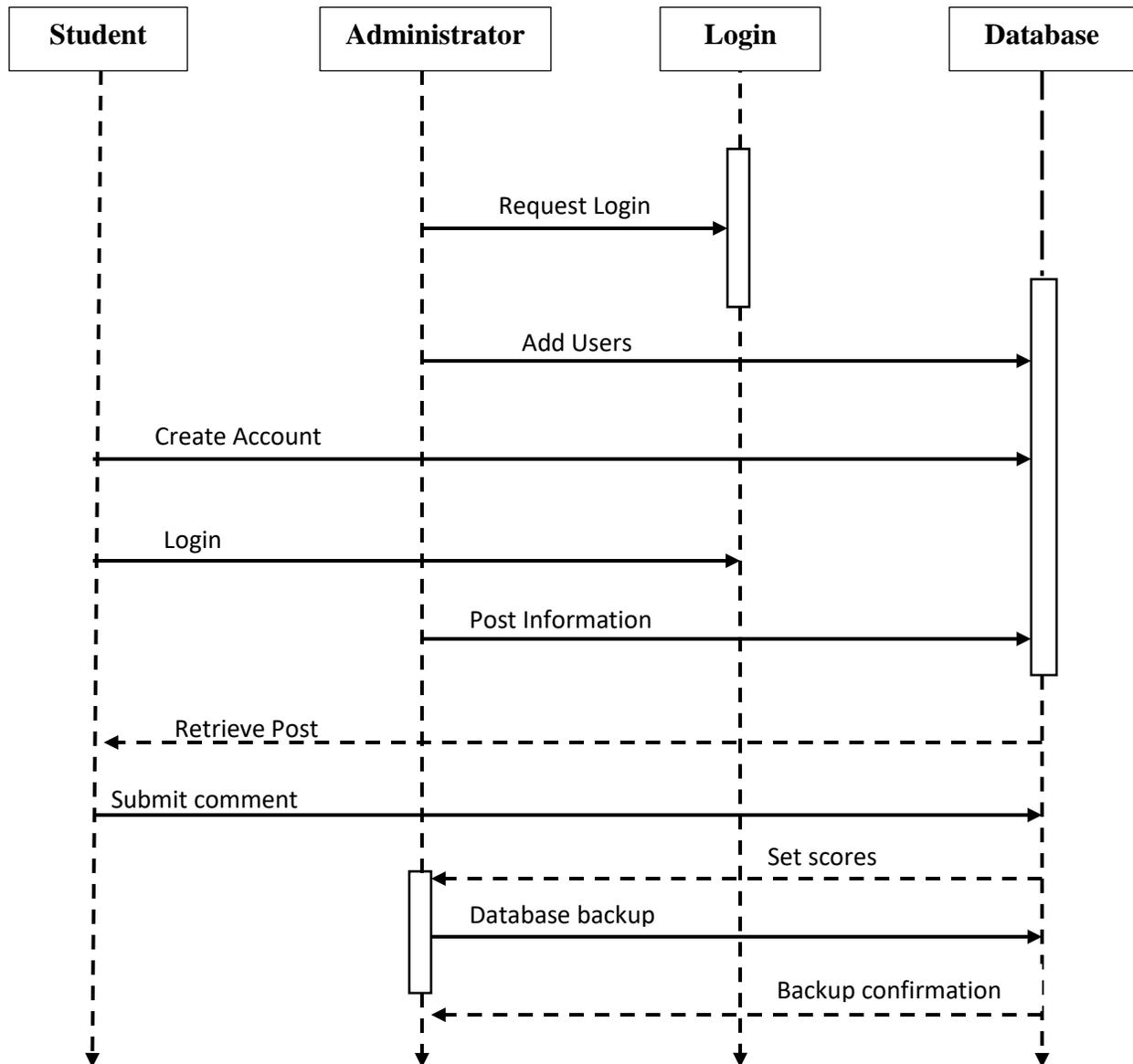


Fig 4.8 Sequence diagram

4.7 Interface Design

Sommerville (2004), describes an interface as the graphics, controls and menus at the user's end that are used by the user for interaction purposes to enable one to have communication with the application and invoke desired functionality. The interface can be defined a mediatory platform that gives users interaction with the system. An ideal interface should be clear and easily comprehensible as much as it should be user oriented. The user interface primarily focuses on menus, input and output. Interface design is the design aspect that is centred around the user and it therefore has to be captivating and assistive to the user.

4.7.1 Menu Design

A menu is the platform or interface from where the available options of navigating the system can be accessed from by the user. It can be tailored in a way that each particular user or group of users have different menus they view depending on the access levels differentiated and granted to them respectively.

4.7.1.1 Main Menu

It is the main page or welcome page that is presented to a user upon opening the system.

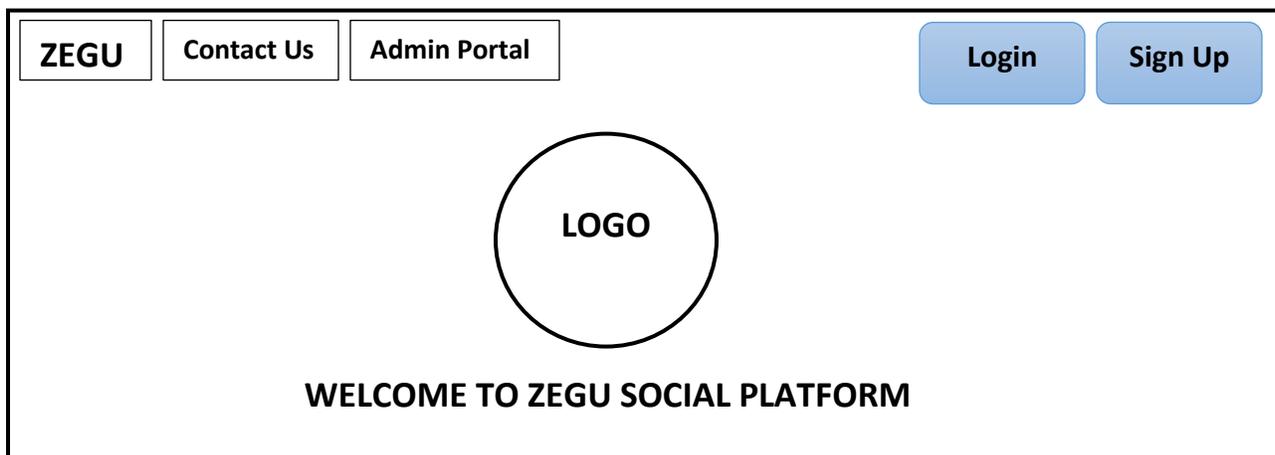


Fig 4.9 System Homepage

4.7.1.2 Sub Menus

These are specific menus that are to be used for purposes of navigating to different pages and will be presented basing on the of users' access level and the respective privileges that they have.



Fig 4.10 Student User Menu

Administrators Menu

It is a menu that will be visible only to the admin level user who will be responsible for monitoring system statistics through having the right to view the probability statistics on a dashboard.

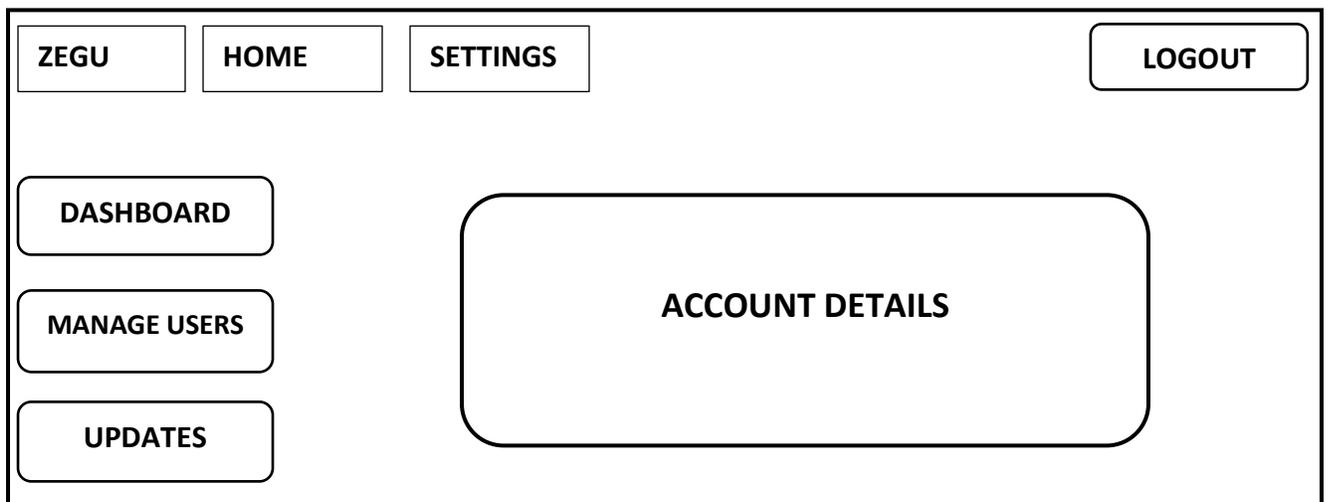
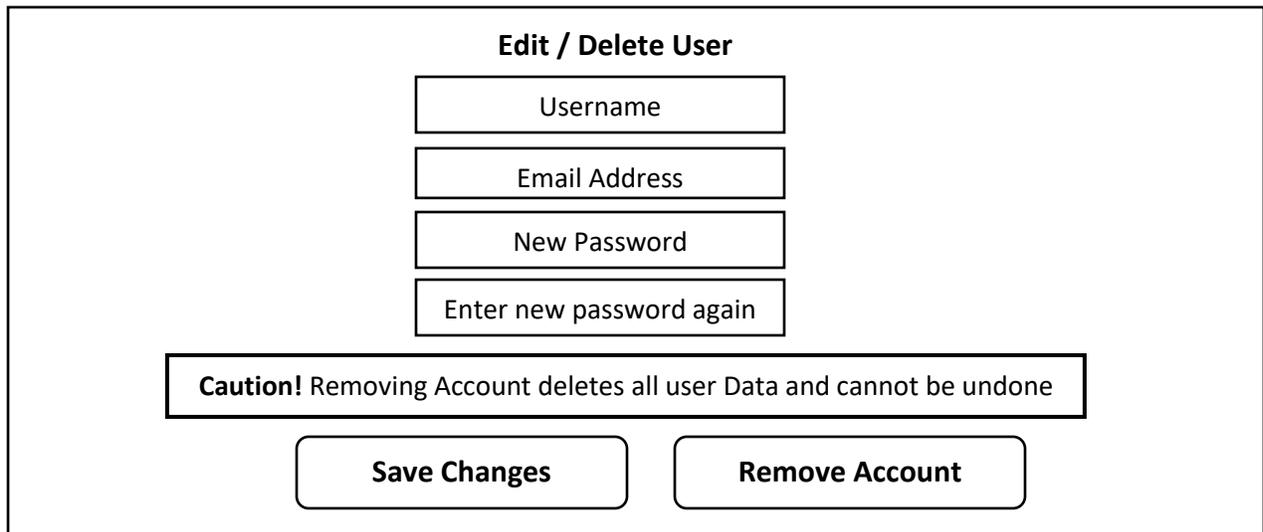


Fig 4.11 Administrator's sub-menu

4.7.2 Input Design

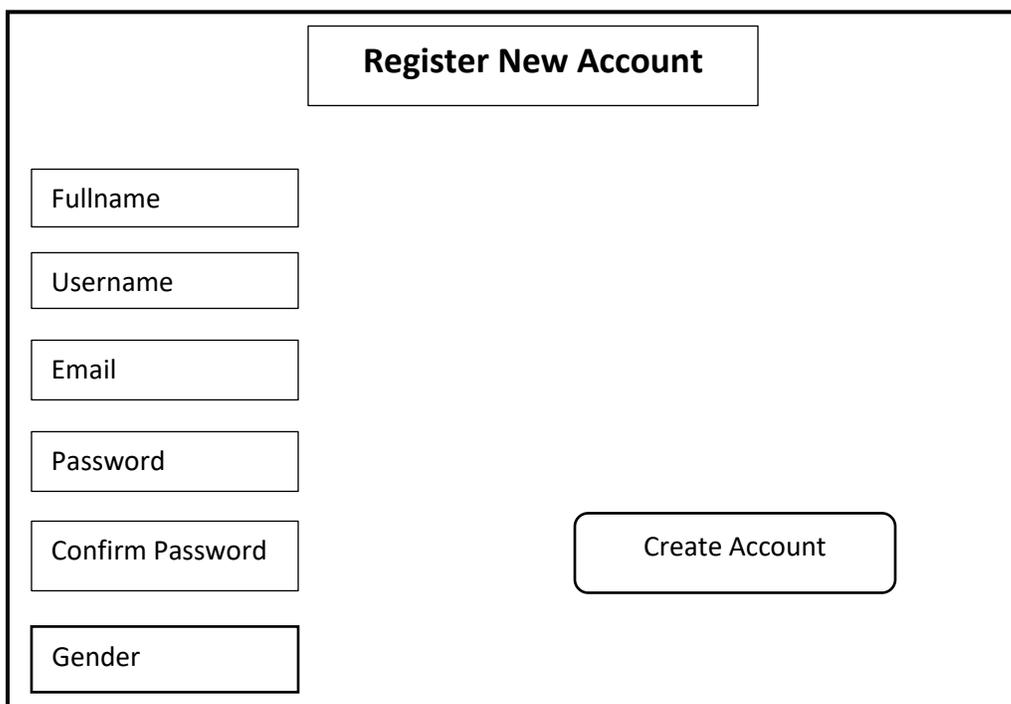
This is concerned with interfaces that allow for the capturing of raw data into the system prior to processing and for storage in the database. In designing input forms, validation must be enforced and ensured on every field in order to avoid database inconsistency or system errors that emanate from incorrect data being fed into the system.



The form is titled "Edit / Delete User" and is enclosed in a rectangular border. It contains the following elements from top to bottom:

- A title box containing the text "Edit / Delete User".
- Four stacked rectangular input fields labeled "Username", "Email Address", "New Password", and "Enter new password again".
- A wide rectangular box containing the text "Caution! Removing Account deletes all user Data and cannot be undone".
- Two rounded rectangular buttons at the bottom: "Save Changes" on the left and "Remove Account" on the right.

Fig 4.12 Edit User Form



The form is titled "Register New Account" and is enclosed in a rectangular border. It contains the following elements from top to bottom:

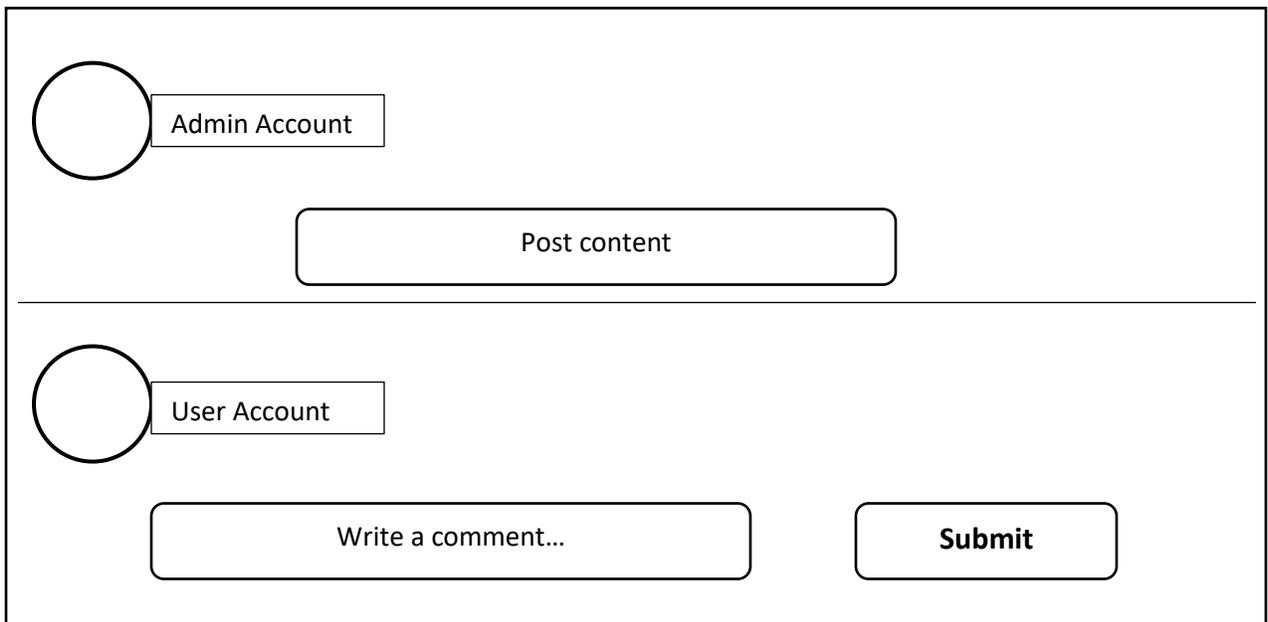
- A title box containing the text "Register New Account".
- A vertical stack of six rectangular input fields labeled "Fullname", "Username", "Email", "Password", "Confirm Password", and "Gender".
- A single rounded rectangular button labeled "Create Account" positioned to the right of the "Confirm Password" field.

Fig 4.13 User registration form



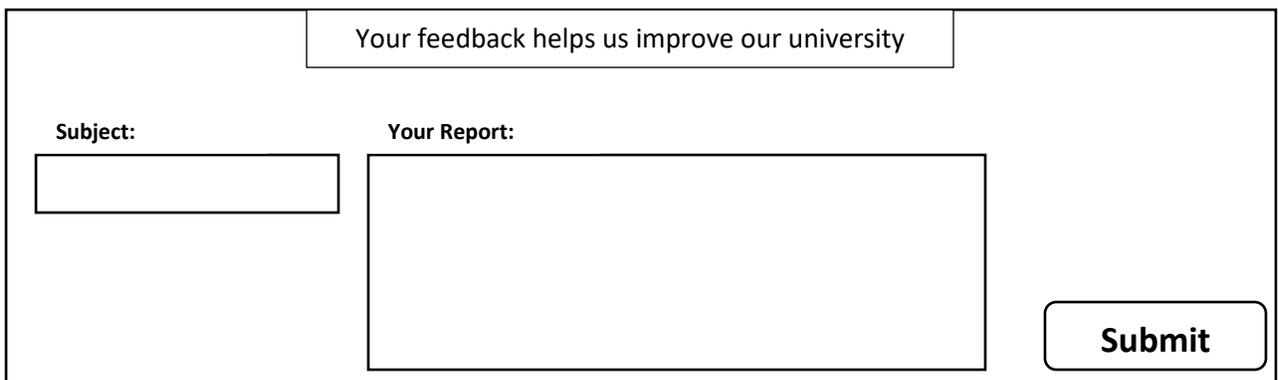
A wireframe of a post creation form. On the left, there is a circular profile picture placeholder. To its right, a rectangular box contains the text "Admin Account" above "Account name". Below this, a wide rounded rectangular button contains the text "Share post to the community...". To the right of this button are two smaller rectangular buttons: "Post Privacy" and "Post".

Fig 4.14 Create and share post form



A wireframe of a comment submission form, divided into two sections by a horizontal line. The top section features a circular profile picture placeholder, a rectangular box with "Admin Account" to its right, and a wide rounded rectangular button with "Post content" centered inside. The bottom section features a circular profile picture placeholder, a rectangular box with "User Account" to its right, a wide rounded rectangular button with "Write a comment..." centered inside, and a smaller rounded rectangular button with "Submit" centered inside.

Fig 4.15 Comment submission form



A wireframe of a feedback submission form. At the top, a wide rounded rectangular button contains the text "Your feedback helps us improve our university". Below this, the form is split into two columns. The left column is headed "Subject:" and contains a rectangular input field. The right column is headed "Your Report:" and contains a larger rectangular input field. At the bottom right of the form is a rounded rectangular button with "Submit" centered inside.

Fig 4.16 Feedback Submission Form

4.7.3 Output Design

It primarily focuses on the manner in which information will be displayed or conveyed out of the developed system after processing from input data provided. Information will be conveyed from the system in different presentations such as forms, tables or dialog boxes and system alerts to mention a few.

DASHBOARD							
Post		Date		Sentiment		Polarity Scores	●

Fig 4.17 Administrator's dashboard

Key Opinions List							
Subject		Keyword		Comment Ref		Post Ref	

Fig 4.18 Key Opinions List output form

Posts History				
Post id	Content	Date	Comments #	Compound Sentiment

Fig 4.19 Posts history Form

ALERT!

User successfully registered! You can Login now.

Fig 4.20 Confirmation of registration form

4.8 Pseudo Code

Heathcote (2005), states that this is basically a structured language simplified for the purpose of representing advanced programming variations in a way which is generalised and easy to comprehend not requiring deeper rooted knowledge of program syntaxes for particular programming languages. This is a kind of programming technique which is informal normally in structuring algorithms.

a) **Login**

ENTER email AND secret key

SELECT from users in MySQL database

IF email AND secret key are correct

THEN display user menu form

ELSE

Show “Login details invalid”

b) **Register User**

ENTER registration details

Verify authentication credentials

IF authentication credentials match THEN

Check if identifier is free and unique

IF TRUE THEN

INSERT record into MySQL database

Echo “User successfully registered into system”

c) Comment capturing Pseudo Code

ENTER post details and message

INSERT post into MySQL database

ENTER comment on post

Retrieve post_id as comment identifier

Allocate unique id to comment

IF comment has post_id AND comment_id

THEN

INSERT comment into MySQL database

ELSE

Return to Allocate unique comment_id

d) Send notification Pseudo Code

SELECT from MySQL database

WHERE table is probability scores

Check probability figure

IF probability figure is greater than limit THEN

Invoke send alarm notification to Administrator

ELSE

Return to check probability figure

4.9 Security Design

It is the fundamental function in the development of software that seeks to ensure security in software and make them less prone or nearly invulnerable risks known that pose probability of harm or put at risk the proper functioning of the system being developed (Heathcote, 2004). In designing systems, security is achieved through the implementation of various measures which could be rapid testing and different verification and safeguarding methods.

4.9.1 Physical security

It is concerned with the system protection in a bid to avert it from threats of a physical nature and natural adverse occurrences that expose the system to data loss and system failure resulting from jeopardy (Brown, 2010). It also focuses on deterring intended acts by individuals targeted at bringing danger or faults to the software by illegitimately gaining system access in an unwarranted way. The system's physical security is going to be enforced by use of different physical measures that will include securing the premises housing the hardware or infrastructure of the ZEGU protest prediction system. Furthermore, physical locks are to be installed to provide security to the equipment and hardware that are components of the system and only authorised personnel will be able to access the hardware using hi-tech mechanisms such as biometric accessing. In addition, the actual system which is the software will be accessed through numerous reliable authentication mechanisms.

4.9.2 Network security

The aspect aims to compel compliance to policies and agreed upon practices that will control and regulate how the system is to be used over the networks and the granting of access into the system by the different outside entities which will need system interaction (Thayer, 2005). The ZEGU protest prediction system is partially dependant on the web from which the social platform which captures the comments will be running on and thus network security measures are essential in the building and running of the new system. Handling of external links to the outside networks where there will be need for communication with remote hosts will be the responsibility of the server. Thus, the server will act as a proxy in the network security setup. The entire local network within

the university campus will be protected by a firewall and all devices connecting to the system through the system making up the full system.

4.9.3 Operational security

French (2013), says that this security aspect oversees the security enforcements to be set up so as to give insurance on the protection of the system in its normal daily lifetime operation. It is also concerned with the privacy and protection of personal information of the end users that will be interacting with the system, therefore, specifies such measures that enforce data integrity and privacy enforcement. Correct functionality of the system should be consistent throughout the operation of the ZEGU protection system so that it does not deviate from achieving the desired function goals. Security in terms of operational processes seeks to protect the new system from attacks by viruses targeted at corrupting the system data and may result in the system going down for a distracting amount of time. Therefore, the system's operational security design aspect must make sure and guarantee that adherence to secure limits is maintained so as to enhance a smooth and secure running of operations with the system.

4.10 Conclusion

Thorough description of the design aspects relating to the system to be developed have been given giving light on the structure of the system and how it going to be setup physically and logically. The flow of information that will be occurring in and amongst the system entities have been shown through the context and dataflow diagrams. The system's setup structure and architecture were defined and outlined in the architectural design section and further focus was put on the physical design as well clearly describing the relationship of the software with the hardware. Database design was looked at in detail showing the relations between entities in the system through different UML diagrams. The program design of the new system was also illustrated using relevant diagrams that convey adequate information. Interface design and security designs were also explained enhancing a clear comprehension of the ZEGU protest prediction system overall design. The upcoming section is the implementation stage that is going to focus on the delivering, testing and new system maintenance.

CHAPTER 5: IMPLEMENTATION PHASE

5.1 Introduction

Implementation is referred to as the process of deploying and setting up the newly developed system in its operational environment (Heathcote, 2004). The implementation phase involves fundamental activities of the project that facilitate the delivery of the system to its operational environment. Subsections that will be covered are coding which outlines the scripting languages that were used to build the system modules. Testing of the system at various stages will also be looked at as well as the final delivering of the system which is the implementation. A thorough description of the changeover strategies available for delivering of the system will be provided within the chapter and the implemented strategy will be highlighted. Further focus will be on system maintenance in its lifetime use using different strategies as well as recommendations for future development and enhancement of the system will be given as well.

5.2 Coding

Brown (2010), outlines that coding is a well-structured exercise of writing programs or software in relevant programming languages for execution on a computer to achieve stated objectives. The coding was done using high level OOP languages and programs termed compilers were used to convert these high-level instructions into machine language which is understood and can be executed by the computer. For the purpose of the ZEGU protest prediction system, which is extensively reliant on the web, the ideal scripting language for web-based systems which is PHP was used. Other design enhancing packages and languages were used to develop the interface of the system. The coding exercise involved several parties which included fundamentally the administrator, the programmers, the analyst and others involved in the research. The code snippets for the system are given in the appendices section of the document.

5.3 Testing

Brookshear (2013), defines the term testing as a procedure of evaluating the developed system in terms of all its functionalities to determine whether or not it fulfils its stated objectives.

This is an essential stage in system development as it ensures quality of the software which is going to be given to users since errors and faults in the system are exposed and corrected during this testing phase. The testing is done using several techniques and at various dimensions by different parties in order to establish a solid conclusion on the way the systems deliver. Testing was done on the system to verify that the system met the specified requirements both functional and non-functional. System testing also focused on the validation of the system that is fundamental for ensuring correct data entry into the system by users. The techniques that were used by the developers for testing the system include unit testing which was done through white box testing as well as black box testing. For software testing and system integration testing, module testing and subsystem testing at different system levels were applied. The diagram below illustrates how the testing process was structured and done on the system before and during its implementation.

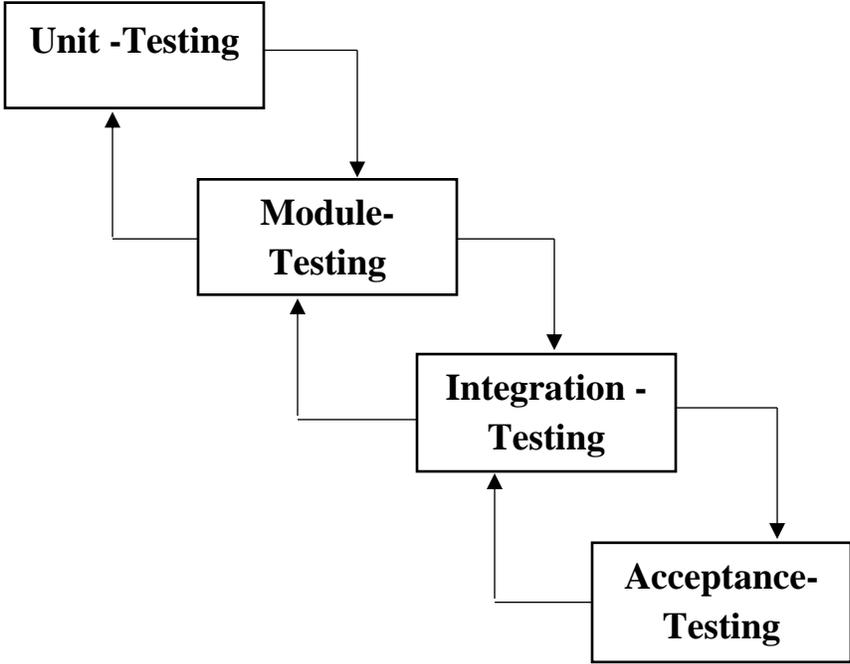


Fig. 5.1 Diagram for Testing criteria

5.3.1 Unit Testing

It involves testing system components as single independent units before they are put together to form modules (Brown, 2010). Unit testing is done for earlier identification of errors at a stage where they are less challenging to correct and therefore ensures that program units are error free and running smoothly before being integrated with other units. This testing was carried out as white box testing where the developers carry out the code-based testing. The satisfaction of the end users as per functionality was then later assessed in black box testing. The units were tested as to whether they were functioning to the optimum and updating all the required elements. The screenshot below shows the unit testing of the system where the user registration process unit was tested.

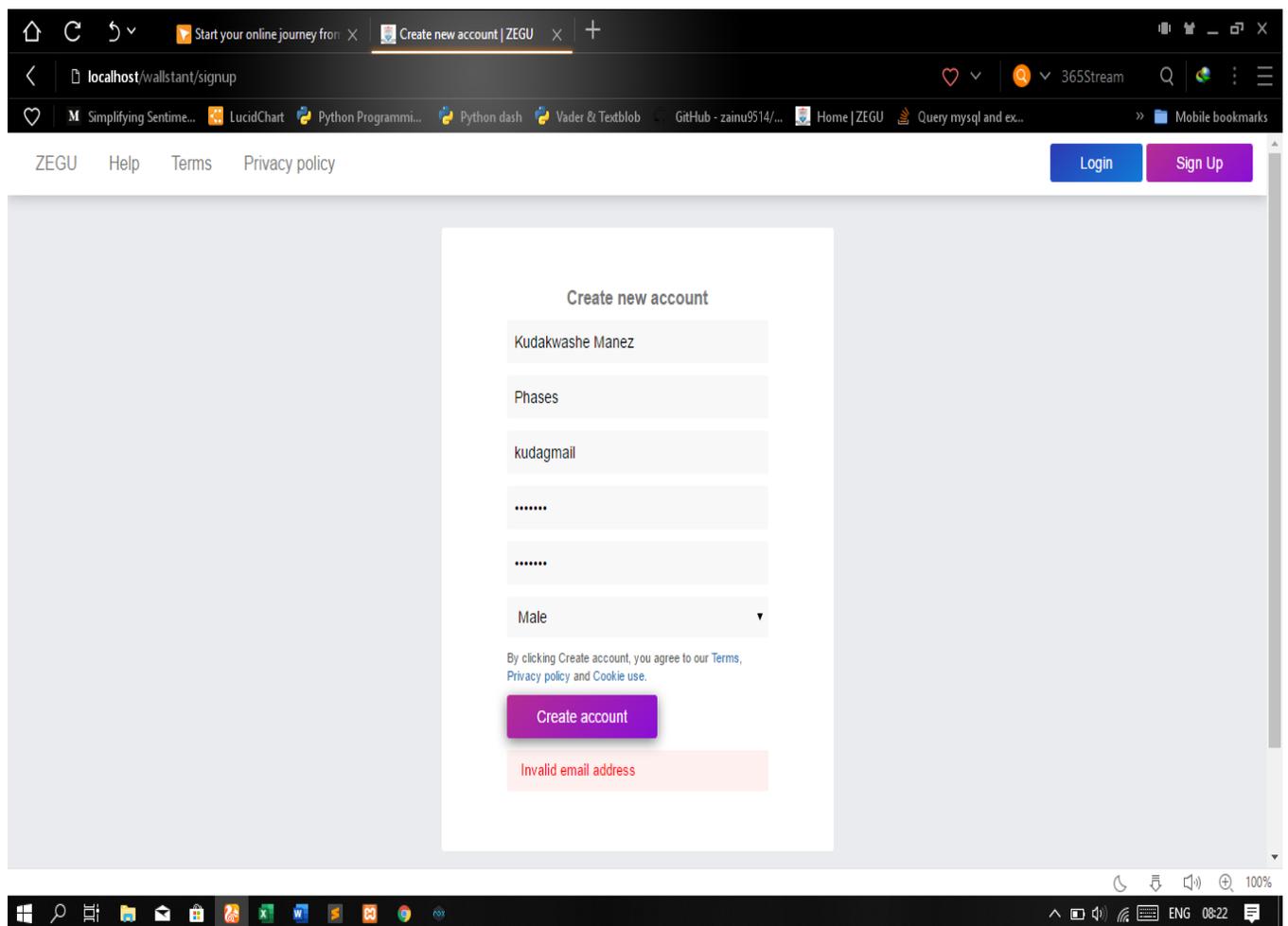


Fig 5.2 Unit testing on user registration module

5.3.2 Module Testing

With module testing, independently well functioning units are combined together to form modules and these seek to accomplish a collective functionality. Also known as subsystem testing, this testing criteria is applied to check if merged system components and units are functioning well, in an error free manner, that depend on one another to achieve a desired collective goal (French, 2013). The developers combined several units logically related into modules and tested out how these modules were functioning bringing up and correcting any errors identified. The screenshots below show the various scenarios that were tested in the ZEGU protest prediction system under module testing.

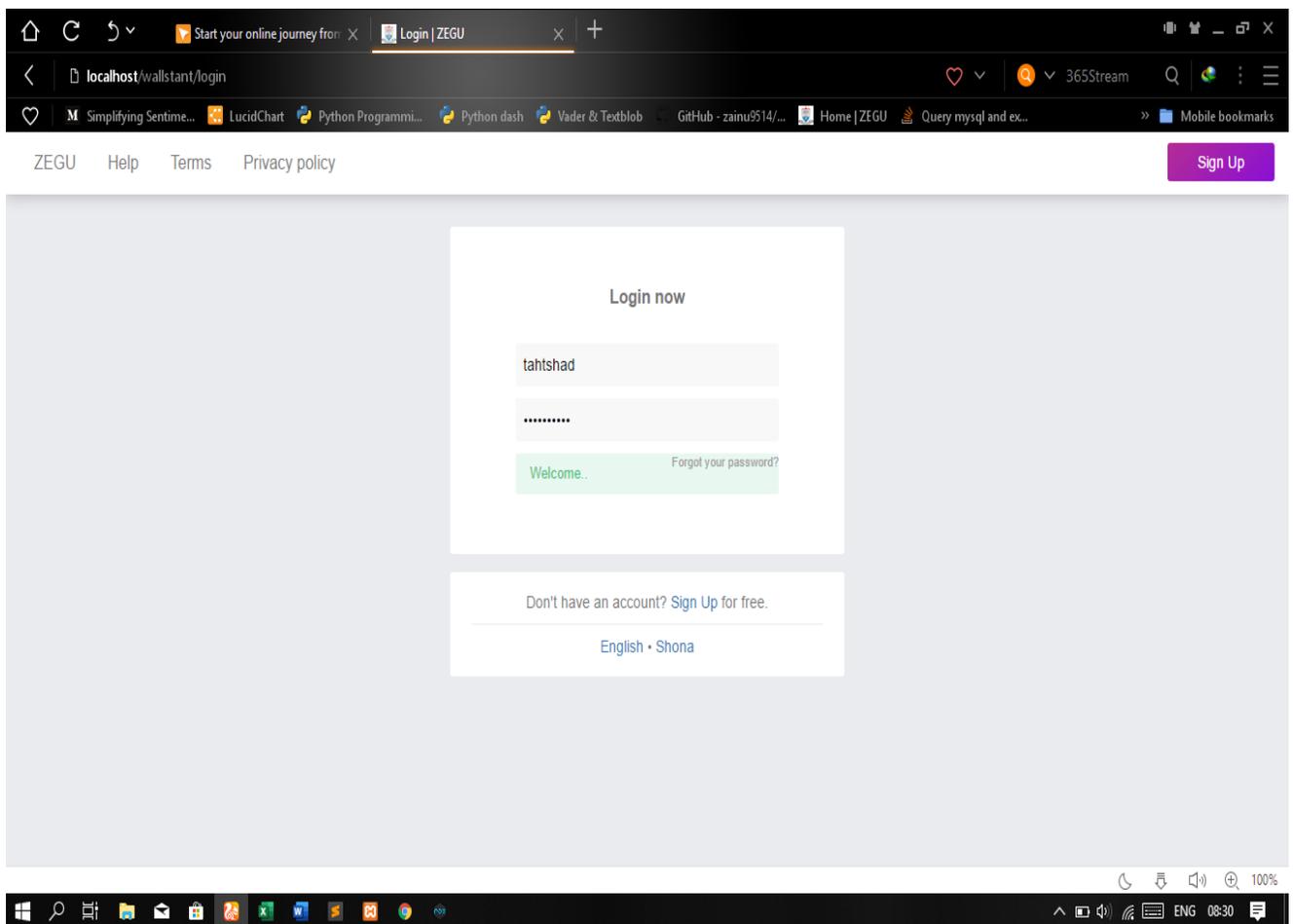


Fig 5.3 Module testing

5.3.3 Integration Testing

Brown (2010), says that integration testing is concerned with the testing of the system modules brought together into one integrated system to check whether the units and modules will merge perfectly to provide desired and anticipated functionality at the system level. It is an essential testing stage and technique as it ensures that the modules are able to intercommunicate in systematic way delivering efficient functionality to the users correctly. Integration testing is where the developers verify that the modules pass arguments to each other perfectly without causing system failure and that a collective goal can be achieved by the different system modules working together.

Sentiment Polarity Scores

Post_id	Content	Negative	Neutral	Positive	Compound	Action
19001	Click to read content	0.0	0.189	0.811	0.6468	View Graphs Delete Record
19002	Click to read content	0.265	0.122	0.002	-0.213	View Graphs Delete Record
19003	Click to read content	0.515	0.485	0.0	-0.4914	View Graphs Delete Record
19004	Click to read content	0.0	0.389	0.692	0.598	View Graphs Delete Record

Fig 5.4 Integration Testing

5.3.4 Acceptance Testing

After completion of a system development and when software application is considered set to be delivered to the end users it goes through the final testing stage where the level of user acceptance for the system is assessed. Buelens(2012), describes it as a testing method carried out to establish whether the developed system has satisfied the requirements specified.

This is very essential because the software may match the requirements of the user but he may not favour the outlook and appearance thereby rejecting it. Acceptance testing is characterised by two components namely alpha and beta testing. The acceptance testing was carried out for the ZEGU protest prediction system through presenting the system to a target group of the system users who evaluated the functionality and usability of the system thereby allowing the determination of the degree of acceptance.

5.3.5 Validation

Marakas (2013), defines validation as an essential system function that is concerned with ensuring correct data input when user input is taken into the system. The system must be designed in such a way that it rejects wrong format of data in respective fields of data entry. Validation can be implemented in various forms to the system all working to help maintain data integrity in the database. It can be used to direct a user to enter only the data to be taken in a particular field, thus it should in some way the user the type of data to input when it rejects incorrect input.

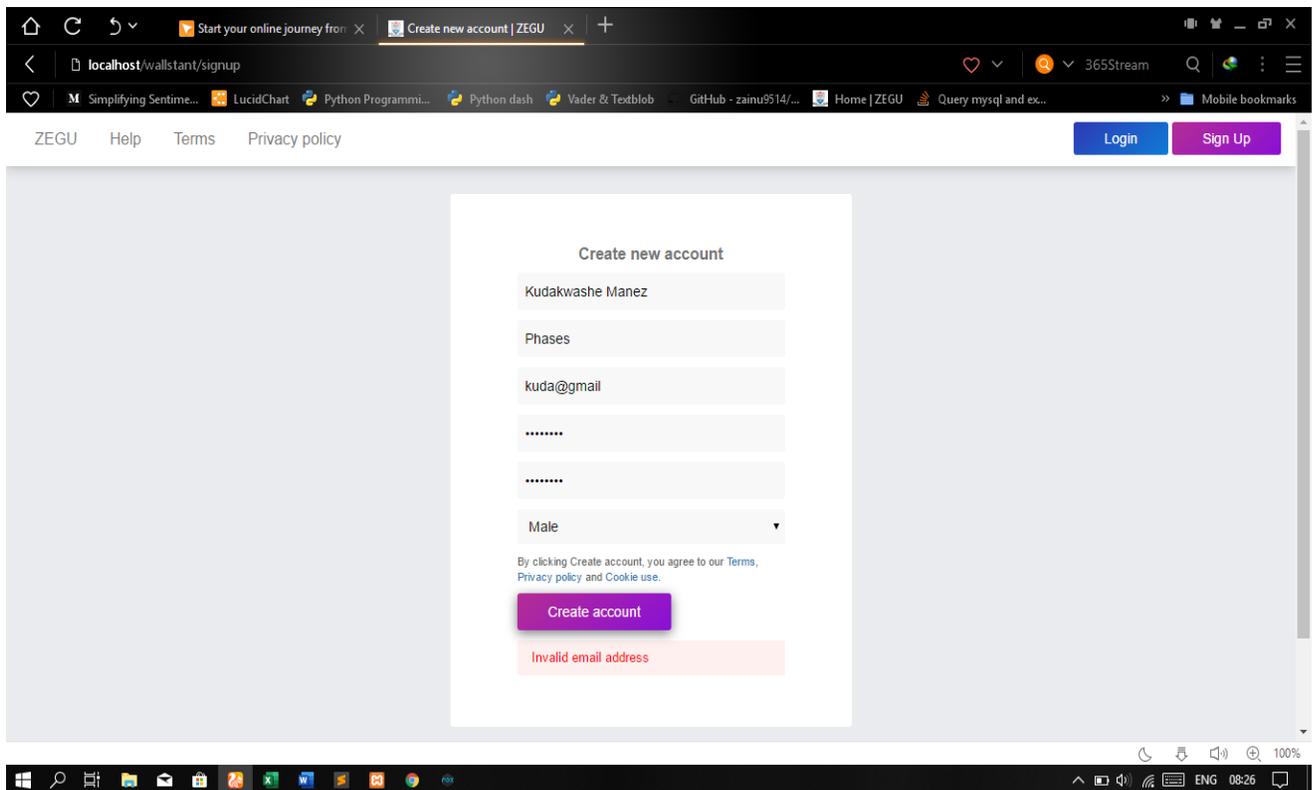


Fig 5.5 Validation of email address input

The image shows a web form titled "Create new account". The form contains several input fields: a name field with "Tabeth", a password field with "Kumb!ca\$h", an email field with "kumbigmail", and two fields for a password confirmation, both containing ".....". A dropdown menu for gender is set to "Female". Below the form, there is a purple "Create account" button. A red error message box is displayed below the button, containing the following text:

Error in username :

- ✘ Special characters not allowed.
- ✘ Username should be in English.
- ✘ Only (_) allowed between words.
- ✘ Numbers and letters are allowed.
- ✘ White spaces not allowed between words.

Fig 5.6 Username input validation

5.3.6 Verification

This involves setting certain checks that are done on system data to verify the correct implementation of functions by the new system as anticipated (Grant, 2010). The system is evaluated in relation to the requirements given for it as both functional and non-functional to see if these are being fulfilled. A well developed system must exhibit capabilities to make comparisons of data given from users and the system data in executing processes.

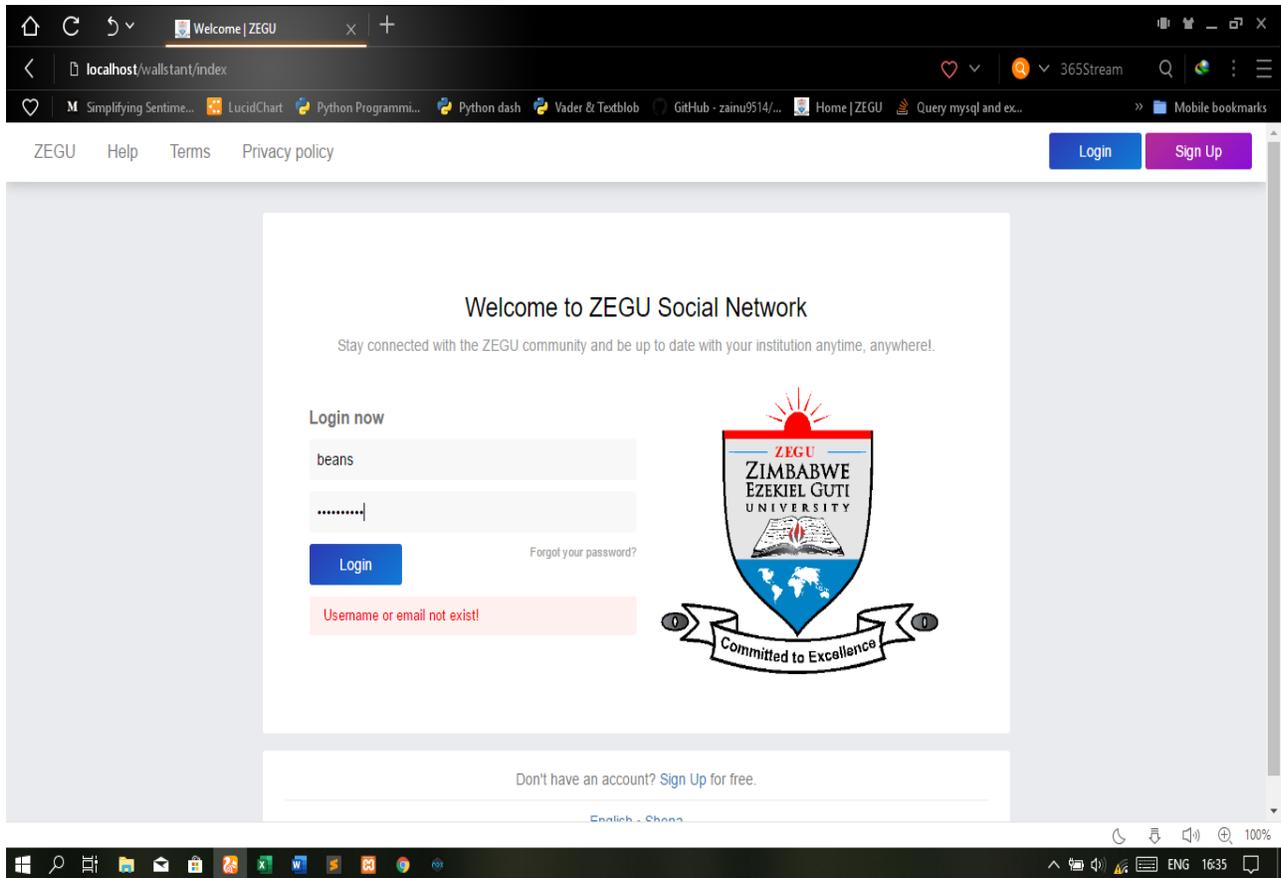


Fig 5.7 Verification of user login credentials

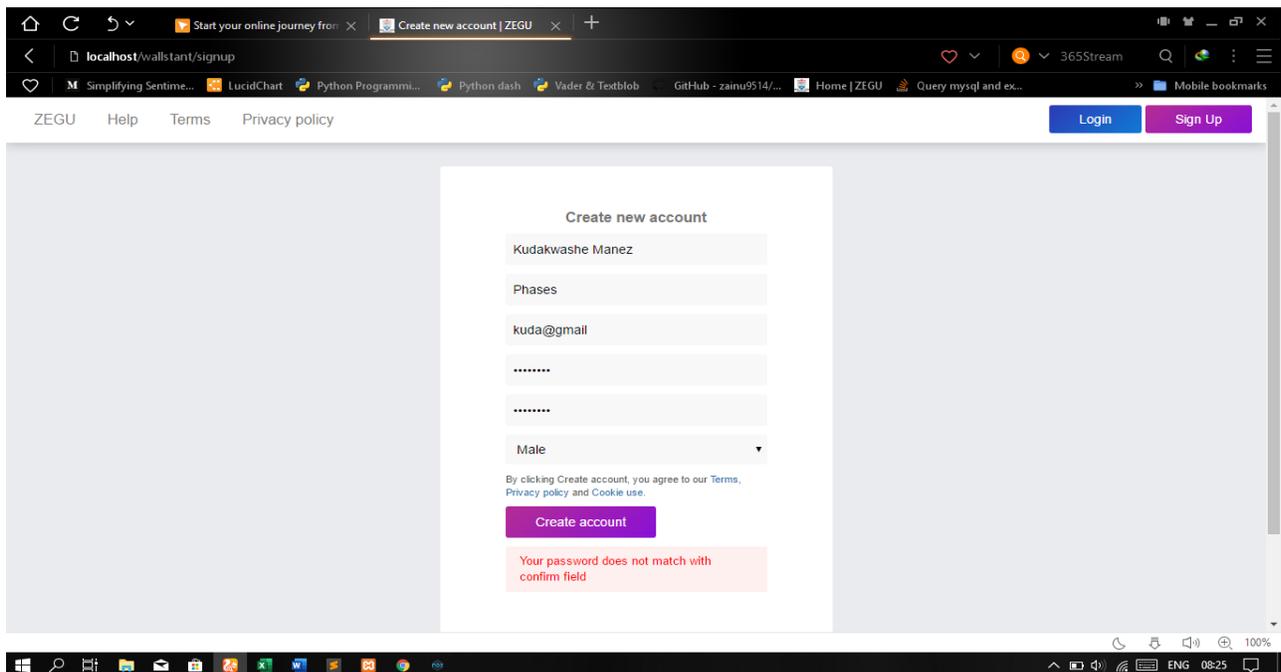


Fig 5.8 Verification of passwords on user registration

5.3.7 Security Testing

This testing was done to assess the fulfillment of the security design stated in the previous chapter. The system had to be tested on how it secured user data and prevented vulnerability from unauthorized persons and malicious intentions. The screenshot below illustrates the security that was implemented on the login module to limit the number of login attempts by any given user before access is restricted for a given period of time.

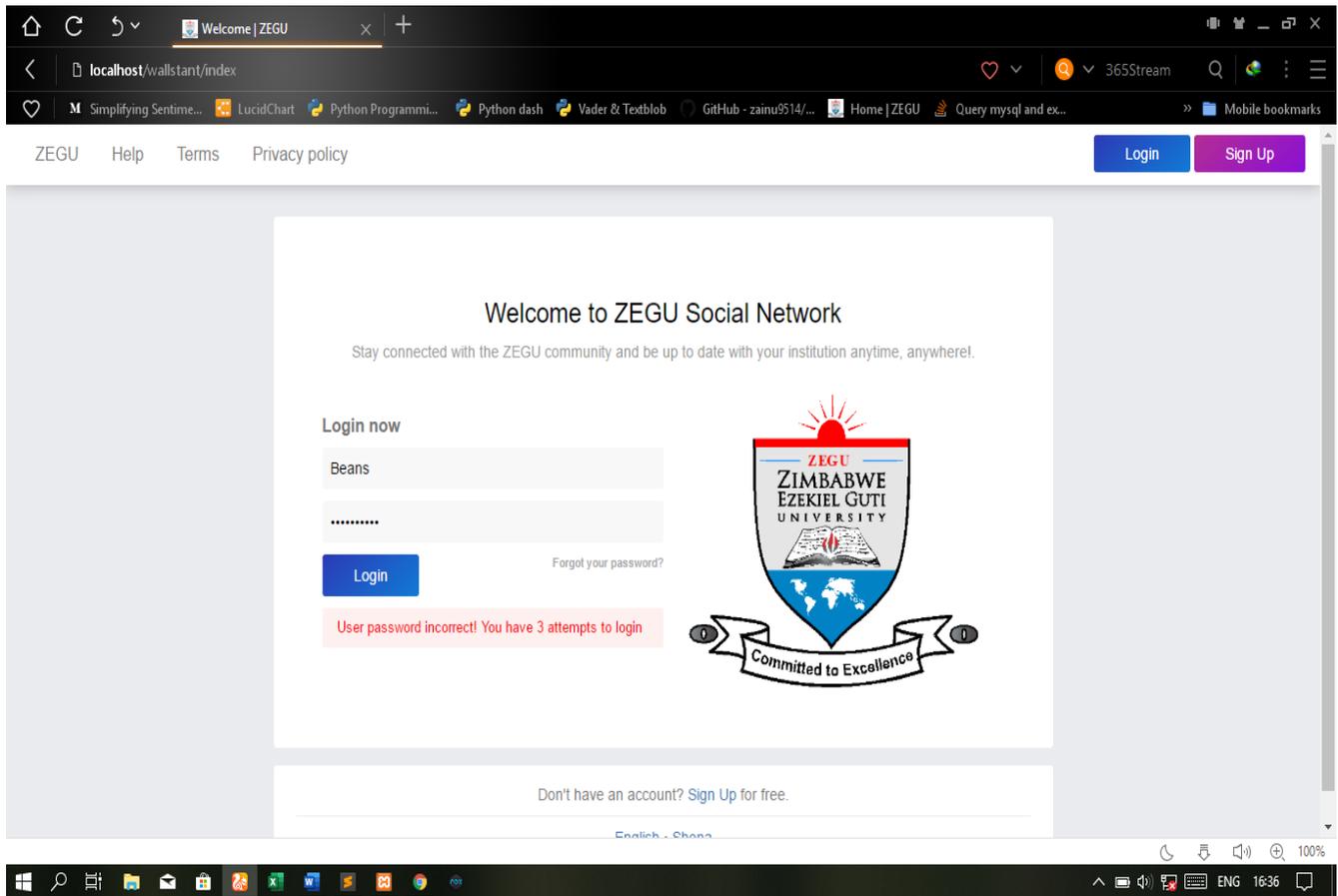


Fig 5.9 Security testing on the login module

5.4 Installation

Brown (2010), states that installation is a process of putting the system into a usable state ready to be utilised for the purposes for which it was designed for. Therefore, the installation section main focus is on installing all the components of the ZEGU protest prediction system which includes the hardware and the software. The hardware was setup at the institution and all required connections between the components were made and compatibility checked. After ensuring correct setup of the equipment on which the software system is to run, installation of the new system was then done and all utility programs needed to facilitate the smooth operation of the system were added. Installation encompassed other project activities that could be conducted after the system was put into usable form and such activities included the training of end users and choosing of the appropriate changeover strategy to the newly developed system.

5.4.1 User Training

Capozzi (2012), states that this is a process of transferring knowledge and the necessary skills required to operate and interact with a certain object or system from one individual with the knowhow to the other. The primary objective of user training is to equip system users with the appropriate knowhow on how to use and interact with the ZEGU protest prediction system. There are basically two groups of users that will interact with the system that is the students who will use the social platform and the administrators who will have additional access to the dashboard of the protest prediction system. The students' platform is made less challenging to comprehend as it will be challenging to gather them for training sessions on system' characteristics and also since they are already familiar with using social networks, they will easily understand the functionality. However, data input will be validated strictly for all the system users to ensure that they become used to the correct practices on the use of ZEGU protest prediction system. The administrators of the system require relatively intensive training on using and interpreting results from the dashboard and this was done through presentation of slides that were prepared with the actual visualisations of the system functionalities. Practical exercises were also carried out with the system administrators using demo data so as to help them familiarise with the system and its correct operation.

5.4.2 Data Migration

Grant (2010), says data migration is the process of transferring data across storage forms or between information systems. It is a necessary process normally when upgrading systems or changing from local to cloud storage. For the ZEGU protest prediction system, there was less data that required to be moved to the new system since there was not any manual system that provided the exact same functionality before the system was developed. Therefore, the developers of the system did not have many challenges in carrying out the exercise and the risk of data loss was minimised.

5.4.3 System changeover strategies

Changeover of the system is described as the procedure of shifting from the current system in use to another developed or introduced system when users have been sufficiently acquainted with skills on how to use the new system (Buelens, 2011). There are a number of changeover methods that can be adopted to deploy the system to the ultimate user. A single suitable strategy will be chosen and implemented from the various options available. Strategies of changing over the system that are discussed in this section are the direct, phased and parallel changeover.

5.4.3.1 Direct changeover

Grant (2010), states that direct changeover is a straight forward and simple strategy employed to migrate to the newly introduced system from the current system in use. In this type of migration, the current system is abandoned the moment the new system is readily setup for use at the institution. The strategy is relatively risky to choose due to the fact that if the new system fails, there will be a downtime and data may be lost.

Direct Changeover Advantages

- It is implemented within a minimum period of time.
- It is easy to conduct and easier for users since they focus on understanding only one set of processes.
- The newly installed system is made to function right after it is ready to be utilised.
- It involves the least costs since only a single system is going to be maintained at a time.

Direct Changeover disadvantages

- If the system happens to fail, the consequences will be fatal as there will be no back up plan.
- The system may fail to deliver as expected and show a fault that cannot be easily corrected without suspending operations for some time which will disadvantage the institution.

5.4.3.2 Parallel changeover

This can be defined as a situation whereby the newly developed system is run at the same time with the currently existing system for a period of time until an establishment can be made that the new system can conduct the operations of the organisation independently and reliably.

Parallel Changeover Advantages

- The current system will be referred to as an alternative for backup security in case the introduced system does not give the expected functionalities.
- It allows for the new system to be evaluated in terms of the extent to which it addresses the problems that existed by comparing it with the old system.

Parallel Changeover Disadvantages

- The institution or organisation implementing this strategy may incur increased costs in maintaining two system at once.
- Likely to result in users being reluctant to learn the new system processes since they will be having a familiar system around.

5.4.3.3 Phased changeover

Laudon (2013), defines this strategy as the process when an organisation or the developers introduce the system to its users in gradual stages up until the entire system is fully deployed for full scale use in the organisation. It seeks to get the users to appreciate the system slowly and easily as functionalities are rolled out them a few at any given time to enhance ease of understanding.

Phased Changeover advantages

- The newly developed system is introduced and implemented with much caution thereby minimising the effects of total system failure.
- The users are given adequate time to familiarise with each aspect of the system as it comes to them.

Phased Changeover disadvantages

- Identification of faults in the later phases of the implementation process may prove to be disastrous and time wasting since earlier rectification could be done if the system was implemented fully at once.
- It requires a lengthy period of time before the institution will be able to accurately realise the true merits from the system.

5.4.3.4 Recommendations on the changeover strategy

The strategy recommended for changeover to the ZEGU protest prediction system is direct changeover. This is the applicable strategy on the situation at the organisation since there was no other system relating to the new system that was in existence. The developed system will be installed fully and will operate on full scale at the institution building its own data.

5.5 Maintenance

Bell (2005), says that maintenance of systems software is the modifications and amendments to a software product post its delivery to the users in a bid to rectify errors that were missed in testing and to continuously perfect the system so that it runs efficiently. Technology is changing rapidly in the modern day and maintenance is necessary for software system in order to ensure that they do not become obsolete. There is various maintenance criterion that can be applied on computer systems for corrections and updating purposes. The maintenance types that will be used for the ZEGU protest prediction system are outlined in the subsequent sections namely perfective, corrective and adaptive maintenance.

5.5.1 Perfective maintenance

Grant (2010), outlines this maintenance type as the continuous improvement and updating of a functional computer system so that it performs and functions at its best possible level and yield satisfaction to the users. Therefore, perfective maintenance is concerned with the addition of features that facilitate optimal performance of a system in its given environment. The ZEGU protest prediction system will undergo continuous testing and appraisal and from this process some defaults or shortcomings will be noted thus calling for the maintenance of the system to reach perfection or to edge closer to perfection.

5.5.2 Corrective maintenance

Henry (2004), gives a description of this maintenance type as the rectification of bugs that emerge in the lifetime use of the system and after users start to interact with it on a frequent basis. Developers of the system conduct thorough tests on the system but it is normally the case that not all errors of the system can be identified during these testing exercises and such errors will be encountered by the users. This maintenance is largely the responsibility of the internal Information Technology team in the organisation as they are the one who are readily available on standby to address daily operational issues of the system. Reported errors are then fixed through corrective maintenance by correcting the system's functionality to be as anticipated by the users. Consultation is normally made to the developers of the system during the early phase of the system's existence as the errors that will be identified will need their expertise and familiarity with the system.

5.5.3 Adaptive maintenance

Brown (2010), defines this type of maintenance as the maintenance that is necessary to prevent the system from becoming obsolete in the rapidly changing technological environment. In the modern day, several integrations to system give an edge of advantage by utilising the vast APIs that are available to enhance systems communications and thus adapting to these innovations calls for adaptive maintenance. The ZEGU protest prediction system may, in the future, need to encompass changes in the procedures or operations at the university thus adaptive maintenance becomes essential.

5.5.4 Recommendation

The recommended type of maintenance for the ZEGU protest prediction system is mainly the adaptive maintenance so that the system to moves along with the rapidly everchanging technological environment. This type of maintenance is to be applied mainly but along with all the other mentioned maintenance types so as to ensure a smooth functioning and error free software system.

5.6 Recommendations for development in future

In the future for development prospects, the developers and maintenance team of the system should focus on the following areas of the system:

- Integrate a live update of the sentiment output that will be showing live the changes in the polarity figures through the graphs and pie charts.
- Perform automated opinion mining on the text in the comments retrieved from the database for the administration to know the likely needs of the student community.
- Integrate the system with other popular and extensively used independent social network platform to diverse the information and opinions gathered.

5.7 Conclusion

The activities and processes involved in the implementation phase have been outlined in this chapter and detail on them presented. The coding has been explained and the coding practices that were applied in the development of the system were outlined. Various software testing techniques have been looked at in their respective sections, giving, along with them, the visualisations that show the results of the testing that was carried out on the system. Ways in which the system could be installed were then further discussed to figure out the appropriate installation or changeover strategy that would best suit the nature of the newly developed system. Further focus was on the maintenance of the system after it has been installed for use at the institution. Then recommendations were made on the changeover strategy which is direct changeover and also on maintenance the recommendation to use adaptive maintenance mainly with other types was given.

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APPENDICES

Appendix A: User Manual

The user manual is created in provision for the system users to be able to gain a clear understanding of the system and how it operates. The user manual explains how the ZEGU Adverse Behaviour and Protest Prediction System will work and should be used as a reference guide to the operation of the system.

Home Page

The ZEGU Adverse behavior and protest prediction system is an online system that is accessed over web browsers. All of its functionalities are based on a web server. The user accesses the homepage upon typing the address <http://localhost/zegu/home> on the web. The below page will be displayed to the user.

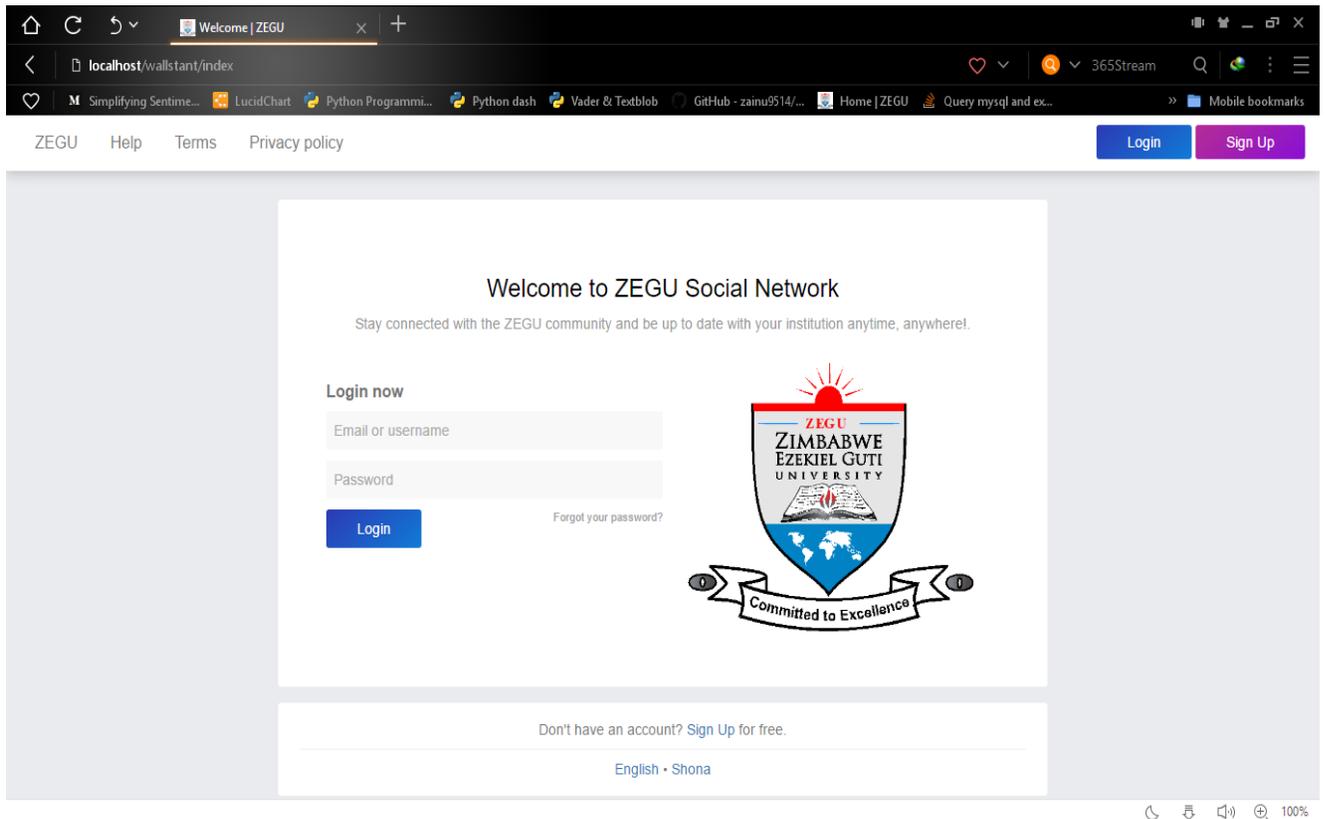


Fig A1: System Homepage

From the homepage, a user can navigate to several pages through the options provided on the page and can also login into the system direct from this page.

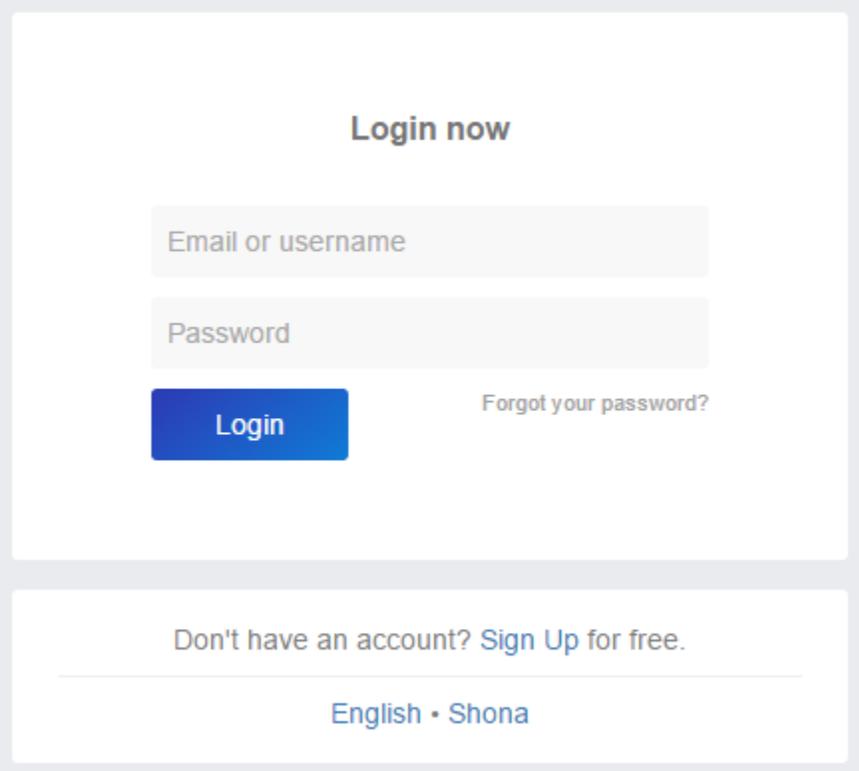
ZEGU: this is the home button which will navigate back to the system home screen from any other page.

Help: this navigates to the help page which offers helpful information in relation to this system and also a link to the manual accessible online.

Privacy policy: the button navigates to the privacy policy page which specifies the regulations governing the use of the ZEGU social site for general users since the system models a social site.

Contact us: this option navigates to the contact us page where contact details to the system's administrators is found as well as to the institution authorities responsible for students' welfare.

Login: the button directs the user to the login page from which one can login into the system and access content relevant to them as afforded to them by the system's administrators.

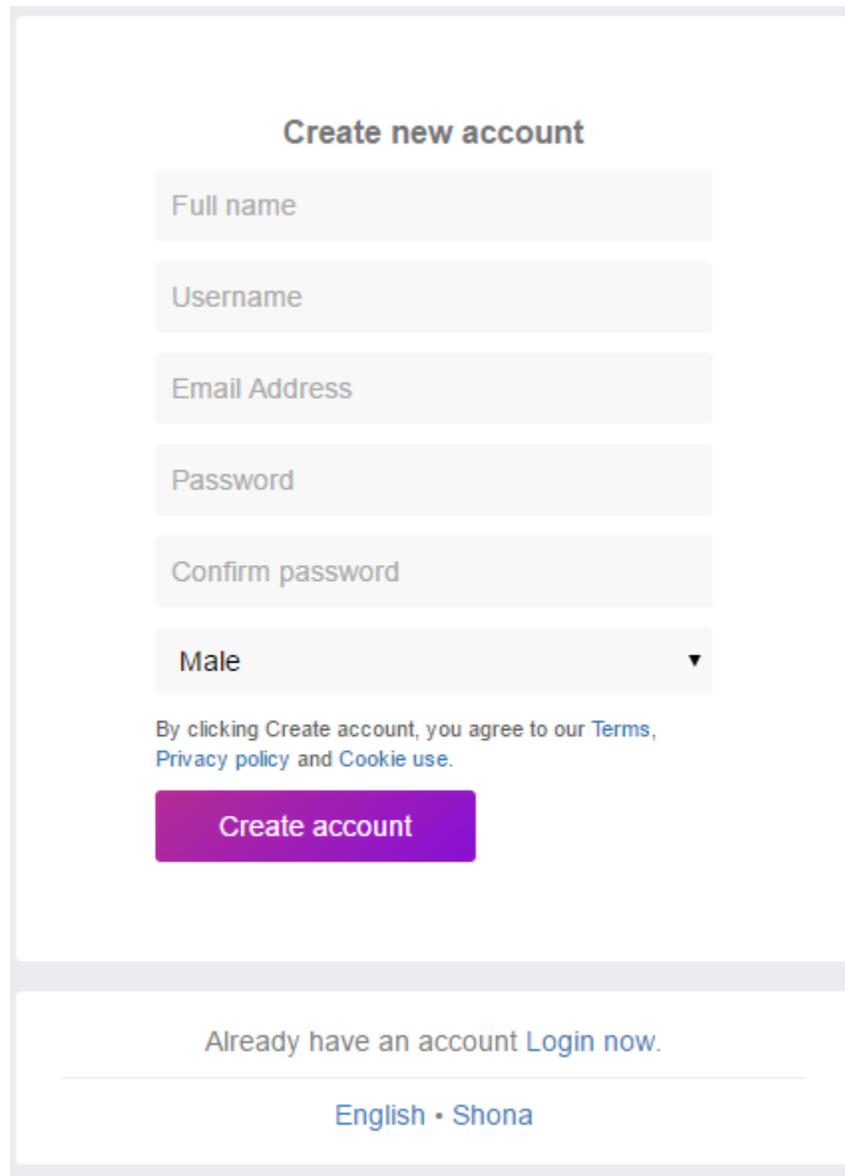


The image shows a login interface with the following elements:

- Title:** "Login now" centered at the top.
- Input Fields:** Two text input fields, the first labeled "Email or username" and the second labeled "Password".
- Buttons:** A blue "Login" button and a link "Forgot your password?" to the right.
- Footer:** A link "Don't have an account? Sign Up for free." and a language selector "English • Shona" at the bottom.

Fig A2: Logging into the system

Signup: this a navigation option to the signup page where new users can register their details into the database in order to access the system services and become part of the ZEGU social network.



The image shows a registration form titled "Create new account". It contains several input fields: "Full name", "Username", "Email Address", "Password", and "Confirm password". Below these is a dropdown menu currently set to "Male". A purple button labeled "Create account" is positioned below the form. A disclaimer text reads: "By clicking Create account, you agree to our [Terms](#), [Privacy policy](#) and [Cookie use](#)." At the bottom of the form, there is a link: "Already have an account [Login now](#)." and a language selector: "English • Shona".

Fig A3: Registering user details into the system

A user can register into the system from this page by submitting details for all required fields. Validation and verification are put in place with informative messages to guide a user on the type of data one is supposed to feed into each particular field.

Submitting Post

After the administrators have logged into the system, the user homepage is displayed with navigation tools arranged in their relative order. From here, the administrator is able to post to the student community by setting 'Post privacy' to 'public' so that every member registered on the social platform will be able to view the notice and comment to it.

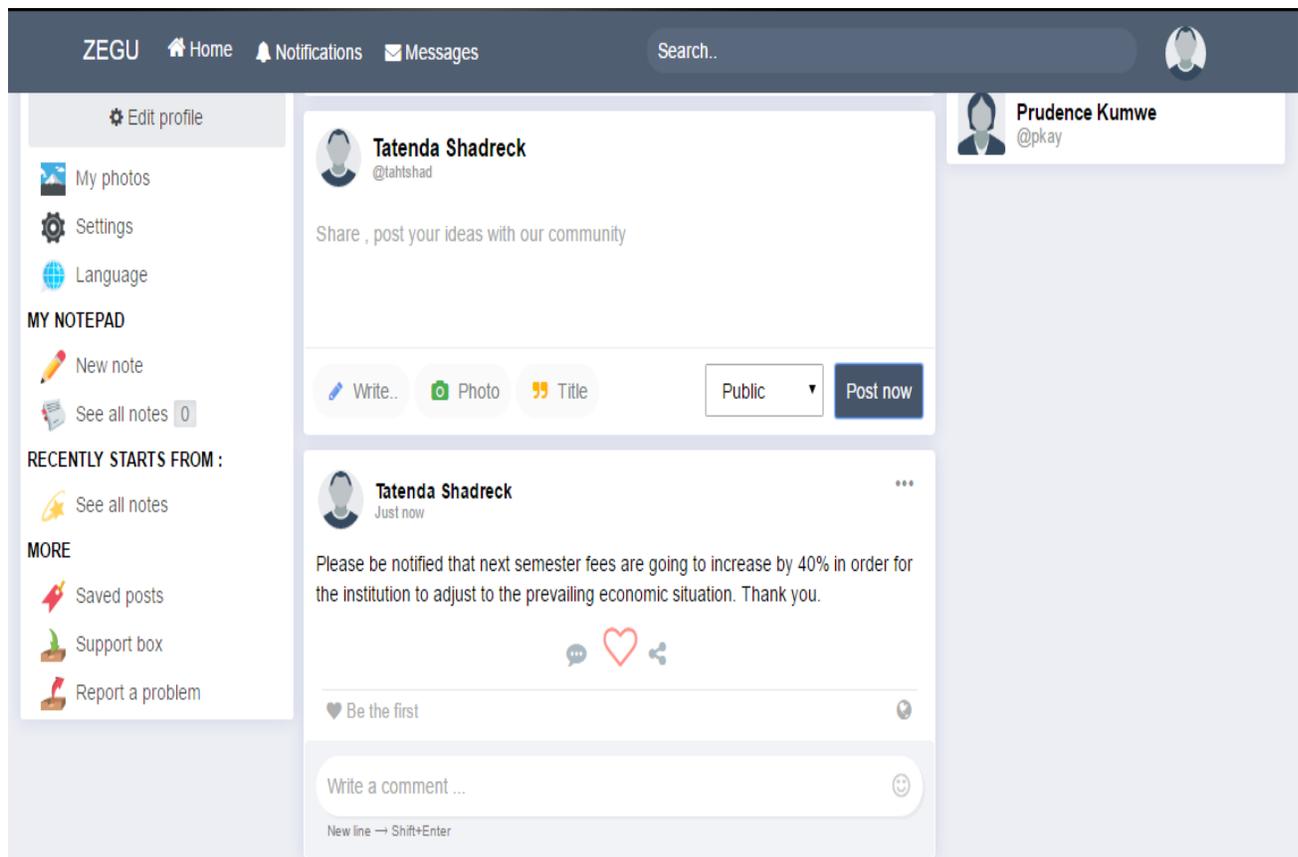


Fig A4: Submission of a notice post

Any user can also view notifications from their own account and check to see who reacted to information relating to their accounts. New followers will also appear in this 'notifications pull down menu' which is designed to be useful to the administrator to be notified of any reactions made to the post and information they convey

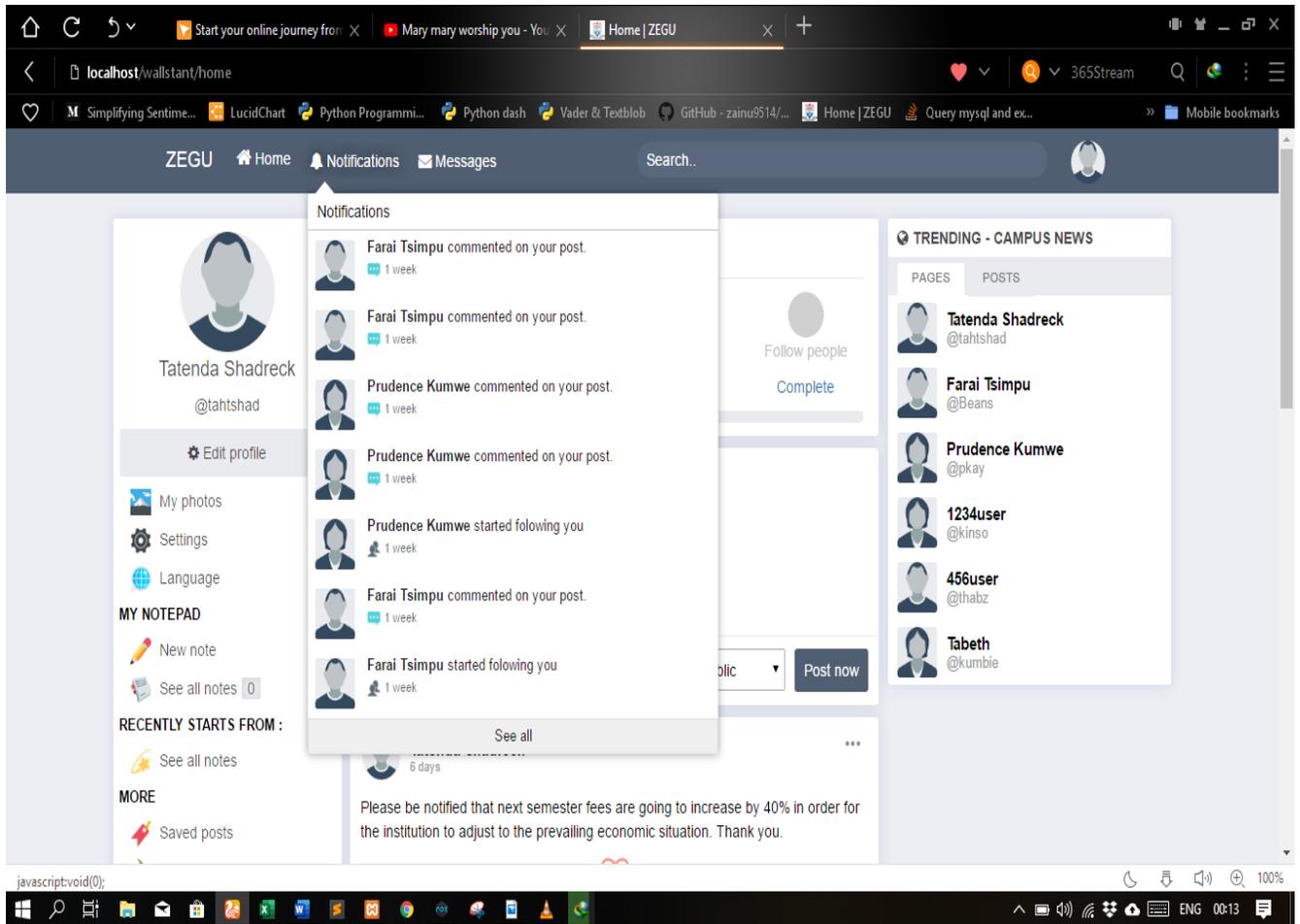


Fig A5: Notifications pull down menu

User menu

The menu is accessible by clicking the user's profile picture or avatar on the top right corner of the user home when a user is logged into the system. It provides various options that include logging out from the system, settings and the support box. If an account in use is an administrator's account then the menu shows one more extra option specifically for administrators which is the option to access the dashboard.

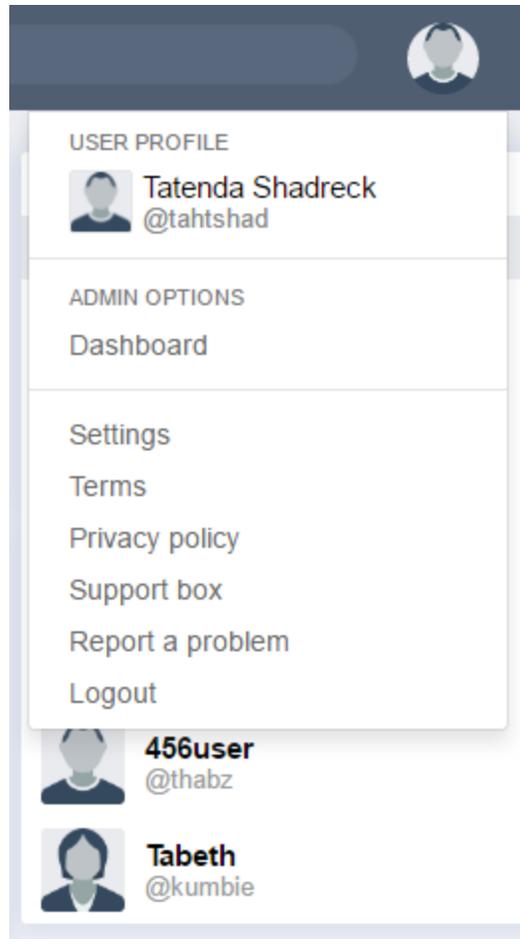


Fig A6: User menu showing dashboard option

Administrator's Dashboard

This is the platform from which an administrator can access the administrator tools and it is only accessible from administrator accounts. From here, the administrator is presented with a dashboard that he can use to manage various system components including editing users and removing them from the system as well as checking other system statistics. On the dashboard is an option that links to the sentiment analysis dashboard page and the administrator can be redirected to this page by a click of a button.

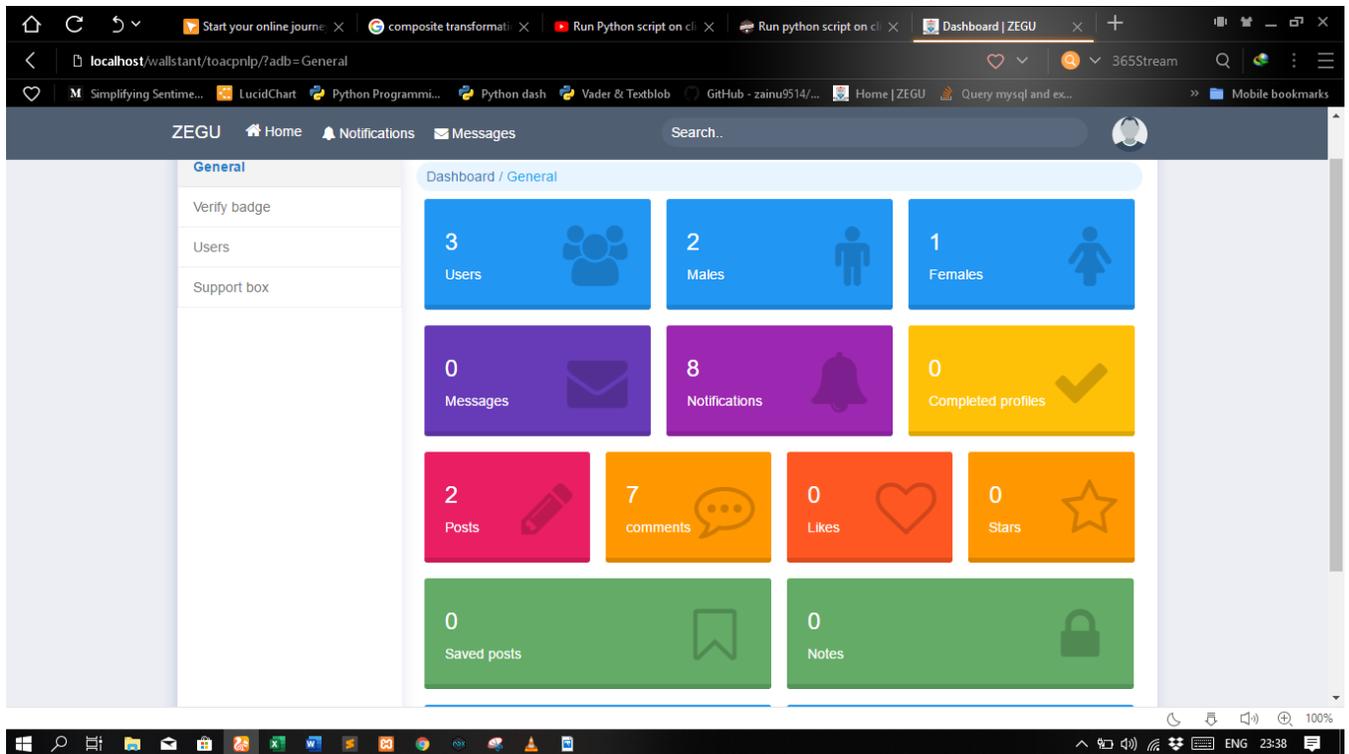


Fig A7: Administrator’s Dashboard

The administrators can view a list of the posts they posted by admin accounts displayed in tabular form with the sentiment details also shown along with these posts. From the tabular view displayed, there is an option of showing graphical presentations of the sentiment data that any admin can view.

Sentiment Polarity Scores

Post_id	Content	Negative	Neutral	Positive	Compound	Action
19001	Click to read content	0.0	0.189	0.811	0.6468	View Graphs Delete Record
19002	Click to read content	0.265	0.122	0.002	-0.213	View Graphs Delete Record
19003	Click to read content	0.515	0.485	0.0	-0.4914	View Graphs Delete Record
19004	Click to read content	0.0	0.389	0.692	0.598	View Graphs Delete Record

Fig A8: Posts and sentiment scores form

Sentiment Analysis of comments dashboard

The dashboard for the administrators from which they can view all analysis information and the percentage of compound sentiments for the administration's posts. To access this portal, an admin has to click on the sentiment analysis button from the general system dashboard for admin users on the social platform and the below interface will be shown.

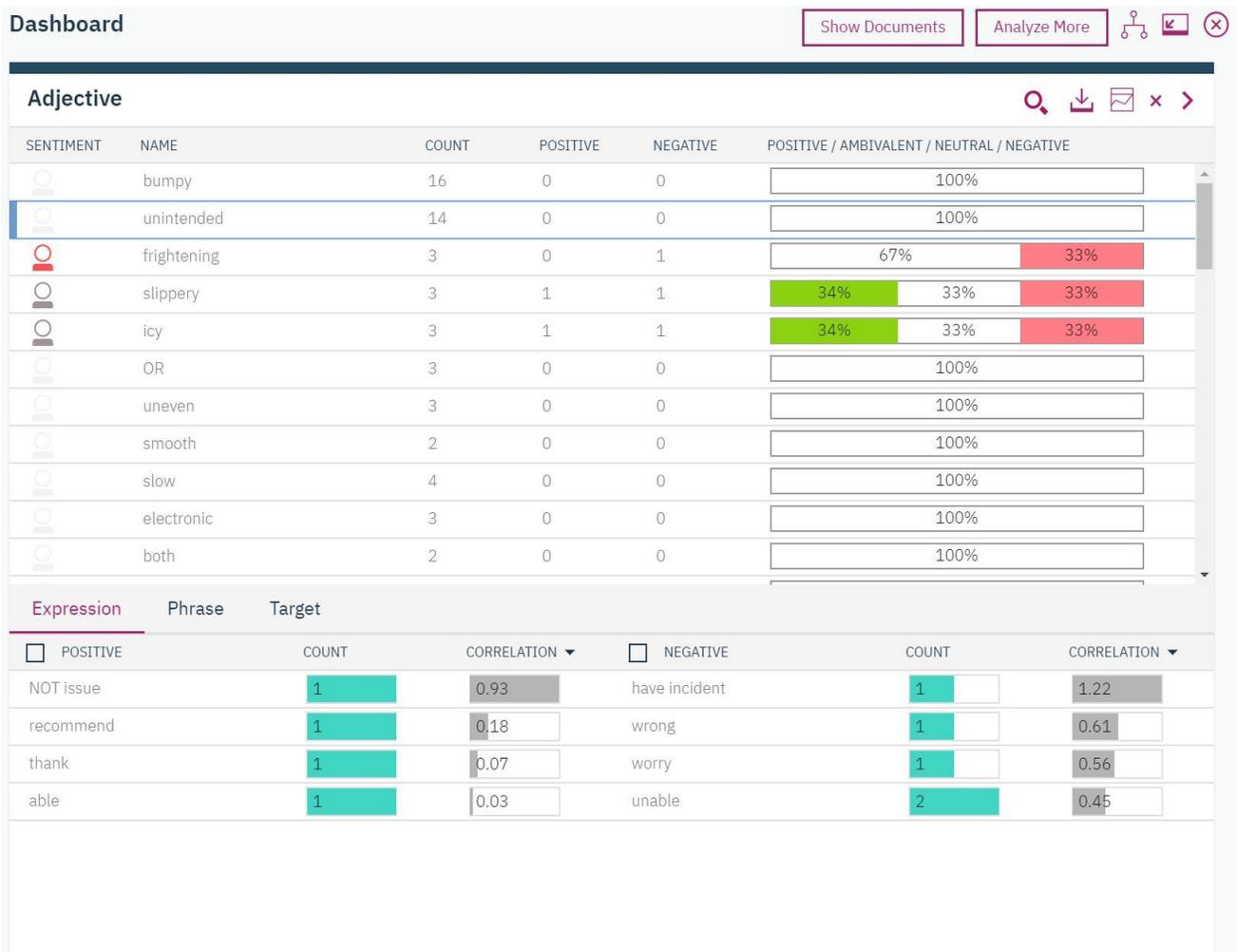


Fig A9: Sentiment Analysis dashboard

The overall sentiment of each post navigated to is shown and the different colour codes represent different sentiment types.

The green colour represents the positive sentiment level.

The red colour represents the negative sentiment level and,

The grey colour represents the neutral sentiment level which shows the population which is neither negative nor positive towards the post.

The information at the administrator’s disposal can further be graphically summarised into pie charts by clicking on the show graphs link from the sentiments table and it will display pie charts showing the sentiments proportions.

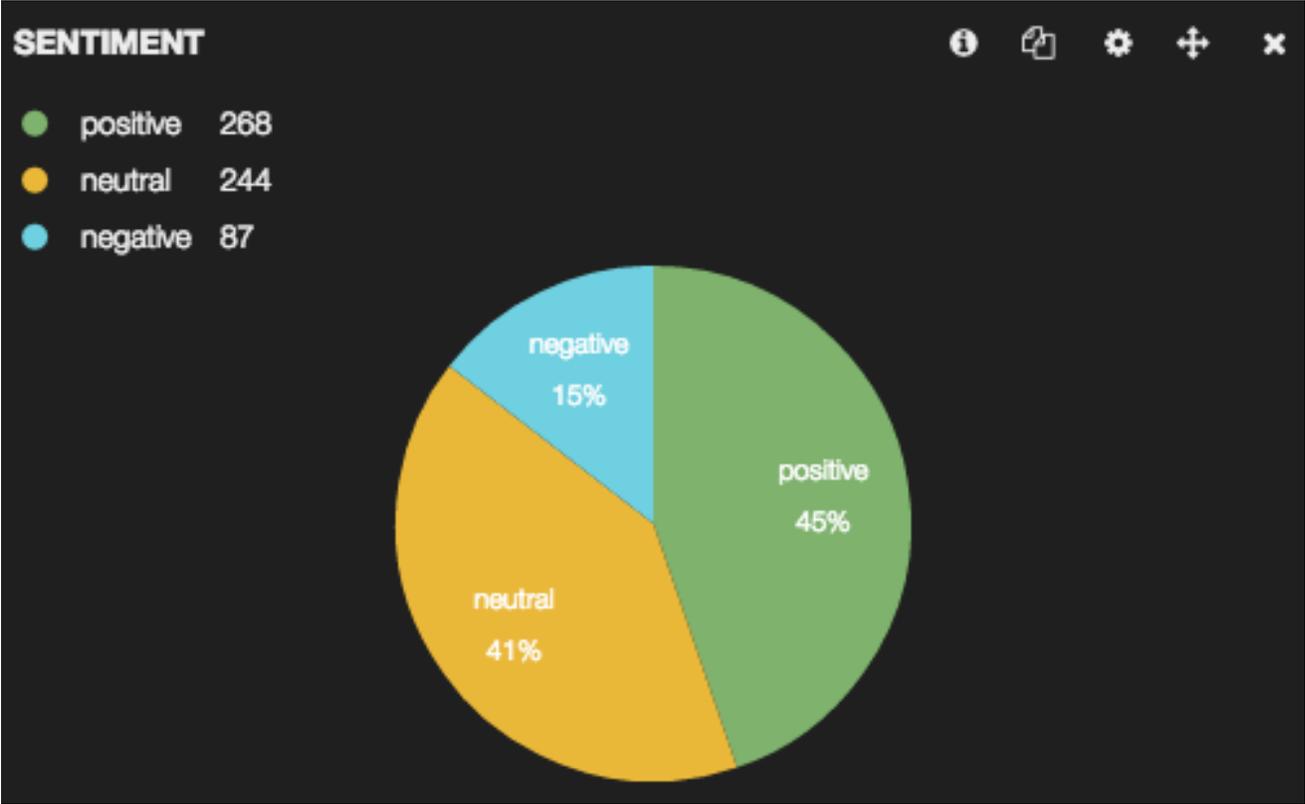


Fig A10: Pie chart for sentiment scores proportions

The colour codes of the sentiment classes can be configured to the user’s taste through the settings tab.

Appendix B: Fact Finding Methodologies

Appendix B1: Interview Checklist

This is the question guide that was used during conducting interviews at the ZEGU institution with the sample questions.

The institution's administration

Questions:

1. What is the frequency of occurrences of student protests against the university administration at this institution?

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

2. What do you think are the other contributing factors to the rising of the need for putting in place protest curbing measures at the university?

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

3. How does the institution retrieve opinions from within the student community concerning their welfare and relations with the institution authorities?

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

4. Is the current method of opinion mining being implemented at the university working out effectively and to what extent does the opinions identified represent the student base?

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

5. What is the degree of disturbances resulting from any of the previous protests in terms of both infrastructure and daily institutional operations?

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

Date:

Appendix B2: Questionnaire

Dear Participant

I Tatenda S. Tsimpu, a Midlands State University student studying Information Systems Honours degree. I wish to work with your institution in partial fulfilment of my fourth year project to gather information on how student protests and uprisings are handled at the university. I have attached a questionnaire to this cover note and hereby request for your time to assist me with the information required in the questionnaire. You are assured that any information collected will be maintained on private and confidential basis and will be used only for academic purposes.

I am looking forward to receiving your favourable response.

Research Questionnaire

Please fill out the form providing appropriate details on the questions asked herein and tick the appropriate box where applicable.

1. What kind of system or procedures are in use at the university for handling protests currently?

Manual

Computerised

2. What is your rating of the way protests are handled at the university and the response to students' grievances?.

Very good

Good

Bad

Very bad

3. Briefly outline your thoughts and views towards sentiment analysis systems and how you think it can be applicable at the institution in relation to the protests subject.

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

4. Being a Christian centred educational institution, would you say that the need to preserve a peaceful student environment and good relations between the university and its students one of the top priorities? Explain your answer.

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

5. Would you be in favour of the idea of developing a new computerised system to predict the possibility of protests at the university? Tick in the appropriate box.

Yes **No** **Indecisive**

Give a brief reason to support your decision.

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

Date:

THANK YOU FOR YOUR COOPERATION

Appendix C: Code Snippets

Create User Account

```
<?php
error_reporting(E_ALL ^ E_NOTICE);
session_start();
if(isset($_SESSION['Username'])){
    header("location: home");
}
$getLang = trim(filter_var(htmlentities($_GET['lang']),FILTER_SANITIZE_STRING));
if (!empty($getLang)) {
    $_SESSION['language'] = $getLang;
}
// ===== config the languages
// =====
error_reporting(E_NOTICE ^ E_ALL);
if (is_file('home.php')){
    $path = "";
}elseif (is_file('../home.php')){
    $path = "../";
}elseif (is_file('../../home.php')){
    $path = "../../";
}
include_once $path."langs/set_lang.php";
?>
<html dir="<? echo lang('html_dir'); ?>">
<head>
    <title><? echo lang('create_new_account'); ?> | ZEGU</title>
```

```

<meta charset="UTF-8">

<meta name="description" content="Wallstant is a social network platform helps you meet
new friends and stay connected with your family and with who you are interested anytime
anywhere.">

<meta name="keywords" content="signup,social network,social media,Wallstant,meet,free
platform">

<meta name="author" content="Munaf Aqeel Mahdi">

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<?php include "includes/head_imports_main.php";?>
</head>

<body class="login_signup_body">
<!--===== [ Nav bar ]=====-->
<div class="login_signup_navbar">

<a href="index" class="login_signup_navbarLinks">ZEGU</a>

<a href="#" class="login_signup_navbarLinks"><? echo lang('help'); ?></a>

<a href="#" class="login_signup_navbarLinks"><? echo lang('terms'); ?></a>

<a href="#" class="login_signup_navbarLinks"><? echo lang('privacyPolicy'); ?></a>

<div style="float: <? echo lang('float2'); ?>;">

<a href="login" class="login_signup_btn1"><? echo lang('login'); ?></a>

<a href="signup" class="login_signup_btn2"><? echo lang('signup'); ?></a>

</div>

</div>

<!--===== [ main contains ]=====-->

<div align="center">

<div class="login_signup_box2" style="text-align:<? echo lang('textAlign'); ?>">

<!--===== [ sign up sec ]=====-->

<h4 align="center"><? echo lang('create_new_account'); ?></h4>

<p><input type="text" pattern="^[a-zA-Z]+$" title="Enter alphabetic characters only!"
name="signup_fullname" class="login_signup_textfield" id="fn" placeholder="<? echo
lang('fullname'); ?>" /></p>

```

```
<p><input type="text" name="signup_username" class="login_signup_textfield" id="un"
placeholder="<? echo lang('username'); ?>"/></p>
```

```
<p><input type="email" name="signup_email" class="login_signup_textfield" id="em"
placeholder="<? echo lang('email'); ?>"/></p>
```

```
<p><input type="password" name="signup_password" class="login_signup_textfield"
id="pd" placeholder="<? echo lang('password'); ?>"/></p>
```

```
<p><input type="password" name="signup_cpassword" class="login_signup_textfield"
id="cpd" placeholder="<? echo lang('confirm_password'); ?>"/></p>
```

```
<p>
```

```
<select class="login_signup_textfield" name="gender" id="gr">
```

```
<option selected><? echo lang('male'); ?></option>
```

```
<option><? echo lang('female'); ?></option>
```

```
</select>
```

```
</p>
```

```
<p style="font-size: 11px;color: #5d5d5d;margin: 8px 0px; ">
```

```
<? echo lang('by_clicking_signup_str'); ?> <a href="terms"><? echo lang('terms');
?></a>, <a href="privacy"><? echo lang('privacyPolicy'); ?></a> <? echo lang('and'); ?> <a
href="cookie"><? echo lang('cookie_use'); ?></a>.</p>
```

```
<button type="submit" class="login_signup_btn2" id="signupFunCode"><? echo
lang('create_account'); ?></button>
```

```
<p id="login_wait" style="margin: 0px;"></p>
```

```
</div>
```

```
<!--===== [ login sec ] =====-->
```

```
<div style="background: #fff; border-radius: 3px; width: 420px; padding: 15px; margin:
15px;color: #7b7b7b;" align="center">
```

```
<? echo lang('already_have_an_account'); ?> <a href="login"><? echo lang('login_now');
?></a>.<hr style="margin: 8px;">
```

```
<a href="?lang=english">English</a> &bull; <a href="?lang=العربية">Shona</a>
```

```
</div>
```

```
</div>
```

```

<script type="text/javascript">
function signupUser(){
var fullname = document.getElementById("fn").value;
var username = document.getElementById("un").value;
var emailAdd = document.getElementById("em").value;
var password = document.getElementById("pd").value;
var cpassword = document.getElementById("cpd").value;
var gender = document.getElementById("gr").value;
$.ajax({
type:'POST',
url:'includes/login_signup_codes.php',
data:{'req':'signup_code','fn':fullname,'un':username,'em':emailAdd,'pd':password,'cpd':cpasswor
d,'gr':gender},
beforeSend:function(){
$('.login_signup_btn2').hide();
$('#login_wait').html("<b><? echo lang('creating_your_account'); ?></b>");
},
success:function(data){
$('#login_wait').html(data);
if (data == "Done..") {
    $('#login_wait').html("<p class='alertGreen'><? echo lang('done'); ?>.</p>");
    setTimeout(' window.location.href = "home"; ',2000);
}else{
    $('.login_signup_btn2').show();
}
},
error:function(err){
alert(err);
}
}

```

```

});
}
$('#signupFunCode').click(function(){
signupUser();
});

$(".login_signup_textfield").keypress( function (e) {
    if (e.keyCode == 13) {
        signupUser();
    }
});
</script>
</body>
</html>

```

Database connection

```

<?php
$servername = "localhost";
$username = "root";
$password = "";
$dbname = "wallstant";

try
{
    $conn = new PDO("mysql:host=$servername;dbname=$dbname;charset=utf8mb4",
$username, $password);
    $conn->setAttribute(PDO::ATTR_ERRMODE, PDO::ERRMODE_EXCEPTION);
}
catch(PDOException $e)

```

```

    {
    echo "Connection failed: " . $e->getMessage();
    }

// ===== config the languages
=====

error_reporting(E_NOTICE ^ E_ALL);

if (is_file('home.php')){
    $path = "";
}elseif (is_file('../home.php')){
    $path = "../";
}elseif (is_file('../../home.php')){
    $path = "../../";
}

include_once $path."langs/set_lang.php";

// ===== user verified badge style

$verifyUser = "<span style='color: #03A9F4;' data-toggle='tooltip' data-placement='top'
title='".lang('verified_page')." class='fa fa-check-circle verifyUser'></span>";

// ===== check user if exist or not (for removed account).

$usrSessID = $_SESSION['id'];

$usrRemovedAcc = $conn->prepare("SELECT id FROM signup WHERE id=:usrSessID");
$usrRemovedAcc->bindParam(':usrSessID',$usrSessID,PDO::PARAM_INT);
$usrRemovedAcc->execute();

$$usrRemovedAccCount = $usrRemovedAcc->rowCount();

if (isset($usrSessID)) {
    if($$usrRemovedAccCount < 1){
        session_destroy();
    }
}

?>

```

Sentiment Analysis on Text

```
from vaderSentiment.vaderSentiment import SentimentIntensityAnalyzer

analyzer = SentimentIntensityAnalyzer()

count=0

v=0
x=0
y=0
z=0

with open("test.txt","r") as f:
    for line in f.read().split("\n"):
        count+=1
        vs = analyzer.polarity_scores(line)
        v += (vs['neg']*100)
        x += (vs['neu']*100)
        y += (vs['pos']*100)
        z += (vs['compound'])

    # print(count)

v=v/(count-1)
x=x/(count-1)
y=y/(count-1)
z=z/(count-1)

print(v,"% ")
print(x,"% ")
print(y,"% ")
print(z)
```

Sentiment Dictionary

```
import os
import re
import math
import string
import requests
import json
from itertools import product
from inspect import getsourcefile
B_INCR = 0.293
B_DECR = -0.293
C_INCR = 0.733
N_SCALAR = -0.74
def negated(input_words, include_nt=True):
    input_words = [str(w).lower() for w in input_words]
    neg_words = []
    neg_words.extend(NEGATE)
    for word in neg_words:
        if word in input_words:
            return True
    if include_nt:
        for word in input_words:
            if "n't" in word:
                return True
    if "least" in input_words:
        i = input_words.index("least")
        if i > 0 and input_words[i - 1] != "at":
            return True
```

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return False

def normalize(score, alpha=15):
    norm_score = score / math.sqrt((score * score) + alpha)
    if norm_score < -1.0:
        return -1.0
    elif norm_score > 1.0:
        return 1.0
    else:
        return norm_score

def scalar_inc_dec(word, valence, is_cap_diff):
    scalar = 0.0
    word_lower = word.lower()
    if word_lower in BOOSTER_DICT:
        scalar = BOOSTER_DICT[word_lower]
        if valence < 0:
            scalar *= -1
        # check if booster/dampener word is in ALLCAPS (while others aren't)
        if word.isupper() and is_cap_diff:
            if valence > 0:
                scalar += C_INCR
            else:
                scalar -= C_INCR
    return scalar

```