CHAPTER 1: INTRODUCTION

1.1 Introduction

Traffic Safety Council of Zimbabwe network key performance indicator tracker system, is meant to monitor the internet at TSCZ. The system will permit the network administrators to stay informed about the network behavior at the organization, that is to say it will determine and keep track of network traffic statistics, Further to that the system will also be in a position to calculate network speed at any given time, In addition to that, the software package will also push for notifications on network summary. Moreover the system will gather network statistics for easy troubleshooting by IT Technicians .The system shall also be in position to calculate network bandwidth at any given time hence this will enable the organization to already know the required bandwidth for the organization on a specific period, Lastly the system will be in a position to provide a dashboard reporting metric for tracking, monitoring and analyzing network key performance indicators (KPI) in real time. This phase will also outline the problem statement, background study as well as the aim. Objectives of the project will also be clearly highlighted, Methods and instruments will be explained as well as rationale and project justification.

1.2 Background of study

Technological upkeep is critical to any organization however; it became only a problem when various network usage arise from both the network administrators, and employees. Currently the organization could not ascertain bandwidth required hence this resulted in acquiring less or more bandwidth than the optimum from the service providers, as there is no yardstick for benchmarking. Consequently, the organization suffers slow network speed, network congestion, service disruption just to mention a few. Moreover, the organization could not provide network speed reports whenever required for example by the audit team as it was done once every two weeks. Further to that, there is unavailability of network performance indicators such as network speed, bandwidth utilization in the time of network troubleshooting or decision-making. Apart from that, there is unavailability of assistance to gather network statistics for troubleshooting in times of network failures. In addition to that, presently the organization lacks notifications in times of network downtimes because of that this drives the motive of creating a solution to eliminate the challenges that are presently encountered with the organization.

1.2.1 Background of the organization

The Traffic safety council of Zimbabwe emanated from Traffic safety board which then came into existence as a result of well wishers made up of various associations in Harare (then Salisbury),Chinhoyi ,Gweru(then Gwelo),Masvingo and Mutare(then Um-tali),these well-wishers come together as they were concerned about the numerous road accidents, loss of life as well as loss of property.the consistence lead to the formulation of a board that was now responsible for controlling and managing of road safety awareness events under the leadership of the transport and energy secretary ,however ,it become functional in 2000.

1.2.2 Organizational structure

An organogram shows the manner in which people manage time and use resources in order to achieve various organizational goals.Aquinas(2009). The organizational structure control the procedures in which obligations, responsibilities and authority is represented, composed and coordinated. Further to that, it shows the manner in which how information moves in hierarchical levels among the employees, senior management positions and ranks.
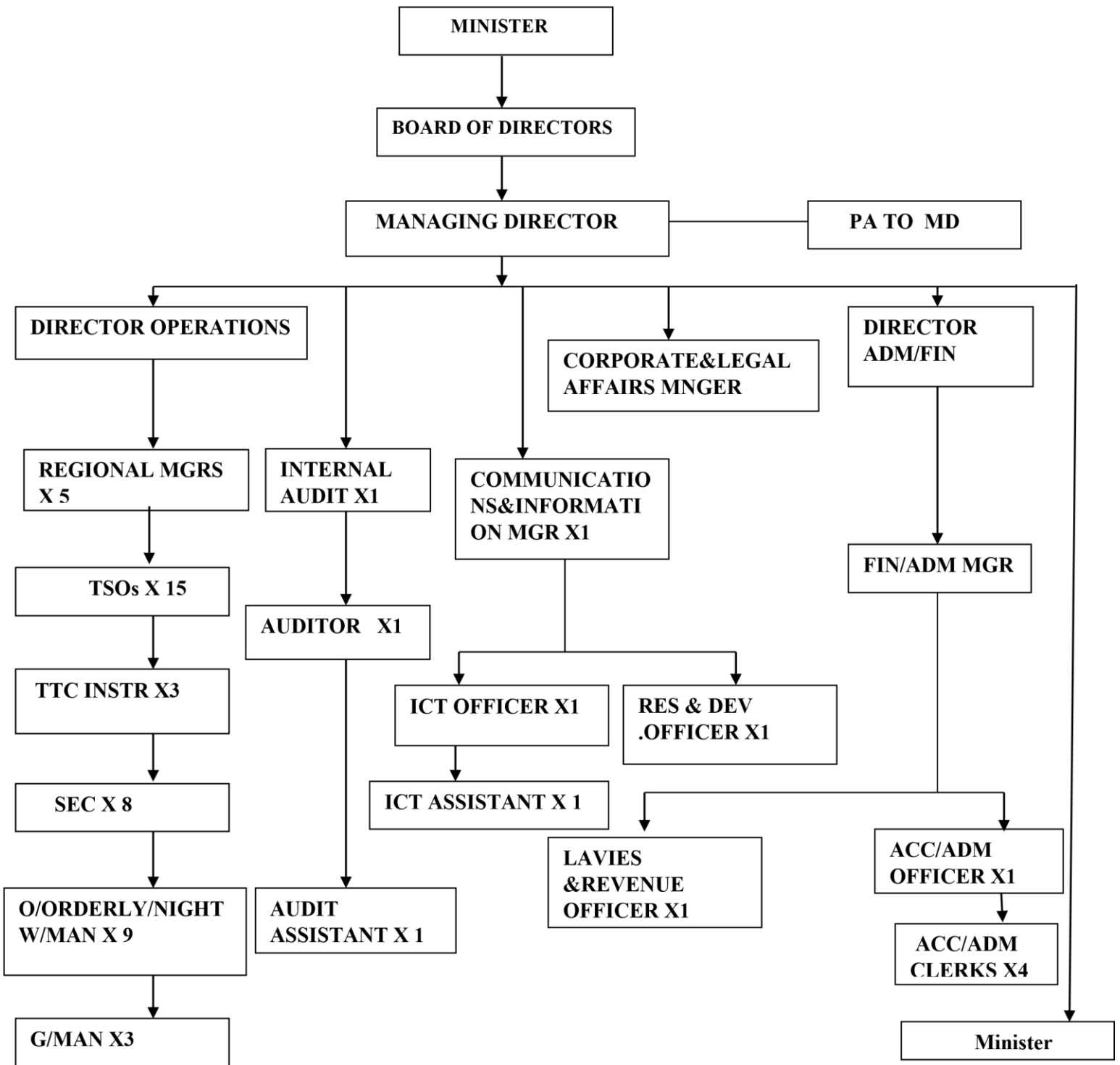
```
                    ┌─────────────────┐
                    │     MINISTER    │
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                    ┌────────▼──────────┐
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- **MINISTER**
- **BOARD OF DIRECTORS**
- **MANAGING DIRECTOR** — **PA TO MD**

- **DIRECTOR OPERATIONS**
- **CORPORATE&LEGAL AFFAIRS MNGER**
- **DIRECTOR ADM/FIN**

- **REGIONAL MGRS X 5**
- **INTERNAL AUDIT X1**
- **COMMUNICATIONS&INFORMATION MGR X1**
- **FIN/ADM MGR**

- **TSOs X 15**
- **AUDITOR   X1**

- **TTC INSTR X3**

- **ICT OFFICER X1**
- **RES & DEV .OFFICER X1**

- **SEC X 8**

- **ICT ASSISTANT X 1**

- **O/ORDERLY/NIGHT W/MAN X 9**
- **AUDIT ASSISTANT X 1**
- **LAVIES &REVENUE OFFICER X1**
- **ACC/ADM OFFICER X1**

- **ACC/ADM CLERKS X4**

- **G/MAN X3**

- **Minister**

Figure: 1.1 Organisational structure

1.2.3 Vision

To be a council working in harmony at all levels in the public and private sectors in the professions as well as in the community to achieve status as a regional leader in elimination of road deaths ,property damage, and road traffic accidents.

1.2.4 Mission statement

To encourage safety on roads through teaching, training, information publicity and researching in co-collaboration with   various stakeholders.

1.3 Problem statement

Traffic Safety Council of Zimbabwe is facing various challenges, which is inclusive of the following:

- The organisation could not ascertain bandwidth required hence this resulted in acquiring less or more bandwidth than the optimum from the service providers, as there is no yardstick for benchmarking. Consequently, the organisation suffers slow network speed, network congestion, service disruption just to mention a few.
- The Information Technology department could not provide network speed reports whenever required for example by the audit team as it was done once every two weeks.
- The unavailability of network performance indicators such as network speed bandwidth utilisation in the time of network troubleshooting.
- In times of network downtimes or network challenges, administrators will be aware if they are informed by the users, which increases service downtime and resolution time, unlike in a situation where they get notifications as soon as the challenges erupts. Therefore, IT Admins are always reactive instead of proactive especially when users start to complain.
- The unavailability of assistance to gather network statistics for troubleshooting in times of network failures.

In summary what's the organization is actually lacking is a tool to notify administrators of the network performance, there is nothing to ascertain accuracy in bandwidth or anything to determine network speed, further to that, there are poor network speed indicators.

1.4 Aim

To develop a network key performance indicator network monitoring software for TSCZ.

 1.5 Objectives

The expected network key performance indicator network monitoring system seeks to assist in trouble shooting network challenges and to achieve the following objectives:

- To calculate network speed.

- To calculate network bandwidth.

- To generate push notifications on network summary

- To gather network statistics for troubleshooting

- To provide a dashboard reporting metric for tracking, monitoring and analysing Network key Performance Indicators in Real Time

1.6 Instruments and methods

1.6 .1 Instruments

Windows 10 operating system (OS)

The benefits associated with this OS include:

- The first benefit is speed that is to say windows 10 streamlines the overall start up experience   by cutting down on bloat ware and unnecessary start up processes. The result is a refreshingly fast overall user experience.

- Usability as a merit , this means that windows 10 also brings significant improvements in functionality and usability further to that Overall, Windows 10 puts a premium on functionality, bringing a simplicity to the design and user experience

- **Visual studio 2015 ASP.Net with C#** - Active server page is an incorporated Web development ideal that contains the basic services for one to create excellent online applications.

- **2014 SQL Server** – which is a standard query language server is an collaborative and cooperative database management system.

1.6.2 Methods

There were numerous measures undertaken in order to collect data concerning the existing system at TSCZ IT department.

1.6.2.1 Questionnaires

This technique was the one firstly implemented. Saris and Gallhofer (2014),ascertain that questionnaires gives access to large audiences from many unions .On 12 January 2018 four questionnaires were distributed within the organization one to the IT department and the other three to the technical support team who gave their views on information of the current information. Only the head of the ICT department and the support team were given the questionnaires, as they were the only ones who were well vested with the current system, because of that it did not take much time to have response from the technique.

1.6.2.2 Document Review

Duplicate replica of printed records were revealed , which has dramatically illustrations and adequate details on how the information flows in the current system ,as a result of that the author had an appreciation for the need for a network monitoring system

1.7 Justification and rational

The intended network key performance indicator monitoring system will be of paramount important to the organization as it suits exactly to the requirements of the company. Further to that, the system will work as a problem solver to the challenges being currently encountered by the IT administrators, IT technicians as well as employees. Network administrators will be able to provide network speed reports whenever required for example by the audit team, hence this will give a true reflection on how the company resources will be utilized, further to that the system will also provide notifications on network summary in times of network downtimes hence this will enable the IT technicians to be more proactive instead of reactive to network problems. The new system will calculate bandwidth at any given time, which will assist the organization to ascertain the optimum bandwidth required to be used for a certain period from the service providers. The newly software package shall have the capacity also to gather network statistics for troubleshooting network challenges hence less manual effort will be required from IT technician which in turn results in the smooth flow of the business operations .Overly the system will provide a dashboard reporting metric for tracking, monitoring and analyzing network key performance indicators in real time.

1.8 Conclusion

This chapter specifically concentrated on the problem statement as well as the anticipated software objectives, alongside with the explanations which further elaborates the goals for the need of the new software package to exist . Further to that instruments such as Visual studio 2015, Asp.net with C# ,Sql Server 2014 and windows 10 operating system was clearly mentioned apart from that methods such as interviews, questionnaires and document review were also clearly outlined in this chapter ,The vision ,mission statement and the organizational structure was clearly elucidated. The next phase is the planning phase which will seek to highlight essentially the feasibility study and other essential elements.

CHAPTER 2: PLANNING PHASE

2.1 Introduction

The chapter shall concentrate upon the preparation processes towards establishing TSCZ network key performance indicator monitoring system. Further to that, this chapter shall clearly explore the business values that will emerge through system usage, moreover a viability study will also be carried out to consider whether the system can be effectively executed or not. Several risks will also be identified and their counter measures. This chapter shall as well classify all stakeholders of the software framework and the various interests they can look forward to be addressed to by the system. The project working plan shall also be clearly highlighted.

2.2 Business value

Shannon et al (2008), alluded that , all the expected positive features that come along with the anticipated system to the organization as business values . System development should however come as a solution package to the problem that the organization will be facing ,meaning to say more effort should be unleashed during the process of coming up with the system number of mechanisms that fall under business value, these include Shareholder value, Employee knowledge, and customer value **.**

- **Customer Value :** TSCZ network tracker system enables customers to be served in a more efficient and convenient way as there is less internet supply interruptions to specific attendants serving defensive driving students and aspiring driving instructors. There are therefore less queues, and traffic safety officers will carry their duties without interrupted internet as they check their dashboards online for registered and non-registered students this will result in the smooth flow of the business operations, thereby enhancing customer values**.**

- **Shareholder value:** This is a magnitude change in value of TSCZ shareholders , as soon as the system will be successfully implemented ,major shareholder such as the government will be benefiting since one of its mandate is to ensure road safety on its citizens, this is achieved as there will be an increased number of people who will be

able to attend defensive driving courses for per day as the TSCZ officers will be marking the answer scripts online without uninterrupted internet supply.

- **Employee knowledge:** This is achieved as employees (administrators) get an early warning signal, perhaps the network speed drops and the operational status is unhealthy. Problems are diagnosed quickly, even before their occurrences as the tracker from unusual speed performance detects them earlier.

2.3 Feasibility study

According to Marakas and O'Brien (2012), asserted the viability study as the evaluation on how the organization will benefit or costs that will be suffered as a result of developing the proposed software package to the company ,this means to say that the feasibility study aims on scrutinizing that, if the software go through will it be viable with the amount of appearing resources plus interval restraints .Additionally it can be called feasibility examination. Moreover, the aims of the feasibility study maybe shown below:

- Outlining either the system will be in a position to be implemented in contemporary technology, within the specified program and financial plan.
- Scrutinizing weather the system framework will meet the organisational requests or not
- Ascertain whether the system may be integrated by existing software

The feasibility examination can be undertaken in different major ways, which are operational, technical, economic, and social feasibility .Moreover the mentioned techniques shall be summarily explained below.

2.3.1 Technical feasibility

According to Gary and Rosenblatt (2009), it is the process of evaluating, analyzing weather the organization has the technological mussel and skills to embrace the change in the technology. In order to witness a successful change and system development, some factors should be closely considered that is to say the nature of hardware and software available should have the capacity to sustain the development, likewise necessary skills are also important ingredients for software success.

Hardware requirements

The below   table clearly highlight all the necessary hardware requirements   essential for the company for anticipated system development to become feasible

Table 2.1 Hardware requirements

Hardware Items	Specification	Quantities	Availability-status	Comment
Desktop computers	Dell core i7, 8GB Ram , 1TB hard drive	2	Yes	The organization is willing to acquire additional 1
Mobile Sma Phones		3	Yes	The organization is willing to acquire 3 additional phones
Ethernet port	24 port	5	yes	
Switches	24 port	2	yes	
Network cards	10-100 LAN	10	yes	
Server	2.5GHz Intel CPU 16GB Ram 1TB hard drive	1	yes	
Sim cards	Eco net sim	4	yes	The organization is willing to acquire 2 additional sim cards
Wireless routers	3.5GH	2	yes	
Ethernet cables	Cat 5	20	No	The organization is willing to acquire all the mentioned items

Table 2.2 Software specifications.

Software required	Package	Availability status	Comment
Operating system	Windows 10 professional	yes	
Visual studio	Vs 2015 professional	yes	
Browser	Firefox	yes	
Anti-virus	Avira	yes	
SQL Server	5.6	No	The company is ready to acquire

Table 2.3 Technical expertise   specifications

Expertise	Comment
Programmer	The programmer is well vest in the programming language and has done several projects to success
Users	Users are literate when it comes to computers and additionally free training will be provided

From the assessment above it can be noted that, the hardware is available, the software is available as well as the technical expertise is also well equipped.

2.3.2 Economic feasibility

Somerville (2011) ,noted that the process is rooted on stressing the monetary benefits that accrue from the system package. The feasibility study technique is agreeably employed after scrutinizing the effectiveness, ability worthiness and usefulness of the anticipated system package. Several tools are used to measure economic feasibility that is inclusive of the cost benefit analysis, as this method acknowledges the gains (monetary or non-monetary benefits) expected from the system and make a comparison with its costs. According to Walters (2009), the verdict to come up and engage the system is grasped only if the benefits are exceeding the costs, further to that investment appraisal is another crucial tool as it focuses on assessing the value of investments these techniques include payback period, return on capital investment as well as net present value.

2.3.2.1 Cost benefit analysis

Friedman (2009) ,alludes that ,it is a tool that is widely used to estimate total costs as well as benefits that can be brought by a project, further to that CBA takes into account the costs and benefits that are interlinked with the software existence .Moreover, under this technique costs are categorized into operational and developmental, this applies also to the benefits as they are intangible and tangible benefits.

2.3.2.1.1 Intangible Benefits

According to Laudon and Laudon (2010), these are not simply figured, and they include better customer services, excellent when it comes to making corporate decisions .Intangible benefits are hard in figuring to fiscal terms. These are linked to qualitative characters of the system. Some of the intangible benefits includes;

Table 2.4 Intangible benefits

Intangible benefits	Anticipated values in monetary form
Improved tasks interest	$240
Decreased workload	$250
Enhanced Clients gratification	$450

Total benefits	$940

2.3.2.1.2 Tangible benefit

Laudon and Laudon (2010) ,alludes these as profits that may be calculated and allotted a financial cost. From such, diminished formative and functioning costs combined with increment in real money inflow is also incorporated.

Table 2.5 Tangible benefits

Tangible benefits	Anticipated values in monetary form
Decrease in Service Level Agreement breech cost	$1500
Decrease in use of paperwork	$70
Reduction in time expended in manual check -ups	$600
Improved client sales	$2000
Expanded compelling work time usage	$700
Total benefits	**5370**

2.3.2.2 Costs

According to Hansen et al (2009), these are necessary expenses that come along when an organization intends to do something,how ever in this venture in order to develop the proposed software the following costs must be encountered.

2.3.2.2.1 Development costs

Walters (2009) ,characterized these costs as the financial amounts that will be utilized in building up any concepts. Further to that they also narrates that these costs are directly proportion to making inquiries ,creating   as well as establishing the software, apart from that they highlighted that ,these cost are accrued in setting up the software and refining it hence it is inclusive of maintenance expenses.

Table 2.6 Technical hardware costs

Development Costs	Amount	Availability status
1 Server	$2000	Available
6 Mobile Smart phones	$200	available
Sim cards	$2	available
SMS gateway	$75/Unlimited per year	available
Total	**2277**	available

Table 2.7 Technical software costs

Recommended components	Amount	Availability status
1 Windows server	$600	Available
1 SQL Server	$600	Available
Total cost	**$1200**	**Available**

2.3.2.2.2 Operational cost

They are costs which can be associated with the way the new software functions, this means to say that ,these cost are meant to guarantee that the new software package will be performing according to user recommendations as well as their requirements, Overall Operational costs involve costs of   supporting the existing system, that is to say hardware cost that are inclusive of hardware upkeep costs, software cost as well as   gate way subscriptions .Similarly it can contain general workforce that are directly involved in operating and   maintaining the software package, Moreover these costs are classified into two that is to say fixed cost and variable cost, fixed costs these are cost that happen at a frequent intervals however at a reasonable fixed rate on the other hand variable costs happen in proportion to the usage   facet.

Table 2.8 Operational Costs

Operational cost	Amount($)
Installing	350
Maintaining	350

14

Training program	350	
Total	**1050**	

However this system development proceeded since all the costs are suppressed by its benefits, this may be clearly shown on the Cost benefit analysis   table below .The table below shall clearly illustrate the CBA analysis for 2019 and 2020.

Table 2.9 Cost benefit analysis

Year	2019	2020
Benefits	$	$
Tangible	5370	3500
Intangible	940	1000
Costs		
Developmental	2277	-
Operational	1200	1050
Documentation	250	-
Total Benefits	**6310**	**4500**
Total Costs	**(3727)**	**(1050)**
Net Benefits	**2583**	**3450**

2.3.2.3 Investment Appraisal

It is the analysis of how an investment will benefit the organization in the long or short run, further to that this analysis takes into account all the necessary calculations determine the worthiness of taking a project or not ,it is guided by the following techniques.

2.3.2.3.1 Return on Investment

Lucey (2008) asserted that, most cases, the computation   evolve from the return on invested capital   are critical statistics as they provide a guideline frame work to the organization inline with the decisions   to come up with the system As determined by the management, this

calculation shall consider   the   profitability of the project   by   taking into comparison the financial benefits after the deductions with related costs.

Formulae of ROI: $= \dfrac{approximated\ benefits - approximated\ cost}{approximated\ cost}$

$= \underline{\textbf{6033(2583+3450)-4777(1050+3727)}}$

4777

=26.29 %

Comment

The return on invested capital is low due to high cost of development incurred in the initial stages but however it is expected to increase in the long run as these costs are only incurred once in project lifetime ,however the return on investment is highlighting that the projects is feasible.

2.3.2.3.2Payback Period

As clarified by Lucey (2008), used in investment appraisal, payback period is a method that centers on the time taken by the incoming cash inflow takes to be equal to the cash outflow that is the injected capital . A verdict is made using payback period, by taking the lowest payback time. By way of agreement, it is recommended to accept lower payback period project as it is presumed that a greater payback is associated with greater risks. Some of the benefits associated with the payback is that less risks are encountered as it only consider short payback periods Hence forth the initial investment cost is $ 3727 the inflows are 6310 for 2019 and $4500 for 2020, To calculate the actual payback period, a formulae is used

Payback time = **Capital to be Invested/Estimated Annual Net Cash Flow.**

Hence, the payback time for this project is:

Payback time =$3727/$6310

$$=0.590$$

$$= 6 \text{ months}$$

Comment

6 months is highly favorable shorter payback period this means to say the project is feasible economically

2.3.3 Operational feasibility

Kendall and Kendall (2011) alludes that functioning viability is highly dependable on the organizational workforce , shall put the anticipated system to work, after buildup .It also serves to find out in what manner the anticipated software project will resolve complications and also

how it satisfy   the user specifications discussed in the analysis of requirements. Once the software package is in operation, it is operationally feasible because:

- The system has a user manual   in the event that the network administrators are facing challenges to operate it   they can simply go through the user manual to understand it better.

- The system has also excellent graphical user interface hence this will facilitate the users to interact with the software package   without any problems   hence this clearly indicates the   operational viability.

- The system users are computer literate this means to say that they are less chances for them to encounter operation related problems   hence this   favours the operational viability of the system.

- There is   report   generation   by the software package   hence this will allow administration to see how the network resources will be utilized within the organization, further to that it shows that it is operational feasible.

- The system has also backup so whatever the calamity maybe faced during the times of operations the organization will be provided with a backup compact hence makes the system operations secure   and more feasible   for the system to exist.

2.3.4 Social Feasibility

Daintihh (2004) asserts that it is the process of analyzing impacts that the anticipated system might have , so that there can be a better understanding to the scale as well as reach of the projects social impacts. Social feasibility   takes into account the system package and the environment, this is to say:

There will be reduction in deforestation because   fewer papers will be required as the system is paperless.

In addition to that, workers will have increased quality of life in the sense that less stress associated with the work is incurred as there will be smooth flow of the organization operations, this will also enable workers to spend more time with their families this is so because working overtime will be eliminated.

2.4 Feasibility summary

According to the results computed on each and every feasibility study , it is highly recommended that the decision makers approves the anticipated software package as all the feasibility studies indicate that it is viable to carry it on.

2.5 Risk Analysis

According to Bentley (2004), this dwells on identifying hazards or jeopardies that affects the projected system and ways to mitigate these risks. As signified by International Risk Management Standard (2009), risks are divided into technical risks, programmatic risks, and process risks. It was further alluded that technical risks are associated with the knowledge base being employed and features like understanding, reproducibility among others. The technical risk to be incurred in executing the software is that it is difficult to implement therefore the date of execution tends be advised. Programmatic risks are inevitable and are beyond the operational limits. As a result of improper process implementation, failed system or some external events risks, process risks are incurred. The following table shall highlight risk and their mitigation strategies.

Table 2.10 Risks and their mitigation strategies

Risks identified	Strategy
Fault ridden software	-Massive software package testing include integration-testing, validation testing as well as verification testing. -Offering the software package on a trial version then improve highlighted errors on the system in the long run.
Budget deficit	-Reserve funds to provide for unexpected deviations mainly budget shortages
Extending Due datelines	-Effective time management but however not forcing workers to rush as this may compromise the software quality.
Un expected sms gateway failure	Signing of memorandum of agreement as well as service level agreement with the telecommunication mobile network provider

Unexpected software package failure	-Provide system maintenance and check up on regular time intervals

2.6 Stakeholder analysis

Stakeholder analysis as referred by Will and Kilvington (2010) concerns on identifying all the interested parties (stakeholder) on the projected software package as well as the expectation they have so that they are addressed by the system .Stakeholder are either influencers or influenced to act on the impact of activities. Stakeholder have indirect or direct interests on a business venture or project for instance the government, competitors, as well as customers.

Table 2.11 stakeholder expectations

Stakeholders	Expectations	Precedence	Answers
Developers	Set-up the networkKPI monitoring system in line with the time schedule	high	Working within time frames
Technical employees	Software frame work habitually monitors network key performance indicators	high	Developing a console package to be run in task scheduler
Workers	24/7 Software package uptime	middle	Monitor network services and make sure they are running

2.7 Work Plan

This is a document, which is used by consulting firms to institute a project (Kendall and Kendall 2005). A project plan proposes the project period and stipulated budget the project is supposed to run from. A project plan had to be regularly checked and implemented at every phase. Hiccups may occur anytime leading the plan to abandoned or altered for perfections.

Table 2.12 Time Schedule

Part	Starting date	Ending date	Time interval (weeks)
Proposal of the project	1 August 2018	7 August 2018	1
Planning	10 January 2019	24 January 2019	2
Analysis	2 March 2018	9 March 2018	2
Design	1 April 2019	21 April 2019	3

Implementation date to be advised

2.7.1 Gantt chart

It is a pictorial graphical representation that shows a list of activities to be carried out on project

Phase		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Project proposal	■	■														
Planning			■	■												
Analysis					■											
Design							■	■								
Coding									■	■						
Testing											■	■				
Implementation													■			
Maintenance														■		
Documentation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
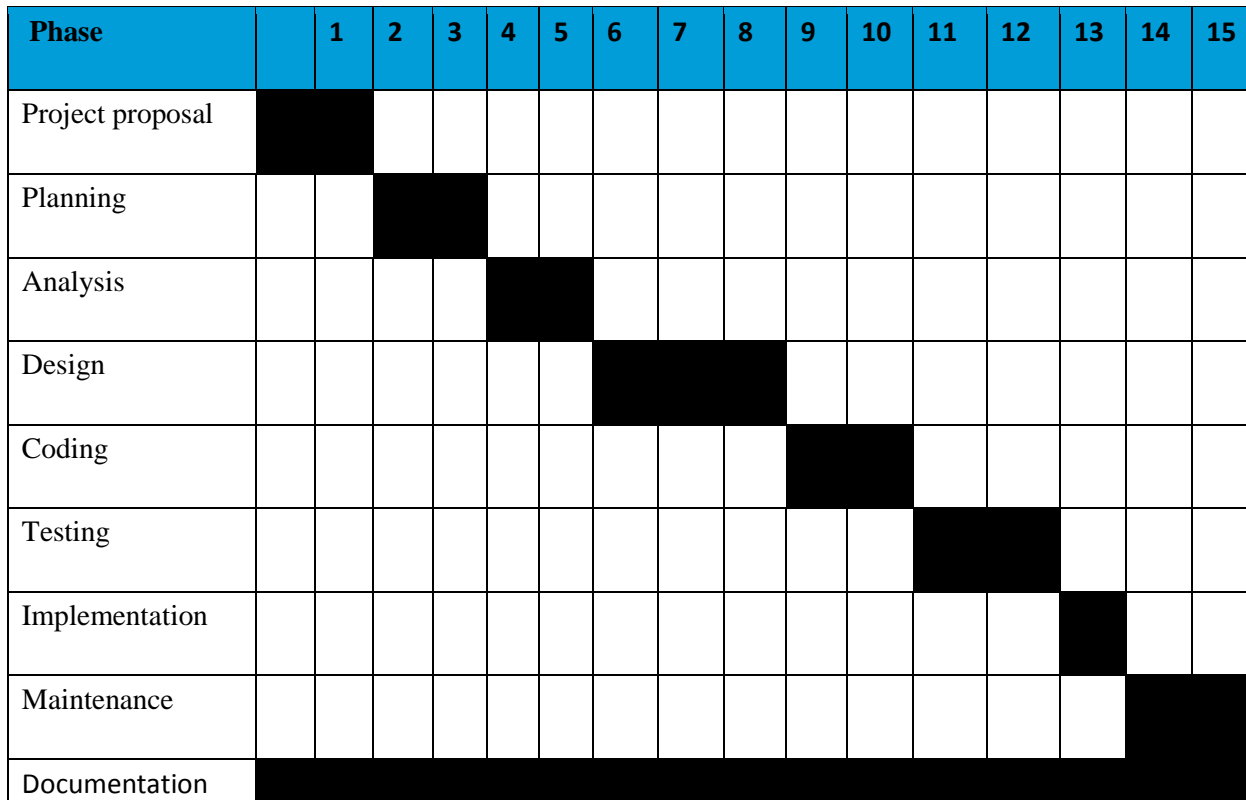
 Figure 2.1 Grant Chart

2.8 Conclusion

Overally, the planning stage paid attention on business value which consisted customer value, shareholder value and employee knowledge. Feasibility study was conducted technically, economically, socially and it was deemed viable. Risks analysis was clearly explored, risks such as SMS gateway failure, software operational failure as well as economic instabilities were thoroughly examined inclusive of mitigation strategies for the mentioned risks. Stakeholder analysis as well as outlining a work plan schedule were clearly elucidated in this phase. This software development initiative qualifies to be feasible on its entire magnitude as highlighted above considering these. The system developer is set to take forward the next processes of the project however; the next chapter is the analysis segment likewise deep examination of the current system at TSCZ will be witnessed.

CHAPTER 3: ANALYSIS PHASE

3.1 Introduction

This chapter will pay attention on the fundamentals of the analysis phase this include methodologies to be used for gathering information which was implemented , further to that it will explore the current system at TSCZ through revealing deep details of the current procedures . Furthermore, the existing systems inputs, processes and outputs will also be highlighted. Data analysis shall be emphasized on in this phase, however it will be simplified as a result of using context and data flow diagrams in order to demonstrate the flowing of data on the existing system framework. This segment shall also disclose out the loopholes of the current system procedures. Moreover, the examination stage shall evaluate options of developing the system that include upgrading the existing system, outsourcing and in-house development as a result of that that refer back to study of feasibility.

3.2 Information gathering methodologies

(Saris and Gallhofer, 2014), asserted that, gathering of information is a method that is implemented in order to gather data from various stakeholder that have direct or indirect interest on the system .To come up with the necessary information ,questionnaires, document review and observation among others were effectively used in data collection concerning the existing system at TSCZ.

3.2.1 Document Review

The researcher reviewed the records, which have illustrations and details on the flow of information on the current system. Hereafter the researcher had an appreciation of network

related problems and used this as the basis in making enhanced requirements. The technique was applied during the researcher's internship from 2017-2018.

3.2.2 Partially closed ended questionnaires

(Saris and Gallhofer, 2014), asserted that, questionnaires are research tools that contain high integrity questions with the motive to gather important data. The questions however are not meant to defy the precision on responder (Mellenbergh, 2008). This type of questionnaires enabled the respondents to pick a solitary brief and have space to legitimize the method of reasoning behind the decision provoked. Set of questionnaires were designed, and given to head of IT team, technical support team, and employees, as they were well knowledgeable with the existing system.

3.2.2.1 Merits experienced on using questionnaires
- The availability of adequate time enhanced the employees to respond the questions on their own time.
- Since the questionnaires were close ended, this guaranteed appropriate responses, additionally; room for clarification was there also.

3.2.2.2 Disadvantages experienced using questionnaires
- Though there was space for clarification, a portion of the data given was excessively constrained however.
- Other interviewees did not answer the questionnaire papers.

3.2.3 Observation

Observation consist of inspecting, observing, evaluating, and analyzing the function capabilities of the software package beneath observation (Blaxter 2006). This technique is considered as the most effective information gathering tool as facts are collected from their natural setting, first-hand data is met on how the system performs, from that the escape clauses and shortcomings of the understudy system are viewed. However, the process of observing was conducted in the TSCZ IT department where network troubleshooting was done manually.

3.2.3.1 Advantages
- It improved prospects of having more syem sincerity.
- The researcher figured out how to acquire data of the procedures and entities to be included in the anticipated software frame work

3.2.3.2 Disadvantages

- It required more time of the observant, as he has to be in the field all the time.

- Since the given period was limited, the researcher could not be able to acquire all the vital information.

3.3 Analysis of the current system

Gathering of data turned out to be of utmost use, as it brought about loopholes and faults of the current system. The techniques brought large chunks of information, from difficulties experienced by the users, to the clients finishing point with the current system framework, from employees' opinion, to suggested improvements essential to the current system. Additionally, the abilities and features employees consider essential to be in cooperated or not in the anticipated system, framework .Data collection reveals that the organization is using a manual network monitoring.

3.3.1 Description of current system

Currently TSCZ receives bandwidth directly from the service provider that passes through the proxy server further to that there are no particular mechanism that checks bytes being received and those being sent to come up with optimum bandwidth required. Moreover, there is no a mechanism again to analyse packets for instance fragmented packets ,outgoing packets with errors, henceforth the availability of such a mechanism helps to show the root cause in times when network is down. Network performance indicators are not available in the times of network troubleshooting this means to say that when the network is down the I T Technician manually checks the routers and switches , mostly when the problem persist the routers are restarted in order to redistribute packets to various departments but if the problem persist the service provider will be conducted to rectify the problem .Apart from that , there is no ascertainment of bandwidth to be utilized or required that is to say the unavailability of yardstick hence slow network and congestion is seen as a result of less bandwidth is being used than expected, Moreover since the system is manual there is no statistics to show network speed ,Currently TSCZ does not have a networking tracker system that assist in network troubleshooting ,monitoring and assist for decision making.

3.4 Process analysis

Rosenblatt (2014) characterized it as the classification of procedures into segments this is employed in order to aid in system elements that is outputs, inputs and processes. Furthermore ,Baltzan and Philips (2015) put forward that , process analysis is only undertaken in order to anticipate the picture of the systems functionality and to ensure either each and every process is being executed as expected hence this assist in areas where there is need to improve the process through getting rid of uneconomical activities hence maximizing productivity.

Table 3.1 Inputs processes and Outputs

Entities	Inputs	Processes	Outputs
Calculation of network speed	Start time End time Website	Estimate network speed	Network speed records
Network statistics	network interface name	Monitor network statistics	Network statistics files
Network availability	network interface name	Estimate network bandwidth	Network bandwidth records
Faults	Fault cause Date Fault Description Date Identified	Check network faults	Fault details records

3.4.1 Activity diagram

According to Kendall and Kendall (2014) asserts that these are diagrams that are demonstrated using charts using graphs containing functions and events that will in return move in a logical sequence with provision for par excellence, and replication The diagrams are meant to signify a replication of both the organizational processes as well as the computers , they illustrate the thorough movement of control.
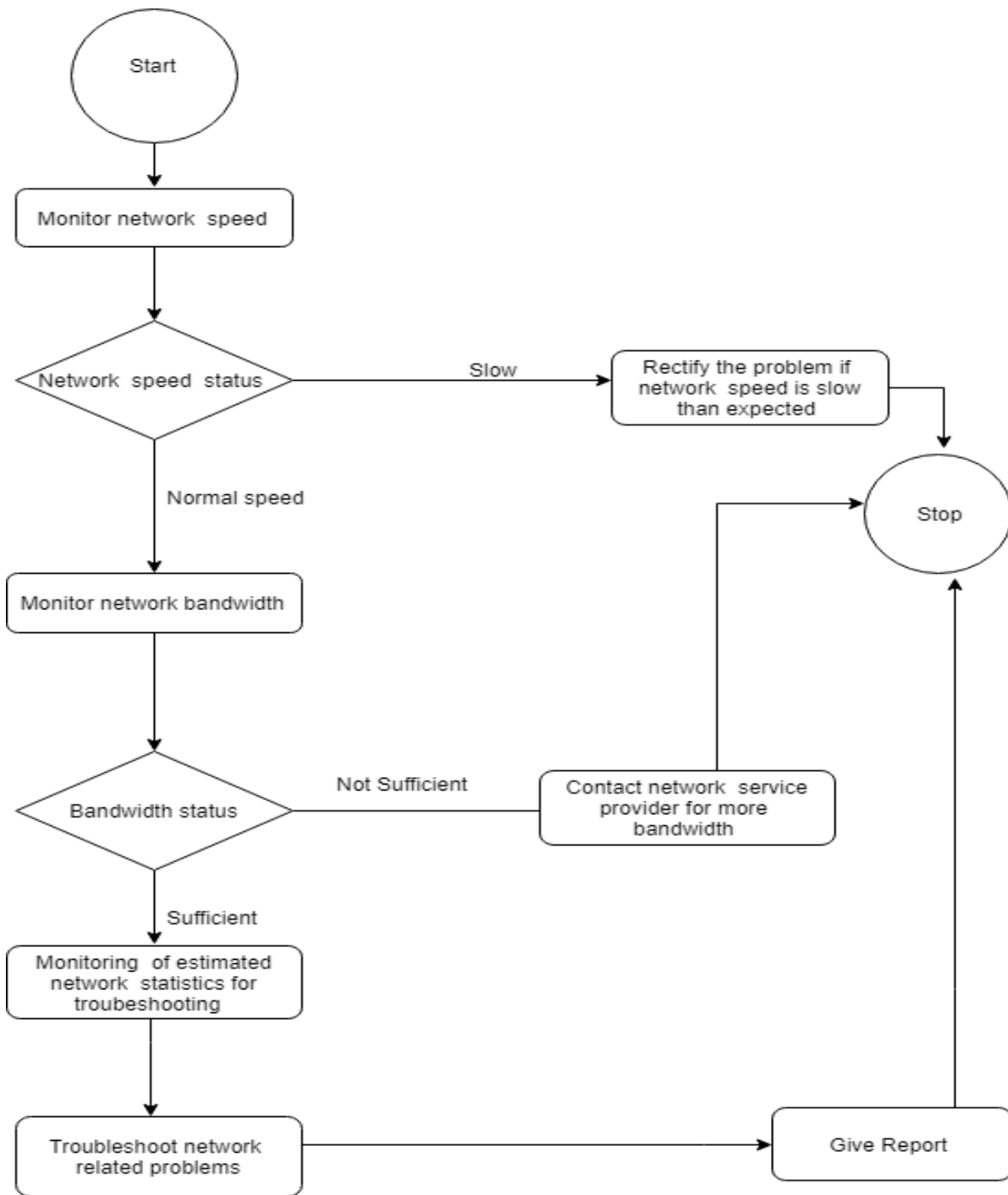
Figure 3.1 Activity Diagram

Key
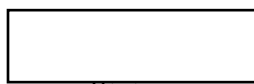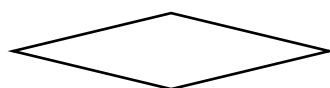
State   Decision   Start/End   Dataflow

3.5 Data analysis

Involves exploring continuous elements within the software framework in connection to their correspondence with the system. Likewise its a process of looking at the connection of entities to the data sources inside the software framework. In information analysis, data flow and contextual diagrams are utilized to decide and outline the manner in which how data flows through each procedure, and how entities interconnect and communicate with the system and with other different entities.

3.5.1 Contextual diagram

According to Rosenblatt (2016) this is a DFD, which shows the upper level dimension only, it is also called Level zero DFD. A context diagram demonstrate on the outline borders of the system framework. There is less specialized ability required due its simple notations. A context diagram however gives a picture on the summary of the system boarders, Moreover it requires less specialized knowledge because of its effortlessness crating of documentations.
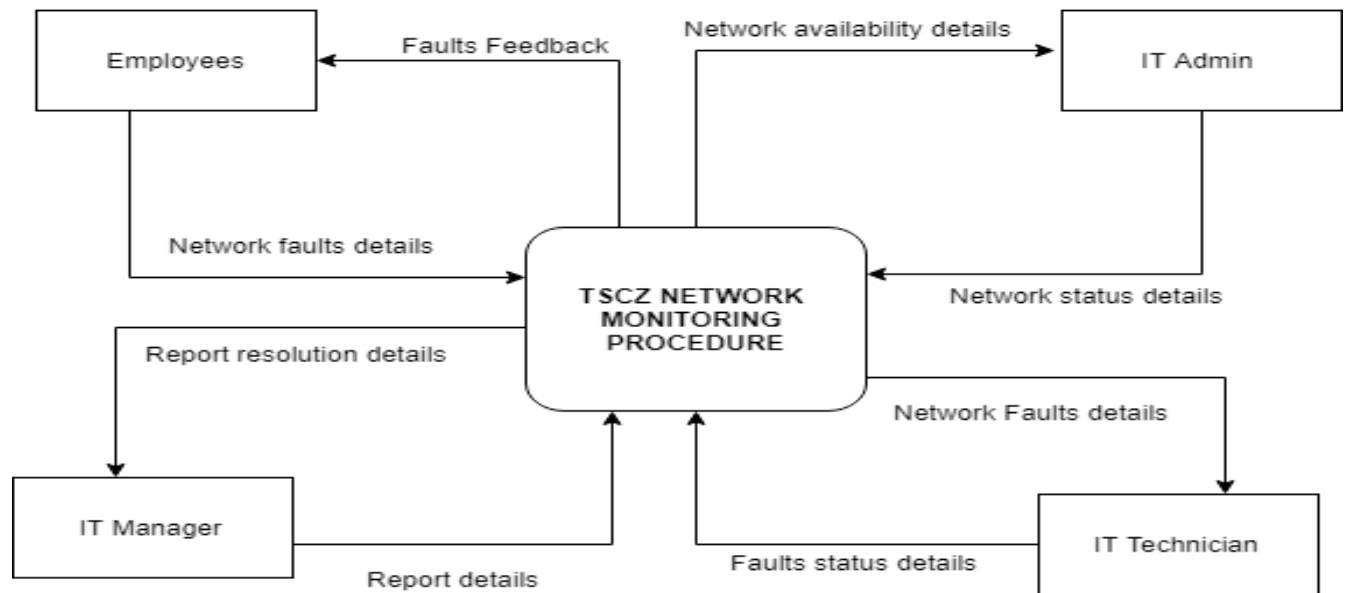
Figure 3.2 Context Diagram

3.5.2 Data Flow Diagram of the existing system

Kendall and Kendall (2014) indicates that the data flow outline exhibits a distinctive description that unveils the profound dataflow inside the system , for example the progression of information flowing starting with one entity then onto the next, and from processes to data stores . In bringing up the diagram, one can basically express the given and offer information to those who have enthusiasm for the processes of the system ,however there are entities , processes and data stores involved to come up with a solid data flow diagram.
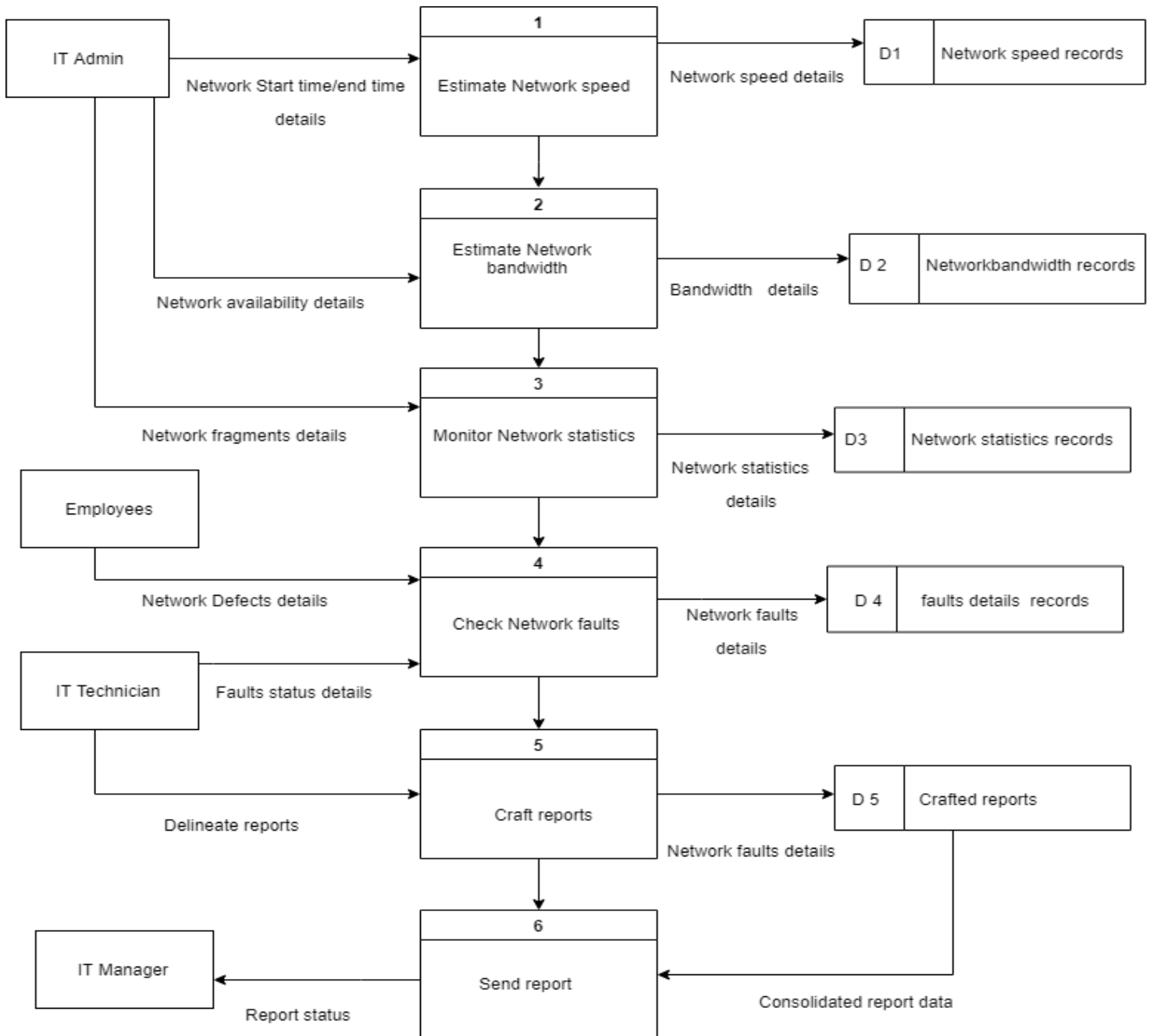
Figure 3.3 Data flow diagram

Key
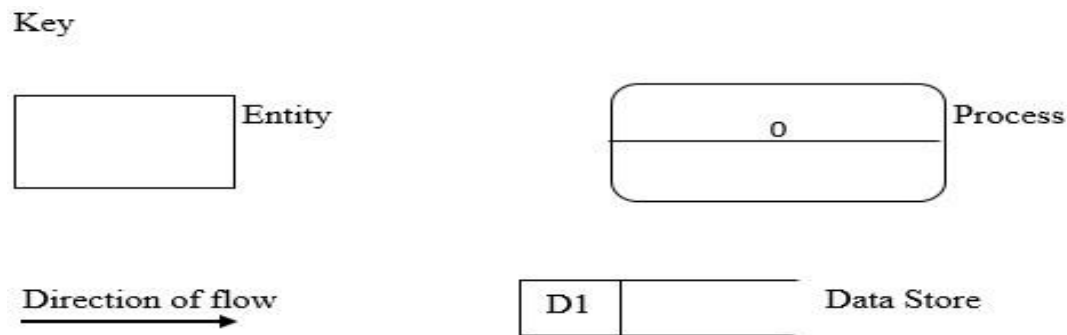
3.6 Current system Weaknesses

- Unavailability of network performance indicators in the time of network troubleshooting
- The organization could not ascertain bandwidth required hence this resulted in acquiring less bandwidth than expected from the service providers as they had no a yardstick to that, as a result of that slow network and network congestion was witnessed due to using limited bandwidth by many users.
- The Information Technology department could not provide network speed reports whenever required for example by the audit team as it was doe once every two weeks
- The absence of notifications in times of network downtimes   due to nature of the prevailing system within the organization resulted in   reactive instead of proactive measures especially when users start to complain
- The unavailability of assistance to gather network statistics for troubleshooting in times of network failures.

3.7 Evaluation of alternatives

The newly projected network monitoring software will curb all the above-mentioned challenges. The developer modelled to select the satisfactory from the three options that is to modifying the existing manual system , subcontracting   and developing   the new system. Before the acceptance of one of these distinct options, some elements have to be put into consideration, as they shall be explained underneath.

3.7.1 Outsourcing Solution

According to (Bucki ,2014) asserted that ,it is a way of attaining IT assistance and support from external stakeholders .It involve subcontracting out of tasks to a third party or an external service provider or organization. In an encounter the firm will opt to buy rather than make in-house, however this software package shall not be developed outside due to the following reasons;

- According to the viability study, contract out was never an option as it was not considered. This means to say that the monetary budget and cost that were lined up for system development did not cater funds for software outsourcing

- Outsourcing means   there will be a serious shift in control over business information, agendas of projects, however discretion will be a major reason of worry as the organization will be pushed to increase the protection of its information and other elements so that they remain in control of their resources.

3.7.2 Improvement of current software

This approach focuses on revamping the existing system framework in a bid to address some loopholes and transforming it to a better model. Nevertheless, modifications on the existing system will not truly reflect the needs of the organization. Moreover, the digital era we are in calls for advanced monitoring tools that keeps administrators in the communication loop on what is happening on the systems they watch over. The current framework is virtually difficult to develop because it is technological inferior.

3.7.3 Developing a network monitoring software

The process involves a complete change of the existing system   into a new tailor made software package by the internal team to fit their requirements. This results in a more vivid system that is required and accurate to the corporate. This approach require the company's software analysts, corporate professionals and others to collectively work together in positioning and executing the new technology, and they will be left in a situation to keep up to date the software package

,enhance and advance the system , when amending to the dynamic needs of the business. This enables the organization to have a total control on the running of the system**.**

Bulding a new network monitoring software was regarded as the best alternative because;

- The system will be a 100 % mirror image of the user requirements.
- Security of the network is maintained.
- The clients will have insight knowledge from creating the network tracker system as they will be a masterpiece in the process and can act as a mere spark that ignite them to bring new innovative ideas in the future.
- There is no jeopardies to the company's information.

3.8 Recommendation

There will be in-house development of new network monitoring system for traffic safety council of Zimbabwe this is so because

- The system will be a reflective image of the user requirements.

- Developing software that the organization owns is supported by the culture as compared to open source software that have high malicious related risks.

- Further to that, the in-house development passed during the feasibility study hence this gives the green light to develop the system within the organization has its budget is accounted for.

3.9 Requirement Analysis

According to Jeffrey (2010) ,requirements are central known attributes to be joint, before the building of a plan. Software's requirements examination is characterized as a composed procedure for sorting most appropriate resources to meet the systems requirements .The requests ought to be quantifiable, significant and separated. The techniques that fall under requirement analysis may be shown below

3.9.1 Functional Requirements

Marsic (2008) ,asserts that, it is a procedure of combining all the processes, entities, inputs, data stores and outputs to guarantee that objectives of the system are met. These are framework specific details, which however decide on the achievement or disappointment of the venture. Function requirements of the intended system are clarified underneath;

Business Procedures

According to Wang and Wang (2012) states that these are procedures or activity people actualize in order to obtain a result. On software package development business procedures, will consider generation of notifications on network summary, as this will be done by the system further to that the network monitoring system will be in a position to track key performance indicators such as network speed, utilized bandwidth, as well as packets with errors.

Operator alleged information

This alludes to the proportion of the viability of the system ordinarily on the end users side. This incorporate the different issues, for example, the capacity of the IT Technicians to successfully monitor network speed, bandwidth utilization as well as gathering of network statistics.

Business guidelines

The regulations are the objectives that the organization looks to accomplish that control how different business forms are undertaken in an organizations. For this situation, real objective of the any organization is for the IT division to give excellent administrations however on this situation, the automated network monitoring software package will help to advance the quality of ICT services henceforth improving efficiency.

3.9.1.1 Use case diagrams

It is a diagram that illustrate the systems elements and how they will coordinate with each other internally ,the elements will therefore symbolize system users. This is according to Walters (2009).

3.8.1.2 Use case diagram
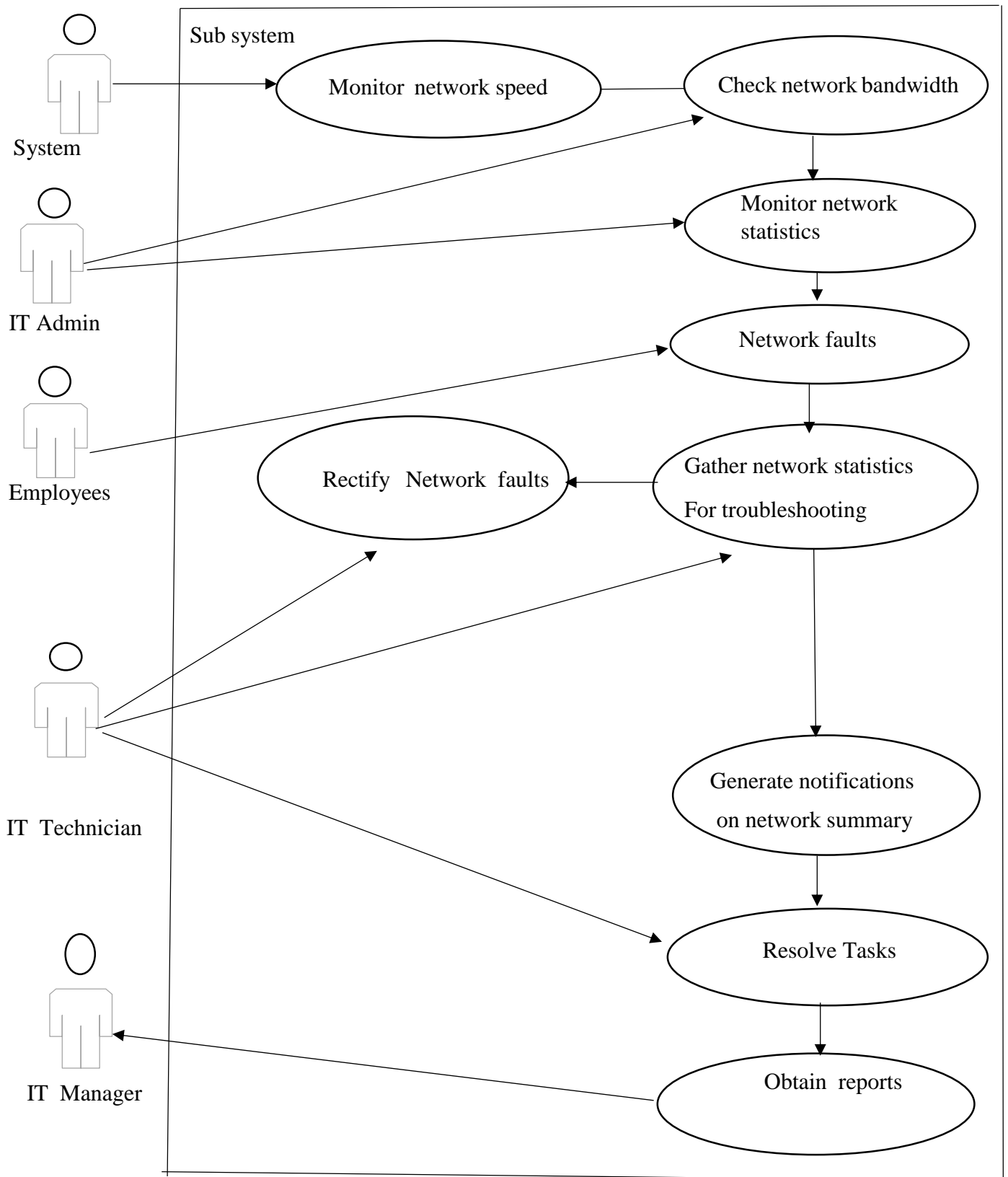
Figure: 3.4: Use Case Diagram

3.9.2 Non-functional requirements

Those are prerequisites which cannot be estimated by system functionality. They indicates the procedure to be utilized to quantify the systems operations rather than its manner that is its excellent features of the software package.

Usefulness

For this situation, the functionality of the software package is on the utilization of the system that is the manner by which the users interact with the software framework , how neighborly the user interfaces are and how simple is it to utilize the system is.The consistent correspondence among the developer and the administration will along these lines assist in coming up with the system which is easy to understand. Moreover, the utilization of client manual will help the administration to viably utilize the software framework.

Supplier

This is likewise another prerequisite, which concerns the providers of the different hardware equipment items that will be utilized in the process of developing and implementing the software package. The seller ought to obtain a decent status with its clients so that the products acquired are most dependable. The software designer shall guarantee that all the instruments utilized are of great caliber for instance the Visual studio platform for management-developing and the Sql server, that shall be given legitimately from Microsoft, which is highly dependable.

Performance

The framework will likewise perform successfully and proficiently as it is one of its primary purpose for its existence .System dependability is witnessed as the system will be implemented on a proxy server from where the organization directly receives bandwidth from internet service providers ,this means to say that there will be elimination of manual network trouble shooting as the challenges will be quickly identified firstly from the server were the system will be hosted. Because of this, increased performance at the work place will be noticed.

3.10 Conclusion

This chapter examined the current system and aided in data collection critical for system development. Process and data analysis was also fully explained on this phase as activity diagrams ,data flows and context diagrams of the existing system was clearly shown. Numerous options were evaluated and developing software package in-house was chosen best strategy. Requirement analysis was not left out has functional and non-functional requirements were

fully highlighted, use case diagrams has been also fully covered in this chapter, the researcher can now go to the next chapter where design of the projected software shall be availed.

CHAPTER 4: DESIGN PHASE

4.1 Introduction

This chapter will examine various modules found in the phase of design. Firstly it will discuss the software package design, hence the functionality of the software. Using the contextual and data flow diagrams of the anticipated system, the design would be reinforced. The proposed systems architectural design that is to say the necessities of the software that describes the software top-level structure, will be considered in this stage. This phase will also enlighten how the software interact meaning to say the physical design. This phase will also embark on database design, on the basis of entity relationship diagram (ERD), database tables and enhanced entity relationship diagrams (EERD).In addition to that there is also use of package and class diagrams in the chapter, further more this phase will further clarify the program design of the software package . Security plan, which incorporate physical, network and operational security, interface, main menu, input and output design including all input forms in the system, main and sub menus shall be enlightened in this chapter.

4.2 System design

Dennis (2015) lauds that software design comprises planning the software solutions and actually solve the problems identified in the problem definition. System design can be regarded as the implementation of those software solutions to identified set of challenges. Design system encompass lower level components, algorithm design, high-level components and architecture design. Further to that ,Dennis(2015) asserted that, the design of a system is a predetermined activity of uttering the involved system modules .The projected system is however supposed to be designed based on the user requirements and its complete analysis as this phase is the most critical stage in system development

The system design phase of the system development lifecycle(SDLC) process would eventually transfer from the " what questions '' that is readily found in the analysis chapter to the ''how questions''. Moreover, system design institute input, output, databases, forms, systematization schemas and specifications of the system processing. Programming language, hardware plus software platforms to be used are decided in this phase of the system. Also in this stage, to be determined are Information assemblies, control mechanisms, challenges of the software, tools foundation, capability and abilities of the software, structure of the interface,

training processes, manuals guides on system usage , stand by formats and staff will be required in this level

There are many tools and techniques implemented in the illustration and clarification of system design. Moreover, these apparatus include, , flow charts as well as decision trees hence forth in order to come up with this new software package the technique that will be used to describe in full will be data flow diagram and contextual diagram

System design eliminates the difficulties encountered in system development as it divide the process into small sub events and activities that leads to the coordination among these activities so that the objectives and goals will be attainable ,the diagram below clearly depict the process of designing a system.

```
                                    ——————————— Identify Design Goals

                                    ——————————— System Decomposition

                                    ——————————— Identification of Concurrency

                                    ——————————— Hardware Allocation

System Design  ———————————|
                                    ——————————— Data Mgmt

                                    ——————————— Global Resource Hand Leap

                                    ——————————— Software Control Implementation

                                    ——————————— Boundary Condition
```
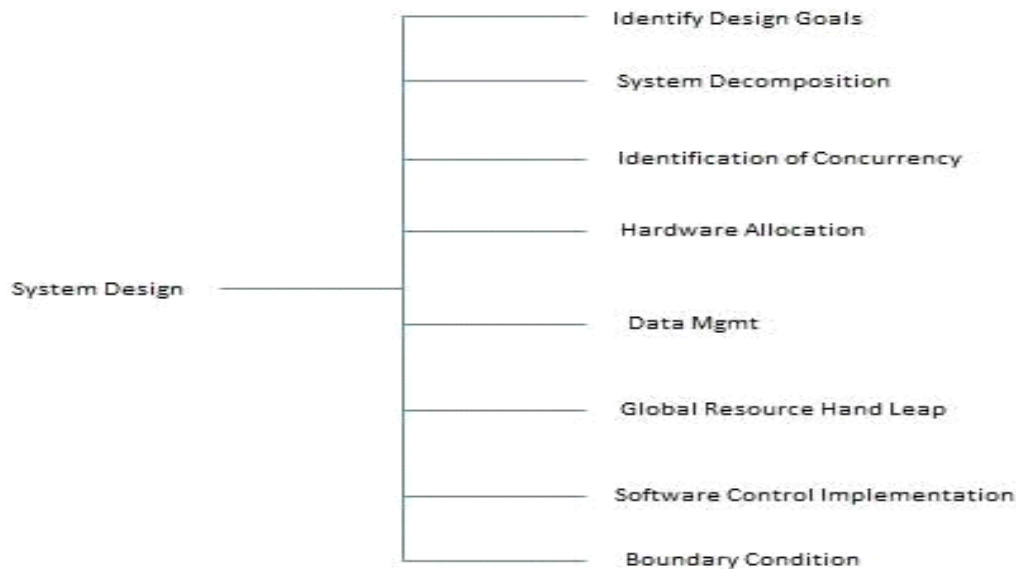
The system design phase considers numerous inputs such as work statements, Requirement determination plan (RDP),current situation analysis and gathering the requirements of the intended system which is inclusive of the conceptual data models ,data flow diagrams , meta data which is data about data. On the other hand the system design outputs eventually maybe for example a data schema , general change in organizational infrastructure in preparation of the proposed software framework .

4.2.1 Description of the proposed system

The software package shall operate on the proxy server, as it will reflect as soon as the organization will be connected on internet through receiving of packets from the service provider (SP). The proposed system shall calculate bandwidth, network speed, Notify network admins with the network PI summary and assist in providing an array of decisions using network statistics captured into the database.

4.2.2 Context diagram

Also known as mini DFD, which depicts the skeletal or minimal view of how entities moves as a process, reflecting its relationship with outside entities. A context diagram should be assembled firstly with the analyst before the construction of the actual data flow diagram Gary (2011). In addition, a context diagram it reflects the top dimension view to the systems data .The context diagram may be clearly shown   below.
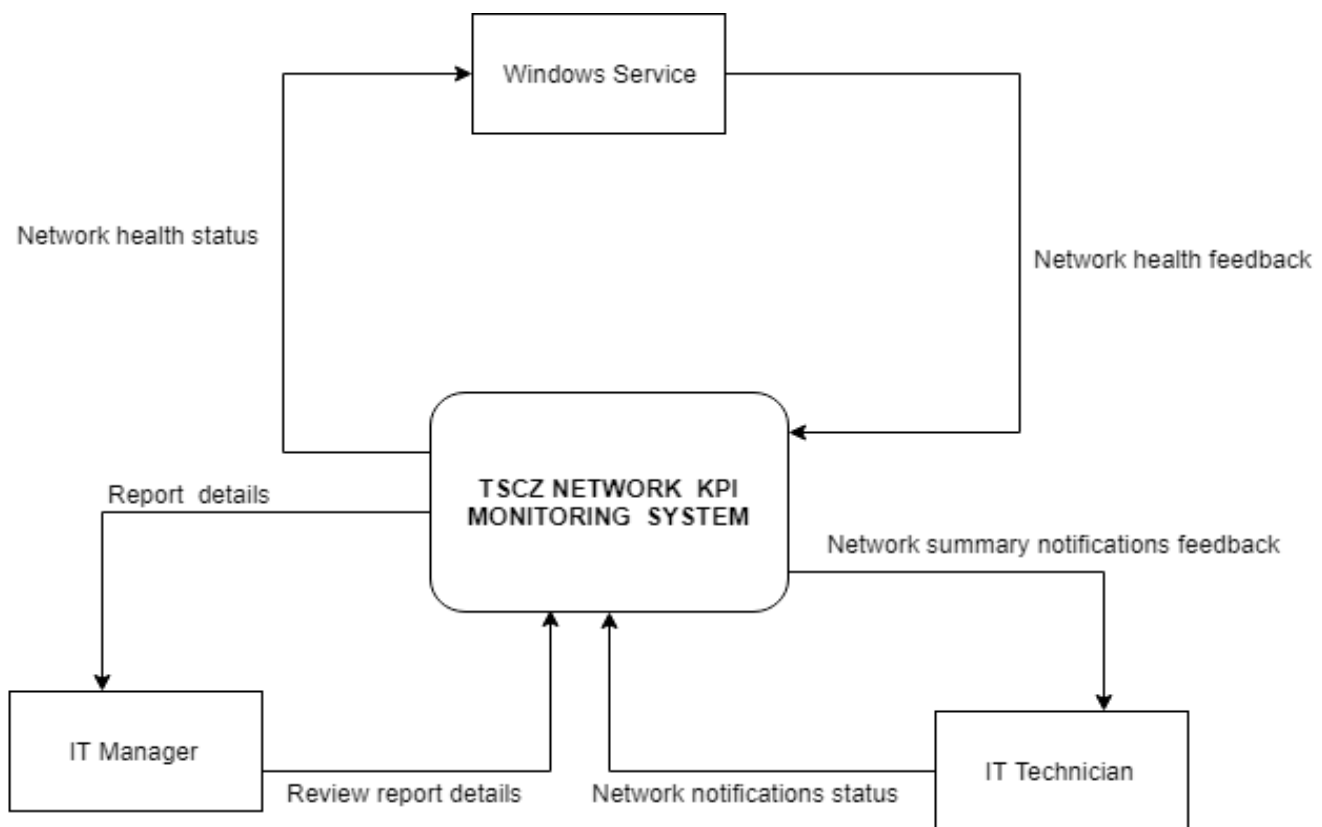
Figure 4.1 Context diagram

4.2.3 DFD of the proposed System

A DFD gives graphic illustration that will provide profound material around the movement of information inside the system, Date (2012) .This is to say it shows the manner in which data moves starting with one object then onto the next and starting with one procedure then onto the next in the construction of this diagram .DFD for the anticipated system may clearly be highlighted beneath.
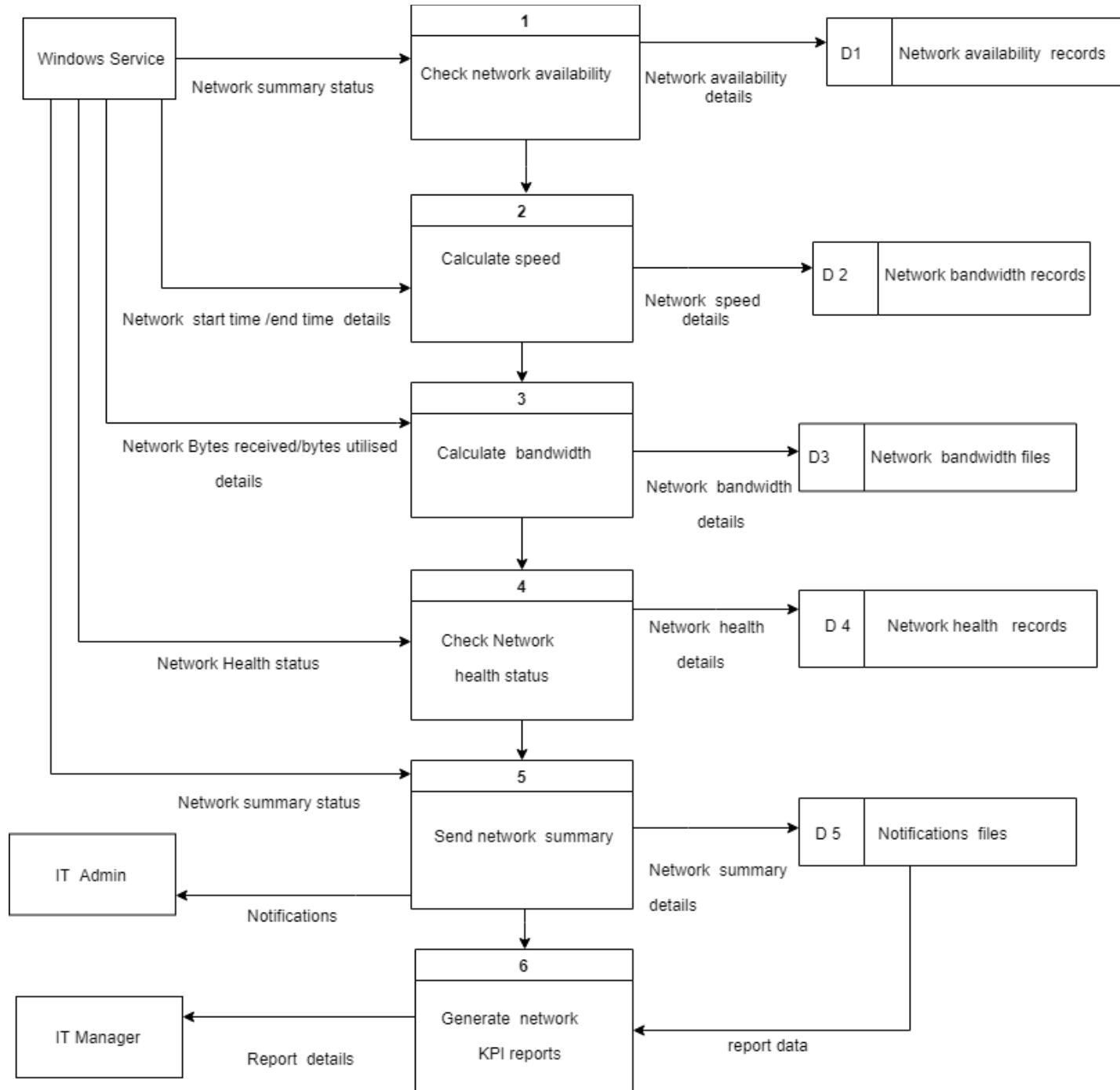
Figure 4.2 Data flow diagram

Key
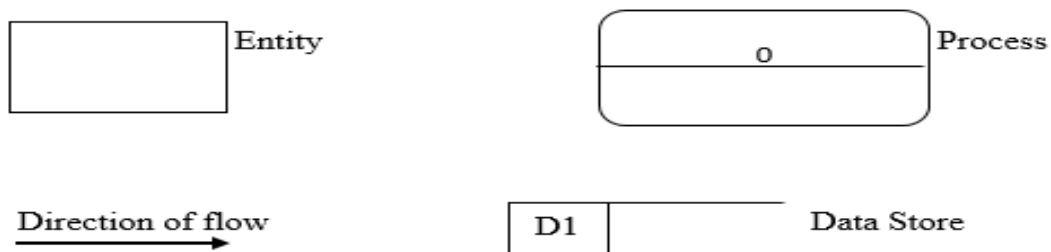
4.3 Architectural design

The design is implemented in order to ascertain on the optimum as well as the best way of bringing out together architectural components. This entails a collective joint of software, hardware and network infrastructure for the software package to execute at its optimum level. Kendall and Kendall (2014) views architectural design as a model, which is used to outline the assembly, states, behavior and additional interpretations and views of a software. The hardware to be utilized in the projected system is the main target, and how the installation is to be made. The architecture design in system development encompasses the identification of small elements that leads to the creation of a system, the platform for controlling those sub systems and interaction. The diagram below illustrate major components that will be put into use by the network monitoring software.
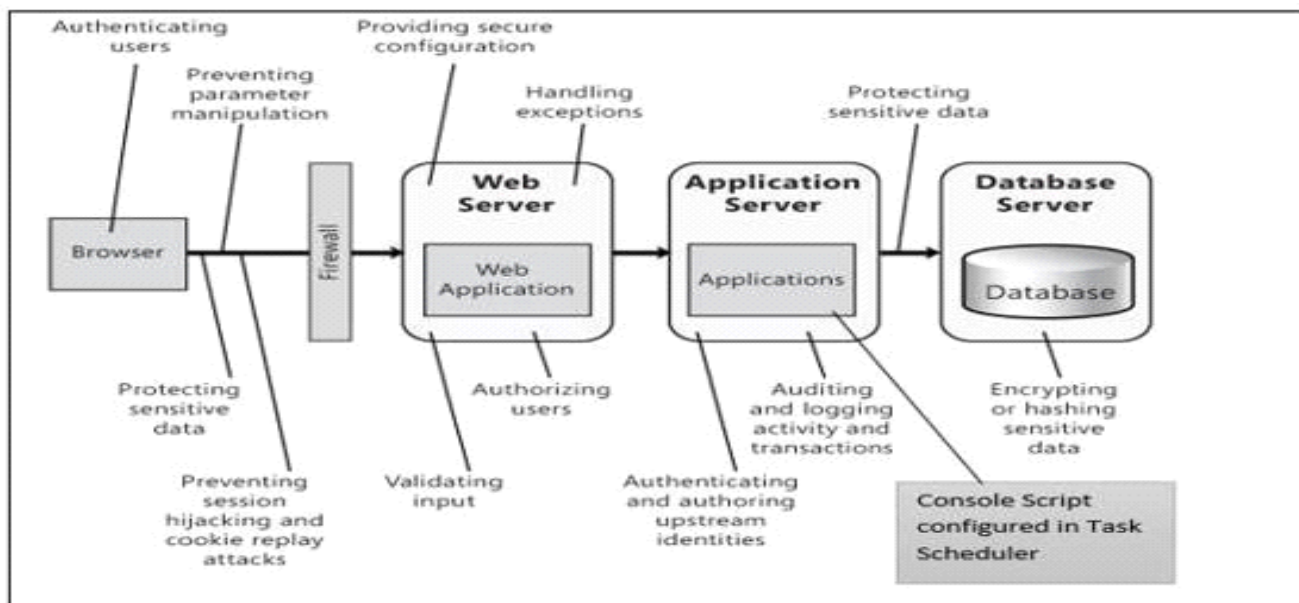
Figure: 4.3: Architectural design

4.4 Physical design

It is expounded as the process of transforming a circuit picture into the layout which is physical and explains the location of cells with their paths showing their interconnectedness (Rosenblatt and Tilley 2016).Physical design consists phases which includes the condition of input and output devices, database design and identification of back up procedures. It also plans the application of the system, specifies new software's and hardware has to use, devise a test and implementation plans. Additionally, it consists expense update, benefits, date of conversion and the constrains of the software on a brighter picture, physical design displays the precise arrangement of the network's physical parts, encompassing of data and network cables, routers, network switches, workplaces of course with their computer terminals just to mention but a few. The arrangement includes an illustration that would be in a diagrammatically form .The diagram beneath shows the physical design.
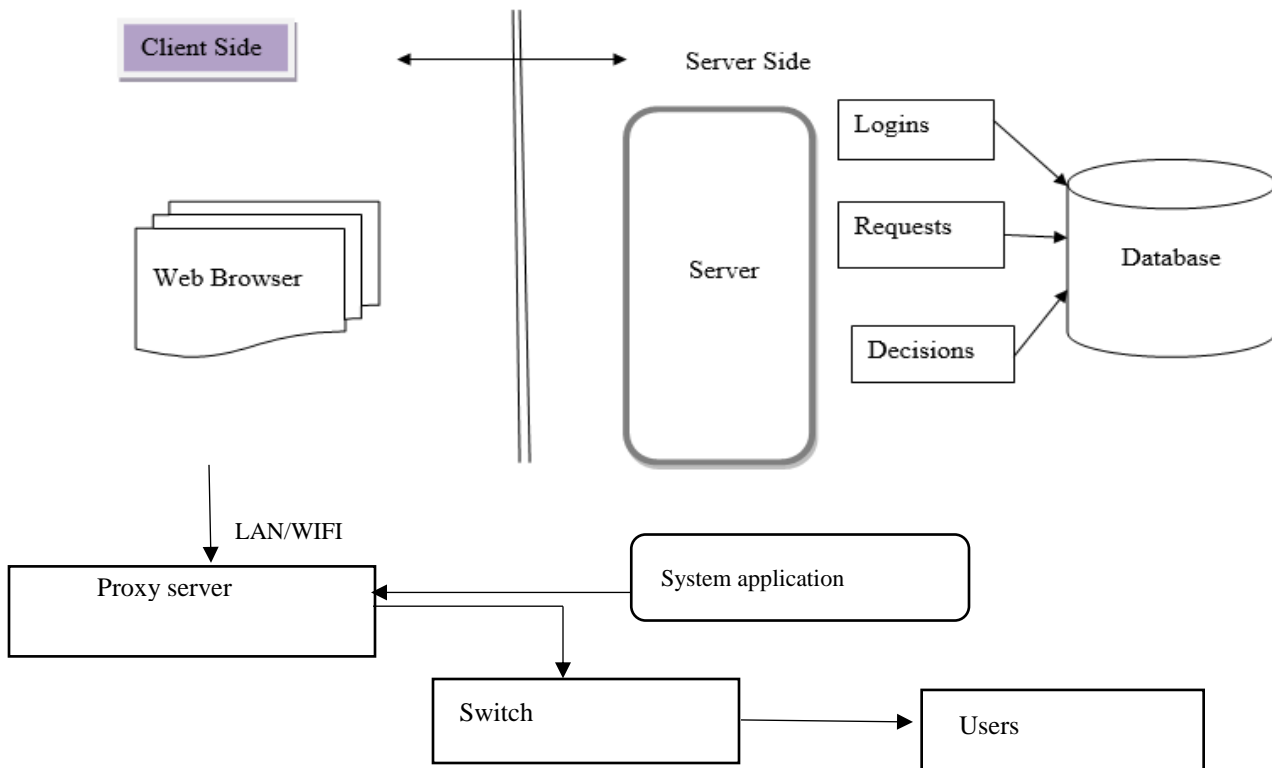
Figure: 4.4: physical design

4.5 Database design

As represented by Date (2012), database configuration is a procedure of raising a total information model of the database. The information model contains of all the required sensible and physical plan decisions just as the physical stockpiling limits, which are required in age of a structure in the information definition language (DDL) which would then be useful in the formation of the database. For the plan of the database, the ANSI/SPARC engineering will be utilized which comprises of three major diagrams that are inclusive of interior dimension, applied just as the outer dimension. The engineering encourages information autonomy. The major three schemas will be illustrated below

• The external layer

This layer provide is mainly concerned about accessing information, this means to say that, various users may access different information using the same platform v

•The conceptual layer

This layers shows all the elements within the database that is to say it illustrate the numerous attributes relationship between the database

• The Internal layer

This insinuates the actual appearance of the data base however it decides how the information is stored in the system database.
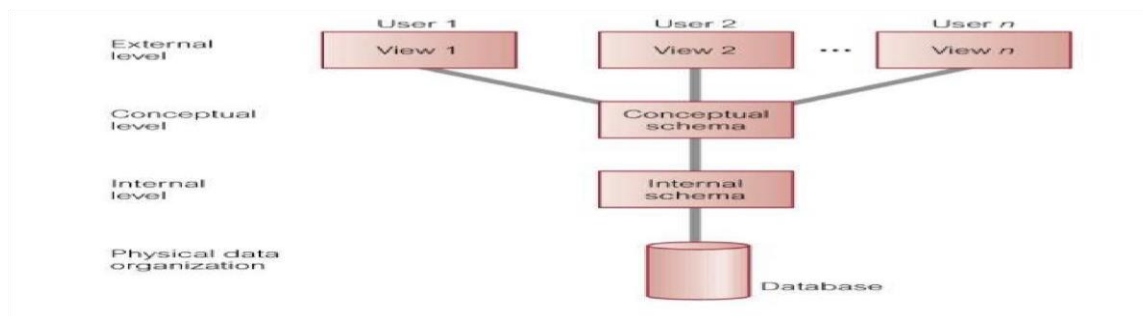
Figure 4.5 Three level architectural diagram

4.5.1 Database Tables

According to Gillenson (2011), information that is need in the structure is secured on the data tables in lines and portions that are also called database tables. The projected software package database tables will appear as follows:

Table 4.1 Database table

Entities	Field name	Data type and length	Description
Users / Technicians	Technician ID	Varchar (500)	-Uniquely identifies technician
	Password	Varchar (500)	-User's Login secret token
	Access Level	Varchar (500)	-role privilege
	Full name	Text	-technician's full name
	Email Address	Varchar(500)	-User's mail address
	Phone number	Varchar(500)	-Either true or false (1 for true, 0
	User Status	Bit	for false)
Bandwidth	Speed	Varchar (500)	-speed of network MB/S
	Interface type	Varchar (500)	-interface type of network
	Bytes send	int(100)	-number of bytes send
	Bytesreceived	int (100)	-bytes received
	Bandwidth	decimal(18,2)	-bandwidth utilized
	DateTime	Date time	-date and time monitored
	Operational Status	Varchar (100)	-status of the operation
	CheckedBy	Varchar(500)	-Name of System entity who checked it
NetworkSpeed	Interface ID	Varchar (500)	- Identifies the interface
	Availability	Varchar (500)	- IP address of the network
	IP Address	Int(100)	-routes of the network
	ConnectionTypee.g.	Varchar (100)	- number of packets received
	(Ethernet/wifi)	Varchar (100)	-Is remote device up/down
	Speed	Varchar (100)	-Is remote port open/closed
	Date_Time	Date time	-date and time monitored
	OperationalStatus	Varchar (100)	-status of the operation

	CheckedBy	Varchar(500)	-Name of System entity who checked it
Packet Analyser	Interface type	Varchar (500)	-interface unique identifier
	Server Name	Varchar (500)	-server's Name
	Address	Text	-packets address
	Time	Varchar (500)	- date and time
	Packets	Varchar (500)	- packets ID
	PacketsWithErors	Int(100)	- Packets With Errors
	PacketsReassembled	Int(100)	-Packets Reassembled
	Packetsrequiringreasse mbly	Int(100) Int(100)	-Packets requiring reassembly -Packets with address headers
	Packetswithaddresshe aders	Int(100) int(100)	-Packets With No Route -Total Time to Live for a packet
	PacketsWithNoRoute Ttl CheckedBy	Int(100)	-Name of System entity who checked it
NetworkMonitorSum mary	SummaryID	vachar(500)	-SummaryID
	Speed	Int(100)	-Speed
	BytesSent	int(100)	-Bytes Sent
	Bytesreceived	int(100)	-Bytes received
	Operationalstatus	Vachar(500)	-Operational status
	PacketsComment	Vachar(500)	-Packets Comment
	AnalysisComment	Vachar(500)	-Analysis Comment
	Availability	Vachar(500)	-Availability
	SystemDecision	Vachar(500)	-SystemDecision
	CheckedBy	Vachar(500)	-Name of System entity who checked it
Notifications	NotID	vachar(500)	-NotID
	ToEmail/Mobile	Vachar(500)	-ToEmail/Mobile
	NotType e.g.Whatsapp/email	Varchar(500)	-NotType e.g.Whatsapp/email
	FromEmail		-From_Email
	Message	Vachar(500)	-Message
	TimeSent	Date time	-Time Sent

4.5.2 Enhanced Entity Diagram

As indicated by Tupper (2011), it is a diagrammatic illustration of various relationships that exist between the system entities
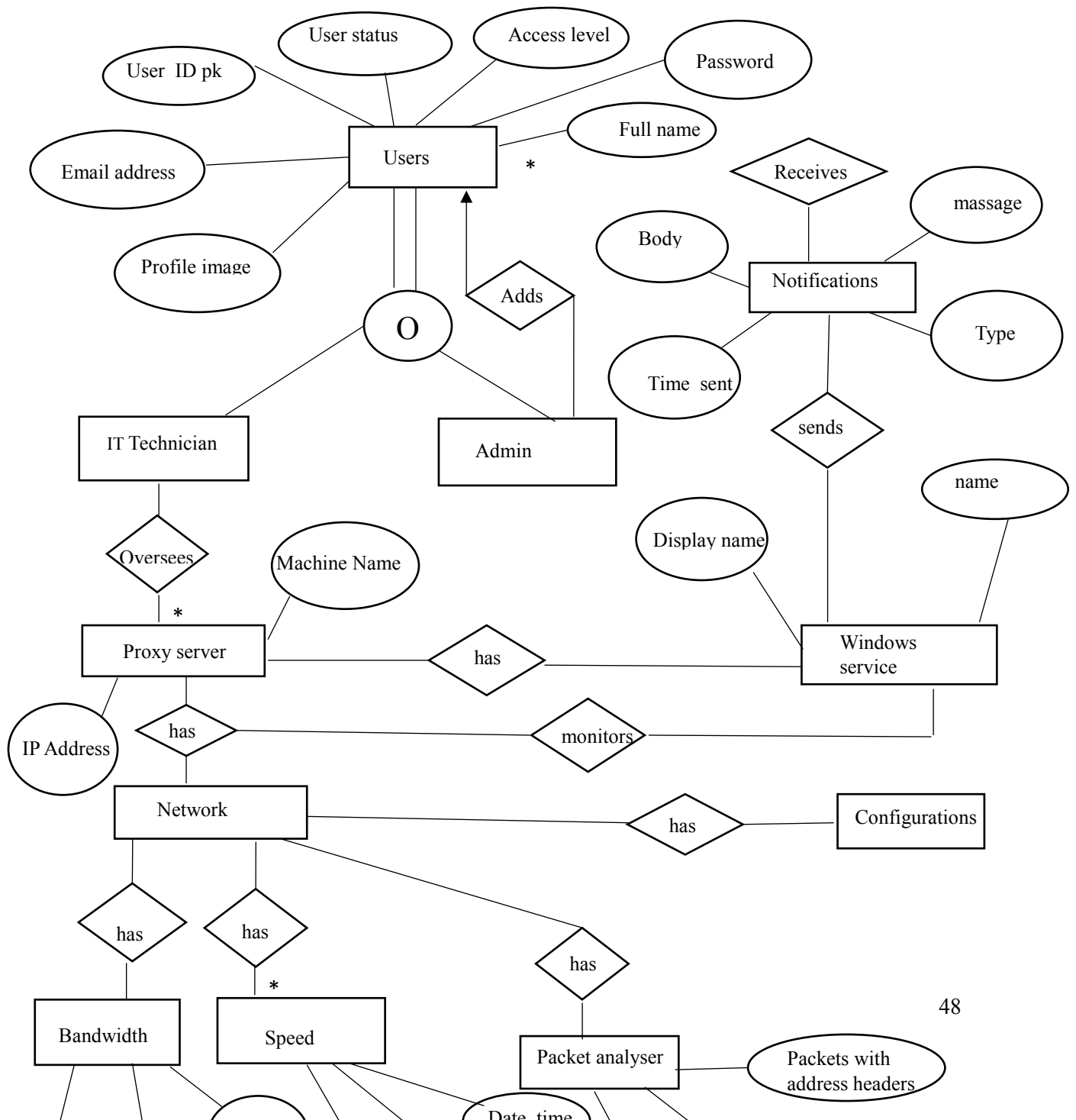
4.6 Program design

This is a technique that is mainly used to document and design ways and processes in software, however program design is linked with pseudo code but there is a slightly different in that , program design is executed by writing of pure language which in turn has no terms that would have any suggestion of using any programming language, According to Rosenblatt (2014), describes program design as the activities of proceeding from the requests that are anticipated in the software to the description of program , several phases in different software development life cycle models recognize that design in program is one of the most fundamentals phases, in the process of program design they are inputs involved . In the course of the stage, the design conclusions are set stating the functionality of the program and how it would attain the stipulations. The program design stage produces a program description in a format that accommodates the basis of later execution and implementation. Often in the system design stage, is where the partition of two sub phases is done thus architectural design and a single unique full detailed design.

As enlightened earlier, the architectural design inmost times is provided as a basis of main elements of the program with their connections, the chief procedures these elements use and the core data arrangements. On the other hand, the full detailed design would then refine and improves the architecture design to the level where the implementation begins.

4.6.1 Package diagram

It is an integrated exhibiting language diagram that describes packages, habits and dependencies among other packages. Unified exhibiting diagrams demonstrates a number of views of a software, for instance an application model with multi layers. The utilization of the chart reduces system complexities. A package diagram just as one of UML diagrams portrays both arrangement and dependency of sub systems and of different modules. When sketching a package diagram, several nodes are put to use which includes package node, an element, a dependency, package merge just to mention a few.
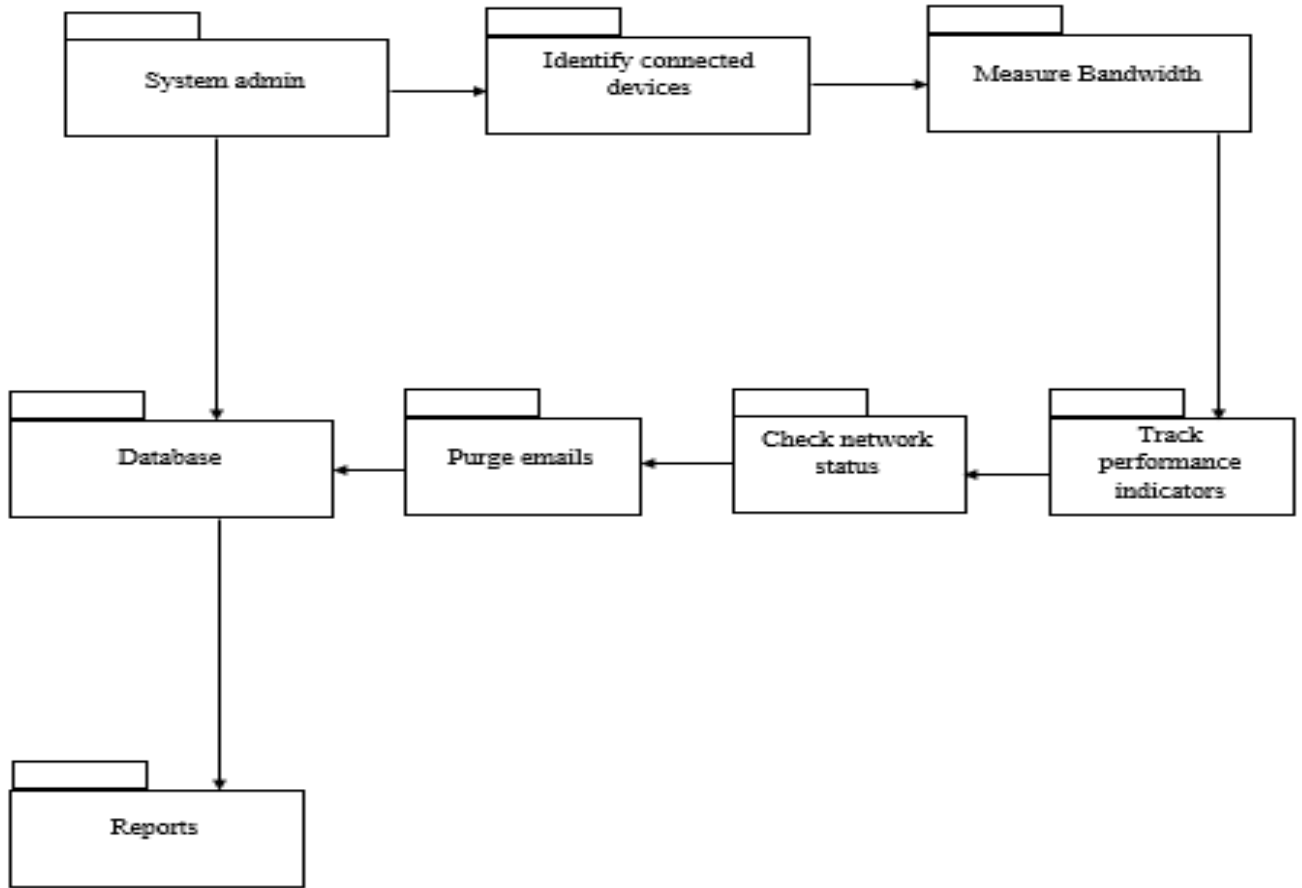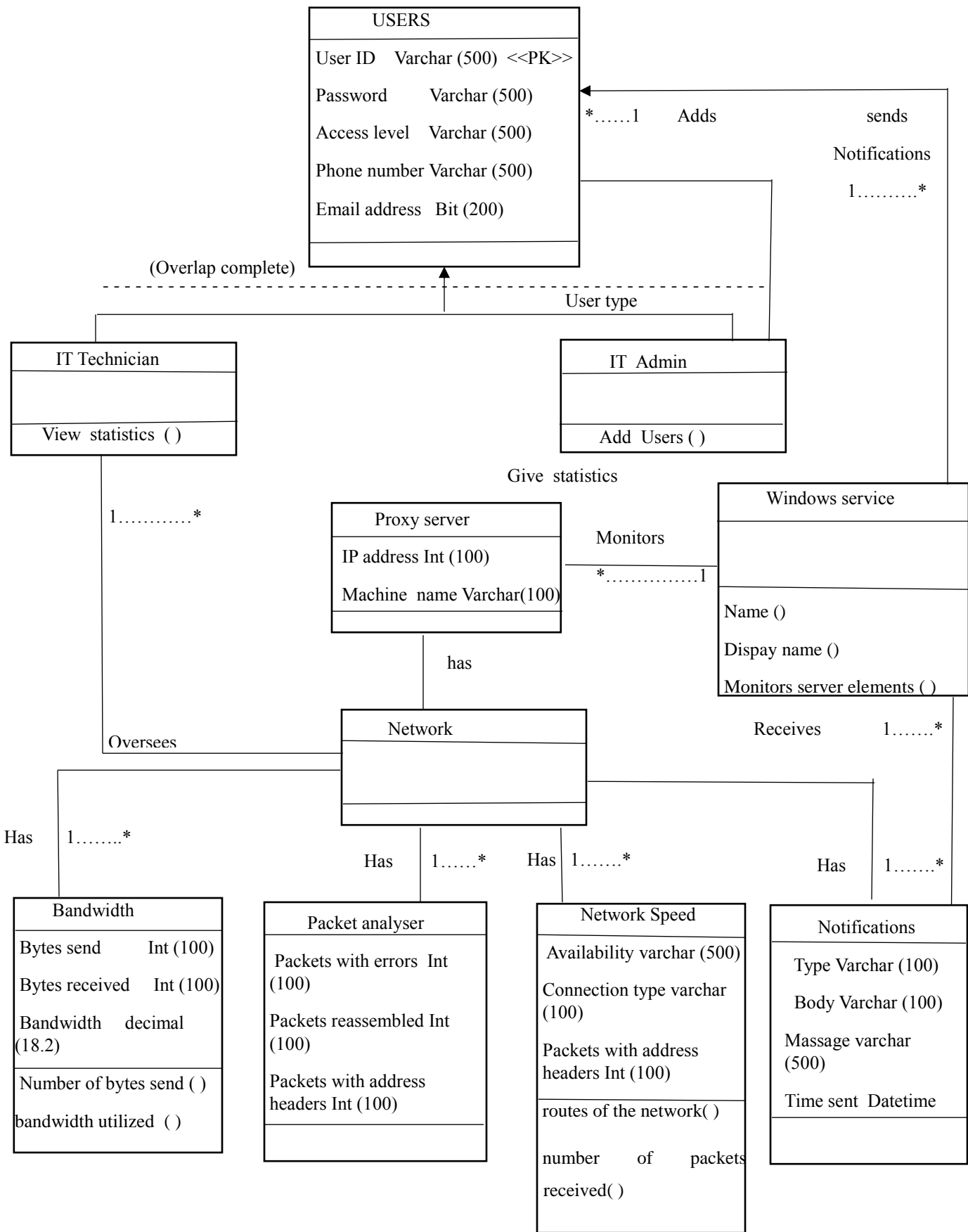
Figure 4.7 Package diagram

4.6.2 Class diagram

The diagram is frequently used in describing elements and items inside a program and their connectedness. They also demonstrate on how each class functions, together with their particular properties. Class diagrams also demonstrates the interrelationships of the system, class attributes, class operations, inheritance, association and aggregation. Class diagrams are variously used in detailed design modelling and conceptual modelling. The relationship between one class and the other is signified with association whereas the separation of entities, which have similar features, are fully signified by classes. Class diagrams are shown using rectangles, which are subdivided into partitions; the first partition is where the name of the class is center placed, written in bold and capital letters. The second partition comprises the list of the class attributes aligned to the left, and not in bold and in lowercase and then the third partition has all the write operations. The class diagram may be shown below.

USERS

USERS		
User ID Varchar (500) <<PK>>		
Password Varchar (500)		
Access level Varchar (500)		
Phone number Varchar (500)		
Email address Bit (200)		

*……1   Adds   sends

Notifications

1………..*

(Overlap complete)

User type

IT Technician	
View statistics ( )	

IT Admin	
Add Users ( )	

Give statistics

1………….*

Proxy server	
IP address Int (100)	
Machine name Varchar(100)	

Monitors

*……………1

Windows service	
Name ()	
Dispay name ()	
Monitors server elements ( )	

has

Network	

Receives   1…….*

Oversees

Has   1……..*

Has   1……*   Has   1…….*   Has   1…….*

Bandwidth	
Bytes send Int (100)	
Bytes received Int (100)	
Bandwidth decimal (18.2)	
Number of bytes send ( )	
bandwidth utilized ( )	

Packet analyser	
Packets with errors Int (100)	
Packets reassembled Int (100)	
Packets with address headers Int (100)	

Network Speed	
Availability varchar (500)	
Connection type varchar (100)	
Packets with address headers Int (100)	
routes of the network( )	
number of packets received( )	

Notifications	
Type Varchar (100)	
Body Varchar (100)	
Massage varchar (500)	
Time sent Datetime	

4.6.3 Sequence Diagram

It is also known as the event diagrams is another tool in program design used to further illustrate the development of the intended software package. Date (2012) asserts that event diagrams shows how the components of the software cooperates in a certain manner. It shows entities, which are found in the situation at hand as well as order, classification, arrangement of the message, whithe objects exchange among themselves to perform their duties of the scenario. A sequence diagram uses parallel vertical lines called lifelines, dissimilar objects that live concurrently as well as horizontal lines, which are the messages that the objects exchange among them in their sequence as they happen.
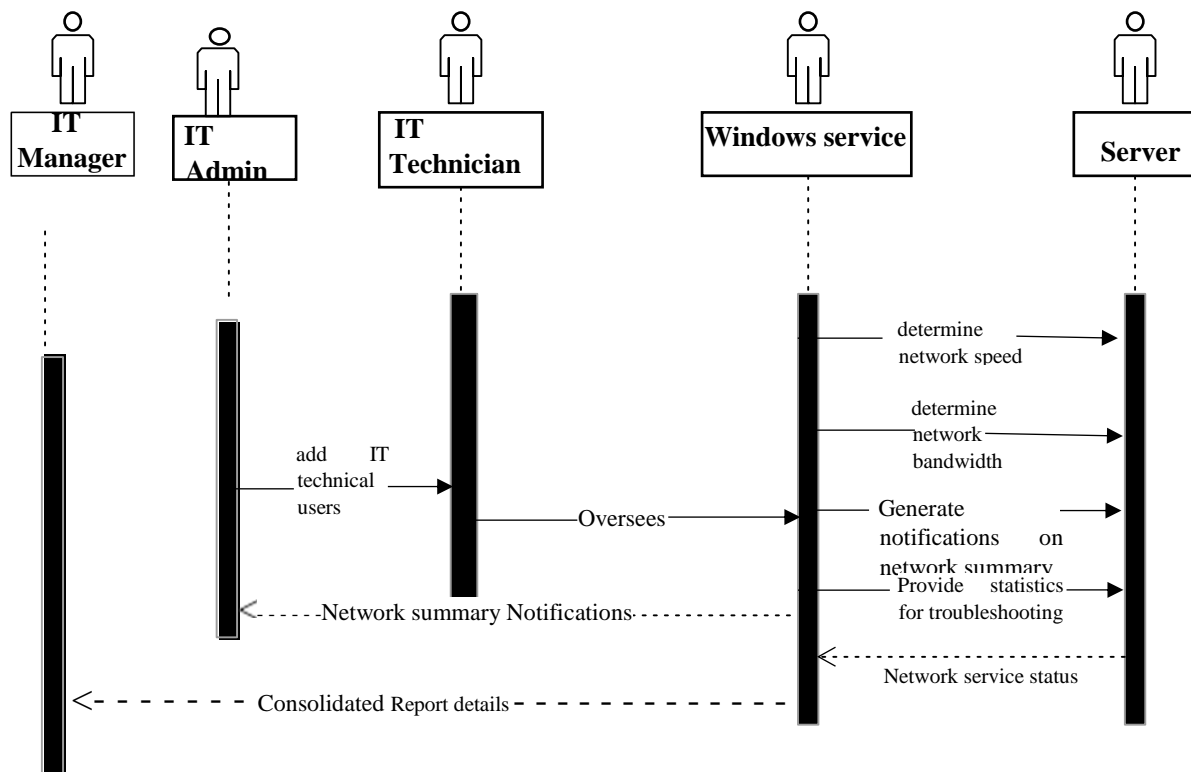
Figure: 4.9 Sequence diagram

Key of sequence diagram

External participant   System response   Massage   system activation

52
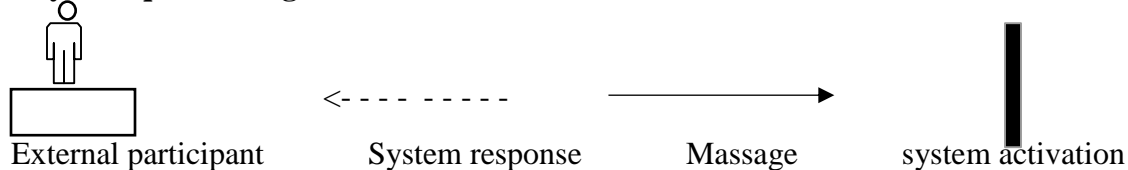
4.7 Interface design

user interface design   (UID)   is the process of coming up with   various designs of user interfaces for   various applications as well as computers taking for instance   mobile phones devices ,various appliances used indoors , plus other automated   electronic devices that seeks to achieve usability by the users.

According to (Garrett and Garrett, 2014). It is a way of creating   various forms and appropriate massages for end users in order for them to cooperate and   put the system into use, further to that , Dickins   etal (2015)asserted that the process of coming with an interface design is an engineering   process which is in line with coming up with   graphical view, feedback and reactions to provocations   that enables interaction and system usage. Another vital component of interface design is that   it comprises of friendly and timely responses this is so because it carries a psychological bearing to end users. This is to say for an interface design to be more acceptable by users it should contain forms that are user friendly, accurate and appropriate reactions to events, distinguished images, eye- catching colours,accurate and appropriate use of various symbols ,offering assistance, enhanced graphics and   uncongested and noticeable controls this enables the end users to have a positive attitude and enthusiasm or desire to use the system. The menu, submenu, input forms and output forms are shown in the coming sections.

4.7.1 Menu design

According to Oxford University (2014) designing of menu centers around on giving a rundown of interactive directions or facilities or alternatives accessible in the application. In software engineering, a menu is described as set of choices presented to the computer application users helping them to find data or when executing any functionality of a program. Menus designs are usually found in graphical user interfaces like windows applications. They are sometimes engaged in speech recognition applications. The use of graphical user interface menu drop downs, a clickable event or element, can be a textbox, a label or a button, can cause more elements to turn up beneath that event. On a windows application, text buttons like view help, edit performs the functionality indicated and another menu can be produced.

Speech recognition systems presents menu in a set of audible selections where the users relate to the system through a button clicking, discourse audibly. Most of these menus are common in telephone responding programs. The intended software package shall be moderately a console version and partially containing graphical user interfaces to highlight output.
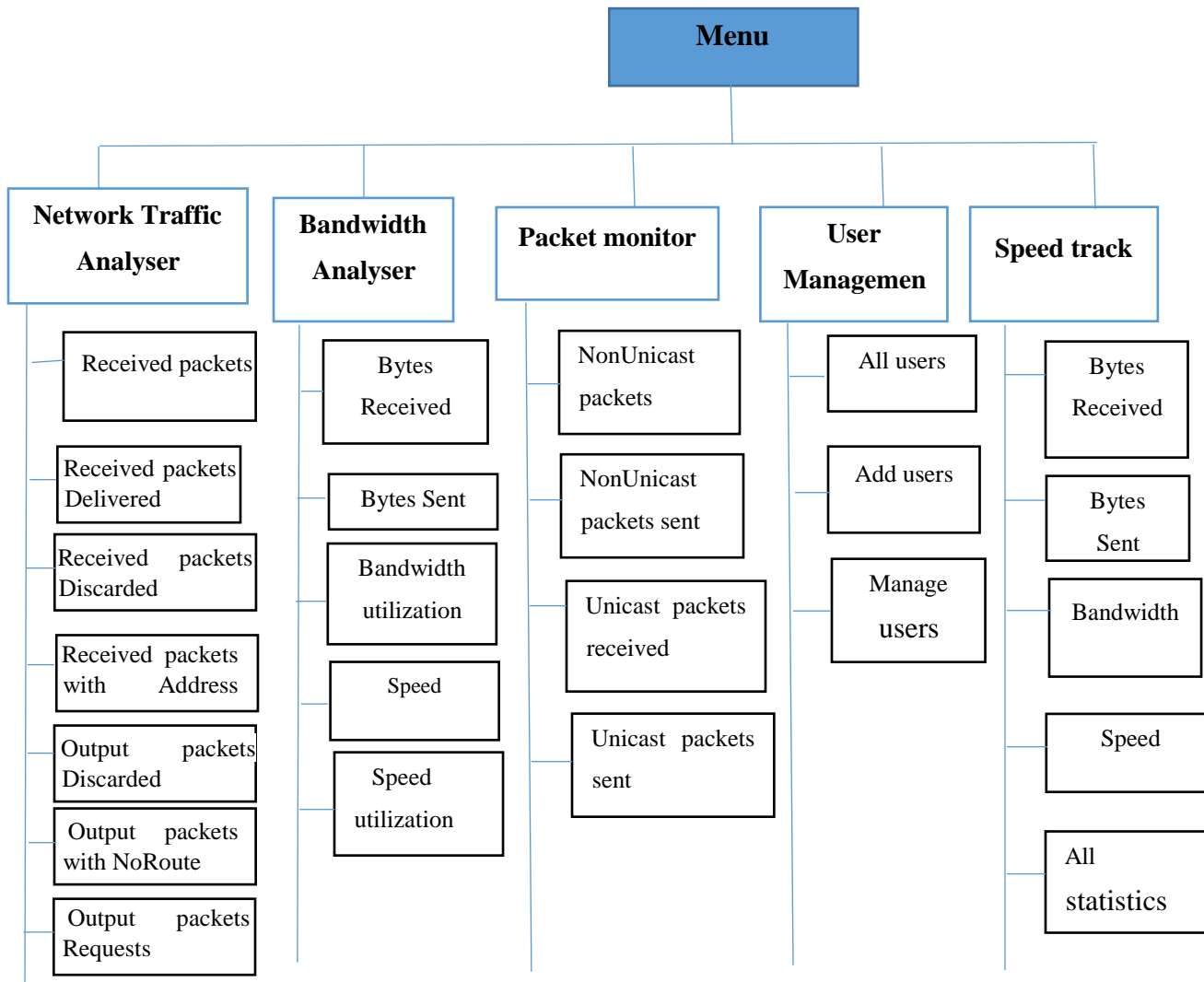
4.7.1.1 Main menu

Figure 4.10 Main menu

 Sub menus

They will instantly appear as soon as they are clicked all admins will have the privileges to access all menus and submenus, however IT Technician will access specified menus.

4.7.2 Input design

By knowledge of principles of basic design, several objectives of input design are put into consideration; some of the objectives includes coming up with a design, which reduces input volume, making a design of input, and data entry procedures, designing data capture source documents, implementing validation checkpoints and operative input controls. In addition, during input design phase, data input methods is to be designed in a way that avoid errors which

arises when entering data. The data input methods rely on whether the final users enter data manually in forms and later the data be entered by operators or the data has been entered directly on computers. Mistakes and errors can be evaded by the system through constructing a clear form with clear instructions on it and reduced key hits, an input form, which sends immediately a feedback when there is an error.

Add new user page

The I T administrator is liable to add new employees (IT Technicians) to the system. The added technicians ,will only be monitoring network movement across the organization and also they will be able to receive   WhatsApp massages in the event that the network is down.

Users

Details of employees

Full name

Technician ID

Email address

Contact Phone Number

Password

Confirm password

Add user

Figure 4.11 Add new user

Report search

The network admin will enter the specified dates in order to retrieve the desired reports from the system, further to that the admin should also specify the type of report need to be retrieved from the system.

Reports for

Type here for example bandwidth ,speed ,configuration

Date from

Date and time is fetched from the database for each report item

Date To

Date and time is fetched from the database for each report item

Reports overview for the specified period

Reports will be displayed here

Search

Figure 4.12 Report search

4.7.3 Output design

Kernel (2005) asserted that information systems is regarded as an important part to do in any software and the designing of output forms constitutes of all the outputs needed in the system and output controls as well as prototype layout of the reports. Output design objectives includes designing forms which provides the intended purpose and elimination of coming up with non-required output, development of output design that links with user's specifications, design that deliver suitable amount of output, for decision purposes the outputs should be readily available so that quality decisions can be reached on time.

Reports are mainly crucial point of output design and there are chiefly three types of reports needed by the management which are the detailed reports, summary reports and exception reports. Detailed reports are there in supporting the management to make plans and to control and these reports comprises of the current information that do not have restrictions. Summary reports are used when full details are not needed and are in categories and summaries of the trends and potential problems. Also exceptions reports encompass of filtered data in a certain format and standard.

Bandwidth measurement output form

Interface	speed	Bandwidth	Time	Bytes send	Bytes received	Date stamp
Ethernet	52.56	84665	11/02/2019	46678990	578985	11/02/2019
Wi-fi	67.86	85002	17/02/2019	77656890	7653765	11/02/2019
Wi-fi	48.32	85285	20/02/2019	877556	343567	11/02/2019
Wi-fi	43.89	85831	11/02/2019	6757665	87654	11/02/2019
Wi-fi	56.78	5435	11/02/2019	6757665	987654	11/02/2019
Ethernet	78.8	87838	11/02/2019	6757665	45678	11/02/2019

Figure 4.13 Bandwidth measurement

IP Address	Address Family	Duplicate address	interface	IsDnsEligible	IPV4Mask	Address VDL
10.240.15.215	Internetwork	Preferred	Wi-fi	False	0.0.0.0	
10.240.15.215	Internetwork v6	Preferred	Wi-fi	True	255.255.0.0	
10.240.15.215	Internetwork	Preferred	Wi-fi	False	255.255.0.0	
10.240.15.215	Internetwork v6	Preferred	Wi-fi	True	0.0.0.0	

Configuration dashboard output form

Figure 4.14 configuration dashboard

Interface type output form

Interface Category	Interface Description	Operational status	Server IP	Date stamp
Ethernet	Realtek PCIe GBE Family controller	Up	194.0.7.48	11/02/2019
Ethernet	BluetoothDevice(Personal Area Network)	Down	194.0.7.48	11/02/2019
Wireless 80211	Intel(R) Dual band wireless	Down	194.0.7.48	11/02/2019
Ethernet	Realtek PCIe GBE	Up	194.0.7.48	11/02/2019

	Family controller			

Figure 4.15 Interface type output

Default Ttl	Received Packets	Received PacketsForwaded	Received PacketsDelivered	ReceivedPackets With unknown protocol	Output packets discarded
128	919875	0	945222	985	252
128	919875	0	945222	985	252
128	919875	0	945222	985	252
128	982645	0	1010697	1044	252

Network health status output form

Figure 4.16Network health status output form

4.8 Pseudo code

Login pseudo code

Begin

    Enter username, password and Acceslevel, Status

    If the credentials are correct

    Check if   Status=Active

If Status= Active

    Logon should be successful based on the access level

    Else

Produce correct details

    Finish t if declaration

Finish the connection

Pseudo code for bandwidth measurement

Start timer and wait for passed time

Verify network availability

If network availability is true then

    Pick   all network interfaces available

Foreach network interface

Obtain NKPI LIKE, Bytes, ServerName,Bytes sent

Attempt to Send Alert if bandwidth is low

Attempt to Open DB Connection

Save NKPI in the DB automatically until looping is over

*Attempt to Abort **DB** Connection as bandwidth check-up completes*

Timer start and stop as per predefined time

else if no network connection available

trigger simulated alarm and voice/Notification

Pseudo code for Network speed & operational status

Check net availability

IF net availability = true THEN

Select all Network Interfaces available

For each network interface

Gather its NKPI LIKE operational status, Speed, InterfaceName ServerName

Attempt to send alert if network speed is low

Attempt to Open DB Connection

Save NKPI in the DB automatically until looping is over

*Attempt to Abort **DB** Connection as network speed check-up completes*

Close the connection of the database

Else

Start simulated alarm sound

Pseudo code to Gather Network Stats

Check net availability

IF net availability = true then

Enter available network interface

Gather Packets stats LIKE   Packets requiring reassembly,Packets with address headers,PacketsWithNoRoute

Attempt to send alert if network speed is low

Attempt to Open DB Connection

Save NKPI in the DB automatically until looping is over

*Attempt to Abort **DB** Connection as network speed check-up completes*

Close SQL Server Database Connection

ELSE

Start simulated alarm sound

4.9 Security design

Security of software's is vital   as it   protects   the system framework   from   all possible interruptions   and harm. Walter (2009) The security structure major three angles, maybe fully explained below.

4.9.1 Physical security

Harmening (2009), physical security is a safety effort intended to renounce unauthorized access to services, equipment's, and assets also to guard against harm and damage to property and employees. Includes the usage of many layers of co-dependent security systems such as the use of security guards, locks, protocols to data access, CCTV watch, biometric, surveillance, protective barriers, among others from theft, terrorist attack and spying.

4.9.2 Network security

As per Kizza (2015), alluded that, securities in networks is intended to guarantee assurance of the network and information passing through the network. It however integrates hardware's and software's However, up to date anti viruses will be employed to scan all   possible harmful programs in order for smooth running of the network framework.
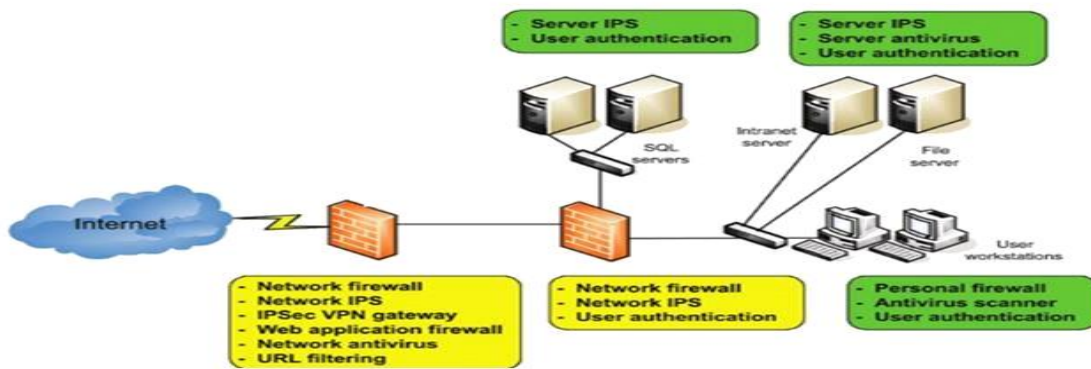
Figure: 4.17Network Security Design

4.9.3 Operational security

The United States Department of Army (2001) characterized it as safe guard procedures used to block accidental or deliberate open exposure of significant or delicate data. It is the way toward shielding shared, individual and fragmented bits of information, which can be incorporated to give a reasonable joined information. It can likewise be characterized as consistent procedure by which organization uses for identification of information and data that requests for protection and recognizing the suitable assurance methods.Baker and Paul (2012) have additionally characterized these as the security restrictions that are utilized to verify authoritative assets while being used, by the advancement of specialized and non-specialized countermeasures against dangers.

4.10 Conclusion

This phase emphasized on the design of the intended software package. All crucial designs have been conceptualized, these includes system design .There was a full description on how the system will fully function , System design was also explained highlighting its elements such as physical design which shows on how the hardware and software interact , database design were EER diagram and database tables was clearly shown , interface design, pseudo code, security design network and operational security was explained .Having discussed much in the design stage, the next phase is the implementation phase were the various critical concepts of coding ,implementation just to mention a few will be fully discussed.

CHAPTER 5: IMPLEMENTATION PHASE

5.1 Introduction

This chapter emphases on the execution of the intended system. This is a critical phase, because most of the viable system developments results in software jeopardies due to failed execution as a result of incorrect installations, neglected maintenance, less or no testing of software. This chapter will therefore cover the coding of the system and the language used, software testing, as well as system security tests, imparting of skill to users through training as well choosing the best recommendation in system maintenance.

5.2 Coding

In data frameworks, coding alludes to build up procedures that brings the improvement of an executable PC program from the origination of a computer fault (Dickins, Stowell and Melmoth, 2015). Nikhil (2015) likewise characterized coding as the way toward combining, analysing, distinguishing and elimination of hidden errors, outlining making amendments as well as mating the computer source codes. The motive behind coding is to bring out computer recognisable as well as instructions that are understandable that will eliminate challenges on a domain specific task. The software package has two packages that is the console based and an online web solution. The package is an online web solution created utilizing Asp.net cu together with the Sql (Structure Query Language) for querying Sql databases.

5.3 Testing

This process is undertaken to identify loopholes. Usability of the system and as well amending the systems loopholes to make the system of better quality and in accordance to the user

specification ,further to that in the course of testing the quality of the system, potential faults that may hinder smooth operation of the system are   recognised hence a proactive measure will be under taken to counter the problem .Mahapata(2016) asserts that , the main motive for a software to go under numerous test is to make sure that it meets user   specification and requirements aswell.the are also major components involved in order for a software to be regarded as tested that is to say validation and verification should not be left behind .Verification makes sure that the system functionality meets the desired objectives that were anticipated at the initial stages whereas validation guarantee the software package will accomplish various requirements of users.

According to Suryn,(2014) alluded that the black box testing procedure is only concerned about what is fed into the system in relation to output of the system , this means to say that ,the software interior mechanisms are not of utmost important as it will not be focused upon. As a result of that the technique is only used for system validation as it will concentrates on user inputs, however   the white box testing procedure mainly takes into account the interior mechanisms be that as it may specialised knowledge is essential to carry out the performances since it is more of verification .

5.3.1 Types of testing

In order for the organization to insure that the   is performing up to their standard there should take more of their precious time in testing the software package before approving it as the their own product however they are various means and ways of software testing hence this may be
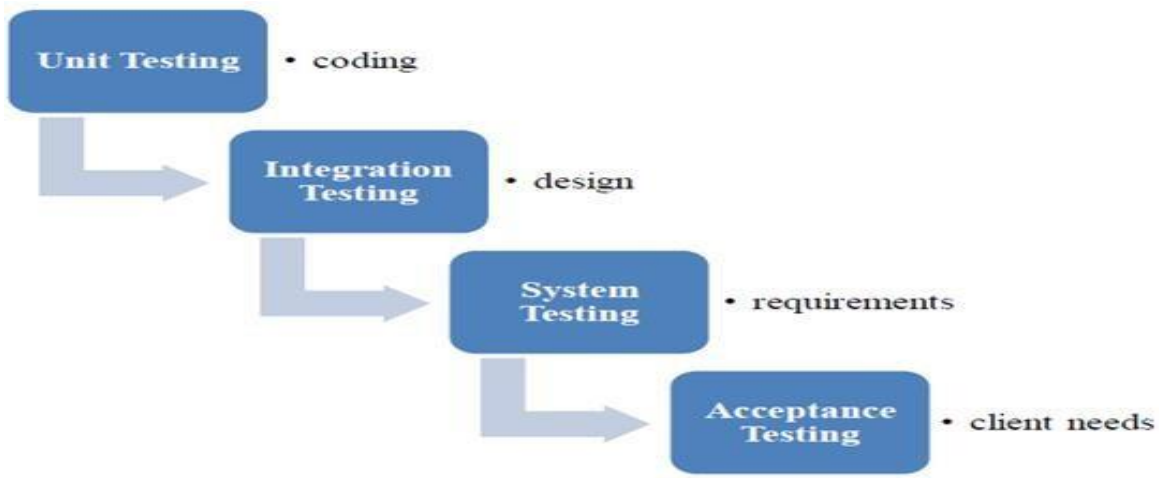
shown on the chart below

 Figure: 5.1: Types of testing

5.3.2 Unit Testing

This is a process that takes all the involved system elements as they will be scrutinised separately .this is done in order to verify either the elements are performing up to the expected user standards or not ,during the course of testing if a loophole is encountered in any of the system elements ,a proactive measure will be taken to solve that. The screen shot to follow clearly illustrate the testing procedures undertaken, however the concept of black box testing was employed to verify weather the user was gratified with the functionality.

Figure 5.2 add member form

This element was thoroughly tested as it was performing as it was expected, this means to say that users were easily added and the element ensures that all the added members details were being successfully exported to the database in order for them to have easy admission to the system.

5.3.3 Sub System testing

Under this scenario the numerous separated system elements are brought together in order to come up with a sub system however it will be then put into test to check for loopholes, The process is usually undertaken soon after the unit testing. These tests are run to the extent that the sub systems with errors will be modified. Moreover, the numerous tests were run on the different system segments, the following screen shot illustrate the log in page, system users will have the right to admission and readdressed to their particular system dashboards.
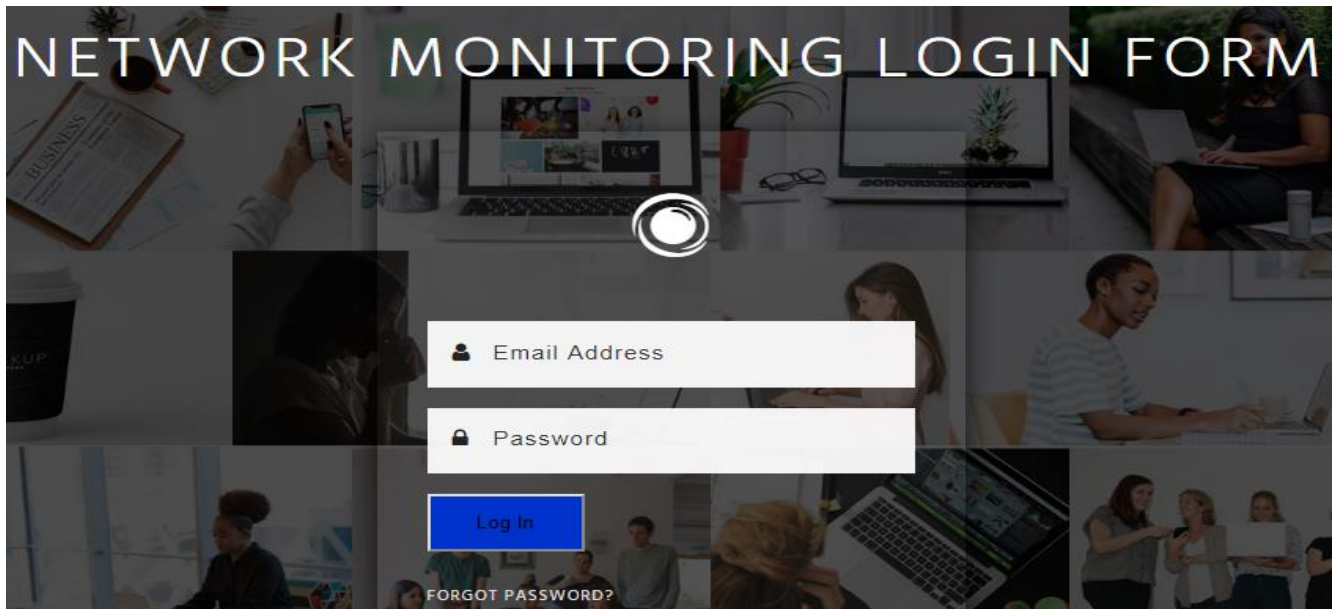
Figure 5.3Admin log in

.
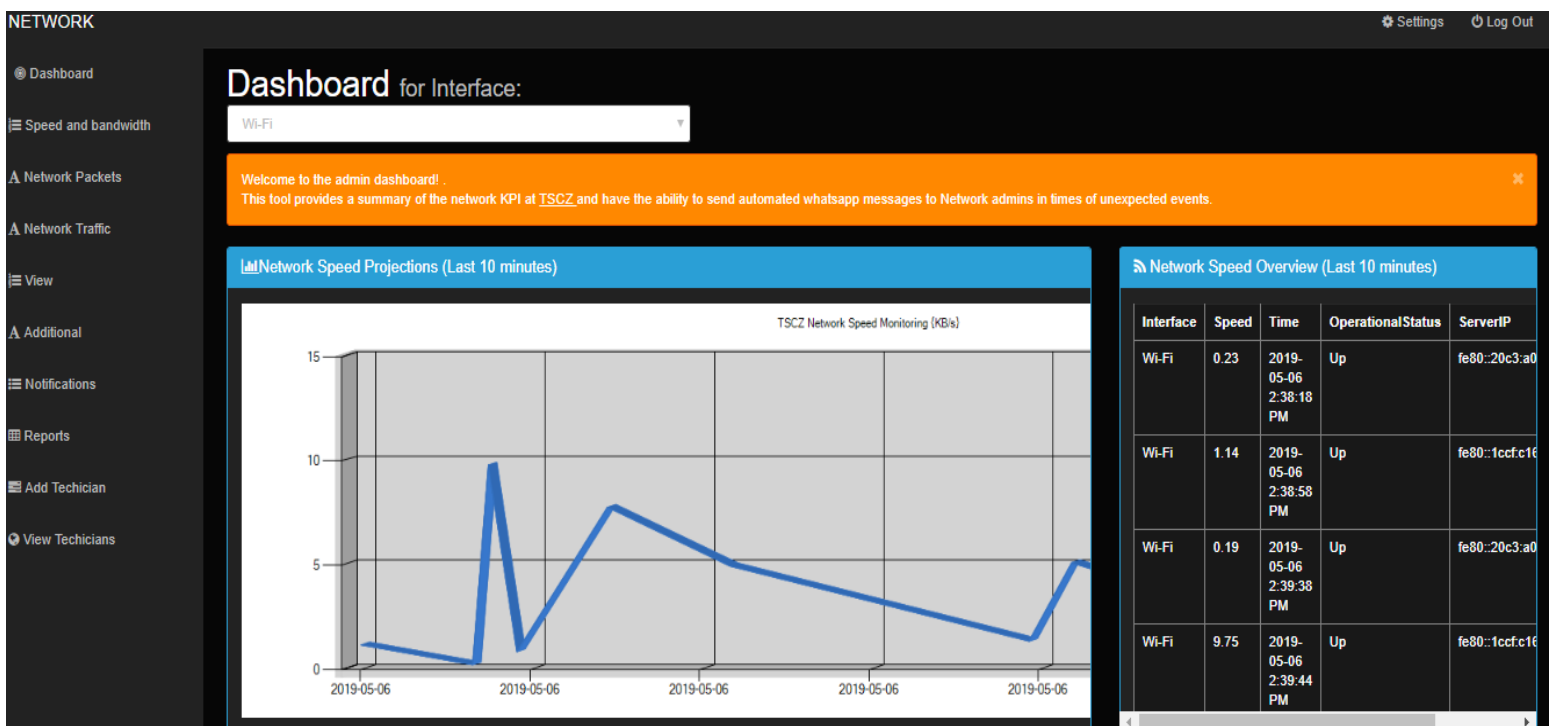
Figure 5.4 Admin home page

The system was put under scrutiny to verify either the administrator will be readdressed to the respective dashboard or not, however the test come out favourably as the admin was direct to the respective dashboard.

Figure 5.5 User information

The IT Admin is capable to manage users in such a way that once a manage user button is clicked a window will appear such that the admin may activate or deactivate a certain user. The appearing window may be clearly shown below.

Figure 5.6 user management

The admin is also capable to add new roles to the   users for instance a technician can be added as a new admin with admin privilege rights.
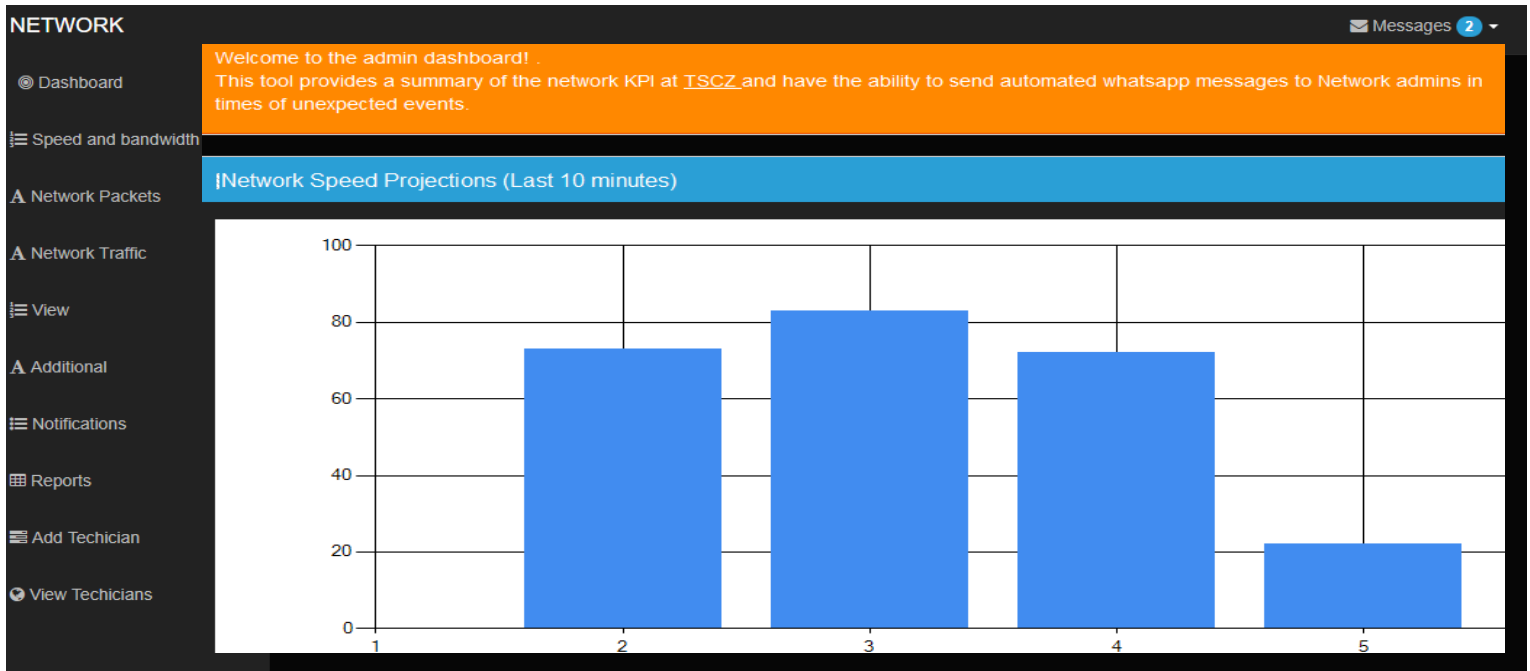

Figure 5.7 IT Technician dashboard

5.3.4 Acceptance testing

This is a black box testing, frequently executed by the user to make sure that the attained software is satisfying and meet the specifications and requirements and working as according to the user's expectation before the implementation phase. According to Tsui et al (2014), asserted that ,this is a scenario where by the   user expectations   contest in relation to the system performance that is to say to verify either the software package is running as per   user expectation .however this stage is critical as it involves ultimate software users and these users are the key towards acceptable software's ,likewise any software package is deemed ready only if the acceptance testing is completed.
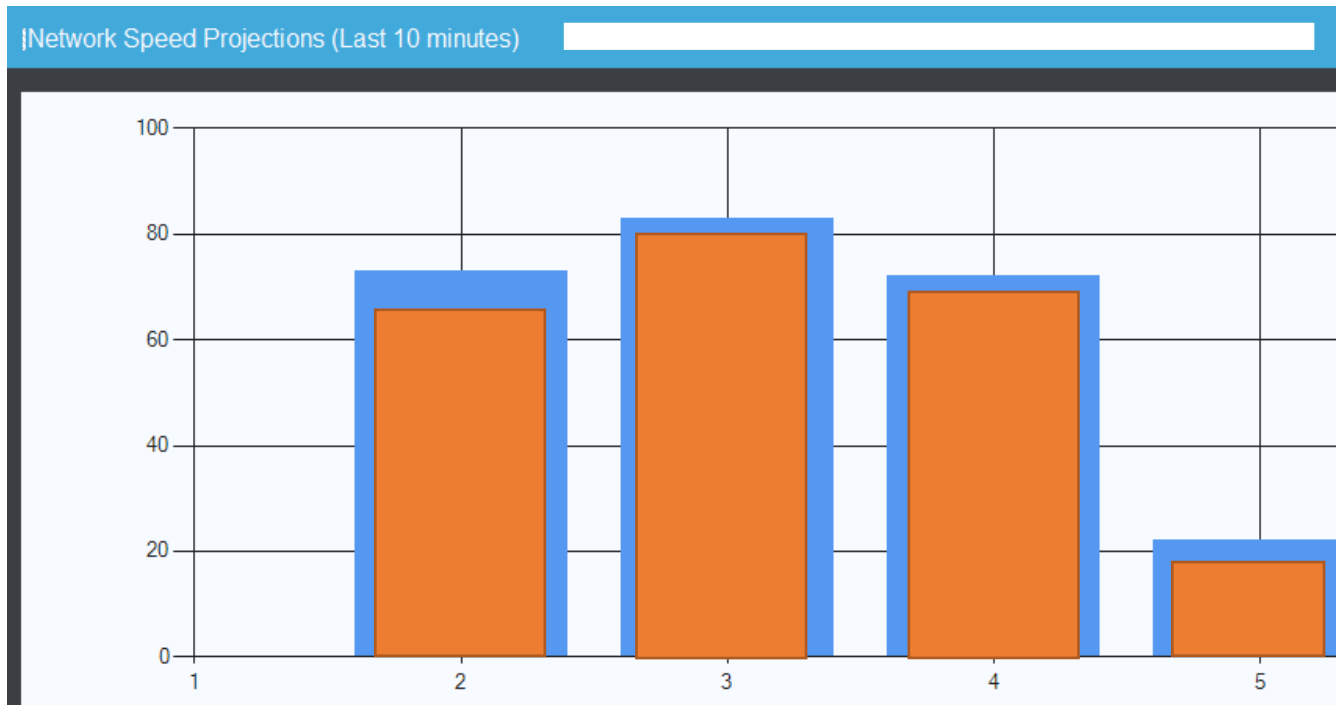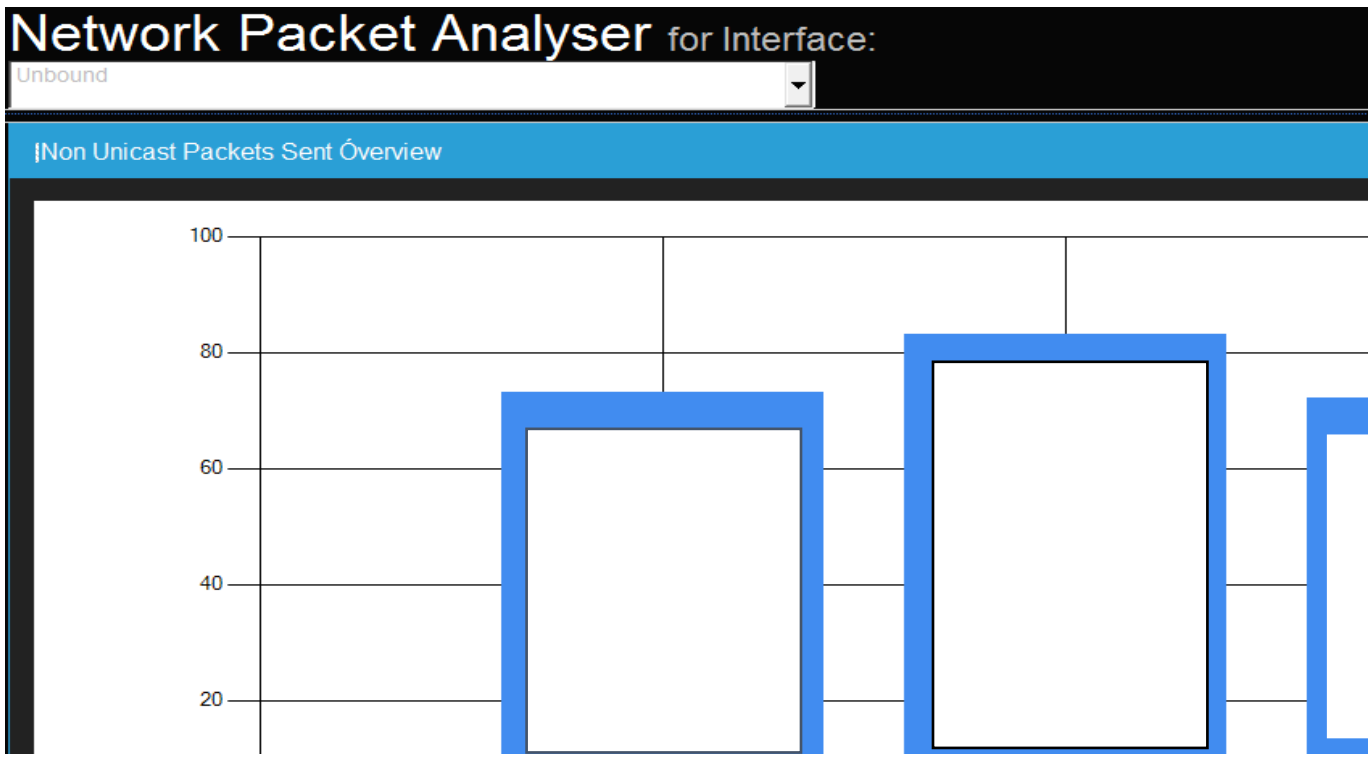
Figure 5.8 Network speed projection

The network speed projection graph will also be shown on real time as the monitoring script will be running .The graph is formulated as it picks statistics for the last 10 minutes from the

current date.

Figure 5.9 Network packet analyser

The network packet analyser non-unicast packets projection graph will also be shown on real time, as monitoring scripts will be running on the background
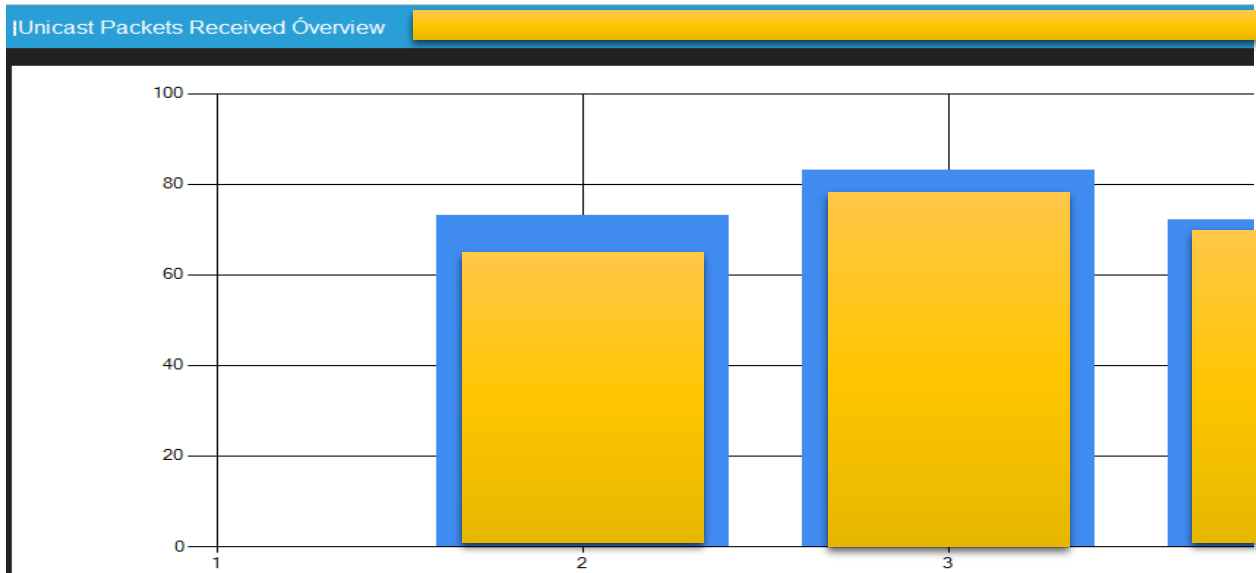

Figure 5.10 unicast packets received

The unicast packets received   will be highlighted on the graph on real time   as monitoring

script will be running on the background**.**

Figure 11 .Bandwidth utilisation chart

Figure 12 Network speed projections

The above monitoring graphs will change in real time as the network monitoring
Scripts will be running on the background.

5.3.5 Verification

```
*****************************NETWORK CONFIGURATION MONITORING STARTED*********************************************
adapter operational status:Up
adapter network interface:Wireless80211
adapter name:Wi-Fi
ip address:fe80::d1c:9883:6b31:f5ef%10
ip address:InterNetworkV6
ip dchp lease lifetime 358549
ip duplicate address detection state Preferred
ip IPv4 Mask 0.0.0.0
ip dNS Eligible False
ip transient False
Address prefered valid time: 06h:28m:15s:000ms
Address valid Time: 06h:28m:15s:000ms
Configuration monitoring data succesfully saved


adapter operational status:Up
adapter network interface:Wireless80211
adapter name:Wi-Fi
ip address:192.168.137.144
ip address:InterNetwork
ip dchp lease lifetime 608738
ip duplicate address detection state Preferred
ip IPv4 Mask 255.255.255.0
ip dNS Eligible True
ip transient False
Address prefered valid time: 23h:58m:44s:000ms
Address valid Time: 23h:58m:44s:000ms
Configuration monitoring data succesfully saved
```

These are procedures that are undertaken in making the software package accurate in the hands of users ,hence forth , it put the software package under scrutinization to guarantee that the system architecture is in tandem with the ultimate system users ,the process verifies and analyse the developed segments in progress ,however the process of verification brought up the question "is the system development okay"   below it shows the screen shots of network configurations

Figure: 5.13 Network configuration verification test

This is a verification test showing network configuration to check either there is any network connection, in the event that the network is unavailable   an alarm will trigger to   alert the

network administrator.Futher to that ,these statistics will be stored to the database after every 40milli seconds.

```
**
***********************************NETWORK SPEED AND BANDWIDTH MONITORING STARTED***********************************
*

SPEED MONITORING SERVER NAME: DESKTOP-5M7LLNG
Interface Name : Ethernet
Interface Name : Local Area Connection* 2
Interface Name : Wi-Fi
adapter operational ststus ..................... :..................... Up
adapter network interface  ..................... :..................... Wireless80211
adapter name ..................... :..................... Wi-Fi
Bytes received ..................... :.....................  3910MB/s
Bytes sent ..................... :..................... 3361MB/s
Bandwidth Utilisation ..................... :..................... 549KB/s
Speed Monitoting Start time ..................... :.....................  2019-05-06 1:53:10 PM
Speed Monitoting End time ..................... :.....................  2019-05-06 1:53:18 PM
SSpeed in KBs ..................... :.....................  5.24 KB./s
Speed Monitoting Time taken ..................... :.....................  8.5874159
SERVER IP  ..................... :.....................  fe80::1878:7a10:6587:18a5%18
SPEED MONITORING DATA SUCCESFULLY LOGGED TO THE DATABASE

Interface Name : Loopback Pseudo-Interface 1
Interface Name : isatap.mshome.net
Interface Name : Teredo Tunneling Pseudo-Interface
*********************************NETWORK SPEED AND BANDWIDTH MONITORING COMPLETED * *********************************
****
```

Figure: 5.14 Network speed and bandwidth   verification test

This is a verification test on network speed and bandwidth at a particular time further to that these statistics will be saved on the database after every 40 milliseconds to the database.

```
*******************************NETWORK PACKET ANALYSIS STARTED*******************************
adapter operational status:Up
adapter network interface:Wireless80211
adapter name:Wi-Fi
interface data incoing parketsdicarded 0
interface data incoming packets with errors 0
interface data incoming unknown protocol packets 0
interface data non unicast packets received 1234
interface data non unicast packets sent 2491
interface data outgoing packets with errors 0
interface data outgoing packets with errors 0
interface data outgoing packets with errors 0
interface data unicast packets receied 10497
interface data unicast packets sent 15564
Packet analyser data succesfully saved
```

Figure :5.15 Network packet analysis verification test

This is a verification   test on the network packets this is to say it analyses the packets henceforth it will assist to identify the cause of bandwidth shortage as fragmented packets, packets with errors, incoming packets with errors will be highlighted.

```
*******************************NETWORK PACKET ANALYSIS COMPLETED*************************************
*******************************NETWORK TRAFFIC ANALYSER STARTED*************************************

IPv4 Statistics
  Forwarding enabled ...................... :..................... True
  Interfaces .............................. :..................... 4
  IP addresses ............................ :..................... 36
  Routes .................................. :..................... 12
  Default TTL ............................. :..................... 128

  Inbound Packet Data:
      Received ............................ :..................... 1757058
      Forwarded ........................... :..................... 0
      Delivered ........................... :..................... 1794021
      Discarded ........................... :..................... 59703
      Header Errors ....................... :..................... 0
      Address Errors ...................... :..................... 899
      Unknown Protocol Errors ............. :..................... 11

  Outbound Packet Data:
      Requested ........................... :..................... 1477959
      Discarded ........................... :..................... 52598
      No Routing Discards ................. :..................... 283
      Routing Entry Discards .............. :..................... 0

  Reassembly Data:
      Reassembly Timeout .................. :..................... 60
      Reassemblies Required ............... :..................... 720
      Packets Reassembled ................. :..................... 360
      Packets Fragmented .................. :..................... 0
      Fragment Failures ................... :..................... 0

Network Traffic data succesfully saved

* *********************************************NETWORK TRAFFIC ANALYSER COMPLETED * ******************
Speed Monitoting Start time ..................... :..................... 2019-05-06 1:52:30 PM
```

Figure: 5.16 Network Statistics verification test

This is a verification test on network statistics   as these will assist the IT technicians to trouble shoot network problems further to that these statistics will be saved on the database after every 40 milliseconds to the database.

5.3.6 Validation

According to Dennis et al (2014),describe the process of validation as putting the software package in the correct manner ,meaning to say the   development of the system   should be meeting the expectorations of the various users .On this scenario   ultimate software users are permitted to be involved during the course of developing the software package ,hence forth the software Package is mandated to perform   efficiently   in a way of allowing correct data only

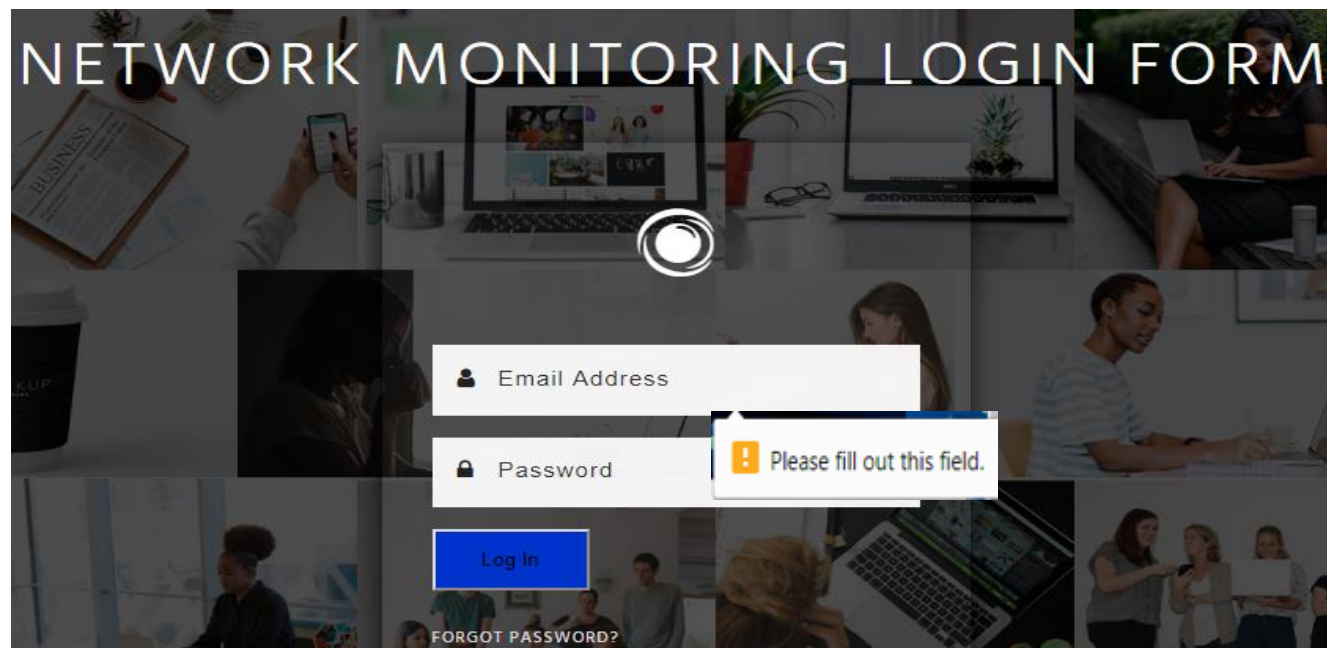in the system. However, the system should not allow numeric in text fields where alphanumeric is required.

Fig 5.17: Empty fields' validation error message

Empty fields Validation

The mechanism is designed in a way that the users should first fill all the empty text fields with their respective credentials in order to successfully log in to the system,attepts by some other users to click the login button without inserting the required details will lead to a pop up massage that acts as a reminder.

Alphanumeric Password Validation

In the process of adding a new user on the system there is a default password that will be created by the admin which is in alphanumeric however the users are encouraged to customize their password once they are logged in but bearing in mind that they should be greater than eight characters,
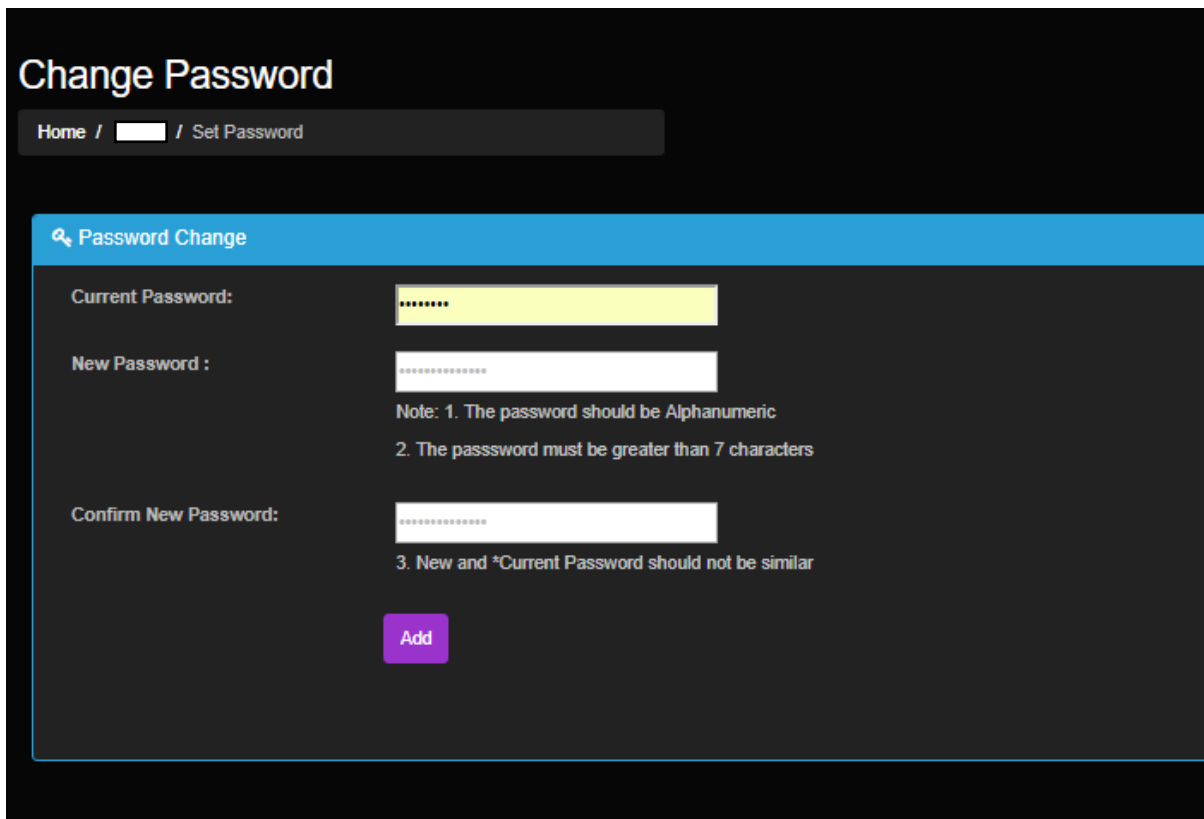
Figure 5.18 Alphanumeric Password Validation

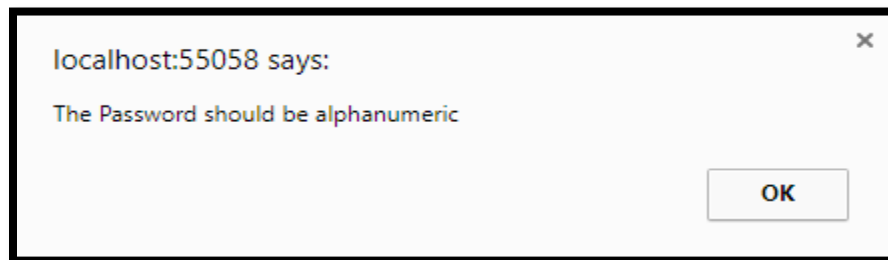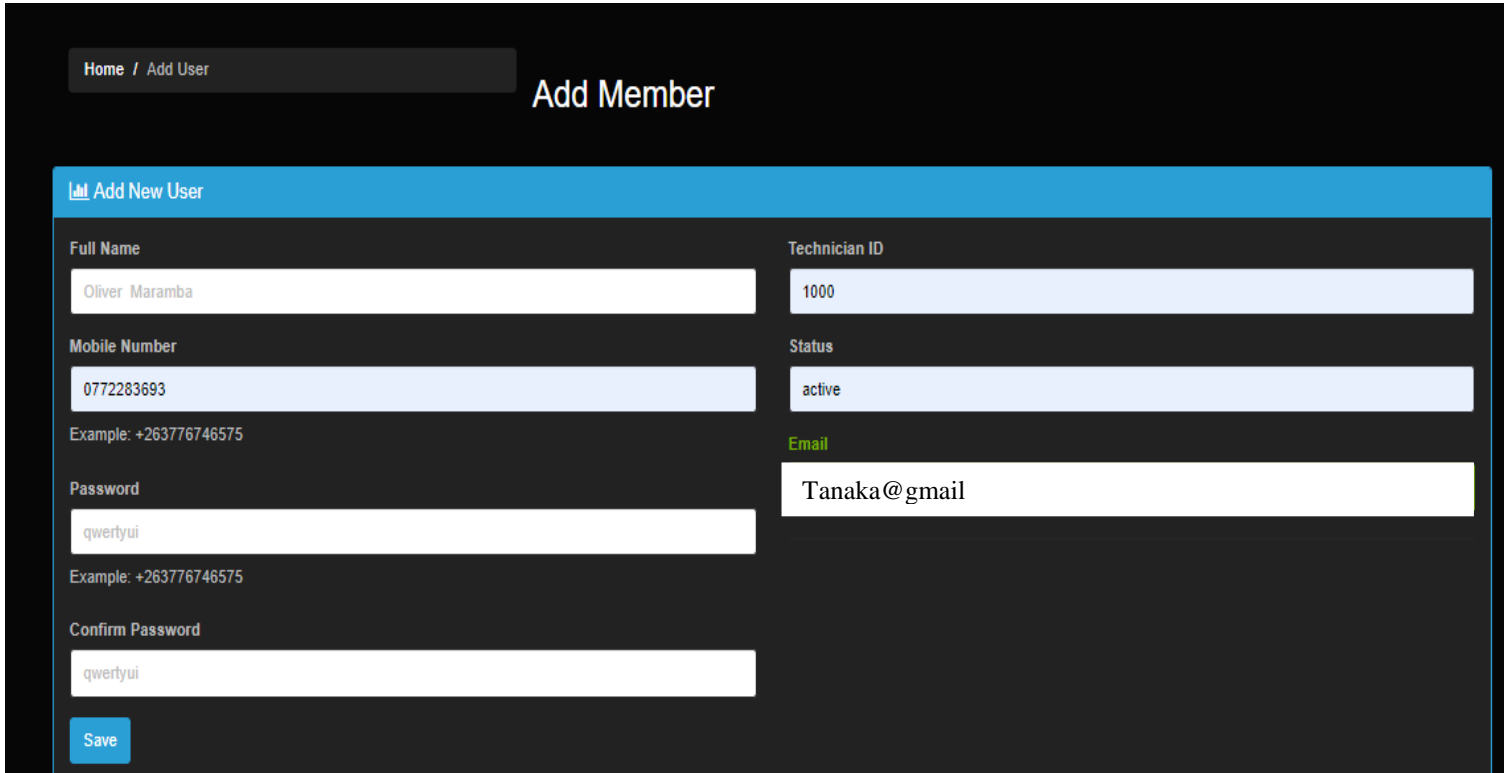In the event that the user inserts incorrect credentials a window will appear .

Figure 5.19 Alphanumeric Password Authentication error message

Email Validation

Correct   inserting of email address is mandated in order for users to successfully log in into their respective homepages, that is to say if the wrong email address is inserted or mismatched like the one is shown below in figure 5.20, an error message in figure 5.21 will pop up.

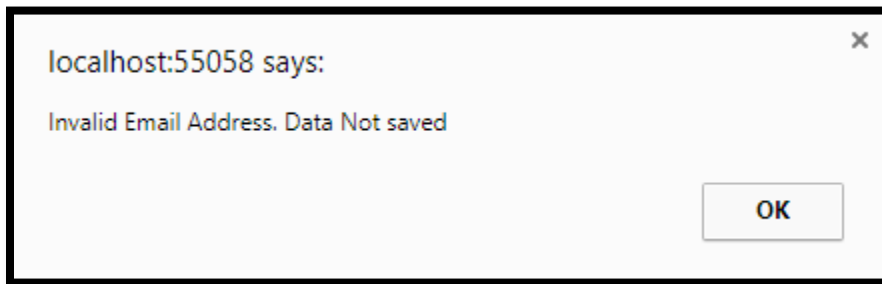**Figure 5.20 Email validation**

Figure 5.21 Email authentication error message

Error massage popping up as a result of violating email address rules and regulations.

5.4 Installation

On this scenario, the software package will be ready for implementation by ultimate user's .In accordance to Nagpal (2011).however the software package shall be employed through direct change over strategy, as the existing system will be terminated giving room for the new system with more technological advancement.

5.4.1 User training

The new automated network monitoring tracker system for TSCZ has various users for different units; the users comprise of the technical support team, for monitoring network statistics, such that there will be awareness of any network hiccups. There is also the administrator unit, concentrating on adding users process names and observing what has been added. Immense training sessions will be employed to users of the system in such that they will be fully aware of what they will be using in the organization. However, users training will be implemented in different phase that is to say Model level and system level

5.4.1.1 Module level

On this level, the user of the system should be well vested with the different types of units, within the system. However, they will only have access to them according to their privilege rights

5.4.1.2 System level

Without the management's appreciation of the system, the system would have been deemed of no use. This is to say the management have to appreciate the existence of the new developed system and all of its functionalities it offers. However, the privileged ones that will have access to the completed system must possess both general and technical knowledge regarding the system and the functionality of each unit and overally being in the position to operate the system. .

5.4.2 Data migration

It is the process of transmitting information from one data store to another or among computers, it is however undertaken for numerous reasons be that to switch servers nor updating it ,A number of serious aspects must be taken into consideration before   any transmission takes place. The features to be taken into account include the time to be taken

during the process of transmitting the data, the jeopardies involved likewise, any technical fault should be considered.

5.4.3 System Conversion

As soon as the software package is successfully accepted in the hands of users ,it will need more efforts from each and every individual that have direct or indirect interest with the system as it will need more caution, care from changing the existing software to the new software frame work .A number of techniques are employed in carrying out the changeover strategy, these are inclusive are direct, parallel, phased as well as pilot strategy.

5.4.3.1 Direct Changeover

This is a procedure that involves replacing the old system instantly without giving room for the existing system to operate together   with the new software, however this strategy is undertaken when there are no serious business   activities that require much attention as it will not give room for disturbances when conversation process start, the major merits is that the new software package is provided within a short space of time. However, in the event of unforeseen circumstances the organisation cannot be able to revert to the existing system.

5.4.3.2 Phased Changeover

This is a scenario whereby the software package is installed in segments meaning to say , one segment is installed after the other that is   only if the   first implemented segments were successfully   implemented. As the time goes on the old system will be substituted with the new software on the entire organisation. This enables the users to be more familiar on how to use the software system however   they are high costs that are involved since each segment carry its own cost.

5.4.3.3 Pilot Changeover

According to Mahapatra (2016)   asserted that it is a technique that operates in such a way where by the new software system is introduced to a certain group of users in order for them to test, analyse as well as giving feedback on system operations this methodology gives room for both systems to be analysed as both system will be running . However, the technique is time consuming.

5.4.3 Recommendation

Parallel changeover technique was highly selected as the top strategy to be implemented on during the course of system conversion. The technique gives the room for employees to obtain logic on how the software package operates

5.5 Maintenance

It is the process of providing modifications or alterations to the final system. This is done in order to achieve maximums system performance .As it is a known fact that the technological environment is not static but rather dynamic hence this will force the developers to come up with various system modules in order to be in tandem with the technological levels.The TSCZ network monitoring tracker system will be maintained on a systematic and arranged order where by the first phase will consist putting into use interim software evaluations meaning to say that ,the new system will be reviewed in quarter basis yearly , further to that , TSCZ IT department its mandate will be to review the system. The process of reviewing the system will be undertaken in order to guarantee the best functionality of the software.

Moreover, the most vital phase is the disaster recovery. Subsequently TSCZ disaster recovery site is operational all the necessary information concerning monitoring statistics of the system will be backed up and it will be done by the operations section of the TSCZ IT department. For offline, back up the section will make use of Back up Tapes and discs. During the end of day operation where back up of other systems will be done, it is when this system would also be backed up

5.5.1 Corrective Maintenance

Sommerville(2015).Asserts that It refers to the process of fixing and correcting of loopholes in order for the systems quality to be improved mistakes, usually the process is identified by users as well as the team of developers.

5.5.1.1Corrective Maintenance plan

They stipulated that, the plan of maintenance was to be carried only for the first quarter of the year where by numerous system defects reports feedback where to be analysed to schedule the defects if any .

5.5.2 Preventive Maintenance

According to Beichelt and Tiitmman (2012) alluded that technological environment is dynamic hence inoder fo the system to be more relevant there is need to enhance how the system functions as a result of that the existence and durability of the system also increases. However the is need for user involvement imparting technological advancement as well as system functionality

Preventive maintenance plan

The maintenance process where to be conducted on annum basis

However, the administration and all the team where to facilitate a planning strategy as all the plans were set to be used.

5.6 Recommendations for future development

- There should be implementation of other notification types to accommodate all the users for example sms, emails may also be implemented
- The system should also be developed in the future to monitor source of packets using ip address
- The system should monitor individual user's traffic passing through a proxy in the future.
- The hardware and the software where the application is operating on should be adequately serviced to allow the application to continue to run smoothly without any problems. .
- In order for the organisation to function its has to be on internet as it will be its backbone hence its name network monitoring, the server on which the system will be running should be always running ,no internet means no internet.
- Advancement in technology has promoted a wide use of android, henceforth there is need to develop such a software application using android

5.7 Conclusion

Coding process was visibly clarified; the software package was thoroughly undertaken on testing procedures to insure that the system was performing according to the expectation of the users. System installations ware clearly clarified hence highlighted the manner on which the

system was to be launched .Data conversation plans as well as changeover strategies methods were clarified featuring the benefits and faults for each ,however parallel change over strategy was recommend. Likewise, the methods of maintaining the system were laid out as well and the organization recommend using all the stipulated strategies for the betterment of the system. Future recommendation were made in that the system should monitor individual users traffic passing through a proxy in the future and also the implementation of other notification types to accommodate all the users such as sms,emails mention just a few. However this shows that the phase of system implementation went well never the less any ldeas,innventions in line with system development are highly welcome inorder to make TSCZ a more favorable operational place.